

BIPOLAR DISORDER DIAGNOSIS WITH RECURRENT NEURAL NETWORKS USING PROBABILITY DENSITY FUNCTION

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Abstract

Millions of individuals all over the globe suffer from the mental condition known as bipolar disorder. The most effective treatment and management of bipolar disorder depend on a prompt and correct diagnosis. Interest in using machine learning algorithms to diagnose bipolar disorder from clinical and neuroimaging data has increased in recent years. In this article, we suggest a unique strategy for bipolar illness categorization by combining clinical and neuroimaging data. The obtained data was then classified using probability density function techniques and a recurrent neural network. Based on clinical and neuroimaging data, our technique has 98% accuracy in classifying bipolar illness. We also used feature selection to discover the most relevant clinical and neuroimaging variables for bipolar disorder categorization. Our findings highlight the potential of machine learning algorithms for accurate and early diagnosis of bipolar disease, as well as the need of combining both clinical and neuroimaging data for bipolar disorder categorization.

Keywords: Bipolar Disease Classification, probability density function, recurrent neural network

I. INTRODUCTION

Bipolar illness is a complicated and chronic mental health issue that affects millions of people worldwide [1]. It is distinguished by strong mood changes, such as hypomanic, manic, and depressed episodes [2]. A person experiencing a manic episode may have increased energy, a reduced need for sleep, quick thinking, grandiose views, and impulsive conduct [3]. Individuals experiencing a depressive episode may suffer emotions of grief, despair, regret, and worthlessness, as well as changes in food, sleep, and activity levels [4].

There are various types of bipolar disorder, each of which is defined based on a person's individual symptoms and mood fluctuation patterns [5]. The basic kinds of bipolar disorder include bipolar I, bipolar II, and cyclothymic illnesses [6]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) is the most widely used categorization system for mental health illnesses, and it recognizes both designated and unspecified bipolar disorders [7].

Bipolar I disorder is defined by at least one manic episode lasting at least one week or requiring hospitalization [8]. A manic episode is distinguished by an unusually high or irritated mood, increased energy, and other symptoms such as grandiosity, reduced sleep need, quick thinking, and impulsivity [9]. Depressive episodes may endure for at least two weeks and are distinguished by sadness, loss of interest or joy, changes in eating and sleep, and suicidal thoughts or acts [10].

Bipolar II illness is distinguished by at least one hypomanic episode, a lesser type of mania that lasts at least four days [11]. Hypomania is similar to mania, although it is less severe and usually does not need hospitalization [12]. Depressive episodes persist at least two weeks in people with bipolar II disease and are equivalent to those experienced by those with bipolar I condition [13].

Cyclothymic disorder is a milder form of bipolar disorder characterized by continuous mood changes that do not match the criteria for a manic or depressed episode [14]. Cyclothymic disorder



A NOVEL APPROACH FOR BIPOLAR DISORDER PREDICTION USING PSO-GKFCM HYBRID CLUSTERING AND WEIGHTED FEATURE SELECTION

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Abstract

Bipolar disorder is a common and serious mental illness affecting millions worldwide. Severe mood swings, such as bouts of sorrow or mania, may significantly influence a person's daily functioning and quality of life. This study proposes an effective technique for predicting bipolar disorder by combining complex data preprocessing, feature selection, clustering. The approach includes an upgraded decision tree and a weighted k-means approach for missing data preparation and analysis. Relevant feature selections are made using a weighted binary BAT approach, reducing the data's dimensionality while preserving essential qualities. The data is then clustered using a hybrid approach combining the particle swarm optimization (PSO) algorithm with the Gaussian Kernel fuzzy clustering algorithm (GKFCM), resulting in a clustering accuracy of 98.6%. Overall, the proposed approach offers an effective and efficient way to predict bipolar disorder with promising results, and it has the potential to be extended to other related illnesses.

Keywords: Bipolar Prediction, Particle Swarm Optimization, GKFCM, Clustering

I. INTRODUCTION

Bipolar disorder is a common and serious mental illness affecting millions worldwide. Severe mood swings, such as bouts of sorrow or mania, may significantly influence a person's daily functioning and quality of life [1]. Early detection and treatment of a bipolar disease may improve a patient's prognosis and reduce the chance of long-term complications [2]. As a result, accurate illness prediction systems are required for the timely diagnosis and treatment of bipolar disorder [3].

Machine learning algorithms have shown significant promise in correctly predicting and diagnosing various diseases, including bipolar disorder, in recent years [4]. Yet, the success of machine learning algorithms is heavily reliant on the quality of input data and the effectiveness of preprocessing and feature selection techniques [5]. This study offers an effective disease prediction strategy for bipolar disorder that combines complex strategies to solve these difficulties [6].

The proposed disease prediction process is divided into four major modules: preprocessing and missing value analysis using an improved decision tree and weighted k-means algorithm, feature selection using a weighted binary BAT algorithm, clustering using a hybrid

A REVIEW ON DETECTION AND PREDICTION OF BIPOLAR DISORDER USING DEEP LEARNING

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Abstract:

In the present times, not only the physical health of human beings but also the mental health is being affected due to various problems that are increasing. The psychological illness refers to certain problems that arise due to the high stress that psychologically causes on humans. These problems can lead to problems such as misconceptions, misunderstandings, excessive anger and stress. And ignoring this can make the problem bigger. This paper gives survey data on the various methods proposed to deal with Psychological illness in the deep learning method. It constantly examines and classifies the best treatments for patients, mental health improvement methods, and selection methods and analyzes for stress relief. Furthermore the results of the deeper learning methods are also analyzed so the results of the better and improved methods are more likely to be further enhanced and its calculation rate adjusted.

Keywords:

Psychological Illness, Various Problems, Deep Learning Methods, Mental Health, Stress Relief

1. Introduction

Around 2% of the world population suffers from manic-depressive illness, and another 2% suffers from bipolar disorder in its subthreshold manifestations [1]. According to the World Health Organization, bipolar disorder is one of the top 10 leading causes of disability-adjusted life years among young adults [2]. According to Nordentoft [3], 7.8% of men and 4.9% of women who have bipolar disorder end their lives by committing suicide. As a direct consequence of this, patient life expectancy decreases by nine years [4]. The diagnostic processes that are now in place for bipolar illness may not be completely successful, and there is typically a ten-year gap between the onset of symptoms and the delivery of a formal diagnosis [5]. This model shows the different ways that bipolar disorder can be treated, diagnosed, and prevented.

Through the use of evidence-based medicine, we have gained a better understanding of risk factors, prognosis and effective treatments associated with the disorder, where the statistical model provides results on an average scale [6]. Greenhalg et al. [7] have brought to our attention the fact that individuals in clinical trials might not necessarily reflect the patients' profile. Because clinical heterogeneity plays an important role in bipolar disorder, this may be especially true in that area of research. As a result of these discoveries, psychiatric research is focusing more and more on techniques like deep learning, whose goal is to make care that is tailored to the needs of each patient [8].

The speed at which new datasets are being produced is referred to as big data, and the term big data is used to describe extremely large and complicated data sets. Big data is characterised by a wide range of levels at which data is generated, ranging from the molecular to the clinical to the socio-demographic to the administrative to the environmental and even social media data. This is one of the most essential properties of big data. Those in research [9]. In recent years, a great number of deep learning algorithms, which are also known as pattern recognition are developed for the purpose of analysing vast volumes of data. In a nutshell, the algorithm initially conducts an analysis of a dataset referred to as training in order to develop a function that is able to differentiate between individuals belonging to various categories. It is possible to determine how accurate the model is by applying it to a new dataset and contrasting the results with the original dataset. Alterations to the algorithm or a further reduction in the amount of data may be utilised in order to effect further improvements in this model [10]. Therefore, these algorithms are ideal for analysing complicated diseases and calculating the particular outcome probability on an individual basis [11].

This research looked at the results of patients with bipolar disorder who had previously been evaluated using these methods. The techniques employed in this research come from the field of deep learning. Research studies that looked at diagnoses were our key area of interest in our inquiry. It was also taken into consideration to include research evaluating treatment and prognosis, as well as the development of data-driven

PREVENTION OF CYBER ATTACK USING CLOUD IOT SYSTEM

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Abstract

Development in technology acts as a boom. Similarly, many hackers are starting to attack the network that increasing the cyber risk. Users and business organizations are highly affected due to the loss of data, corruption, and malware attack. Even they built a multi-level of security nothing seems to be possible to keep an endpoint for that. To compete with it new technologies and trends were embedded to overcome this situation. All this acts as the greatest hindrance to present society. To overcome these network attacks, there is a need for the replacement or collaboration of some modern new technological features and functionalities. That should be user-friendly as well it act as a bridge in fighting against malware and other types of attack. At this place the cloud computing in IOT does wonders. While building a highly secured protective wall using the Rivest Cipher 6 Advanced techniques while interacting that is interchanging the data using IoT, the user could reduce the cyber risk that is faced.

Keywords: Rivest Cipher 6 (RC6), Encrypt, Block Cipher, Decrypt, Internet of Things and Cloud Computing.

1. INTRODUCTION

In this pandemic situation, everyone switched towards dealing with online networks. People started showing interest in accessing their data and information online. At every office work from home concepts and techniques were encouraged for providing a high level of security for the employees. During processing, the data and information would be converted as a single file and it would be transferred for processing. Since the people work from the different place and zones the main key concept that they use is data storage, data sharing, and processing. It gradually increases the cyber risk while processing and executing online. To sort out the problem the highly secured application is designed and using that the employees transfer their data and start working for the betterment of the project works.

Here for adding an extra secured layer the advanced and enhanced Rivest Cipher 6 algorithm has been effectively implemented. This algorithm mainly works as an encryption and decryption concept, where the data cannot be revealed by any external users. During the encryption process, it consists of 4 different w-bit and its registers. These registers are used for storing the data. The initial storage will be in plain text format that gets converted to the cipher. The data would get stored at

that particular same register. In end, a similar method of encryption techniques are followed for extracting that is encryption process. This technique supports reducing the loss of data, which acts as a great plus.

It works out with the multidimensional key, where the concept of rework and fear about what would happen when data is hacked can be reduced. It keeps on processing simultaneously until the specific goal has been met.

2. CAUSE OF ATTACK IN 2021

The change in technology has created a great impact on the implementation and it starts enhancing out the human life. It simplifies the complex issues and lets the user meet all their need from the place where they are. That too the number of people who started using the technology increases multiple times during the Pandemic situation. The concept of work from home, online banking, online shopping, and online meeting was highly encouraged. In every business organization more than approximately 90% of the data has been shared online. That on other hand increases the risks and complexity of the issues. In the network, there are chances for the different types of attacks that create a risky cyber attack.

To overcome and to get rid of the issues new techniques and concepts came into existence. The IoT has created a new paradigm where the network machine, as well as the device, is capable of improving the communication after collaborating to form the new process. The main reason for the cyber attack in IoT-based devices depends on the environmental monitoring, patient monitoring, logistics, and smart grids.

The security management concepts created a great flaw in the challenge due to its transient and dynamic nature that is established in connecting between two devices. Now in this paper, the prediction of cyber attack that occurs at the networks are predicted and analyzed.

PERFORMANCE ANALYSIS OF MACHINE LEARNING CLASSIFICATION TECHNIQUES TO PREDICT LUNG DISEASES

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Abstract: Lung disease is the third most disease in the world. Disease progression and response to treatment in lung diseases vary widely among patients. Accurate diagnosis is crucial in treatment selection and planning for each lung cancer patient. In detection of lung cancer, image processing algorithms have demonstrated superior performance. This study explains various classification approaches that are used to forecast lung cancer in its early stages. The classification of lung tumors as malignant or benign is performed using machine learning algorithms. Machine learning methods involve as: Support vector machine (SVM), Artificial neural network (ANN), Convolutional neural network (CNN), K-Nearest Neighbor (KNN), Multi-Layer Perceptron (MLP), Entropy degradation method (EDM) and Random Forest (RF) are extensively reviewed, and the performance of each is examined for accuracy, sensitivity, and specificity. In this analysis, SVM approach utilizing a short dataset gets the greatest results of 97% accuracy, whereas KNN gets the lowest accuracy 77.8%.

Key words: Lung cancer, ANN, benign, cancer, malignant, CNN, EDM, KNN, MLP

INTRODUCTION

Lung diseases remain the most burdensome manifestation of cancer in almost all countries. High mortality rates from lung diseases have a significant negative impact on the entire world's population. Researchers put forth CAD techniques that can be used to classify issues at an early stage in computed tomography (CT) images [1]. The majority of tests and treatments can be completed fairly quickly, although it could take days or even months, which is normal. Such a delay could lead to major issues for both patients and medical professionals, which would have a negative impact on the survival rate. Therefore, the diagnosis to treatment procedure should be completed extremely quickly in order to improve the patient's condition. The advancement of machine learning techniques has made early lung cancer prediction possible [2]. Some machine learning algorithms for predicting lung cancer are explored in this paper. Neural network is an effective tool for building an assistive Artificial Intelligence (AI) based cancer detection system which plays a major role in the classification of the cancer cells as normal or abnormal. An effective cancer treatment can be seen only when the tumor cells are identified from the normal cells. The machine learning based cancer diagnosis [3] mainly focuses on the classification of the tumor cells and training of the neural network which is very important in lung cancer research[4]. This paper discusses different lung cancer classification algorithms such as CNN, SVM, ANN, MLP, KNN, ED, RF and their performances are evaluated.

RELATEDWORKS

Main contributions of some of the researchers who tried to develop a lung cancer prediction system analyzed using different classification algorithms are summarized below.

Sasikala et al. [5] proposed a convolutional neural network (CNN) based approach for classification of lung cancer tumors as benign and malignant. This system is trained by inputting the lung cancer tissue images of variant shape and size. CNN obtained high accuracy of 96% when compared with other conventional neural network systems which makes this method more efficient. In order to detect the cancer types of different size and shape, CNN will use large datasets for training in the forthcoming years. This paper concludes by suggesting a 3DCNN method that can be used for improving the performance of the system and also by improving the hidden neurons with deep network.

LUNGS SEGMENTATION AND CLASSIFICATION USING MACHINE LEARNING IN CHEST X-RAY IMAGES

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Abstract:

The identification and prediction of lung illnesses are increasingly vital and difficult. Image processing and machine learning techniques approaches are frequently used to detect early-stage of lung disease. Healthcare providers are still facing challenges in detecting cancer. The true origin of cancer and the complete treatment process remains a mystery. To identify the regions of the lungs affected by cancer, various image processing techniques are utilized. These techniques involve reducing noise, extracting features, detecting damaged regions, and comparing patient's medical history of lung cancer data. This research applies image processing and machine learning techniques to demonstrate accurate detection and prediction of lung cancer. The dataset of X-ray images used in the study was sourced from UCI repositories. To enhance the quality of the images, a local binary fitting mean filter was utilized during the image preprocessing stage. The K-means method was then applied to segment the images. This segmentation enabled the identification of the lung portion within the images. The data was classified using different machine learning algorithms, including RF, ANN, SVM and NB. The results revealed that the ANN model had the most accurate prediction of lung cancer. The main objective of the study is to segment the lungs portion and detect lung cancer with image processing and machine learning approaches.

Keyword: Machine Learning, Lung Cancer, Median Filter, Segmentation, Chest x-ray images, Image processing

Introduction

Lung cancer, which is among the deadliest types of disease, causes approximately one million deaths every year. In the current state of medicine, it is essential to perform lung nodule detection on chest X-ray images. This is because lung nodules are becoming increasingly common and are the leading cause of this disease [1]. The images are transmitted into a computer, which then manipulates them to create a cross-sectional image of the body's internal organs and tissues [2]. The American Cancer Society assesses that a patient's likelihood of surviving lung cancer is 47%, if it is discovered at an early stage. It is extremely improbable that lung cancer in its early stages will be accidentally discovered on an X-ray image [6]. Lesions with a diameter of 510 millimeters or less that are spherical are notoriously difficult to find. Figure 1 displays an X-ray image of a normal and lung cancer.

In [3] developed a CAD approach with two experiments. In the first case, 300 X-ray images were used for computer simulation, while in the second, 888 X-ray images were used for patient-based ground truth. The method was developed using the LIDC-IDRI dataset, and images with wall thickness larger than 2.5mm were removed. The simulated pictures lung region was randomly implanted with spherical nodules of varied sizes. A 10-fold cross-validation method was used to analyze network hyper-parameterization and generalization in order to evaluate the CAD technique. The detection sensitivities were assessed in relation to the average number of false positives per image. By evaluating the mean and standard error between predicted and actual values, localization and diameter estimates accuracy was evaluated. Results regularly exhibited superior detection accuracy.

PARTICLE SWARM OPTIMIZER GUIDED ACTIVE CONTOUR MODEL FOR LUNG IMAGE SEGMENTATION

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Abstract: - Snakes, also known as active contour models, are widely used in a variety of applications, including object boundary detection, image segmentation, object tracking, and energy-minimization-based classification. While standard optimization techniques can be used to achieve energy minimization, more recently, techniques based on evolutionary algorithms inspired by nature have been created. Particle swarm optimization (PSO) is one such evolutionary method that has been widely applied in active contours. Conventional PSO provides accurate curve recognition in the object border because it converges quickly and is readily took in a local minimum. The suggested PSOGACM has each control point in the snake and also has a swarm to assign in it. Subsequently, the swarms exchange information with one another to jointly seek for their optimal spots. The active contour model considerably improves the PSO-based search process's performance. The outcomes of the experiments show that the suggested strategy is more effective than traditional methods. The proposed system has accuracy of 91.15%, sensitivity of 89.20%, and precision of 88.23% is more effective and more accurate.

Keywords: Region of Interest, Particle swarm optimization, Guided active contour integration, lung disease.

I. Introduction

For automatic object boundary detection, Kass et al. presented deformable models called active contours [1]. A challenge of minimizing energy caused by certain elements of a picture, such as shape and edge information, is the active contour model. By reducing energy concepts like internal and external energy, the active contour model progressively develops the ultimate shape of the intended object. These energy components in a digital image are calculated from object features at discrete points called control points; a spline curve is fitted through these control points to create the contour. The energy terms increasingly approach the ideal object boundary as they are minimized at these places. Thus, the contour begins with an initial shape, deforms repeatedly, and finally decreases to encircle the item.

The local minimum problem is one of the many issues with the active contour model. Because the energy minimization process relies on the initial selection of the control points, it is very likely to become stuck in local minima when initialization is done incorrectly. The active contour algorithm's initialization and convergence are accompanied by two problems. First, it's usually necessary to select the initial control points in proximity to the actual boundary. If not, the contour is probably going to converge to the incorrect outcome. The second issue is that concave boundaries are typically hard for active contours to capture. This

GOLD MARKET DATA PREDICTION USING KNN WITH PSO

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Abstract - The research employs the K-Nearest Neighbors (KNN) algorithm optimized by Particle Swarm Optimization (PSO) for predictive analysis in the gold market. This method integrates PSO to optimize the feature selection process within KNN, using a comprehensive dataset. Historical market data, economic indicators, and sentiment analysis contribute to the feature set. KNN makes predictions based on the selected features, fostering a refined forecast mechanism. Evaluations and refinements further enhance the model's precision and forecast accuracy, demonstrating the amalgamation's effectiveness in robust gold market trend predictions.

Keywords: Gold Price Prediction, K-Nearest Neighbors, Particle Swarm Optimization, Probabilistic Method;

1. Introduction

Advancement in the fundamental aspects of information technology over the previous many decades has changed the path of businesses. As perhaps of the most captivating development, financial markets distinctly affect the country's economy. The World Bank detailed in 2018 that the Gold market capitalization overall has outperformed 68.654 trillion US\$. Over the last few years, gold trading has become a center of attention, which can largely be attributed to technological advances. Investors search for tools and techniques that would increase profit and reduce the risk. However, Gold Market Expectation (SMP) is definitely not a basic errand because of its non-straight, dynamic, stochastic, and questionable nature. SMP is an illustration of time-series gauging that immediately inspects past information and assessments future information values. Financial market expectation has involved

stress for experts in different disciplines, including economics, mathematics, material science, and computer science. Driving profits from the trading of Gold is a crucial element in the forecast of the Gold market. The Gold market is subject to different boundaries, such as the market value of a share, the efficacy of the business, governmental initiatives, the GDP of the nation, the rate of inflation, natural disasters, and so forth. The Efficient Market Hypothesis explains why the price of gold is not determined by fresh knowledge, and follows a random walk pattern, such that they cannot be predicted solely based on past information. This was a widely accepted theory in the past. With the coming of technology, researchers showed the way that Gold market costs could be anticipated partially. Historical market data, combined with the data extracted from social media platforms, can be analyzed to predict the changes in the economic and business sectors. The performance of Gold market forecast



A STUDY ON BRAND PREFERENCE & BRAND SATISFACTION OF REFRIGERATOR

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Abstract:

A brand is essential for businesses of all sizes because it increases value, gives employees direction and motivation, and makes acquiring new customers easier. One of the significant components of a brand is a logo because people instantly recognize it as the 'face' of a business. A professional logo design is simple enough to be memorable but powerful enough to give a company's desired impression. The finished logo is simple enough to be memorable but powerful enough to make the right impression. Just as people are likely to purchase from a business that appears polished and legitimate, families need to feel comfortable before committing to a product. Consumer durables are those products which do not wear out quickly and can be used for a long period. Today so many brands of consumer durables are available in the market. Brand & price are two most important variables which influence consumer's decision regarding purchase of consumer durables. The studies observe Brand preference & satisfaction of Refrigerator. The implement adopted for the collection of data was the questionnaire. The sample size is 100 respondents. Convenient sampling method is used to test the research. This study used in percentage analysis for factors influence brand preference & brand satisfaction of refrigerator. This research of the study conducted in Coimbatore district.

Key Words: Brand, Branding, Brand Preference, Brand Satisfaction

Introduction:

Consumer durables are those products which do not wear out quickly and can be used for a long period. Today so many brands of consumer durables are available in the market. Brand & price are two most important variables which influence consumer's decision regarding purchase of consumer durables. "Brand is a name that influences buyers". While purchasing a single consumer durable, people generally come across so many brands. The present study is intended to find out different brands used and preferred by consumers in the market. People tend to buy quality products or top brands when it comes to consumer durables. But price sometimes becomes a barrier. So it is seen that people tend to compare brands with price. Because there are customers who are willing to buy several trusted brands of consumer durables but because of high price they cannot afford to purchase those. It is also seen that some consumers are very much loyal to some brands when it comes to consumer durables. The study also focuses on those consumers in the sense that what propels them to buy only selected brands i.e., to find out the reasons for brand preference. In today's marketplace teeming with thousands of products and services, all of which are being commoditized, a brand stands out from the clutter and attracts attention. A brand name can create and stand for loyalty, trust, faith, premium-less or mass-market appeal, depending on how the brand is advertised and promoted. A brand differentiates a product from similar products and enables it to charge a higher premium in return for identity and greater faith in its function. A brand is also likely to survive longer than just an undifferentiated product. A brand is akin to a living being; it has an identity, personality, name, culture, vision, emotion, and intelligence. The brand owner confers all these. It and needs to be continuously looked at to keep the brand relevant to the target it intends to sell.

Brand Preference:

Brand preference represents which brands are preferred under assumptions of equality in price and availability. Brand preference measures quantify the impact of marketing activities in customers' hearts and minds and potential customers. Higher brand preference usually indicates revenues and profit, making it an indicator of company financial performance. It signifies desirability or selection of an alternative. It can be further seen as a consumer's predisposition towards a brand that varies according to the cognitive, affective and cognitive effects that the brand has had on the consumer. Understanding the pattern of consumer preference can be critical for a brand's success. To drive preference towards a brand, marketers strategies to improve top-of-mind awareness and increase the probability that the brand is included in the consideration set.

Brand Satisfaction:

Satisfaction is often used as a predictor of future consumer purchases. Satisfied customers have a higher likelihood of repeating purchases in time, recommending that others try the source of satisfaction and becoming less receptive to the competitor's offerings. Specifically, satisfaction is found to be a necessary precursor of



BRAND EQUITY FOR REFRIGERATOR

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Introduction:

A brand is seen as one of a company's most valuable assets. It represents the company's face, the recognizable logo, slogan, or mark that the company associates with. The company is often referred to by its brand, and they become the same. A company's brand carries a monetary value in the stock market, affecting stockholder value as it rises and falls. For these reasons, it is essential to uphold the integrity of the brand. When a company decides to settle on a brand to be its public image, it must first determine its brand identity or how it wants to be viewed. The aim is to make the brand memorable and appealing to the consumer. Once a brand has created positive sentiment among its target audience, it has built brand equity. A successful brand accurately portrays the message or feeling the company is trying to get across and results in brand awareness. If done right, a brand increases sales for the specific product being sold and other products sold by the same company.

A brand is essential for businesses of all sizes because it increases value, gives employees direction and motivation, and makes acquiring new customers easier. One of the significant components of a brand is a logo because people instantly recognise it as the 'face' of a business. A professional logo design is simple enough to be memorable but powerful enough to give a company's desired impression. The finished logo is simple enough to be memorable but powerful enough to make the right impression. Just as people are likely to purchase from a business that appears polished and legitimate, families need to feel comfortable before committing to a product. Logo can quickly identify the business as a trusted centre for education in the community. A brand can also help a business get word-of-mouth referrals. A strong brand often guarantees future business. A brand is the bundle of values and attributes that define the value delivery to customers and businesses. 'Brand' may involve catchphrases and excellent visuals, but brand-building requires more. When a brand is understood, developed, and managed the way great brands do, it is far substantial and meaningful. It will give confidence to businesses through trust and expertise. The beautiful brand will make proud to share and market business. The brand sets a foundation to move forward with the business. It will set the tone for everything with a strong strategy in place, refer back to it and make sure those products and services align with the brand's mission and vision.

Brand Equity:

Brand equity and customer value increase through effectiveness and efficiency of marketing plans, brand loyalty, price and profit margin, brand development, business leverage, and competitive advantage add value to the company. Strong brands have high brand equity because they have valuable assets that offer several competitive advantages. Because consumers demand high equity brands, the manufacturer has a negotiation position; and quickly launches product lines and brand extensions. Brand equity also provides some price protection because loyal consumers will pay for the brands they admire. All brands have some measure of brand equity. Powerful brands such as LG, Samsung, and Whirlpool have substantial brand equity. There are two definitions of brand equity, the first - a set of brand assets and liabilities linked to a brand. The second definition is 'the differential effect that brand knowledge has on consumer response to that brand's marketing. The brand equity concept might be understood better if examined in a broader framework that assesses the brand's cumulative effect across the stages of the consumer's choice process. Information processing effects influence a choice set generation. Finally, the decisions extend the aggregate conceptualization inherent in the 'additive' brand impact notion of brand equity to a comprehensive approach that focuses on the brand's role across the dynamic consumer choice processes.

Dimensions of Brand Equity:

Sources of Brand Equity:

Brand Equity Dimensions After extensive literature survey 11 key brand equity dimensions have been identified. They are listed below – the listing is based on the number of referenced work found in the literature survey done

- **Quality:**

Aaker's (1991) defines Quality as consumer's perception of the overall quality or superiority of a product or service with respect to its intended purpose, relative to alternatives. Quality from a consumer's perspective is referred to as 'perceived quality'. Quality, in the customer's context, is not technical but perceptions about the products, tangible and intangible, that the consumer observes. Perceived quality can be



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**CUSTOMER'S PERCEPTION ON DIGITAL COUPON CODE BASED SALES
PROMOTIONAL ACTIVITIES**

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ABSTRACT

A digital coupon is a discount code for a product or service that is either transmitted or stored online.. Digital coupons are manufacturer or store coupons redeemed electronically and do not require printing. Shoppers can digitally clip the coupons and redeem at the register with their phone number. This coupons are discounts and promotions to retailers and existing customers. They are directed at consumers and usually share a percentage of discounts, free shipping or some other form of discount decided by the retailer. E-coupons can be used to attract coupon-prone consumers, increase product visibility and encourage the customers' for repeat purchase. This study is focused on customer's perception on digital coupon code based sales promotional activities. The main objectives of the study are to identify the perception and satisfaction of digital coupon code based sales promotional activities in Pollachi Taluk. The data collected from 120 respondents through structured questionnaire in Pollachi Taluk. Convenient sampling method was used for collection of data.

Key words : Digital coupon, Sales promotional and Customers

INTRODUCTION

Today digital coupon codes are best sales promotional activities. It can depend on a variety of factor, such as perceived value of the offer, ease to use and the overall experience of the customer. A well - executed sales promotional campaign that can help to create positive perception among customers and increase brand loyalty. A coupon (also promo code or voucher) is a single code that represents a discount. In the online shopping context, a coupon code is a string of computer-generated letters and numbers that a customer can enter at the checkout to receive a discount or another effect. Coupons can take various forms they can be public codes for a board target group or personalized and unique coupon codes assigned to specific customers. Digital coupons codes are a popular tool used by businesses to attract the customer's. Digital coupons used for gifts, discounts, offers, credit points and promotions offered by an online store to current or prospective customers.

OBJECTIVES OF STUDY

1. To study the socio economical profile of the digital coupon code users
- 2 To identify the perception and satisfaction of digital coupon code based sales promotional activities in Pollachi Taluk.

METHODOLOGY

1 Source of data

The present study is based on both primary and secondary data. The primary data is collected with the help of structured questionnaire. The secondary data is collected from the books, magazines, websites and journals etc,

ii. Sampling method

The study is concerned with Customer's perception of digital coupon code-based sales promotional activities. The questionnaire collected from 120 respondents in Pollachi Taluk. Convenient sampling techniques were used for the collection of data.

iii. Framework of analysis

The present study aims to know about the level of Customer's perception on digital coupon code-based sales promotional activities. The collected data from the respondents have been analyzed through simple percentage method, Chi square test and Weighted Average Ranking Method.

THE ROLE OF AI IN TALENT ACQUISITION: OPPORTUNITIES AND CHALLENGES

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Abstract

The relentless advancement of Artificial Intelligence (AI) technologies has permeated various facets of human resource management, with particular significance in the realm of talent acquisition. This review research paper explores the evolving landscape of AI in talent acquisition, shedding light on the opportunities and challenges it presents. As organizations strive to attract, assess, and retain top-tier talent, the integration of AI tools into recruitment processes has become pivotal. The paper commences by elucidating the transformative impact of AI on traditional hiring practices, emphasizing the efficiency gains, reduced bias, and enhanced predictive capabilities that AI-driven solutions offer. It delves into the utilization of natural language processing, machine learning algorithms, and predictive analytics in the screening and evaluation of candidates, providing insights into the potential to match skillsets and cultural fit more accurately. However, as AI becomes increasingly integral to talent acquisition, challenges and ethical considerations emerge. The paper scrutinizes issues related to algorithmic bias, privacy concerns, and the potential dehumanization of the hiring process. It critically evaluates the balance between automation and the human touch, emphasizing the need for ethical AI practices to mitigate biases and maintain transparency throughout the recruitment lifecycle. Furthermore, the paper examines the implications of AI on workforce dynamics, including the reskilling imperative and the evolving role of HR professionals in managing AI-driven processes. It also discusses the importance of ongoing research, regulations, and industry standards to foster responsible AI implementation in talent acquisition. This review consolidates current knowledge on the role of AI in talent acquisition, providing a comprehensive understanding of the transformative potential and inherent challenges. As organizations navigate this paradigm shift, a nuanced understanding of the opportunities and ethical considerations surrounding AI in talent acquisition becomes imperative for ensuring sustainable and equitable workforce practices.

Keywords:

Artificial Intelligence (AI), Talent Acquisition, Recruitment, Human Resource Management, Machine Learning, Natural Language Processing, Predictive Analytics, Algorithmic Bias.

Introduction

In the rapidly evolving landscape of human resources and talent management, the integration of Artificial Intelligence (AI) has emerged as a transformative force, reshaping the dynamics of talent acquisition. As organizations strive to stay competitive and agile in the digital era, the infusion of AI technologies promises unprecedented opportunities and presents unique challenges in the realm of recruiting and workforce development. This review research paper aims to delve into the multifaceted role of AI in talent acquisition, dissecting the intricate interplay between technological advancements, organizational strategies, and the human element within the recruitment process.

The global business environment is witnessing a paradigm shift in how organizations attract, assess, and retain talent. Traditional recruitment methods are being augmented and, in some cases, supplanted by AI-driven tools and systems. From automating routine tasks to leveraging predictive analytics for candidate assessments, AI promises increased efficiency, objectivity, and scalability in talent acquisition processes. This paper seeks to explore the various facets of AI application in talent acquisition, examining the advantages it offers in terms of cost-effectiveness, time efficiency, and the potential to enhance the quality of hires.

However, alongside these promises lie critical challenges and ethical considerations. The paper will also scrutinize the potential biases embedded in AI algorithms, the impact on candidate experience, and the ethical implications of relying on machines for decision-making in a process traditionally driven by human judgment. By critically evaluating the opportunities and challenges posed by AI in talent acquisition, this research endeavors to provide valuable insights for HR professionals,

A STUDY ON BENEFITS AND PROBLEMS FACED BY ENTREPRENEURS DURING PANDEMIC - A STUDY WITH SPECIAL REFERENCE TO POLLACHI TALUK

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ABSTRACT

This study mainly focuses on the problems faced by the entrepreneurs during pandemic situation. COVID-19 is a massive health crisis but also much more. It is a systemic shock with profound implications, both in the short- and medium- to long-term. This virus has triggered a substantial short-term economic contraction, shuttered many firms, whether big or small, thrown tens of millions out of work, and has other effects on business activities. The objective of the study is to analyze the problems faced by the entrepreneurs during pandemic period. Simple percentage, chi-square test used to analyze the collected data. Some of the findings of the study are Majority of the respondents, 59(49.17%) belong to the age group of 21-30 years. Majority 100(83.3%) of the respondents are male. Most 99(82.5%) of the respondents are married. Majority (50.8%) of the respondents are under graduates. To support these businesses, the government should use different mechanisms by cooperating with wealthy peoples and other non-governmental organizations. Besides, small business owners should manage expectations and communicate with staff, suppliers, banks, and customers throughout this corona virus frightening. Reduce expenses be open to their employees about their finances and keep marketing, use different alternatives to deliver their product, and recover from the crisis.

Key words: Entrepreneurs, Covid 19, Corona virus and SME

I.INTRODUCTION

The small business sector in India employs about 114 million people and contributes to 30% of India's GDP (gross domestic product). It also supplies around half of the country's exports of products and services. Hence, it can be said that more importance should be placed on small- and medium-sized firms and the barriers that they are facing due to the economic slowdown brought upon by the pandemic. Attention must also be paid to the blueprints drawn by firms to overcome these impediments otherwise it is very difficulty them to success in their business activities. Small businesses can overcome the setbacks brought about by economic slowdown through strategies such digitization, innovation and shifting to new business segments. This study is undertaken with an attempt to comprehend the constraints that entrepreneurs have faced during the pandemic and the strategies adopted by them to sustain the lockdown and make a turnabout towards growth and survival. This study also endures to suggest some guidelines which can be beneficial for entrepreneurs and policy-makers.

II REVIEW OF LITERATURE

Papava, (2020) in his study entitled that "The COVID-19 pandemic impact upon housing brokers' workflow and their clients' attitude" suggested that the lockdown was imposed to stop the COVID-19 pandemic, the tourism and passenger transportation sectors were the first to experience problems. This led to the collapse of stock exchanges, which directly affected the real economy.

Papadopoulos et al., (2020) in his studu entitled that "The use of digital technologies by small and medium enterprises during COVID-19: Implications for theory and practice" found that 51% of SMEs believe that digital technologies are essential to ensure their future competitiveness, while two-fifths of management considers them a top priority.



A STUDY ON POLICYHOLDERS PREFERENCE ON CHILD INSURANCE PLAN

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Abstract

Child insurance policies entirely shelter the children's future and facilitate them to achieve major milestones in life. Child plans offer the benefit of waiver of premium, getting rid of the admirable assurance if the policyholder (parent) expires amid policy residency. Child plans also offer a singular amount payout as a death lead to the child on maturity. The present study is intended to find out the policyholders preference for child insurance plan and the factors considered for choosing child insurance plan. The study discloses that majority of the policyholders choose child insurance plan to support children in the absence of parents(s) and for children's medical treatment. Weighted average mean score and Henry garret ranking is applied for analyzing the collected data. The finding of the study also reveals that policyholders are influenced to select the insurance company for low premium with high maturity amount.

Key Words: Child Insurance Company-Child Insurance- Preference of Child Insurance.

I. Introduction

A protected future of a child makes a parent (person) more happy. Everyone presume to a standard of living with a good health, well being of himself and his family, especially of their children. Child insurance plan gives the freedom to have the benefit of these with the child for the reason that his tomorrow is in safe hands. Child insurance plans supports in money at critical milestone in children's carrier path, higher education, children's marriage and absence of parents. Having child insurance plan is fully protected and secured and the insurance company continues to pay the premium even in the absence of the parents.

II. Review of Literature

The studies which are carried out earlier are reviewed in the following paragraph.

Dave krunal (2021) "Impact of Covid 19- customer preference life insurance sector in India" The study concluded that policyholders still prefer public sector companies as compared to private sector companies and the policyholders have pension plans and child benefits plans respectively.

Raju (2020) "A study on customer preferences in life insurance industry in India" customer preference regarding plans & agency, their cause of purchasing the insurance regulations, satisfaction degree & their destiny plans for brand spanking new insurance coverage. **P. Dhanalakshmi**(2018) "Awareness and preference level of LIC policyholders in selected school teachers of Madurai district" . The school teachers are well aware about the life insurance schemes selection and mostly prefer the tax benefits life insurance schemes. **Reenadevi** (2018)" A comparative study of perception and preference of policyholders towards products offered by LIC and SBI Life Insurance Companies in Haryana". The study concludes that demographic variables play a major role in understanding the perception of customer and there is no difference in the preferences of the policyholders of the LIC and SBI Life. **Sunayna Khurana** (2014)" customer preferences in life Insurance Industry in India". The Present Study confirmed that only 56.3 % respondents are ready to buy new insurance plans from same company.

**A STUDY ON BENEFITS OF INFORMATION AND COMMUNICATION TECHNOLOGY
AMONG YOUNG ENTREPRENEURS - A STUDY WITH SPECIAL REFERENCE TO
POLLACHI TALUK**

Dr.M.Deepa

ABSTRACT

Information and communication technology has become a potent instrument to developing countries for transforming social, economic, and political life of the people and for instituting sustainable participatory development frameworks. Information and communication technology and e-business applications provide many benefits across a wide range of intra- and inter-firm business processes and transactions. Information and communication technology consist of a number of components including skills of accessing, recording, arranging, manipulating and presenting data or information using tools and software. The objectives of the study is to identify the level of benefits enjoyed by the entrepreneurs while applying ICT in their business activities. Totslly there are

INTRODUCTION

Information and communication technology has become a potent instrument to developing countries for transforming social, economic, and political life of the people and for instituting sustainable participatory development frameworks. Information and communication technology and e-business applications provide many benefits across a wide range of intra- and inter-firm business processes and transactions. Information and communication technology consist of a number of components including skills of accessing, recording, arranging, manipulating and presenting data or information using tools and software. Electronic commerce, commonly known as e-commerce, consists of the buying and selling of products or services over electronic systems such as the internet and other computer networks.

REVIEW OF LITERATURE

Fang Zhao (2007)⁸ in his study entitled “Issues and challenges facing e-entrepreneurship and e-innovation” concluded that e-entrepreneurship and e-innovation have become emerging disciplines for proactively responding to changes in the e-business world. One of the key issues facing e-entrepreneurship and e-innovation today, as demonstrated by the case studies in this paper is that e-business needs to respond closely to market needs and gain market credibility. Another key issue is that there should be credibility built within the e-business marketplace before inception of the business. In addition, the intangibility of an online service needs to be addressed in order to build brand awareness.

J. Hashim (2007)⁹ in his study entitled “Information communication technology (ICT) adoption among small and medium enterprises owners in Malaysia”, found that the language barrier is also an important factor for SME owners. Most of the sites use english as a medium for communications and the Small and Medium enterprises owners are mostly familiar with the local language.

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A STUDY ON FACTORS INFLUENCING BUYING BEHAVIOUR OF ECO-FRIENDLY PRODUCTS

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ABSTRACT

During the past decade, concern for the environment has emerged as a major socio-political issue among developed nations throughout the world and the increase in the number of environmentally friendly or 'green' products has been significant. The purpose of this study was to factors influencing consumer buying behavior on eco-friendly products. One of the main findings of the research was that consumers ranked No use of pesticides as the first features of eco-friendly products followed by the No preservatives or additives, less environmental impact while manufacturing products and so on The analysis result indicates that, consumers mostly purchase soaps, organic food, ayurvedic medicine, salt, healthcare/ cosmetic products and energy efficient laptop.

KEYWORDS:

Customer – Perception – Eco-friendly products

INTRODUCTION

In today's business world environmental issues plays an important role in marketing. All the governments around the world have concerned about green marketing activities that they have attempted to regulate them. There is escalating awareness among the consumers all over the world concerning protection of environment. Various studies by environmentalists indicate that people are more concerned about the environment. Now most of the consumers, both individual and industrial are becoming more concerned about environment-friendly products.

As a result, green marketing has emerged, which aims at marketing sustainable and socially responsible products and services in the society. This has become the new mantra for marketers to satisfy the needs of consumers and earn better profits. The issue of environmental protection has brought the consumers, the industry, and the government to a common platform where each has to play its own role. The government and legislatures are using their influence to reduce environmental and health hazards due to industrialization and to stimulate the development of cleaner technologies. The time has come for consumers to take the lead in prompting manufacturers to adopt clean and eco-friendly technologies and environmentally-safe disposal of used products, along with preventive and mitigate approaches. To increase consumer awareness, the Government of India launched the eco-labeling scheme known as 'Ecomark' in 1991 for easy identification of environment-friendly products. Any product which is made, used or disposed of in a way that significantly reduces the harm it would otherwise cause the environment could be considered as Environment-Friendly Product. The criteria follows a cradle-to-grave approach, i.e. from raw material extraction, to manufacturing, and to disposal. The 'Eco mark' label is awarded to consumer goods which meet the specified environmental criteria and the quality requirements of Indian Standards. Any product with the Eco mark will be the right environmental choice.

Green consumers are defined as those who avoid products that are likely to endanger the health of the consumer or others; cause significant damage to the environment during manufacture, use or disposal; consume a disproportionate amount of energy; cause unnecessary waste; use materials derived from threatened species or environments. Green marketing was given prominence in the late 1980s and

**CUSTOMERS' EXPERIENCE TOWARDS DIGITAL PAYMENT METHODS AND
TRANSACTIONS FAILURES, A STUDY COVERING SELECTED RESPONDENTS OF
UDUMALPET TALUK**

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College of Arts & Science, Udumalpet.

Mr Rajagopalan S, Part-time Ph.D Scholar, PG and Research Department of Commerce,
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ABSTRACT

Digitalization spreads its application to all the areas irrespective of the nature. It has its application in finance and e-Commerce industry also. Most of the stores, retail outlets and business points started accepting digital money. Digital payment methods includes cards, internet banking, UPI and so on. The present study aims at exploring customers experience on using digital payment methods and transactions failures and it covers the selected respondents of Udumalpet taluk. The sample of 140 respondents was determined based on convenient sampling and the data were collected through Google forms. The data was analysed using statistical methods. The results showed that the most of the customers use digital payment methods due to its convenience. Almost two-third of the total respondents use digital payment methods for food and beverages. But, customers do not try to understand the updated terms and conditions and they are not aware of payment gateway processing. Some payments get failed but amount debited which annoys the customers more. Also, they expect support from payment solutions internally. It has further scope to research reasons for transaction failures separately.

KEYWORDS Digital payment methods, Transaction failure, Accuracy and speed in digital payments, Payment solution and Payment gateway.

1. INTRODUCTION

Digitalization in banking and payment services is really a boon for individuals, business organizations, financial institutions, non-profit organizations and government. It made the processing of payment very simple and convenient. It also helps in sorting out the issues and challenges involved in making payments online. Many merchants started accepting online payments. Many education institutions started accepting online fee remittances. Healthcare services and entertainment industry also adopted digital payment services.

The aim of the current study is to understand the experiences of customers who access digitized financial services. Also, it attempts to explore the customers' experiences in case of transaction failures. The study covers the population from Udumalpet taluk from which the sample size of 140 respondents is drawn for collecting data. For sample selection, Convenient sampling method was devised.

Research Gap

The previous researches tried attempts to demonstrate the attitude, awareness, perception and satisfaction. But, the present study focuses on the customers' experiences towards digital payment methods and transactions failure. The study also has further scope to research selected digital payment method to analyze and conclude the specific areas. The study is subject to time constraint and small amount of statistical errors. But the due care was taken to analyze the data.

2. REVIEW OF LITERATURE

Amarinder Singh et.al (2020) attempted to explore A Study on Digital Payment Awareness and Usage in India. Digital payments become familiar trend in almost every sector in India. Several initiatives by the government such as Digital India movement, results in internet penetration in the country and it creates more awareness among the people towards digital payments. One of the major factors which influences the adoption of the digital payment is the demonetisation decision

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Abstract

India is the world's biggest two-wheeler producer. In India, the two-wheeler industry makes about 7% of the country's manufacturing GDP. Additionally, it accounts for 2% of GST receipts. India is thought to have about 190 million two-wheelers. At the moment, more than 80% of India's total automotive production is two-wheelers. The installed production capacity for two-wheeler manufacturers in India is more than 25 million units. The motorcycle and scooter segments make up the majority of the two-wheeler market. The present study has been carried out to identify the customer preference towards two wheelers in Coimbatore district. The study mainly depends on primary data, which was collected from 312 Customers in Coimbatore district. The data has been collected by distributing the questionnaire. A convenient sampling method is adopted to select the sample Customers. The collected data are analyzed using simple percentage and weighted average to process the data and draw inferences.

Keywords:

Two-wheeler, Customer Preferences, Coimbatore District

INTRODUCTION

India's growth and development are significantly influenced by the two-wheeler sector. One of the key factors influencing economic growth has been identified as the two-wheeler industry, which is a pioneer in manufacturing product and process technology. The Indian economy has been expanding at a rate of about 8% during the previous few years. When it comes to producing two-wheelers, India has a competitive cost edge. It has made enormous strides in terms of implementing new technology, and spreading flexibility has altered the business environment. The two-wheeler sector currently satisfies both the needs of Indian customers and those of customers worldwide. The two-wheeler industry is currently exhibiting signs of matching both the growth of the Indian market and the quickening expansion of its position on the global market.

In 2022, 18 million units of two-wheelers were sold in India. The market is anticipated to develop at a compound annual growth rate (CAGR) of 17.80% from 2023 to 2028, according to projections made by IMARC Group. A few of the main reasons propelling the market include the rising personal car ownership trend, customers' growing concerns about high levels of traffic pollution, and the growing travel and tourism industry.

A number of Indian-specific facts have contributed to the trend of two-wheeler ownership. Poor public transportation in many places of India is one of the main contributing reasons. Additionally, two-wheelers provide the Indian family with a great degree of ease and mobility. Due to India's expanding middle class, which is made up of millions of people who can buy a basic two-wheeler, two-wheelers are currently driving the process of mass motorization.

With overcrowded public transport and social distancing norms in the post-Covid era, people prefer to commute in their own vehicles. This is where bikes and two-wheelers have gained tremendous popularity, especially in tier 2 and tier 3 cities where public transport might not be very convenient and easy to use.

Bikes are not only cheaper, or low maintenance but they also have a long life. They give you the feeling of freedom to explore speeds and roads. They not only provide thrill and adventure but also a stress-free drive. They give you energy and the chill which lets you explore new roads and cities.

CERTIFICATE OF PUBLICATION

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**CONSUMER SATISFACTION TOWARDS TWO WHEELERS IN COIMBATORE
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ABSTRACT

The two-wheeler business has grown significantly in the last several years, and Coimbatore District has become a major market for this industry. The purpose of this study is to investigate and evaluate Coimbatore District consumers' satisfaction with two-wheelers. In order to collect thorough data, the research uses a mixed-methods strategy that combines quantitative surveys and qualitative interviews. In order to get quantitative information from a wide sample of Coimbatore District two-wheeler owners, a structured questionnaire has been developed. Aspects including after-sales service, product features, brand perception, and general satisfaction levels are all covered in the poll. A minority of respondents will also participate in in-depth interviews. This study uses a thematic analysis approach to find trends and topics that either help or impede consumer happiness in the two-wheeler sector. In order to determine whether demographic variables like age, gender, income, and employment have a major impact on consumer satisfaction, the research also takes these elements into account. The study attempts to give a nuanced picture of the varied consumer landscape in Coimbatore District by looking at these characteristics. The results of this study should provide manufacturers, marketers, and legislators in the two-wheeler sector with insightful information. Gaining a better understanding of customer satisfaction is essential for expanding product offers, raising the caliber of services, and building brand loyalty. The study's findings can help guide strategic choices meant to enhance customer satisfaction and maintain the expansion of the two-wheeler market in the Coimbatore District.

Keywords: Consumer satisfaction, Two-wheelers, Coimbatore District

Introduction

The industry for two-wheelers has grown remarkably in the last few years, which is indicative of the growing dependence on these vehicles for personal mobility. The southern Indian district of Coimbatore has seen a sharp increase in customer demand, making it a major two-wheeler market. In order to comprehend and solve the issues influencing customer satisfaction in this dynamic market, producers, marketers, and policymakers face both opportunities and problems as a result of this growth. Any industry must prioritise customer happiness, and the two-wheeler market is no different. In order to adapt their products and services to the changing wants and preferences of Coimbatore District consumers, producers and marketers must have a thorough understanding of the elements that either help or impede customer happiness.

The purpose of this study is to examine the nuances of Coimbatore District consumers' happiness with two-wheelers. Using a mixed-methods approach that combines qualitative interviews with quantitative surveys, the study aims to give a thorough understanding of the different factors impacting consumer choices and experiences after making a purchase. Essential elements including product attributes, post-purchase servicing, and brand perception are covered by the structured questionnaire used in the quantitative phase. In order to evaluate the influence of demographic factors on customer satisfaction, factors such as age, gender, income, and occupation will be taken into account. The goal of this investigation into demographic variables is to identify patterns and trends in the varied consumer environment in the Coimbatore District.

It is anticipated that the research's conclusions will be beneficial to industry participants, providing knowledge that can guide strategic choices. Manufacturers may improve service quality, expand their product options, and foster brand loyalty by getting a better grasp of consumer satisfaction. The ultimate goal of this study is to provide useful insights derived from a thorough investigation of



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A STUDY ON PRE –PURCHASE BEHAVIOUR OF WORKING WOMEN TOWARDS SELECTED WHITE GOODS IN POLLACHI TALUK

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ABSTRACT

One of the most essential components of modern business knows how working women behave in the marketplace. It is the study of the variables influencing working women' decisions, behaviours, and attitudes—from making purchases to influencing others. Businesses can make more profitable and successful business decisions by gaining a deeper understanding of their working women through the analysis of this behaviour.

Businesses can determine the needs, preferences, and motives behind customers' purchases by doing consumer behaviour research. Businesses can create efficient marketing strategies to satisfy consumer requests and raise customer satisfaction by learning why people purchase particular goods or services. Long-term sales stability is ensured, and a deeper understanding of clients is fostered by comprehending consumer behaviour. Pre-purchase behaviour actually includes an understanding of the consumer's set of decisions. The objective of the study is to analyze the demographic profile of the working women and study the pre-purchase behaviour of the working women in Pollachi taluk. The sample taken for the study is 100. A well-structured questionnaire is used to collect the data of the working women in Pollachi taluk.

Key words:

Pre-purchase , consumer behaviour and white goods

Introduction:

Research on consumer behaviour is consulted by corporations, political campaigns, and charitable groups to decide how best to promote goods, people, or causes. Sometimes they do this by playing on people's worries, their unhealthy routines, or their worst inclinations. Furthermore, buyers may be their own worst enemies by acting rashly and making decisions based on emotion, poor reasoning, or a transient desire for social status. However, customers do not have to be helpless: by being more knowledgeable about the many tactics used by businesses and the reasons behind people's frequently confusing purchase decisions, people may make more deliberate judgments about what, why, and if to buy.

People in industrialized nations spend most of their money on non-essentials and only a small percentage on necessities. Buying decisions driven more by desire than necessity are frequently irrational and instead are shaped by trends, personality, and emotion. Marketers constantly research how people and groups make decisions about what to buy and react to marketing strategies in order to stay competitive.

Statement of the problem:

In business world, many brands of products are produced and marketed by a single manufacture. The decision whether to buy or not depends only on the basis of consumer motives. Modern market is consumer oriented and now the consumer is the decisive force. Hence, it is inevitable to have a study thorough study on customers' attitudes and preference towards demographic profile of the working women and study the pre-purchase behaviour of the working women in Pollachi Taluk. Therefore, this study is mainly analyzing the consumer pre –purchase behaviour with help of questionnaire

A DESIGN AND IMPLEMENTATION FOR AUTOMATIC WASTE SEGREGATION USING DEEP LEARNING TECHNOLOGY

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Abstract: This paper proposes a machine to segregate waste into different parts using ConvoWaste, a smart object detection algorithm based on Deep Convolutional Neural Network (DCNN) and image processing techniques. The system classifies waste precisely, placing detected waste into corresponding bins using a servo motor-based system. Ultrasonic sensors in each bin and dual-band GSM-based communication notify authorities of bin levels and optimal trash-out times. The entire system is controlled remotely via an Android app, automating waste disposal to desired locations. Utilizing this system aids recycling and resource optimization, contributing to a circular economy. Additionally, the system offers low-cost services with high accuracy, leveraging advancements in Artificial Intelligence (AI) technology.

Key words: DCNN, GSM, AI, Ultrasonic Sensor, ConvoWaste Model

I. INTRODUCTION

Urban waste management refers to the processes and actions required to manage waste from inception to final disposal, ensuring a clean environment and proper resource utilization. Waste is generated daily through various activities such as industrial, household, and medical activities. Manual waste management is difficult, time-consuming, and costly due to the large volumes of waste generated. This necessitates the implementation of automatic waste management systems to recycle, reuse, and reduce waste production. According to [1], in the European region, 56% or 423 million tons of generated waste was recycled domestically in 2016, while 24% or 179 million tons was deposited in landfills. This paper highlights the importance of proper waste management systems for waste recycling processes. Utilizing modern technology alongside effective waste management systems can yield numerous benefits if implemented correctly.

Mentioned in [2], the circular economic system aims to increase resource utilization efficiency to enhance a country's overall economy and environmental sustainability. The main concept of circular economy (CE), defined in [3], focuses on managing resource circularity, efficiency, and optimization by utilizing waste as resources to create economic value. CE encompasses both natural and human resources. Proper urban waste management is highlighted as one of the most challenging constraints for developing and undeveloped countries by the United Nations (UN), as suggested in [4].

In Saibaba Colony, the area in Coimbatore, 3500 tons of mixed solid waste are produced daily. Unfortunately, only 1800 tons of this waste are collected and disposed of properly using conventional labor-intensive methods. The remaining waste either remains uncollected or accumulates in backyards or landfills [5]. To address waste management issues and environmental sustainability concerns, waste segregation machines were introduced to prevent pollution caused by mixed waste. Initially, these machines relied solely on different types of sensors to classify waste into categories such as dry, wet, and metal waste [6]. However, the proliferation of urbanization and socialization has altered the approach to managing large amounts of waste, moving away from sensor-based applications. Instead, recent advancements in AI technology, particularly in Deep Convolutional Neural Networks (DCNN) and image processing, have revolutionized waste segregation machines. This paper proposes a system

AN INTELLIGENT GARBAGE SORTING SYSTEM BASED ON EDGE COMPUTING

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Abstract: The development of an Intelligent Garbage Sorting System, particularly focusing on distinguishing between biodegradable and non-biodegradable waste, represents a significant advancement in waste management. By harnessing the capabilities of Edge Computing, this system aims to revolutionize the sorting process by bringing computational power closer to the source of waste generation. Utilizing sensors and machine learning algorithms deployed at the edge, the system can rapidly and accurately categorize incoming waste into biodegradable and non-biodegradable categories in real-time. This innovative approach offers numerous benefits. Firstly, by processing data locally, the system reduces latency and dependency on centralized infrastructure, enabling swift decision-making and response times. Secondly, it enhances the overall efficiency of waste sorting operations by minimizing the need for human intervention and ensuring precise classification, thereby optimizing recycling and composting processes. By seamlessly integrating Edge Computing with intelligent garbage sorting, this system paves the way for more sustainable and environmentally-conscious waste management practices. The integration of Region-based Fully Convolutional Network (R-FCN) into an Intelligent Garbage Sorting System, leveraging Edge Computing, represents a cutting-edge approach to efficiently classify biodegradable and non-biodegradable waste. By deploying R-FCN at the edge, the system can accurately identify and categorize various types of waste in real-time based on their spatial regions. This innovative combination not only enhances the speed and accuracy of waste sorting processes but also minimizes reliance on centralized infrastructure, thereby promoting sustainable and responsive waste management practices.

Key words: Biodegradable, Non-Biodegradable, Edge Computing, R-FCN

INTRODUCTION

Intelligent garbage sorting systems represent a pivotal advancement in waste management, aiming to enhance efficiency and sustainability in handling biodegradable and non-biodegradable waste streams. Leveraging the capabilities of Edge Computing has emerged as a promising avenue to address the challenges associated with traditional centralized approaches. By bringing computational power closer to the point of waste generation, Edge Computing enables real-time processing and decision-making, thereby revolutionizing sorting processes. In this context, the integration of Region-based Fully Convolutional Network (R-FCN) into such systems holds immense potential, offering a sophisticated method to accurately categorize waste based on spatial regions.

Region-based Fully Convolutional Network (R-FCN) represents a state-of-the-art deep learning architecture specifically designed for object detection tasks. Unlike traditional convolutional neural networks (CNNs), R-FCN excels in precisely localizing objects within images by dividing them into a set of regions of interest (ROIs) and applying convolutional operations selectively to each region. This enables more efficient processing and higher accuracy in identifying objects, making it an ideal candidate for garbage sorting applications. By integrating R-FCN into an Edge Computing framework, the sorting system can analyse waste materials in real-time, distinguishing between biodegradable and non-biodegradable items with unprecedented accuracy and speed.

The convergence of Edge Computing and R-FCN-based intelligent garbage sorting systems heralds a new era in waste management practices. By harnessing the power of localized computation and advanced deep learning techniques, these systems offer significant improvements in waste sorting efficiency, resource utilization, and environmental sustainability. Moreover, the ability to deploy such systems at the edge reduces reliance on centralized infrastructure, making them adaptable to diverse environments and scalable for widespread implementation. As such, the integration of R-FCN into Edge Computing-based garbage sorting systems represents a transformative solution to the pressing

DEEP LEARNING APPROACH IN SEPARATION OF BIODEGRADABLE AND NON-BIODEGRADABLE WASTE USING FASTER R-CNN

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ABSTRACT

Solid waste management plays a crucial role in the Smart City and Clean India mission by effectively separating waste into recyclable and energy-generating categories. Manual waste separation is risky and time-consuming, so an automated system is proposed in this paper. When waste is thrown into a dustbin, an image is captured and compared with a dataset using the Faster R-CNN algorithm. The dataset includes various objects such as food, plants, fruits, plastics, metals, batteries, paper, and cardboard, each labeled accordingly. OpenCV and TensorFlow are used to analyze the captured image and determine whether the object is biodegradable or non-biodegradable, drawing a boundary box around it. This research extends to the future by considering the conversion of separated biodegradable waste into energy through biomethanation plants. The goal is to reduce landfill waste to less than 5%, which would significantly benefit the overall ecosystem and environment by preventing pollution. Coimbatore's proximity to the Western Ghats, an important hotspot, highlights the significance of solid waste management in preserving the environment and receiving the southwest monsoon. Implementing automated waste categorization systems and promoting sustainable waste management practices are crucial for achieving the objectives of the Smart City and Clean India mission, leading to a cleaner and greener environment.

Keywords : Faster R-CNN, OpenCV, TensorFlow, Biomethanation, Biodegradable, Non-Biodegradable

INTRODUCTION

Importance of Solid Waste Management

Solid waste management is of paramount importance in India due to several reasons. Firstly, India has a rapidly growing population and urbanization rate, leading to increased generation of waste. Effective waste management is crucial to prevent environmental pollution, health hazards, and the spread of diseases. Secondly, improper solid waste management has adverse effects on the environment. Open dumping and burning of waste contribute to air, water, and soil pollution. It also leads to the emission of greenhouse gases, exacerbating climate change. Furthermore, solid waste management plays a crucial role in conserving natural resources. Recycling and proper disposal of waste can help reduce the demand for raw materials,

promote resource efficiency, and contribute to sustainable development.[1]

Additionally, solid waste management has social and economic implications. It provides employment opportunities in waste collection, segregation, recycling, and waste-to-energy projects. Effective waste management also enhances the quality of life by creating clean and healthy living environments. Given these reasons, the Indian government has recognized the importance of solid waste management and has implemented various initiatives and policies to address the issue. These include the Swachh Bharat Abhiyan (Clean India Mission), waste segregation at source, promoting recycling and composting, and establishing waste treatment and disposal facilities.[2]

A STUDY OF YOLO V7 ALGORITHM TO PREDICT BIODEGRADABLE AND NON-BIODEGRADABLE SOLID WASTE

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Abstract: Solid waste management plays a crucial role in the Smart City and Clean India mission by effectively separating waste into recyclable and energy-generating categories. A Manual waste separation is risky and time-consuming, so an automated system is proposed in this paper. When waste is thrown into a dustbin, an image is captured and compared with a dataset using the Faster R-CNN algorithm. The dataset includes various objects such as food, plants, fruits, plastics, metals, batteries, paper, and cardboard, each labelled accordingly. OpenCV and TensorFlow are used to analyse the captured image and determine whether the object is biodegradable or non-biodegradable, drawing a boundary box around it. This research extends to the future by considering the conversion of separated biodegradable waste into energy through Bio-Methanation plants.[4] The goal is to reduce landfill waste to less than 5%, which would significantly benefit the overall ecosystem and environment by preventing pollution. Coimbatore's proximity to the Western Ghats, an important hotspot, highlights the significance of solid waste management in preserving the environment and receiving the southwest monsoon. Implementing automated waste categorization systems and promoting sustainable waste management practices are crucial for achieving the objectives of the Smart City and the Clean India mission, leading to a cleaner and greener environment. [3]

Keywords: Faster R-CNN, OpenCV, TensorFlow, Bio-Methanation, biodegradable, non-Biodegradable

INTRODUCTION

In Tamil Nadu more than 59 % of waste ends up in landfills that contaminate the soil, ground water and emit dangerous greenhouse gases. The manual separation of biodegradable and non-biodegradable wastes can't succeed. The TN government constructs Bio-Methanation Plant to generate energy from Biodegradable waste constructed at Bharathi Park, Coimbatore which generates 150 – 170 Unit of electricity per day. The main problem is that the unit can't get biodegradable waste in proper manner. The aim of the project is to use 99 % in an effective manner without ends up in landfills. [1] This can be achieved by separating the waste in two different mediums to recycle and generate energy. This research is focused on this area to make India as a success in Smart City mission and Clean India. Waste management places a vital role in the Smart city and Clean India mission that can be achieved by separating the solid waste into two medium and make use of those waste effectively for recycling and energy production. The management activity performed on solid waste management will safe guard the environment in a healthy way. At present 59 % of waste are ends in landfills in India which become a main source on affecting the eco system and environment. This can be reduced from 59 % to less than 5 % by using recycling and WtE project. [2]

The purpose of using Deep Learning is to predict the type of waste by attaching the camera in the dustbin which will capture the image of the waste material thrown into the dustbin. The API will be trained by MS COCO dataset (Common Object in Context) which will be compared with the captured image to predict a level of waste medium.

- Medium 1 – Waste for recycle (plastic, metal, glass)
- Medium 2 – Waste for producing energy by using WtE (Waste to Energy) project.



GRANULATED RCNN AND MULTI-CLASS DEEP SORT FOR BIODEGRADABLE AND NON-BIODEGRADABLE SOLID WASTE DETECTION

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ABSTRACT:

Solid waste management (SWM) is a major problem for many urban local bodies (ULBs) in India, where urbanization, industrialization, and economic growth have resulted in increased municipal solid waste (MSW) generation per person. Waste management reduces greenhouse gas emissions and improves the quality of air and water, and the condition of any area affected by the waste. This can be overcome by separating the solid waste into two separate medium. The first one will collect the biodegradable waste such as paper, vegetable and fruit waste which can be converted in to energy by using Biomethanation plant. The second one will collect non-Biodegradable waste such as plastic, can, bottles which can be used for recycling purposes. The Biodegradable and Non-Biodegradable wastes separation should be implemented in automatic manner by applying granulated RCNN (G-RCNN) and multi-class deep SORT (MCD-SORT) to predict the type of waste item in accurate manner. The waste material detection has two stages: waste object or material localization (region of interest ROI) and classification. In deep convolution neural network, the G-RCNN is an improved version of the well-known Fast RCNN and Faster RCNN which helps to extract RoIs by incorporating the unique concept of granulation. Granulation with spatio-temporal information enables more accurate extraction of RoIs (waste object regions) in unsupervised mode. Compared to Fast and Faster RCNNs, G-RCNN uses (i) granules (clusters) formed over the pooling feature map, instead of its all feature values, in defining RoIs, (ii) only the positive RoIs during training, instead of the whole RoI-map, (iii) videos directly as input, rather than static images, and (iv) only the objects in RoIs, instead of the entire feature map, for performing waste object classification. All these lead to the improvement in real-time detection speed and accuracy. MCD-SORT is an advanced form of the popular Deep SORT. In MCD-SORT, the searching for association of objects with trajectories is restricted only within the same categories. This increases the performance in multi-class tracking.

KEYWORDS:

BIOMETHANATION PLANT, RCNN, MCD-SORT, ROI, BIODEGRADABLE.

INTRODUCTION

The objective of this paper is to predict the waste item category by capturing image and collects in separate chambers. The camera placed inside the dustbin will capture the image of the waste item. The Raspberry pi helps to compare the image with the dataset in the cloud. The Artificial Intelligence concept is applied to train itself to find the captured waste item category. The image classification algorithm is applied using Tensor Flow in executing digital image processing to find the corresponding chambers for waste collection. The Tensor Flow is a Python friendly open source library for numerical computation that makes machine learning concepts in an efficient manner. The algorithm will be trained with all types of waste material and thus while throwing the waste into the dustbin, it get predicted and as per the prediction the corresponding chamber opens to collect waste. The project helps in collecting waste in different chambers by detecting biodegradable and non biodegradable waste. The manual collection of waste can be overcome therefore the collection of waste can be computerized and accuracy level will be more. This will

decrease the percentage of non biodegradable waste into land which increases the land water and overcome the pollution. The waste management places a vital role in Smart city and Clean India mission that can be achieved by separating the solid waste into two medium and make use of those waste effectively for recycling and energy production.

PROBLEM STATEMENT

Most recyclable waste ends up in a dump yard due to the lack of efficient waste management. Waste management rules in India are based on the principles of "sustainable development", "precaution" and "polluter pays". These principles mandate municipalities and commercial establishments to act in an environmentally accountable and responsible manner—restoring balance, if their actions disrupt it. The increase in waste generation as a by-product of economic development has led to various subordinate legislations for regulating the manner of disposal and dealing with generated waste are made under the umbrella law of Environment Protection Act, 1986

A COMBINED POC- HBCR TECHNIQUE USING BLOCK CHAIN AND DEEP LEARNING FOR FAKE NEWS DETECTION AND PREVENTION

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Abstract

The detection and suppression of rumors and false information continues to be a significant challenge for researchers and architects of social networks. Verifying information legitimacy and dependability is in fact a crucial security requirement for social network platforms because the majority of users in social media typically spread newsworthy material. Block chain technology and machine learning have significantly advanced society in general and the field of artificial intelligence in particular, especially in terms of human vision. The leadership of block chain technology has been expanded to a number of industries that support significant developments in the artificial smart and machine network. Fake news is becoming prevalent in today's society. It is now simpler than ever to create and manufacture fake information because there is such a wide selection of free stuff available. It is feasible to create a prediction system and expand the scope of the classification of the news by combining block chain technology with machine learning for fake news identification and prevention. The Proof of Credibility (PoC) block chain-based strategy is introduced in this paper along with proposed HBCR (hybridized BERT, CNN, and RNN model), a deep learning model for identifying fake news and preventing its spread through social networks. On a fake news dataset of noteworthy tweets gathered from various news sources on Twitter, the functionality of the PoC protocol has been evaluated and tested using FAKE NEWS dataset. The findings showed that the suggested technique was effective in identifying rumors and preventing their spread. According to this new research, a suggested Deep learning framework and increased usage of block chain technology could help stop the spread of fake news by enabling content creators to concentrate on areas where the false information is most likely to cause harm to the general population.

Keywords: Block chain technology, Proof of Credibility (POC), social networks; fake news detection, deep learning, machine learning, HBCR technique.

1. Introduction

The development of decentralized apps, where security is a major concern, is now possible thanks to block chain technology. Any transaction that has ever been made is forever recorded here. Some unreliable sites have published phony and alluring news articles over the years. Since there are no regulatory frameworks in place, it is impossible to confirm this story. As a result, these unreliable sources are free to publish whatever they want, which occasionally even throws society into disarray. Unsuitable news can now spread more fast than ever before thanks to social media and the ease with which it is now possible to access the internet. Fake news might occasionally be more appealing than the truth. People end up being misled as a result. A new

HYBRIDIZED CNN-RNN-LSTM DEEP LEARNING TECHNOLOGY FOR FAKE NEWS DETECTION IN SOCIAL MEDIA

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Abstract: In today's culture, social media is the main way that people absorb news because it is the simplest and most convenient way for individuals to share news with one another. However, there's a danger that this will lead to the widespread dissemination of erroneous information. These erroneous reports have an adverse effect on both the person and society as a whole. These false reports undermine morality and encourage crime, which worsens people's mental and physical health as well as the spread of infections. In order to prevent the spread of misleading information, it is imperative to halt it at the source. We can only do this if there is proof that the news being reported is true and trustworthy. This can be done only if there is proof that the news being reported is true and trustworthy. In order to produce a flawless output, the aim of this paper is to generate real news and detect fake news with the highest degree of accuracy. As a result of previous survey carried out, a hybridized system utilizing CNN, RNN, and BERT have been proposed for fake news classification. In this proposed framework the BERT algorithm is used for extracting features from the news stories being posted. CNN machine learning classification technique is used in this proposed system to train the dataset, and RNN-LSTM classification algorithm is utilized to classify and detect fake news by cross-verifying it with other datasets. The results obtained shows that the proposed hybridized system work well for fake news classification and gave us an average accuracy of 99%.

Key words: CNN, RNN, BERT, fake news detection, evaluation metric, accuracy.

INTRODUCTION:

Numerous emerging technologies aid in our understanding of how people behave in this technological age. Human-machine contact was simply a fiction up to this point. A vast heavenly body, a civilization of living beings all across the world, and a tie that ties us to the same continent are all present. It gives us a large society to live in and ties us together because we share the same planet. This civilization is being built by a group of individuals with the authority to dominate a particular territory. Society is surrounded by a variety of elements, including people, the environment, and numerous sectors that could help people become better. The state's government establishes a set of rules that the populace must follow in order to keep an eye on these behaviors. The development of security policy by the government may benefit from several emerging technologies. Artificial intelligence, which was initially described by John McCarthy in 1955, is one of the most widely used technologies. Later discoveries included predictive analysis, neural networks, natural language processing, machine learning, and deep learning. Each discipline has made tremendous advancements as a result of the advent of new technologies. As a result, these technologies have been incorporated into every government policy that might be advantageous to the populace. Information that has been purposefully misrepresented or fraudulently asserted to be factual is referred to as fake news.

These stories are commonly used to support web publications because they have the potential to influence public opinion, advance political agendas, or simply confuse people. This topic was chosen because it is evolving into a major social issue. As a result, there are riots, lynchings, and a toxic internet atmosphere. A tool that can identify whether a certain piece of information is accurate or false and give users a sense of its authenticity so they may choose whether or not to take action is critically needed because fake news has the potential to be harmful. RNNs and Convolutional Neural Networks (CNN) are two examples of complex learning methods that are frequently employed to identify muddled representations.

To analyze sequential data, LSTM, a tree-coordinated discontinuous neural connection, is used. The front-to-back and back-to-front viewing of specific sequences is possible because to the bi-directional LSTM. The model's presentation is evaluated using easily accessible FAKE datasets of

A REVIEW ON BLOCK CHAIN TECHNIQUES FOR FAKE NEWS DETECTION IN SOCIAL MEDIA

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Abstract: The block chain is a relatively new piece of computer science technology. In recent years, interest in the Research and Scientific Industry has increased. Cryptocurrency is the first application to which it has drawn attention. Block chain acts as an unchangeable distributed ledger that conducts business with unreliable users in a decentralized network. It creates a novel distributed architecture without a centralized authority that uses smart contracts to execute transactions and communicate states. Block chain applications include Internet of Things, financial services, risk management, reputation systems, and online wallets based on crypto currency. This essay intends to disseminate information regarding the expanding significance of block chain technology in practical applications. Additionally, this study compared standard consensus algorithms with block chain's fundamental elements and technology.

Key words: Block chain, Fake News, Fake News Detection using block chain, consensus algorithm, block chain approaches..

INTRODUCTION:

Block chain is less complicated than other technology subjects like artificial intelligence, machine learning, etc. However, it is also significant since Block chain includes so many various components of differing degrees of complexity. They initially allow a group of users to record transactions in a distributed ledger that is only accessible to that group, ensuring that once a transaction is published, it cannot be modified. Block chain can be compared to a public, unchangeable ledger where all transactions must be committed to before being saved and where data is kept in a chain of blocks. When fresh blocks are added to the chain, it continues to climb. These features of block chain allow it to save money and increase efficiency dramatically.

Block chain has a much wider range of applications than cryptocurrencies do. It enables payments to be made without the use of a bank or arbitrator. Many financial services, including online payments, digital assets, remittance, etc., employ block chain technology. Other applications for block chain technology include managing medical records, banking transactions, notary services, user identity verification and status, data tracking, etc. [5] and internet interaction-based systems, including security services, secure transactions, smart contracts, public services, internet of things (IoT), etc. In order to understand how the block chain functions in general, this paper compares the normal consensus algorithm to the block chain, explores its uses, and clarifies some common misconceptions.

It demonstrates that there are alternatives to bitcoin, like as Ethereum, that are available on the market. As a result, the Ethereum and Litecoin implementation process was initiated by the block chain application developer. The technological features of block chains, their security, and their applicability are the main topics discussed in this article.

Block chain technology Overview

It is a method of storing data in a digital ledger in which a chronological chain of groups of valid transactions, known as blocks, is formed, with each block being cryptographically connected to the one before it. A very general explanation of a block chain is given by Wikipedia: "A block chain is a continuously expanding list of records, called blocks, that are linked and secured using cryptography." Each block includes a timestamp, a cryptographic hash of the preceding block, and

**A REVIEW ON INTEGRATING BLOCK CHAIN AND MACHINE LEARNING TECHNIQUES FOR FAKE NEWS
DETECTION IN SOCIAL MEDIA**

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Abstract

In this Internet era, most of the communication among public is done through social media and this highly developed communication has led to many problems of which propagation of fake news through social media platforms has affected the public a lot. Each and every day millions of news are being broadcast among people, as it has become the faster mechanisms to reach the public easily. The main idea of propagating such kind of fake news through social media may be to disparage a famous person, to construct fake opinion, to create positive impact on elections or stock exchanges or to create violence and spoil the law and order situations prevailing in a particular location. Many researchers nowadays make use of block chain technology to detect and classify the fake news being propagated through news channels. Block chain technologies when used produces several advantages like transparency, immutability and back tracking facilities which can be used for the detection and spreading of fake news in social media. Block chain technology also provides a reliable decentralized network, which can be used to publish news. In addition, Block chain with the help of decentralized applications and smart contracts can provide a platform in which fake news can be detected through public participation. Hence in this paper a clear review on deep learning and how block chain technology can be used to detect fake news is discussed and the best algorithm suitable for detection of fake news in social media will be identified by comparing it with other traditional algorithms using several metrics. The results obtained clearly shows that RNN_LSTM deep learning technique when used with Ethereum based smart contract technique can be a secured framework for detecting fake news in social media.

Keywords: Block chain, Fake News, text mining; block chain; detection algorithms words; Fake News Detection using block chain, Block chain to curb fake news

Introduction

Technological improvement and advancement in internet communication has made it possible for public to make use of these smart electronic gadgets for reliable and faster communication from anyplace. This obvious benefit has opened the doors for gathering the information being distributed throughout an organization and to effectively build their social foundation and make their perspective heard. This situation has permitted the birth and formation of new websites which can provide enormous measures of knowledge to the public without any charge and huge number of audience are anxious to extend their knowledge through these websites. This simplicity of creating online news to share information among public has mislead to the concept of disseminate news of all kinds, so that also the transmission of distortions, alternate realities and lies has increased. This event is popularly called as Fake News which has created problems in finding out reliable information on the Internet. Social media platforms like face book, twitter, Instagram has become the source for creating all kinds of global and local news for majority of people in this generation. This broad casting revolution has motivated the fake news generators to spread fake news in social media which takes a short period of to spread tremendously all over the world. The news broadcasted in social media becomes viral worldwide just within few days. These opportunities motivated the individuals to take the advantage of people's tendency and start sharing appealing news without knowing its authenticity or consequences.



Performance Evaluation of Proposed HBCR Deep Learning Model for Fake News Detection in Social Media

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ABSTRACT

Social media is the primary means by which people in today's culture consume news since it is the simplest and most practical way for people to communicate with one another. There is a chance that this will result in the broad transmission of false information, though. These false reports have a negative impact on the individual and society as a whole. The spread of illnesses and morality are undermined by these erroneous claims, which also fuel criminality and impair people's physical and mental health. It is essential to stop false information at the source in order to stop its spread. This is only possible if there is evidence that the news being reported is reliable and true. The purpose of this paper is to generate true news and accurately identify phony news in order to achieve a faultless output. As a result of previous survey carried out in our previous works, a hybridized system utilizing CNN, RNN, and BERT (HBCR-Hybridized BERT, CNN and RNN) have been proposed for fake news classification. In this proposed HBCR framework the BERT algorithm is used for extracting features from the news stories being posted. CNN deep learning classification technique is used to train the dataset, and RNN-LSTM classification algorithm is utilized to classify and detect fake news by cross-verifying it with FAKES dataset. The results obtained shows that the proposed HBCR system work well for fake news classification and gave us an average accuracy of 99%. The performance of this proposed system has been compared with state of art algorithms like SVM, KNN, Random Forest, BERT, CNN, RNN and combined CNN&RNN. Among all this techniques this proposed HBCR technique has proved to be effective in terms of all the metrics like accuracy, precision, Recall and F1 score.

Keywords: CNN, RNN, BERT, HBCR, fake news detection, evaluation metric, accuracy.



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Research Publications 2023-2024

1. **Vignesh A.**, Amal TC., Vasanth K (2024). Food contaminants: Impact of food processing, challenges and mitigation strategies for food security. Food Research International 191, 114739.
2. **Vignesh A.**, Amal TC., Sarvalingam A., Vasanth K (2024). A Review on the Influence of Nutraceuticals and Functional Foods on Health. Food Chemistry Advances 5, 100749.
3. **Vignesh A.**, Amal TC., Sivalingam R., Selvakumar S., Vasanth K (2024). Unraveling the Impact of Nanopollution on Plant Metabolism and Ecosystem Dynamics. Plant Physiology and Biochemistry 210, 108598.
4. **Vignesh A.**, Amal TC., Sivalingam R., Selvakumar S., Vasanth K (2024). Influence of ecological factors on the phytochemical composition and bioactivity of *Berberis tinctoria* Lesch. wild edible fruits. Biochemical Systematics and Ecology 112, 104771.
5. **Vignesh A.**, Menaka C., Amal TC., Vasanth K (2024). Plant ecosystems and sustainable development in the Western Ghats, India. Journal of Ecology and Conservation 2(1) 1-4.
6. **Vignesh A.**, Amal TC., Vasanth K (2024). An Investigation into the Impact of Millets on Global Health and Sustainability. Journal of Nutraceuticals and Health 2(1) 25-26.
7. Sathiyaraj, G., Akilesh, M., **Vignesh, A.**, Kumar, K. N., Gopinath, S., Mohanapriya, S., ... & Dharmaraj, N. (2025). Benzothiazole-based Schiff base for sensing Ca²⁺ ions: Synthesis, DFT studies, toxicity evaluation in zebrafish embryo and in silico analysis of MMP-9 inhibition. Journal of Photochemistry and Photobiology A: Chemistry, 458, 115985.
8. **Vignesh, A.**, Amal, T. C., Kalaiyarasan, J., Selvakumar, S., & Vasanth, K. (2023). An effective bio-inspired synthesis of palladium nanoparticles using *Crateva religiosa* G. Forst. leaf extract: a multi-functional approach for environmental and biomedical applications. Biomass Conversion and Biorefinery, 1-24.
9. Sathiyaraj, G., **Vignesh, A.**, Priyanka, K., Neethu, K. S., Badhmapriya, D., Preethi, K., Dharmaraj, N., & Kaveri, M. V. (2023). Construction of 3-amino-9-ethylcarbazole scaffold for multifunctional applications: Chemosensor for copper (II) ions along with antibacterial, antioxidant and anti-inflammatory activity. Results in Chemistry, 6, 101141.
10. Menaka, C., **Logamadevi, A.**, Mahalakshmi, B., & Poongodi, T. (2023). Phytochemical screening and GC-MS profiling on flowers of *Crossandra nilotica* Oliv. Indian Journal of Natural Sciences, 14(79), 60001-60010.
11. Alahupreeti, J., **Rajalakshmi, K.**, & Pavithra, K. (2023). Phytochemical screening of *Parmotrema plantilobatum* (Hale) Hale. For its dye yielding potential. Indian Journal of Natural Sciences, 14 (79), 1. 60001-60010.

12. **Vignesh, A.**, Amal, T. C., Selvakumar, S., & Vasanth, K. (2023). Unraveling the role of medicinal plants and Gut microbiota in colon cancer: Towards microbiota-based strategies for prevention and treatment. *Health Sciences Review*, 100115.
13. **Logamadevi, A.**, and Menaka, C. (2023). Physicochemical parameters, phytochemical screening and qualitative analysis of inorganic nutrients of *Persicaria glabra* (Willd.) Gomez de la Maza. *Journal of Pharmacognosy and Phytochemistry*, 12 (1), 121-124.



Construction of 3-amino-9-ethylcarbazole scaffold for multifunctional applications: Chemosensor for copper(II) ions along with antibacterial, antioxidant and anti-inflammatory activity

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Microbes inhibition

ABSTRACT

This work describes the fabrication of a carbazole derivative **1** namely (E)-5-(diethylamino)-2-((9-ethyl-9H-carbazol-3-yl)imino)methylphenol(**1**) based colorimetric probe for the selective detection of copper (II) ions. The as-prepared carbazole derivative was characterized using various spectral techniques including UV–visible absorption, Emission, FT-IR, ¹H NMR, ¹³C NMR and mass spectra. The colorimetric chemosensing potential of the synthesized carbazole derivative **1** to detect Cu²⁺ ions in a solution of different cations at different emission wavelengths based on photo-induced electron transfer (PET) mechanism was undertaken. In addition, the probe **1** showed significant DPPH scavenging activity. Antimicrobial and anti-inflammatory activities of the carbazole derivative **1** were also assessed. The selectivity of probe **1** towards Cu²⁺ ions could be exploited to reduce copper induced toxicity.

Introduction

Copper is an essential trace element, the third most abundant metal in human (after Fe²⁺ and Zn²⁺) and present in higher concentrations in the liver [1] and brain [2]. It is an inevitable, nutrient redox active ion for normal brain function [3] due to the high oxygen demand and oxidative metabolism of brain tissues, neurons and glia alike cells. Copper is a necessary cofactor for many brain-specific enzymes that control the homeostasis of neurotransmitters, neuropeptides and dietary amines. In addition, copper also functions as an active site in antioxidant enzymes such as cytochrome c oxidase (CcO) and Cu/Zn superoxide dismutase (SOD1) [3]. It is also needed for the production of ceruloplasmin, a protein that helps transport of iron in the blood and in the production of white blood cells and in the activation of enzymes which are the part of immune system. The excess concentration or deficiency of Cu²⁺ has led to several diseases such as Alzheimer's disease [4], Menkes syndrome, haematological manifestations [5]. Further, higher consumption of copper leads to accumulation in liver and kidney that may

cause gastrointestinal diseases and neurological disorders such as Wilson's disease [6], amyotrophic lateral sclerosis [7], Parkinson's diseases, hypoglycemia [8], dyslexia and infant liver damage [9]. Therefore, monitoring of Cu²⁺ level in living cells with higher sensitivity and selectivity is vital [10]. Various techniques have been developed for the detection and determination of Cu²⁺ ions such as organic fluorophores [11] or chromogenic sensors [12], a DNA enzyme based method [13], colorimetric detection [14], absorbance spectrophotometry, atomic absorption spectroscopy (AAS) [15] and inductively coupled plasma mass spectroscopy (ICP-MS) [16]. However, a suitable probe for naked eye detection of Cu²⁺ ions is still desirable and chemosensors are the excellent choice, in this regard.

Developing a suitable chemosensor for heavy metal ions turn into substantial because of the direct benefits applied to major sectors such as environment, industry, biology and human health. Chemosensors are particularly attractive due to their metal ion specific fluorescence nature, high sensitivity, selectivity and ease of preparation. Compounds that are capable of detecting the heavy metals by fluorescence is the

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Systematic Review / Meta-analysis



Unraveling the role of medicinal plants and Gut microbiota in colon cancer: Towards microbiota- based strategies for prevention and treatment

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Colon cancer
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ABSTRACT

Colon cancer remains one of the leading causes of morbidity and mortality worldwide. Given its widespread prevalence, the identification of new anticancer drugs is crucial. Medicinal plants have provided many natural products that have proven to be successful anticancer drugs in clinical use and have shown significant efficacy. Over the last decade, researchers have gathered significant information regarding the contribution of gut microbiota to the development and progression of colon cancer. Manipulating the gut microbiota to reverse microbial dysbiosis is an innovative strategy for addressing human diseases and intestinal disorders. Recent scientific findings have shown that this approach has a significant positive impact on the prevention and treatment of colon cancer. This review aims to provide a comprehensive understanding of the fundamental concepts related to intestinal microbiota and dysbiosis, as well as the interactions between microbiota and phytochemicals that can affect the bioavailability and bioactivity of these compounds. The primary components of the gut, including carbohydrates, enzymes, lipids, vitamins, and secondary metabolites such as alkaloids, flavonoids, polyphenols, and terpenoids, can activate gut dysbiosis. While these strategies show promising outcomes by rectifying microbiota proportion, modifying innate immune systems, emphasizing gut barrier operation, inhibiting pathogen colonization, and exhibiting selective cytotoxicity against colon cancer cells, further research is necessary to fully understand their mechanisms of action. This review also highlights the relationship between medicinal plants, gut microbiota, and colon cancer, which may lead to the development and clinical translation of potential microbiota-based strategies for cancer prevention.

1. Introduction

Cancer is a complex malignancy and a major cause of morbidity and mortality worldwide. There are many different types of cancer, among which, colorectal cancer found in the colon or rectum and ranks as the third most common cause of cancer-related deaths in both men and women [1]. The exact cause of colon cancer is not fully understood, but it is believed to develop as a result of a combination of genetic, environmental, and lifestyle factors. Some known risk factors for colon cancer include age, inherited genetic mutations, inflammatory bowel disease, and unhealthy dietary choices [2]. In particular, a diet that includes red and processed meats has been shown to increase the risk of colon cancer. Excessive smoking and alcohol consumption are

increasing the risk of cancerous growth by disrupting the lining of the colon and damaging the structure or sequence of Deoxyribonucleic acid (DNA) in colon cells [3]. According to estimates from the world health organization (WHO), there will be 20 million new cancer cases projected in 2025 [4]. Colon cancer is becoming increasingly prevalent in India, with a higher incidence rate in urban areas compared to rural areas. In fact, according to the Indian Council of Medical Research (ICMR), the incidence of colon cancer in India is expected to be 4.4 and 4.1 per 1,00,000 in men by the year 2025 [5]. There is a stigma attached to discussing health issues related to the colon, which can make people reluctant to seek medical attention for symptoms such as abdominal pain, changes in bowel habits, or rectal bleeding [6]. To address the increasing incidence of colon cancer, it is important to raise awareness about the risk factors

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An effective bio-inspired synthesis of palladium nanoparticles using *Crateva religiosa* G.Forst. leaf extract: a multi-functional approach for environmental and biomedical applications

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Abstract

The biogenic synthesis of metal nanoparticles (MNPs) through the reduction of metal ions using secondary metabolites extracted from plants is considered an eco-friendly and bio-safe method. In this study, palladium nanoparticles (Pd-NPs) were synthesized through biogenic synthesis. Pd-NPs were obtained using an aqueous leaf extract of *Crateva religiosa*, exhibiting the desired physicochemical properties in terms of structure, optics, and photocatalytic activity. The characterization of prepared biogenic Pd-NPs was achieved by UV-Vis spectroscopy, FT-IR, XRD, SEM, EDX, and HR-TEM. As a result of characterization, UV-Vis spectrum exhibited a maximum absorbance at a wavelength of 420 nm. In the XRD analysis, five basic peaks attributed to Pd-NPs, and an average crystallite size was 10.31 nm. In addition, SEM and HR-TEM determined that Pd-NPs have a quasi-spherical shape, and an average size of 15–20 nm was tested antimicrobial activity with *Bacillus subtilis*, *Klebsiella pneumonia*, *Aspergillus niger*, and *Aspergillus tamarii*. Pd-NPs at 30 µg/mL exhibited bacteriocidal and anti-fungistatic activity. In addition, Pd-NPs inhibited the formation of the biofilm layer by *B. subtilis* and *K. pneumoniae* by 85.63% and 92.78%, respectively. Pd-NPs also exhibited potential free radical scavenging activity in a dose-dependent manner. Pd-NPs displayed a remarkable anti-inflammatory activity of 96.68% according to the albumin denaturation inhibitory assay. Furthermore, they exhibited anticancer activity against A549 cell lines, with an IC-50 value of 28.25 µg/mL determined through *in vitro* cytotoxicity assessment using the MTT assay. The photocatalytic activity was observed by the degradation of fast green dye (95.28%) and Rose Bengal dye (95.15%) at pH 3 and 150 min of exposure time and under sunlight. Moreover, the Pd-NPs positively impacted seed germination on horse gram. Overall, the results indicate that Pd-NPs, obtained through biogenic synthesis, have the potential to serve as agents for various biological and environmental applications.

Keywords *Crateva religiosa* G.Forst. · Palladium nanoparticles · Green synthesis · Anti-biofilm · Photocatalytic activity · Seed germination

Highlights

- An effective bio-inspired synthesis of Pd-NPs using *Crateva religiosa* extracts (CRE)
- Pd-NPs' distinct properties make them highly promising for biomedical use
- Synthesized Pd-NPs help FGD and RBD degradation in industrial effluents
- Pd-NPs positively impacted seed germination applications on horse gram
- This study offers a practical, affordable, and safe approach to producing inorganic NPs

Extended author information available on the last page of the article

1 Introduction

In today's world, pollution is a significant threat, mainly driven by industrial developments like the paper industry, textiles, and tanneries, which contaminate water sources [1]. Among these industries, textiles are particularly problematic due to their release of dye effluents, reducing dissolved oxygen solubility and increasing biological oxygen demand in aquatic ecosystems. Dye effluents harm aquatic ecosystems, reducing sunlight penetration and disrupting photosynthesis in plants, affecting aquatic life's food sources and causing lasting pollution [2]. Fortunately, nanotechnology's rapid advancement has given nanomaterials a vital role in treatment processes, drawing attention



Influence of ecological factors on the phytochemical composition and bioactivity of *Berberis tinctoria* Lesch. wild edible fruits

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ABSTRACT

Berberis tinctoria Lesch. is an endemic wild plant with significant medicinal value in traditional ethnomedicine. Although its chemical composition has not yet been studied, tribal communities in Nilgiri-Hills (NH) and Palani-Hills (PH) use it as food and to cure various ailments. The present study aims to analyze the influence of ecological factors on the accumulation of active compounds and antioxidants in *B. tinctoria* fruits. The anti-proliferative effect was also evaluated. Thus, two distinct geographic locations within the *B. tinctoria* cultivation area were selected. The contents of soil pH, organic carbon, nitrogen, phosphorus, potassium and primary and secondary active metabolites in the fruits were measured. Bioactive compounds were tentatively identified by liquid chromatography-mass spectrometry (LC-MS) analysis. Qualitative and quantitative phytochemical screening revealed that major primary and secondary metabolites were more abundant in fruits from the NH region, especially in terms of total phenols and alkaloids. The data acquired highlight that soil physicochemical properties have a highly positive correlation with secondary metabolites content and bioactivity. In particular, NH ethyl acetate (NH-EAF) extracts showed higher antioxidant and anti-inflammatory activity, as well as antibacterial activity against *Staphylococcus aureus* and *Enterococcus faecium*. Furthermore, NH-EAF extract showed cytotoxic effects with IC₅₀ equal to 102.85 µg/mL and 123.39 µg/mL towards Raw 264.7 and Caco-2 cell lines, respectively. The results of this study confirmed that the fruit variability of phytochemicals and biological activities is due to geographical variation and ecological factors.

1. Introduction

Bioactive compounds found in wild edible fruits particularly those rich in antioxidants, have caught the attention of scientists in recent years due to their potential benefits for human health. Epidemiological reports have shown that plant-derived bioactive compounds may prevent the onset and progression of various types of cancer and cardiovascular diseases (Samtiya et al., 2021; Cai et al., 2022). Up to 50% of the drugs used in cancer and other treatments are derived from natural products such as morphine, vincristine, atropine and artemisinin sourced solely from plant resources (Veeresham, 2012; Newman and Cragg, 2020). As a result, herbal medicinal products that contain a defined concentration of plant-derived bioactive compounds are an attractive strategy for controlling diseases, as they can be readily used as

dietary supplements with minimal toxic effects (Salehi et al., 2020). However, variations in bioactive metabolites within the same plant species from different geographical regions can pose challenges in selecting plants for therapeutic potential and developing herbal medicine (Ahmed et al., 2020). To address this, preliminary phytochemical screening of plants from different geographical locations is necessary to determine the concentration of key metabolites in specific plant parts, which can help to identify the quantitative variations of a particular bioactive compound during plant development under different environmental stress (Vilkickyte and Raudone, 2021). As a consequence, plants collected in different seasons exhibit distinct spatial-temporal variations, affecting their pharmacological activity (Vignesh et al., 2022a). Similarly, biotic stress can also induce variation in the secondary metabolites produced by plants inevitably imposing the development of herbal products (Sharma et al., 2022) (see Tables 8 and 9).

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Unraveling the impact of nanopollution on plant metabolism and ecosystem dynamics

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ABSTRACT

Nanopollution (NPOs), a burgeoning consequence of the widespread use of nanoparticles (NPs) across diverse industrial and consumer domains, has emerged as a critical environmental issue. While extensive research has scrutinized the repercussions of NPs pollution on ecosystems and human health, scant attention has been directed towards unraveling its implications for plant life. This comprehensive review aims to bridge this gap by delving into the nuanced interplay between NPOs and plant metabolism, encompassing both primary and secondary processes. Our exploration encompasses an in-depth analysis of the intricate mechanisms governing the interaction between plants and NPs. This involves a thorough examination of how physicochemical properties such as size, shape, and surface characteristics influence the uptake and translocation of NPs within plant tissues. The impact of NPOs on primary metabolic processes, including photosynthesis, respiration, nutrient uptake, and water transport. Additionally, this study explored the multifaceted alterations in secondary metabolism, shedding light on the synthesis and modulation of secondary metabolites in response to NPs exposure. In assessing the consequences of NPOs for plant life, we scrutinize the potential implications for plant growth, development, and environmental interactions. The intricate relationships revealed in this review underscore the need for a holistic understanding of the plant-NPs dynamics. As NPs become increasingly prevalent in ecosystems, this investigation establishes a fundamental guide that underscores the importance of additional research to shape sustainable environmental management strategies and address the extensive effects of NPs on the development of plant life and environmental interactions.

1. Introduction

Nanoparticles (NPs), often defined as particles with at least one dimension less than 100 nm, have found ubiquitous applications in diverse industries, including electronics, medicine, agriculture, and cosmetics (Alprol et al., 2023). Their remarkable properties, such as size-dependent reactivity and unique surface characteristics, have led to numerous technological advancements. NPs have extensive applications across various sectors, including agriculture, chemical manufacturing, consumer goods, coatings, optics, electronics, cosmetics, food production, medicine, textile manufacturing, plastics, paints, fuel additives, wastewater treatment, and environmental remediation (Jan et al., 2022). However, the proliferation of NPs in the environment raises

concerns about their unintended impacts (Zhang et al., 2023). As the continuous production and utilization of NPs persist, reports from consumer products based on both nanotechnology and online databases indicate that over 600 products and 2870 products, respectively, incorporate NPs (Jan et al., 2022). The use of NPs in the fields of biology and medicine has undergone substantial growth, with reported values of US\$17.5 billion in 2011, a notable increase to US\$53.5 billion in 2017, and a further increase to US\$79.8 billion in 2019 (Javed et al., 2019). The annual consumption of silver nanoparticles (Ag NPs) amounts to 450 tons, while the production of zinc nanoparticles (Zn NPs) reaches 5500 tons per year (Jan et al., 2022).

Pollution caused by nanopollution (NPOs) also referred to as "invisible pollution", is considered the most serious pollution to be controlled and managed. The term "Nanopollution" encompasses these

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SHORT COMMUNICATION



An Investigation into the Impact of Millets on Global Health and Sustainability

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ABSTRACT

This article explores the resurgence of millet as a potential solution to global nutrition and wellness security challenges. Millets, ancient grains with rich nutritional content and remarkable adaptability, have been overshadowed by modern agriculture. However, their nutritional profile, resilience to climate variability, and socio-economic significance make them a promising ally in combating malnutrition, food insecurity, and diet-related chronic diseases. The article discusses the nutritional composition of millets, their health benefits, and their role in sustainable agriculture. It also examines the environmental sustainability and socio-economic impacts of millet cultivation. Despite their potential, challenges such as limited consumer awareness and policy support hinder their widespread adoption. The article underscores the importance of collaborative efforts among stakeholders to promote millets in mainstream diets and food systems. Ultimately, embracing millets can pave the way towards a more resilient, equitable, and healthier future for all.

KEYWORDS

Millets; Nutrition; Wellness; Food Security; Sustainability; Global Health

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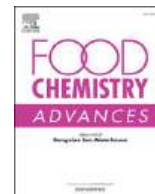
Introduction

In an era characterized by growing concerns over global nutrition and wellness security, the rediscovery of ancient food crops offers a beacon of hope. Among these traditional treasures, millets stand out as a remarkable resource with the potential to address some of the most pressing challenges facing humanity today. Originating from the cradle of agriculture, millets have sustained civilizations for thousands of years, offering sustenance resilience, and vitality to millions across the globe [1]. Yet, their significance had been overshadowed by the rise of modern agriculture and the dominance of a few staple crops [2]. Today, as we confront the complex interplay of malnutrition, food insecurity, and diet-related chronic diseases, the renaissance of millets presents a timely and compelling opportunity. These humble grains, belonging to the Poaceae family, possess an array of nutritional virtues that rival, if not surpass, those of their more celebrated counterparts. Rich in proteins, fibers, vitamins, and minerals, millets offer a balanced and wholesome dietary foundation that can nourish bodies and fortify health [3,4]. Moreover, their gluten-free nature makes them a boon for individuals with celiac disease or gluten sensitivity, providing an inclusive option for diverse dietary needs [5,6]. Beyond their nutritional bounty, millets exhibit a remarkable capacity to thrive in diverse agro-climatic conditions, from arid savannas to mountainous terrains [7]. This inherent adaptability makes them a resilient crop, capable of withstanding environmental stresses such as drought, heat, and soil degradation [8,9].

In a world grappling with the impacts of climate change, where agricultural systems are increasingly vulnerable to disruptions, the resilience of millets offers a ray of hope. By diversifying cropping systems and promoting agro-biodiversity, millets can contribute to building more robust and

climate-resilient food systems [10]. Furthermore, the cultivation and consumption of millets hold promise for fostering sustainable development and advancing socio-economic equity. In many regions, especially in sub-Saharan Africa and parts of Asia, smallholder farmers rely on millets as a vital source of livelihood [11]. Revitalizing millet-based agricultural systems can enhance food sovereignty, empower local communities, and alleviate rural poverty. Moreover, the promotion of millet-based value chains can generate employment opportunities along the entire food value chain, from production to processing, marketing, and distribution [12]. However, the journey towards harnessing the full potential of millets for global nutrition and wellness security is not without its challenges. Despite their nutritional and ecological virtues, millets have long been relegated to the margins of agricultural research, policy, and investment. The dominance of commodity-driven agricultural models and the lack of market incentives have hindered the widespread adoption of millets, perpetuating their underutilization and neglect [13].

Moreover, consumer preferences, shaped by decades of dietary homogenization and reliance on refined grains, pose a formidable barrier to the reintroduction of millets into mainstream diets. Addressing these challenges requires a concerted effort from multiple stakeholders, including policymakers, researchers, civil society organizations, and the private sector. Governments can play a crucial role in creating an enabling policy environment that incentivizes millet cultivation, supports smallholder farmers, and promotes consumer awareness and demand. Investment in research and development is equally essential to unlock the full potential of millets, from breeding high-yielding varieties to improving



A review on the influence of nutraceuticals and functional foods on health

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Fiber

ABSTRACT

In recent years, functional foods have gained attention for their potential health benefits beyond basic nutrition, serving as rich sources of proteins, carbohydrates, vitamins, and dietary fiber. Enriched with bioactive compounds such as polyphenols, tannins, flavonoids, and alkaloids, these foods have shown promise in inhibiting cell signaling pathways related to proliferation, communication, and apoptosis. Key components in functional foods offer health benefits. Omega-3 fatty acids scavenge free radicals, reducing the risk of chronic diseases like heart disease and cancer. Antioxidants in foods such as sesame seed oil promote cardiovascular health and have anti-inflammatory effects. Curcumin inhibits cancer by suppressing inflammatory cytokines. Understanding their mechanisms of action is crucial for realizing therapeutic benefits. However, identifying suitable bioactive substances and comprehending their role in disease prevention are challenging. As we enter the functional food era, this review aims to present the current state of functional foods and nutraceuticals, exploring their applications for human wellness. Recognizing nutrition's individualized nature of nutrition is a central theme, emphasizing the importance of tailored dietary recommendations based on diverse responses to these functional elements, ensuring that personalized approaches are aligned with individual health goals.

1. Introduction

Functional foods are defined as foods that provide health benefits that extend beyond their fundamental nutritional value (Hammoudi Halat et al., 2023). In the past decade, despite the growing popularity of organic and natural foods, functional foods have significantly captured public interest. The food industry is keen to market these foods for their potential to promote health or maintain wellness. However, such claims are backed up by the lack of knowledge among the public, which is often linked to poor dietary choices (Bliss, 2024). The current state of the art on functional foods focuses significantly on the recovery, enhancement, and fortification of nutrients and bioactive compounds in foods to improve their health benefits. However, functional food design can only be applied when food side streams adopt a sustainable and health-oriented focus to develop new ingredients and formulations (Cena & Calder, 2020). Functional foods and nutraceuticals represent a departure from the customary fare, introducing a novel dimension to the concept of nourishment. Unlike their conventional counterparts, these specialized consumables are distinguished by their inherent capacity to go beyond providing basic sustenance and actively contributing to the

promotion and preservation of health (Harford et al., 2011). This paradigmatic shift in nutritional philosophy has given rise to a fervent exploration of the multifaceted world of functional foods and nutraceuticals, prompting a deep inquiry into their composition, the intricate mechanisms through which they operate, and the robust scientific evidence that substantiates their potential impact on human health. At the heart of this review lies a comprehensive endeavor to unravel the complexities surrounding functional foods and nutraceuticals.

Delving into their composition unveils a diverse array of bioactive compounds that distinguish them from traditional foods (Akhtar et al., 2023). These compounds, ranging from vitamins and minerals to phytochemicals and essential fatty acids, endow these functional consumables with properties that extend beyond basic nutrition. Whether derived from natural sources or fortified with additional bioactive elements, these foods possess a unique amalgamation of ingredients that distinguishes them as potent contributors to holistic health (Singh et al., 2023). Understanding the mechanisms of action through which functional foods and nutraceuticals exert their influence is fundamental to appreciating their transformative potential. These consumables operate at the cellular and molecular levels, modulating physiological functions

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Review

Food contaminants: Impact of food processing, challenges and mitigation strategies for food security

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ABSTRACT

Food preparation involves the blending of various food ingredients to make more convenient processed food products. It is a long chain process, where each stage posing a risk of accumulating hazardous contaminants in these food systems. Protecting the public health from contaminated foods has become a demanding task in ensuring food safety. This review focused on the causes, types, and health risks of contaminants or hazardous chemicals during food processing. The impact of cooking such as frying, grilling, roasting, and baking, which may lead to the formation of hazardous by-products, including polycyclic aromatic hydrocarbons (PAHs), heterocyclic amines (HCAs), acrylamide, advanced glycation end products (AGEs), furan, acrolein, nitrosamines, 5-hydroxymethylfurfural (HMF) and *trans*-fatty acids (TFAs). Potential health risks such as carcinogenicity, genotoxicity, neurotoxicity, and cardiovascular effects are emerging as a major problem in the modern lifestyle era due to the increased uptakes of contaminants. Effects of curing, smoking, and fermentation of the meat products led to affect the sensory and nutritional characteristics of meat products. Selecting appropriate cooking methods include temperature, time and the consumption of the food are major key factors that should be considered to avoid the excess level intake of hazardous contaminants. Overall, this study underscores the importance of understanding the risks associated with food preparation methods, strategies for minimizing the formation of harmful compounds during food processing and highlights the need for healthy dietary choices to mitigate potential health hazards.

1. Introduction

The term “chemical contamination” signifies the presence of chemicals in areas where they should not be or in concentrations exceeding safer levels (Perveen, 2023). Hazardous chemicals are the significant contributor to food contamination, which may cause serious health problems (Onyeaka et al., 2024). This may be accumulated in the food in their early stages as a result of environmental sources of contaminants such as air, soil, and water (Pathak et al., 2022). Hazardous chemical contaminants, particularly those generated during food processing methods, are widespread in many commonly used mass-produced

cooking materials. These items include cooking vessels, vegetable disinfectants, pesticides, detergents, color deodorants, personal care products, and etc. (Lin et al., 2023). Even the food and water we consume are not safe from the accumulation of chemicals at unsafe concentrations. The occurrence of food contamination, whether accidental or deliberate, poses a regrettable situation with significant repercussions for human health (Unuofin & Igwaran, 2023). The human body is continuously exposed to a wide range of chemicals found in food, which have the ability to produce mutagenic reactions and cause a various disease. Exposure to food-borne diseases significantly contributes to the development of certain human diseases (Das et al., 2021;

Abbreviations: ADHD, Attention-deficit/hyperactivity disorder; AGEs, Advanced glycation end products; CO₂, Carbon dioxide; DiMeIQx, 2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline; DNA, Deoxyribonucleic acid; GMP, Good manufacturing practices; HACCP, Hazard analysis and critical control points; HCAs, Heterocyclic amines; HDL, High-density lipoprotein; HMF, 5-hydroxymethylfurfural; HNO₂, Nitrous acid; LDL, Low-density lipoprotein; MeIQx, 2-Amino-3,4,8-trimethylimidazo[4,5-f]quinoxaline; MSG, Monosodium glutamate; NH₃, Ammonia; NO₂, Nitrite; PAHs, Polycyclic aromatic hydrocarbons; PCBs, Polychlorinated biphenyls; PFCs, Perfluorinated compounds; PhIP, 2-Amino-1-methyl-6-phenylimidazo[4,5-b]pyridine; ROS, Reactive oxygen species; TFAs, Trans-fatty acids; WHO, World health organization.

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SHORT COMMUNICATION



Plant ecosystems and sustainable development in the Western Ghats, India

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ABSTRACT

The Western Ghats of India, a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site, is a biodiversity hotspot crucial for ecological balance and human sustenance. This review explores the vital role of plant ecosystems in this region, highlighting their contributions to carbon sequestration, water regulation, and soil fertility. Despite their importance, these ecosystems face significant threats from deforestation, climate change, and unsustainable land-use practices. The advocates for integrated conservation and sustainable development strategies, emphasizing the need for biodiversity-friendly agricultural practices, robust governance, community involvement, and education. It also underscores the potential of sustainable tourism to generate economic benefits while promoting conservation. Examining successful case studies and outlining future directions, the review calls for a concerted effort to preserve the Western Ghats' ecological integrity, ensuring sustainable development and human well-being for generations to come.

KEYWORDS

Western Ghats; Plant ecosystems; Sustainable development; Conservation; Biodiversity.

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Introduction

The Western Ghats of India stand as a testament to our planet's incredible biodiversity and ecological richness [1]. Stretching along the Western coast of the Indian subcontinent, this United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site is not only a haven for countless species of flora and fauna but also a crucial ecosystem that sustains life for millions of people [2]. At the heart of this natural wonder lie the plant ecosystems, the green guardians that provide us with invaluable services essential for our survival [3]. Yet, the delicate balance of these ecosystems is under threat, challenged by human activities and the changing climate [4]. Recognizing the critical importance of these ecosystems, several ongoing efforts aim to mitigate the threats to the Western Ghats [5]. Conservation initiatives include establishing protected areas, enforcing environmental laws, and promoting sustainable agricultural and forestry practices [2]. Community-based projects focus on raising awareness and engaging local populations in conservation activities. Organizations and government bodies are working together to develop and implement policies that balance development needs with ecological preservation [6]. This review proposes an integrated approach to conservation and sustainable development in the Western Ghats, emphasizing the need for a synergistic relationship between human activities and ecological health. The proposed solution includes enhancing biodiversity-friendly practices in agriculture and forestry, strengthening governance and enforcement mechanisms, and fostering community-led initiatives for natural resource management. Additionally, the paper advocates for sustainable tourism and education programs to create economic incentives for conservation and in still a culture of stewardship among local communities. Combining ecological science with

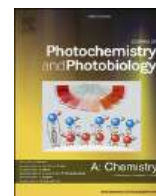
socio-economic strategies, this review aims to provide a holistic framework for sustainable development in the region. The objective is to highlight the critical role of plant ecosystems, identify effective conservation practices, and propose actionable steps to ensure the long-term resilience of both natural and human communities in the Western Ghats. This integrated strategy not only aims to preserve biodiversity but also to enhance the well-being of millions of people dependent on these ecosystems.

Biodiversity and its Ecosystem

The Western Ghats are home to a diverse array of plant species, many of which are endemic to the region [7]. This biodiversity is a crucial component of ecosystem services that support agriculture, medicine, and local economies, as shown in Figure 1. For instance, the dense forests are vital for water retention and supply, providing water to major rivers such as the Godavari, Krishna, and Kaveri, which are lifelines for millions of people, supporting agriculture, drinking water supplies, and hydroelectric power generation [8]. Additionally, the plant ecosystems play a crucial role in soil fertility and erosion control, with tree and plant roots binding the soil to prevent landslides and soil erosion, especially during the monsoon season [9]. The Western Ghats' biodiversity includes over 7,400 species of flowering plants, with a significant proportion being endemic [10]. This rich floral diversity is essential for maintaining genetic diversity and ecosystem resilience. Plants like the Nilgiri Blue (*Strobilanthes kunthiana* (Nees) T. Anderson ex Benth), which blooms once every 12 years, and critically endangered species such as *Piper barberi* Gamble, highlight the unique botanical richness of the region [11]. This diversity supports a range of

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Benzothiazole-based Schiff base for sensing Ca^{2+} ions: Synthesis, DFT studies, toxicity evaluation in zebrafish embryo and *in silico* analysis of MMP-9 inhibition

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ABSTRACT

A new heterocyclic Schiff base, 2-(2-benzo(d)thiazol-2-yl)hydrazono)methyl)phenol (**BTAZ**) synthesized from 2-hydrazinobenzothiazole and salicylaldehyde was characterized by spectral, mass and single crystal XRD data and subjected to sense Ca^{2+} ions in methanol–water mixture (1:1, v/v) using UV–visible absorption and fluorescence emission spectral studies. The probe **BTAZ** showed specific detection of Ca^{2+} ions in a solution containing various metal ions with a detection limit as low as 5.1×10^{-6} M via photo-induced electron transfer (PET) pathway. The binding stoichiometry between **BTAZ** and Ca^{2+} was determined to be 2:1 by Job's plot method. The stoichiometry and optical properties of both **BTAZ** and **BTAZ**- Ca^{2+} complex showed good correlation with theoretical results based on DFT and TD-DFT calculations. The pharmacological evaluation of the probe **BTAZ** against bacterial and fungal stains also demonstrated its notable efficacy to control their growth *in vitro* along with anti-oxidant capabilities. Further, toxicity assay of the probe **BTAZ** against zebrafish embryo did demonstrate that it is non-toxic to the test model *in vivo*. Ability of the probe **BTAZ** to inhibit matrix metalloproteinase-9 (MMP-9) enzyme was analyzed in detail using *in silico* experiments.

1. Introduction

Research on the detection of metal cations, anions and wide range of small molecules using chemical sensors has aroused interest because of their extensive applicability in the fields of biology and industries.

Calcium is the most common mineral in aqueous environments, physiological fluids, biomaterials and the human body. Designing and synthesizing efficient probes for metal ions have become very significant because of their close relationship with the environment, industry, biology, and human health. Chemosensors based on ion-induced

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Physicochemical parameters, phytochemical screening and qualitative analysis of inorganic nutrients of *Persicaria glabra* (Willd.) Gomez de la Maza

Dr. A Logamadevi and C Menaka**Abstract**

The present study investigated with physicochemical parameters, phytochemical analysis, and qualitative analysis of inorganic nutrients of *Persicaria glabra* (Dense flower Knotweed). Physicochemical parameters such as ash values, extractive values were determined. The methanolic extract of *P. glabra* leaves and stem revealed the presence of bioactive compounds such as alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, saponins, proteins, amino acids, reducing sugars, phenols, emodins, and phlobatannins. Whereas in the stem terpenoids and saponins were absent. The qualitative analysis of inorganic acid radicals in leaves showed the presence of carbonates and sulfates, whereas nitrates, phosphates, and sulfates were found in the stem. The inorganic basic radicals of the leaves and stem revealed the presence of arsenic, sodium, calcium, iron, and ammonium, whereas zinc is only found in the leaves. According to these findings, the presence of phytoconstituents and physicochemical parameters is useful for the development of novel drugs and assessing plant quality. Furthermore, this plant contains vital inorganic nutrient elements that may be useful for humans as dietary supplements for day-to-day life and to heal various ailments.

Keywords: *Persicaria glabra*, physicochemical parameters, extraction, phytochemical analysis, inorganic nutrients

Introduction

Phytochemicals are very simply plant-derived chemicals. They are naturally occurring defense chemicals present in different parts of plants such as leaves, roots, seeds, stems and barks etc. Medicinal plants produce primary and secondary metabolites with different functions. The secondary metabolites like alkaloids, terpenoids, and phenolic compounds are known to be responsible for the therapeutic potential of the medicinal plants.

In this study the physicochemical parameters studied are total ash, acid-insoluble ash, methanol and water soluble extractive values. Ash content is used to determine the quality and purity of crude drugs.

Water-soluble ash is used to estimate the amount of inorganic compounds in drugs, whereas acid-insoluble ash contains silica and indicates contamination with earthy material. The amount of the active constituents in a given amount of plant material when extracted with a particular solvent is determined by the estimation of extractive values.

A solution containing different Phytoconstituents is obtained by the extraction of any crude drug with a particular solvent. Whether the crude drug is exhausted or not is indicated by the composition of these Phytoconstituents, which depend on the nature of the drug and the solvent used.

Persicaria glabra belongs to the family Polygonaceae and is commonly known as dense flower knotweed. This is an entirely glabrous plant, except the leaves which are often red-gland dotted; the ochrea (stipules fused into a sheath surrounding the stem) is completely eciliate. Inflorescence is a dense raceme, small pink with white flowers. Fruits are achene, flattened, shiny, dark brown to black in color. It grows on wet areas like lake, pond, and margins of ditches ^[1, 2].

It is one of the medicinal plants that are used as an analgesic and anti-cancer. Generally, juice of this herb is used as a painkiller and leaf paste is used as an anti-cancer drug ^[3]. The present study deals with physicochemical parameters, phytochemical analysis and inorganic nutrients in the leaves and stem of *Persicaria glabra*.

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Phytochemical Screening of *Parmotrema planatilobatum* (Hale) Hale. for Its Dye Yielding Potential

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ABSTRACT

Lichens are symbionts that produce distinct, secondary chemicals with significant pharmacological potential. Many phytochemicals are revealed to be species-specific, and the chemical nature of lichen species differs. The present study investigated the major bioactive constituents of the lichen *Parmotrema planatilobatum* in five different solvents by increasing polarity (hexane, chloroform, ethyl acetate, acetone, and methanol). The qualitative phytochemical screening of crude extracts revealed the presence of alkaloids, phenols, proteins, amino acids, reducing sugars, tannins, steroids, terpenoids, flavonoids, and quinones. Lichens are the source of colorant due to their distinct metabolic components. Moreover, the dye yielding potential of *P. planatilobatum* was assessed using three methods; they are ammonia fermentation method (AFM), the cow urine method (CUM), and the DMSO extraction method (DEM). The different colors derived using the mentioned approaches were documented. The dye extraction results were buffy brown in the AFM method, isabella in the CUM method, and ivory yellow in the DEM method. These compounds have the ability to produce dyes as well as having exceptionally intense pharmacological effects.

Keywords: *Parmotrema*, phytochemical and dye extraction.

INTRODUCTION

Lichens are epiphytic, intelligent living form that develop from the symbiotic union of a specialised fungal partner and an algal partner (green algae or cyanobacteria) [1]. The lichens are classified by three distinct types, such as crustose, foliose and fruticose. Moreover, they thrive in a wide variety of habitats including tree trunks, bark, wood, leaves, rocks, moss and soil. Also, it can survive in harsh climatic conditions around the world such as adverse temperatures, drought, salinity, pollution, and unstable nitrified conditions [2].





Phytochemical Screening and GC- MS Profiling on Flowers of *Crossandra nilotica* Oliv.

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ABSTRACT

The present work aims to perform phytochemical screening and Gas Chromatography-Mass Spectrometry analysis of flower extracts of *Crossandra nilotica* Oliv. Phytochemical screening of methanolic flower extracts revealed the presence of alkaloids, proteins, carbohydrates, phenols, flavonoids, betacyanins, coumarins, emodins, glycosides, steroids, terpenoids, and quinones. Furthermore, GC-MS analysis of the extract identified 72 bioactive compounds, out of which 20 were major compounds based on high peak areas such as 1,3-Dioxolane, 2-phenyl-2-(phenylmethyl)- (9.81%), Propylthiouracil (9.42%), 1,2,5-Oxadiazol-3-amine, 4-(phenylmethoxy)- (9.41%), 2-Methylheptanoic acid (9.38%), Tricyclo[4.2.2.0(1,5)]decane (9.37%), 2-Undecanethiol, 2-methyl- (9.37%), 1,2,4,5-Tetrazin-3-amine, 6-methyl- (9.19%), etc. It is the first report on *Crossandra nilotica* screened for phytochemicals and GC-MS analysis. The identified bioactive compounds have a wide range of biological activities, which may help in the protection against various diseases.

Keywords: Extraction, Phytochemical screening, GC-MS analysis, Bioactive compounds, Biological activity



CONSUMER PERCEPTION TOWARDS ECO-FRIENDLY PRODUCT

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ABSTRACT

“An ounce of prevention is worth a pound of cure” is the proverb that tells it's easier to stop something, before it has happens. The pandemic has caused people across world to pay closer attention to their health, symptoms of illness and to adopt new behaviors to minimize risk of transmission such as Conscious of environment, Social distancing, wearing mask and Hygiene Sanitization. This study explores how these factors affect the perception of the consumers towards the eco-friendly product. Consumers are now becoming more ecological and health conscious and desire to purchase the eco-friendly product. In this study, it brings the behavior of the consumer on eco-friendly product before and during pandemic will be discussed. The Coimbatore is the third largest city in Tamilnadu, it is also known as Manchester of South India. The main object of the study is to identify the demographic and usage profile of the selected consumers and to know the perception level of the consumer towards eco- friendly products. Questionnaire method will be used to collect the data from 125 consumers through convenient sampling method in Coimbatore district. The collected data have been analyzed using the Simple Percentage and Likert's scaling methods. The finding of the study will be definitely useful for the consumers to know the advantages of eco-friendly product, marketer to know the behavior of the consumer and government to take necessary steps to educate the consumers to buy the eco-friendly product.

Keywords: Eco-friendly, Products, Attitude, Perception, Pandemic

PREMABLE OF THE STUDY

The corona virus offers countries a chance to build revival plans that will reverse current trend and change our consumption and production pattern towards the eco-friendly product. The eco-friendly product and its production, are about the restructure of economic from environmental dilapidation, increase the efficiency of the resources and promoting eco-friendly product among the consumers. It can also contribute significantly to poverty mitigation and the transformation of the countries towards low-carbon and green economies. The eco-friendly product consumption and production refers to the use of services and related products, which looks after the basic needs of the consumers and provide the better quality of life by minimizing the use of natural resources and toxic material as well as that emission of water and pollutants over the life cycle of the services and to prevent the sources for the future generation. The pride and Farrell was rightly stated that eco-friendly product refers to an organizational effort in designing, promoting and pricing and distributing the product without any harm to the environment. The eco-friendly product plays a vital role particularly in the modern market. Additionally the development of eco-friendly product has opened the opportunity for the companies for co-brand their products into separate line. The silicon 'India reveals that the majority of Indian consumers are familiar with eco-friendly products, have confidence that eco-friendly products are better for environment and feel that bio based ingredients enhance the desirability of a product. More than 63 per cent of consumers are familiar with eco-friendly products and of those, 85 per cent have confidence that they are better for the environment. As a result of this businessman can increase the volume of consumers who are more anxious about the environment. These consumers show more concern about the environmental issues into their purchasing decision and the concentrate on the product whenever they purchases.

REVIEW OF LITERATURE

Anil kumar and Mridanish Jha (2017) in their study entitled “A study on attitude of consumers towards eco-friendly products” concluded that the producers ought to enhance the plan of eco-

accommodating items so as to pull in customers successfully. The advertisers or retailers must place eco-accommodating items in their shops in such a way, buyers can find effectively while purchasing.

Nagamani and Navaneetha (2017) in their study entitled, “Perception of sellers of eco-friendly products – an analytical study “revealed that the retailers had opined that majority of the consumers specifically identified eco-friendly products and showed their interest to pay more for eco-friendly products. They also stated that there was lack of awareness among the consumers about eco-friendly products available in market and high investment required for business was the most common problem they faced.

Nagaraju and Thejaswini (2016) in their study entitled, “A Study on Consumer Attitude towards Eco-Friendly FMCG Products With Reference To Hubli City in Karnataka” found that the absence of learning and not awareness of the advantages were limitations for acquiring eco-accommodating items. Greater part of the respondents purchased eco-accommodating items for wellbeing reason. The study reasons that consumer was developing to the ethics of eco-friendly products. So, the government, the association should have known about the majority and the consumers’ needs to consolidate their hands in bringing the biological adjust.

Preeti Pillai and Junare (2016), in their study entitled, “A Study on Consumers’ Perception towards Eco-friendly Products in Ahmedabad “ concluded from their research that eco-friendly consumers were youthful, taught, and was of administration classification. Further, females have appeared towards utilization of vitality effective climate control system

Shirmila Stanley (2015) in her study entitled,” A Study on the Perception and Impact of Sustainable Green Consumption Practices of Women in Preserving Ecology with Special Reference to Chennai City” revealed that awareness about eco-friendly products was gradually getting and the message of sparing nature was spreading gradually. Also, larger part of the women would like to purchase eco-friendly items disregarding the way that such items were overrated.

STATEMENT OF THE PROBLEM

Today, society is clustered with various marketing activities and the activities are coupled with the surroundings. Among this the marketing play a vital role in the development of the eco-friendly product. The eco-friendly product is now a leading concern of the market. Green marketing is nothing but only the development and improvement of pricing, promoting and distributing the products which do not damage the environment. Therefore, marketers have to establish and communicate a strong environmental image by promoting the green purchase behavior of the people. Green marketing is perceived as an opportunity by many organizations to achieve their long term goals. Green strategy can be effectively implemented only by persuading the consumers to buy eco-friendly products. Moreover, it is the prime duty of each and every citizen of India to protect the environment by purchasing eco-friendly products. Therefore, an in-depth study is made on the intention of people to buy eco-friendly products before and during pandemic. The focus on consumers is understandable as this group is representing a new generation of consumers with a strong potential impact on green environment.

OBJECTIVES OF THE STUDY

Now a day the world getting worse due to globalization, deforestation and ozone depletion. Additionally this covid pandemic has exaggerated the countries for the past two year. It results on many deaths, economy fall down. People kept themselves isolated that’s leads to cruel depression. The results of this had made the consumer to switch their preference from normal product to the eco-friendly product and they strongly believe that their health has spoiled because of the usual products and environment. Hence, it becomes compulsory for the marketer to understand the importance, attributed and comprehensive profile of the eco-friendly product consumers.

The following are the main objectives of the study:

1. To study the demographic and usage profile of the selected consumers.
2. To study the perception level of consumers towards eco-friendly product. and
3. To offer valuable findings and recommendations to the marketer and the government.

RESEARCH METHODOLOGY

Coimbatore district has been ranked 4th for investment climate and ranked 17th among the top global outsourcing cities. It enjoys a very pleasant climate all the year round, aided by the fresh breeze that flows through the 25 kms long Palakkad gap. The rich black soil of the region has contributed to Coimbatore's flourishing agriculture industry and, it is in fact the successful growth of cotton that served as a foundation for the establishment of its famous textile industry. The result has been a strong economy and a reputation as one of the greatest industrial cities in South India.

Research design

Coimbatore is an important commercial district which consists of eleven Taluks namely Coimbatore north, Coimbatore south, Perur, Madukkarai, Annur, Mettupalayam, Sulur, Pollachi, Kinathukaduvu, Annamalai and Valparai revenue Taluk, with 3,654,026 of total population in 2021.

Sampling

Data is collected from One Hundred and Twenty Five consumers by adopting convenient sampling method. Interview schedule will be used to collect the opinion of the 125 consumers towards the eco-friendly products. Secondary data have been used to explain the theoretical aspects of the study and it will be collected through the Annual Report and articles from journals, bulletins and websites.

Framework of analysis

The collected data will be analyzed by using Simple Percentage.

RESULTS AND DISCUSSIONS

The first part of the study discussed about the demographic profile & eco-friendly products usage profile by using the variables area of residence, age, gender, educational qualification, marital status, income per month, total income of the family, type of products purchased, purchase location, amount spent for purchasing and period of using eco-friendly products. On the other hand, in the second part of the study discussed about the consumer perception towards eco-friendly products.

Demographic Profile & Eco-Friendly Products Usage Profile

Demographic Profile

The following table shows the demographic profile of the respondents.

Table-1 Gender of the Respondent

S.No	Gender	No. of Respondent	Percentage
1	Male	58	46.40
2	Female	67	53.60
	Total	125	100.00

The table 1 reveals that the 46.40 percentage of the respondents are male and 53.60 percentages of the respondents are female.

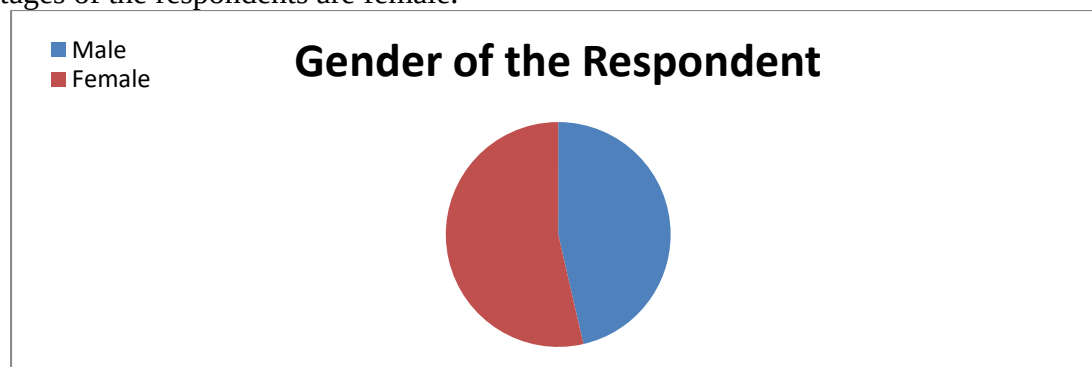


Table-2

S.No	Area of Residence	No. of Respondent	Percentage
1	Rural	42	33.60
2	Urban	45	36.00
3	Semi Urban	38	30.40
	Total	125	100.00

The table 2 reveals that the 33.60 percentage of the respondents resides in rural area, where 36.00 percentages of the respondents resides in urban area and 30.40 percentages of the respondents are resides in semi urban area.

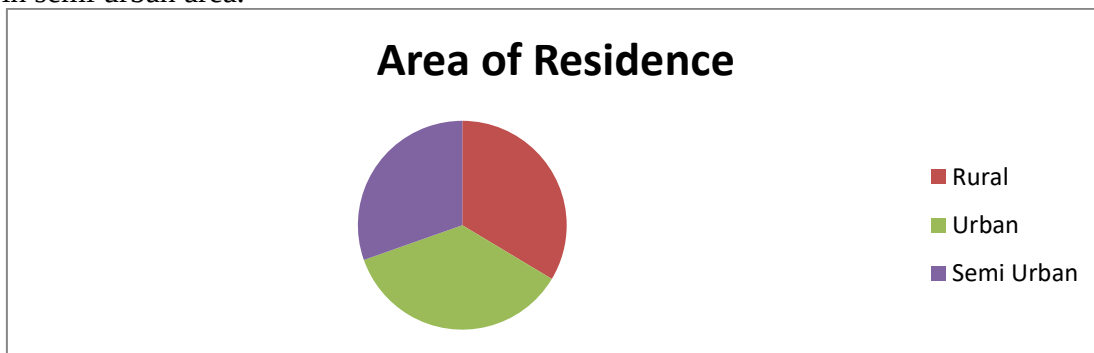


Table-3
Age of the Respondent

S.No	Age of the Respondent	No. of Respondent	Percentage
1	Below 20	23	18.40
2	20-30 Years	32	25.60
3	30-40 Years	46	36.80
4	40-50 Years	15	12.00
5	Above 50	09	7.20
	Total	125	100.00

The table 3 reveals that the 18.40 percentage of the respondents resides are below the age of 20 years, where 25.60 percentages of the respondents are between the age group of 20 and 30 years, 36.80 percentage of the respondent age group are between 30 and 40 years, 12.00 percentage of the respondents are between the age of 40 and 50 years and 7.20 percentages of the respondents are above the age group of 50 years.

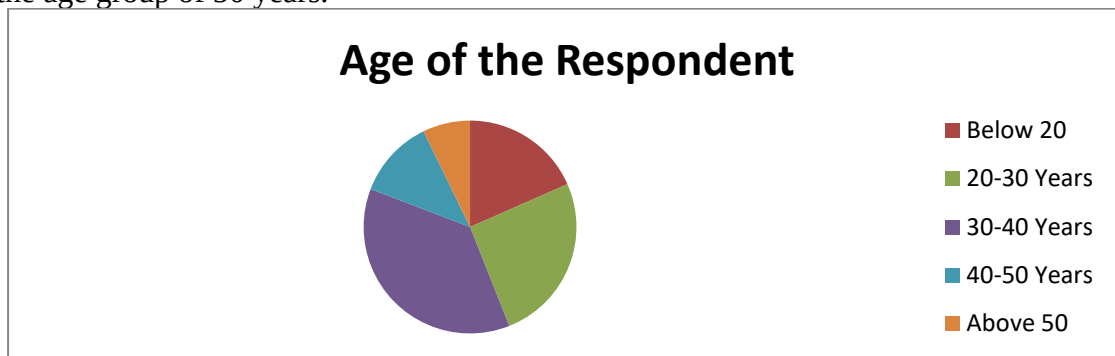


Table-4
Educational Qualification of the Respondent

S.No	Educational Qualification	No. of Respondent	Percentage
1	Up to HSC	27	21.60
2	Degree	46	36.80
3	Diploma	20	16.00
4	Professional	19	15.20
5	Un Educated	13	10.40
	Total	125	100.00

The table 4 reveals that the 21.60 percentage of the respondents resides are educated upto HSC, where 36.80 percentages of the respondents are degree holders, 16.00 percentage of the respondent are diploma holders, 15.20 percentage of the respondents are professionals and 10.40 percentages of the respondents are uneducated.

Educational Qualification



Table-5 Marital Status of the Respondent

S.No	Marital Status	No. of Respondent	Percentage
1	Married	66	52.80
2	Unmarried	38	30.40
3	Single	21	16.80
	Total	125	100.00

The table 5 reveals that the 52.80 percentage of the respondents are married, where 30.40 percentages of the respondents are unmarried and 16.80 percentages of the respondents are single.

Marital Status



Table-6 Income of the Respondent

S.No	Income of the Respondent	No. of Respondent	Percentage
1	Below Rs 20,000	16	12.80
2	Rs 20,001-Rs 30,000	32	25.60
3	Rs 30,001-Rs 40,000	38	30.40
4	Rs 40,001- Rs 50,000	15	12.00
5	Above 50,000	24	19.20
	Total	125	100.00

The table 6 reveals that the 12.80 percentage of the respondents income are below Rs 20,000 where 25.60 percentages of the respondents income are between Rs 20,001 and Rs 30,000, 30.40 percentage of the respondent income are between Rs. 30,001 and Rs 40,000, 12.00 percentage of the respondents income are between Rs 40,001 and Rs 50,000 and 19.20 percentages of the respondents income are above Rs 50,000.

Income of the Respondent



Table-7 Total Income of the Family

S.No	Total Income of the Family	No. of Respondent	Percentage
1	Below Rs 30,000	23	18.40
2	Rs 30,001-Rs 50,000	22	17.60
3	Rs 50,001-Rs 70,000	42	33.60
4	Rs 70,001- Rs 1,00,000	18	14.40
5	Above 1,00,000	20	16.00
	Total	125	100.00

The table 7 reveals that the 18.40 percentage of the respondents family income are below Rs 30,000 where 17.60 percentages of the respondents family income are between Rs 30,001 and Rs 50,000, 33.60 percentage of the respondent family income are between Rs. 50,001 and Rs 70,000, 14.40 percentage of the respondents family income are between Rs 70,001 and Rs 1,00,000 and 16.00 percentages of the respondents family income are above Rs 1,00,000.

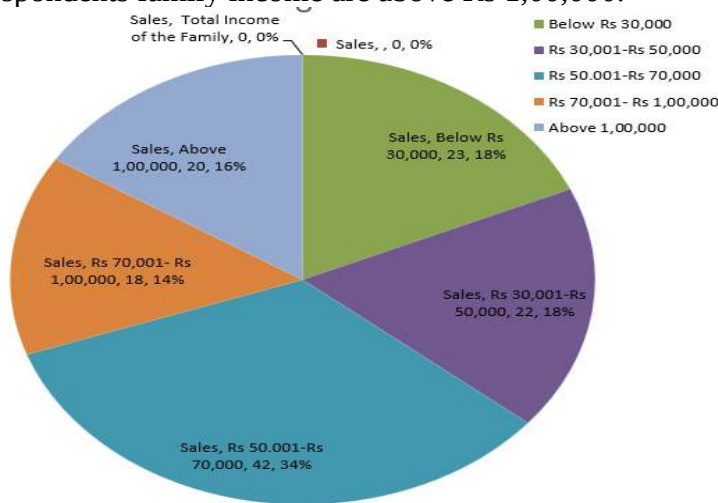


Table-8 Type of Product Purchased

S.No	Type of Product Purchased	No. of Respondent	Percentage
1	Organic vegetables	50	40.00
2	Food products	49	39.20
3	Cosmetics	26	20.80
	Total	125	100.00

The table 8 reveals that the 40.00 percentage of the respondents purchase organic vegetables, where 39.20 percentages of the respondents purchase food products and 20.80 percentages of the respondents buy cosmetics.

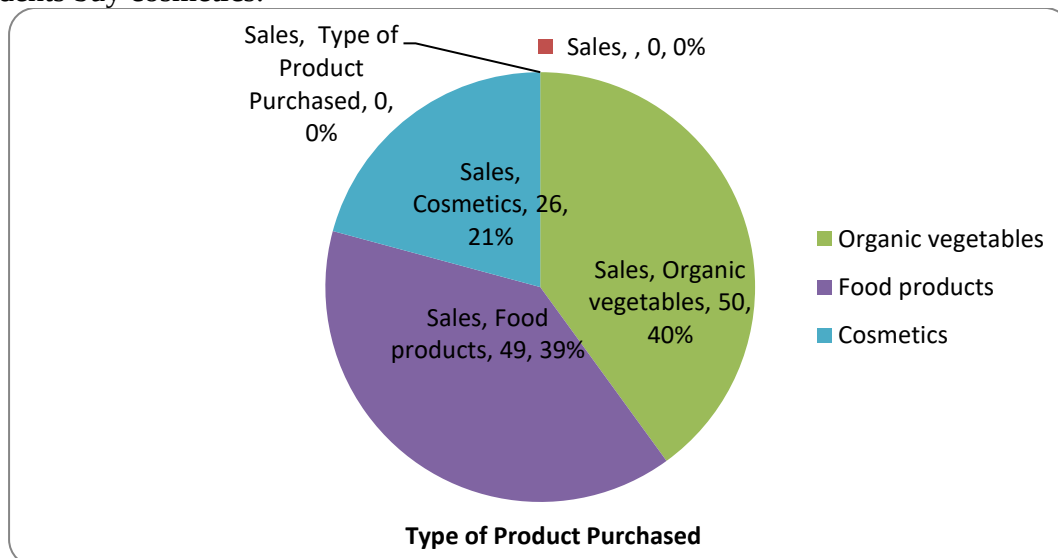


Table-9 Purchase Location

S.No	Purchase Location	No. of Respondent	Percentage
1	Retail Store	14	11.20
2	Departmental Store	18	14.40
3	Malls	21	16.80
4	Show rooms	28	22.40
5	Super market	23	18.40
6	Trade Fair and Exhibition Halls	21	16.80
	Total	125	100.00

The table 9 reveals that the 11.20 percentage of the respondents purchase in retail store, where 11.40 percentages of the respondents purchase in departmental store, 16.80 percentage of the respondent purchase in malls, 22.40 percentage of the respondents purchase in show rooms, 18.40 percentage of the respondent purchase in super market and 16.80 percentages of the respondents purchase their product in trade fair and exhibition halls.

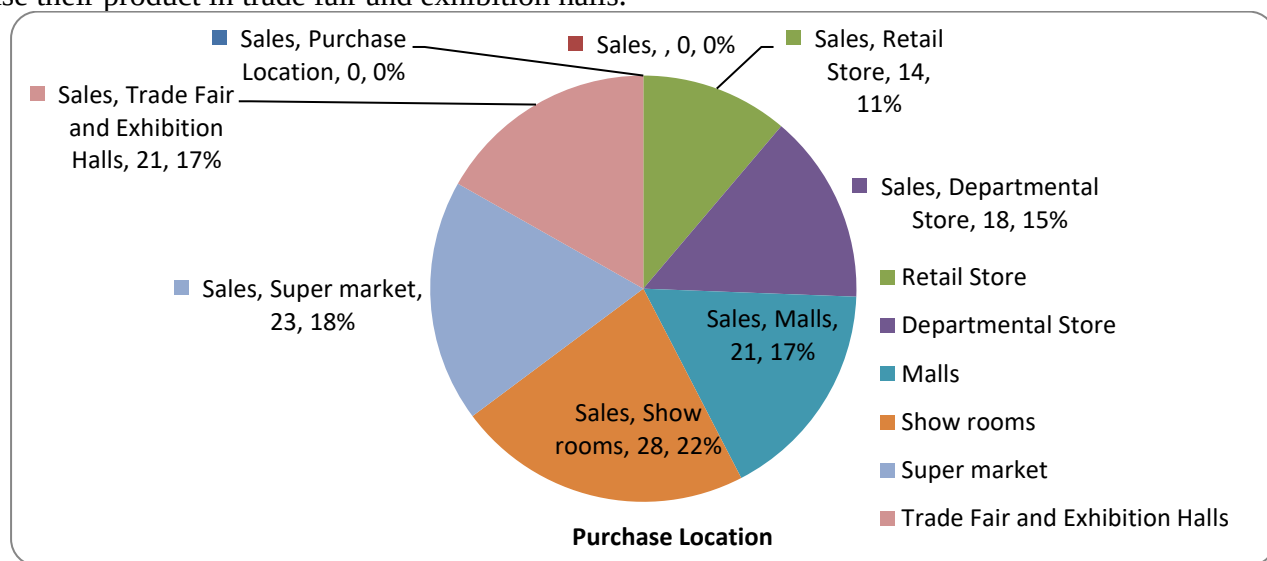


Table-10 Amount Spent on Purchase

S.No	Amount Spent on Purchase	No. of Respondent	Percentage
1	Below Rs 5,000	31	24.80
2	Rs 5,001-Rs 10,000	43	34.40
3	Rs 10,000 – Rs 20,000	30	24.00
4	Above Rs. 20,000	21	16.80
	Total	125	100.00

The table 10 reveals that the 24.800 percentage of the respondents spent are below Rs 5,000 for purchasing where 34.40 percentages of the respondents spent between Rs 5,001 and Rs 10,000 for purchasing, 24.00 percentage of the respondent spent between Rs. 10,001 and Rs 20,000 for purchasing, 16.80 percentages of the respondents spent above Rs 20,000 for purchasing eco-friendly products.

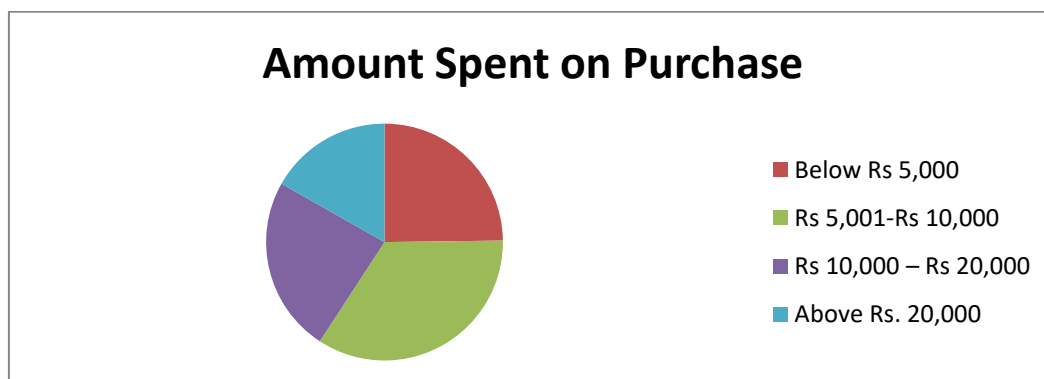
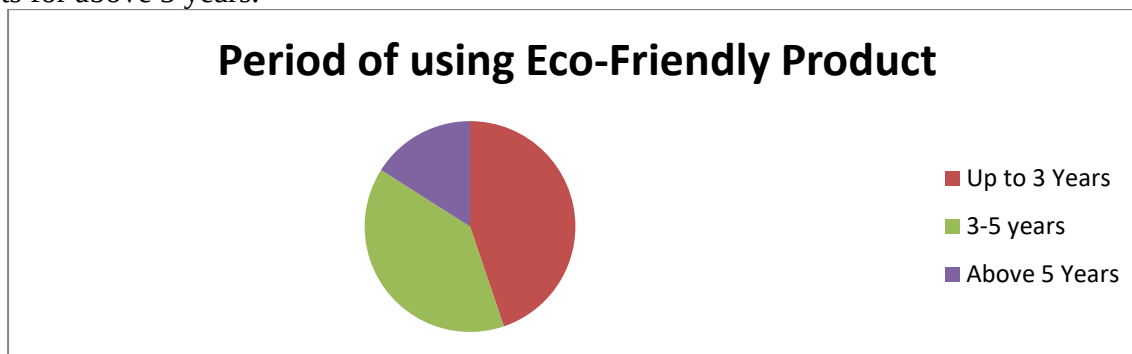


Table-11 Period of Using Eco-Friendly Product

S.No	Period of Using Eco-Friendly Product	No. of Respondent	Percentage
1	Up to 3 Years	56	44.80
2	3-5 years	49	39.20
3	Above 5 Years	20	16.00
	Total	125	100.00

The table 11 reveals that the 44.80 percentage of the respondents purchase the eco-friendly products upto 3 years, where 39.20 percentages of the respondents purchase the eco-friendly products between 3 and 5 years and 16.00 percentages of the respondents purchase the eco-friendly products for above 5 years.



Consumer Perception towards Eco-Friendly Products

In this part it has discussed about the consumer perception towards eco-friendly products. For this, nine statements have been framed for examining the consumer perception with 5 point Likert's scaling method. The mean of the statements is given in the following table

Table 12 Consumer Perception towards Eco-friendly Products

S.No	Factor	Mean Score
1	Made out of Normal Products	3.83
2	Green Label & Marks	3.84
3	Price	3.60
4	Product Excellence	3.59
5	Product Worth	3.33
6	Bio-Degradable	3.95
7	Recycling/Reuse Features	3.77
8	Environmental Knowledge & Concern/Care	3.51
9	Ozone Free Nature	3.80

It is indicated from the above analysis that among the nine categories of consumer perception towards eco-friendly products, bio-degradable attains the maximum level of consumer perception with the mean score of 3.95 and followed by green label & marks with the mean score of 3.84.

CONCLUSION

In this study it has been revealed that eco-friendly products are good for the health and environment. Eco-friendly products are good superiority and the recitals of these are improved than the conservative products. World is the only planet where human beings can live, so people need to take extra care to prevent the environment and earth. All should know the status of being nature friendly.

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**EMPOWERING RURAL WOMEN THROUGH FREEBIE SCHEMES OF
TAMIL NADU STATE GOVERNMENT**

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Abstract

This article has mainly focused on the innovative scheme of free bus travel and how it benefited the people and sparked to empower the women in the male centric society. Tamil Nadu is a welfare State which implemented innovative schemes for enhancement of people status gradually. On the consequence, the Government of Tamil Nadu has announced the scheme for women welfare and empowerment named “Free Bus Travel Scheme” which has given the free travel to all women in Tamil Nadu. The intention of the scheme was announced by the Government of Tamil Nadu to increase the mobility of women. This scheme has increased the women’s mobility and their savings. Tamil Nadu, being a role model for implementing the innovative free schemes for entire India. All the state has attributed the concept for their convenience and applied the different phenomenon. Earlier, Tamil Nadu Government has given the doles and freebies to the people, especially those have in the poverty line. Some of the electronic goods also provided to enhance the economic and educational enhancement. Now the tern has changed beyond the stereo type of schemes and programs. Conceptually, the Government has announced the free travel for all women might be stupendous character which directly or indirectly enhance the women status and empower the women in this society.

Keywords:, Innovative freebie schemes and Socio-Economic Empowerment of Rural Women

Introduction

Rural women in India are concentrated in agriculture to a much larger extent than men. Around 60 percent of India’s population engaged in farming, women contribute to almost 70-80 percent of farming activities but they are neither legally nor socially recognized as farmers. The term “freebies” has become a point of contention in the political culture of India. In order to woo voters to their side, political parties try to outdo each other

by promising free goods, such as mobile phones, laptops, etc. There are economic, if not moral aspects to it. The moral aspect to it is that when it comes to choosing political parties, it all boils down to how much a party has given incentives packaged as freebies, in other words it can almost be said that political parties are bribing people into voting for them. The economic aspect is how sustainable it is for the state to keep providing freebies at state expenses.

Distribution of freebies in election or pre-election existence is a deeply ingrained tradition which is accustomed to democratic India. Freebies often takes the form of cash, bribes, free rice, saris, or loan waivers and its mandatory practice by parties has predominantly overtaken the centre stage in all election campaigns. Simply put 'Freebies' are public welfare measures – goods or services – offered free of cost by the government. As far as the Indian context is concerned, freebies are not precisely defined in the legal framework. As of now it is used as a political term by the Central Government to express its disapproval of certain schemes at the state-level. It is highly likely that the meaning will change as time evolves. Now it must be noted that certain expenditures done under populist pressures are questionable to say the least, but given the astronomical rise of income inequality among the Indian populace, some of these freebies may be justified in order to put the economy on its right track.

Empowering Rural Women

The Tamil Nadu government's primary objective for this program was to enable women, particularly in the rural areas, to acquire knowledge for social and economic development. From these research findings, it can very well be argued that this unique non-traditional strategy of the Tamil Nadu government was one of the most effective, targeted interventions of the Dravidian administration to uplift and empower women. Historically, the Justice Party, precursor to the DMK, played a big role in women's empowerment. Subsequently, three areas in which Tamil Nadu achieved tremendous success- helping shrink traditional cleavages of caste, religion and gender- are attainment of educational outcomes, healthcare and inclusive industrial growth. Success in these three areas are intertwined. Commendable results were achieved in the field of education in Tamil Nadu by Dravidian parties through a slew of financial interventions (freebies)- such

as free mid-day meal scheme, free bus pass, free cycles and free laptops- and affirmative actions- including both horizontal and vertical reservations. Along with free colour TV, schemes to remunerate women graduates among others have paid huge dividends in the attainment of the educational goals of women.

Review of Literature

Ramesh Pandita¹ (2022) in his article entitles “Politics of Freebies” had stated that Strange it may sound but the fact it remains that people riding the costliest cars, living lavish & dignified lifestyles, owning millions and billions of rupees have actually been reduced to be labelled as beggars by their own Chief Minister for supporting his freebie politics and are shamelessly happy to receive a meager Rs 300/- or so a month as waiver on their electricity and water bills. **Nipun² (2020)** in his report “Freebies Culture In Indian Politics”, had concluded that freebie schemes must be used for individuals who are in desperate need of basic necessities. It must not be used by political parties in a way that lowers election competition between them. Elections must be held in a free and fair manner in order to benefit society and to assist the needy. **Saksham Vashishtha³ (2023)**, in his article entitled “The Role of Freebies in Indian Politics”, had pointed out that freebie schemes are the social welfare regimes whereby material goods are distributed to the poor and vulnerable populations of the country and helping their uplift their socio-economic condition. According to the conclusion of **Kuunal Bakshi & Shreya⁴ (2023)**, “A Critical Analysis of Distribution of Election Freebies” Freebies in general is bribery Not just the cash- from laptops to cows to mixers grinders to all sort other goodies, political parties of all ilk, belief and ethics have infused a draconian culture in the Indian democracy, a culture where freebies has been not used as a tool to cure the social apathy, but conducted to create financial gains, private assets and to achieve major vote pluralities.

Importance of the Study

¹ **Ramesh Pandita**, “Politics of Freebies, March 2022,

² **Nipun**, “Freebies Culture in Indian Politics”, brillopedia, July 11, 2022

³ **Saksham Vashishtha**, “Journal of Emerging Technologies and Innovative Research (An International Scholarly Open Access Journal, Peer-reviewed, Refereed Journal)”, Vol.10, No.7, July 2023, EISSN: 2349-5162

⁴ **Kuunal Bakshi & Shreya**, “A Critical Analysis of Distribution of Election Freebies”, A Journal on Contemporary Issues of Law”, June, 2023

Tamil Nadu State Government is offered a number of Freebies schemes to the people for socially and economically empowering of rural women. There have been studies which showed the poverty-reducing effect of the Public distribution System. The free or subsidized rations under PDS allows food grains to be available for cheap for consumers while assuring remunerative prices to farmers. Subsidized food grains distributed under the PDS contribute to ensuring basic food security. The Pradhan Mantri Garib Kalyan Anna Yojana (PMGKAY) kept many away from the brink of starvation during the novel corona virus pandemic. Mid-day meals in schools have been proven to contribute to increased enrolment and retention in schools and addresses classroom hunger. It also resulted in keeping the evil of child labour under control. Tamil Nadu government's free bus pass for women has encouraged more women to join the workforce, in turn leading to economically stable families and women's empowerment. The introduction of free colour television in villages has resulted in decrease in domestic violence and also enabled women's empowerment as women have been able to connect with the outside world through visual media. It has ensured self-respect, as women and children are able to watch TV in their houses rather than visit the homes of those who are rich and own TV sets. Subsidies such as free laptops have now become necessities for increasing productivity, knowledge and skills. The small amounts given to the poor are called 'freebies', while freebies that the rich get through low tax rates and exemptions are referred as 'incentives'. Fiscal incentives are given to encourage corporate/entrepreneurs to boost industrial growth.

Statement of the Problem

Because the country's education system is deteriorating, the majority of people are in favor of improving and concentrating on education. Therefore, the state government has taken steps to improve education, and one of the steps in helping the education system is launching the Pudhumai Penn Scheme. This initiative also prioritizes the education of female residents. Mr. Stalin established the Moovalur Ramamirtham Ammayar memorial 'Puthumai Penn' (Modern Woman) Scheme, which stipulated that female students who attended government schools from grades 6 to 12 and were interested in pursuing higher education were eligible to receive a monthly stipend of 1,000 rupees. Further, lack of education, insufficient of water resources, transport cost, Unemployment, lack of income, poverty and lack of financial supports are the major constraints to the people especially in

rural India. Hence, urgently need to undertake this study in order to know various schemes like offered by Tamil Nadu State Government for the welfare of the rural people in the study area.

Tamil Nadu Chief Minister M.K. Stalin inaugurated '**Pudhumai Penn**' on September 5 in Chennai. Delhi Chief Minister Arvind Kejriwal was there. In Chennai, Bharathi Women's College had an event. During the ceremony, Mr. Kejriwal presented 26 schools of excellence and 15 model schools established by the Tamil Nadu government in imitation of his AAP administration in Delhi.

Naan Mudhalvan program,

Under the 'Naan Mudhalvan program, the Tamil Nadu Skill Development Corporation (TNSDC) will offer courses to government college students in Tamil Nadu on drones, 5G, and ChatGPT. Approximately 4,767 students have already signed up for Chat GPT for the upcoming semester, while 3,600 have chosen to participate in drone testing and design sessions, according to J. Innocent Divya, the managing director of Tamil Nadu Skill Development Corporation (TNSDC). The Chat GPT course will be administered by GUVI, an IIT-M and IIM-A-incubated Ed-tech company, while Vaayusastra Aerospace, an IIT-M Incubation Cell and IIT-M Rural Technology Business Incubator-incubated company, will instruct students on drone fundamentals, aerodynamics, design, calibration, simulation, assembly, and flying.

The main objective of the Tamil Nadu Naan Mudhalvan Scheme is to identify, train and offer career and academic guidance to talented students in government-run and state educational institutions. Through this scheme, students of Tamil Nadu will be able to get training that will help them in achieving their career goals. This scheme will make students of Tamil Nadu self-dependent. Other than that through this scheme, the standard of living of students will also improve. Talented students will get proper guidance with the implementation of this scheme which will help them in choosing the correct career path.

Tamil Nadu Education Assurance Scheme

In order to help girls to pursue higher education, the Government of Tamil Nadu implements various kinds of schemes. Through these schemes, financial assistance is provided to the girls. Recently the Government of Tamil Nadu has launched the Tamil Nadu higher education assurance Scheme. Through this time the Government of Tamil Nadu is

going to provide financial assistance to the girls in order to pursue higher education. This article covers all the important aspects of the yojana. You will get to know how you can take advantage of the **Tamil Nadu Higher Education Assurance Scheme 2023**. Other than that you will also get details regarding this scheme's objective, benefits, features, eligibility, required documents, application procedure, etc.

Tamil Nadu Free Laptop Scheme 2023

Tamil Nadu Free Laptop Scheme has been launched by Chief Minister Edappadi K Palaniswami for students who recently passed the 10th or 12th standard examination. The online application form-filling procedure will commence very soon. Applicants have to fill out the application form before the last date. Eligibility criteria, documents required for application submission, specifications of the laptop, and other information that is mandatory are available here in this article.

Today's world is the world of digitization. To survive in this digital world it is necessary for students to learn the latest technology. Free Laptop Scheme 2023 is an initiative of the state government of Tamil Nadu. Under this scheme, the government is going to distribute laptops to the beneficiaries. The aim of the government behind launching this scheme is to help those students who are financially weak and unable to buy a laptop or computer or to encourage the students in their further studies and modern technology

Tamil Nadu Naan Mudhalvan Scheme

In order to develop the skills of youths both Central and state governments implement various kinds of skill development schemes. Through these schemes, various kinds of skill development programs are implemented. By participating in these programs youth can develop their skills. Recently the Government of Tamil Nadu launched the **TN Naan Mudhalvan Scheme**. Through this scheme, the government is going to develop the skills of 10 lakh youths annually. This article covers all the important information regarding the scheme. You will get to know how you can take advantage of this scheme by reading this article. The chief minister of Tamil Nadu MK Stalin launched an ambitious skill Development Scheme called Tamil Nadu Naan Mudhalvan Scheme on 1st March 2022. Through this scheme, the government is going to equip 10 lakh youth across the state annually with skills that will help them to realize their talents for the benefit of the country. Through this scheme, academic guidance will be provided to talented students in

government-run and State educational institutions. This scheme will identify the talents and train the students which will ultimately help them in getting a better career. Through this scheme, spoken English lessons will be provided to the students so that they can face the interview panel successfully

Illam Thedi Kalvi Scheme

In order to improve the standard of education both state and Central governments launch various kinds of schemes. Through these schemes, various facilities are provided by the government. Recently the Government of Tamil Nadu launched Illam Thedi Kalvi Scheme. Through this scheme, education will be provided to the student in physical mode. This article will cover all the important information regarding **Illam Thedi Kalvi Scheme 2023**. The Government of Tamil Nadu has launched Illam Thedi Kalvi Scheme. Through this scheme, education will be provided to the students in a physical manner. Volunteers will be assigned for every class and for every subject. These volunteers will impart education to the students through door-to-door campaigns. All those students who cannot afford transport will be able to take benefit from this scheme. The salary of volunteers under this scheme will be Rs 25000 per month. Around 1 lakh students will be able to take benefit from this scheme. Those students who have suffered learning loss with psychological problems due to pandemic situations will be targeted under this scheme. Around 86550 people are registered to work as volunteers under this scheme. Out of these 86550 citizens, 67691 are women, 32 are transgender and 18557 are men.

Pudhumai Penn Scheme

Chief Minister M.K. Stalin will inaugurate the **Pudhumai Penn Scheme** in Chennai in the presence of Delhi's CM Arvind Kejriwal. Under "Pudhumai Penn," all female students from Classes 6 to 12 in government schools will be paid 1,000 a month till they finish their undergraduate degree, diploma, or ITI. Their bank account will be credited. Students may get various scholarships. This plan aims to encourage higher education among economically disadvantaged females. Additionally, 6 million females will benefit annually from this plan. The initiative was budgeted for 698 crores in 2022-23. M.K Stalin and Arvind Kejriwal inaugurated a social welfare initiative and model school scheme in Tamil Nadu. The program would provide monetary assistance to students who are enrolled in educational institutions who fulfill the norm requirements. In addition, this program is

geared toward improving the general well-being of female students and encouraging them to continue their education. The article discusses the Puthumai Penn Scheme, including its aims, relevance, and advantages. We will also discuss the key features of this plan.

Pudhumai Penn Scheme Benefits

The Pudhumai Penn Scheme is different from other schemes since it focuses on providing financial assistance, encouraging female students to continue their education, and discouraging parents and guardians from allowing their daughters to be married at a young age. Because of the foresight to focus on contemporary circumstances, the Puthumai Penn Scheme is going to usher in a new era of innovation within the next several years. A monetary award of Rs 1,000 per month will be provided to female students who are pursuing an education till they have either graduated or earned a certificate or diploma, irrespective of the field. Because it is common knowledge that female students in our country are discouraged from pursuing an education, this program offers a boost to the confidence of young women. The scheme aims to help 6 lakh females per year and has been budgeted at Rs 698 crore. Under Pudhumai Penn, money would be immediately paid to student bank accounts to assure their education. This means there will be no mediator in receiving money, just the children and the bank. The plan discourages child marriages and empowers women. They shouldn't accept anything that hurts their pride. Debit cards were given out to a total of 613 students during the initial phase of the plan. Talking about the initial stage of the scheme, this will be beneficial to around 6,500 students in the Tiruchi district who are now enrolled in institutions of the arts, sciences, and engineering.

Kalaigarn Magalir Urimai Thogai Scheme

The Tamil Nadu government has identified 1.06 crore women, as eligible to benefit from the Kalaigarn Magalir Urimai Thogai (women's basic income) scheme, which Chief Minister M.K. Stalin is set to launch in Kancheepuram on September 15, the birth anniversary of former CM. C.N. Annadurai. The Chief Minister M.K. Stalin is set to launch in Kancheepuram on September 15, the birth anniversary of former CM. C.N. Annadurai. During his speech at a meeting he chaired at the Secretariat in Chennai to review the arrangements being made towards the launch, Mr. Stalin said a total of 1.63 crore applications were received, of which 1,06,50,000 have been short-listed to benefit from the scheme. ATM cards would be issued in certain numbers initially, and will have to be issued

to all. Though the Tamil Nadu government in its budget for 2023-24 stated that a sum of ₹7,000 crore has been allocated for this scheme, it is believed that the scheme will cost more. The CM on Monday said that a total sum of ₹12,000 crore would be allocated for this scheme annually. A senior official told *The Hindu* that the allocation of ₹12,000 crore would not be for the ongoing year, as a few months have already passed before the formal launching of the scheme on September 15. The CM advised officials to ensure that there were no faults anywhere while implementing the scheme.

Zero Ticket Bus Travel Scheme for Women

In May 2021, the Government of Tamil Nadu announced a scheme whereby women travelers can travel without paying any fare in government run normal-fare buses (for short distances up to 30 kilometers) in cities and towns in the state. Women are issued zero-tickets (a fare less ticket) when they travel in these buses. Free travel facilities have been provided for all women including working women, Transgender and girls who are pursuing higher education in ordinary fare city buses operated under the control of the Tamil Nadu State Transport Corporation since 2021.

Tamil Nadu Government announces and implements lots of scheme for the welfare of people of Tamil Nadu. One of the social welfare schemes for Tamil Nadu Women is Zero Ticket Bus Travel Scheme. It was announced and launched in the year 2021. The main objective behind launching Zero Ticket Bus Travel Scheme is to encourage women of Tamil Nadu for higher work participation and reduce the dependency on private mobility. Most of the Working Women, Girls Students and Women Labourers doesn't have their own convenience to commute one place to another. They regularly pay for travelling fare which overburden them financially. So to unburden the Women of Tamil Nadu financially, Government came up with a idea to provide free of cost travel in government run buses. Under Tamil Nadu Zero Ticket Bus Travel Scheme, No women have to any fare if they are travelling in Government of Tamil Nadu run buses. Zero Fare Ticket will be issued to women beneficiary at the time of travelling. Free of cost travel in government run buses will only valid up to 30 kilometers. Women Beneficiary has to carry one photographed identity card for verification purpose. Transgenders are also eligible for free of cost travel under Zero Ticket Bus Travel Scheme of Tamil Nadu. Free of Cost Bus Service will only provided in Tamil Nadu Government run Ordinary/ City Buses or Buses operated under the

control of Tamil Nadu State Transport Corporation. There is no need to apply anywhere to avail the benefit of free of cost travel in buses. Women Beneficiary can directly travel free of cost under Zero Ticket Bus Travel Scheme for Women of Government of Tamil Nadu.

Conclusion

The socio-economic conditions of the people can be improved through the efforts as well as supports of the government. Tamil Nadu State Government through offering different types freebie schemes provides employment opportunities to the people, reduces unemployment problems, generates income, alleviates poverty, contributes to industrial production, country's GDP, market share, export earnings, develops entrepreneurship, utilizes the available natural and human resources, provides food security, removes the disequilibrium among the people, reduces social evils empowers rural women and thereby strengthen rural economy. Therefore, it concluded that the freebie schemes of Tamil Nadu State Government are the uplifts for empowering the rural women in terms of both socially and economically.

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Study on Transformations to Sustainable Development in Tamil Nadu in the Effect of Implementing Socio-economic Development Schemes by Government of Tamil Nadu

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Abstract : The present study is mainly focused on the Socio Economic Development schemes implementing by the Government of Tamil Nadu through various schemes namely Freebies Schemes through different channels namely Non-merit Freebie Schemes and Freebie Schemes and Social Reforms, Democratize the accessibilities of uplifting schemes for Survival growth, Education, Opportunities, Financial assistance, Women empowerment Schemes, Improving standard of living, strengthening economic stability for sustainable development by various socio-economic development oriented Tamilnadu Freebie Schemes, Policy Formulation based on the Social Justice Values and Equity in Society. Therefore, an attempt is made in the present study to highlight various supports as well as efforts of Government of Tamilnadu state's unique and inevitable initiatives for socio-economic development through freebie schemes. Transport for women, Pudumaippen, Makkalai Thedi Maruthuvam, Kalaingar Urimai Thohai Thittam, Seed money for Higher education, Illamthedikalvi, NaanMuthalvan, and other infrastructure facilities,

Key words : Freebie, Schemes, Socio-economic, Society, Subsidize, Welfare, Development, Empowerment

INTRODUCTION

Tamil Nadu is still one of the few socialist-democratic states in India, Welfare schemes have long influenced Tamil Nadu politics. In 1967, when hunger was a major issue, Perarignar C.N. Annadurai became Chief Minister riding on his promise of 'One rupee for one padi (litre) rice'. The government soon found out that the promise was even expensive and unsustainable, but the welfarism continued which has, in the post-liberalisation period, managed to significantly increase its per capita income and Gross Domestic State Product (GSDP), while also maintaining a steady trend of interventions into welfare. Not only as 'freebies' – Tamil Nadu has given India a market-friendly Dravidian welfare model. This is the story of Tamil Nadu – the state that has given India a unique template. One, by pursuing targeted welfare schemes, often exonerate as 'freebies', and two, by pursuing economic growth through market forces. The state shows that the twin track is

possible. Interestingly, despite spending high on freebies and populist schemes, Tamil Nadu has maintained inclusive growth over the decades.

Review of Literature

Nipun (2020) in his report “Freebies Culture In Indian Politics”, had concluded that freebie schemes must be used for individuals who are in desperate need of basic necessities. It must not be used by political parties in a way that lowers election competition between them. Elections must be held in a free and fair manner in order to benefit society and to assist the needy. **Saksham Vashishtha (2023)**, in his article entitled “The Role of Freebies in Indian Politics”, had pointed out that freebie schemes are the social welfare regimes whereby material goods are distributed to the poor and vulnerable populations of the country and helping their uplift their socio-economic condition.

Importance of the Study

Tamilnadu Government Freebie schemes is an important aspect to study about progressive growth of Socio-economic development initiatives to make society towards Self-actualized socially potential and as well as sustainable society. Eradicating the factors behind the day to day hungry of the people only not a problem alone but for a state of Tamilnadu Government and to the a response to various elite and popular mobilizations the Indian state, despite its departure from any socialist tendency, maintains a number of welfare schemes, programmes and subsidies, upon which the poor depend heavily for sustenance that would be behind the successive endeavour of Tamilnadu to become Richest State of India & achieve TN's Trillion Dollar Goal towards Self-actualized socially potential society.

It is therefore necessary to study and document the wholesomeness of the Socio-Economic Development model of Dravida Model Government of Tamilnadu, hence the interest of researcher to undertake a study in this area. The researcher thus carried out this study to explore the various aspects and suggest measures. This study would help to refer mainly public utility services namely Planning and execution system of Social welfare departments which connected with where ever the Freebie schemes applicable departments, welfare initiatives, revenue administration, future researcher, public software in different ways. It would also be of help and provide a fund of knowledge to the students about of Socio-economic Development, make exact in-depth understanding, clarity, awareness about of freebie system among public for that reasons pointless criticism get flatten with it. In recent trend socio-economic development initiatives, welfare scheme, The subsidies, Freebie schemes are getting challenges due to anti-social elements even the schemes are greatly having efficient track records for that a good initiatives requires documentation about its processes.

Statement Of The Problem

We are Living in an “information society”, But bombarded with the beliefs and inequality practices imposing on people since earlier era to till date by the dominance of unfair narratives and fictional code which divides the human survival rights, natural talents and abilities into four divisions/class by the heredity caste system, Still, which is not allow people to live as per the avilable sources and opportunities to avail education in all the platform and earning capacity based on their learning abilities and efforts taken for dignified survival without any restrictions and limitation.

In recent days, widely we may possibly hearing *unpleasant* debate and voices against inequality, Socio-Economic Development initiatives to sustainable developoment, Freebie schemes and various welfare Programme which successfully executing by Government of Tamilnaduwith great track record in State growth as “Tamilnadu is second richest state in India”. -

Objectives

- To understand the awareness of people on the various welfare schemes provided at free of cost
- To understand the impact of freebies welfare schemes on socio-Economic Development of people in Tamilnadu

How 'freebies' boosted Tamil Nadu's economy –

Transformations to Sustainable Development in Tamil Nadu

The scheme has “profoundly changed” the lives of employed and college-going women, who make up 40 per cent of bus passengers in the state. “It empowers them to travel without asking anyone’s permission,. Women’s participation in the economy and social activities outside their homes has profoundly improved. It has had a bigger impact than expected

Welfare schemes and doles have long influenced Tamil Nadu politics. In 1967, when hunger was a major issue, C.N. Annadurai became chief minister riding on his promise of ‘One rupee for one padi (litre) rice’. His government soon found out that the promise was expensive and unsustainable, but the welfarism continued.

After the demise of C.N.Annadurai at 1969 as a CM, Dr.Kalaingar.M.Karunanithi, continued the same government as chief minister with revolutionary socio-economic development initiatives & Executions, At 1977, M.G. Ramachandran modified an existing mid-day meal scheme to attract children to school. His successors such as J. Jayalalithaa further polished the scheme, The current DMK government, under Chief Minister M.K. Stalin, has now Introduced various Socio-Economic development initiatives schemes to include breakfast for primary school children as well first in India.

Interestingly, despite spending high on freebies and populist schemes, Tamil Nadu has maintained inclusive growth over the decades. Per capita income has gone up from less than Rs20,000 in the late 1960s to Rs60,000 in 2012

The Freebies can be identified that through two ways for better understanding, Merit Freebies schemes and Non-Merit freebie schemes.

Merit Freebies : Pudhumai Penn, Seed money for Higher education, Illamthedikalvi, Rs.7500/per month for aspirants those who preparing for UPSC priliminari Exam and Rs.15000/per month for aspirants who cleared preliminary exam and going to appear UPSC Main Exams, Cost-free Bus pass for Students, schoolbag, cycle, laptop, food-already continuing as mid-day meals since 1957 and in recently with nutrient, Recently in Govt. of Tamilnadu extended the phases as Chief Minister's Morning-Breakfast for school students childrenetc.,

Non-Merit Freebies : Cost-free Bus travel for woman in Tamilnadu, Cost-free Electricity supply for Agriculture, waived loans of Formers cost worth 6000Cr at year of 2006. Colour television(2006), Kalaingar mahalir urimai Thohai Scheme, Makkalai Thedi Maruthuvam, Innuyir kappom 48, Chief Minister's Comprehensive Health Insurance Scheme, Periyar Samaththuva Puram, The non-merit Freebies scheme is not only helps to poors and also further it expands to industrial growth by offering various facilities to establish Industrial Parks through that creating employment opportunities it indirectly leads to establish ancillary units namely MSMEs and many more and other infrastructure facilities.

Women Empowerment Through Freebie Schemes

Objective of the Schemes towards Women Empowerment

- Recognition of the work of women who work tirelessly throughout their lives for the family is paramount.
- Next, the entitlement amount of 12 thousand rupees per annum is meant to improve the livelihood of women, raise the standard of living and lead them to live with self-respect in the society.

Historical background

- A flip through the pages of history reveals the fact that the matriarchal social system has guided mankind in the first place.
- Even with the invention of tillage tools and the transition to an agrarian society, women's labor was equal to that of men.
- But over time, in the name of religion and age-old traditions, women were confined inside the home.
- They were denied education. Women's labor is rejected. As a result of many social reformers working to open the door of the locked iron cage, demolish women's slavery and restore social and economic freedom for them, today girls are studying more in school and college courses and women are excelling in education.
- The fact that more women are passing civil service exams also shows the maturity of the Tamil society.
- It is an undeniable fact that even today women are the economic backbone of many families.

Economic Value for Women's Labour

This women's rights project has been introduced in the name of the "Kalaingar" to celebrate women's rights by giving property rights to women, reservation in education, employment and local government bodies, while duly recognizing the work of women who are not counted in this way.

Hence, the scheme has been carefully named as 'Women's Entitlement Fund' rather than 'Women's Grant'.

Though the Tamil Nadu government in its budget for 2023-24 stated that a sum of ₹7,000 crore has been allocated for this scheme, it is believed that the scheme will cost more. The CM said that a total sum of ₹12,000 crore would be allocated for this scheme annually.

Global Gender Gap Report

- In the Global Gender Gap Report (2023), India ranks 127 out of 146 countries ranked.
- In terms of purchasing power, the global average annual income of women is estimated to be around \$11,000, while the average annual income of men is estimated at \$21,000.
- That is, women earn almost half of what men earn. Globally, the study also found large gender differences in annual income.
- The Government of Tamil Nadu is launching this mega scheme to recognize the economic value of undervalued women's labor and provide economic independence to women from poor families engaged in low-paid jobs such as agriculture and domestic work.

Female Labor-force Participation Rate

- According to International Labor Organization data for 2022, the female labor force participation rate in India is **23.97%**. The female labor force participation rate in Tamil Nadu is **28.5%**. This is higher than the national average.
- According to the Economic Survey report released for the year 2022-23, the female labor force participation rate in Tamil Nadu has increased by **12%** percent.
- Women's opportunities for employment and economic advancement are increasing due to exemplary state government schemes like free bus travel for women, innovation girl.

Global studies

- In the name of Universal Basic Income, such a scheme has been implemented in many countries in the world in an experimental manner, in certain areas, only in a few sections.
- Economists are of the opinion that many significant changes have taken place through the program implemented on such an experimental basis.
- Studies have shown that through this program, there is a chance of reducing poverty by half, women prioritize the funds available for their children's education, nutrition and medical expenses, and come forward to start small businesses.
- Above all these, women have gained self-confidence. If a program that has been implemented sporadically in some countries of the world as an experimental effort is getting so much benefit, then this huge initiative to be implemented in Tamil Nadu will create huge economic benefits in the Tamil community in the future.

CONCLUSION

The study is mainly focused on Transformations to Sustainable Development in Tamil Nadu in the Effect of Implementing Socio-economic Development Schemes by Government of Tamil Nadu. It explores and examines factors influencing Tamilnadu which formulating the policies, taking initiatives and execute the Freebies schemes & its objective behind the state policy and at the same time the factors influence the people & their circumstances to avail Freebies schemes towards socio-economic development, equity in Education & Employment Opportunity and future perspective state growth with the development of standard of living and also aims at uplifting the people from the below poverty line.

“These 'freebies' are really welfare schemes that are economic necessities to propel inclusive and sustainable growth,” said Prof J. Jeyaranjan, vice chairman of the State Planning Commission.

Cobalt (II), Nickel (II) and Palladium (II) complexes appended terpyridine-based ligand: Synthesis, spectral characterization, anticancer activity and apoptosis investigation

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Abstract

Three new complexes containing 2-thiophenylterpyridine (TP) ligand, namely, **[Co(stpy)₂]Cl₂ (Co-TP)**, **[Ni(stpy)Cl₂]₂ (Ni-TP)** and **[Pd(stpy)Cl]Cl (Pd-TP)** were synthesized and subsequently characterized employing various spectroscopic techniques including UV–Visible, IR, ¹H NMR, EPR, and ESI-MS analysis. ESI-MS spectra suggested the complexes **Co-TP** and **Ni-TP** to be six coordinated with two ligand units and the complex **Pd-TP** to be a four-coordinated mononuclear square planar complex. The dimeric nature of the complex **Ni-TP (M₂L₂Cl₄)** was established by X-ray diffraction analysis, which confirmed the bridging of two nickel centers by two chloride ions. The ligand and complexes were assessed for their cytotoxic behavior by using MTT colorimetric assay. The compounds **TP**, **Co-TP**, **Ni-TP** and **Pd-TP** displayed significant antiproliferative activity on A549 (human lung carcinoma) and MM2 (human breast cancer) cell lines and had no toxic effect on human normal embryonic kidney cells (HEK 293). Further, the morphological changes associated with MM2 and A549 cells triggered by the tested compounds due to apoptosis have been validated with the help of AO-EB and DAPI staining assays.

CONFLICT OF INTEREST STATEMENT

The authors declare no competing financial interest.



Design and development of copper cobaltite (CuCo_2O_4) nanoparticle for antibacterial anticancer and photocatalytic activity

K. Tamil Thendral^a  , M. Amutha^a, R. Ragunathan^b

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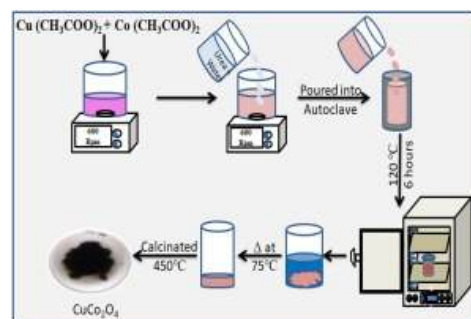
<https://doi.org/10.1016/j.matlet.2023.134720> 

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Abstract

In this paper, hydrothermal technique has been utilized for the fabrication of spinel-type copper cobaltite nanoparticles (CuCo_2O_4 NPs). The prepared nanoparticle was characterized using FT-IR, SEM, XRD and EDAX techniques. The XRD spectra of CuCo_2O_4 show the formation of a cubic spinel-type CuCo_2O_4 nanocomposite. The FTIR graph determines the existence of metal-oxygen bonds. SEM images reveal the morphology of the nanoparticles. The synthesized materials were tested against the pathogens using agar-well diffusion method. The CuCo_2O_4 nanoparticles shows that have potent bactericidal properties. MTT assay was done to evaluate the cytotoxic activity of CuCo_2O_4 NPs against a cervical cancer cell (HeLa) with an IC_{50} value of $0.72\text{ }\mu\text{g/ml}$. Addition to these biological applications, the nanoparticle also degrade toxic dyes under direct sunlight.

Graphical abstract



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Parthenium hysterophorous flower template assisted SnO₂ nanostructure as photoanode for dye sensitized solar cell

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ABSTRACT

The synthesis process of tin oxide (SnO₂) nanostructures and the performance of alizarin-based SnO₂ dye-sensitized solar cells have been investigated in the current work. For the first time, tin oxide nanostructures with various pH values are synthesized using the template taken from parthenium hysterophorous flower which acts as the photoanodes. SnO₂ film coated with alizarin dye, a platinum counter electrode, and an iodine electrolyte are used to fabricate DSSC. The structural, morphological, and optical characteristics of the SnO₂ nanostructures are investigated using powder X-ray diffraction (XRD), scanning electron microscopy (SEM), photoluminescence (PL), attenuated total reflectance (ATR) spectra, and UV-visible spectroscopy techniques. Current density-voltage (J-V) parameters are measured using electrochemical workstation with solar illumination.

1. Introduction

Dye sensitized solar cells (DSSCs) have gained significant attention over the past 20 years when compared to silicon and thin film solar cells due to their low cost, simple manufacturing process and higher efficiency. When using nanostructures of TiO₂ [1], SnO₂ [2], ZnO [3], Nb₂O₅ [4], and CeO₂ [5] as the semiconductor layer, the light collecting efficiency of DSSC is primarily reliant on the light absorption of dye molecules attached to the semiconductor surface layer. SnO₂ with higher bandgap and electron mobility [6] finds superior applications when compared to TiO₂ and SnO₂ nanostructures.

The dye molecules Ruthenium (Ru) which is synthetic, toxic and high cost material is nowadays substituted by plant pigments which are eco-friendly, low cost, simple, irrespective of their low stability and efficiency. The natural dyes are synthesised synthetically and employed as dye molecules for the fabrication of DSSC in order to address this low stability and low efficiency. Alizarin (1, 2-dihydroxyanthraquinone) used to colour textile is one of the most well-known red dyes ever used in DSSC. Traditionally, it was derived from the roots of plants of the madder genus [7,8] and herein it was purchased commercially from sigma aldrich.

Amongst the advanced available techniques adopted for the synthesis of nanostructures, template assisted technique is a low cost and

user friendly method. Despite having modest anti-inflammatory and antioxidant qualities, it has very little economic significance [9]. Extracts prepared from the leaves of this plant were utilized for the preparation of silver nanoparticles, ZnO and TiO₂ etc. [10,9].

As far as we are aware, there are no reports of Parthenium Hysterophorous blooms being used as a template for the production of SnO₂ nanostructures. Using a template made from a parthenium hysterophorous flower, SnO₂ nanostructures are synthesised in this study at four different pH levels (7, 8, 9 and 10). The effect of these pH levels on the structural, morphological, and DSSC performance of the nanostructures is then investigated using X-ray diffraction, field emission scanning electron microscopy, infrared spectroscopy, UV – Vis spectroscopy and photoluminescence spectroscopic studies.

2. Experimental details

2.1. Materials used

Tin chloride (II) dehydrate, FTO Glass Slide, Chloroplatinic acid Hexahydrate (H₂PtCl₆H₂O), Ethanol, Alizarin dye, methanol and Ethylene glycol are purchased from Sigma Aldrich and were used. Flowers from a nearby patch of Parthenium hysterophorus are gathered and dried in the shade.

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Effect of pH on the morphology of TiO₂ nanostructures

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Titanium oxide (TiO₂) nanostructures with different morphologies ranging from spheres, rods to sheets were prepared using solvothermal route. The effects of pH on the structural, morphological and optical properties of TiO₂ nanoparticles were investigated. Nanostructures are characterized using Attenuated Total Reflectance (ATR), Powder X-ray Diffractometer (XRD), Scanning electron Microscope (SEM) and UV- Visible Spectroscopy.

(Received February 25, 2023; Accepted June 20, 2023)

Keywords: Titanium oxide, Nanostructures, Morphology

1. Introduction

Titanium dioxide has been one of the most studied materials for many ecological and universal applications. Titanium oxide (TiO₂) is available in the form of nanocrystals or nano rods having a high surface area. Titanium oxide exhibits good photo catalytic properties, hence is used in antiseptic and antibacterial compositions(1), degrading organic contaminants and germs (2) , as a UV-resistant material (3), manufacture of printing ink, self-cleaning ceramics and glass coating (4), making of cosmetic products such as sunscreen creams, whitening creams, morning and night creams (5), used in the paper industry for improving the opacity of paper (6). TiO₂ exists in three main phases: anatase, brookite and rutile. Precipitating nanoparticles from a solution of chemical compounds can be classified into six major categories: colloidal methods, sol – gel processing, water – oil microemulsions method, hydrothermal synthesis, solvothermal synthesis and polyol method. When compared to other techniques solvothermal synthesis has many advantages such as easy and precise control of the size, shape distribution , crystalline of the final product through adjusting the parameters such as reaction temperature, reaction time , solvent type , surfactant type, precursor type and also pH .

Solvothermal synthesis is a method for preparing a variety of materials such as metals, semiconductors, ceramics, and polymers. The process involves the use of a solvent under moderate to high pressure and temperature that facilitates the interaction of precursors during synthesis. pH is an important factor that influences the synthesis of nanoparticles by solvothermal synthesis. pH of the solution has considerable effect on morphology, size, surface area and properties of nanomaterials. Therefore, nanoparticle size can be controlled by altering the pH of the solution media. Hence, in this present study, TiO₂ nanostructures are prepared by solvothermal method and the effect pH on the nature of TiO₂ nanostructure is studied.

2. Experimental

2.1. Preparation

The Ti(OH)₂ colloidal suspension was prepared by hydrolysis of titanium tetra isopropoxide(TTIP). In a typical process, 3 ml of titanium tetra isopropoxide was mixed with 10

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Synthesis, characterisation and ethanol sensing applications of MoO₃ – MoO₂ nanostructures at room temperature

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In the present work, MoO₃ - MoO₂ nanocomposite is synthesised via hydrothermal method and is characterised using various state-of-the-art techniques. The high crystallinity of the sample is observed from XRD and FESEM reveals the 2D plate like layered structures with hexagonal facets. The prepared composite is subjected to ethanol sensing at room temperature and it is observed that the material exhibits 4.5% for 25 ppm ethanol with response time as 98 s and recovery time as 219 s. The observed small response of the composite material MoO₃ – MoO₂ with longer response-recovery time might be due to the large sized fibrils observed.

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Keywords: Molybdenum oxide, hydrothermal, Ethanol, Sensitivity, Room temperature

1. Introduction

Transition metal oxides like chromium oxide, tungsten oxide, vanadium oxide, molybdenum oxide formed by 2D / 3D framework of octahedra or tetrahedra results in complex structures [1 - 4]. Among these common metal oxides, a low cost and low toxic ‘Molybdenum oxide’ exists in various compositions with multiple valence states from stoichiometric molybdenum oxide (MoO₃) to partially reduced MoO_{3-x} (2 < x < 3). Molybdenum trioxide (MoO₃) exists in three phases - a thermodynamically stable orthorhombic phase (α- MoO₃), a metastable monoclinic phase (β - MoO₃) and a hexagonal phase (h-MoO₃) [1, 4]. MoO₃, an n-type semiconductor with band gap 3.2 eV [5] is a pioneer component with rich structural polymorphism and stable bilayered structure held by van der waal forces [6]. The redox reactions and van der waals gap between octahedran Mo-O sheets in MoO₃ favours superior ion intercalation capability resulting in various applications like catalysis, display devices, petroleum refining, gas sensor devices, photoluminescence, etc [1, 7]. The band gap of the material could also be modulated due to the presence of oxygen vacancies. Because of the unique double layer structure, MoO₃ possess high theoretical capacity, high chemical and thermal stability. But MoO₃ in bulk form is limited due to low electrical conductivity, slow ion diffusivity which results in rapid capacity fading and lower capacity [4]. MoO₂ possess a strong metallic Mo-Mo bond resulting in good electrical conductivity even at room temperature. The morphological evolution [6 - 11] of molybdenum oxides (MoO₂ and MoO₃) with different nanostructures have been identified as the suitable promising candidates for device fabrication especially gas sensing applications.

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Synthesis and characterization of NiO nanoparticles using *Sesbania grandiflora* flower to evaluate cytotoxicity

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ABSTRACT

Conventional nanoparticle (NP) synthesis based on physical and chemical processes are costly and are mostly associated with harmful effects on environment, whereas the use of plant extract is eco-friendly and cost effective which could act as reducing, stabilizing and capping agent. Herein, the present study is aimed to synthesize nickel oxide nanoparticles from nickel nitrate precursor and *Sesbania grandiflora* flower extract. Synthesized nickel oxide nanoparticles were characterized by Ultraviolet-Visible, FT-IR, SEM and XRD analyses. Ni-O stretching vibrations at 418 cm^{-1} in the FT-IR spectrum confirmed the formation of NiO NPs. The XRD pattern revealed the crystallite size of the NiO NPs to be in range of 19.9–60.4 nm. The morphology of the NiO NPs as revealed by the SEM images, which was rod like structure. The anticancer activity of the synthesized NiO NPs was evaluated with MM2 (human breast cancer cells) and HeLa (human cervical cancer cells) and compared with *cisplatin*. In MM2, the IC_{50} value of the NiO NPs is $33.57 \pm 1.37\text{ }\mu\text{g/mL}$ whereas in HeLa, the IC_{50} value is $26.92 \pm 1.67\text{ }\mu\text{g/mL}$. The value is significant when compared with the conventional standard drug *cisplatin* ($17.80 \pm 0.30\text{ }\mu\text{g/mL}$ for MM2 and $15.06 \pm 0.84\text{ }\mu\text{g/mL}$ for HeLa).

Introduction

Nanotechnology is one among the most active interdisciplinary research fields and has potential industrial and pharmaceutical applications. Its significance is much realized in the last decade since it enabled the researchers, producers and consumers to engineer functional systems at nano-level to cover a majority of applications [1]. Nanoparticles range from 1 to 100 nm in size and possess optical, electrical, magnetic and chemical properties owing to the increase in surface area [2–4]. Recent years have witnessed a glory in the synthesis of metal and metal oxide nanoparticles, which are potential candidates for catalysis and medicine [5]. There are different synthetic procedures for nanoparticles like hydrothermal, solvothermal, sol-gel, thermal decomposition, co-precipitation etc., [6–15]. These protocols mostly involve the use of complex procedures, special equipment's and toxic chemicals. Hence in the recent studies, there is a need for easy, eco-friendly and low toxic procedures to prepare nanoparticles [8,16].

In this regard, Green synthesis is an environmentally friendly approach, in which various plant extracts, are utilized for the

preparation of metal oxide nanoparticles [17–25]. The plant *Sesbania grandiflora* known as agati in Tamil language and humming bird tree in English, belongs to the family Fabaceae. It contains valuable phytochemicals like alkaloids, terpenoids, flavonoids, steroids, anthraquinone, catechin, phytosterol tannins, etc., [26,27]. It is one of the rare plants having both flowers and leaves edible, their nutrients could be easily absorbed with no allergic reactions reported so far. The flowers are excellent source of calcium, iron and also contain Vitamin B. All the parts of the plant are widely used in traditional ayurvedic medicine to treat a broad spectrum of diseases including tumor, liver disorder, constipation, intestine inflammation and urinary infection [28].

Among transition metal oxide nanoparticles, Nickel oxide nanoparticles (NiO NPs) have received significant attention in recent years due to their unique physicochemical properties and potential applications in various fields such as catalysis, batteries, printing, textiles, pseudo-capacitors, optical switches, biomolecule immobilization (mainly through magnetic force exerted by Ni NPs), adsorption and additive manufacturing [29–37]. NiO NPs are the most engineered due to their wide band gap energy, p-type conductivity, correlated with

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Research Article

Transition Metal Catalyst Free and Single-Step Synthesis of Significant Thiosemicarbazones *via* Oxidative Coupling Strategy

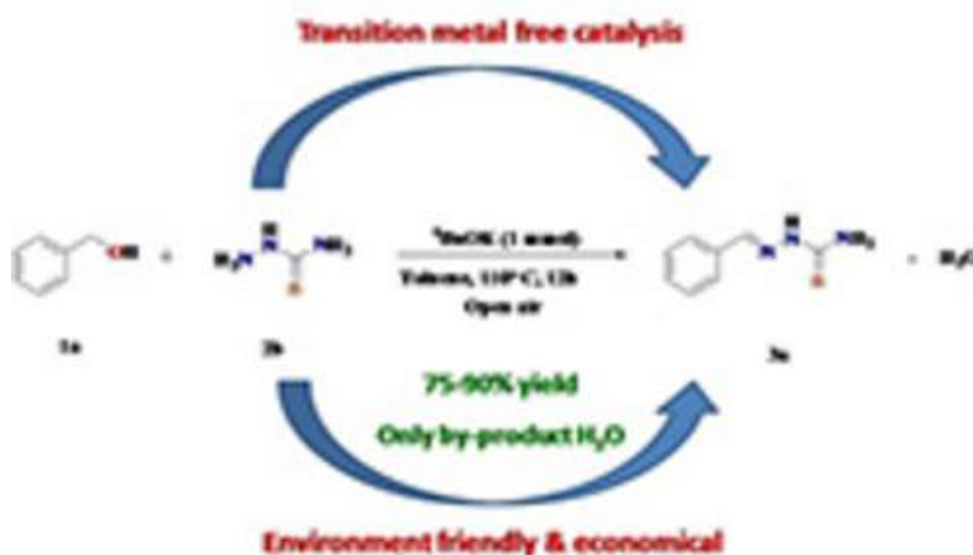
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Graphical Abstract

The efficacy and selectivity of the transition metal-free catalysis have been emphasized in constructing thiosemicarbazone derivatives from the dehydrogenative coupling of alcohols and thiosemicarbazides under aerobic conditions. A broad spectrum of thiosemicarbazones was obtained in good-to-excellent yields up to 90 %, with water as the only by-product



Abstract



Versatile biopolymer–functionalized copper cobalt oxide nanocomposite (Ch/CuCo₂O₄): Synthesis and applications in antibacterial, anticancer, and photocatalysis

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Highlights

- CuCo₂O₄ nanoparticles were prepared, and their surface were coated with the biopolymer chitosan.
- Explored the antibacterial capabilities of the Ch/CuCo₂O₄ nanocomposite.
- Used as an anticancer agent in an in vitro study against the HeLa cell line.
- Biocompatibility assessment was performed with the normal L-929 cell line.

AN EMPIRICAL STUDY ON STUDENT AWARENESS OF UNIFIED PAYMENT INTERFACE SERVICES

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Abstract

This empirical study investigates the sources of awareness of Unified Payment Interface (UPI) services among students, focusing on their knowledge, and the factors influencing their awareness. UPI, a real-time payment system in India, has revolutionized digital payments, making it crucial to understand its penetration among the tech-savvy student demographic. The study found that both personal networks and digital media play pivotal roles in shaping UPI awareness among the study's participants. The chi-square analysis underscores the significant associations between gender, age, and family income with the sources of awareness for the Unified Payment Interface. These findings illuminate the intricate interplay between socio-economic variables and sources of awareness concerning UPI awareness, offering insights into how individuals access and accumulate knowledge about digital payment systems.

Keywords:

UPI Services, Awareness, Digital Payment, Socio-Economic Variables, Information Sources.

I. Introduction

In an era marked by rapid technological advancement and digital transformation, payment systems have undergone a significant evolution. One such innovation is the Unified Payment Interface (UPI) services, which have gained immense popularity in India. As the use of UPI services continues to grow, it is crucial to understand the awareness levels among students, who are often early adopters of technology. Unified Payments Interface (UPI) is a revolutionary digital payment system that has transformed the way financial transactions are conducted in India. Developed by the National Payments Corporation of India (NPCI), UPI has gained immense popularity and has become a cornerstone of the country's digital economy. At its core, UPI is a real-time payment system that allows individuals to link their bank accounts to a mobile application, enabling seamless and secure transactions. It operates 24/7, allowing users to transfer funds, pay bills, make purchases, and even invest in financial products with just a few taps on their smartphones. UPI transactions can be conducted through various channels, including mobile apps, websites, and USSD (Unstructured Supplementary Service Data) codes, making it accessible to a wide range of users.

This empirical study seeks to examine and analyze students' awareness of UPI services, providing insights into their understanding and the factors that impact their awareness.

II. Review of Literature

Rajeswari et al. (2021) investigated that over the past decade, India has experienced substantial growth in internet and mobile phone usage, driven by factors like government initiatives such as Digital India. This has led to a significant increase in the adoption of digital payments, encompassing transactions made through internet and mobile banking, as well as card payments at point of sale (POS). The study highlights the importance of consumer perception in driving the adoption of digital payments and aims to analyze awareness levels and usage purposes. Results indicate that respondents are highly aware of debit cards, and digital payment systems are predominantly used for utility payments, reflecting the convenience and positive perception of these methods.

Rastogi et al. (2021) found that a multi-faceted impact of UPI on financial literacy, financial inclusion, and economic development. Financial literacy significantly influences financial inclusion, which in turn plays a crucial role in driving economic development. This relationship is mediated by factors

such as financial stability and trust. The study's implications suggest that UPI not only enhances financial literacy but also indirectly contributes to the financial inclusion and economic development of disadvantaged populations. These findings provide valuable insights for policymakers to formulate more effective UPI-related policies in the future, making this study unique in its exploration of the connections between UPI, financial literacy, financial inclusion, and economic development.

Thirupathi and Akula (2022) examined that the Unified Payments Interface (UPI) is a technology that consolidates multiple bank services, enabling seamless fund routing and merchant payments through a single mobile application. Its significance arises from the government and RBI's commitment to creating an affordable, user-friendly, and secure digital payment system for India's vast population. The RBI and NPCI have played pivotal roles in promoting digital payments, leading to a rapid increase in UPI transactions due to its simplicity and cost-effectiveness. Among users, especially the younger generation and students, UPI is popular. A study at Satavahana University, Telangana, reveals that most postgraduate students use UPI primarily for mobile recharges and fund transfers.

Harikrishnan (2023) investigated the customer preferences for UPI payments over cash, highlighting the rising popularity of UPI as a secure and convenient digital payment system in India. It aims to identify the factors that influence consumer choices among various UPI service providers. The findings are based on a survey of 150 individuals, reflecting the profound impact of technological advancements on payment systems and the significant role of UPI in fostering growth among smaller and medium-sized enterprises.

Khatte and Soni (2023) conducted the study to know the demographic perception towards UPI. Primary data is collected from 655 UPI users from Delhi NCR India in which 314 are males and 341 are females. For gender perception t-test is used and for different generation's perception ANOVA is used. There is no significant difference in the perception of Male and Female towards UPI, so null hypothesis is accepted. Empirical results of problems in UPI are found to be significant at 1 percent level of significance and 99 percent level of confidence, therefore significant difference is found in the perception of age groups.

III. Objective of the study

The main objective of study is to identify the sources of awareness of Unified Payment Interface services among the college students.

IV. Research Methodology

The target population comprises 525 undergraduate and postgraduate students from various educational institutions in Coimbatore District. A convenience sampling method is employed to collect the primary data. The secondary data collected from books, articles, bank websites, published reports etc.

V. Data Analysis

The research used the Statistical Package for Social Science (SPSS) for the data analysis. The percentage and chi-square has been applied to identify the awareness of UPI services.

Percentage Analysis

Table 1 Socio-Economic Profile

Variables	UPI (Numbers = 525)	Percentage
Gender		
Male	289	55
Female	236	45
Age (Years)		
17 – 20 Years	445	85

Variables	UPI (Numbers = 525)	Percentage
21 – 24 Years	80	15
Marital Status		
Married	11	2
Unmarried	514	98
Residential Status		
Rural	301	58
Semi urban	112	21
Urban	112	21
Educational Qualification		
Degree	479	91
Diploma	17	3
Professional Course	29	6
Family Income (Rs.)		
Up to Rs.25,000	308	59
Rs.25,001 – Rs.50,000	117	22
Rs.50,001 – Rs.75,000	78	15
Above Rs.75,000	22	4

Source: Primary Data

Interpretation: Table 1, shows that 55% of the respondents are male and 45% of the respondents are female. The age group shows that 85 % of the respondents belong to the age group of 17 years - 20 years, and 15 % of the respondents belong to the age group of 21 years -24 years. Marital status depicts that 2% of the respondents are married and remaining 98% of responds are unmarried. Residential status of the students indicates that 21% of the respondents belonged to the urban area, 21% of the respondents belonged to the semi-urban and 58% of the respondents belonged to the rural area. Educational qualification indicates that 91% of the respondents are pursuing degree, 3% of the respondents are pursuing diploma and 6% of the respondents are pursuing professional courses. Family monthly income shows 59% of the respondents are under the income group up to Rs. 25,000, 22% of the respondents are under Rs.25,001 – Rs.50,000, 15% of the respondents are under the income group of Rs.50,001 – Rs.75,000, 4% of the respondents are under income category above Rs.75,000.

Awareness of UPI

Awareness of UPI services refers to the extent to which individuals are knowledgeable about and informed regarding the Unified Payment Interface, a digital payment system widely used for online transactions and money transfers in India. This awareness is crucial in promoting financial inclusion and encouraging the adoption of digital payment methods in the country, contributing to a cashless economy.

Table 2 Sources of Awareness

Variables	UPI (Numbers = 525)	Percentage
Source of Awareness		
Bank Officials	30	6
Internet	134	26
Television	3	1
Newspaper	20	4

Variables	UPI (Numbers = 525)	Percentage
Family	63	12
Relatives	4	1
Friends	142	27
Social Media	129	23

Source: Primary Data

Interpretation: Table 2 indicates that awareness of UPI is primarily driven by digital channels such as the internet (26%) and social media (23%), along with personal networks like friends (27%) and family (12%). Traditional sources like newspapers (4%) and television (1%) play a smaller role in spreading awareness about UPI.

Chi –Square Analysis

The chi-square test has been used to examine whether there exists any association between two variables. The test determines the association between the socio-economic factors of the respondents and awareness of the Unified Payment Interface Services.

Null Hypothesis (H0) and Alternative Hypothesis (H1)

The following hypotheses have been formulated and will be tested:

H0: There is no significant association between gender and sources awareness of UPI services among college students.

H1: Gender is significantly associated with sources awareness of UPI services among college students.

H0: Age is not a significant factor in determining sources awareness of UPI services among college students.

H2: Age is a significant factor in determining sources awareness of UPI services among college students.

H0: Marital status has no significant influence on sources awareness of UPI services among college students.

H3: Marital status has a significant influence on sources awareness of UPI services among college students.

H0: Family income does not significantly affect sources awareness of UPI services among college students

H4: Family income significantly affects sources awareness of UPI services among college students.

Table 3: Gender and Sources of Awareness

Gender	Sources of Awareness								Total
	Bank Official s	Inter net	Telev ision	News paper	Family	Relative s	Friend s	Social Media	
Male	11	80	1	18	21	0	88	70	289
Female	19	54	2	2	42	4	54	59	236
Total	30	134	3	20	63	4	142	129	525
Df:7	Chi-square : 35.40		P Value: .000						Signifi cant

Source: Primary Data

Interpretation: Table 3, depicts that male students have sources of awareness from friends and female students have sources of awareness from social media. The calculated P value is less than 0.05 there does exist a significant association between gender and sources of awareness. Hence, the null hypothesis is rejected. The sources of awareness are more strongly associated with gender.

Table 4: Age and Sources of Awareness

	Sources of Awareness	Total
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Age (Years)	Bank Official s	Inter net	Telev ision	News paper	Family	Relative s	Friend s	Social Media	
17 – 20	23	101	3	20	59	4	125	110	445
21 – 24	7	33	0	0	4	0	17	19	80
Total	30	134	3	20	63	4	142	129	525
Df:7	Chi-square: 20.57		P Value: .004						Signifi cant

Source: Primary Data

Interpretation: Table 4, shows that friends seem to be more influential source for the age group (17-20), while the age group (21-24) relies more on the internet for information. The chi-square test indicates a significant association between age groups and sources of awareness. The calculated P value is less than 0.05 there does exist a significant association between age and sources of awareness. Hence, the null hypothesis is rejected.

Table 5: Marital Status and Source of Awareness

Marital Status	Source of Awareness								Total
	Bank Official s	Inter net	Telev ision	News pape r	Famil y	Relative s	Friend s	Social Medi a	
Married	1	4	0	0	3	0	0	3	11
Unmarried	29	130	3	20	60	4	142	126	514
Total	30	134	3	20	63	4	142	129	525
Df:7	Chi-square : 6.57		P Value: .474						Not Signific ant

Source: Primary Data

Interpretation: Table 5, indicates that there is no significant association between marital status and the sources of awareness. The calculated P value is greater than 0.05 there does not exist a significant association between marital status and sources of awareness. Hence, the null hypothesis is accepted.

Table 6: Family Income and Source of Awareness

Family Income	Source of Awareness								Total
	Bank Official s	Interne t	Telev ision	News pape r	Famil y	Relative s	Friend s	Social Media	
Up to Rs.25,000	23	85	3	3	39	4	90	61	308
Rs. 25,001 - Rs. 50,000	2	20	0	6	11	0	38	40	117
Rs. 50,001 - Rs.75,000	5	23	0	11	10	0	8	21	78
Above Rs. 75,000	0	6	0	0	3	0	6	7	22
Total	30	134	3	20	63	4	142	129	525
Df:21	Chi-square : 63.74		P Value: .000						Signif icant

Source: Primary Data

Interpretation: Table 6, reveals those with lower family incomes up to Rs. 25,000 tend to rely more on friends and internet for information, while those with higher family incomes above Rs. 75,000 are more inclined to use the internet and social media. The calculated P value is less than 0.05 there does

exist a significant association between family income and sources of awareness. Hence, the null hypothesis is rejected.

VI. Findings

- The percentage analysis shows that a demographic overview of the respondents, majority of respondents (55%) male, the majority of respondents (85%) fall within the age range of 17 to 20 years, the majority (98%) are unmarried, in terms of residential status most (58)% of respondents reside in rural areas, Educational perspectives, majority (91%) of respondents are pursuing degrees, Family monthly income distribution shows that most (59%) of respondents fall within the income group of up to Rs. 25,000. Additionally, sources of awareness on UPI is primarily driven by with personal networks like friends (27%), followed by digital channels such as the internet (26%) and social media (23%). The crucial role of both personal networks and digital mediums in shaping UPI awareness among the study's respondents.
- The chi-square analysis reveals that gender, age and family income are a significant association with sources of awareness of Unified Payment Interface. The complex interplay between demographic variables and information sources in the context of UPI awareness, shedding light on the nuanced ways in which individuals access and gather knowledge about digital payment systems.

VII. Conclusion

This study delved into the awareness of UPI services among students, offering valuable insights into their knowledge and the factors influencing their awareness. The analysis revealed that personal networks, such as friends and family, alongside digital channels like the internet and social media, play pivotal roles in shaping UPI awareness. Furthermore, socio-economic factors, including gender, age, and family income, were found to be significantly associated with the sources of awareness.

The evolving landscape of information dissemination, where digital mediums have become increasingly influential in spreading awareness about financial technologies like UPI. Moreover, the study underscores the importance of considering socio-economic variables when designing awareness campaigns and educational initiatives related to digital payment systems. As the world continues to embrace digital financial solutions, understanding the dynamics of awareness among the younger generation, as explored in this study, remains crucial. The insights generated here can inform strategies for enhancing UPI awareness and adoption, contributing to the broader goal of financial inclusion and a digitally empowered society.

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**SATISFACTION TOWARDS WOMEN EMPOWERMENT SCHEMES IN TAMILNADU
STATE TRANSPORT CORPORATION LIMITED, COIMBATORE**

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ABSTRACT

Tamil Nadu State Transport Corporation Ltd. (TNSTC) is a government owned public transport bus operator in Tamil Nadu, India. It operates intercity bus services to cities within Tamil Nadu, and from Tamil Nadu to its neighbouring states. In an era of encouraging as much as possible the shift of passenger traffic to public transport and to more environmentally friendly transport modes in general, transport operators have a major role to play. Recently, the government announces free travel facilities for all women including working women, Transgender and girls who are pursuing higher education in ordinary fare city buses operated under the control of the Tamil Nadu State Transport Corporation since 2021. Thus, this study has aimed to analyse the satisfaction towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore. The nature of this study is descriptive and quantitative method. For this purpose, the researcher has selected 75 women passengers randomly who are travelling in Tamilnadu State Transport Corporation Limited, Coimbatore. A structured questionnaire has been framed and distributed among population to collect the primary information. The collected data are entered in Microsoft Excel 2013 and analyzed by applying the statistical techniques namely percentage analysis, standard deviation and Chi-square test with the help of SPSS 22.0. The result indicated that high level of satisfaction towards women empowerment schemes is perceived by women passengers who accepted as ‘providing valuable service’ and ‘playing dynamic role at women empowerment schemes’.

Keywords: Satisfaction, Social Welfare Schemes, Women Passengers, Perception, Women Empowerment Schemes, Tamilnadu State Transport Corporation Limited.

1. INTRODUCTION

Before independence, there had been continuing road passenger transportation business in unrecognized system. In India, the states and city transportation is managed by Respective State Governments. Tamilnadu State Transport Corporation Limited is one of them and it provides valuable services & safety to the passengers particularly women. The government of Tamil Nadu announced a women empowerment scheme that enables all working women in the State to travel free of cost in government-owned city and town buses with immediate effect. Since a concrete definition has not been given for the term ‘working women’, every woman would qualify as a beneficiary in this scheme. The main intention behind this scheme is to increase the work participation rate of women and to promote public transportation. Since there is no restriction on the number of trips a day or month, it appears to be a simple and straightforward scheme of open-ended subsidies for travel by women. The previous government implemented a scheme aimed at women’s empowerment by providing direct subsidies to buy two-wheelers to working women whose annual income was below a certain level. However, the main criticism of the scheme was that the women who would otherwise use public transport were incentivised to use two-wheelers, creating the possibility of increasing traffic congestion on the roads and polluting the air by burning fossil fuels.

2. REVIEW OF LITERATURE

According to Yannis Tyrinopoulos (2014) revealed that female respondents tended to place their attention on punctuality, waiting conditions and driver behavior, while male respondents on invehicle transport conditions and the existence and quality of transfer information. Also, the analysis indicated that male respondents were, in general, more satisfied with transit services than

female respondents. In case of Ingle Sangapal Prakash (2016) displayed that most of respondents were agreed about MSRTC providing valuable services/facilities to the society and there were agreed about the MSRTC played a very vital role in the development of the district. Moreover, most of the respondents were satisfied about the services of MSRTC.

In view of Zhao et al. (2023) assumed that the seating arrangement and smoothness of travel of Macau's public transport services need to be improved and the dial-a-ride service's price setting and waiting time need to be improved. Further, the price setting, convenience of hailing, and payment method of the taxi service need to be improved. Furthermore, the satisfaction level of the dial-a-ride service is significantly higher than that of the taxi service. The author Gajendran (2012) mentioned that passengers were more aware of the medical relief and trauma care facilities available on the NH than on the other roads. On the NH, they were aware of the availability of ambulance and emergency services in case of any accident. Also, most of the passengers felt safe while traveling in public and private sector bus transports in Tamil Nadu. Further, passengers traveling on the NH do feel unsafe to some extent.

3. STATEMENT OF THE PROBLEM

Road transport has close relationship with people life style. It is important for development of industrialization and country. The Tamilnadu government announces various social welfare and women empowerment schemes through Social Welfare & Women Empowerment Department. In recent, Tamil Nadu's scheme facilitating free bus travel for women is laudable as it will boost their work participation rate, but the government evaluates the actual demand and provide transport undertakings with adequate subsidy as compensation. Although women passengers getting more facilities through Transport Corporation, all the passengers are not getting satisfaction towards women empowerment schemes in Coimbatore. In this juncture, the researcher aimed to analyze the satisfaction towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore.

4. OBJECTIVES OF THE STUDY

- To discover the demographic profile of the selected respondents in Tamilnadu State Transport Corporation Limited, Coimbatore.
- To examine the satisfaction towards women empowerment schemes in the study area.

5. HYPOTHESIS OF THE STUDY

- There is no significant relationship between opinion of the passengers on providing valuable service and satisfaction towards women empowerment schemes.
- There is no significant relationship between opinion of the passengers on playing dynamic role and satisfaction towards women empowerment schemes.

6. RESEARCH METHODS

The research is mainly based on survey and descriptive research. The researcher has desired to collect the present information among women passengers through immediate survey about women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore. For examining this, around 75 women passengers were selected randomly as sample size. For gathering the required primary data, the researcher has framed a well-structured questionnaire that inclusive of demographic profile and satisfaction towards women empowerment schemes in TNSTC with the help of 5 points Likert's scale technique. By using the statistical tools such as percentage analysis, mean score analysis, standard deviation and Chi-square analysis, the collected data were classified into tables though MS-Excel and analyzed via SPSS 22.0 software.

7. RESULT AND DISCUSSION

7.1 Demographic Profile of the selected respondents

The demographic profile of the selected women passengers are furnished in the following table.

Table 1: Demographic Profile of the selected passengers

No.	Variables Name	Number of Respondents	Percentage
1	Age Group		
	• Upto 30 Years	34	45.3
	• 31 - 40 Years	18	24.0
	• 41 - 50 Years	14	18.7
	• Above 50 Years	9	12.0
	Total	75	100.0
2	Education Qualification		
	• No formal education	12	16.0
	• School level	31	41.3
	• College level	17	22.7
	• Professional	15	20.0
	Total	75	100.0
3	Providing valuable service		
	• Yes	52	69.3
	• No	23	30.7
	Total	75	100.0
4	Playing dynamic role at Women Empowerment Schemes		
	• Yes	46	61.3
	• No	29	38.7
	Total	75	100.0
5	Travelling Purpose		
	• For working	23	30.7
	• For studying	28	37.3
	• Personal work	17	22.7
	• Others	7	9.3
	Total	75	100.0

- From the above table, it is observed that 45.3% of the passengers are belong to upto 30 years of age group, 24.0% of the passengers are came into 31-40 years age category, 18.7% of the passengers are 41-50 years aged and 12.0% of the passengers are under above 50 years age group.
- From the analysis, it is displayed that 16.0% of the passengers have no formal education, 41.3% of the passengers are completed educated school level, 22.7% of the passengers are qualified college level and 20.0% of the passengers are qualified professional degree.
- From the analysis, it is noticed that 69.3% of the passengers opined that providing valuable service to women in TNSC and 30.7% of the passengers are opined that not providing valuable service to women in TNSC.
- From the analysis, it is assumed that 61.3% of the passengers opined that playing dynamic role at women empowerment schemes in TNSC and 38.7% of the passengers are opined that not playing dynamic role at women empowerment schemes in TNSC.
- From the analysis, it is confirmed that 30.7% of the passengers are travelling for working, 37.3% of the passengers are travelling for studying, 22.7% of the passengers are travelling for personal work and 9.3% of the passengers are travelling for other purposes.

7.2 Satisfaction Towards Women Empowerment Schemes in TNSCT

This section has explored that the satisfaction of the passengers towards women empowerment schemes in TNSCT. For this study, six statements have been framed about satisfaction towards women empowerment schemes and measured by using 5 points Likert's scaling method.

It is examined from the analysis that among the six categories of satisfaction of the passengers towards women empowerment schemes, they mentioned that 'free services with responsible' with the mean score and standard deviation of 3.77 and 1.09 respectively followed by 'environmental attitude encourages to use transport' with the mean score and standard deviation of 3.49 and 1.30 respectively.

7.3 Relationship between Demographic Profile and Satisfaction towards Women Empowerment Schemes (Chi-Square Test)

With a view to find the degree of association between demographic profile of the selected passengers and their satisfaction towards women empowerment schemes in TNSCT, a cross-tabulation has been developed. In order to find the relationship between selected independent variables and satisfaction towards women empowerment schemes, hypotheses were developed and analyzed through applying Chi-square test.

Opinion on Providing valuable service to women and Satisfaction towards women empowerment schemes

H₀: There is no significant relationship between opinion of the passengers on providing valuable service and satisfaction towards women empowerment schemes.

Table 2: Opinion on Providing valuable service and Satisfaction towards Women Empowerment Schemes

S. No	Providing valuable service	Level of Satisfaction			Total	Mean Score	Chi-Square Value
		Low	Medium	High			
1	Yes	5 (21.7%)	16 (69.6%)	2 (8.7%)	23 (100.0%)	3.44	19.357 (0.000*)
2	No	11 (21.2%)	11 (21.2%)	30 (57.7%)	52 (100.0%)	3.40	
	Total	16	27	32	75		

Note: Parenthesis indicates 'p' value; * – Significant at 1% level

It is divulged from the above table that high level of satisfaction towards women empowerment schemes is perceived by passengers opined as 'providing valuable service'. Also, the 'p' value is lesser than 0.05 and the null hypothesis is rejected. Hence, there is a significant relationship between opinion on providing valuable service of the passengers and satisfaction towards women empowerment schemes.

Opinion on Playing dynamic role and Satisfaction towards Women Empowerment Schemes

H₀: There is no significant relationship between opinion of the passengers on playing dynamic role and satisfaction towards women empowerment schemes.

Table 3: Opinion on Playing dynamic role and Satisfaction towards women empowerment schemes

S. No	Playing Dynamic Role at Women Empowerment	Level of Satisfaction			Total	Mean Score	Chi-Square Value
		Low	Medium	High			

	Schemes						
1	Yes	9 (19.6%)	8 (17.4%)	29 (63.0%)	46 (100.0%)	3.46	23.195 (0.000*)
2	No	7 (24.1%)	19 (65.5%)	3 (10.3%)	29 (100.0%)	3.38	
	Total	16	27	32	75		

Note: Parenthesis indicates 'p' value; * – Significant at 1% level

It is pointed out from the above table that high level of satisfaction towards women empowerment schemes is perceived by passengers opined as 'playing dynamic role at women empowerment schemes'. Further, the 'p' value is lesser than 0.05 and the null hypothesis is rejected. Therefore, there is a significant relationship between opinion on playing dynamic role of the passengers and satisfaction towards women empowerment schemes.

8. FINDINGS

- It is found from the analysis that majority (45.3%) of the passengers are belong to upto 30 years.
- It is assumed from the analysis that majority (41.3%) of the passengers are educated school level.
- It is illustrated from the analysis that majority (69.3%) of the passengers opined that providing valuable service to women in TNSTC.
- It is inferred from the analysis that majority (61.3%) of the passengers opined that playing dynamic role at women empowerment schemes in TNSTC.
- It is proved from the analysis that majority (37.3%) of the passengers are travelling for studying purpose.
- It is displayed from the mean score analysis that they mentioned that 'free services with responsible' followed by 'environmental attitude encourages to use transport' with the mean score of 3.77 and 3.49 respectively.
- It is divulged from the analysis that high level of satisfaction towards women empowerment schemes is perceived by passengers opined as 'providing valuable service'. The Chi-square test asserted that there is a significant relationship between opinion on providing valuable service of the passengers and satisfaction towards women empowerment schemes.
- It is revealed from the analysis that high level of satisfaction towards women empowerment schemes is perceived by passengers opined as 'playing dynamic role at women empowerment schemes'. The Chi-square test justified that there is a significant relationship between opinion on playing dynamic role of the passengers and satisfaction towards women empowerment schemes.

9. SUGGESTIONS

- The government shall make use of advertisement including social media to bring awareness about the availability of women empowerment schemes in Tamilnadu State Transport Corporation Limited and to promote the new policies among passengers.
- Tamilnadu State Transport Corporation Limited should ensure the proper maintenance of buses and bus stands should be planned to retain the existing and attracting the new passengers for the survival of transport industries in the long run.
- The bus personnel should behave in smooth, pleasant and helpful manner with women passengers in order to increase their empowerment and satisfaction level.
- In general, poor road conditions and bad driving are as the main reasons for road accidents. Hence, government should take necessary steps to rectify these types of grievances of the women passengers otherwise it will lead to dissatisfaction.

10. CONCLUSION

This study aimed to analyze the satisfaction towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore. This study noticed that there is a significant relationship between satisfaction towards women empowerment schemes and the variables like opinion on providing valuable service of the passengers and opinion on playing dynamic role of the passengers. This study suggested that most of the passengers were satisfied on women empowerment schemes and they felt safe while traveling in bus transports in Coimbatore. Further, Tamilnadu State Transport Corporation Limited should announce and develop women empowerment schemes to enhance the satisfaction of women passengers in Coimbatore.

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CUSTOMER SATISFACTION TOWARDS FEATURES OF DIGITALISED BANKING SERVICES

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Abstract

As the banking sector in India rapidly moves towards digitisation, customer satisfaction towards digitalized banking services has become increasingly important in the modern era. With the advancement of technology, customers expect banks to provide digital solutions that are convenient, efficient, and user-friendly. Digitalized banking services have enabled customers to access banking services 24/7 without the need for visiting a physical branch. This study examines the level of customer satisfaction towards the features of digitalised banking services in Coimbatore, India. The convenient sampling method was employed, which included a questionnaire survey and semi-structured interviews with customers of various banks in Coimbatore. Primary data collected from 531 bank customers in Coimbatore District of Tamilnadu. The Factor analysis is applied for the data analysis. The results of a study that identified seven factors related to customer satisfaction in the banking industry. The significant factors that raised customer satisfaction were identified based on their component loading of 0.5 and above. The contribution of each factor towards customer satisfaction was also identified, with factor one contributing the most at 33.767 percent, and the other factors contributing in descending order. This study provides insights that can help banks to enhance customer satisfaction by addressing these concerns.

Keywords: *Digitalised Banking, Customer Satisfaction, Features of Digitalised Banking Service, Factor analysis, Kaiser-Meyer-Olkin and Bartlett's test of Sphericity.*

I. Introduction

Digitalisation has transformed the way customers interact with their financial institutions. In India, the adoption of digital banking services has been increasing steadily over the years. The Reserve Bank of India (RBI) has actively encouraged digital banking as a strategy to enhance financial inclusion and improve the

accessibility to banking services. The COVID-19 pandemic has also accelerated the adoption of digital banking services as customers look for safer and more convenient ways to manage their finances.

According to Ismail and Alawamleh (2017)¹ the banking industry has been revolutionized by electronic communications and e-commerce, resulting in changes to both

internal operations and customer interactions. Digitalised banking services refer to banking services that are provided through digital channels such as websites, mobile apps, and other electronic platforms. In recent years, the banking industry has undergone significant transformation due to the rapid growth of digital technologies. The adoption of digitalised banking services has become a crucial aspect of the modern banking landscape, and it has significantly impacted the way customers interact with their banks. George and Kumar (2013)² state that in the banking industry, there is a growing trend of utilizing electronic delivery channels to offer low-cost products and services that are convenient for customers. Internet Banking is one among them. Internet Banking, an outcome of the merging of e-commerce and the banking and financial service industry, emerges as a valuable product. Rajasulochana and Murthy (2022)³ E-banking involves offering banking products and services through electronic delivery channels. As the pace of change continues to accelerate, it is essential for banks to understand the evolving expectations of their customers. Digitalised banking services offer several benefits to customers, such as convenience, accessibility, and speed. Customers can now access their bank accounts, make transactions, pay bills, and perform other banking services from the comfort of their homes or on-the-go through their mobile devices. With digital banking, customers no longer have to visit a physical branch, wait in long queues or complete tedious paperwork. Moreover, digitalised banking services have also provided customers with more control over their finances. With features like instant notifications, customers can stay informed about their account activities, monitor their expenses, and detect fraudulent activities in real-time.

Kolanchinathan et al. (2021)⁴ Internet banking is revolutionizing the banking industry and significantly impacting banking relationships. The traditional limitations of

conducting banking transactions solely within branch premises are no longer in effect. With genuine Internet banking, individuals can effortlessly handle inquiries and transactions online, eliminating the need for physical branch visits (anywhere banking) and enabling access at any time. Providing Internet banking is increasingly becoming a "need to have" than a "nice to have" service. Digitalised banking services have become an integral part of the modern banking landscape, offering several features that provide customers with convenience and control over their finances. These services are accessible through electronic platforms such as websites, mobile apps, and other electronic channels. Customers can perform various banking services such as transferring funds, paying bills, and checking account balances from anywhere and at any time. It provides customers with real-time notifications of their account activities, expenses, and fraudulent activities. This feature enables customers to stay informed about their finances and take action quickly in case of any suspicious activity. Banks can use customer data analytics to offer personalised services to their customers. By analysing customer data, banks can gain insights into their customers' behaviour and preferences, which they can use to offer customised services and products that meet their customers' needs. Digitalised banking services are more cost-efficient for banks and allow for faster transaction processing. By digitising processes and automating back-end operations, banks can reduce their costs and operate more efficiently. This, in turn, allows for faster transaction processing and improved customer service.

II. Review of Literature

Bultum (2014)⁵ found that the primary reason is the low ICT level, security risk, lack of competition, and trust are challenges of the National Bank of Ethiopia (NBE) in Ethiopia. Unyathanakorn and Rompho

(2014)⁶endeavouring to reveal that the customer expectations have a positive and a strong correlation with the perceived quality of the services. Belas et al. (2016)⁷indicates that security issues influencing customer's satisfaction. Every financial institution now places a premium on maintaining happy and loyal customers. Thus, banks are necessary to apply technologies to protect against hacking attacks to ensure their trustworthiness. If the bank enables us to achieve, the bank can get higher levels of trust in electronic payments security. Muluka et al. (2016)⁸recommended to the bank to providing digital banking services with fast, accessible, easily adaptable and devised suitable techniques based on customer desires. Asiyambi and Ishola (2018)⁹point out that the customers were satisfied with e-banking services and the banking organisations recommended increasing awareness of gains associated with E-banking services to non-adopters and more investment in e-banking infrastructure to promote e-banking services. Boshkoska and Sotiroski (2018)¹⁰surveyed 409 clients in the Republic of Macedonia'. Several variables have a role, including familiarity, age, degree of education, complexity, and proficiency with computers and the internet. The adoption and happiness of customers are affected by these variables. Clients' ability to access their checking accounts electronically is conditional on factors such as their age, education, household income, and computer literacy. Online banking is more popular among younger customers than among those of retirement age. Clients' higher level of education significantly influences e-banking services usage compared to those with less education. Hamid et al. (2018)¹¹ client satisfaction with electronic banking services such as online banking, automated teller machines, and telephone banking is higher. Additionally, client happiness is significantly impacted by online banking services. The group recommended that banks in the Sudan raise their clients' technological literacy and provide the

necessary infrastructure to support the widespread use of electronic banking services. Bhatnagar (2015)¹² shows that demographics like age, education, occupation, and money have a role in shaping the degree of consciousness. In addition, there was no distinction between public and private bank clients in terms of knowledge of or engagement with financial technology. Rajesh and Palpandi (2015)¹³ indicate that technology-based services help the banks in improving transactions. The SMS alert and E-mail alert, and accounting statement are the technology-enabled services for cybercrime safety and security. There is a relationship between the demographic profile of customers and service or frequency of use of the banking services. Rajput (2015)¹⁴ found that the ATM, bill payments, and getting the bank statements are the services frequently used by the customers. Forty-five per cent of the respondents have a positive perception, and they are satisfied with e-banking services. Forty-six per cent of them said e-banking is safe and secure, followed by 45 per cent of the respondent's opinion that time-saving is the advantage of e-banking. Musiime and Ramadhan (2011)¹⁵shows that there was a significant relationship between Internet banking and customer satisfaction, as evidenced by their continued usage of the service, and the bank's ability to retain the majority of its Internet banking users.

III. Objective of the Study

The main objective of the study is to identify the prominent features that influence the customer's satisfaction towards digitalised banking services in Coimbatore District of Tamilnadu.

IV. Methodology

According to Bhattacharyya (2009)¹⁶ the research technique is the approach used to tackle the research issue in a methodical and scientific manner. The researcher is responsible for developing the approach. It is not enough to just know what to do; one must also be able to put the approach to use. Goddard, W., & Melville,

S. (2004)¹⁷ indicates the various sources of information available to the researcher, and describe ways in which such information can be accessed. Hamilton, J. (2005)¹⁸ emphasize that a primary source is an original document that has made it through the ages intact. Secondary resources consist of studies conducted by others. Primary and secondary data were gathered for this study. 531 bank clients in the Coimbatore District of Tamil Nadu were surveyed using a predetermined set of questions to acquire the raw data. Secondary sources such as newspapers, periodicals, reports, books, bank websites, etc. were mined for this information. Fifty non-sample clients participated in the pilot trial. To improve the data reliability, Cronbach's value is greater than 0.7 of the questionnaire. A five-point (1 to 5) Likert scale, statement used in the questionnaire. Data was collected between the 1st week of December 2018 and the last week of May 2019 through convenience sampling. Out of the 650 questionnaires distributed among Digitalised banking customers, only 531 customers responded to the statements. The SPSS package is used for statistical analysis.

V. Analysis and Discussion

According to DeCoster (1998)¹⁹ factor analysis encompasses a set of techniques employed to investigate the influence of underlying constructs on the responses of various measured variables. Factor analysis was used to identify the thirty variables which are considered as features of digitalised banking services. The variables are assigned into seven categories: Debit cards, Credit cards, Cash deposit machines, Internet banking, SMS banking, Missed call banking, and Mobile banking. Factor analysis is employed to identify the prominent features that influence customers' satisfaction towards digitalised banking services.

The KMO test is designed to assess the suitability of data for factor analysis, while Bartlett's test of sphericity is employed to evaluate the adequacy of the correlation matrix. Shrestha, N. (2021)²⁰. KMO and Bartlett's tests in Table 1 are significant above 0.70. The information may therefore be used for a factor analysis. KMO statistics (0.906) and Bartlett's sphericity test values (29553.33, df: 465, Sig=0.000) further supported the usefulness of factor analysis; these results showed that the sample size was big enough to make reliable inferences.

Table1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	.906
Bartlett's Test of Sphericity Approx. Chi-Square	29553.33
Df	465
Sig.	.000

Table2. Factors related to Customer Satisfaction towards features of Digitalised Banking Service

Features	Factors						
	1	2	3	4	5	6	7
Credit Card							
Credit Score	.967						
Reward Points	.964						
Extension of the Payment Period	.964						
Cashback Offers	.957						
Credit Limit	.951						
Easy Approval	.947						
Cash Deposit Machine							
No Need to Fill Slips		.961					

Features	Factors						
Immediate Receipt		.960					
No Need to Sort Currencies Denomination Wise		.959					
Instant Credit in the Account		.956					
Transaction Limit		.955					
No Need to Stand in Queues		.955					
Mobile Banking							
Cost-Free Mobile Applications			.934				
User-Friendly Applications			.934				
Receive Alerts and Notification			.925				
MPIN Based Security			.922				
Missed call Banking							
An Easy Way for an Enquiry				.932			
Toll-Free Number				.931			
No Access to the Internet				.929			
SMS Banking							
Automatic Alert					.948		
Immediate Services					.943		
SMS Charge					.942		
Debit Cards							
Withdrawal Limit						.743	
Great Discount Offer						.704	
Access Point						.695	
Expiry Date						.694	
Security						.678	
Internet Banking							
Transaction Limit							.856
Availability of Services							.855
Cost of Services							.843
Eigen Values	10.468	4.552	3.652	2.932	2.533	1.705	1.182
% of Variance	33.767	14.683	11.779	9.457	8.170	5.501	3.814
Cumulative % of Variance	33.767	48.450	60.230	69.686	77.856	83.358	87.171

(Source: Primary Data)

Table 2 demonstrates how the seven components may be found by looking for Eigen values larger than 1. Component loadings of 0.5 or higher indicate a very substantial influence on customer satisfaction. One which is responsible for 33.76 percent of the positive effect on

customer satisfaction. Additional factors include: 14.683, 11.779, 9.457, 8.170, 5.501, and 3.814, all of which lead to happy customers. Eighty-seven point one-seven percent of customer satisfaction may be attributed to these seven criteria.

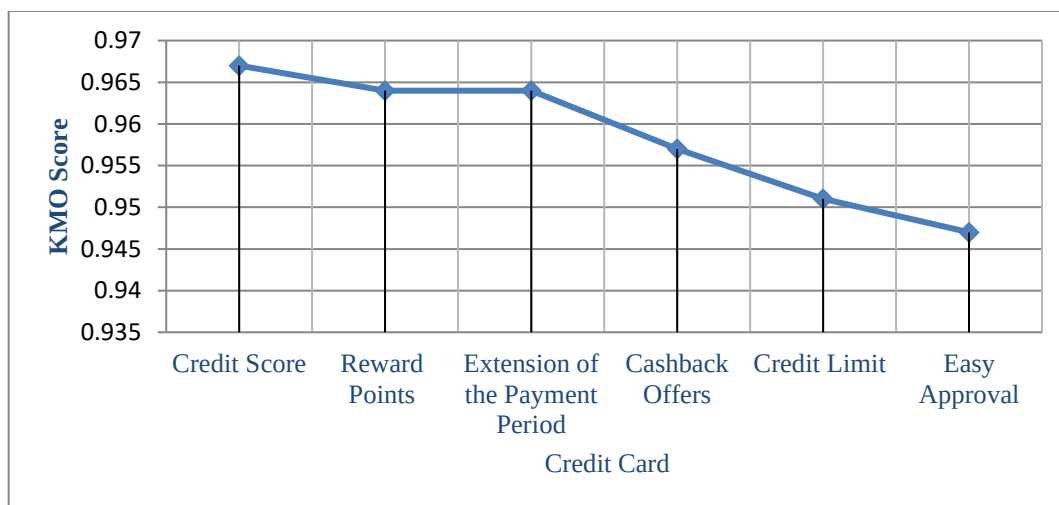
**Figure 1**

Figure1 indicates that credit score (.967), reward points (.964), Extension of the payment period(.964), cashback offers(.957),

credit limit(.951) and Easy approval(.947) have a component loading of 0.5 and above. Hence, these variables form the first factor

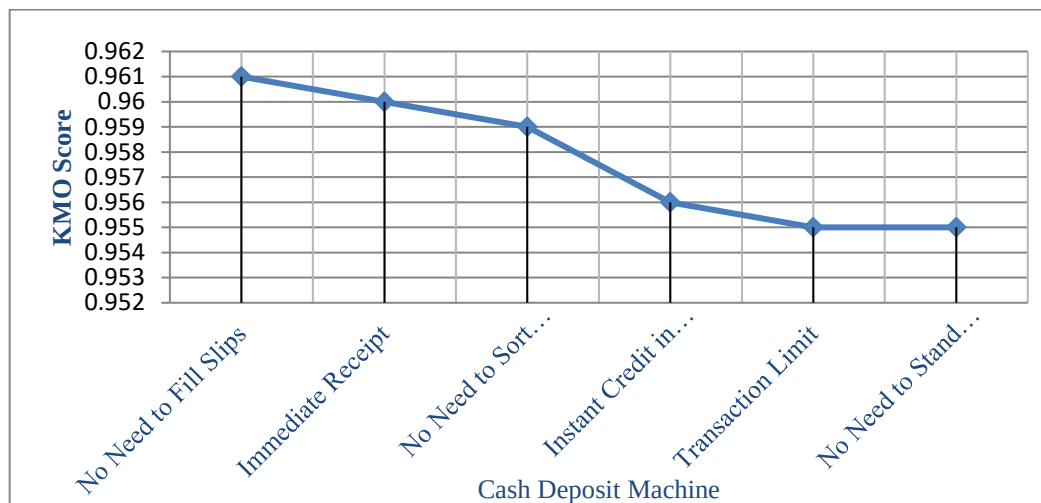
**Figure2**

Figure 2 shows the second factor, no need to fill slips(.961), immediate receipt(.960), no need to sort currencies denomination

wise(.959), instant credit in the account(.956), transaction limit(.955) and no need to stand in queues(.955) are significant

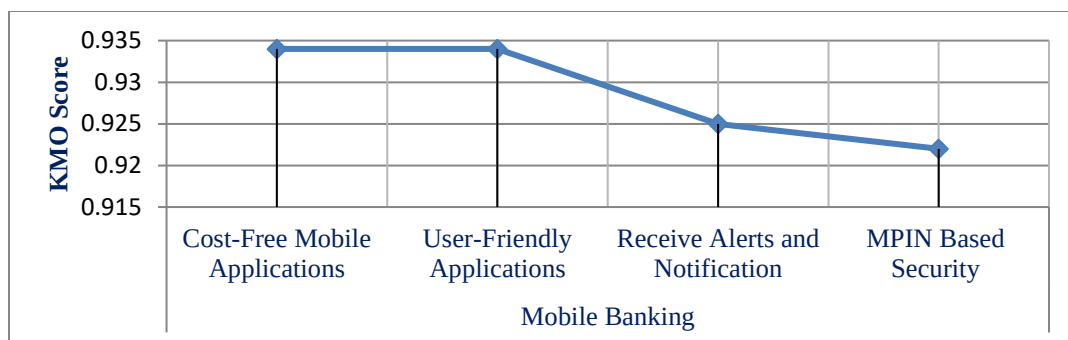
**Figure3**

Figure 3 indicates that the Cost-free mobile applications (.934), User-friendly applications (.934), receive alerts and notifications (.925) and MPIN based security (.922) is significant in the third factor.

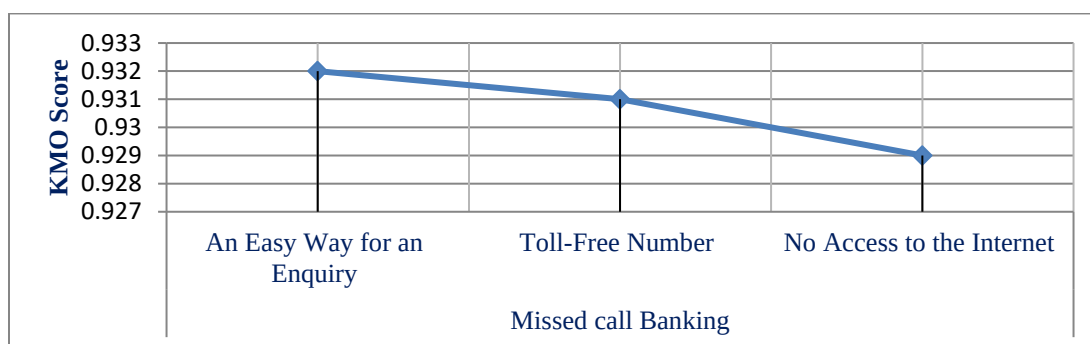
**Figure4**

Figure 4 shows that the fourth factor, an easy way for an enquiry (.932), a toll-free number (.931) and no internet access (.929) is significant.

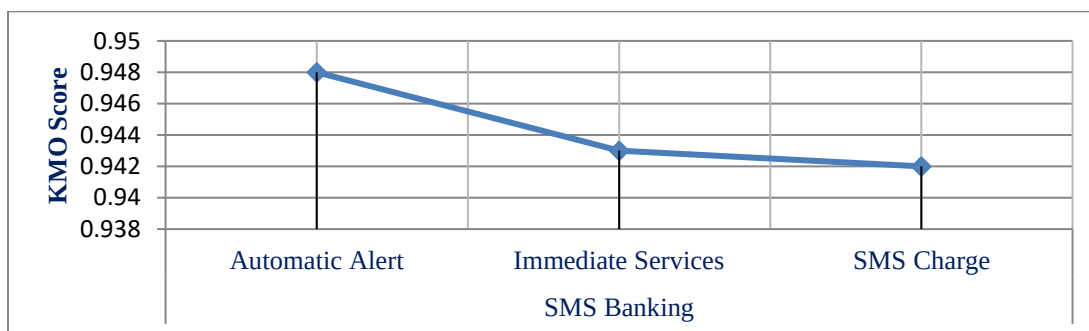
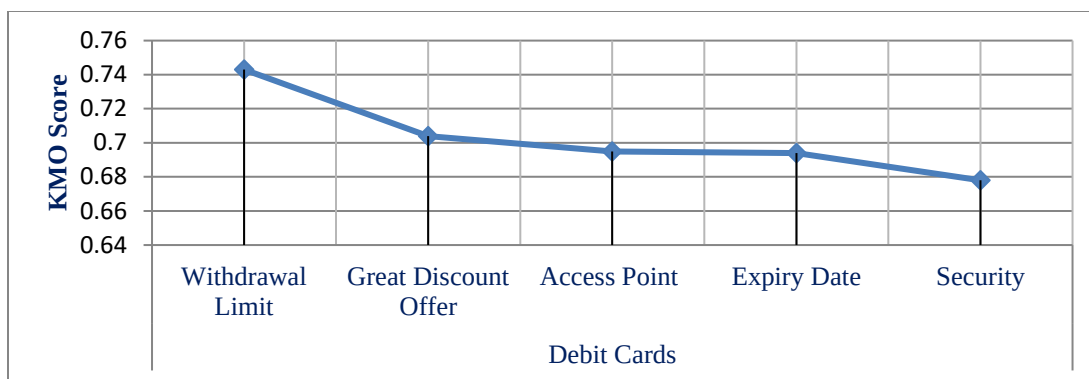
**Figure 5**

Figure5 indicates that the Automatic alerts (.948), immediate services (.943) and SMS charges (.942) are significant in the fifth factor.

**Figure 6**

The sixth factor, withdrawal limit (.743), great discount offer (.704), access point (.695), expiry date (.694) and security (.678) are significant that indicates in Figure 6.

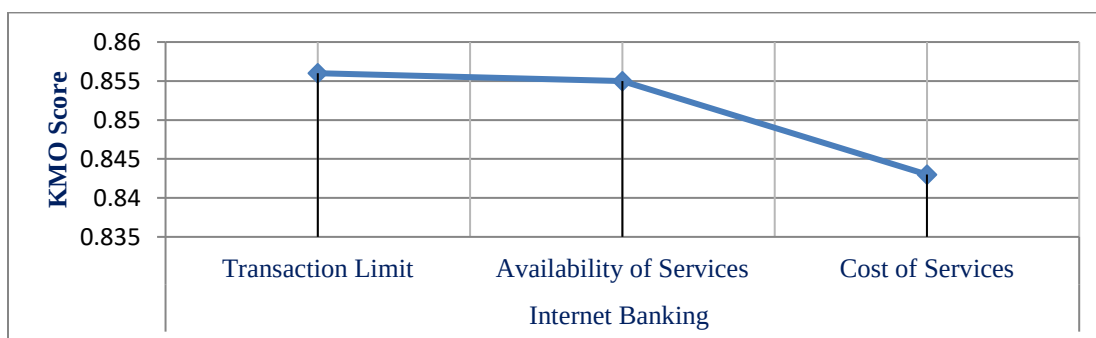
**Figure 7**

Figure 7 shows that the transaction limit (.856), availability of services (.855) and cost of

services (.843) are significant in the seventh factor.

VI. Conclusion

The Digitalised banking services have revolutionised the banking industry, providing customers with more convenience and control over their finances while allowing banks to operate more efficiently and effectively. As technology continues to advance, digital banking services will likely continue to evolve, offering even more benefits to both customers and banks. The customer's satisfaction is significant to the banks for stand out of the competition and creates brand ambassadors. The banks offer a variety of digitalised banking services for satisfying Digital banking customers. It has revolutionized the way people interact with their finances by providing a convenient, accessible, and secure way to perform banking transactions.

Factor analysis was utilized to determine the 30 factors that are regarded as characteristics of digitalized financial services, as shown by the findings of this research. The variables are assigned into seven categories such as debit cards, credit cards, cash deposit machines, internet banking, SMS banking, missed call banking, and mobile banking. Customer satisfaction with digitalized financial services is examined using factor analysis to determine the most important factors. In a seven-factor analysis of consumer satisfaction, credit card features account for 33.767%. The bankers may improve the features of other digitalised banking services, their input can be valuable in enhancing digitalised banking services.

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OVERVIEW OF UNIFIED PAYMENTS INTERFACE IN INDIA: REVOLUTIONIZING DIGITAL PAYMENTS

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Abstract

India has witnessed a remarkable transformation in its digital payments landscape, with the Unified Payments Interface (UPI) emerging as a game-changer. UPI, a real-time payment system developed by the National Payments Corporation of India (NPCI), has redefined the way people transact, making digital payments more convenient, accessible, and secure than ever before. This article provides an overview of UPI's journey, its impact on the Indian economy, and the factors that have contributed to its widespread adoption.

Keywords: Unified Payments Interface, Features, Impact on the Indian Economy.

Introduction

In an era marked by technological advancements and a shift towards digital solutions, the Unified Payments Interface (UPI) has emerged as a groundbreaking innovation that has revolutionized the way financial transactions are conducted in India. Launched in 2016 by the National Payments Corporation of India (NPCI), UPI has rapidly transformed the landscape of digital payments by offering a seamless, secure, and real-time platform for transferring funds, making payments, and conducting various financial transactions. With its user-centric approach and transformative impact on financial inclusion, UPI stands as a testament to India's journey toward becoming a digitally empowered economy. This article delves into the key features, benefits, and the overarching significance of UPI in reshaping the country's payments ecosystem.

Hota (2016)¹ Indian payment systems have rapidly evolved, driven by the Reserve Bank of India's Vision Document on Payment Systems emphasizing reduced cash usage. The adoption of mobile and card payment systems is integral to this effort. The National Payments Corporation of India (NPCI) has introduced a transformative project allowing bank customers to conduct real-time money transfers using an email-like financial address. This applies to both person-to-person (P2P) transactions and Business to Consumer (B2C) collections.

The Unified Payments Interface aims to simplify person-to-person (P2P) and person-to-merchant (P2M) transactions. UPI enables users to link multiple bank accounts to a single mobile application, offering a seamless and interoperable platform for transferring funds instantly. This revolutionary system effectively bridges the gap between various banks, providing a standardized, user-friendly interface for all types of transactions.

Review of Literature

Franciska and Sahayaselvi (2017)² discover that the Information Technology (IT) has brought about a transformative impact on various aspects of our lives, notably simplifying digital payments. The Indian government's push during the Demonetization period prompted a shift towards digital transactions. This transition from traditional to digital payment systems ensured safety, security, and convenience. Technological advancements in smartphones and internet accessibility have further accelerated the adoption of digital payments in the Indian market. The percentage of digital payments through alternative modes is also rapidly increasing. The expanding coverage of mobile networks, internet access, and electricity is extending the reach of digital payments to remote regions. It is evident that the future of transaction systems is moving towards a cashless mode.

Mohapatra (2017)³ explores India's payment systems have rapidly evolved. The Reserve Bank of India's Vision Document on Payment Systems outlines measures to establish a cash-reduced society, with a focus on adopting mobile and card payment systems. A transformative project by the National

Payments Corporation of India (NPCI) is introduced, allowing bank customers to conduct real-time money transfers and collections using just an e-mail address, serving as a financial address for both person-to-person (P2P) and Business to Consumer (B2C) transactions.

Mahesh and Bhat (2021)⁴ reveals The Indian banking sector is actively promoting digital payments, gaining momentum post-demonetization and the digital India initiatives. The introduction of the Unified Payment Interface (UPI) by the National Payment Corporation of India (NPCI) has revolutionized and cost-effectively enabled digital payment services. The proliferation of smartphones and technological advancements has facilitated mobile payment usage for users, financial institutions, and banks. UPI's potential to foster a paperless and cashless economy by utilizing virtual payment addresses is noteworthy for achieving a digital economy. The need to assess UPI's contribution toward this digital economy goal is paramount.

George et.al (2023)⁵ reveals that the Unified Payments Interface (UPI) is a novel payment system in India facilitating swift and secure money transfers, bill payments, and receipts through a single platform. UPI has significantly simplified and expedited the payment process in the country, offering advantages like convenience, safety, and cost-effectiveness. Despite issues like user awareness and security concerns, UPI holds substantial potential to revolutionize the Indian digital payment sector, offering businesses fresh avenues to connect with customers effectively.

Features of Unified Payments Interface

The Unified Payments Interface (UPI) stands as a transformative force in India's digital payments landscape, propelled by a host of key features that have redefined how financial transactions are conducted. One of its foremost attributes lies in its capacity to facilitate instant transfers, reshaping the speed and convenience with which money moves in the digital realm. Unlike traditional banking channels, UPI enables users to send and receive funds in real-time, unbound by geographical or temporal constraints. This round-the-clock availability, 365 days a year, has not only eradicated the notion of waiting for bank working hours but has also infused a new sense of immediacy and efficiency into financial interactions.

The foundation of UPI's attractiveness lies in its remarkable user-friendliness, effectively dismantling barriers to entry within the digital payments realm. Through UPI, transactions can be initiated using virtual payment addresses (VPAs) or QR codes, negating the necessity of revealing sensitive bank account information with each transaction. This groundbreaking approach not only expedites the payment process but also bolsters security by mitigating potential risks. Additionally, UPI's adeptness in establishing connections sets it apart, forging a robust, interoperable framework that bridges divides among diverse banks and payment service providers. This open architecture not only cultivates a healthy competitive environment but also charts a course for inventive solutions, thus broadening the horizons of digital payment capabilities.

Security stands as a paramount concern in the digital age, and UPI tackles this with a multi-pronged approach. Each UPI transaction requires authentication through an MPIN (Mobile Personal Identification Number), and biometric verification adds an additional layer of security. These measures collectively ensure that financial transactions conducted through UPI remain impervious to unauthorized access, fostering user confidence and trust. The comprehensive embrace of security measures has significantly contributed to the growing adoption of UPI, particularly as users seek assurances that their financial interactions remain private and safeguarded.

However, UPI's impact stretches beyond its role as a mere conduit for fund transfers. Its evolution into a versatile platform that supports bill payments, ticket bookings, and an array of services has transformed it into a comprehensive financial ecosystem. This expansion has not only consolidated various financial needs onto a single platform but has also rendered UPI an indispensable tool for managing diverse aspects of modern life. By seamlessly integrating these services, UPI has effectively positioned itself as an all-encompassing solution, further augmenting its appeal and utility.

The confluence of government support, technological advancements, and a tech-savvy population has played a pivotal role in the meteoric rise of UPI. Initiatives such as Digital India and demonetization have primed the Indian populace for digital adoption, providing a fertile ground for UPI's growth. The increasing proliferation of smartphones, coupled with the accessibility of mobile internet, has democratized access to digital platforms like UPI, enabling users from various strata of society to engage with modern financial systems seamlessly.

Impact on the Indian Economy

The advent of the Unified Payments Interface (UPI) has exerted a profound impact on the Indian economy, reshaping the way financial transactions are conducted and catalyzing a cascade of transformative effects. One of the most remarkable outcomes has been the surge in financial inclusion. UPI's user-friendly interface and accessibility have brought digital payments within the reach of a vast segment of the population, including those previously excluded from the formal financial system. This has not only expanded financial access but has also led to a reduction in the reliance on cash transactions, aligning with the government's push for a less-cash economy.

Small and micro-businesses have been particularly empowered by UPI. The ease of accepting digital payments through UPI has enabled these enterprises to move away from cash-based transactions, formalizing their financial operations and contributing to enhanced tax collection. This shift has further integrated these businesses into the mainstream economy, bolstering economic growth and fostering entrepreneurship.

The reduction in cash usage, driven by UPI's convenience, has had a multiplier effect on various fronts. It has curbed the informal economy and improved transparency, resulting in increased tax compliance and contributing to the country's fiscal health. Additionally, UPI has invigorated economic activities by facilitating swift and secure transactions. Industries such as e-commerce and retail have witnessed significant growth due to the ease of online payments enabled by UPI, augmenting the overall economic landscape.

Furthermore, UPI's impact reverberates across urban and rural areas alike. It has bridged geographical gaps by enabling seamless transactions, even in remote locations with limited banking infrastructure. This has transformed the way people access and manages their finances, enhancing their financial well-being and reducing the reliance on physical bank visits.

Factors Driving Adoption of Unified Payments Interface

The unprecedented adoption of the Unified Payments Interface (UPI) in India can be attributed to a dynamic interplay of multifaceted factors that have fueled its remarkable growth. A pivotal catalyst has been the proactive stance of the Indian government in promoting digital payments. Initiatives like Digital India and the drive towards a less-cash economy have provided the necessary impetus for UPI's integration into the daily lives of citizens. The demonetization drive in 2016 further underscored the need for digital alternatives, propelling UPI into the forefront as a reliable and convenient platform for transactions.

The increasing digital literacy and tech-savviness of India's population have also played a pivotal role in driving UPI's adoption. As smartphone penetration surges across the country, more individuals have gained access to the necessary tools for utilizing UPI. The user-centric design of the interface, which simplifies transactions through virtual payment addresses (VPAs) and QR codes, has addressed barriers to entry and encouraged a diverse demographic to embrace digital payments. Additionally, the collaborative spirit within the financial sector, with banks, fintech companies, and payment service providers working in tandem, has fostered a fertile ground for innovation and expanded the range of services UPI can provide. As these factors synergize, UPI continues to reshape the payments landscape, forging a path toward a more digitally inclusive and empowered India.

Conclusion

The Unified Payments Interface (UPI) has transformed the way Indians transact and interact with their finances. With its speed, security, and ease of use, UPI has emerged as a powerful tool for financial inclusion and economic growth. As India continues on its journey towards becoming a more digitally empowered nation, UPI stands as a shining example of how technology can revolutionize financial systems, making them more inclusive, efficient, and resilient.

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MAKING THE RIGHT CHOICE: REASONS TO CHOOSE LIC INSURANCE POLICY

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ABSTRACT

This study aims to identify the reasons for preferring Life Insurance Policy and examine the satisfaction level towards selecting a Life Insurance policy. This study also shows how policyholders feel about the life insurance company policy in the Coimbatore district. About 100 samples were taken from the Coimbatore district population and analyzed using statistical tools like Chi-square and simple percentages. The result shows how policyholders are willing to take the policy to safeguard their lives and families.

Keywords: *Policyholders, Insurance, Reasons and Preference*

Introduction

Insurance is a risk transfer mechanism through which one entity pays another entity in the event of loss, according to a signed contract between the insurer and the life assured. It has grown to encompass a wide variety of products. Insurers conceptualize, design, obtain approvals, and offer their products. In return for these products, the intended beneficiary is convinced to buy. Nowadays, consumers are increasingly comfortable using social media, mobile phones, and other items to get recommendations from friends, family, and colleagues, buy from wherever they are located, and share their experiences afterwards. People are always looking for security, which is vital in forming families, tribe communities, and groups. The policyholders' attitude level indicates the extent to which they have availed themselves of the services.

Review of Literature

Sneha Singh et al. (2022) examined that customers and businesses consider customer happiness an essential factor in providing value to their products and services, resulting in customer satisfaction.

Arathi (2021) stated that LIC has many strategies for nationwide and different regions, and nowadays, insurance is most famous as a more transparent instrument against death and life. Customer awareness programs should take place in rural areas to educate all about the benefits of life insurance.

Nisha et al. (2019) found that as consumer preferences for products fluctuate occasionally, market analysis should be carried out regularly to monitor consumers' changing needs and wants. GST is one of the current issues for the insurance sector, and the rural area people were affected by this tax. Therefore, Life Insurance Companies should provide better awareness activities to their customers.

Nivedita et al. (2018) found that customers are satisfied with the features and premiums of life insurance policies. Most have a long business history with their current agents, but few wish to buy more products from their current agents or recommend others to buy a product from them.

Sanmugam Annamalah (2013) developed that the primary intention for purchasing life insurance is financial security for the family. However, individuals now buy life insurance as a medium to long-term tax-favoured savings and investment vehicle.

Objectives

1. To find the reasons for preferring the Life Insurance Policy of policyholders.
2. To examine the satisfaction of LIC policyholders towards selecting a Life Insurance policy.

Source and Methodology

This study was conducted using primary and secondary sources. Primary data were collected through an online survey with a structured questionnaire, and secondary data were collected through articles, magazines, journals, internet and research websites.

Analysis and Interpretation

This study was analyzed using a well-structured questionnaire circulated to 100 policyholders to collect relevant information. All data collected were compiled and analyzed, and the results were framed in a table. Based on the results of the analyses, relevant issues were described.

Findings

Table 1 discloses that out of 100 policyholders.

- According to the data provided, a high majority of the policyholders surveyed were female (82%).
- The majority of policyholders were also under the age of 30 (51%).
- In terms of education, the majority of policyholders were PG graduates (56%).
- The majority of policyholders were married (92%).
- Regarding employment, most policyholders were employed in the private sector (72%).
- The majority of policyholders also lived in joint families (53%).
- In terms of family size, most policyholders had more than four members in their family (33%).
- Regarding location, most policyholders lived in semi-urban (town) areas (43%).
- Regarding family income, most policyholders had two earning members in their family (66%).
- The majority of policyholders also earned up to ₹3,00,000 as personal annual income (67%).
- Finally, most policyholders earned up to ₹5,00,000 as family yearly income (33%).

Table 1
Socio-Economic Profile of LIC Policyholders

Socio Economic Variable	No. of Policy Holders	Percentage(%)
Gender:		
Male	18	18
Female	82	82
Age		
Up to 30 years	51	51
31-45	45	45
46-60	02	02
OVER 60	02	02
Ed. qualification		
School level	02	02
Diploma Holders	02	02
UG	21	21
PG	56	56
Professional Course	17	17
Others specify____	03	03
Marital status		
Married	92	92
Unmarried	08	08

Socio Economic Variable	No. of Policy Holders	Percentage(%)
Family type		
Joint	53	53
Nuclear	47	47
Total no of members		
2	05	05
3	32	32
4	30	30
More than 4	33	33
Occupation		
Self Employed	20	20
Private sector employee	72	72
Govt employed	03	03
Business Person	03	03
Retired Employee	02	02
Area		
Rural	41	41
Semi-urban	43	43
Urban	16	16
Total no. of earning members		
1	16	16
2	66	66
More than 2	18	18
Personal Annual Income		
Up to ₹3,00,000	67	67
₹3,00,001 to ₹5,00,000	13	13
₹5,00,001 to ₹ 7,00,000	06	06
Above ₹7,00,000	14	14
Family annual income		
Up to ₹5,00,000	33	33
₹5,00,001 to ₹10,00,000	25	25
₹10,00,001 to ₹15,00,000	24	24
Above ₹15,00,000	18	18
No. of Policy taken(Self)		
1	70	70
2	22	22
3 and above	08	08

Socio Economic Variable	No. of Policy Holders	Percentage(%)
Type of Policy Taken		
Children Future Plan	12	12
Endowment Policy	03	03
Group Insurance Policy	05	05
Money Back Policy	21	21
Pension Plans	15	15
Special Plans	07	07
Term Policy	22	22
Jeevan Anand Women's policy	03	03
Whole life policy	12	12
Mode of Premium		
Single Premium	08	08
Monthly	44	44
Quarterly	23	23
Half-yearly	13	13
Annually	12	12
Reasons for taking Policy		
Need for insurance is felt.	74	74
Motivated by agent	07	07
Tax Saving Purpose	19	19
No. of Policy taken(Family)		
1	41	41
2	38	38
3 and above	21	21
Total premium paid (Annual):		
Less than ₹1,00,000	70	70
₹1,00,001 to ₹2,00,000	25	25
₹2,00,001 to ₹3,00,00	02	02
Above ₹3,00,000	03	03
Mode of Payment		
Cash	50	50
Cheque	05	05
Salary Saving Scheme	13	13
Internet	32	32

- According to the data provided, a high majority of policyholders surveyed perceived a need for insurance (74%) expressing this sentiment.
- The majority of policyholders also took out one policy for themselves (70%).
- Regarding policies for their families, most policyholders took out one policy (41%).
- Regarding the type of policy taken out, most policyholders took out term insurance (22%).
- Regarding premium payments, most policyholders paid less than ₹1,00,000 as their total annual premium, with 100 (70%).
- Most policyholders also paid their premiums monthly, with (44%).
- Finally, in terms of payment methods, the majority of policyholders made their payments through cash (50%).

Table 2
Aspects Associated with Satisfaction Level on Preferring LIC Insurance Policy

Variables	χ^2	Variables	χ^2
Gender	2.516	Personal income	14.938**
Age	17.176**	The family income per month	32.002**
Educational Qualification	27.458**	Reasons for taking policy	35.688**
Marital status	3.055	No. of Policy taken(self)	18.264**
Occupation	27.556**	No. of Policy taken(family)	5.519
Area of residence	24.074**	Type of Policy	63.192**
Family type	2.132	Total annual Premium	9.180
Total number of members	40.370**	Mode of Premium	34.986**
Total number of earning members	8.418	Mode of Payment	50.683**

** Significant @ 5% level

Table 2 shows the association between variables and the policyholders' satisfaction level using the Chi-square tool with a 5% significance level.

Age(17.176), educational qualification(27.458), occupation(27.556), area of residence(24.074), number of members(40.370), personal income (14.938) and family income(32.002), the reason for taking the policy (35.688), number of policies taken for self(18.264), type of policy (63.192), mode of premium (34.986) and mode of payment(50.683) are associated with the satisfaction level on preferring LIC insurance policy.

Reasons for preferring LIC Insurance are Due to Government undertaking, traditional insurer, prompt payment of maturity amount, high sum assured with a low premium, high return, financial sound, attractive bonus, easy availability of loan, low rate of interest on the loan, innovative products, availability of salary saving scheme, quick service, friends/relatives in LIC, advice of friends/relatives and other reasons.

Table 3
Aspects Associated with Reasons for Preferring LIC Insurance Policy

Variables	χ^2	Variables	χ^2
Gender	4.150	Personal income	29.346**
Age	2.791	The family income per month	34.952**
Educational Qualification	17.025	Reasons for taking Policy	3.157
Marital status	1.043	No. of Policy taken(self)	3.794
Occupation	32.109**	No. of Policy taken(family)	16.546**
Area of residence	21.282**	Type of Policy	50.601**
Family type	7.514**	Total annual Premium	7.958
Total number of members	18.445**	Mode of Premium	24.535**
Total number of earning members	25.466**	Mode of Payment	13.774**

** Significant @ 5% level

Table 3 shows the association between the variables and Reasons for selecting LIC policy with the chi-square at 5% significant level.

Occupation(32.109), area of residence(21.282), family type (7.514), number of members(18.445), number of earning members (25.466), personal income (29.346) and family income (34.952), number of policies taken for family(16.546), type of policy(50.601), mode of premium (24.535) and method of payment(13.774) are associated with the reasons for preferring LIC Insurance Policy.

This table enforces that associated variables are the main reasons behind the policyholder's willingness to take LIC policy.

Table 4
Aspects Associated with Intention for Preferring LIC Insurance Policy

Variables	χ^2	Variables	χ^2
Gender	6.274**	Personal income	32.320**
Age	25.620**	The family income per month	24.223**
Educational Qualification	39.306**	Reasons for taking Policy	12.086**
Marital status	17.289**	No. of Policy taken(self)	31.097**
Occupation	15.247	No. of Policy taken(family)	21.965**
Area of residence	19.349	Type of Policy	44.505**
Family type	3.967	Total annual Premium	24.341**
Total number of members	15.054**	Mode of Premium	58.129**
Total number of earning members	12.776**	Mode of Payment	54.609**

** Significant @ 5% level

Table 3 carry out information regarding the association between variables and their intention in taking LIC policy as a Policyholder using Chi-square tool with 5% significance level.

Gender(6.274), age(25.620), educational qualification(39.306), marital status(17.289), number of members (15.054), number of earning members(12.776), personal income(32.320) and family income(24.223), reasons for taking the policy (12.086), number of policies taken for self (31.097) and number of policies taken for family (21.965), type of policy (44.505), total annual premium (24.341), mode of premium (58.129) and mode of payment(54.609) are associated with the intention for preferring LIC Insurance Policy.

This table reveals that policyholder intentions are carried out through the associated variables in buying insurance policy.

Recommendations

The study reveals that the primary reasons for policyholders' intentions to purchase insurance policies are to safeguard themselves and their families. However, they were unclear in selecting policies because they did not receive precise information regarding the policy and its features. Therefore, it is recommended that LIC send regular updates regarding the policies to policyholders and keep them informed about new policies as well.

Conclusion

The insurance sector is one of the most rapidly growing sectors in India. A person must be insured to protect themselves and their family members, as the amount cannot be saved due to price changes and the tax slab. This study concludes that safeguarding themselves and their families, investing in long-term benefits, and the image of a government undertaking company are the main reasons behind the preference for taking a LIC policy. Many other reasons also play a role, but these are the primary factors that this study analyzes.

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“IMPACT ASSESSMENT OF GST IMPLEMENTATION ON SMALL AND MEDIUM SCALE TRADERS”

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ABSTRACT

Implementing the Goods and Services Tax (GST) posed a significant challenge, particularly in educating India's population of 1.33 billion about the new system. This was especially difficult in regions where change is often met with resistance. In the post-GST period, many returns were mismatched, leading to technical difficulties for Indian taxpayers and further complicating the new tax system. Consequently, most dealers faced issues submitting reports and reclaiming Input Tax Credits (ITC). As a result, the World Bank has deemed GST as a complex tax system. This study aims to investigate potential issues arising from the implementation of GST. Data was collected from 275 respondents who operate businesses in and around the Coimbatore District using a questionnaire. Respondents were selected using a convenience sampling method. The data was then analyzed using simple percentage, ANOVA and T-test statistical tests. The findings of this study will benefit traders in enhancing their understanding of the GST concept. It will also guide them on how to avoid common errors when filing monthly returns and effectively claim common problems they may encounter under various circumstances.

Keywords:

Traders, GST, Small and Medium Traders, Tax

INTRODUCTION

The Goods and Services Tax (GST) is a significant indirect tax reform adopted by many countries, each implementing it uniquely. GST replaced all other indirect taxes in India, including state VAT, central excise duty, service tax, and central sales tax. GST is a value-added tax on goods and services that applies to every stage of the production process, benefiting all parties involved, from the producer or service provider to the ultimate consumer. GST has fundamentally transformed India's tax structure intending to create a unified Indian market by eliminating distortions in the cost of goods and services. India categorizes its goods and services into four sectors based on GST rates: 5%, 12%, 18%, and 28%. Overall, GST simplifies the tax payment process. Organizations registered for GST are required to submit monthly, quarterly, and annual returns via the Government of India's GST portal. They must disclose their purchases and sales of goods and services and the taxes collected and paid. As per Prime Minister Narendra Modi, businesspeople and traders with zero transactions, known as "Nil filers," can now file taxes via SMS (The Hindu, dated 30th June 2019). The MSME Act of 2006 was established to assist Micro, Small, and Medium Enterprises (MSMEs) in their initiation and expansion. It also enhances their competitiveness both domestically and internationally. Several modifications were recently made to simplify the GST returns filing process. On 30th October 2017, the Ministry of Micro, Small, and Medium Enterprises Development Act (MSME) launched MSME Samadhaan to support micro and small business owners nationwide. Specific funds are allocated for fostering enterprise competitiveness, with various programs and schemes available.

REVIEW OF LITERATURE

Ahmad et al. (2016) conducted a study to examine taxpayers' awareness, perceptions, and acceptability of the GST implementation. The findings indicated that public awareness of GST has not

yet reached an adequate level. This was evident from the general questions that respondents, as end users, should have been familiar with. Consequently, respondents' perceptions of the impact of GST introduction were predominantly negative.

Dani (2016) suggested that the Indian government should study other countries' GST regimes and their effects. She also emphasized the need to protect India's vast population from inflation resulting from GST implementation. Furthermore, she posited that GST would simplify the current indirect tax system and eliminate inefficiencies caused by the existing diverse tax structure.

Kumar (2017) investigated people's perceptions of the newly established tax system. He recommended that the government should issue proper guidelines to society on the procedures for GST implementation to ensure its efficient execution.

Lourdunathan and Xavier (2017) conducted a study to understand the challenges and examine the opportunities for GST adoption. They concluded that implementing GST in India would lead to a "One Nation, One Tax Market." They also found that GST positively impacts various industries and sectors. They suggested that the government should take necessary measures to strengthen GST, such as providing adequate training, seminars, and workshops.

STATEMENT OF THE PROBLEM

Today marks the commencement of the world's most extensive indirect tax system, effectively eliminating all barriers to interstate trade. Implementing GST promises clear rules for filing tax returns and streamlined bookkeeping, offering benefits to producers and dealers. Furthermore, it has been demonstrated that GST can reduce overall compliance costs for small-scale producers and traders, who might otherwise have to price their goods higher. The introduction of GST has significantly impacted the Indian economy in several ways. For instance, it has simplified the tax structure, making it more understandable and manageable for businesses. It has also fostered a more competitive market by eliminating cascading taxes and promoting fairness in the taxation of goods and services. However, implementing such a large-scale tax reform is not without its challenges. It requires substantial changes in business processes, systems, and working practices. Despite these challenges, the potential benefits of GST for the Indian economy are significant. This study aims to understand how traders perceive this new tax reform. By examining their experiences and attitudes towards GST, we can gain valuable insights into its impact on small and medium traders. This information is crucial as it can guide future policy decisions and help refine the GST system for better compliance and ease of business. In conclusion, while GST implementation has brought about significant changes in the Indian tax landscape, its long-term benefits for economic growth and ease of business are undeniable. Through continuous learning and adaptation, traders can leverage this new system.

OBJECTIVES OF THE STUDY

The following are the objectives of the study:

1. To identify the socio-economic profile of the traders.
2. To examine the concerns that may arise as a result of the GST implementation.

RESEARCH METHODOLOGY

Both primary and secondary data underpin this study. Primary data was collected through interviews with 275 small and medium-sized business owners in the Coimbatore District, using a convenience sampling. These interviews provided firsthand insights into the experiences and perceptions of these business owners regarding the implementation of GST. Secondary data was gathered from government and the income tax office annual reports. Additionally, journal articles, bulletins, and online resources were reviewed to provide a broader context and deeper understanding of the topic. This combination of primary and secondary data ensures a comprehensive analysis of the impact of GST on small and medium traders. The collected data was then analyzed using Percentage Analysis, ANOVA and T-

Test statistical methods. These methods were chosen for their ability to effectively handle the type of data collected and answer the research questions posed in this study.

LIMITATION OF THE STUDY

1. The Coimbatore District is the only area of the study. The data analysis statistical tools have their limits.
2. The opinions offered by small and medium-sized traders could be swayed. Consequently, while generalizing the result, care must be exercised.

FINDINGS OF THE STUDY

Table 1 shows the classification of respondents based on the socio-economic profile of the traders.

Table 1 Socio-Economic Profile of the Traders

Variables	Frequency & Percentage
Area of Residence	
Urban	163 (59.3)
Rural	82 (29.8)
Semi-Urban	30 (10.9)
Gender	
Male	202 (73.5)
Female	73 (26.5)
Age (in Years)	
Under 30	29 (10.5)
31-40	111 (40.4)
41-50	83 (30.2)
Above 50	52 (18.9)
Educational Qualification	
Upto Higher Secondary	83 (30.2)
UG	140 (50.9)
PG	39 (14.2)
Others	13 (4.7)
Nature of Family	
Joint Family	36 (13.1)
Nuclear Family	239 (86.9)
Monthly Income	
Up to ₹ 1,00,000	39 (14.2)
₹1,00,000 – ₹3,00,000	112 (40.7)
₹3,00,000- ₹5,00,000	84 (30.5)
Above ₹5,00,000	40 (14.5)
Annual Income	
Below ₹2,50,000	84 (30.5)
₹2,50,000- ₹ 5,00,000	86 (31.3)
₹5,00,000- ₹ 7,50,000	52 (18.9)
Above ₹ 7,50,000	53 (19.3)
Total	275 (100.0)

Table 1 reveals that the majority of respondents reside in urban. This is likely due to the greater availability of resources, ongoing infrastructure development, and increased commercialization in these areas. The majority of respondents are men, which could be attributed to the general tendency of

women to be more risk-averse than men. Most respondents fall within the age range of thirty-one to forty, a group often characterized as emerging leaders and risk-takers.

Of the 275 respondents, 140 (50.9%) pursued undergraduate studies, believing it would aid in developing their soft skills such as responsibility, time management, accountability, and emotional intelligence. Many respondents reported a monthly income between ₹1,00,000 and Rs 3,00,000 and an annual income between ₹2,50,000 and ₹5,00,000. This income bracket is indicative of the economic status of the majority of the respondents.

DETERMINANTS OF LEVEL OF IMPACT ON IMPLEMENTATION OF GST (ANOVA AND T-TEST)

In order to ascertain the level of impact on the implementation of GST and the variables that determine the impact of the implementation of GST by using ANOVA and T-Test.

Table 2 Determinants of Level of Impact on Implementation of GST (ANOVA and T-Test)

	N	Mean	Std. Dev.	Result
Area of Residence				
Urban	163	47.2195	5.76781	ANOVA =1.695 P=.186 P>0.05 Not-Significant
Rural	82	46.3558	6.58098	
Semi-Urban	30	44.9000	5.56064	
Gender				
Male	202	45.5990	6.51539	T-Test =22.741 P=.000 P<0.05 Significant
Female	73	48.8219	3.38847	
Age				
Under 30	29	47.4483	5.97965	ANOVA =4.163 P=.007 P<0.05 Significant
31-40	111	47.7387	5.04293	
41-50	83	45.3735	5.94838	
Over 50	52	44.8846	7.38216	
Educational Qualification				
Up to Higher Secondary	83	44.2169	7.39322	ANOVA =5.969 P=.055 P>0.05 Not- Significant
UG	140	47.2286	5.43416	
PG	39	47.9487	3.73426	
Others	13	47.9231	3.92559	
Nature of the Family				
Extended Family	36	46.9444	6.68022	T-Test =0.230 P=.632 P>0.05 Not-Significant
Nuclear Family	239	46.3808	5.92117	
Monthly Income				
Up to ₹1,00,000	39	46.2821	5.47698	ANOVA =0.051 P=.985 P>0.05 Not-Significant
₹1,00,000 - ₹ 3,00,000	112	46.6071	5.79897	
₹3,00,000 - ₹ 5,00,000	84	46.3095	6.36439	
Above ₹ 5,00,000	40	46.5000	6.55548	
Annual Income (₹)				
Below ₹2,50,000	84	46.8810	4.88026	ANOVA =2.610 P=.052 P>0.05
₹2,50,000 - ₹5,00,000	86	44.9884	6.45982	
₹ ₹5,00,000 - ₹ 7,50,000	52	47.2308	6.69098	

	N	Mean	Std. Dev.	Result
Above ₹ 7,50,000	53	47.3962	5.93341	Not-Significant
Form of Organization				
Sole Proprietorship	215	45.6093	6.36476	T-Test =21.371 P=.000 P<0.05 Significant
Partnership Firm	60	49.4833	3.03366	
Nature of Business				
Textiles	33	47.9394	3.63953	ANOVA =1.033 P=.399 P>0.05 Not-Significant
Fast-moving consumer goods	107	46.5794	5.58981	
Pharmaceuticals	29	46.6552	9.23996	
Electronic goods	68	46.1176	5.99136	
Construction/Hardware	26	46.0385	4.87016	
Automobile	12	43.5833	7.41569	
Age of Business				
Under 5	55	47.1636	5.81725	ANOVA =6.748 P=.000 P<0.05 Significant
5 – 10	112	47.9643	5.13686	
10 – 15	82	44.4024	4.72986	
Over 15	26	44.9231	3.58394	
Member of Trade Union				
Yes	221	46.7783	5.79347	T-Test =0.687 P=.408 P>0.05 Not-Significant
No	54	45.1296	6.74899	
Annual Turnover				
Below ₹ 1 crore 50 Lakhs	165	45.4909	6.61725	ANOVA =3.686 P=.013 P<0.05 Significant
Above ₹1 crore 50 Lakhs and	69	48.0435	4.84293	
Below ₹ 2 crores				
Above ₹2 crore and below	27	47.8148	3.73175	
₹5 crore				
Above ₹5 crore	14	47.3571	5.47171	
Supply of Goods				
Intra state	207	46.3527	5.42077	ANOVA =0.425 P=.654 P>0.05 Not-Significant
Inter-State	54	47.0556	8.29507	
Both	14	45.6429	3.77455	
Nature of GST Registration				
Regular Scheme	220	46.4636	6.07890	T-Test =0.036 P=.850 P>0.05 Not-Significant
Compounding Scheme	55	46.4182	5.81088	
Type of Customer				
Business to Business	193	47.1865	5.32745	ANOVA =11.069 P=.000 P<0.05 Significant
Business to Consumer	67	45.7761	6.93655	
Both	15	40.0667	6.23889	
Sources of Updating GST-Related Information				
Newspaper	45	48.5778	5.69086	ANOVA =9.414

	N	Mean	Std. Dev.	Result
Television / Radio	5	43.3500	1.67332	P=.000 P<0.05 Significant
Internet / Websites	30	49.3000	4.42680	
Friends / Relatives	10	48.7000	2.83039	
Social Media	65	47.8615	4.69666	
Seminar / Lecture	20	45.9500	3.73427	
Auditors	100	51.6000	6.69445	
Frequency of Updating GST-Related Information				
Hourly	13	45.0580	2.07550	ANOVA =5.376 P=.001 P<0.05 Significant
Daily	28	49.5357	3.61563	
Weekly	69	49.8462	5.70574	
Monthly	165	46.2485	6.41112	
Ways of maintaining the accounts				
Manual	41	44.0244	8.38894	ANOVA =4.674 P=.010 P<0.05 Significant
Computerization	165	47.1636	5.12917	
Outsourcing	69	46.2029	6.01121	
Mode of Filing GST Return				
Monthly	220	46.4636	6.07890	T-Test =0.036 P=.850 P>0.05 Not-Significant
Quarterly	55	46.4182	5.81088	
GST Filing personnel				
Self	41	46.9697	7.20459	ANOVA =1.545 P=.215 P>0.05 Not-Significant
Chartered Accountant	165	45.5122	4.65705	
Tax Practitioner	69	45.7826	7.83257	
Mode of Using Mail ID/ Mobile Number				
Self	24	46.9810	6.97186	T-Test =3.835 P=.051 P>0.05 Not-Significant
Auditor	210	43.4583	5.53887	
Mode of Filing GSTR 3B Return				
Payment of Tax	84	47.1071	4.83217	T-Test =4.553 P=0.034 P<0.05 Significant
Carryforward of Input Tax Credit	191	46.1675	6.45904	

ANOVA and T-Test reveal that out of twenty-two variables, eleven variables exhibit a significant difference in the level of impact on the implementation of GST. These variables include gender, age, form of organization, age of business, annual turnover, types of customers, frequency of updating GST-related information, sources of updating GST-related information, methods of maintaining accounts, and the mode of filing the GSTR 3B return. This suggests that these factors play a crucial role in successfully implementing and understanding GST.

CONCLUSION OF THE STUDY

For decades, the country has implemented various taxes at different stages of business. While this system provided more options for honest taxpayers, it also gave dishonest taxpayers more significant

opportunities to exploit the system. To address this issue, the government introduced the Goods and Services Tax (GST) to simplify the nation's tax structure. In January 2022, India collected the second-highest gross GST, amounting to ₹1,38,394 crore, marking a 15% increase from the previous year (as reported on 1st February 2022). This indicates the effectiveness of GST in enhancing tax compliance and revenue collection. However, the implementation of GST has elicited mixed responses from the public. According to a survey, 42.20% of the 116 respondents believe introducing GST will have a moderate impact. This suggests that while some see GST as a positive reform, others may have reservations or face challenges adapting to the new system. The government must continue educating taxpayers about GST and provide the necessary support to ensure a smooth transition and compliance. This will not only help in maximizing the benefits of GST but also in building public trust and acceptance towards this significant tax reform.

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- <https://concept.ink/lw1kwixs/xl4i3x4.php?id=b1f69c-gst-basic-knowledge-pdf>
- How Will India's Move To A Goods And Services Tax (GST) Affect Indian NGOs? – Daily Filing. <https://dailyfiling.com/how-will-indias-move-to-a-goods-and-services-tax-gst-affect-indian-ngos/>
- Is It Mandatory to Include Your GST Number. <https://www.kotakgeneral.com/blog/motor-insurance/is-it-mandatory-to-include-your-gst-number-in-your-car-insurance-policy>
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**PERCEPTION TOWARDS WOMEN EMPOWERMENT SCHEMES IN TAMILNADU
STATE TRANSPORT CORPORATION LIMITED, COIMBATORE**

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ABSTRACT

Tamil Nadu State Transport Corporation Ltd. (TNSTC) is a government owned public transport bus operator in Tamil Nadu, India. The vast majority of public transportation is funded and operated by local government authorities. Mobility is the prerequisite to accessing goods and services, such as health, jobs, education and leisure. Women face more restrictions to mobility and their travel patterns differ from those of men due to their differences in needs and tasks. While public transportation comes in many forms, it can be defined as a system that moves people from one area to another in an efficient, affordable manner. Women face different challenges when it comes to mobility, whether it is inclusion, safety, accessibility or entering the workforce in the transport sector. Hence, this study has intended to analyse the perception towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore. This study followed research design is descriptive method. For this objective, the researcher has chosen 82 women passengers who are travelling in TNSTC, Coimbatore through random sampling method. A structured questionnaire has been administered among population to collect the required information related demographic profile and their perception towards women empowerment schemes by 5 points Likert scaling method. The collected data are entered in Microsoft Excel 2019 and analyzed by performing the statistical techniques namely percentage analysis, mean score, standard deviation and ANOVA with the help of SPSS 22.0. The analysis illustrated that maximum level of perception towards women empowerment schemes is perceived by passengers who belong to 41-50 years of age group, opined as providing valuable service, felt as playing dynamic role at women empowerment schemes and travelling for personal work in TNSTC, Coimbatore.

Keywords:

Women Passengers, Public Transport, Tamilnadu State Transport Corporation Limited, Women Empowerment Schemes.

1. INTRODUCTION

Public transportation is a form of local travel that enables more people to commute together along designated routes. Typical examples of types of public transportation include buses, trains, and trams. High-speed rails, airlines, and coaches dominate public transportation between cities. Transportation is an essential component of human life as well as any country's economic life. Commerce, agriculture, and the service industry all rely on it to survive. It aids in the movement of people and objects from one location to another. Tamil Nadu State Transport Corporation Ltd. (TNSTC) is a government owned public transport bus operator in Tamil Nadu, India. It operates Intercity bus services to cities within Tamil Nadu, and from Tamil Nadu to its neighbouring states. It also operates town busses from major cities and towns of Tamil Nadu to its neighbourhoods. A well-functioning transportation network is a must for a rising country like India's future economic progress. Public services can be described as the provision of services or meeting the needs of individuals or groups with an interest in the organization while adhering to the organization's rules and procedures. The challenges women face when it comes to mobility are inclusion, safety, accessibility or entering the workforce in the transport sector. Women tend to make more and shorter trips, at more varied times. They use public transport and walk more than men. This often leads to higher expenditures due to the fact that public transport is often based on tariffs that charge per trip, in contrast to time-based charging. Transport definitely plays a significant role in ameliorating or exacerbating the social conditions of women, particularly

those who are poor. And it is proven that as women's incomes increase, differences in travel behaviour between men and women decrease.

2. REVIEW OF LITERATURE

In view of Naveen Bangalore Ramu and Anjula Gurtoo, (2019) displayed that timely service, women-friendliness, ticket price affordability and service to price satisfaction were common to passengers from Europe and India whereas significantly impact commuters' perceived service value devised as overall satisfaction. Specifically, external tangibles such as clean drinking water, clean bus stops were however significantly more important for passengers in Europe, while handling of luggage was a more appropriate tangible for passengers in the Indian context. The result from Vinayak Shivaji Salokhe and Omprakash Halder (2022) assumed that due to rise in fuel prices and rise in air pollution people were preferring to travel by public transport system in urban and rural part of the countries in the world. Additionally, the functional aspect had a significant impact on customer satisfaction and required more attention in order to improve it. Hence, the main factors that contributed to a better degree of satisfaction were frequency, pricing, punctuality and trip time.

The authors Francesco Filippi et al. (2013) revealed that more than competition and liberalization were needed to improve public transport services and the users' positional disadvantage must be reduced and lack of power remedied. Also, users should be empowered to influence the service, which will give flexibility to the system and foster bottom-up development. In addition, they can become partners in the design and innovation of public services and entrepreneurs in the exploitation of new services. In case of Tamilselvi and Bandita K. Panda (2021) observed that Ola did not have any women representative in the decision-making level and M Auto also had interest towards the environment along with women empowerment thus fulfilling the parameters for effective development process. Further, there is always a supply demand for women chauffeurs and it is the responsibility of the service providers, government and society as a whole to accept changes and also to frame development models in such a way that it has to be long term.

3. STATEMENT OF THE PROBLEM

TNSTC has provided several services to people and also started online booking facilities to book bus tickets between major cities served by TNSTC. TNSTC comprises a diverse array of categories, which include Mofussil Services, Town Services, MTC, Ghat Services, Inside State Services (Express), and Outside State Services (Express). Recently, the government announces free travel facilities for all women including working women, Transgender and girls who are pursuing higher education in ordinary fare city buses operated under the control of the Tamil Nadu State Transport Corporation since 2021. In general, women specific barriers to safe public transport include fear and experiences of sensual harassment and violence while accessing and using public transport. Also, overcrowding, lack of space and information, delay or unreliable public transport services have a disproportionately higher impact on women than men. Considering this point of view, the researcher aimed to analyze the perception towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore.

4. OBJECTIVES OF THE STUDY

- To explore the demographic profile of the selected passengers of Tamilnadu State Transport Corporation Limited, Coimbatore.
- To analyze the perception towards women empowerment schemes among selected passengers in the study area.

5. HYPOTHESIS OF THE STUDY

- There is no significant difference in mean perception towards women empowerment schemes with regard to their age group.

- There is no significant difference in mean perception towards women empowerment schemes with regard to their opinion towards playing dynamic role.

6. RESEARCH METHODS

This study followed research design is descriptive and survey method. This study has administered a well-structured questionnaire to collect the required information about the demographic profile and perception towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore by utilizing 5 points Likert's scale technique.

For this study, the sample size has covered of 82 women passengers via random sampling method. The collected sample data are entered into Microsoft Excel and analyzed by using the statistical tools such as percentage analysis, mean score, standard deviation and ANOVA through SPSS 22.0 software.

7. RESULT AND DISCUSSION

7.1 Demographic Profile and Perception towards Women Empowerment Schemes

The following table displays the demographic profile and perception towards women empowerment schemes of the selected women passengers as given below.

Table 1: Demographic Profile and Perception towards Women Empowerment Schemes

No.	Variables Name	Number of Respondents	Percentage	Mean
1	Age Group			
	• Upto 30 Years	20	24.4	3.58
	• 31 - 40 Years	13	15.9	3.46
	• 41 - 50 Years	28	34.1	3.76
	• Above 50 Years	21	25.6	3.17
	Total	82	100.0	
2	Providing valuable service			
	• Yes	45	54.9	3.54
	• No	37	45.1	3.48
	Total	82	100.0	
3	Playing dynamic role at Women Empowerment Schemes			
	• Yes	29	35.4	3.65
	• No	53	64.6	3.26
	Total	82	100.0	
4	Travelling Purpose			
	• For working	10	12.2	3.57
	• For studying	22	26.8	3.50
	• Personal work	34	41.5	3.70
	• Others	16	19.5	3.10
	Total	82	100.0	

- The above analysis exposes that 24.4% of the women passengers are upto 30 years aged, 15.9% of the women passengers are belong to 31-40 years, 34.1% of the women passengers are 41-50 years aged and 25.6% of the women passengers are above 50 years aged.
- The analysis illustrates that 54.9% of the women passengers opined that providing valuable service in TNSTC and 45.1% of the women passengers are opined that not providing valuable service in TNSTC, Coimbatore.

- The analysis observes that 35.4% of the women passengers opined that playing dynamic role at women empowerment schemes in TNSC and 64.6% of the women passengers are opined that not playing dynamic role at women empowerment schemes in TNSC, Coimbatore.
- The analysis infers that 12.2% of the women passengers are travelling for working, 26.8% of the women passengers are travelling for studying, 41.5% of the women passengers are travelling in TNSC for personal work and 19.5% of the women passengers are travelling for other purposes.

7.2 Perception towards Women Empowerment Schemes in TNSC

This section has discussed about the perception towards women empowerment schemes in TNSC, Coimbatore. For this study, six statements have been developed about perception towards women empowerment schemes and computed by using 5 points Likert's scaling method.

It is revealed from the analysis that among the six categories of perception towards women empowerment schemes, they noticed that 'service satisfaction for free service' with the mean score and standard deviation of 4.07 and 0.90 respectively followed by 'women friendliness' with the mean score and standard deviation of 3.83 and 1.04 respectively.

7.3 Testing of Hypothesis (ANOVA)

This section has analyzed that the relationship between the demographic profile of the selected passengers and their perception towards women empowerment schemes in TNSC, Coimbatore. In order to analyse the relationship between selected independent variables and perception towards women empowerment schemes, a hypothesis has been developed and tested by using ANOVA.

Age Group and Perception towards Women Empowerment Schemes

H₀: There is no significant difference in mean perception towards women empowerment schemes with regard to their age group.

Table 2: Age Group and Perception towards Women Empowerment Schemes (ANOVA)

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	4.283	3	1.428	6.548	0.001*
Within Groups	17.006	78	0.218		
Total	21.289	81			

Note: * – Significant at 1% level

It is illustrated from the ANOVA that the 'p' value is lesser than 0.05 therefore the null hypothesis is rejected. Hence, there is a significant difference in mean perception towards women empowerment schemes in TNSC with regard to their age group.

Opinion towards Playing Dynamic Role and Perception towards Women Empowerment Schemes

H₀: There is no significant difference in mean perception towards women empowerment schemes with regard to their opinion towards playing dynamic role.

Table 3: Opinion towards Playing Dynamic Role and Perception towards Women Empowerment Schemes (ANOVA)

	Sum of Squares	df	Mean Square	F	'p' value
Between Groups	2.801	1	2.801	12.121	0.001*
Within Groups	18.488	80	0.231		
Total	21.289	81			

Note: * – Significant at 1% level

It is confirmed from the ANOVA that the 'p' value is lesser than 0.05 accordingly the null hypothesis is rejected. So, there is a significant difference in mean perception towards women empowerment schemes in TNSC with regard to their opinion towards playing dynamic role.

8. FINDINGS

- It is assessed from the analysis that most (34.1%) of the women passengers are 41-50 years aged. It is found that maximum level of perception towards women empowerment schemes is perceived by passengers belong to 41-50 years of age group.
- It is showed from the analysis that most (54.9%) of the women passengers opined that providing valuable service in TNSCTC. It is identified that maximum level of perception towards women empowerment schemes is perceived by passengers who opined as providing valuable service in TNSCTC.
- It is mentioned from the analysis that most (64.6%) of the women passengers opined that not playing dynamic role at women empowerment schemes in TNSCTC. It is noted that maximum level of perception towards women empowerment schemes is perceived by passengers who felt as playing dynamic role at women empowerment schemes in TNSCTC.
- It is pointed out from the analysis that most (41.5%) of the women passengers are travelling for their personal work. It is proved that maximum level of perception towards women empowerment schemes is perceived by passengers who travelling in TNSCTC for personal work.
- It is examined from the mean score analysis that among the six categories of perception towards women empowerment schemes, they noticed that 'service satisfaction for free service' and 'women friendliness' with the mean score of 4.07 and 3.83 respectively.
- It is revealed from the ANOVA that there is a significant difference in mean perception towards women empowerment schemes in TNSCTC with regard to their age group.
- The 'F' test analysis showed that there is a significant difference in mean perception towards women empowerment schemes in TNSCTC with regard to their opinion towards playing dynamic role.

9. SUGGESTIONS

- It is found that maximum level of perception towards women empowerment schemes is perceived by passengers belong to 41-50 years of age group. So, the staff of TNSCTC should understand all age categories of women's mobility and ensure their empowerments in public transport.
- It is identified that maximum level of perception towards women empowerment schemes is perceived by passengers who opined as providing valuable service in TNSCTC. Hence, it is suggested that the bus conductor should behave friendliness, pleasant and helpful manner with women passengers to enhance their empowerment in TNSCTC.
- It is noted that maximum level of perception towards women empowerment schemes is perceived by passengers who felt as playing dynamic role at women empowerment schemes in TNSCTC. Thus, TNSCTC should develop inclusive mobility services and empower women in the public transport sector.
- It is proved that maximum level of perception towards women empowerment schemes is perceived by passengers who travelling in TNSCTC for personal work.
- Hence, TNSCTC should confirm the safety of women passengers in transport and may promote various empowerment services to them.

10. CONCLUSION

This study aimed to analyze the perception towards women empowerment schemes in Tamilnadu State Transport Corporation Limited, Coimbatore. The public transportation plays a critical role as a means to human being commute between different places through providing good service quality. This study pointed out that there is a significant difference in mean perception towards women empowerment schemes in TNSCTC with regard to their age group and their opinion towards playing dynamic role.

Therefore, TNSTC should integrate different modes of transport according to cost, efficiency and convenience as well as should improve women empower and infrastructure in the transport sector.

11. ACKNOWLEDGMENT

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AUGMENTED DOLPHIN SWARM OPTIMIZATION-BASED SECURED GAUSSIAN AD-HOC ON-DEMAND DISTANCE

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VECTOR (ADSO-SGAODV) ROUTING FOR QUALITY OF SERVICE ENHANCEMENT IN MOBILITY-ENABLED ...

Authors V VEERAKUMARAN, ARUCHAMY RAJINI

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Description Mobility-Enabled Wireless Sensor Networks (ME-WSNs) are a specialized class of wireless sensor networks (WSNs) that incorporate the capability of node mobility. Node mobility in ME-WSNs introduces several advantages but brings new challenges in efficiently routing data packets and allowing intruders to join the network. To address the routing challenges in ME-WSNs and enhance Quality of Service (QoS), an "Augmented Dolphin Swarm Optimization-Based Secured Gaussian Ad-Hoc On-Demand Distance Vector (ADSO-SGAODV)" routing protocol is proposed. ADSO-SGAODV works by efficiently discovering and maintaining routes for data transmission while conserving energy and ensuring secure communication. It employs a hybrid optimization-based approach, combining Gaussian AODV and Dolphin Swarm Optimization (DSO). ADSO-SGAODV utilizes a Support Vector Machine (SVM) to ensure intelligent decision-making in route selection. ADSO-SGAODV selects cluster heads based on fuzzy logic and specific criteria such as energy level and distance to the base station. This feature enhances network scalability and load balancing, ensuring efficient utilization of resources in a dynamic ME-WSN environment. ADSOSGAODV focuses on providing robust security measures to safeguard data during transmission. Secure Communication protocols are implemented to encrypt data, preventing unauthorized access and maintaining data confidentiality. Trust-Based Access Control with Encryption is employed in ADSO-SGAODV to establish trust among nodes and ensure data communication integrity within the network. Through extensive ...

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NOVEL DEEP LEARNING APPROACHES FOR OPINION MINING WITH MACHINE LEARNING

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ABSTRACT:

The popularity of online marketplaces over the past several decades, online vendors and merchants now request feedback from their customers on the goods they have purchased. As a consequence, millions of evaluations are produced every day, which makes it challenging for a potential customer to decide whether to buy the goods or not. For product makers, it is challenging and time-consuming to analyse this massive volume of comments. The challenge of categorizing reviews according to their general semantic content (positive, negative, neutral) is examined. SVM and Nave Bayes, two different supervised machine learning approaches, have been tested on Amazon beauty goods to perform the study. Then, their accuracy levels were contrasted. The outcomes demonstrated that the SVM technique performs better than the Nave Bayes.

KEYWORDS:

INTRODUCTION

online marketplaces over the past several decades, online vendors and merchants now request feedback from their customers on the goods they have purchased. Every day, millions of evaluations are written about various goods, services, and locations online. Due of this, the Internet is now considered to be the most significant source for information about products and services. People frequently shop online at Amazon, one of the biggest e-commerce sites, where they may read hundreds of evaluations left by other consumers about the things they want to buy. These evaluations provide insightful thoughts regarding a product, such as its features, quality, and suggestions, which aids buyers in understanding nearly all of its details. Customers gain from this, but it also benefits merchants who produce their own goods since it makes it easier for them to comprehend customers' wants.

2. SENTIMENT CLASSIFICATION AND ANALYSIS

Sentiment analysis, commonly referred to as opinion mining, is a challenge in natural language processing (NLP), which entails finding and extracting subjective data from text sources. The goal of sentiment classification is to categorise user evaluations that have been published as either positive or negative, so the system does not have to fully comprehend the semantics of each word or document.

Yet, it's not enough to just assign words a good or bad connotation. There are several difficulties present. It is not always effective to categorise words and sentences based on their preceding positive or negative polarity. For instance, the word "amazing" has a positive connotation by itself, but if it is used with a word of negation, such as

"not," the context might radically shift

2.1 SENTIMENT CLASSIFICATION USING MACHINE LEARNING METHODS

By employing example data, machine learning seeks to create an algorithm that will improve the system's performance. There are two primary phases to the sentiment analysis solution that machine learning offers. The model must first "learn" from training data before it can be used to categorise unobserved data in the subsequent stage.

Different categories may be used to classify machine learning algorithms:

Learning that is either supervised, semi-supervised, or unsupervised.

In supervised learning, the algorithm learns from training data in a manner similar to a teacher monitoring their pupils' learning (Brownlee 2016). The supervisor is somehow instructing the algorithm as to what results it should produce. Data for both the required input and output are therefore given. Additionally, the training data must already be labelled.

Unsupervised learning is taught on unlabeled data with no matching output, as opposed to supervised learning. The underlying structure of the data collection should be discovered by the algorithm on its own. This implies that in order to decide the output without having the correct answers, it must find comparable patterns in the data. Clustering is one of the most crucial techniques for unsupervised learning issues. Semi-supervised learning, which combines the advantages of supervised and

Book Supporting Documents



Aruchamy Rajini

Artificial Intelligence

Authors Mr. V. Veerakumaran Dr. Aruchamy Rajini

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A STUDY ON UVA AND UVB FILTERS WITH RELATED TO DERMATOLOGY RECOMMENDATIONS FOR EFFECTIVE GROWTH OF HUMAN LIFE

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Abstract

Skin cancer remains the most common cancer affecting States population, estimating at least 9,500 cases diagnosed per day. The National Cancer Institute predicts that approximately 99,780 new cases of melanoma will be diagnosed in 2023. Exposure of ultra violet radiation (UVR) to the skin is a major preventable risk factor. UVR, composed of UVA (320-400nm) and UVB (280-320nm) radiation, has damaging acute and chronic effects on the skin barrier, detrimentally associated with 90% of non-melanoma skin cancers (NMSCs) and 65% of malignant melanomas. With increasing incidences for all types of skin cancer, decreasing exposure to UVR, in the form of sunscreen application and photo protective clothing, is essential for protecting against potential skin cancer development

Keywords: Ultra-violet rays, Cosmetic Ingredient, Sunscreen, Photo-reactive, Dermatitis

Introduction

Sunscreens are a constantly evolving component of the dermatologist's therapeutic armamentarium. This article attempts to compile some of the important aspects of sunscreens, including their classification, various indices related to photo protection, and some of the debatable issues related to sunscreens in general. The focus is on material which is current, while at the same time being relevant for the postgraduate. The primary use of sunscreens is to protect the skin from the short-term and long-term effects of ultraviolet radiation. In today's scenario of procedure-centered dermatology, sunscreens have become an indispensable part of every patient's post-procedure skin care routine.

Spectrum of UV radiation

The biologically active components of ultraviolet (UV) radiation include UVA and UVB radiation. The primary targets of UV radiation in the skin and their corresponding effects are given below

UVB (290-320 nm)

- Responsible for the most severe damage
- Direct impact on cell DNA and proteins
- Acute damage - sunburn
- Long-term damage - cancer

UVA (320-400 nm)

- Not directly absorbed by biological targets
- Penetrates deeper than UVB
- Affects connective tissue by producing reactive oxygen species; produces profound immune suppression
- Responsible for tanning, photo aging, photo carcinogenesis, exogenous photosensitization and many idiopathic photo dermatoses (including polymorphous light eruption)

Sea-level solar UV radiation is approximately 95-98% UVA and 2-5% UVB. UVC is completely absorbed by stratospheric ozone that also attenuates UVB. A given solar UVR spectrum varies with the solar zenith angle (the angle between an imaginary perpendicular line and a line from its base to the sun), which is dependent on time of day, season, and latitude. The highest UVB content is found when the sun is directly overhead with the shortest path (e.g., noon, at the equator, at high altitude).

Classification of Sunscreens

The last FDA sunscreen monograph was issued in 1999, with a list of 16 approved sunscreen agents. It recommends that sunscreens be classified as organic and inorganic, replacing the previously used terms "chemical" and "physical", respectively. There are three commonly used nomenclatures for

sunscreens in the world. These are the International Nomenclature Cosmetic Ingredient (INCI) name, US adopted name (USAN), and trade name. Taking avobenzone (USAN) as an example, the INCI name for avobenzone is butyl methoxydibenzoyl methane, while Parsol 1789 is one of its many trade names.

A. Organic Sunscreens

Organic UV filters are active ingredients that absorb UV radiation within a particular range of wavelengths, depending on their chemical structure. Once the UV filter absorbs energy, it moves from a low-energy ground state to a high-energy excited state. From this excited state, any of the following three processes may occur, depending on the ability of the filter to process the energy it has absorbed:

1. Photostable filter: This type of filter dissipates its absorbed energy to the environment as heat energy, and returns to the ground state. It is subsequently fully capable of absorbing UV energy again.
2. Photounstable filter: The filter undergoes a change in its chemical structure, or is degraded after absorbing UV energy. It is not capable of absorbing UV energy again.
3. Photoreactive filter: In its excited state, the filter interacts with surrounding molecules, including other ingredients of the sunscreen, oxygen, and skin proteins and lipids. This leads to the production of reactive species, which may have unwanted biological effects.

Organic sunscreens are further divided into UVB and UVA filters:

UVB filters

1. PABA derivatives - Padimate O
2. Cinnamates - Octinoxate, Cinoxate
3. Salicylates - Octisalate, Homosalate, Trolamine salicylate
4. Octocrylene
5. Ensulizole

UVA filters

1. Benzophenones (UVB and UVA2 absorbers) - Oxybenzone, Sulisobenzene, Dioxybenzone
2. Avobenzone or Parsol 1789 (UVA1 absorber)
3. Meradimate (UVA2 absorber)

Although avobenzone is the only sunscreen agent that has its absorption peak in the UVA1 spectrum (357 nm), making it a very effective UVA filter, it has the disadvantage of being photounstable. This is overcome, to some extent, by adding agents that photostabilize avobenzone, to the final sunscreen product. These agents include other UVA filters such as oxybenzone, UVB filters such as enzacamene (not yet FDA approved), salicylates, octocrylene, broad spectrum filters such as bemotrizinol (not yet FDA approved), and inorganic filters such as titanium dioxide and zinc oxide.

Newer generation broad spectrum (UVA + UVB) filters - Ecamsule (Mexoryl SX), Silatriazole (Mexoryl XL), Bemotrizinol (Tinosorb S), Bisotrizole (Tinosorb M)

Ecamsule is primarily a UVA filter, the patent for which is held by L'Oréal (sunscreens containing ecamsule are exclusive to L'Oréal and its brands). Tinosorb M is the first of a new class of UV filters that combine the properties of both UV conventional filters (organic and inorganic) - it scatters, reflects and absorbs UV light. Apart from Ecamsule, these filters are not yet US FDA approved, but are being used in other countries, such as the European Union and Canada.

B. Inorganic Sunscreens

1. Zinc oxide
2. Titanium dioxide
3. Others - iron oxide, red veterinary petrolatum, kaolin, calamine, ichthammol, talc

Inorganic agents function by reflecting, scattering or absorbing UV radiation. Their opaque nature and "whitening effect" are an inherent disadvantage, which may be minimized by the use of micronized or ultrafine particles.

Systemic Photoprotective Agents

In addition, there are several compounds that have a systemic photoprotective effect; these are sometimes referred to as "systemic sunscreens."

β -carotene, antimalarials, ascorbic acid, α -tocopherols (i.e., vitamins A, C, and E), retinol, selenium, green tea polyphenols, PABA, antihistamines, aspirin, indomethacin, corticosteroids.

1. Sunscreen-Related Indices:

Practicing dermatologists often encounter patients complaining of worsening pigmentation or recurrent polymorphous light eruption in spite of using sunscreens with "good sun protection factor (SPF)" or "SPF >50". It is important for both dermatologists and the public to be aware that a good SPF value will not protect the skin from the entire UV spectrum. In fact, in 2007, the FDA has proposed that the expansion of SPF be changed to "sunburn protection factor" to indicate that it is only an index of protection against sunburn or UVB-induced erythema, and hence does not necessarily imply UVA or broad spectrum protection.

2. UVA protection indices

a. Japanese standard (persistent pigment darkening; in vivo method):

UVA dose that induces persistent pigment
darkening 2 to 24 hrs after exposure in
sunscreen protected skin

UVA dose that induces persistent pigment
darkening 2 to 24 hrs after exposure in
unprotected skin

b. Australian/New Zealand Standard (in vitro method):

8- μ m layer of the product should not transmit more than 10% of radiation of 320 to 360 nm
OR

20- μ m layer of the product should not transmit more than 1% of radiation of 320 to 360 nm

c. European Union guidelines:

UVA protection factor (persistent pigment darkening method) = $1/3$ of SPF and Critical wavelength = 370 nm

d. Boots star rating system (used in the United Kingdom): *In vitro* measurement of the ratio of a product's UVA (320-400 nm) absorbance over its UVB (290-320 nm) absorbance is used to calculate its Boots star rating [Table - 2]. Products with better UVA absorbance have a higher Boots star rating.

3. Immune protection factor (IPF): ability of sunscreen products to prevent UV-induced immunosuppression. IPF is assessed by complex methods such as the ability of a sunscreen to inhibit either the sensitization or elicitation arm of contact or delayed-type hypersensitivity reactions to allergens such as dinitrochlorobenzene (DNCB) and nickel, respectively. IPF is considered to correlate better with the UVA-protectiveness of a sunscreen than with its SPF.

UV protection factor (UPF) = the ratio of average effective UV radiation irradiance transmitted and calculated through air to the average effective UV radiation irradiance transmitted and calculated through fabric (indicates how much longer a person can stay in the sun when fabric covers the skin, erythema being the end-point).

Grading of UPF:

- good protection (UPF 15 to 24)
- very good protection (UPF 25 to 39)
- excellent protection (UPF 40 to 50+)
- Fabric SPF is similar to SPF, except that fabric is used to protect the skin while testing, instead of a sunscreen. [11]

5. Sunglass standards

- Luminous transmittance = Amount of light transmitted through a sunglass lens (e.g. a lens with 20% luminous transmittance allows 20% of the light to pass through it)
- The Australian Standard (AS/NZS 1067:2003) classifies sunglasses and fashion spectacles based on the amount of UV radiation that passes through the lenses:

Categories of lenses: 0 to 4

0. Fashion spectacles (luminous transmittance 80-100%): providing some protection from UV radiation but no reduction in sunglare.

1. Fashion spectacles: providing protection from UV radiation and limited reduction of sunglare - not suitable for driving at night.

2. Sunglasses for general use: providing good protection from UV radiation and sunglare.

3. Sunglasses providing extra protection from UV radiation and sunglare.

4. Sunglasses providing a high level of protection from UV radiation and sunglare (luminous transmittance 3-8%) - must not be used when driving.

- UVB transmittance: 5 percent of luminous transmittance (e.g., for lenses with luminous transmittance of 20 percent, 99 percent of UVB should be blocked out).

- UVA transmittance: lens categories 0 to 2: luminous transmittance, lens categories 3 and 4: 50% of luminous transmittance.

- Minimum vertical diameter for adult sunglasses = 28 mm

- Minimum vertical diameter for child sunglasses = 24 mm

Some sunglasses may also be labeled with an eye protection factor (EPF) number, developed by the Australian Radiation Protection and Nuclear Safety Authority (ARPANSA) ranging from 1 to 10. Sunglasses labeled EPF of 9 or 10 transmit very little UV radiation. Other sunglasses may be labeled UV 400 (blocking 100% of UV) or state the amount of UV radiation blocked as a percentage such as 99.9% or 100%.

The only way to assess the protection of sunglasses is to have the lenses measured, either by the manufacturer or by a properly equipped optician. Dark lenses do not automatically filter out more harmful UV radiation and blue light as compared to light lenses. Inadequate dark lenses are even more harmful than inadequate light lenses (or wearing no sunglasses at all) because they provoke the pupil to open wider. As result, more unfiltered radiation enters the eye. The only "visible" quality test for sunglasses is their fit. For the best protection, one must use wraparound, close fitting, large-lens sunglasses that help to reduce reflected UV radiation and glare that can pass around the edge of the sunglasses and reach the eyes.

Sunscreen-Related Definitions

Critical wavelength: The wavelength below which 90% of the sunscreen's UV absorbency occurs

Broad spectrum sunscreen: Critical wavelength > 370 nm AND UVA protection factor > 4

Water-resistant sunscreen: Maintains the label SPF value after two sequential immersions in water for 20 min (40 min)

Very water-resistant sunscreen: Maintains the label SPF value after four sequential immersions in water for 20 min (80 min)

In the United States, a product that has been shown to be water-resistant or very water-resistant, can also be labeled as "sweat resistant."

Recommendations for Sunscreen Application

Sunscreen should be applied properly to all sun exposed areas (in a concentration of 2 mg/cm^2), and allowed to dry completely before sun exposure. It should be reapplied every 2 hours, and after swimming, vigorous activity, excessive perspiration, or toweling.

Debatable Issues

1. Sunscreen use in infants

Although not known to be hazardous, the use of sunscreens is not recommended for infants younger than 6 months.

2. Contact dermatitis

The most common cause of contact dermatitis (photoallergy) among sunscreens is oxybenzone.

3. Nanosized particles

Nanosized particles range in size from 1-100 nm. Microfine forms of zinc oxide and titanium dioxide have a particle size of 20-50 nm. Nanotechnology makes inorganic sunscreens more cosmetically acceptable (less whitening of skin after application). In recent years, there have been concerns that

nanoparticles can induce free radical formation in the presence of UV radiation. However, studies show that these particles remain on the surface of the skin or in the stratum corneum, and are hence safe for human use.

4. Vitamin D production

UVB radiation is responsible for more than 90% of vitamin D production in the skin. It is said that a few minutes exposure of the face, arms, and hands to noonday summer sunlight two or three times a week is sufficient for vitamin D synthesis. [14] There have been concerns that widespread use of sunscreens, particularly those with high SPF, may lead to a significant decrease in vitamin D production. However, there is evidence that though sunscreens can significantly reduce the production of vitamin D under very strictly controlled conditions, their normal usage does not generally result in vitamin D insufficiency. [15] In fact, vitamin D and calcium levels have been found to be relatively normal in xeroderma pigmentosum patients, in spite of strict photo protection.

5. Hormonal effects

Some sunscreens (oxybenzone, avobenzone, octinoxate, padimate O) have been tested for their estrogenic/anti-androgenic properties in animal studies. [4] However, the endocrine effects of these agents remain controversial, warranting further human studies.

New Sunscreen Technologies

Sun Spheres

SunSpheres are styrene/acrylate copolymers that do not absorb UV irradiation but enhance the effectiveness of the active sunscreen ingredients. The SunSphere polymer beads are filled with water, which migrates out of the particle, leaving behind tiny air-filled spheres, which have a lower refractive index (1.0) than the dried sunscreen film (1.4-1.5). As a result, scattering of UV radiation occurs, increasing the probability of contact with the active UV filters in the sunscreen. SunSpheres are also available in a powder form, and can boost SPF by 50 -70% making it possible to reduce the concentration of active ingredients.

Microencapsulation

Active sunscreen ingredients are entrapped within a silica shell, as a result of which, allergic or irritant reactions to the active ingredient can be minimized, and incompatible sunscreen ingredients can be safely combined, without loss of efficacy.

Conclusion

Use of photo protection to block UVR is essential for decreasing the risk of chronic damage to the skin and serving as prevention for developing NMSC and some melanomas. Consumers should rely on the AAD website and follow current recommendations for how to choose appropriate sunscreens. Many products sold at major retailers, like Walmart and Walgreens, meet all recommendations for effective sunscreen, while both beauty retailers, Ulta and Sephora, have significantly less products that have all three components. Most products available in the drug store and beauty market do provide sun screen with water resistance. Understanding sunscreen labels may provide clarification on ambiguous terminology located on these labels and improve consumer education about choosing the appropriate sunscreen recommended by expert dermatologists.

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EFFECTIVE DEEP LEARNING ARCHITECTURES TO IMPROVE AGRICULTURAL PRODUCTION QUALITY

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Abstract: Agriculture, a powerful word that requires no definition, contributes the most profitable share of the Indian Economy. On a wider view, intensifying productivity requires very basic things like improving the quality and quantity of the productivity and dwindling the agricultural expenses. There are certain cases that affect productivity, among which the presence of weeds and pests in crop fields stands top. Traditional methods, such as manual removal of weeds and spraying of agrochemical products like herbicides, and pesticides have chances of harming the crops and also add to the expenses. Selective treatment against weeds and pests is a cost-effective method that reduces manpower and usage of the agrochemical, at the same time it requires an effective computer vision system to identify issues and should be smaller in size to run in the resource-constrained device. Machine learning-based activities for identifying weed portions and pest detections are tedious and time-consuming processes. This research work presents a method of effective segmentation in the agricultural field, to accomplish this; a convolution neural network is proposed named Reduced Residual U-Net Convolution (RRUNC) network. It is an encoder-decoder based architecture. This network employs semantic process to analyse the crop field images pixel-wise. In order to reduce the parameter size, the deep convolution technique is used which curtails the number of parameters generated by the model with a very negligible in the accuracy. The experimental findings show that the proposed deep learning-based RRUNC model outperformed well in terms of segmentation results with good accuracy and less error-rate.

Key words: Agriculture, Convolution, Pest, Residual, Weeds.

I. INTRODUCTION

The agricultural sector plays a crucial role in the economy and is considered to be one of the cornerstones of the economy of developing countries, especially India. Because food and raw materials are not the only things that agriculture provides: it also gives employment for a huge number of the population in India. According to the Indian Agriculture and Allied Industry report published in November 2021, about 58% of India's population relies on agriculture as its primary source of income. A total of 17.8% of India's Gross Value Added (GVA) in FY20 came from agriculture and related sectors. Globally, India is ranked fifth in terms of production, consumption, export, and expected growth.

Traditional agricultural activities spend a lot of time and expenditure on their agricultural work due to the lack of use of technological advancements. To preserve their production from weeds, farmers utilized physical weeding and spraying of herbicides in the past. Manual weed removal increases expenditures and takes more time and effort, thus increasing labour costs. While spraying herbicides over agricultural land may spoil the soil, it also has the potential to turn plants deadly, posing a risk to human health. Farmers are losing interest in their agricultural labour as a result of this, and are leaving the industry. To address these difficulties and boost production with existing agricultural land, agricultural activities should utilize modern research and technology development. This research focuses on finding a more efficient strategy to deal with weeds and pests.

Weeds are the most important biotic constraint impacting agricultural production. Weeds are invasive plants. The presence of weeds in a crop field impairs the yield, quantity, and quality. It degrades the crop yield invisibly. The weeds absorb all the nutrients required by the crops from the

soil, water, and fertilizer. In the absence of adequate nutrients, crops may become of poor quality and hence susceptible to crop diseases. Weeds are not susceptible to pests and diseases since these are normally controlled by their natural habits. As a result, it quickly spreads across a wide area taking up more space on agricultural land which decreases crop yields.

Pests are another major threat to agriculture productivity. Pests infest agriculture fields, causing a variety of diseases and wreaking havoc on plants. The presence of pests in agricultural land prevents farmers from getting good yields from their harvests. Consequently, identifying pests earlier in their life cycle is an essential and profitable practice for farmers, as they can avoid most of the crop diseases that affect their crops. But in reality, it is difficult to identify these diseases at an early stage.

For pest identification, they rely on visual assessments done by the agronomist force (Yadav et al. 2021). Identifying the right agronomists at right time is not practically possible. Most pest diseases have identical characteristics, making it difficult to identify correctly even for experienced farmers. As a result, it may lead to inadequate treatment, which is equally damaging to plants. Pest can be controlled a little easier in earlier stages rather than in posterior stages. But, many pests in their early stages are worm-like, and so it's more difficult to classify them. Some of the sample pest images of earlier and later stage are shown in Figure 1. Therefore, farmers might fail to take the right action at the earliest stage, and before implementing the necessary measures the pest may spread to half of the field. Utilizing current technology and automating a few of their activities could allow them to overcome these challenges, like weed detection, and pest detection that cannot be solved using traditional methods.

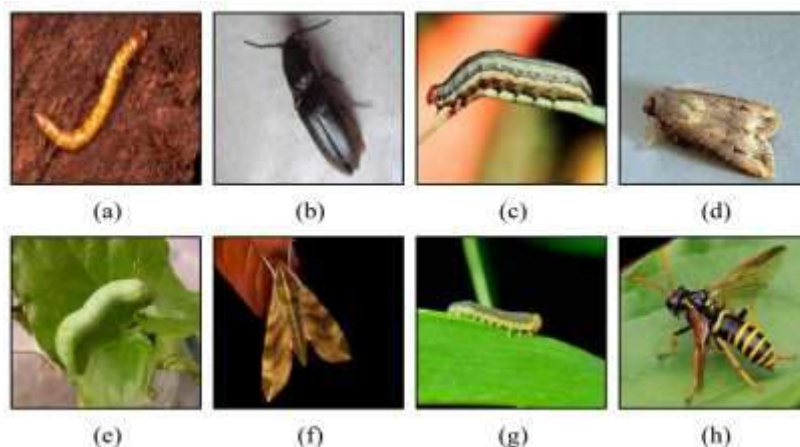


Figure 1. Some of the sample images of pests that are in worm type in its earlier stage. a) Wireworm – earlier stage, b) Wireworm – later stage, c) Armyworm – earlier stage, d) Armyworm – later stage, e) Ampelophaga – earlier stage, f) Ampelophaga – later stage, g) Wheat sawfly – earlier stage, h) Wheat sawfly – later stage

II. LITERATURE SURVEY

This section provides an overview of the contributions of computer vision applications to agricultural activities against weeds and pests. In the real world, especially in the agriculture field, a deep learning model that is both computationally and accurately efficient is required. The majority of research work in the deep learning field is concerned with developing new deep learning architecture to improve efficiency, while a few studies look at parameter and model size reduction.

Simonyan & Zisserman (2014) proposed a way of constructing a deep learning model. A constant and small-sized kernel 3x3 is used in all the convolution layers of their proposed CNN model, where the depth of this model was 16 -19 convolution layers. Here, each layer is equipped with ReLU activation and Batch Normalization function. As we descended deeper into the model, the number of filters doubled, such as 64, 128, 256, and 512.

For autonomous driving car applications, Badrinarayanan et al. (2017) presented an encoder-decoder based SegNet architecture. Here, the proposed model was organized in such a way that every block/layer in the encoder has a corresponding block/layer on the decoder side. In this work, the usage of pixel-wise labeling to segment road scene objects like vehicles, buildings, pedestrian trees, and other objects for smooth driving of a car, is considered. Both encoder and decoder have 13 convolution layers on each side. Yasrab et al. (2017) proposed a CNN for Semantic Segmentation for driver Assistance system (CSSA), which employed a semantic segmentation technique. The structure of the CSSA architecture is based on SegNet architecture along with the dropout layer. The model size of CSSA was ~30 MB and Class Average Accuracy achieved (CAA) was 60.2%.

The U-net architecture, which is an encoder-decoder type model, was proposed by Ronneberger et al. (2015). A contracting path and a symmetric expanding path are the two major components of this model. The significance of the proposed work lies in combining the contracting path with expanding path by creating a concatenation path that integrates the feature map generated in the contracting path with the expanding path. Since this model used the unpadded convolution, there is a possibility of losing corner features.

For segmenting the head-shoulder section of pedestrians, Xie et al. (2019) used a modified version of the UNet architecture. Because it used a large number of filters in the convolution layers of its design, it created a significant number of parameters. Augustaukas and Lipnickas (2019) proposed a pixel-wise road pavement defect detection method. The underlying model structure was based on the U-Net architecture and the convolution layers in this model were using padded convolution operations. This was used to detect the pixel-level cracks in the road which helped in the maintenance and monitoring of roads.

Naqvi et al. (2020) introduced the OcularNet model for accurately detecting ocular areas like the iris and sclera. The suggested OcularNet model was a SegNet architecture with lite-residual encoders and decoders. The key functionality of this work was using the residual skip-connection between the convolution layers of the SegNet model. It helps to transfer the high-frequency information among the convolution layers, which were used to attain precise ocular regions segmentation with the true boundary of ocular regions.

The DenseNet model was developed by Huang et al. (2017), in which each layer is connected to every other layer in the model using the concatenation operation in a feed-forward way. As a result of this, feature maps generated by all the preceding layers could be given as to a layer and its own feature map was used as input to its subsequent layers. Hence the vanishing gradient problem was reduced, and feature maps were better utilized with dense connectivity.

For efficient object identification, Tan et al. (2020) developed EfficientDet, a one-stage object detector that used a weighted bidirectional feature network and a tailored compound scaling algorithm. The proposed EfficientDet model was delivered as different variants, such as EfficientDet D0 to D7. All these variants were evaluated with the COCO dataset and achieved better accuracy with fewer parameters.

Yankun et al. (2021) introduced the Large Motion Trend fusion (LMT-CH) vehicle tracking algorithm, which was based on the big motion trend coupled with the colour histogram. The EfficientDet model was employed as the underlying model in this vehicle tracking algorithm, which increased the accuracy of the real-time applications. The approach's shortcomings were that accuracy might be marginally reduced if vehicles suffered significant changes during the drive.

The motivation behind the work proposed by Chen et al. (2021) was guiding model selection for the critical task of Vehicle and pedestrian detection in autonomous driving applications. In this work, the authors analyzed several object detection models, including Faster R-CNN, R-FCN, and SSD, along with several typical feature extractors, such as ResNet50, ResNet101, MobileNet_V1, MobileNet_V2, Inception_V2, and Inception_ResNet_V2. Further, all the above models were pre-trained with the COCO dataset for improving their performance. Later, various experiments were conducted on these pre-trained models using the benchmark KITTI dataset. Finally, the authors demonstrated that Faster R-CNN ResNet50 obtained the highest AP and SSD MobileNet_V2 was the fastest model.

A CNN architecture without anchors was built by Liu et al. in 2020. He also made a frame-by-frame technique incorporating a lightweight stacked hourglass network to predict the heatmap at the center point of a surgical tool for real-time surgical tool detection during robot-assisted surgery. On the VisDrone2019 dataset, Pailla et al. (2019) employed CenterNet with the HourGlass-104 backbone network for real-time object detection, outperforming other significant object detection models.

Chen et al. (2019) suggested a separable convolution-based CNN model with greater parameter efficiency to adaptively extract forensics-related features from picture patches. To achieve parameter efficiency, the suggested model uses a separable convolution technique rather than the traditional convolution technique. The proposed model was used with a smaller size image like 32×32 .

This section also discussed various existing research work carried out on the process of detecting weeds, and pests in the agricultural field, which includes both machine learning, and deep learningbased approaches. Machine Learning-based approaches struggle hard to produce better results because of their manual feature extraction process. Deep Learning-based approaches simplified the feature extraction process that helps to improve the model's performance. As a result of this, efficient deep learning models were developed to aid in the improvement of Smart farming performance in terms of crop-weed segmentation, and pest detection in agricultural activities.

III. MATERIALS & METHODS

To build a computer vision application for segmenting pest and weed portions in the agricultural field images, an encoder-decoder based on the deep learning model is built and trained using a large number of images and their corresponding target label images. In these images, the pixels can be categorized into three classes: background, pests, and weeds. Accurate pest-weed section segmentation is made feasible by identifying every pixel in the image rather than just one whole image (Long et al. 2015). Later, this trained model can be utilized to segment pest-weed portions from the unseen images. This work proposes a pest weed segmentation model based on Unet (Xie et al. 2018), DeepUnet (Li et al. 2018), and Residual Blocks (Naqvi et al. 2020), where the strength of residual and skip connections is incorporated into the encoder-decoder model.

The primary objective of the proposed approach is to build an effective computer vision system using a deep learning model to facilitate pixel-wise labeling in-order to classify the crops and weeds accurately in the agricultural land. This can be used to aid robotics to do selective spraying and mechanical weed removal. The proposed model is effective in every way, including obtaining a high segmentation accuracy, being less computationally complex, reduction in the size of the model, and having a lower error rate. The system framework of the proposed work is shown in Figure 2.

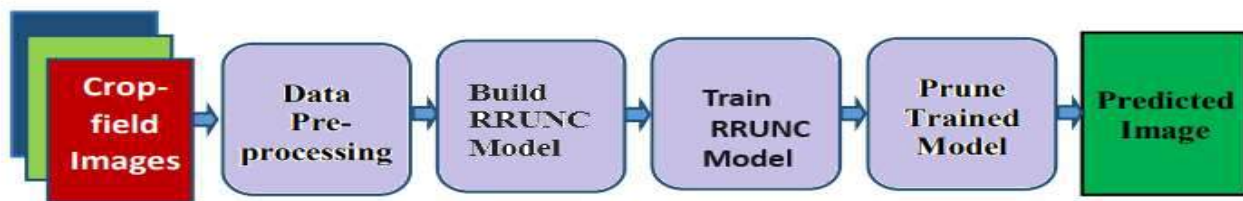


Figure 2. The system framework of the proposed crop-weed

3.1 Data Pre-processing

The dataset used here is the benchmark dataset, Crop/Weed Field Image Dataset (CWFID) proposed in the work (Haug&Ostermann 2014). This dataset contains 60 RGB images with their corresponding annotated label images. The annotation process of the CWFID dataset was done by the experts (Haug&Ostermann 2014). The portions of the actual crop field images are categorized into three classes, namely crop, weed, and background. In the label images, the crop field portions are shaded with different colours such as red, yellow, and black for the crop, weed, and background portions, respectively.

Dataset is fuel for building a deep learning model for any application. The success of building an efficient deep learning model requires a large number of images to train the model otherwise model is prone to overfit. An effective way to address this issue is data augmentation. Data augmentation is used to create new transformed images from existing original images available in the dataset. With this, a larger dataset can be created from the existing smaller dataset. This helps to upgrade the ability of the model to generalize and improve its performance since it creates more variance in training images.

Initially, the existing 60 RGB images and annotated images are divided into a 5:1 ratio for the training and testing process. At this rate, both the actual crop-field and label images are applied for various augmentation operations like rotation, horizontal flipping, vertical flipping, height shifting, width shifting, zooming, and shearing. In order to create a valid pair of actual and label images during the augmentation process, these augmentation operations must be applied in the same order on both, the actual field images and the label images. This is an extremely crucial task when augmenting the training images of encoder-decoder based segmentation model. The effect of each augmentation operations on a sample actual and label image, with this augmentation process, a new dataset containing 750 training images and 100 testing images is created, and every image is resized to $224 \times 224 \times 3$.

3.2 Proposed Model Architecture

To achieve the precise crop-weed segmentation, a model called Reduced Residual U-Net Convolution (RRUNC) is proposed in this work, which is an Encoder-Decoder based U-Net architecture (Ronneberger et al. 2015) where depth-wise separable convolution is used as core convolution operation. It contains two major sections, namely the contracting path and expanding path. This architecture has 19 convolution layers in total, which is fewer than some of the top architectures, including VGG19 (Simonyan & Zisserman 2014), SegNet (Badrinarayanan et al. 2017), and Deep UNet (Li et al. 2018). The structure of the proposed RRUNC architecture is illustrated in Figure 3.

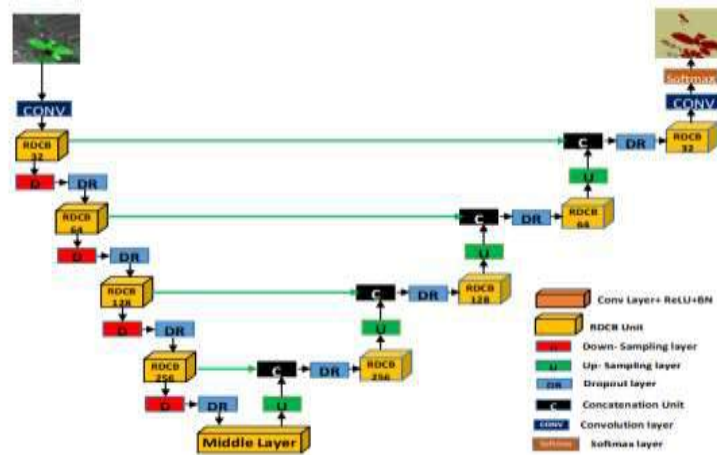


Figure 3. The Structure of proposed Reduced Residual U-Net Using Convolution (RRUNC) Model Architecture

In the proposed RRUNC, a Residual Deep Convolution Block (R-DCB) is introduced. Among the 19 convolution layers, 16 convolution layers are organized as 8 R-DCB units (in which 4 units are located in the contracting path; 4 units are located in the expanding path), one-layer acts as the middle layer, and two layers are used to input and output the image. Additionally, a down-sampling layer and a dropout layer are added in the contracting path following each R-DCB unit, and an up-sampling layer is added corresponding to the down-sampling layer in the expanding path. Going deeper into the contracting path, the number of filters used in the R-DCB unit is increased as 32, 64, 128, and 256 which is lesser than the number of filters used in the modified U-Net network (Xie et al. 2018), and the reversed order is used in expanding path. The middle layer contains 512 numbers of filters.

Here, the output of each R-DCB unit in the contracting path is integrated with the same level of R-DCB unit in the expanding path using a concatenation path via the concatenation unit. The output of each contracting path R-DCB unit is combined with the feature map from the appropriate up-sampling layer using the concatenation path and concatenation unit, which is then fed into the R-DCB unit. Hence, the location information from the contractive path is integrated with contextual information in the expanding path to form generalized information that helps to obtain excellent segmentation accuracy.

3.3 Residual Deep Convolution Block (R-DCB)

The structure of the R-DCB unit is shown in Figure 4. Each unit contains two convolution layers and one residual connection. Each convolution layer is followed by the ReLU activation layer and Batch Normalization (BN) layer to increase the segmentation accuracy and its outputs are represented by y_1 and y_2 . Assume x , y are the input and output of an R-DCB unit, the ReLU activation function and Batch Normalization are represented by σ , the convolution operation is represented by M_{ci} and the function of the RDCB unit is represented by $MR\text{-}DCB(x)$ respectively. The mathematical form of y_1 and y_2 are mentioned in Equations (3.1) and (3.2) respectively.

$$y_1 = \sigma (M_{c1} (x)) \quad (3.1)$$

$$y_2 = \sigma (M_{c2} (y_1)) \quad (3.2)$$

$$= \sigma (M_{c2} (\sigma (M_{c1} (x)))) \quad (3.3)$$

The residual connection layer adds both outputs y_1 and y_2 and then it is fed into ReLU activation layer and BN layer whose output is represented in the Equation (3.4).

$$y = MRDCB(x) = \sigma (y_1 + y_2) = \sigma (\sigma (M_{c1} (x)) + \sigma(M_{c2} (\sigma (M_{c1} (x))))) \quad (3.4)$$

The residual connection path in the RDCB unit facilitates local residual learning to improve the information flow among the architecture blocks. It will improve the representation capacity of the model and will curtail the error rate of the segmentation with the smaller dataset. So, the corner features of the crops and weeds can be predicted accurately.

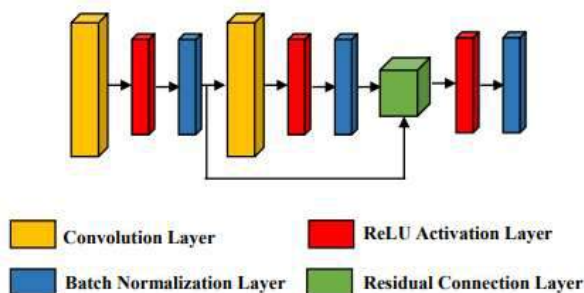


Figure 4. The Structure of Residual Deep distinguishable Convolution Block (RDCB) Unit

3.4 Pruning the Model

Usually, the machine/deep learning model is the core component of computer vision applications. Since the target environment (agricultural land) includes resource-constrained devices, building a real-time computer vision application to aid farmers requires a smaller size model. Although larger deep learning models may perform better in a lab environment, they are more difficult to implement in devices with limited resources. Even though it has been deployed, it fails to give better results. For this, the proposed deep learning model has been compressed using filter pruning.

After building the final model, the model will undergo a training process till achieving better validation accuracy and test accuracy. Subsequently, the model will be exposed to the pruning process to reduce the size of the model (Gaikwad & El-Sharkawy 2018, Mao et al. 2019). During the pruning process, the redundant and insignificant connections and their corresponding lowest magnitude weights are iteratively eliminated. So, the connection between the channels will become sparse. This pruning process achieves significant size reduction in the final model and it can be delivered by less than ~3MB in size without significant recession in performance.

IV. EXPERIMENTAL ENVIRONMENT DESIGN

The design of the experimental environment for implementing the proposed model and the evaluation metrics used to measure the performance of the proposed model are discussed here.

4.1 Experimental Setup

All the models utilized in this work are based on Tensor Flow and Keras framework. These models have been experimented on the online Google Colab platform which provides NVIDIA TeslaT4 GPU with CUDA Version 11.2, RAM of 13 GB, and Disk Space of 68 GB. Google Colab is a Google product that allows python code to be run on a cloud environment via a web browser, and hence there is no hardware restriction for it. Simple computers with an internet connection are capable of running it.

The proposed network is trained from the scratch using a dataset of 750 RGB images and its equivalent annotated images or labelled images; each image is a size of $224 \times 224 \times 3$. For tracking the performance of the model during training epochs, the training dataset is split into training and validation datasets using the cross-validation method. Since the $\text{validation_split} = 0.2$ is used here, 20% of the images from the training dataset are brought into the validation set. Hence, 600 images are used for the training process and 150 images are used for the validation process in every epoch. When cross-validation is used, images from training and validation datasets are shuffled between them on each training epoch. Hence, all the images in both the training and validation dataset are

utilized for training the model. Even though the training and validation split reduces the training samples, it will not degrade the model performance because of the cross-validation method.

Later, for testing the trained model, a separate test data set is built using a holdout method, which contains 100 crop field images and their equivalent label images. The holdout method for training and testing split was chosen because it helps to evaluate the model's ability in segmenting the weed and pest portions on unseen images.

The proposed model is trained with 80 training epochs with the batch size as 5 images per batch and each epoch contains 120 steps. The loss function used here is categorical_cross_entropy. Since, it has three classes which are crop, weed, and soil, this loss function is quite suitable. This measures the cross-entropy loss between the label and prediction. For this, labelled images are transformed into one-hot representations for facilitating the comparison between prediction and labels. During the training, the loss between the prediction and labels is optimized utilizing an ADAM optimizer with a learning rate of 0.001. It is a stochastic gradient descent method that depends on the adaptive estimation of first-order and second-order moments.

After pruning the model, two more training epochs were implemented for fine-tuning the model. The other significant deep learning architecture like SegNet (Badrinarayanan et al. 2017), U-Net (Xie et al.2018), and Residual U-Net (Yang et al. 2019) are implemented and their architecture configuration details are given in Figure 5. These architectures are trained with the same augmented CWFID dataset in the same experimental setup and the performance is evaluated for comparison.

Layer	Kernel Size	No of Layers	No of Filters	Output Shape
Conv_IP	3×3	1	64	224×224×64
Conv_1C	3×3	2	64	224×224×64
R_ConC1	-	-	-	224×224×64
Down_sampl	2×2	1	-	112×112×64
Conv_2C	3×3	2	128	112×112×128
R_ConC2	-	-	-	112×112×128
Down_sampl	2×2	1	-	56×56×128
Conv_3C	3×3	2	256	56×56×256
R_ConC3	-	-	-	56×56×256
Down_sampl	2×2	1	-	28×28×256
Conv_4C	3×3	1	512	28×28×512
R_ConC4	-	-	-	28×28×512
Down_sampl	2×2	1	-	14×14×512
Conv_Mid	3×3	1	512	14×14×512
Up_sampl	2×2	1	-	28×28×512
Concat_1	-	-	-	28×28×1024
Conv_1E	3×3	1	512	28×28×512
R_ConE1	-	-	-	28×28×512
Up_samp2	2×2	1	-	56×56×512
Concat_2	-	-	-	56×56×768
Conv_2E	3×3	2	256	56×56×256
R_ConE2	-	-	-	56×56×256
Up_samp3	2×2	1	-	112×112×256
Concat_3	-	-	-	112×112×384
Conv_3E	3×3	2	128	112×112×128
R_ConE3	-	-	-	112×112×128
Up_samp4	2×2	1	-	224×224×128
Concat_4	-	-	-	224×224×192
Conv_4E	3×3	2	64	224×224×64
R_ConE4	-	-	-	224×224×64
Conv_OUT	3×3	1	3	224×224×3
Softmax	-	-	1	224×224×3

Figure 5. The configuration of Residual U-Net architecture

4.2 Evaluation Metrics

In this work, six metrics are used to evaluate the performance of the model, which are

- Accuracy (A),
- Error-rate (E),
- Overall Precision (OP),
- Overall Recall (OR),
- Overall F1 score (OF),
- Number of Parameters (NoP)

Accuracy (A) states that the percent of the pixels in the prediction image is predicted correctly. Error-rate (E) is expressed as the rate of pixels in the prediction image is predicted wrongly, when compared to label images. Overall Precision (OP) is expressed as the ratio of correctly predicted positive observations to all predicted positive observations. Over Recall (OR) is the ratio between the number of correctly predicted positive observations and the total number of observations in the actual class. Overall F1 score is a metric that considers both OP and OR and it is a harmonic mean of OP and OR.

The mathematical forms of the above metrics are mentioned in Equations 4.5 to 4.9, respectively. The Number of Parameters (NoP) generated by the model is a total number of the learnable elements of all the convolution layers in CNN for deep convolution respectively.

$$\text{Accuracy (A)} = (\text{OTP} + \text{OTN}) / (\text{OTP} + \text{OTN} + \text{OFP} + \text{OFN}) \quad (4.5)$$

$$\text{Error-rate (E)} = -Y_j * \log(P_j) \quad (4.6)$$

$$\text{Overall Precision (OP)} = \text{OTP} / (\text{OT P} + \text{OFP}) \quad (4.7)$$

$$\text{Overall Recall (OR)} = \text{OTP} / (\text{OTP} + \text{OFN}) \quad (4.8)$$

$$\text{Overall F1} = 2 \times \text{Overall Precision} \times \text{Overall Recall} / (\text{OP} + \text{OR}) \quad (4.9)$$

where OTP is Overall True Positive, OTN is Overall True Negative, OFP is Overall False Positive, OFN is Overall False Negative, t is the total number of samples, P_j represents the j th predicted output of the model, and Y_j represents the corresponding j -th target pixel value.

$$\text{Accuracy (A)} = (\text{OTP} + \text{OTN}) / (\text{OTP} + \text{OTN} + \text{OFP} + \text{OFN}) \quad (4.10)$$

V. RESULTS AND DISCUSSION

At first, the deep learning architectures SegNet (Badrinarayanan et al. 2017), U-Net (Xie et al. 2018), Residual U-Net (Yang et al. 2019), and proposed RRUSC (Reduced Residual U-Net using Standard Convolution) networks are implemented with a standard convolution technique. These models are trained using the training parameters mentioned in Table 1. The metrics of the proposed architecture RRUSC are considerably good, achieving a segmentation accuracy of 96.14% at validation time and 95.37% at testing time, which is higher than that of others. The overall F1 score achieved by the proposed RRUNC is also good and better than other state of the art models. So, it is computationally very expensive since it is implemented using a standard convolution technique.

Table 1. Training Parameters

Training Parameters	Values
Batch size	5
Steps per epoch	120
Learning rate	0.001
Optimizer	ADAM optimizer
Loss function	categorical cross_entropy

As part of the crop-weed segmentation task on the CWFID dataset, Hashemi-Beni et al. employed FCN-8s, FCN-16s, FCN-32s, and U-Net deep learning models (Hashemi-Beni et al. 2022). The performance comparison of the proposed RRUNC model with the existing work is presented in Table 2. From Table 2, the proposed Pruned RRUNC achieved a better segmentation accuracy of 96.06%, when compared to that of the existing models.

Table 2. Comparison with existing work

ModelName	A (%)	NoP (Million)	Model Size (MB)
FCN-8s	81.1	-	-

FCN-16s	77.2	-	-
FCN-32s	68.4	-	-
U-Net	77.9	-	-
Proposed Pruned RRUNC	96.06	0.655	2.34

A-Accuracy, NoP-Number of Parameters, -Not given in the paper

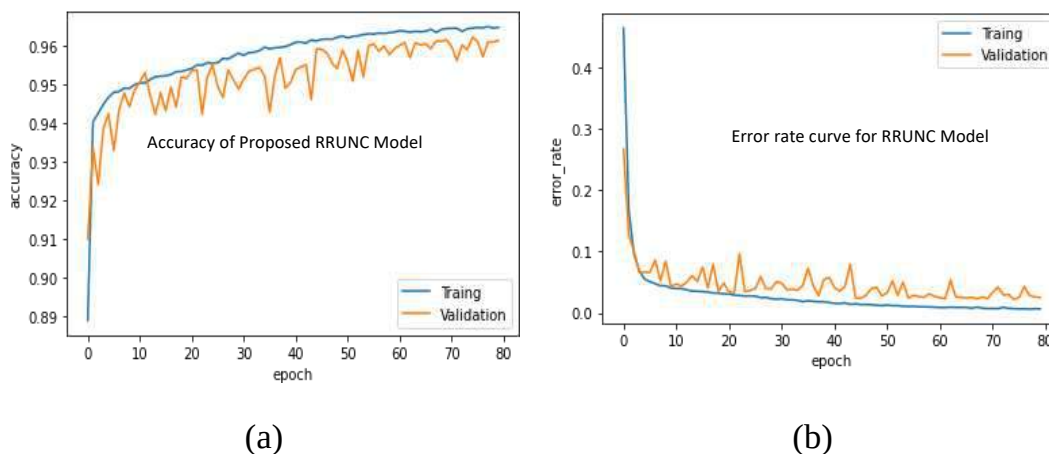


Figure6. Learning curves of the proposed RRUNC Model,

a) Accuracy curve, b) Error rate curve

VI. CONCLUSION

An encoder-decoder based deep learning model, named Reduced Residual U-Net using Convolution (RRUNC) network is proposed in this work for crop-weed segmentation. Residual Deep separable Convolution Block (R-DCB) was introduced. The proposed model is constructed in a computationally effective manner without degrading the performance of the model. The performance of this proposed model was evaluated using the benchmark dataset Crop Weed Field Image Dataset (CWFID). The experimental findings show that the proposed deep learning-based RRUNC model outperformed well in terms of segmentation results with good accuracy and less error-rate. This proposed smaller model size is more suitable to build a lightweight computer vision application for weed portions and pest detection on agricultural land. It is also easily deployed on resource-constrained portable devices used by the farmers in the agricultural field.

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A NETWORK APPROACH FOR LOAD BALANCING AND PRIVACY PATH SELECTION IN WIRELESS COMMUNICATION

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Abstract: A Load Balancing in Privacy Path Selection (LBPPS) in wireless Network process for searching straight paths to transfer packets from source to destination through cluster head with the selected base station is implemented. This LBPPS method performs gateway mobility load balancing in the network order to achieve higher aggregated throughput among data transfer. The Load Balancing in Privacy Path Selection (LBPPS) detection scheme path grouping protocol examines every node in the network and monitors its neighbours' behaviour. Also, it detects any abnormal action of neighbours' to ascertain whether the node abnormally behaving is indeed malicious. As a result, the abnormal node is considered as a malicious node.

Key words: Load Balancing, Privacy, Preserving, Routing, Gateway.

INTRODUCTION:

Mechanism of Load Balancing in Privacy Path Selection (LBPPS) is a key component in traffic and refers to distributing traffic load more evenly in the network. Uneven load distribution is caused by varying user demands or uneven node distribution, where the latter may be a consequence of the unplanned and mobile nature of MANETs. Furthermore, specific network nodes are more vulnerable to become congested than others due to their location or assigned role. Nodes located in the centre of the network tend to be more congested than nodes in the periphery, either because most packets have to traverse these central nodes or contend with a higher number of neighboring nodes for the medium. Nodes having the role as *gateways* between network domains may be more congested since all inter-domain traffic has to traverse through them.

Avoiding congestion at such key nodes is critical in maintaining network connectivity and the services they provide. Figure 1.1 describes the Mechanism of Load Balancing in Privacy Path Selection process flow. Existing load balancing protocols adjust the routes dynamically to balance the traffic load based on current load distribution knowledge. (Broch et al. 1998) used multi-path routing to share the traffic equally to different nodes or path, which introduces much additional overhead. A novel approach (Hasanpour et al., 2017) is developed in targeting load balancing in ad hoc networks using quantum game theory's properties. The Quantum Load Balancing (QLB) algorithm proposed is implemented, and significant gain is stated about the QoS metrics such as delay and jitter.

REVIEW OF LITERATURE

Nodes in wireless sensor networks, which are difficult to replenish with limited energy consumption. If the energy consumption is fast, the unbalanced load will reduce the node lifetime and affect the network performance. Therefore, it is essential to study how to reduce sensor nodes' energy consumption and improve nodes energy use rate to prolong the network lifetime. Wang et al. (2020) proposed load balancing routing method for cluster head optimization in WSN. It helps to calculate an optimal number of clusters. CH selection uses unequal clustering algorithm for unbalanced nodes. The experimental results showed that the proposed algorithm when compared with LEACH and UCDP algorithm, will balance the loading and effectively extend the life cycle of wireless sensor network. The algorithm was divided into two stages: unequal clustering and establishing paths between clusters. In order to solve the problem of unbalanced, the nodes were formed as clusters. The study used tiny OS2 simulator. The simulation results showed that the method could save the sensor nodes energy consumption in a cluster. Wajgi and Thakur (2012) proposed a load balancing technique using the cluster to increase network scalability. The model

used backup nodes and increase the network lifetime and provides high throughput. The proposed approach assumes a heterogeneous network with the sensor nodes having

The existing models did not efficiently address QoS improvement and energy efficiency. Motivated by this, the study presented a novel hybrid approach for improving those parameters. The model has link estimation and learning of network techniques for achieving excellent performance. Simulations have been done for varying scenarios such as speed, and the number of nodes. The analysis was done on throughput, delay analysis and packet delivery ratio for different methods. The proposed load balancing approach shows improved performance when compared to existing methods.

METHODS AND FINDINGS

LOAD BALANCING IN PRIVACY PATH SELECTION (LBPPS)

In the Mobility model, V_{max} and T_{pause} are the two relevant key parameters determining nodes' mobility behaviour. If the V_{max} is small, and the pause time T_{pause} is long, Ad Hoc networks become stable. If the node movement is faster (i.e., V_{max} is large) and the pause time T_{pause} is smaller, the topology is highly active. The variation of these two parameters, especially the V_{max} , the Random Waypoint model generates several mobility scenarios with different levels of nodal speed.

The Mobility metric captures and quantifies this nodal speed. The measurement of the relative speed between node i and j at time t is given by,

$$Speed(i, j, t) = \left| V_i(t) - \frac{V_j(t)}{M} \right| \quad \text{eqn. (1.1)}$$

The Mobility metric is then calculated as relative speed averaged over all node pairs and overall time. The definition is given as follows,

$$M = \frac{1}{|i, j|} \sum_{i=1}^N \sum_{j=i+1}^N \frac{1}{T} \int_0^T Speed(i, j, t) dt \quad \text{eqn. (1.2)}$$

where $|i, j|$ is the number of diverse node pair (i, j) , n is the total number of nodes in the field (i.e., ad hoc network), and T is the time required for simulation.

Gateway load balancing refers to distributing inter-domain traffic more evenly and intelligently between the gateways to achieve higher aggregated throughput. The prerequisite is two or more gateways deployed in the network, providing connectivity to external network domains such as the global Internet. Since all inter-domain traffic has to traverse the gateway nodes, they are consequently more vulnerable to congested. So it is necessary to deploy multiple gateways in the network to increase the overall capacity and alleviate the probability of congestion. Also, it provided redundancy and increased robustness. Furthermore, it can also lead to fairness improvement, i.e. with only one gateway; different nodes enjoy different capacities depending on their proximity to the gateway. However, with multiple gateways, the average distance to the available gateways is the same for all nodes.

Although the deployment of multiple gateways provides several advantages, it also introduces several issues and challenges that need to be addressed effectively to exploit these advantages effectively. They may cause a gateway to be overloaded, while others may be strongly underused, either due to uneven node distribution or user demands. Hence, without proper load balancing, a potential risk for degradation in the performance.

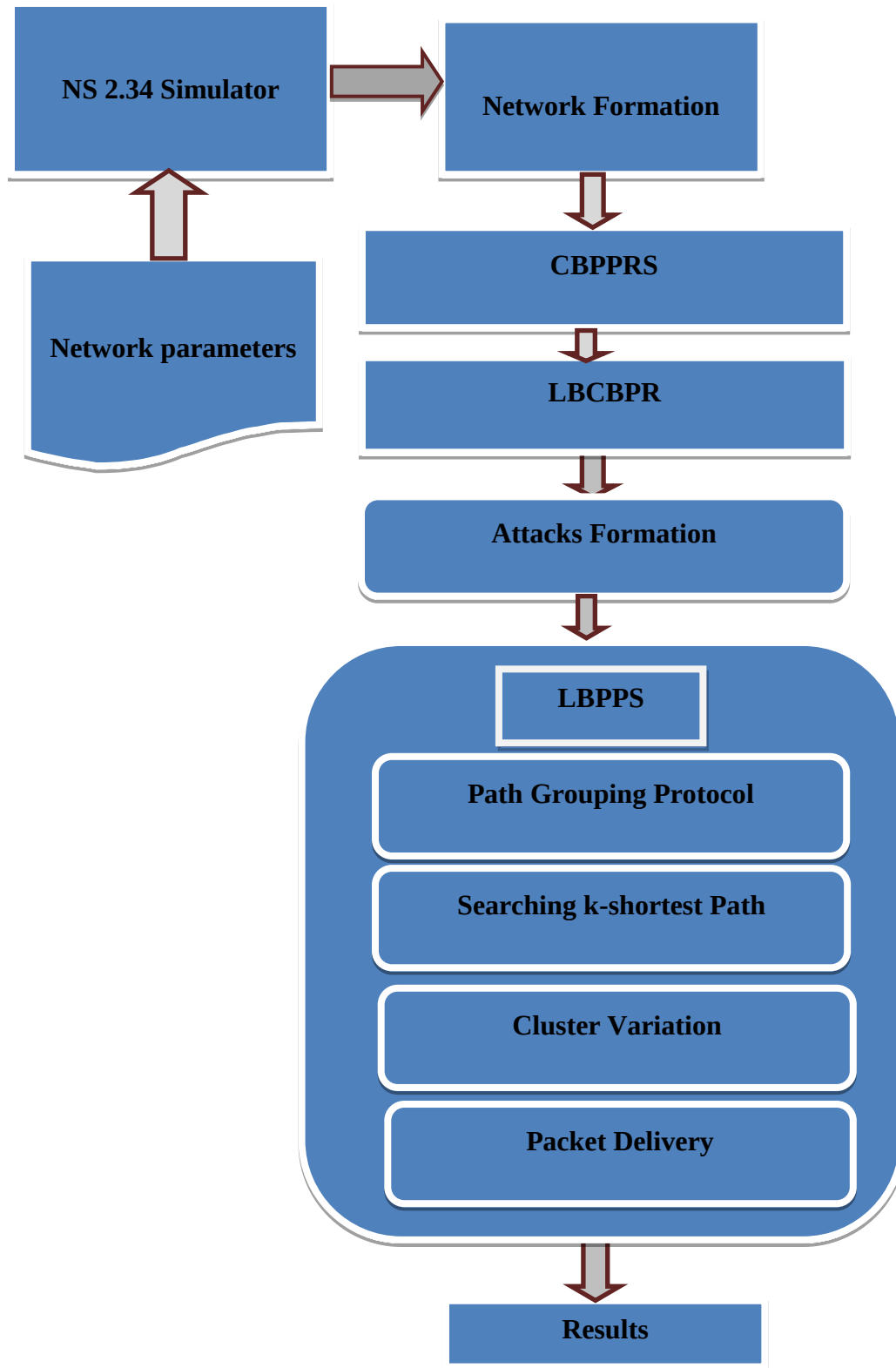


Figure1.1 Mechanism of Load Balancing in Privacy Path Selection (LBPPS)

The LBPPS searching the k-path in the mobile ad hoc network can be either unidirectional or bidirectional. The control messages are transmitted periodically one hop away for sensing the neighbouring nodes so that they are not forwarded further. When the first host receives the Hello message, it sets the second host's status to uneven in the routing table. When the first host sends control message including the message of the link it has to the second host to be asymmetric, the second host automatically set the first host status to symmetric in the routing table.

LBPPS algorithm predicts the distributed attacks in a mobile ad-hoc network. In the detection scheme path, grouping protocol examines every node in the network and monitors its neighbours' behaviour. In detecting any abnormal action by its neighbours', a distributed algorithm is raised to determine whether the node behaving is malicious. The protocol works by combining some security components present in each node in the networks. These components are as follows: (i) detection, (ii) privacy collector, (iii) privacy manager, (iv) Privacy propagator.

MECHANISM OF LOAD BALANCING IN PRIVACY PATH SELECTION (LBPPS) ROUTING

Algorithm 1: Mechanism of Load Balancing in Privacy Path Selection Routing

Initialize $CH \leftarrow 0$; $LBCPR \leftarrow 0$; $LBPPS \leftarrow 0$;

Process

Step 1: source node needs a route to the destination the protocol starts route discovery. During route discovery, source node broadcast RREQ packets through neighbouring nodes

Step 2: Searching the neighbour cluster list present source to destination.

Step 3: Check gateway mobility balancing (gmb)

Step 4: *if* $gmb \neq CH$ *then*

$CH = CH + 1$

end if

Step 5: *if* $gmb_count > nodecount_thresh$ *then*

//declare the target node and their previous hop nodes are attacker nodes.

forward (attacklink);

break;

end if

Step 6: select privacy cluster path for packet delivery

Meanwhile, the algorithm establishes detection, privacy collector privacy manager and privacy propagator to complete the privacy path selection. An experimental result shows that the proposed algorithm better outperforms than existing HsecGR and Trust-ECC methods. Routing overhead, insufficient packet delivery ration and other QoS parameters are some of the flaws in an inefficient load balancing scheme. Primary research is being done on the problem through congestion estimation and traffic control. Some methods use energy and power metrics for making routing decision for load balancing. Clustering-based approaches are one among them (Whaiduzzaman et al., 2014).

The primary research challenges for MANETs are QoS improvement and energy efficiency. Existing methods did not efficiently address these. Therefore, this research became a motivation by presenting

a novel hybrid approach for load balancing, which improves QoS and energy efficiency performances. The primary aim of this research addresses a novel algorithm for efficient load balancing. This proposed method addressed both load balancing and energy efficiency in parallel.

For securing an ad hoc network, the attributes to be considered are Availability, confidentiality, integrity, authentication and no repudiation (Zhou and Hass, 1999; Kar, 2017). Availability ensures the survival of the network even after the denial-of-service attacks. Confidentiality ensures the disclosure of information to unauthorized entries. Integrity guarantees that no transmitted message is corrupted. Authentication ensures the identity of the node to which it communicates. Non repudiation ensures the origin cannot deny the transmission. The ad hoc networks' features pose many challenges and no standard routing protocol that resolves all the issues.

ILLUSTRATION OF RESULTS

Packet Delivery Ratio

The Energy packet delivery ratio is the percentage of the number of packets received by the destination node to the number of packets generated by the source node. The Proposed system performs the best in terms of packet delivery ratio followed by distributed weight cluster manner.

$$EPDR = \left(\frac{\text{Amount of Sending messages}}{\text{Amount of Receive messages}} \right) \times 100 \quad \text{eqn. (1.3)}$$

Table 1.1: Comparison of Packet Delivery Ratio between Existing Trust-ECC and Proposed LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust- ECC	98.25	91.5	88.23	85.99
LBPPS	99.02	93.47	90.09	87.88

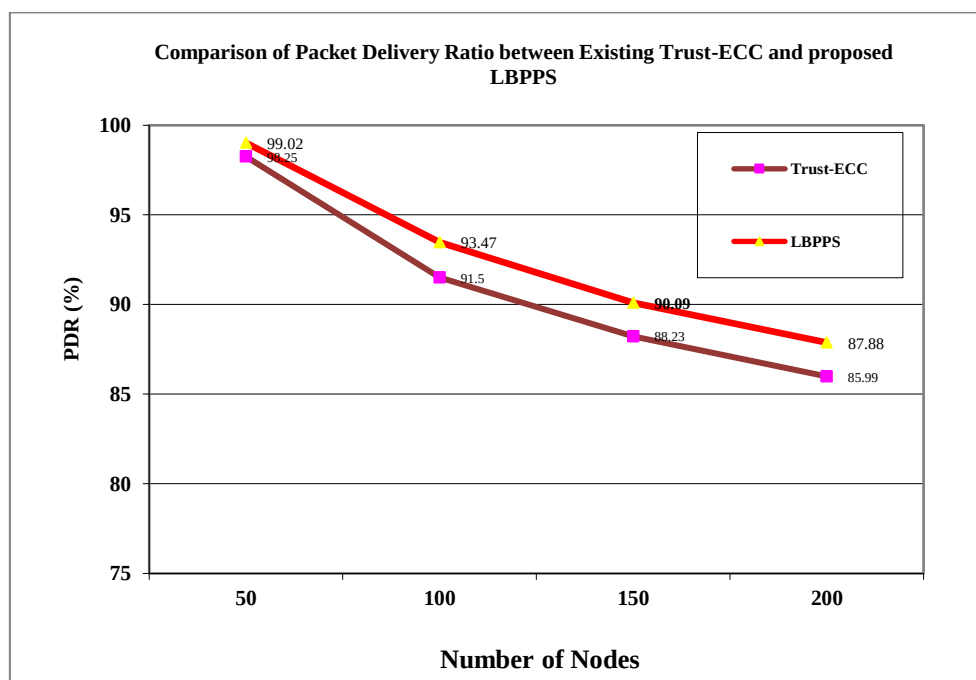


Figure 1.2: Packet Delivery Ratio

Throughput

Comparing the energy throughput of the network is given using Figure 1.3 shows the proposed algorithm's performance of the traditional cache management technique. The Y-axis shows the throughput, and the X-axis shows the Time duration in-network experimentations to represent the network's performance.

$$EX = \frac{\text{Number of message requests}}{\text{Total Time duraiton}} \quad \text{eqn. (1.4)}$$

Table 1.2: Comparison of Throughput Ratio between Existing Trust-ECC and Proposed LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust- ECC	25.5	26.8	19.5	17.5
LBPPS	24.47	25.18	19.06	15.33

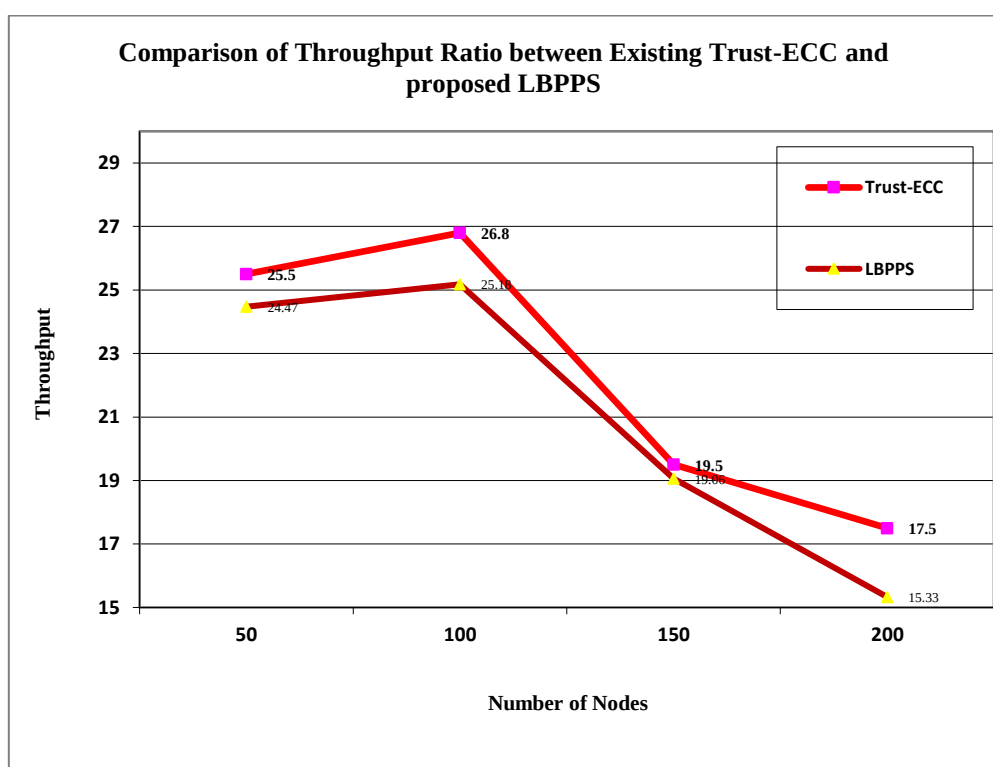


Figure 1.3: Throughput Performance

Routing Control Overhead

Routing control overhead is a measure of the total number of forwarded packets in the network i.e. the number of times it is forwarded. In order to find routes, routing protocols used to send control information (packets). This control information includes route request sent, route reply send and route error sent packets. Routing overhead can be defined as a ratio of the total number of control packets sent to the total number of data packets delivered successfully.

$$\text{Routing Control Overhead} = \frac{\text{Total number of control packets sent}}{\text{Total number of successfully delivered data packets}} \quad \text{eqn. (1.5)}$$

Table 1.3: Comparison of Routing Overhead between Existing Trust-ECC and Proposed LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust- ECC	2.5	8.5	13	15.6
LBPPS	1.8	6.2	10.4	12.4

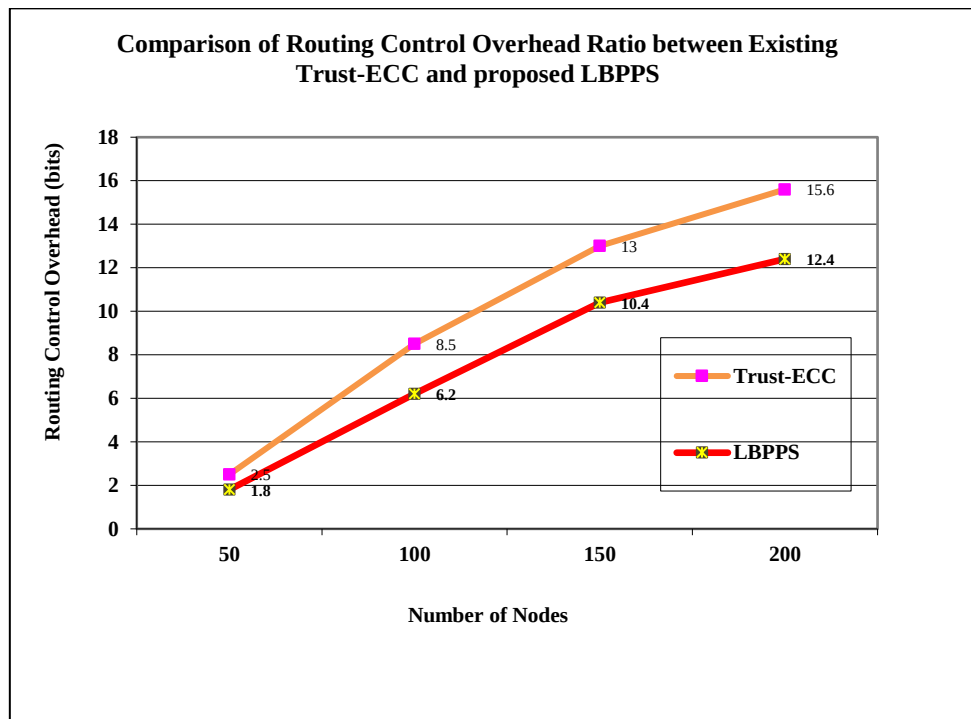


Figure 1.4: Routing Overhead

Packet Loss Rate

The Packet Loss Rate (PLR) is an important performance measure for Wireless networks. Since these data flows are guaranteed, the number of packets lost or dropped during transmission must be kept low. In a transmission interval, the PLR can be calculated as follows:

$$PLR = \frac{N^{tx} - N^{rx}}{N^{tx}} \times 100 \% \quad \text{eqn. (1.6)}$$

Table 1.4: Comparison of Packet Loss Rate between Existing Trust-ECC and proposed LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust- ECC	4	14	18	22
LBPPS	3	11	14	16

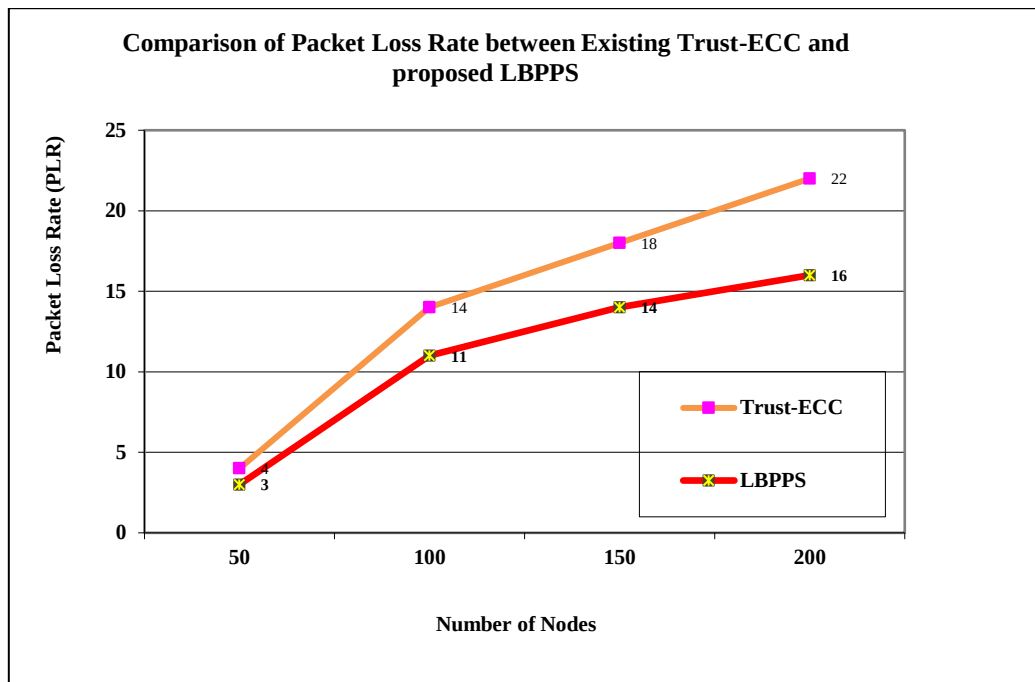


Figure 1.5: Packet Loss Rate

Average Delay

The delay of a packet in a network is when it takes the packet to reach the destination after it leaves the source. The average delay averages the overall transmitted packets in the network. The queuing delay is not considered. A source node sends the packet directly to the destination if it is within the transmission range else it forwards it to the relay nodes.

Table 1.5 Comparison of Average Delay between Existing Trust-ECC and LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust-ECC	0.35	2.42	5.8	8.6
LBPPS	0.32	2.19	4.86	7.2

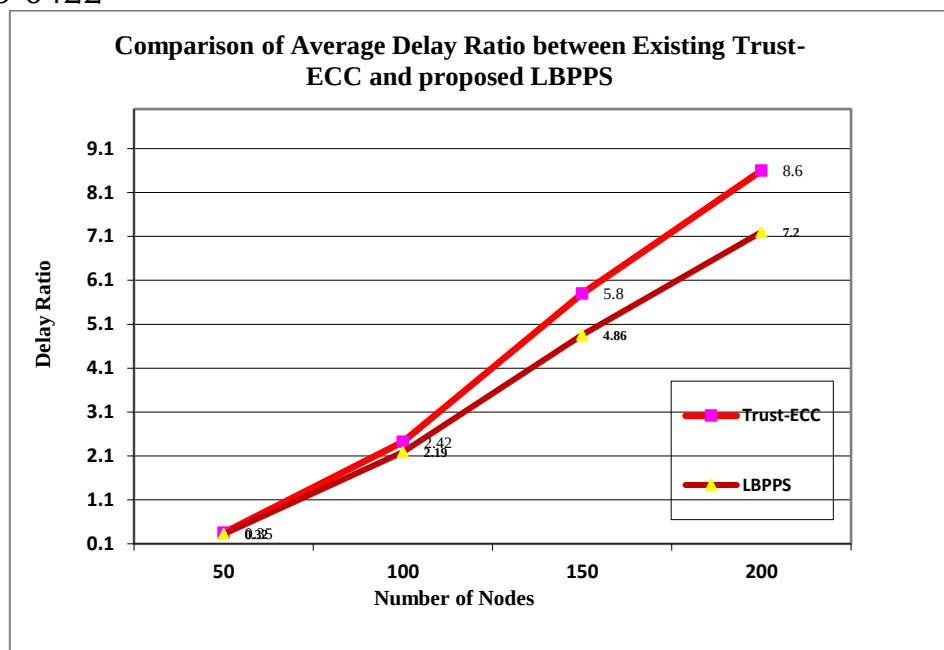


Figure 1.6: Average Delay

CONCLUSION

Wireless systems carry confidential information, and the broadcasting nature makes the transmitting information vulnerable to eavesdropping. This dynamic secret key formed for all the nodes in this research work certainly reduces the threat given in the routing protocol's path. Establishing trusts among sensor nodes can be a practical approach to counter attacks. This is commonly obtained by a system that measures the trustworthiness by a rating system. The load-balancing cluster-based privacy routing model presented handles the load imbalance in the network by the distributing equally to the nodes centrally placed. The research model decides a path which occupies mobile nodes with fewer load using routing metric and a minimization principle.

Through LBPPS load balancing and prevention of attacks are accomplished. The model compared with Trust-ECC methods. The proposed algorithm provides complete privacy path selection, and through trusted key management the quality of secure communication is achieved.

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A NETWORK APPROACH FOR LOAD BALANCING AND PRIVACY PATH SELECTION IN WIRELESS COMMUNICATION

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Abstract: A Load Balancing in Privacy Path Selection (LBPPS) in wireless Network process for searching straight paths to transfer packets from source to destination through cluster head with the selected base station is implemented. This LBPPS method performs gateway mobility load balancing in the network order to achieve higher aggregated throughput among data transfer. The Load Balancing in Privacy Path Selection (LBPPS) detection scheme path grouping protocol examines every node in the network and monitors its neighbours' behaviour. Also, it detects any abnormal action of neighbours' to ascertain whether the node abnormally behaving is indeed malicious. As a result, the abnormal node is considered as a malicious node.

Key words: Load Balancing, Privacy, Preserving, Routing, Gateway.

INTRODUCTION:

Mechanism of Load Balancing in Privacy Path Selection (LBPPS) is a key component in traffic and refers to distributing traffic load more evenly in the network. Uneven load distribution is caused by varying user demands or uneven node distribution, where the latter may be a consequence of the unplanned and mobile nature of MANETs. Furthermore, specific network nodes are more vulnerable to become congested than others due to their location or assigned role. Nodes located in the centre of the network tend to be more congested than nodes in the periphery, either because most packets have to traverse these central nodes or contend with a higher number of neighboring nodes for the medium. Nodes having the role as *gateways* between network domains may be more congested since all inter-domain traffic has to traverse through them.

Avoiding congestion at such key nodes is critical in maintaining network connectivity and the services they provide. Figure 1.1 describes the Mechanism of Load Balancing in Privacy Path Selection process flow. Existing load balancing protocols adjust the routes dynamically to balance the traffic load based on current load distribution knowledge. (Broch et al. 1998) used multi-path routing to share the traffic equally to different nodes or path, which introduces much additional overhead. A novel approach (Hasanpour et al., 2017) is developed in targeting load balancing in ad hoc networks using quantum game theory's properties. The Quantum Load Balancing (QLB) algorithm proposed is implemented, and significant gain is stated about the QoS metrics such as delay and jitter.

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METHODS AND FINDINGS

LOAD BALANCING IN PRIVACY PATH SELECTION (LBPPS)

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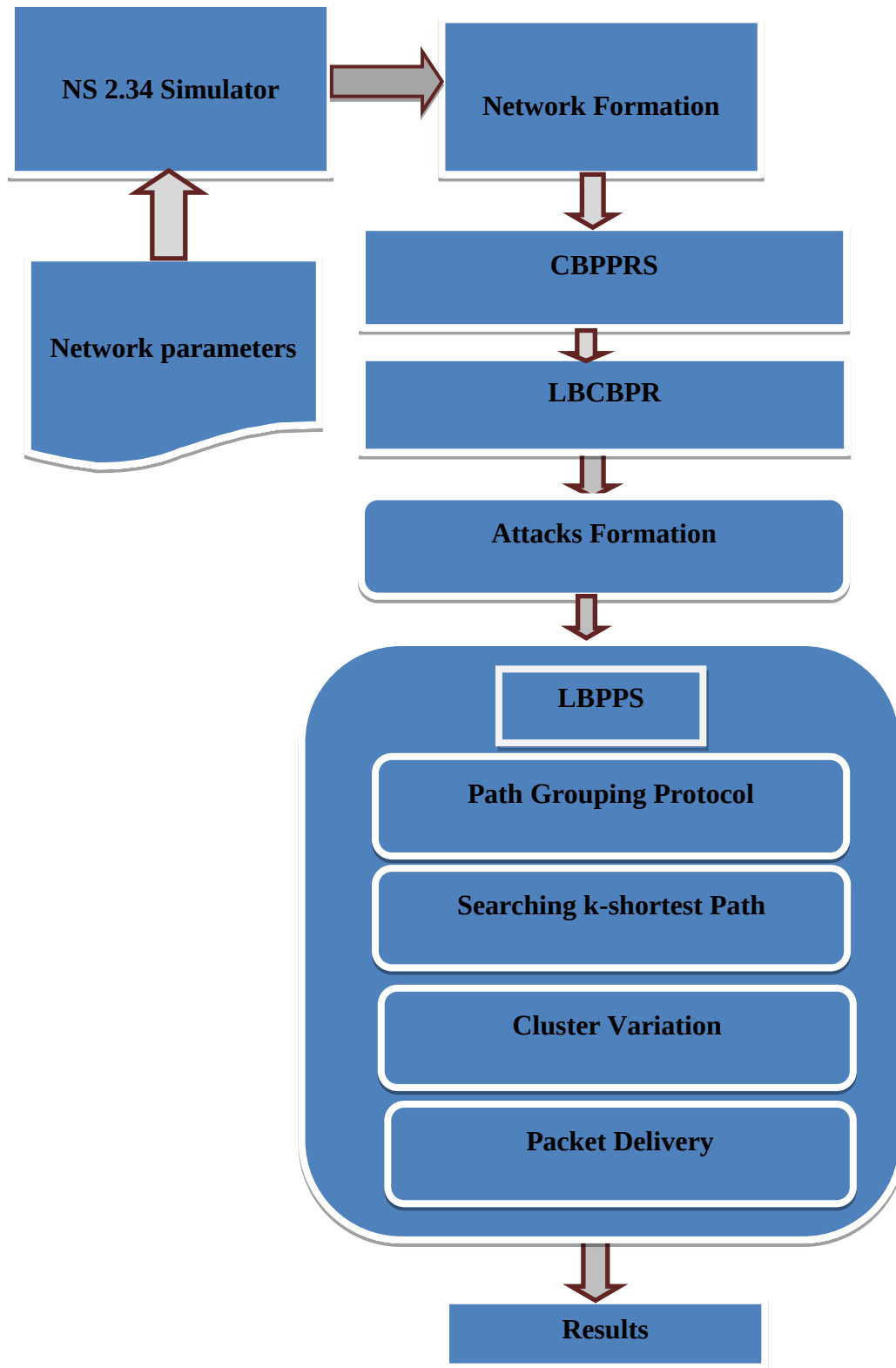


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MECHANISM OF LOAD BALANCING IN PRIVACY PATH SELECTION (LBPPS) ROUTING

Algorithm 1: Mechanism of Load Balancing in Privacy Path Selection Routing

Initialize $CH \leftarrow 0$; $LBCPR \leftarrow 0$; $LBPPS \leftarrow 0$;

Process

Step 1: source node needs a route to the destination the protocol starts route discovery. During route discovery, source node broadcast RREQ packets through neighbouring nodes

Step 2: Searching the neighbour cluster list present source to destination.

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$CH = CH + 1$

end if

Step 5: *if* $gmb_count > nodecount_thresh$ *then*

//declare the target node and their previous hop nodes are attacker nodes.

forward (attacklink);

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Step 6: select privacy cluster path for packet delivery

Meanwhile, the algorithm establishes detection, privacy collector privacy manager and privacy propagator to complete the privacy path selection. An experimental result shows that the proposed algorithm better outperforms than existing HsecGR and Trust-ECC methods. Routing overhead, insufficient packet delivery ration and other QoS parameters are some of the flaws in an inefficient load balancing scheme. Primary research is being done on the problem through congestion estimation and traffic control. Some methods use energy and power metrics for making routing decision for load balancing. Clustering-based approaches are one among them (Whaiduzzaman et al., 2014).

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ILLUSTRATION OF RESULTS

Packet Delivery Ratio

The Energy packet delivery ratio is the percentage of the number of packets received by the destination node to the number of packets generated by the source node. The Proposed system performs the best in terms of packet delivery ratio followed by distributed weight cluster manner.

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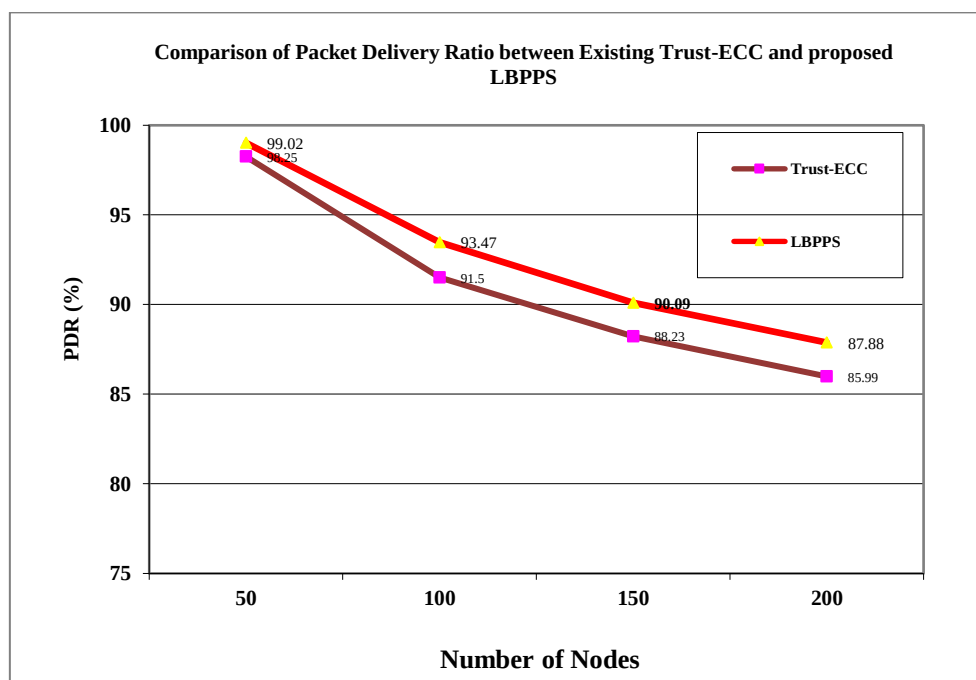


Figure 1.2: Packet Delivery Ratio

Throughput

Comparing the energy throughput of the network is given using Figure 1.3 shows the proposed algorithm's performance of the traditional cache management technique. The Y-axis shows the throughput, and the X-axis shows the Time duration in-network experimentations to represent the network's performance.

$$EX = \frac{\text{Number of message requests}}{\text{Total Time duraiton}} \quad \text{eqn. (1.4)}$$

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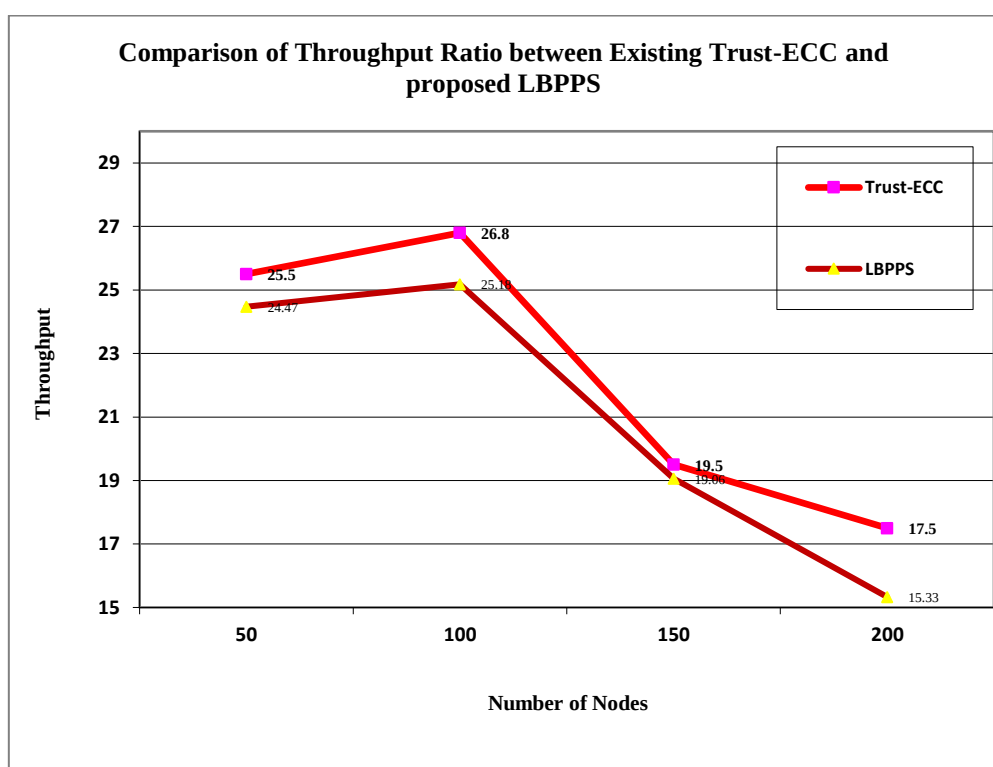


Figure 1.3: Throughput Performance

Routing Control Overhead

Routing control overhead is a measure of the total number of forwarded packets in the network i.e. the number of times it is forwarded. In order to find routes, routing protocols used to send control information (packets). This control information includes route request sent, route reply send and route error sent packets. Routing overhead can be defined as a ratio of the total number of control packets sent to the total number of data packets delivered successfully.

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Table 1.3: Comparison of Routing Overhead between Existing Trust-ECC and Proposed LBPPS Algorithm

Number of Nodes	50	100	150	200
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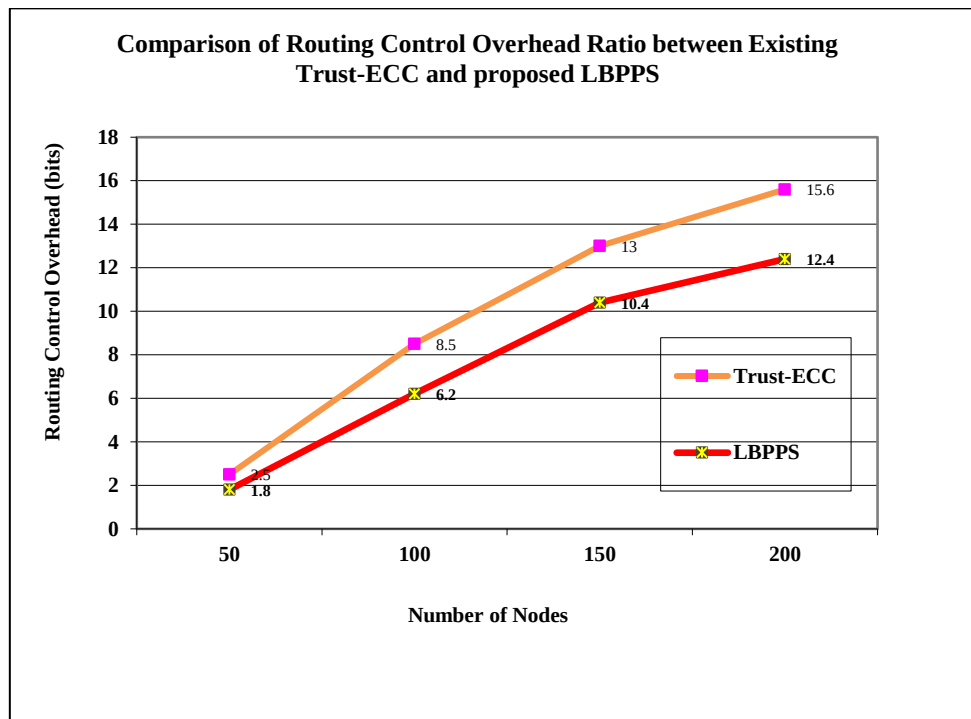


Figure 1.4: Routing Overhead

Packet Loss Rate

The Packet Loss Rate (PLR) is an important performance measure for Wireless networks. Since these data flows are guaranteed, the number of packets lost or dropped during transmission must be kept low. In a transmission interval, the PLR can be calculated as follows:

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Table 1.4: Comparison of Packet Loss Rate between Existing Trust-ECC and proposed LBPPS Algorithm

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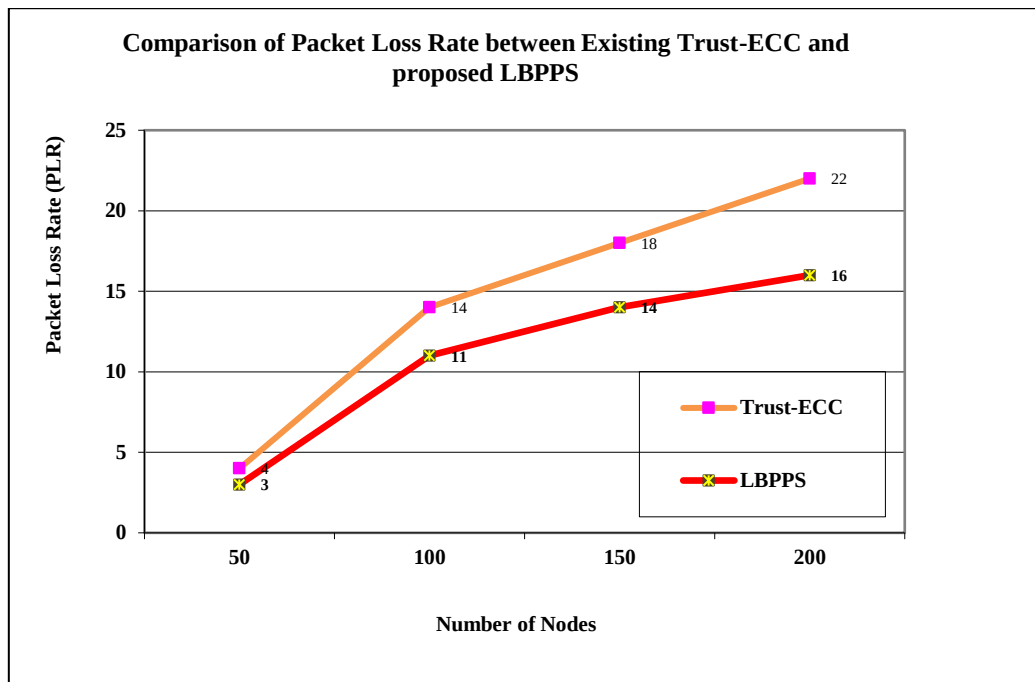


Figure 1.5: Packet Loss Rate

Average Delay

The delay of a packet in a network is when it takes the packet to reach the destination after it leaves the source. The average delay averages the overall transmitted packets in the network. The queuing delay is not considered. A source node sends the packet directly to the destination if it is within the transmission range else it forwards it to the relay nodes.

Table 1.5 Comparison of Average Delay between Existing Trust-ECC and LBPPS Algorithm

Number of Nodes	50	100	150	200
Trust-ECC	0.35	2.42	5.8	8.6
LBPPS	0.32	2.19	4.86	7.2

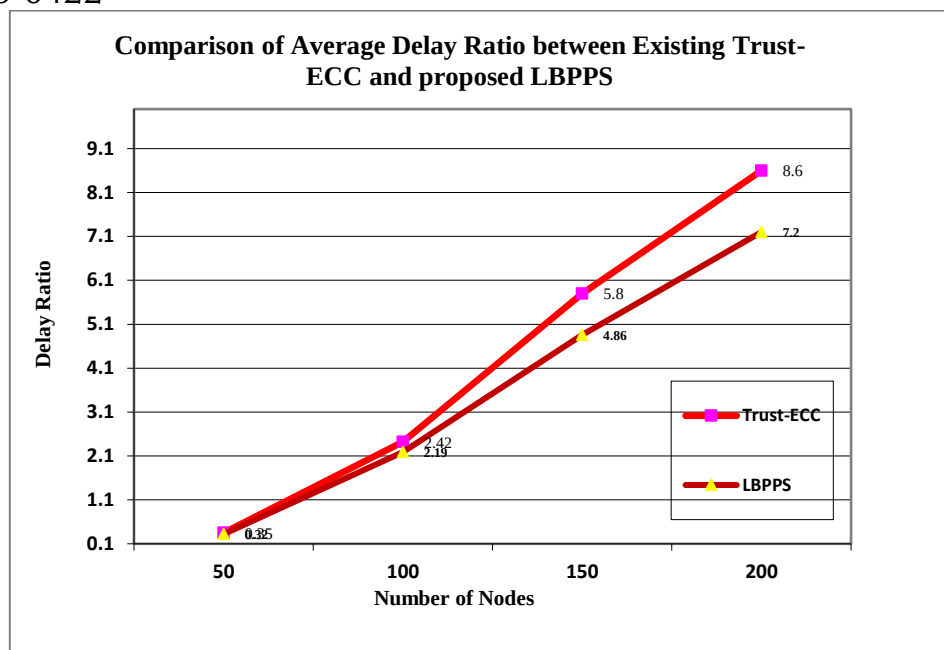


Figure 1.6: Average Delay

CONCLUSION

Wireless systems carry confidential information, and the broadcasting nature makes the transmitting information vulnerable to eavesdropping. This dynamic secret key formed for all the nodes in this research work certainly reduces the threat given in the routing protocol's path. Establishing trusts among sensor nodes can be a practical approach to counter attacks. This is commonly obtained by a system that measures the trustworthiness by a rating system. The load-balancing cluster-based privacy routing model presented handles the load imbalance in the network by the distributing equally to the nodes centrally placed. The research model decides a path which occupies mobile nodes with fewer load using routing metric and a minimization principle.

Through LBPPS load balancing and prevention of attacks are accomplished. The model compared with Trust-ECC methods. The proposed algorithm provides complete privacy path selection, and through trusted key management the quality of secure communication is achieved.

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EFFECTIVE DEEP LEARNING ARCHITECTURES TO IMPROVE AGRICULTURAL PRODUCTION QUALITY

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Abstract: Agriculture, a powerful word that requires no definition, contributes the most profitable share of the Indian Economy. On a wider view, intensifying productivity requires very basic things like improving the quality and quantity of the productivity and dwindling the agricultural expenses. There are certain cases that affect productivity, among which the presence of weeds and pests in crop fields stands top. Traditional methods, such as manual removal of weeds and spraying of agrochemical products like herbicides, and pesticides have chances of harming the crops and also add to the expenses. Selective treatment against weeds and pests is a cost-effective method that reduces manpower and usage of the agrochemical, at the same time it requires an effective computer vision system to identify issues and should be smaller in size to run in the resource-constrained device. Machine learning-based activities for identifying weed portions and pest detections are tedious and time-consuming processes. This research work presents a method of effective segmentation in the agricultural field, to accomplish this; a convolution neural network is proposed named Reduced Residual U-Net Convolution (RRUNC) network. It is an encoder-decoder based architecture. This network employs semantic process to analyse the crop field images pixel-wise. In order to reduce the parameter size, the deep convolution technique is used which curtails the number of parameters generated by the model with a very negligible in the accuracy. The experimental findings show that the proposed deep learning-based RRUNC model outperformed well in terms of segmentation results with good accuracy and less error-rate.

Key words: Agriculture, Convolution, Pest, Residual, Weeds.

I. INTRODUCTION

The agricultural sector plays a crucial role in the economy and is considered to be one of the cornerstones of the economy of developing countries, especially India. Because food and raw materials are not the only things that agriculture provides: it also gives employment for a huge number of the population in India. According to the Indian Agriculture and Allied Industry report published in November 2021, about 58% of India's population relies on agriculture as its primary source of income. A total of 17.8% of India's Gross Value Added (GVA) in FY20 came from agriculture and related sectors. Globally, India is ranked fifth in terms of production, consumption, export, and expected growth.

Traditional agricultural activities spend a lot of time and expenditure on their agricultural work due to the lack of use of technological advancements. To preserve their production from weeds, farmers utilized physical weeding and spraying of herbicides in the past. Manual weed removal increases expenditures and takes more time and effort, thus increasing labour costs. While spraying herbicides over agricultural land may spoil the soil, it also has the potential to turn plants deadly, posing a risk to human health. Farmers are losing interest in their agricultural labour as a result of this, and are leaving the industry. To address these difficulties and boost production with existing agricultural land, agricultural activities should utilize modern research and technology development. This research focuses on finding a more efficient strategy to deal with weeds and pests.

Weeds are the most important biotic constraint impacting agricultural production. Weeds are invasive plants. The presence of weeds in a crop field impairs the yield, quantity, and quality. It degrades the crop yield invisibly. The weeds absorb all the nutrients required by the crops from the

soil, water, and fertilizer. In the absence of adequate nutrients, crops may become of poor quality and hence susceptible to crop diseases. Weeds are not susceptible to pests and diseases since these are normally controlled by their natural habits. As a result, it quickly spreads across a wide area taking up more space on agricultural land which decreases crop yields.

Pests are another major threat to agriculture productivity. Pests infest agriculture fields, causing a variety of diseases and wreaking havoc on plants. The presence of pests in agricultural land prevents farmers from getting good yields from their harvests. Consequently, identifying pests earlier in their life cycle is an essential and profitable practice for farmers, as they can avoid most of the crop diseases that affect their crops. But in reality, it is difficult to identify these diseases at an early stage.

For pest identification, they rely on visual assessments done by the agronomist force (Yadav et al. 2021). Identifying the right agronomists at right time is not practically possible. Most pest diseases have identical characteristics, making it difficult to identify correctly even for experienced farmers. As a result, it may lead to inadequate treatment, which is equally damaging to plants. Pest can be controlled a little easier in earlier stages rather than in posterior stages. But, many pests in their early stages are worm-like, and so it's more difficult to classify them. Some of the sample pest images of earlier and later stage are shown in Figure 1. Therefore, farmers might fail to take the right action at the earliest stage, and before implementing the necessary measures the pest may spread to half of the field. Utilizing current technology and automating a few of their activities could allow them to overcome these challenges, like weed detection, and pest detection that cannot be solved using traditional methods.

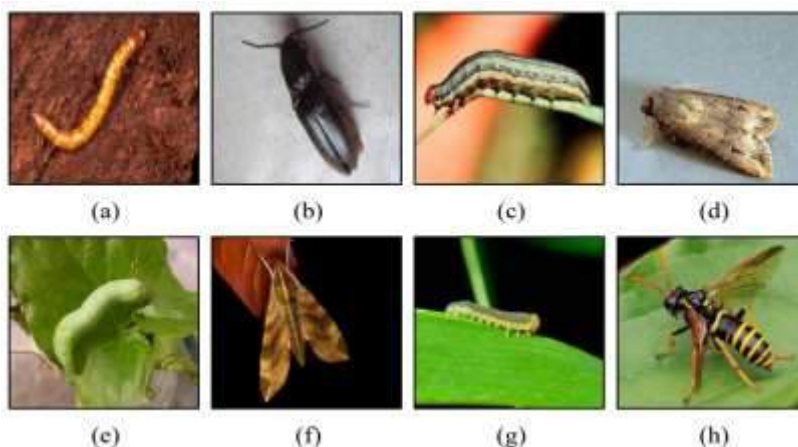


Figure 1. Some of the sample images of pests that are in worm type in its earlier stage. a) Wireworm – earlier stage, b) Wireworm – later stage, c) Armyworm – earlier stage, d) Armyworm – later stage, e) Ampelophaga – earlier stage, f) Ampelophaga – later stage, g) Wheat sawfly – earlier stage, h) Wheat sawfly – later stage

II. LITERATURE SURVEY

This section provides an overview of the contributions of computer vision applications to agricultural activities against weeds and pests. In the real world, especially in the agriculture field, a deep learning model that is both computationally and accurately efficient is required. The majority of research work in the deep learning field is concerned with developing new deep learning architecture to improve efficiency, while a few studies look at parameter and model size reduction.

Simonyan & Zisserman (2014) proposed a way of constructing a deep learning model. A constant and small-sized kernel 3x3 is used in all the convolution layers of their proposed CNN model, where the depth of this model was 16 -19 convolution layers. Here, each layer is equipped with ReLU activation and Batch Normalization function. As we descended deeper into the model, the number of filters doubled, such as 64, 128, 256, and 512.

For autonomous driving car applications, Badrinarayanan et al. (2017) presented an encoder-decoder based SegNet architecture. Here, the proposed model was organized in such a way that every block/layer in the encoder has a corresponding block/layer on the decoder side. In this work, the usage of pixel-wise labeling to segment road scene objects like vehicles, buildings, pedestrian trees, and other objects for smooth driving of a car, is considered. Both encoder and decoder have 13 convolution layers on each side. Yasrab et al. (2017) proposed a CNN for Semantic Segmentation for driver Assistance system (CSSA), which employed a semantic segmentation technique. The structure of the CSSA architecture is based on SegNet architecture along with the dropout layer. The model size of CSSA was ~30 MB and Class Average Accuracy achieved (CAA) was 60.2%.

The U-net architecture, which is an encoder-decoder type model, was proposed by Ronneberger et al. (2015). A contracting path and a symmetric expanding path are the two major components of this model. The significance of the proposed work lies in combining the contracting path with expanding path by creating a concatenation path that integrates the feature map generated in the contracting path with the expanding path. Since this model used the unpadded convolution, there is a possibility of losing corner features.

For segmenting the head-shoulder section of pedestrians, Xie et al. (2019) used a modified version of the UNet architecture. Because it used a large number of filters in the convolution layers of its design, it created a significant number of parameters. Augustaukas and Lipnickas (2019) proposed a pixel-wise road pavement defect detection method. The underlying model structure was based on the U-Net architecture and the convolution layers in this model were using padded convolution operations. This was used to detect the pixel-level cracks in the road which helped in the maintenance and monitoring of roads.

Naqvi et al. (2020) introduced the OcularNet model for accurately detecting ocular areas like the iris and sclera. The suggested OcularNet model was a SegNet architecture with lite-residual encoders and decoders. The key functionality of this work was using the residual skip-connection between the convolution layers of the SegNet model. It helps to transfer the high-frequency information among the convolution layers, which were used to attain precise ocular regions segmentation with the true boundary of ocular regions.

The DenseNet model was developed by Huang et al. (2017), in which each layer is connected to every other layer in the model using the concatenation operation in a feed-forward way. As a result of this, feature maps generated by all the preceding layers could be given as to a layer and its own feature map was used as input to its subsequent layers. Hence the vanishing gradient problem was reduced, and feature maps were better utilized with dense connectivity.

For efficient object identification, Tan et al. (2020) developed EfficientDet, a one-stage object detector that used a weighted bidirectional feature network and a tailored compound scaling algorithm. The proposed EfficientDet model was delivered as different variants, such as EfficientDet D0 to D7. All these variants were evaluated with the COCO dataset and achieved better accuracy with fewer parameters.

Yankun et al. (2021) introduced the Large Motion Trend fusion (LMT-CH) vehicle tracking algorithm, which was based on the big motion trend coupled with the colour histogram. The EfficientDet model was employed as the underlying model in this vehicle tracking algorithm, which increased the accuracy of the real-time applications. The approach's shortcomings were that accuracy might be marginally reduced if vehicles suffered significant changes during the drive.

The motivation behind the work proposed by Chen et al. (2021) was guiding model selection for the critical task of Vehicle and pedestrian detection in autonomous driving applications. In this work, the authors analyzed several object detection models, including Faster R-CNN, R-FCN, and SSD, along with several typical feature extractors, such as ResNet50, ResNet101, MobileNet_V1, MobileNet_V2, Inception_V2, and Inception_ResNet_V2. Further, all the above models were pre-trained with the COCO dataset for improving their performance. Later, various experiments were conducted on these pre-trained models using the benchmark KITTI dataset. Finally, the authors demonstrated that Faster R-CNN ResNet50 obtained the highest AP and SSD MobileNet_V2 was the fastest model.

A CNN architecture without anchors was built by Liu et al. in 2020. He also made a frame-by-frame technique incorporating a lightweight stacked hourglass network to predict the heatmap at the center point of a surgical tool for real-time surgical tool detection during robot-assisted surgery. On the VisDrone2019 dataset, Pailla et al. (2019) employed CenterNet with the HourGlass-104 backbone network for real-time object detection, outperforming other significant object detection models.

Chen et al. (2019) suggested a separable convolution-based CNN model with greater parameter efficiency to adaptively extract forensics-related features from picture patches. To achieve parameter efficiency, the suggested model uses a separable convolution technique rather than the traditional convolution technique. The proposed model was used with a smaller size image like 32×32 .

This section also discussed various existing research work carried out on the process of detecting weeds, and pests in the agricultural field, which includes both machine learning, and deep learningbased approaches. Machine Learning-based approaches struggle hard to produce better results because of their manual feature extraction process. Deep Learning-based approaches simplified the feature extraction process that helps to improve the model's performance. As a result of this, efficient deep learning models were developed to aid in the improvement of Smart farming performance in terms of crop-weed segmentation, and pest detection in agricultural activities.

III. MATERIALS & METHODS

To build a computer vision application for segmenting pest and weed portions in the agricultural field images, an encoder-decoder based on the deep learning model is built and trained using a large number of images and their corresponding target label images. In these images, the pixels can be categorized into three classes: background, pests, and weeds. Accurate pest-weed section segmentation is made feasible by identifying every pixel in the image rather than just one whole image (Long et al. 2015). Later, this trained model can be utilized to segment pest-weed portions from the unseen images. This work proposes a pest weed segmentation model based on Unet (Xie et al. 2018), DeepUnet (Li et al. 2018), and Residual Blocks (Naqvi et al. 2020), where the strength of residual and skip connections is incorporated into the encoder-decoder model.

The primary objective of the proposed approach is to build an effective computer vision system using a deep learning model to facilitate pixel-wise labeling in-order to classify the crops and weeds accurately in the agricultural land. This can be used to aid robotics to do selective spraying and mechanical weed removal. The proposed model is effective in every way, including obtaining a high segmentation accuracy, being less computationally complex, reduction in the size of the model, and having a lower error rate. The system framework of the proposed work is shown in Figure 2.

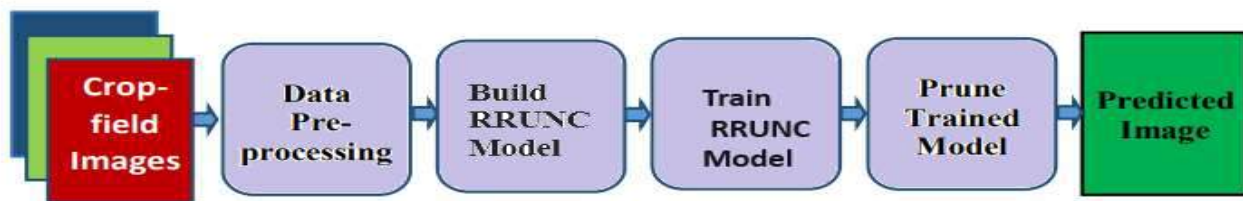


Figure 2. The system framework of the proposed crop-weed

3.1 Data Pre-processing

The dataset used here is the benchmark dataset, Crop/Weed Field Image Dataset (CWFID) proposed in the work (Haug&Ostermann 2014). This dataset contains 60 RGB images with their corresponding annotated label images. The annotation process of the CWFID dataset was done by the experts (Haug&Ostermann 2014). The portions of the actual crop field images are categorized into three classes, namely crop, weed, and background. In the label images, the crop field portions are shaded with different colours such as red, yellow, and black for the crop, weed, and background portions, respectively.

Dataset is fuel for building a deep learning model for any application. The success of building an efficient deep learning model requires a large number of images to train the model otherwise model is prone to overfit. An effective way to address this issue is data augmentation. Data augmentation is used to create new transformed images from existing original images available in the dataset. With this, a larger dataset can be created from the existing smaller dataset. This helps to upgrade the ability of the model to generalize and improve its performance since it creates more variance in training images.

Initially, the existing 60 RGB images and annotated images are divided into a 5:1 ratio for the training and testing process. At this rate, both the actual crop-field and label images are applied for various augmentation operations like rotation, horizontal flipping, vertical flipping, height shifting, width shifting, zooming, and shearing. In order to create a valid pair of actual and label images during the augmentation process, these augmentation operations must be applied in the same order on both, the actual field images and the label images. This is an extremely crucial task when augmenting the training images of encoder-decoder based segmentation model. The effect of each augmentation operations on a sample actual and label image, with this augmentation process, a new dataset containing 750 training images and 100 testing images is created, and every image is resized to $224 \times 224 \times 3$.

3.2 Proposed Model Architecture

To achieve the precise crop-weed segmentation, a model called Reduced Residual U-Net Convolution (RRUNC) is proposed in this work, which is an Encoder-Decoder based U-Net architecture (Ronneberger et al. 2015) where depth-wise separable convolution is used as core convolution operation. It contains two major sections, namely the contracting path and expanding path. This architecture has 19 convolution layers in total, which is fewer than some of the top architectures, including VGG19 (Simonyan & Zisserman 2014), SegNet (Badrinarayanan et al. 2017), and Deep UNet (Li et al. 2018). The structure of the proposed RRUNC architecture is illustrated in Figure 3.

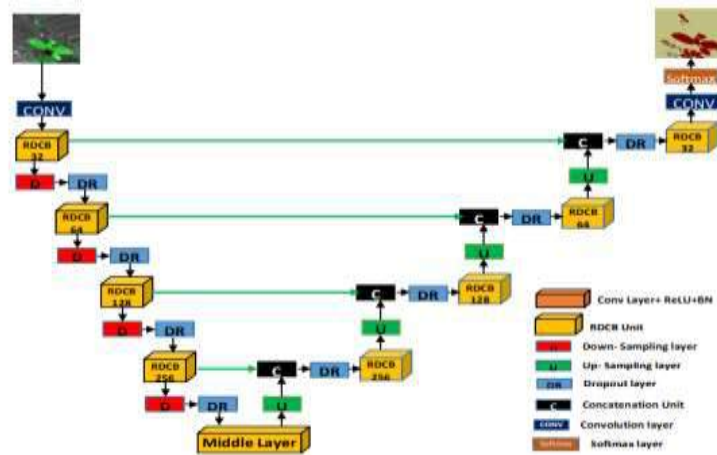


Figure 3. The Structure of proposed Reduced Residual U-Net Using Convolution (RRUNC) Model Architecture

In the proposed RRUNC, a Residual Deep Convolution Block (R-DCB) is introduced. Among the 19 convolution layers, 16 convolution layers are organized as 8 R-DCB units (in which 4 units are located in the contracting path; 4 units are located in the expanding path), one-layer acts as the middle layer, and two layers are used to input and output the image. Additionally, a down-sampling layer and a dropout layer are added in the contracting path following each R-DCB unit, and an up-sampling layer is added corresponding to the down-sampling layer in the expanding path. Going deeper into the contracting path, the number of filters used in the R-DCB unit is increased as 32, 64, 128, and 256 which is lesser than the number of filters used in the modified U-Net network (Xie et al. 2018), and the reversed order is used in expanding path. The middle layer contains 512 numbers of filters.

Here, the output of each R-DCB unit in the contracting path is integrated with the same level of R-DCB unit in the expanding path using a concatenation path via the concatenation unit. The output of each contracting path R-DCB unit is combined with the feature map from the appropriate up-sampling layer using the concatenation path and concatenation unit, which is then fed into the R-DCB unit. Hence, the location information from the contractive path is integrated with contextual information in the expanding path to form generalized information that helps to obtain excellent segmentation accuracy.

3.3 Residual Deep Convolution Block (R-DCB)

The structure of the R-DCB unit is shown in Figure 4. Each unit contains two convolution layers and one residual connection. Each convolution layer is followed by the ReLU activation layer and Batch Normalization (BN) layer to increase the segmentation accuracy and its outputs are represented by y_1 and y_2 . Assume x , y are the input and output of an R-DCB unit, the ReLU activation function and Batch Normalization are represented by σ , the convolution operation is represented by M_{ci} and the function of the RDCB unit is represented by $MR\text{-}DCB(x)$ respectively. The mathematical form of y_1 and y_2 are mentioned in Equations (3.1) and (3.2) respectively.

$$y_1 = \sigma (M_{c1} (x)) \quad (3.1)$$

$$y_2 = \sigma (M_{c2} (y_1)) \quad (3.2)$$

$$= \sigma (M_{c2} (\sigma (M_{c1} (x)))) \quad (3.3)$$

The residual connection layer adds both outputs y_1 and y_2 and then it is fed into ReLU activation layer and BN layer whose output is represented in the Equation (3.4).

$$y = MRDCB (x) = \sigma (y_1 + y_2) = \sigma (\sigma (M_{c1} (x)) + \sigma(M_{c2} (\sigma (M_{c1} (x))))) \quad (3.4)$$

The residual connection path in the RDCB unit facilitates local residual learning to improve the information flow among the architecture blocks. It will improve the representation capacity of the model and will curtail the error rate of the segmentation with the smaller dataset. So, the corner features of the crops and weeds can be predicted accurately.

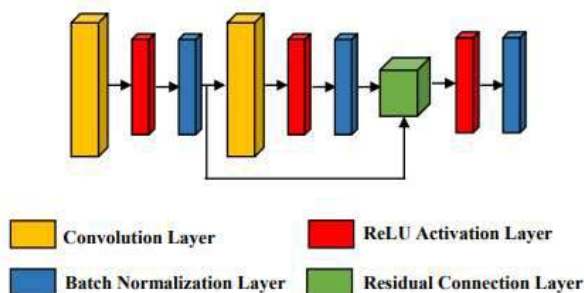


Figure 4. The Structure of Residual Deep distinguishable Convolution Block (RDCB) Unit

3.4 Pruning the Model

Usually, the machine/deep learning model is the core component of computer vision applications. Since the target environment (agricultural land) includes resource-constrained devices, building a real-time computer vision application to aid farmers requires a smaller size model. Although larger deep learning models may perform better in a lab environment, they are more difficult to implement in devices with limited resources. Even though it has been deployed, it fails to give better results. For this, the proposed deep learning model has been compressed using filter pruning.

After building the final model, the model will undergo a training process till achieving better validation accuracy and test accuracy. Subsequently, the model will be exposed to the pruning process to reduce the size of the model (Gaikwad & El-Sharkawy 2018, Mao et al. 2019). During the pruning process, the redundant and insignificant connections and their corresponding lowest magnitude weights are iteratively eliminated. So, the connection between the channels will become sparse. This pruning process achieves significant size reduction in the final model and it can be delivered by less than ~3MB in size without significant recession in performance.

IV. EXPERIMENTAL ENVIRONMENT DESIGN

The design of the experimental environment for implementing the proposed model and the evaluation metrics used to measure the performance of the proposed model are discussed here.

4.1 Experimental Setup

All the models utilized in this work are based on Tensor Flow and Keras framework. These models have been experimented on the online Google Colab platform which provides NVIDIA TeslaT4 GPU with CUDA Version 11.2, RAM of 13 GB, and Disk Space of 68 GB. Google Colab is a Google product that allows python code to be run on a cloud environment via a web browser, and hence there is no hardware restriction for it. Simple computers with an internet connection are capable of running it.

The proposed network is trained from the scratch using a dataset of 750 RGB images and its equivalent annotated images or labelled images; each image is a size of $224 \times 224 \times 3$. For tracking the performance of the model during training epochs, the training dataset is split into training and validation datasets using the cross-validation method. Since the `validation_split = 0.2` is used here, 20% of the images from the training dataset are brought into the validation set. Hence, 600 images are used for the training process and 150 images are used for the validation process in every epoch. When cross-validation is used, images from training and validation datasets are shuffled between them on each training epoch. Hence, all the images in both the training and validation dataset are

utilized for training the model. Even though the training and validation split reduces the training samples, it will not degrade the model performance because of the cross-validation method.

Later, for testing the trained model, a separate test data set is built using a holdout method, which contains 100 crop field images and their equivalent label images. The holdout method for training and testing split was chosen because it helps to evaluate the model's ability in segmenting the weed and pest portions on unseen images.

The proposed model is trained with 80 training epochs with the batch size as 5 images per batch and each epoch contains 120 steps. The loss function used here is categorical_cross_entropy. Since, it has three classes which are crop, weed, and soil, this loss function is quite suitable. This measures the cross-entropy loss between the label and prediction. For this, labelled images are transformed into one-hot representations for facilitating the comparison between prediction and labels. During the training, the loss between the prediction and labels is optimized utilizing an ADAM optimizer with a learning rate of 0.001. It is a stochastic gradient descent method that depends on the adaptive estimation of first-order and second-order moments.

After pruning the model, two more training epochs were implemented for fine-tuning the model. The other significant deep learning architecture like SegNet (Badrinarayanan et al. 2017), U-Net (Xie et al.2018), and Residual U-Net (Yang et al. 2019) are implemented and their architecture configuration details are given in Figure 5. These architectures are trained with the same augmented CWFID dataset in the same experimental setup and the performance is evaluated for comparison.

Layer	Kernel Size	No of Layers	No of Filters	Output Shape
Conv_IP	3×3	1	64	224×224×64
Conv_1C	3×3	2	64	224×224×64
R_ConC1	-	-	-	224×224×64
Down_sampl	2×2	1	-	112×112×64
Conv_2C	3×3	2	128	112×112×128
R_ConC2	-	-	-	112×112×128
Down_sampl	2×2	1	-	56×56×128
Conv_3C	3×3	2	256	56×56×256
R_ConC3	-	-	-	56×56×256
Down_sampl	2×2	1	-	28×28×256
Conv_4C	3×3	1	512	28×28×512
R_ConC4	-	-	-	28×28×512
Down_sampl	2×2	1	-	14×14×512
Conv_Mid	3×3	1	512	14×14×512
Up_sampl	2×2	1	-	28×28×512
Concat_1	-	-	-	28×28×1024
Conv_1E	3×3	1	512	28×28×512
R_ConE1	-	-	-	28×28×512
Up_samp2	2×2	1	-	56×56×512
Concat_2	-	-	-	56×56×768
Conv_2E	3×3	2	256	56×56×256
R_ConE2	-	-	-	56×56×256
Up_samp3	2×2	1	-	112×112×256
Concat_3	-	-	-	112×112×384
Conv_3E	3×3	2	128	112×112×128
R_ConE3	-	-	-	112×112×128
Up_samp4	2×2	1	-	224×224×128
Concat_4	-	-	-	224×224×192
Conv_4E	3×3	2	64	224×224×64
R_ConE4	-	-	-	224×224×64
Conv_OUT	3×3	1	3	224×224×3
Softmax	-	-	1	224×224×3

Figure 5. The configuration of Residual U-Net architecture

4.2 Evaluation Metrics

In this work, six metrics are used to evaluate the performance of the model, which are

- Accuracy (A),
- Error-rate (E),
- Overall Precision (OP),
- Overall Recall (OR),
- Overall F1 score (OF),
- Number of Parameters (NoP)

Accuracy (A) states that the percent of the pixels in the prediction image is predicted correctly. Error-rate (E) is expressed as the rate of pixels in the prediction image is predicted wrongly, when compared to label images. Overall Precision (OP) is expressed as the ratio of correctly predicted positive observations to all predicted positive observations. Over Recall (OR) is the ratio between the number of correctly predicted positive observations and the total number of observations in the actual class. Overall F1 score is a metric that considers both OP and OR and it is a harmonic mean of OP and OR.

The mathematical forms of the above metrics are mentioned in Equations 4.5 to 4.9, respectively. The Number of Parameters (NoP) generated by the model is a total number of the learnable elements of all the convolution layers in CNN for deep convolution respectively.

$$\text{Accuracy (A)} = (\text{OTP} + \text{OTN}) / (\text{OTP} + \text{OTN} + \text{OFP} + \text{OFN}) \quad (4.5)$$

$$\text{Error-rate (E)} = -Y_j * \log(P_j) \quad (4.6)$$

$$\text{Overall Precision (OP)} = \text{OTP} / (\text{OT P} + \text{OFP}) \quad (4.7)$$

$$\text{Overall Recall (OR)} = \text{OTP} / (\text{OTP} + \text{OFN}) \quad (4.8)$$

$$\text{Overall F1} = 2 \times \text{Overall Precision} \times \text{Overall Recall} / (\text{OP} + \text{OR}) \quad (4.9)$$

where OTP is Overall True Positive, OTN is Overall True Negative, OFP is Overall False Positive, OFN is Overall False Negative, t is the total number of samples, P_j represents the j th predicted output of the model, and Y_j represents the corresponding j -th target pixel value.

$$\text{Accuracy (A)} = (\text{OTP} + \text{OTN}) / (\text{OTP} + \text{OTN} + \text{OFP} + \text{OFN}) \quad (4.10)$$

V. RESULTS AND DISCUSSION

At first, the deep learning architectures SegNet (Badrinarayanan et al. 2017), U-Net (Xie et al. 2018), Residual U-Net (Yang et al. 2019), and proposed RRUSC (Reduced Residual U-Net using Standard Convolution) networks are implemented with a standard convolution technique. These models are trained using the training parameters mentioned in Table 1. The metrics of the proposed architecture RRUSC are considerably good, achieving a segmentation accuracy of 96.14% at validation time and 95.37% at testing time, which is higher than that of others. The overall F1 score achieved by the proposed RRUNC is also good and better than other state of the art models. So, it is computationally very expensive since it is implemented using a standard convolution technique.

Table 1. Training Parameters

Training Parameters	Values
Batch size	5
Steps per epoch	120
Learning rate	0.001
Optimizer	ADAM optimizer
Loss function	categorical cross_entropy

As part of the crop-weed segmentation task on the CWFID dataset, Hashemi-Beni et al. employed FCN-8s, FCN-16s, FCN-32s, and U-Net deep learning models (Hashemi-Beni et al. 2022). The performance comparison of the proposed RRUNC model with the existing work is presented in Table 2. From Table 2, the proposed Pruned RRUNC achieved a better segmentation accuracy of 96.06%, when compared to that of the existing models.

Table 2. Comparison with existing work

ModelName	A (%)	NoP (Million)	Model Size (MB)
FCN-8s	81.1	-	-

FCN-16s	77.2	-	-
FCN-32s	68.4	-	-
U-Net	77.9	-	-
Proposed Pruned RRUNC	96.06	0.655	2.34

A-Accuracy, NoP-Number of Parameters, -Not given in the paper

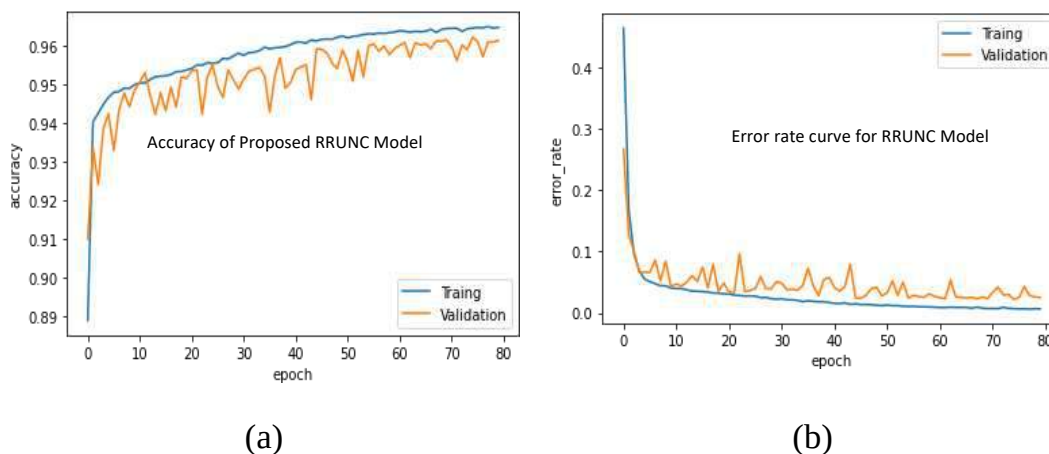


Figure6. Learning curves of the proposed RRUNC Model,

a) Accuracy curve, b) Error rate curve

VI. CONCLUSION

An encoder-decoder based deep learning model, named Reduced Residual U-Net using Convolution (RRUNC) network is proposed in this work for crop-weed segmentation. Residual Deep separable Convolution Block (R-DCB) was introduced. The proposed model is constructed in a computationally effective manner without degrading the performance of the model. The performance of this proposed model was evaluated using the benchmark dataset Crop Weed Field Image Dataset (CWFID). The experimental findings show that the proposed deep learning-based RRUNC model outperformed well in terms of segmentation results with good accuracy and less error-rate. This proposed smaller model size is more suitable to build a lightweight computer vision application for weed portions and pest detection on agricultural land. It is also easily deployed on resource-constrained portable devices used by the farmers in the agricultural field.

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**PERFORMANCE ANALYSIS OF TRADITIONAL DEEP LEARNING-BASED MODEL:
RF-DCNN CLASSIFIER WITH CCNN**

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Abstract

Data mining is essential in the healthcare industry. In this study, we created predictive ensemble models that are well-suited for multiclass dermatitis by combining several basic and weighted rules. The results obtained in this research were contrasted with other information from previous studies to showcase the efficacy of our method. We conducted numerous technical studies utilizing the identical data but different classification methods to evaluate the effectiveness of the suggested skin classification treatment, and subsequently established a multi-model ensemble approach to assess its efficiency. Following this, we employ a multi-model ensemble method to merge the two data mining techniques in order to achieve a maximum accuracy.

Keywords: Accuracy, Dermoscopy, Texture, Classifier, Conventional.

Introduction

The skin is the primary component of the human body. The skin protects the body from UV rays, diseases, injuries, temperature, and harmful radiation, while also assisting in the production of vitamin D3. Since the skin plays a crucial role in regulating body temperature and defending against skin issues, it's essential to maintain its health. Skin conditions may seem benign, but they can pose a threat if not managed correctly. Numerous illnesses exhibit initial symptoms that are often similar, posing a challenge in early diagnosis. Skin disorders can lead to psychological issues as well as physical problems, especially for individuals with facial scarring or deformities. Skin can be affected by a variety of external and internal factors. Some of the factors that impact skin disorders include artificial skin damage, harsh chemicals, challenging illnesses, an individual's immune system, and genetic abnormalities. Skin conditions greatly impact individuals' overall well-being. Treating skin conditions is particularly difficult in the field of science due to the complexities involved in managing symptoms and their variability in different circumstances. Skin conditions are common among various ailments, and using inappropriate treatments for those conditions can lead to adverse consequences. People often contract skin diseases that require prompt treatment.

Literature Review

Imaging Techniques for Skin Lesion

Multiple imaging methods have been identified for examining skin lesions. Photography is the simplest perception method, providing an image of the skin's outer layer. The next phase involves using a polarized light camera in dermoscopy techniques, which reduces surface reflections and highlights the image of the epidermis, the second skin layer. Because of this, it is simpler to predict the formations of lesions like dots, globules, and networks, which are the primary signs of diagnosing skin lesions. Dermoscopy is a technique that enhances the link between medical science and specific visual traits, creating a new form of imaging called epiluminescence microscopy (ELM). This approach has provided a new way to explore pigmented skin lesions through clinical examination of morphological markers. Additionally, ultrasound can visually perceive the lesion, providing another method of diagnosis. Ultrasound imaging is commonly employed to measure the depth of skin lesions, and if there are no differences from healthy skin, then both regions will appear identical. At this stage, the expert examines lesions and employs high-frequency ultrasound (over 30 MHz) to assess how deeply they have infiltrated in order to ensure precise incision and proper surgical approach. On the other hand, optical coherence tomography (OCT) and confocal laser scanning microscopy (CLSM) are also available modalities. Examining with the naked eye has limited sensitivity in detecting early abnormalities such as a lesion. In this specific situation, several non-invasive techniques for examining skin lesions like dermoscopy are utilized. The focus is on

body photography while the other is the confocal technique.

Medical Diagnostic Criteria in Dermatology

Dermatologists use certain diagnostic criteria to distinguish between various types of lesions. Some of these criteria are related to the set of patterns and colors that are observed in the skin lesion images. The first method was proposed in 1985 by Friedman et al. [1] to diagnose skin lesions is called pattern analysis. This method considers a set of patterns, also called global features, that can be found in each type of skin lesions. A specific pattern is characterized by one or more fundamental skin structures by local features (image descriptors) that can cover parts or the entire lesion. In addition, there are a variety of diagnostic approaches such as ABCD rule, Menzies technique, 3-point and 7-point checklist to evaluate lesion structures and patterns, using non-invasive imaging system [2,3]. The standard diagnostic rule of skin lesion is ABCD in the domain of dermatological was suggested in 1994 by Stolz et al [4]. Precisely, the following rule used to evaluate the properties of lesion as asymmetrical, border, color and, diameter [4,5].

Computer Aided Diagnostic System

The primary phase of homogeneous framework is preprocessing. It usually performs the color transformation, image restoration and removing artefacts. Conditions in which lesion images are acquired, directly influence the key features which can be used to discriminate the samples of lesion. Rahman [13] contented that recovery and lesion classification tasks that might be challenging when capturing images are from separate datasets or devices under different conditions (such as lightening). Due to this, a non-uniform pattern of illumination is generated that can disturb complete diagnostic procedures of skin lesion. One of the approaches proposed in the literature is to tackle such challenges by commencing the color calibration of the image acquisition device [14]. Abbas et al. [15], proposed an approach which can enhance the contrast of skin lesion image by making adjustments and map the pixel intensity values of lesions within the stated range of CIE L^*a^*b color space. One major flaw in contrast enhancement in the region with a relatively small intensity range is over noise amplification. These limitations may be addressed by using Contrast Limited Adaptive Histogram Equalization (CLAHE) [16]. The presence of artifacts, usually called noise, is a major obstacle for successful diagnosis of skin lesion by medical imaging. Furthermore, intact skin artifacts are hair shaft, dermoscopic gels, thin blood vessels, shadows, ruler markings, specular reflections, vignetting and air bubbles that can misrepresent diagnosis and hinder the accuracy of automated diagnosis system [17,18].

The change in human opinion about lesions boundary tracing equally promotes for automated approach related to lesion border approximation using segmentation. Dermatologists have reportedly used higher-level knowledge to estimate the lesion border, resulting in the average reproducibility of segmentation results. However, Silletti et al. argued that the state-of-the-art related to automatic segmentation approaches, with the exception of the Fuzzy C-Means (FCM), were poorly performed in comparison with expert dermatologists. The complexity can be attributed, along with many other things such as low contrasts, damage to surrounding skin, blurred boundaries, the existence of artifacts and irregular structures characterizing the skin lesion images. Readers can refer to the pre-processing techniques in the above section for enhancing image contrast and removing other artefacts typically found in global and local image processing in microscopic images. A part of literature, suggested that the tumor areas manually extracted by dermatologists have been found to be inconsistency, sometimes by their characterize attributes, to validate the same by automated segmentation approach, can also help to assist in the reproducibility of results. Recently, to achieve better support for computer diagnosis, the current literature has seen a significant improvement in lesion segmentation from the surrounding healthy skin parts. However, Chang et al. argued that the fully automatic segmentation of all types of skin lesion images is not practical due to image modality and that is why the acquisition of skin lesion images becomes even more complex and certainly important. In some of the findings, for better segmentation results, Karkunen Loeve Transform (KLT), commonly known as the Principal Component Analysis (PCA), has been used to improve the edges of the lesion image. The literature specifies that, in order to achieve comparable lesion segmentation using ensemble methods, bottom-hat and top-hat transformations have been used to

enhance the contrast of lesion images. The literature has charted the numerous border detection approaches that can help to segment the pigmented skin lesion from the neighboring region in an automated mode.

Proposed Methodology

This chapter provides an overview of ensemble learning for classification tasks. Specifically, it focuses on structured skin disease analysis for disease classification. In this chapter, two phases are proposed: Phase one, identifies the most appropriate datasets. Phase two proposed competitive ensemble classification model. It consists of multiple classification models which compete with one another to choose the most appropriate classifier for dataset. These two phases help to improve the classification performance of structured skincare data.

Classification is one of the most important decision-making techniques for selecting data. In this method, the main aim of research is to build Intelligent Skin Disease Prediction System to predict the data as presence of skin disease for improving the classification accuracy. This section comprises of proposed ensemble learning method for classification tasks to prediction of skin disease by classifier are briefly explained.

Convolution models in melanoma diagnosis

In simple words, CNNs are a type of feed-forward neural network that uses a mathematical convolution operation to extract features from images automatically. These features are passed to successive layers that learn more abstract features from previous ones until a final output is yielded, simulating some of the human visual cortex. Consequently, CNNs can build more complex concepts from simpler ones, e.g., they can learn to detect a human face based on more straightforward ideas as a nose and mouth, which are known from much simpler ones such as corners and contours. As a matter of example, Figure illustrates a simple CNN model that learns to predict whether or not a patient has melanoma utilizing mapping the extracted features into more abstract feature spaces. The general layout of CNN architecture is significant, including layers, activation function, and hyper-parameters. Layers in CNN are mainly categorized into convolutional, pooling, and fully connected layers. An activation function is a transformation function that maps the input signals into output signals required for the neural network to function. Popular activation functions include linear activation, Sigmoid functions (logistic and hyperbolic tangent functions), Rectified linear units (ReLU), also known as piecewise linear functions, Exponential Linear Unit, and Softmax. Hyper-parameters include filter kernel, batch size, padding, learning rate, and optimizers, etc. Optimizers are used to produce maximum performance from a network model. Examples include Adam, Rmsprop, Nesterov, and Sobolev gradient based optimizer.

Image datasets for the melanoma diagnosis

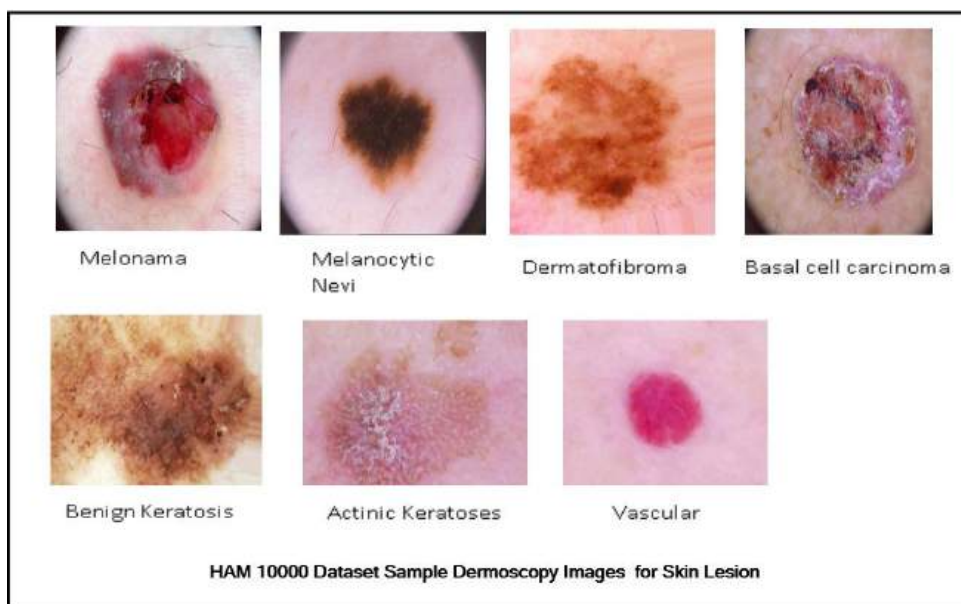
Due to the incidence of melanoma is continuing to increase worldwide, in the last few years, several private and public datasets have been published, thus allowing a better study of this illness and, therefore, the design of better approaches for its automatic diagnosis. The most popular private data collections of dermoscopic images are the Interactive Atlas of Dermoscopy, Dermofit Image Library, and the dataset presented, which conducted a comparison with 21 dermatologists using 129,450 clinical images. Regarding public datasets for studying melanoma, the most extensive collection of datasets can be found in the ISIC repository, which comprises images labeled by expert dermatologists.

The 10015 dermoscopic images of the HAM10000 training set were collected over a period of 20 years from two different sites, the Department of Dermatology at the Medical University of Vienna, Austria, and the skin cancer practice of Cliff Rosendahl in Queensland, Australia. The Australian site stored images and meta-data in PowerPoint files and Excel databases. The Austrian site started to collect images before the era of digital cameras and stored images and metadata in different formats during different time periods.

Dermoscopy is a widely used diagnostic technique that improves the diagnosis of benign and malignant pigmented skin lesions in comparison to examination with the unaided eye. Dermoscopic images are also a suitable source to train artificial neural networks to diagnose

pigmented skin lesions automatically. Recent advances in graphics card capabilities and machine learning techniques set new benchmarks with regard to the complexity of neural networks and raised expectations that automated diagnostic systems will soon be available that diagnose all kinds of pigmented skin lesions without the need of human expertise.

The dataset is essential for training the neural networks we propose for automated diagnosis. The dataset entitled HAM10000 is the skin disease dataset that has been taken out from Kaggle, which has functioned as a baseline database retrieved from the source ISIC archive webpages. Furthermore, the vast majority of research do not use a traditional exploratory technique and only use a small number of datasets. The dataset includes age, gender, and cell type in metadata format, such as a comma-separated values file (.CSV). More than 10,000 dermoscopic data were gathered from people all around the world for this collection. The dataset also includes extra recommendations and methods for dealing with the issues like over-fitting and insufficient data, which will aid in improving the model's accuracy and performance. Melanocytic Nevi (NV), Benign Keratosis-like Lesions (BKL), Dermato-fibroma (DF), Vascular Lesions (VASC), Actinic Keratoses (AKIEC), Basal-Cell Carcinoma (BCC), and Melanoma are the seven categories of skin issues in this dataset. The number of skin samples in each type of lesion contained in the sample is imbalanced. To eliminate this variance, we used data augmentation techniques to bring all classes of lesions into the same digital image range. To improve model generalization, the dataset is separated into three parts: 85 percent training data, 5 percent validation data, and 10 percent testing data. The actual facts connected with the training dataset are used to evaluate the model. The image in our suggested model should be 224 224 pixels wide. The focus of this research is to see how accurate our suggested technique is in diagnosing skin cancer on dermoscopic data. Figure 2 shows the HAM 10000 Dataset Sample Images.



HAM 10000 Dataset Sample Images

Pre-processing Skin Lesion Images

By boosting image quality, the model's ability to generalize can be increased. Preprocessing can reduce the quantity of redundant data in a visual while increasing the intensity of the vital data, simplifying the data, and improving reliability. The word "image resizing" refers to the process of resizing an image. An image size is either boosted or decreased in magnitude to solve the issue of varied pattern sizes in the database. All image will have the same amount of characteristics if the image size is reduced. Additionally, reducing the visual reduces processing time, improving system speed.

Data preparation is the first step in the approach provided in this research article. The preparation of data step includes, the information gathered from records is not always accurate and may contain noise, erroneous or missing numbers, or data that is inconsistent. For our studies, each input sample

image is required to obtain features such as colour, texture, and form. As a result, we must use a variety of data cleaning techniques to eliminate such abnormalities. Even after cleaning, the data are not ready for mining since they are in multiple formats that cannot be utilized directly, thus the data must be transformed into mining-friendly formats. Normalization is the transformation used to achieve this; smoothing, aggregation, and other techniques are also utilized.

Ensembles Method for skin images for a fine-tuned models

The ensemble approach is employed in this research work to increase the performance of algorithms by determining the correctness of the skin disease dataset. Using the Random Forest technique and Convolutional Neural Networks (CNNs), framework analyze two alternative ensemble machine learning techniques.

Random Forest Technique

The Random Forest technique is suitable for the construction and analysis of very large datasets. To improve accuracy and performance, the Random Forest classifier was used. We suggest using random forest algorithms in this study to increase the reliability of skin image segmentation and classification, and comparing them to HAM 10000 data sets. The suggested approach may produce high-resolution feature maps that can aid in the preservation of picture spatial information. This model is both simple and smart, and it performed well in even the most difficult cases. Random forest aids in the construction of a number of decision trees and finally outputs the class to which the input variable belongs, according to Man et al. In our study, random forest helps to address the over-fitting problem that is common with decision tree training set data. To tree learners, they employ bootstrap aggregating approaches. There is a potential of forming a link between the kernel techniques and the random forests, which is commonly referred to as the kernel random forest, which is easier to grasp and interpret. This algorithm's predictive enactment can compete with the greatest supervised learning algorithms, and it provides a constant feature location estimate.

Random forests are a type of meta estimator that seeks to train a number of decision tree-based classifiers on distinct sub-samples of a given dataset while also using averaging principles to improve predicted accuracy and avoid over-fitting. The random forest algorithm entails a large number of different decision trees that work together as an ensemble, and provide a class prediction, with the most votes being the model prediction.

Any of the unique structural model will be outclassed by a large number of substantially uncorrelated trees acting as a committee. The poor correlation across different models is the key issue. The random forest algorithm's trees will protect each other from their discrete faults. Individual decision trees have been proven to be effective for skin lesion classification, however a collection of trees can progress in the right direction even if some of them are incorrect, resulting in total accuracy that is greater than individual decision trees. Because of the large number of decision trees that contribute to the process, the random forests method is regarded a very exact and robust model. Furthermore, it avoids the problem of overfitting since it takes the mean of all the predictions, which cancels the biases.

Algorithm for RF-DCNN Classifier:

Input: HAM 10,000 image dataset

Output: classified into different skin disorder classes

Begin

To extract multi-level features, map the features of skin visuals from the input domain (HAM10000) to the ensemble deep neural network (RF-DCNN);

Get the multi-level distinctive features that were extracted;

for(each input skin image)

Train the RF-DCNN from start to the end;

Get the skin visuals with the two-step feature extracted;

Provide the RF-based DCNN classifier with the features extracted skin data;

Sort the various types of skin conditions into categories;

endfor

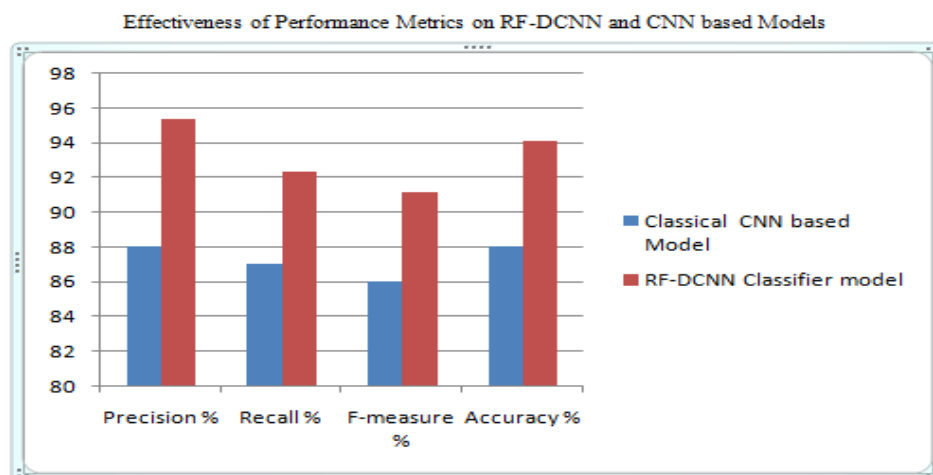
End

Findings of the Research

The performance measures of the suggested models, mean-accuracy, precision, re-call, and f1-score, were utilized to evaluate the performance of the RF-DCNN Classifier model. The performance of the RF-DCNN model is evaluated in this section using the HAM10,000 database using Python 3.6, with HAM visual images from each class being randomly picked for training. This study aided in the development of a system for forecasting skin disorders. Because regulators and medical institutions have never had a comprehensive plan for establishing information systems, this research is the most recent discovery. This might be due to a lack of human resources with formation technological competence and insufficient human resources for information systems. When applied to dermatological datasets, the ensemble technique and feature selection produce better results than individual classifier systems. The ensemble technique is more accurate and effective at predicting skin diseases. Table 4.1 shows how individual deep learners from classic CNN compare to the proposed ensemble classifier in terms of classification performance. Figure shows the performance of the Data mining is essential in the healthcare industry. In this study, we created predictive ensemble models that are well-suited for multiclass dermatitis by combining several basic and weighted rules. The results obtained in this research were contrasted with other information from previous studies to showcase the efficacy of our method. We conducted numerous technical studies utilizing the identical data but different classification methods to evaluate the effectiveness of the suggested skin classification treatment, and subsequently established a multi-model ensemble approach to assess its efficiency. Following this, we employ a multi-model ensemble method to merge the two data mining techniques in order to achieve a maximum accuracy of 96.1 percent. We reached the highest accuracy in the literature on the skin disease dataset. Learning model rather than the newly presented model.

Performance analysis with traditional deep learning-based models

Percentage of performance for various metrics	Classical CNN based Model	RF-DCNN Classifier model
Precision %	88	95.42
Recall %	87	92.33
F-measure %	86	91.17
Accuracy %	88	94.10



The integration model enhanced some of older CNN models with mean-accuracy, precision, f1-score and re-call, as shown in the table 1. Performance evaluation criteria such as accuracy, sensitivity, and specificity may be used to compare skin lesion segmentation and classification performance. We identified various state-of-the-art methodologies for performance comparison in this research, and

the results are displayed in Table 2 below. In this comparison, words like true positive (TP), false positive (FP), true negative (TN), and false negative (FN) are commonly employed (FN). Since the layers are maintained and imported from a previously trained network. The study uses two separate classification methods: the random forest Classifier and the Deep Convolutional Neural Networks Classifier. We reached the greatest mean-accuracy of 96.1 percent after using these strategies.

model we showed in the study stated in Table employed a lot of the same data segmentation. Combined models have a more accuracy, indicating that the combination method identifies seven types of skin disease more effectively than the deep neural network alone. The proposed approach combines the possibilities of predicting different models and incorporates in-depth features from many well-trained and well-configured DCNNs at multiple output levels. This study discusses several data mining strategies for predicting skin diseases. To identify the prediction of skin illness, two machine learning approaches are used: random forest classifier and CNN.

Conclusion

This study aided in the development of a system for forecasting skin disorders. Finally, in the healthcare business, data mining is crucial. In this work, integrated Predictive heterogeneous ensemble models that work well for multiclass dermatitis are developed using a number of simple and weight-bearing rules. The results acquired in this study were compared to other data found in the literature to demonstrate the effectiveness of our technique. We used a large number of technical studies using the same information but various classification techniques to compare the efficiency of the proposed treatment of skin classification, and then developed a multi-model ensemble method to compare the efficiency of the proposed treatment of skin classification. After that, we use a multi-model ensemble approach to combine these two data mining techniques to get the greatest accuracy of percent.

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Abstract

Ensemble classifications are the most significant techniques in the field of ML and choosing the suitable classifier is a challenging task. As a result, the primary goal of this thesis is to identify the appropriate classifier for competitive among various classifiers. This proposed algorithm helps to identify suitable combinations of methods which provide better classification output in terms of accuracy for different classifications of skincare problems using Dermatology publicly accessible dataset ISIC2019 images. Moreover, exploring different combination methods provides better classification out comes on Dermatology datasets and is able to categorize skin disorders.

Keywords:

Skincare, Dermatology, Scaling, Lesion, Detection

Introduction

To solve the skin lesion localization problem by approximating the correct boundaries of it. The approaches used for boundary detection are divided into three parts as manual, semi-automated, and automated approaches to image segmentation. The adopted approach in this thesis is based on self-learning model of neural network. This approach mimics the behavior of visual cortex to perceive the localized object as a lesion. The procedure is based on automated delineation of lesion boundaries for all class skin lesions. The proposed approach performs the activity in minimum computation time with improved accuracy.

To extract features from the skin lesion images which give the clinically relevant information. This information is useful for the understanding of dermatologists and helps to interpret the abnormalities in skin lesion images. However, the clinical inspired system is difficult to implement, but the approaches discussed in the thesis characterize the clinical attributes of the lesion in image space.

To perform the categorical recognition of all ten classes of skin lesions, more vibrant feature descriptors are required. Therefore, there is a need for a competent approach that can empirically improve the feature extraction process for skin lesion recognition in a diagnostic system of dermatology. The robust approach is able to recognize multi-class samples of skin lesions.

Lesion Segmentation

This is a difficult task that literature has carefully researched. The wide range of lesion shapes, sizes, and colors, as well as various skin types and textures, make it crucial to develop an accurate segmentation technique. A lesion border approximation is a needed step for proper extraction of features and consequently describe the characterization of lesions. To avoid miss-classification, there is a demand of appropriate segmentation approach, due to this, these approaches is categorized into manual, semi-automated and automated for a variety of CAD systems used for skin lesion diagnosis. The change in human opinion about lesions boundary tracing equally promotes for automated approach related to lesion border approximation using segmentation. Dermatologists have reportedly used higher-level knowledge to estimate the lesion border, resulting in the average reproducibility of segmentation results. However, Silletti et al. argued that the state-of-the-art related to automatic segmentation approaches, with the exception of the Fuzzy C-Means (FCM), were poorly performed in comparison with expert dermatologists. The complexity can be attributed, along with many other things such as low contrasts, damage to surrounding skin, blurred boundaries, the existence of artifacts and irregular structures characterizing the skin lesion images. Readers can refer to the pre-processing techniques in the above section for enhancing image contrast and removing other artefacts typically found in global and local image processing in microscopic images. A part of literature, suggested that the tumor areas manually extracted by dermatologists have been found to be inconsistency, sometimes

by their characterize attributes, to validate the same by automated segmentation approach; can also help to assist in the reproducibility of results. Recently, to achieve better support for computer diagnosis, the current literature has seen a significant improvement in lesion segmentation from the surrounding healthy skin parts. However, Chang et al. argued that the fully automatic segmentation of all types of skin lesion images is not practical due to image modality and that is why the acquisition of skin lesion images becomes even more complex and certainly important. In some of the findings for better segmentation results, Karkunen Loeve Transform (KLT), commonly known as the Principal Component Analysis (PCA), has been used to improve the edges of the lesion image. The literature specify that, in order to achieve comparable lesion segmentation using ensemble methods, bottom-hat and top-hat transformations have been used to enhance the contrast of lesion images. The literature has charted the numerous border detection approaches that can helps to segment the pigmented skin lesion from the neighboring region in an automated mode .

Lesion Boundary Detection

Lesion boundary detection is the initial phase in the automated investigation of skin lesion images. It is essential for the following reasons: (a) The boundary structure gives significant information for accurate detection of lesions, (b) Extraction of other essential features such as various structures and colors of lesions. Lesion structure and variegated color is completely depends upon the accuracy of lesion outskirts detection. So, it is quite a challenging task due to the following reasons:

- Low contrast between the region of interest and normal skin region.
- Irregular and fuzzy boundary description
- Various types of artifacts blood vessels, skin hair , air bubbles and coetaneous regions
- Presence of multiple lesion
- Color variegation

This can be performed in the two phases as 1) pre-processing and 2) segmentation.

Pre-processing speed up the boundary detection mechanism by transformation of color space, image contrast enhancement, region of interest approximation, and removal of artifacts. In continuation of this, segmentation performed by the division of an image into disjoint areas that are homogeneous in relation to a selected attributes i.e. luminance, texture and color.

Pre-processing

Image preprocessing is an essential step, while dealing with the entitled images that do not have the excellent quality to be analyzed. These images have the lack of attributes due to the artefacts' such as color transformation, illumination effects, skin hairs, nails and blood dots, etc. Following methods have been discussed in the literature to overcome the image shortcoming and handle them nicely for better diagnosis of skin lesion and develop adaptable diagnostic system. For the color transform, there are different color spaces which can be frequently used for image processing include Red-Green-Blue (RGB), (CIE-L*a*b, CIE-X*Y*Z, CIE-L*u*v), Luma with chrominance (Y'PbPr, YIQ, Y'CbCr, Y'UV), Hue-Saturation-Intensity, Hue-Saturation Value and Hue-Saturation-Luminance (HSI, HSV, HSL). Usually, digitized lesion images are generated as RGB. These images are primarily transform into grayscale for performing scalar image processing to represent the image intensity instead of being accepted as a standard color image. An effort has been made by of Dobrescu et al. To ease down the classification accuracy of a skin lesion by converting the individual image sample used in their study to an image of 256 gray levels. But, over year the requirement of multichannel (vector) processing increases and to take benefit of the lesion's original color information, pigmented skin lesion images are traced directly. Afterwards, the main challenge becomes a computational speed in which there is a requirement of vector images.

The primary phase of homogeneous framework is preprocessing. It usually performs the color transformation, image restoration and removing artefacts. Conditions in which lesion images are acquired, directly influence the key features which can be used to discriminate the samples of lesion. Rahman contented that recovery and lesion classification tasks that might be challenging when capturing images are from separate datasets or devices under different conditions (such as lightening).

Due to this, a non-uniform pattern of illumination is generated that can disturb complete diagnostic procedures of skin lesion. One of the approaches proposed in the literature is to tackle such challenges by commencing the color calibration of the image acquisition device. Abbas et al., proposed an approach which can enhance the contrast of skin lesion image by making adjustments and map the pixel intensity values of lesions within the stated range of CIE L^*a^*b color space. One major flaw in contrast enhancement in the region with a relatively small intensity range is over noise amplification. These limitations may be addressed by using Contrast Limited Adaptive Histogram Equalization (CLAHE). The presence of artifacts, usually called noise, is a major obstacle for successful diagnosis of skin lesion by medical imaging. Furthermore, intact skin artifacts are hair shaft, dermoscopic gels, thin blood vessels, shadows, ruler markings, specular reflections, vignetting and air bubbles that can misrepresent diagnosis and hinder the accuracy of automated diagnosis system.

Reported literature clearly specified that the most frequent artefacts are hair shafts and marks of ruler. It has been observed that a great deal of effort has been made to remove hair shaft and markings by a ruler from skin lesion images. An awesome review by Abbas et al regarding comparative study of state-of-the-art algorithms. After the removal of intact artefacts, there is a challenge of lesion approximation and localization. Although images of skin lesions may be quite large, lesion frequently occurs in a relatively small space. For different reasons, an accurate bounding box (the smallest rectangular axis box that comprises the lesion) may be useful. It gives an estimate of the size of the lesion and its related techniques is discussed in the next section.

Image datasets for the melanoma diagnosis

Due to the incidence of melanoma is continuing to increase worldwide, in the last few years, several private and public datasets have been published, thus allowing a better study of this illness and, therefore, the design of better approaches for its automatic diagnosis. The most popular private data collections of dermoscopic images are the Interactive Atlas of Dermoscopy, Dermofit Image Library, and the dataset presented, which conducted a comparison with 21 dermatologists using 129,450 clinical images. Regarding public datasets for studying melanoma, the most extensive collection of datasets can be found in the ISIC repository, which comprises images labeled by expert dermatologists. The 10015 dermoscopic images of the HAM10000 training set were collected over a period of 20 years from two different sites, the Department of Dermatology at the Medical University of Vienna, Austria, and the skin cancer practice of Cliff Rosendahl in Queensland, Australia. The Australian site stored images and meta-data in PowerPoint files and Excel databases. The Austrian site started to collect images before the era of digital cameras and stored images and metadata in different formats during different time periods.

Dermatoscopic is a widely used diagnostic technique that improves the diagnosis of benign and malignant pigmented skin lesions in comparison to examination with the unaided eye. Dermatoscopic images are also a suitable source to train artificial neural networks to diagnose pigmented skin lesions automatically. Recent advances in graphics card capabilities and machine learning techniques set new benchmarks with regard to the complexity of neural networks and raised expectations that automated diagnostic systems will soon be available that diagnose all kinds of pigmented skin lesions without the need of human expertise.

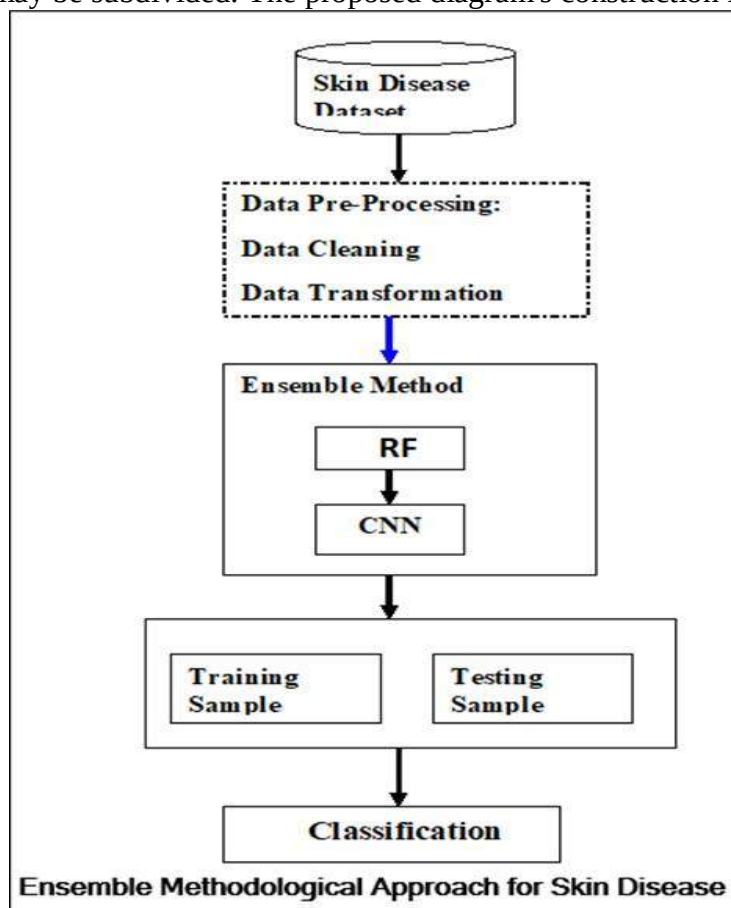
The dataset is essential for training the neural networks we propose for automated diagnosis. The dataset entitled HAM10000 is the skin disease dataset that has been taken out from Kaggle, which has functioned as a baseline database retrieved from the source ISIC archive webpages. Furthermore, the vast majority of research do not use a traditional exploratory technique and only use a small number of datasets. The dataset includes age, gender, and cell type in metadata format, such as a comma-separated values file (.CSV). More than 10,000 dermoscopic data were gathered from people all around the world for this collection. The dataset also includes extra recommendations and methods for dealing with the issues like over-fitting and insufficient data, which will aid in improving the model's accuracy and performance. Melanocytic Nevi (NV), Benign Keratosis-like Lesions (BKL), Dermato-fibroma (DF), Vascular Lesions (VASC), Actinic Keratoses (AKIEC), Basal-Cell Carcinoma (BCC), and Melanoma are the seven categories of skin issues in this dataset. The number of skin samples in

each type of lesion contained in the sample is imbalanced. To eliminate this variance, we used data augmentation techniques to bring all classes of lesions into the same digital image range. To improve model generalization, the dataset is separated into three parts: 85 percent training data, 5 percent validation data, and 10 percent testing data.

Techniques to improve CNN for melanoma diagnosis

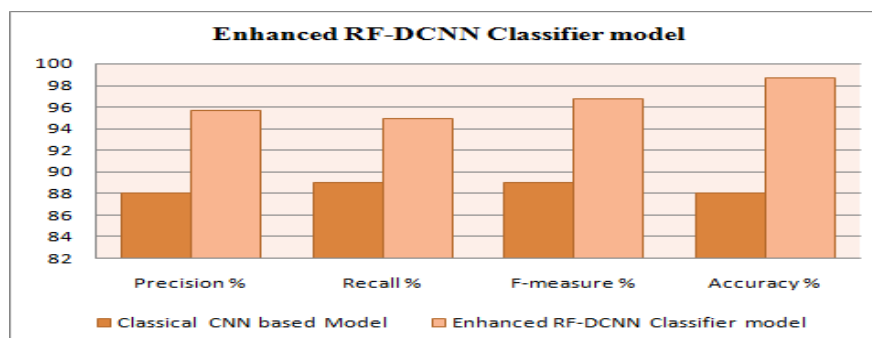
In the last decade, it has been an increasing tendency to develop and use modern CNN architectures to solve complex real-world problems. Researchers also try to apply advanced techniques to train these models better. Here we have summed up four main approaches, namely, transfer learning techniques, data augmentation methods, the development of ensembles of CNNs, and multitask models.

In this section, the Predictive Ensemble Deep Convolution Neural Networks Classifier (RF-DCNN) that is Random Forest Deep Convolution Neural Networks model is briefly described. The purpose of the present study is to develop an effective performance strategy for categorizing ceroscopy images data into seven groups. This section explains how the given approach for identifying, accessing, and analyzing data of skin problems works. The method will be incredibly effective in diagnosing seven different types of skin issues. Preprocessing, feature extraction, and classification are all elements of the architecture that may be subdivided. The proposed diagram's construction is shown in Figure.



Architecture of Enhanced RF-DCNN Classifier based on CNN

Performance for various metrics	Classical CNN based Model	Enhanced RF-DCNN Classifier model
Precision %	88	95.68
Recall %	89	94.93
F-measure %	89	96.78
Accuracy %	88	98.71



Conclusion

The results acquired in this study were compared to other data found in the literature to demonstrate the effectiveness of our technique. We used a large number of technical studies using the same information but various classification techniques to compare the efficiency of the proposed treatment of skin classification, and then developed a multi-model ensemble method to compare the efficiency of the proposed treatment of skin classification. After that, we use a multi-model ensemble approach to combine these two data mining techniques to get the greatest accuracy of 98.71 percent. On the skin illness dataset, we achieve the greatest accuracy in the literature. By employing the first-stage prediction as a feature rather than a separate training, the machine learning-based multi-model collection technique decreases generation mistakes and acquires more information. Furthermore, the complicated interactions between classifiers are automatically learnt using machine learning, allowing the collecting approach to make improved predictions. Furthermore, Enhanced Random Forest Deep Convolution Neural Networks (ERF-DCNN) Classifier has the highest accuracy of any of these approaches, at 98.71 percent. There will be many improvements and extensions in the future. First, the process of getting a skin disease should be in a created smart phone system, then a skin lesion will be found on the skin layer, and finally all the skindiseases in the whole area and the severity of the disease will be detected.

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VARIOUS METHODS AND POSSIBILITIES OF MEDICAL DIAGNOSTIC CRITERIA IN DERMATOLOGY SECTION

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Abstract

Healthcare systems provide personalized services in wide spread domains to help patients in fitting themselves into their normal activities of life. Skin disease is one of the most important serious challenges in the medical field. Since most of the time is wasted in diagnosing the disease. Classification is one of the most important decision-making techniques in many real-world problems. The main objective is to classify the data as skin lesions or healthy skin layers and improve the classification accuracy. Machine learning and deep learning for diagnosis of skin disease, is about learning structures from the skin disease dataset which is provided. Machine learning in recent years have been the evolving, reliable and supporting tool in medical domain.

Keywords:

Diagnosis, Processing, Sensory, Classifier, Disease.

Introduction

This research is focused on the prediction of several common skin disease types of patients based on their personal and clinical information using machine learning classifiers. In this chapter, summarization of the works proposed by various researches in the past decade is done. It is useful to identify the limitations in the works which are proposed in the area of skin disease diagnosis-based machine learning classifiers. The problem in diagnosis of skin disease is a dynamic area in the research field.

During the years, there are several studies has been done on skin disease classification using image processing and machine learning techniques. Before conducting this study a survey was carried to gather the available data on skin disease diagnosis using a machine learning approach. The data were summarized in three categories, that is multi-class, binary and other types of classification studies; to know the current scenario of the technology usage in skin disease diagnosis. This chapter reviews certain aspects of skin lesion having medical orientation. It also provides general information about skin structure and skin abnormalities associated with dermatology, along with some more information about the diagnostic methods used by medical experts. This review not only presents the important work done and published, but also plans to provide general details and ideas on skin lesion issues and attempts to elaborate its medical viewpoints. The limitations of these studies were listed at the end along with the solutions to overcome the same.

Anatomy of Skin

Skin is the longest organ in the human body and provides a cover around the body. It protects from heat, sunshine, injury and infection. Skin also helps to manage the warmth of the body and consists of water, fat, vitamins and minerals of various types. As shown in Figure 2.1, there are two main types of human skin. One is non-hairy (smooth) skin found on the palms and soles, it can be found on the surface as the ridges and sulci, with distinctive patterns for each of them commonly called as dermatoglyphics. It is distinguished by a thick epidermis, which divides them into multiple well-marked layers, as well as a compact stratum corneum, the existence of embodied sensory organs in the dermis, and the lack of hair follicles and sebaceous glands. The second type is hair-bearing skin, made up of hair follicles and sebaceous glands, but lack of encapsulated sensory organs. In addition to this, skin types also differ widely between different types of body.

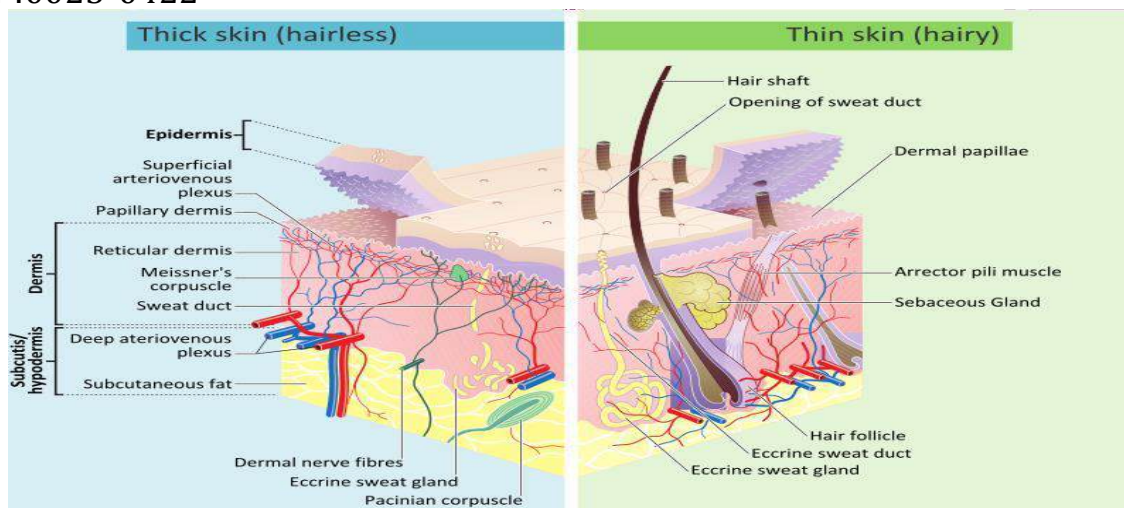


Figure: Human Skin Category

Human skin layers: Skin mainly consists of three primary layers as illustrated in Figure

- The epidermis that provides waterproofing and acts as an infection barrier.
- The dermis that serves as a place for skin appendages including hair.
- Sweat and sebaceous glands refresh the skin surface and hypodermis maintain the thermal control and act as an energy resource

An abnormal lump, bump, ulcer, or colored area and sore on the skin generates skin lesion. In the next section a glimpse of skin lesions and its class is discussed.

Skin lesion

Skin lesions are several types of skin patch which are different from the surrounding area. There is a broad variety of skin lesions that can be categorized in a hierarchical way. Primarily, each lesion is divided according to its source. Malignant lesions such as melanoma build up from melanocytes and the skin cells responsible for the production of a protein pigment called melanin and other class of lesion originated from other types of skin cells, such as the basal or squamous cells. The next step involves the identification of lesion categories, i.e., if it is a malignant neoplasm or benign cells then they define the skin patterns and its pigmentation in related image samples. It can be divided into two groups benign and malignant.

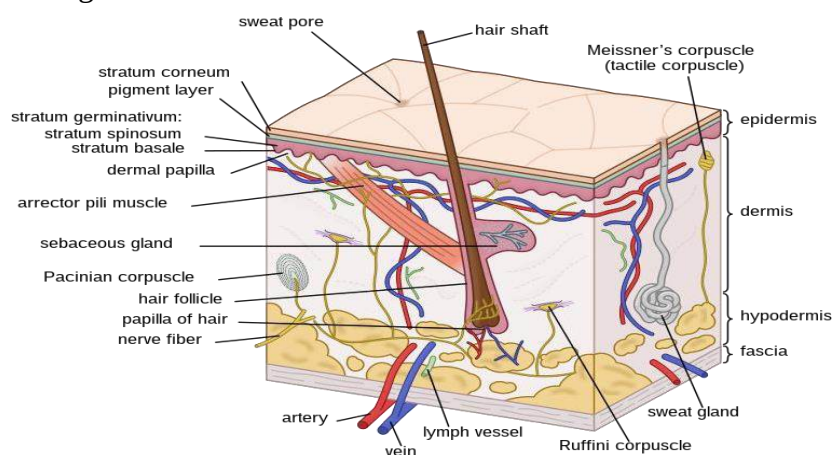


Figure: Layers of Human Skin

There are various sub-groups in each group of samples. Examples, of the these sub-groups or classes in standard data set are pyogenic granuloma (PYO), dermatofibroma (DF) and haemangioma (HAEM) represent benign and another sub-group of lesions or classes are melanoma (ML), squamous cell carcinoma (SCC) and basal cell carcinoma (BCC) represent malignant. Other than that, there is pre-malignant class samples of lesion which can be malignant or benign and difficult to detect, example classes are intraepithelial carcinoma (IEC), actin keratosis (AK), seborrhoeic keratosis (SK). In Figure 2.3 discusses about the sample classes of skin lesion which are available in standard data set of dermotif

except mole(nevi). In India, the most common type of skin cancer are SCC and BCC, due to its slow development, it is considered to be less hazardous than melanoma. The appearances of this cancer class are quite similar to one of the pre-malignant class sample (AK). AK considered to be the source class for SCC and BCC. It grows abnormally to generate a malignant class of skin lesion called as BCC and SCC. On the other side DF, HAEM and ME are vascular lumps or benign forms of skin disorder. Moreover, out of the three cancers, Melanoma is the most severe type and causes majority of deaths related to skin-disease, although it is one of the most common skin cancers

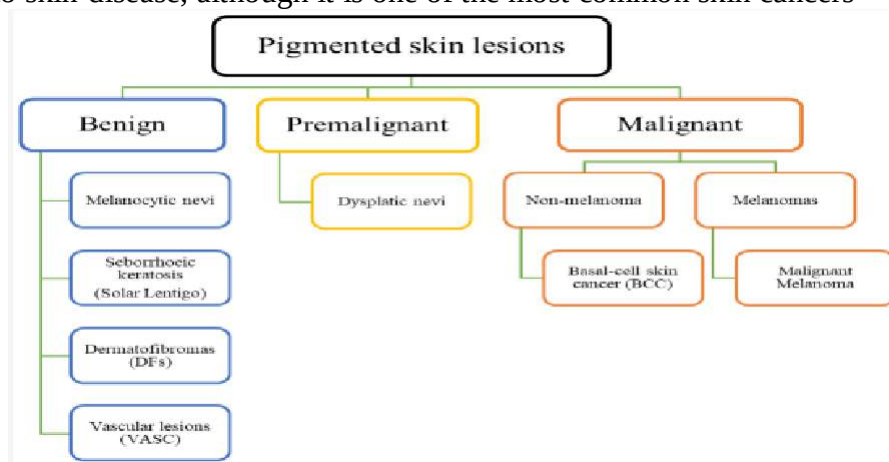


Figure: The pigmented skin lesions at different stages

On the other hand, BCCs and SCCs are less severe but difficult to diagnose as compared to melanoma. Both of cancers (BCC and SCC) have a tendency to expand and effect nearby tissues slowly and severely. Despite the growth rate of SCCs, BCCs are slow but it is quite destructive in behavior. If they are not treated in early stages, could cause severe damages possibly affect other organs of the human body. It is not feasible to simply separate the classes based on the property of skin lesion as color and shape. There are several reasons, including the variation shown in lesion classes. As an example, malignant sample class is having an sample of SCC, BCC and ML. In the next section, various standard procedure of diagnosis is going to be discuss. Although the non-invasive methods are not much accurate, but quite close to the actual facts.

Skin Lesion Image Analysis

The following section reviews two aspects of the related literature, i.e. 1) the diagnosis of skin disease by a dermatologist, 2) computer aided system based skin lesion diagnosis. Common skin diseases are easily diagnosed by observation, but for the severe disorders, there is a need of an efficient diagnostic procedure. In general, dermatologist suggests treatment, according to visual information, some valid questionnaire and based on some empirical criteria of diagnosis. Although, there are few indiscernible ailments which require images of high magnification and histopathological examinations as biopsy such as cancer. In the medical society, a large amount of research focuses on the diagnosis of severe skin diseases by non-invasive approaches. These are based on the characteristics of lesions in medical images, e.g. shape, color, etc. There might be a mapping of skin lesion characteristics with skin lesion images, such as its structure represents the distribution of textures in image space and color variegation in different class of lesion are distributed at various wavelengths of color in medical imaging. This section summarizes the role of image processing in skin lesion screening and the standard medical procedures used to diagnose skin abnormalities.

Imaging Techniques for Skin Lesion

It has been found that there are numerous different imaging techniques used to screen the skin lesions. The least complex perception strategy is photography and this technique gives the picture of skin upper layer. Next subsequent stage is dermoscopy techniques of polarized light camera and it helps to decrease surface impressions and illuminates the image of the epidermis – the second layer of skin. Due to this, it is easier to estimate the structures of lesions such as dots, globules, networks that are the main indicators of skin lesion diagnosis. Dermoscopy is an imaging method that gives a more

straightforward connection between medical science and particular visual attributes and develop a new modality as an epiluminescence microscopy (ELM). This method has opened another way of investigating by clinical examination of morphological markers for pigmented skin lesions. In addition to this, visual perception of the lesion by Ultrasound is another detail modality of diagnosis. Ultrasound imaging is generally used to quantify the profundity of skin lesion and if there are no variations from the normal skin, then there are no distinctions between the two regions. At this point when specialist analyzes lesions and utilizes high recurrence ultrasound (more than 30 MHz) to gauge infiltration profundity so as to make right cut and adopt right medical procedure. However, other modalities are optical coherence tomography (OCT) and confocal laser scanning microscopy (CLSM). Visual review with the bare eyes has a generally low sensibility in identifying early abnormalities as a lesion. In this particular circumstance, a few non-invasive modalities of skin lesion images as dermoscopy. It is all about body photography and other one is the confocal.

Microscopy reflectance (RCM), which are currently being developed to increase diagnostic accuracy by analysis microscopic skin structures. The principle of improvement in this field is the integration for the clinical practice of dermoscopy and computerized photography. Developing advance imaging modalities creates more refined methods of prognosis. Standard dermatology criteria are discussed in the next section.

Medical Diagnostic Criteria in Dermatology

Dermatologists use certain diagnostic criteria to distinguish between various types of lesions. Some of these criteria are related to the set of patterns and colors that are observed in the skin lesion images. The first method was proposed in 1985 by Friedman et al. to diagnose skin lesions is called pattern analysis. This method considers a set of patterns, also called global features, which can be found in each type of skin lesions. A specific pattern is characterized by one or more fundamental skin structures by local features(image descriptors) that can cover parts or the entire lesion. In addition, there are a variety of diagnostic approaches such as ABCD rule, Menzies technique, 3-point and 7-point checklist to evaluate lesion structures and patterns, using non-invasive imaging system. The standard diagnostic rule of skin lesion is ABCD in the domain of dermatological was suggested in 1994 by Stolz et al. Precisely, the following rule used to evaluate the properties of lesion as asymmetrical, border, color and, diameter.

ABCD Rule: They are usually inspired from the four characteristic features of an image used to detect the abnormalities in skin lesion images. The four criteria's are:

Asymmetry Features: Use to assess the degree of asymmetry in terms of shape, color, and texture of lesion.

Shape Features: This feature attempt to describe the lesion shape using attributes such as the area, perimeter and circularity index. The characterization of the lesion's border is associated with shape features, so it is also common to include other features such as the fractal dimension and the index of irregularity.

Color Features: Use to describe the lesion's color properties. In this case, there are different other features such as statistical descriptors (mean, standard deviation, skewedness, entropy, etc.), color histograms, and chromatic differences can be used. Multiple color spaces (e.g., RGB, HSV, L*a*b *) are usually used to extract with other features.

Texture Features: These features are aimed at characterizing skin images structures. Some of the most popular features are the co-occurrence gray level matrix (GLCM) and associated statistics and Gabor filters.

Computer Aided Diagnostic System

The diagnosis of abnormalities in standard skin lesions images is a challenging task. Indeed, even if therapeutic calculations are used, for example, the ABCD criteria and the standard 7- point checklist rules. In every possible case it is difficult to separate lesion class or identify the severe sores of the skin and its types because the inclusion of noise, concealing structures, biological complexity and anisotropy of the imaging system render the automated analysis of dermatological images a difficult

task. Due to this, it reduces the probability of detection and increases the specificity of lesion diagnosis. It also increases the number of histological tests, since this is the standard way of skin lesion diagnosis. In addition to this, different dermatologists may differ in their finding of skin lesion. This is because the assessment of distinctive diagnostic criteria depends on the visual acuity and the opinion of medical expert's. The past downsides inspired to use homogeneous frameworks for abnormality detection in a more precise way.

Feature Extraction

Although, the extraction of features is a vital step but finding an appropriate feature for certain application requires detailed knowledge. A lot of studies have been done in this sector, identifying a wide range of dermatological features that characterize skin lesions and able to classify them accurately. The primary purpose of feature extraction is to quantify the unified signs used by the finite set of pixels for determining the malignancy of a skin lesion or categorizes the lesions class in skin lesion images. In a given image, isolation of features is an important measure for accurate classification.

To perform analogous activity, what dermatologists used to do for classifying the skin lesion images, it is also essential to extract features that characterizes the lesions in a computer aided framework. There are various characteristics that can be used to define skin lesions. These sorts of characteristics can be split into two distinct groups as global and local features used to perform image analysis. The global image features present image as a whole while local feature symbolizes image patches.

However, there is a wide range of dermoscopic images which are characterized the lesions and extraction of these features seems to be difficult task. These features are related to skin distortion, it is also very difficult to analyze the distorted skin caused by bacterial and viral infections of skin in these images. The related features are body location, subject parameters (age), graphics parameters (view angle and illumination effect), image parameters have a major impact on the lesion categorization. All these influential challenges typically increase the overhead in the automatic screening and diagnosis of skin lesion images. There have been various attempts to solve some of the above challenges reported in the literature.

One of the best approach to tackle the above mention challenges is automated feature extraction. It helps to simplify the lesion analysis by image structures and generate important information about the lesion in skin lesion images. The information related to anatomical structures of their typical appearance (shape, size, color, location) or statistical knowledge of their properties, these properties is used to classify the skin lesion images.

Classification Methods

The aim of this stage is to curtail the size of feature vector by eradicating the unimportant and/or redundant features and improve the classification score.

Classification of images depends on selected image features which helps to isolate the image pixels into one of several classes based on specific knowledge of the domain. This could be done by training a model using a set of data and then testing the model using a different set of data that is disconnected from the training set. Typically, the classification results are influenced by the selected descriptors and the strength of the classifier. Automated classification method performance depends equally on the degree of population of the dataset. As reported in the literature on dermatological imaging that follows two main types of classification techniques unsupervised and supervised . They encourage to perform an effective classification by examining the reflection of each pixel and choosing the best signatures to match during skin lesion classification. Several methods of classification for lesion images have been reported in the literature. The Artificial Neural Network (ANN), Support Vector Machine (SVM), K-Nearest Neighbor (KNN), Regression Analysis (RA) and Decision Trees (DT) classifiers are commonly used among these methods. Out of them, ANN consists of an interconnected group of nodes similar to human brain's neurons. Traditionally, neural network models consist of both an adaptive weight adjusted during model training and the ability to use the quantitative characterization of input images.

The accompanying subsections give extra insights and the briefly overview of the state-of-the art about various techniques of lesion border detection, feature extraction and classification that can be used for skin lesion diagnosis. And, the major finding from this review are that most of the research was performed with a homogeneous framework for skin lesion diagnosis, commonly for melanoma only. Although malignant melanoma is a serious class of skin cancer, but other category of cancer prognosis are also required. The other classes of cancers which commonly occur in India are SCC and BCC know as non-melanoma. There is a need for new approaches which is viable to distinguish all other categories such as nevi(moles), tumor, pre-cancer along with cancer class of sample. This also indicates that, many of the systems may fail or may not be able to classify various other classes of non-melanoma skin lesions. In addition to this, the problem of classification for various classes of lesion which belongs to melanoma or non-melanoma was hardly dealt with in the literature. Iyatomi's proposed CAD system which are notable exceptions and differentiate melanocytic and non-melanocytic lesions. Ballerini et al. developed a robust system which can classify the melanoma and non-melanoma class of samples.

Conclusion

We have reviewed that DL has numerous potential applications in the dermatologist's workflow from diagnosis to treatment. DL can improve the dermatologist's practice from diagnosis to personalized medicine. Recent advancements in access to large datasets (e.g., electronic medical records, image databases, omics), faster computing, and cheaper data storage have encouraged DL algorithms' development with human-like intelligence in dermatology. There are many promising opportunities for DL in the dermatologist's practice. The classification of images through CNNs has garnered the most attention for its potential to increase the accessibility of skin cancer screenings and streamline the workflow of dermatologists.

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PERFORMANCE ANALYSIS OF CLASSICAL CNN BASED MODEL VERSUS RF-DCNN CLASSIFIER MODEL

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Abstract

The most important element of the human body is the skin. The skin preserves the body from UV rays, illnesses, wounds, temperature, and damaging radiation, as well as aiding in vitamin D3. Because the skin is so vital in managing core temperature and protecting the body from skin disorders, it's important to keep it healthy. Skin disorders may appear harmless, yet they can be dangerous if not treated properly. Many diseases have early symptoms, but most of them are identical, making it difficult to diagnose the condition at an initial point. Skin disorders cause not only physical but also psychiatric disorders, particularly in individuals whose faces have been scarred or deformed. Skin can be influenced by a range of external and internal factors.

Keywords:

Classification, Mining, Computational, Machine Learning and Deep Learning

Introduction

Artificial skin injury, severe chemical causes, adversity illnesses, a person's immunity, and genetic anomalies are some of the factors that influence skin disorders. Skin diseases have a big influence on people's lives including well. Dermatological illnesses are the most challenging subfields of science to cure because of the complications in treating symptoms and how symptoms alter in various situations. Skin diseases are frequent among many illnesses, and if these tactics are not fit for that form of skin condition, it will cause negative effects. People are frequently infected by skin illnesses, which must be treated as soon as possible.

Problem Statement

This research work addresses the problem of abnormalities detection in skin lesion images. It endeavors to develop efficient and robust approaches for the non-invasive detection of anomalies. The main indications of structured and unstructured skincare data using Ensemble Machine Learning (ML) and Deep Learning (DL) techniques are discussed for skincare Data Analysis. These approaches follow a framework of image processing with the following phases as pre-processing, segmentation, feature extraction, and classification of skin lesion images.

Challenges in skin lesion analysis

Empirical examinations illustrate that people having no medical guidance and no exact education about dermatology are able to group the images of a skin lesion into consistent classes or sub-classes. This sign advocates that some inherent visual features which can serve as guidance in the task of classification. The machine learning approaches can be used to extract these features from the visual classes using image processing and finally establish an automated system.

Challenges for early detection of skin lesions

Existence of blood vessels on a stretch of skin can be easily recognized by a viewer. But as long as there is variability in its pattern and the presence of “discontinuities” (e.g. visible patterns of skin and hairy region), it is difficult to detect them by computer vision approach in automated systems.

Diagnostic criteria like as the ABCD rule does not reflect any knowledge of medical system used by dermatologists during the diagnosis.

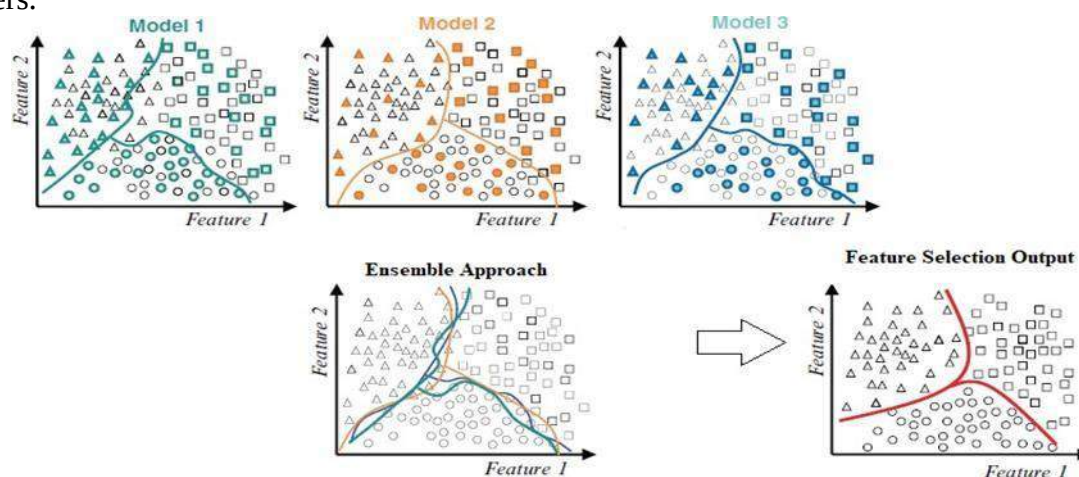
An important issue for lay people is the visual system design, and human perception to perceive skin lesion. The difficulties arise in identifying the multiple-color shades of each lesion. For, discriminating the color shades, human inspired visual models are adopted. This phenomenon identically happens in

skin lesion images for skin lesions color patterns, and it has a lot of implications for pigmented skin lesion screening.

High-performance systems in the domain of dermatology using image processing methods require fast and robust computation.

Ensemble Machine Learning and Deep Learning for Data Analysis

Electronic Healthcare Records (EHR) consists of patients health related information collected from hospitals, healthcare centers, lab tests, etc. Representing this kind of data is available in structured and unstructured format. Considering this data, early disease diagnosis is possible, which can prevent severe skincare problems and reduce mortality rates. Machine Learning (ML) plays a vital role in creating useful insights from healthcare data. Skin disease classification with existing data is also an important problem in the healthcare sector. ML is also used to extract healthcare knowledge by applying innovative methods to improve classification performance. These classification models can improve patient care by enhancing the model decision. Recent studies have proved that classification using a single model obtains less classification accuracy compared to combined model classification. These combinations of multiple models are termed as Ensemble Learning (EL). The advantage of the ensemble is that it is a combination of the best models which perform well compared to the individual classifiers.



Representation of Feature Selection using Ensemble Approach

Likewise, when the dimensionality of data increases, then a preprocessing tool applied is feature selection. The combination of different feature selection models significantly improves the ability to select appropriate features without degrading the classification performance. It is proved that ensemble feature selection performs more effectively than a single selector. The flow of ensemble feature selection is represented in Figure. A similar kind of approach is carried out for ensemble classification also. There are several ensemble methods used for ensemble for analyzing structured and unstructured data.

The co-operative ensemble classification is a combination of classifiers where all the classifiers will make some contribution to the final EL model. Averaging classifiers, weighted averaging classifiers, and stack generalization classifiers are examples of co-operative ensemble classifier techniques. In addition, competitive ensemble classification chooses the most appropriate classifiers among several classifiers.

The two main approaches to competitive learning are:

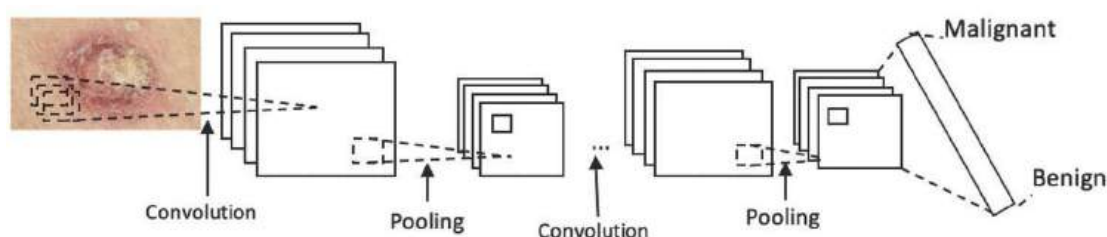
Gating: It works on the concept of divide and conquer, that is, breaking complex problems into small problems to solve them easily.

Rule-based switching: Certain conditions are applied to the model.

Convolution models in melanoma diagnosis

In the following, a general description about the CNN and how to optimize them will be described. In simple words, CNNs are a type of feed-forward neural network that uses a mathematical convolution operation to extract features from images automatically. These features are passed to successive layers

that learn more abstract features from previous ones until a final output is yielded, simulating some of the human visual cortex. Consequently, CNNs can build more complex concepts from simpler ones, e.g., they can learn to detect a human face based on more straightforward ideas as a nose and mouth, which are known from much simpler ones such as corners and contours. As a matter of example, Figure illustrates a simple CNN model that learns to predict whether or not a patient has melanoma utilizing mapping the extracted features into more abstract feature spaces. The general layout of CNN architecture is significant, including layers, activation function, and hyper-parameters. Layers in CNN are mainly categorized into convolution, pooling, and fully connected layers. An activation function is a transformation function that maps the input signals into output signals required for the neural network to function. Popular activation functions include linear activation, Sigmoid functions (logistic and hyperbolic tangent functions), Rectified linear units (ReLU), also known as piecewise linear functions, Exponential Linear Unit, and Softmax. Hyper-parameters include filter kernel, batch size, padding, learning rate, and optimizers, etc. Optimizers are used to produce maximum performance from a network model. Examples include Adam, Rmsprop, Nesterov, and Sobolev gradient based optimizer.



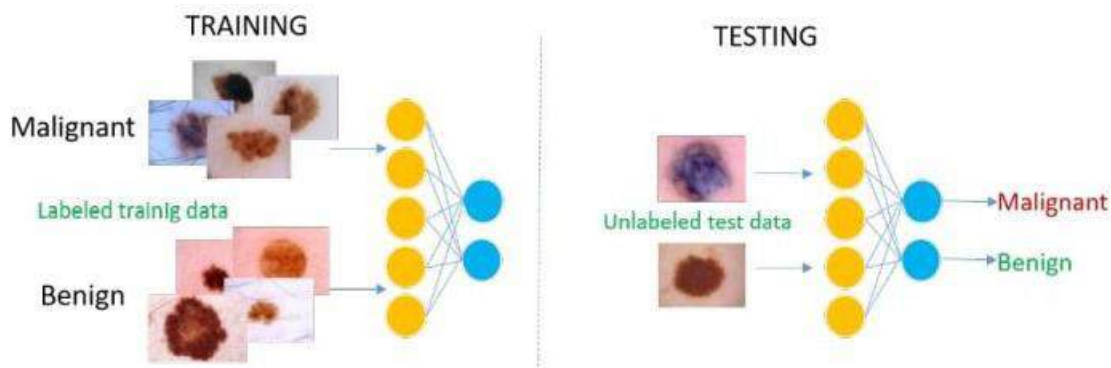
Diagnosis of melanoma with a simple CNN model

CNN architectures

There are various architectures of CNNs available. These architectures are critical factors in building deep learning algorithms. Here, we present a brief review of these classic CNN models, including AlexNet, VGG architecture, Inception architecture, ResNet architecture, DenseNet architecture, Xception architecture, MobileNet architecture, NASNet architecture, and EfficientNet architecture, ect. more than a hundred CNN models.

Classification of Lesion Classification

Skin lesion images can be classified to facilitate the process of detecting melanoma cancer. Several forms of skin cancer can be seen from the skin lesions images. These can be categorized majorly into malignant and benign. They can further be classified into more lesion classes. Melanoma is a malignant lesion and the most deadly of these classes. The image classification involves using selected features of an image to classify the image's pixels into one of the several classes relying on a specific knowledge domain. It could be training a model using a data set and then testing it using one disjoint data set from the training. Most lesion classifications are binary, classifying between malignant and benign moles. The results of classification are typically influenced by the chosen feature descriptors and the classifier's strength. The automated classification performance is equally dependent on the degree of dataset population.



Classification model of melanoma.

The two main classification types reported in the paper concerning medical imaging are supervised classification and unsupervised classification. Supervised classification uses an image analysis tool to generate a statistical categorization (such as mean and covariance) of each identified information class's reflectance. Completing the categorization then fosters effective classification by examining each pixel's reflectance and deciding on the best matching signatures. Decision criteria such as maximum likelihood can be used for overlapping signatures to assign pixels to the highest probable class. Unsupervised classification typically examines many unknown pixels and divides them into several categories based on natural groupings present in the image values using clustering procedures. Essentially, unsupervised classification clusters values that are close together in a measurement space as a single class, thus arranging the data in various categories to be comparatively separated. Sample DL application for lesion classification purposes can be seen in multiple studies.

Algorithm for RF-DCNN Classifier

Input: HAM 10,000 image dataset

Output: classified into different skin disorder classes

Begin

To extract multi-level features, map the features of skin visuals from the input domain (HAM10000) to the ensemble deep neural network (RF-DCNN);

Get the multi-level distinctive features that were extracted;

***for**(each input skin image)*

Train the RF-DCNN from start to the end;

Get the skin visuals with the two-step feature extracted;

Provide the RF-based DCNN classifier with the features extracted skin data;

Sort the various types of skin conditions into categories;

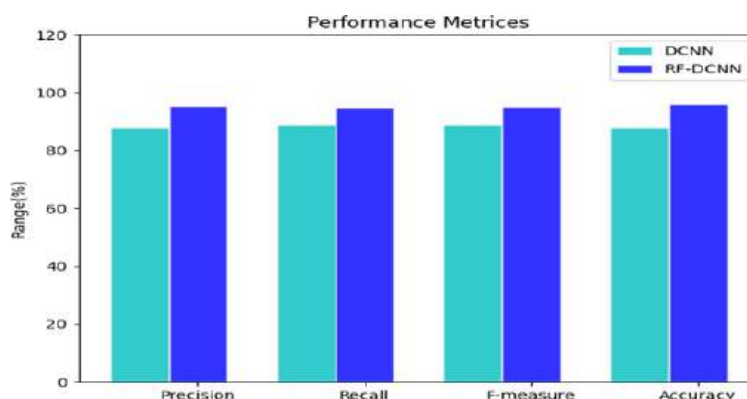
endfor

End

The ensemble technique is more accurate and effective at predicting skin diseases. Table shows how individual deep learners from classic CNN compare to the proposed ensemble classifier in terms of classification performance. Chart shows the performance of the conventional Learning model rather than the newly presented model.

Performance analysis with traditional deep learning-based models

Performance for various metrics	Classical CNN based Model	RF-DCNN Classifier model
Precision %	88	95.41
Recall %	89	94.93
F-measure %	89	95.17
Accuracy %	88	96.1



Effectiveness of Performance Metrics on RF-DCNN and CNN based Models

The integration model enhanced some of older CNN models with mean-accuracy, precision, f1-score and re-call, as shown in the table. Performance evaluation criteria such as accuracy, sensitivity, and specificity may be used to compare skin lesion segmentation and classification performance. We identified various state-of-the-art methodologies for performance comparison in this research, and the results are displayed in Table below. In this comparison, words like true positive (TP), false positive (FP), true negative (TN), and false negative (FN) are commonly employed (FN). Since the layers are maintained and imported from a previously trained network. The study uses two separate classification methods: the random forest Classifier and the Deep Convolution Neural Networks Classifier. We reached the greatest mean-accuracy of 96.1 percent after using these strategies.

Conclusion

This study aided in the development of a system for forecasting skin disorders. Finally, in the healthcare business, data mining is crucial. In this work, integrated Predictive heterogeneous ensemble models that work well for multiclass dermatitis are developed using a number of simple and weight-bearing rules. The results acquired in this study were compared to other data found in the literature to demonstrate the effectiveness of our technique. We used a large number of technical studies using the same information but various classification techniques to compare the efficiency of the proposed treatment of skin classification, and then developed a multi-model ensemble method to compare the efficiency of the proposed treatment of skin classification. After that, we use a multi-model ensemble approach to combine these two data mining techniques to get the greatest accuracy of 96.1 percent. On the skin illness dataset, we achieve the greatest accuracy in the literature.

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Bootstrapping of fine-tuned segmentation and classification network for epidermis disorder categorization

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Abstract

As all people have been affected by various skin related illnesses, categorization of skin disorders has become prominent in recent healthcare system. To identify and categorize skin related syndromes, many transfer learning frameworks were used. Amongst, a Fine-tuned Segmentation and Classification Network (F-SegClassNet) achieved better efficacy by using the novel unified loss function. Nonetheless, it was not apt for the datasets that lack in training images. Hence in this article, Bootstrapping of F-SegClassNet (BF-Seg-ClassNet) model is proposed which solves the imbalanced images in the training set via generating the group of pseudo balanced training batches relying on the properties of the considered skin image dataset. This model fits the distinct abilities of Deep Convolutional Neural Network (DCNN) classifier so that it is highly useful for classifying the skin disorder image dataset with a highly imbalanced image data distribution. According to the Bootstrapping, better tradeoff between simple and complex image samples is realized to make a network model that is suitable for automatic skin disorders classification. In this model, statistics across the complete training set is calculated and a new subset is produced that retains the most essential image samples. So, the skin images are segmented and categorized by this new model to identify the varieties of epidermis infections. At last, the testing outcomes exhibits BF-SegClassNet-model accomplishes the mean accuracy with 96.14% for HAM dataset which is compared to state-of-the-art models.

Keywords Epidermis infection · Deep transfer learning · F-SegClassNet · Imbalanced data · DCNN · Bootstrapping

1 Introduction

Because of the implications in dealing with illnesses and the discrepancies in varying treatments, epidermis or dermatological illnesses are perhaps the vastest and varied sub-fields of medications. Epidermis infections are known amongst many other illnesses, especially

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those that are quickly transmitted, and can be deleterious to melanoma if not identified in their beginning phases [21]. Skin disorders have risen dramatically in recent years in relation to the proportion of all other kinds of infections [7]. Numerous studies suggest that one-fifth of the population is susceptible to skin problems, making recognition difficult.

As a result, accurate classification of these kinds of illnesses plays an important role by assessing different images including skin lesion morphology, biological pattern interpretation, hue, structuring, and lesion orientation [8]. Depending on a self-governing evaluation of clinical epidermis qualities, identification is exceptionally hard, and epidermis aspects are not derived dynamically. To address such issues, a transfer learning framework was developed to characterize skin infections using pre-trained deep learning formations. Pre-trained models have been primarily used to optimize the weights of deep learning using repetitive back-propagation rather than starting with random weights [15].

Many pre-trained DCNN configurations, such as AlexNet, GoogLeNet, VGGNet, and others, have been used to identify skin problems over the decades [14]. According to this perspective, a 2-phase progressive transfer learning method with a completely monitored Residual Network (ResNet152) model pre-trained on the ImageNet [9] was created for customizing the skin disorder categorization framework on the transitional set. In addition, cycle-Generative Adversarial Network (GAN) knowledge was used as a transfer learning procedure for transforming epidermis characteristics from the input space to the feature space. Despite its high efficiency, DCNN's perceptual insight was ineffective for skin-like visuals. To resolve this concern, epidermis objects were separated using the SegNet, which is a deep encoder-decoder system, and the separated objects were categorised using the DCNN [3]. In contrast, the fine-delineation of the boundaries between the Region-Of-Interests (ROIs) in the skin lesion had not been accomplished.

Thus, a modified SegNet with Categorization known as SegClassNet [11] was created wherein the skin lesion visuals enriched by cycle-GAN have been considered as input. At first, dilated convolution has been used instead of classic convolution to obtain multi-scale contextual elements without deteriorating the image quality. After, the encoder encoded such elements and passed them to the decoder, which was preceded by the dropout layer. The Dynamic Conditional Random Fields (DCRFs) has been used in the dropout layer for resolving overfitting and obtaining the separated skin objects. Moreover, those separated objects have been directly passed to the ResNet18 to categorize the epidermis disorders. Conversely, it employs classical error function which limits the network's ability for training discriminant information from epidermis objects. To solve this problem, an F-Seg-ClassNet [12] was created through modifying the ResNet18's layer using the unified triplet along with the group loss. In this model, the embedding from separated objects was trained into the Euclidean distance by the ResNet18 classifier [5, 13, 17].

The outer skin barrier, often known as the epidermis, is a stratified, self-renewing epithelial layer. Thus, it protects the organism from outside danger like bacterial infections and prevents water loss. This cause can be rectified when identified early and the computational techniques can achieve this, which motivated many researchers.

After, l_2 distance was determined among the respective separated objects from Euclidean space to train discriminant information of epidermis objects with the help of unified triplet and group loss functions. Also, the separated objects were categorized by such l_2 distances. Even if it employs transfer learning such as cycle-GAN as image augmentation, this model was not appropriate for the datasets that lack in training images.

Therefore, in this paper, BF-Seg Class Net model is presented to resolve the imbalance images in the training set by creating a collection of pseudo balanced training batches depending on the properties of the given skin image dataset. This BF-Seg Class Net model

fits the distinct abilities of DCNNs so that it will be more powerful to categorize the skin disorder image dataset with a highly imbalanced image data distribution. Based on this bootstrapping, a better tradeoff between simple and complex image samples is achieved for creating a model that is appropriate for robust automatic skin disorders classification. In this model, statistics across the complete training set is determined and a new subset called bootstrap samples is created that retains the most essential image samples. Thus, this BF-SegClassNet model addresses that the samples that are chosen as complex by the actual training iterations are crucial for increasing the classification efficiency.

The further paper is emphasized with: The Section 2 investigates works associated with skin disorder categorization. The Section 3 which tells about the BF-SegClassNet model, The Section 4 displays the efficiency. Finally, The Section 5 which will conclude the work and provides future upcoming enhancement.

2 Literature survey

In [18] presented the new Gabor wavelet-based DCNN to identify malignant melanoma and seborrheic keratosis. This technique was depending on the decomposing the input images to different directions of sub bands. Then, such images are utilized as inputs for many CNNs parallelly for producing the multiple probabilistic estimations. After, decision merging according to sum policy was applied to categorizing skin lesion. But its accuracy was not effective and the dataset was limited in size.

In [16] designed a hybridized technique to handle the class imbalance of skin disorder categorization. In this technique, level of data scheme of mini-batch logic which are balanced will follow augmentation with the algorithm level, with the real time images to scheme of applying novel loss factor. This technique was utilized with developed Custom Fully Connected Layers (CFCL) with two hidden layers for improving the training efficiency. Also, the batch regularization and dropout methods were employed for enhancing the categorization efficiency. But, it does not able to categorize multiple skin disorders concurrently.

In [4] suggested a modified graph cut technique followed by the probabilistic classification called Naive Bayes (NB) to partitioning skin lesions and categorizing skin disorders. At first, the input images were preprocessed to eliminate the noises and converted from RGB to HSV. Also, threshold was used to smooth and filter the images. Then, these images were partitioned depending on the dynamic boundary update. After that, the features from the infected areas were extracted for categorizing the skin disorders. But, the accuracy of this technique was very less compared to deep learner models.

Al-masni et al. [1] developed a combined diagnostic method which integrates a skin lesion edge segmentation phase and a multiple skin lesions categorization phase. Initially, the skin lesion edges were partitioned from the complete dermoscopy images by the Full resolution Convolutional Network (FrCN). After, different CNN classification models were performed on the partitioned skin lesions to categorize the skin disorders. However, the considered skin lesion images were not adequate. Also, it has high difficulty and cost for the labeling task.

Al-masni et al. [10] introduced an intelligent diagnosis technique which worked digitally, for increasing the accuracy of categorizing many skin disorders. In this technique, a Multi-Class Multi-Level (MCML) categorization method motivated by the divide-and-conquer policy was presented. This technique has four different phases: preprocessing,

partition, feature extraction and categorization. The preprocessing was used to remove the noise, black frame, hair and circle from the skin images. Then, the ROI was partitioned using Otsu's thresholding method and the features were extracted from every ROI. Further, such features were categorized by the MCML to differentiate the skin disorders. However, it needs to optimize the loss function for further increasing the categorization efficiency.

Al-masni et al. [19] designed a Global-Part CNN framework that looks the finely grained local data and the global context data of similar significance. In this framework, Global CNN & some CNN were employed. The G-CNN was learned with images of dermoscopy which were downscaled and utilized for extracting the global-scale data to generate the Classification Activation Map. Also, P-CNN was learned along CAM cropped images and utilized for extracting the local-scale data of skin lesion images. Moreover, data-converted ensemble training was executed to enhance the efficiency of categorization by combining the various discriminant data from GP-CNNs which were learned with color constancy converted images, actual images and feature saliency converted images, accordingly. But it has less sensitivity and accuracy.

Al-masni et al. [2] designed a robust and mobile Deep Neural Network (DNN) which differentiates Herpes Zoster from various skin disorders by utilizing the client-submitted images. In this method, a Knowledge Distillation from Ensemble through Curriculum Training (KDE-CT) was developed in which the student network trains from a robust teacher network progressively. On the other hand, this KDE-CT comprises hyperparameters which need to be automatically optimized based on the considered datasets. Some of the researchers worked on the neural network and structural pruning models [6].

Conclusion Artificial intelligence and machine learning may benefit greatly from neural networks. They have various benefits, including the capacity to generalise and learn from data. They do have some disadvantages, though, such the price and the difficulty in understanding the data. The main benefit of deep learning algorithms, as previously explained, is that they attempt to incrementally learn high-level characteristics from data. This does away with the necessity for hard core feature extraction and domain knowledge.

3 Proposed methodology

The BF-SegClassNet-model is explained briefly. Primarily, the dataset of which is collected, and also the multiple-domain adaptation is implemented to the cycle GAN for mapping epidermis characteristics from a source domain (input space) to the target domain (feature space). Afterwards, the modified SegNet is employed for partitioning the skin lesion visuals having high-resolution information. Also, the partitioned images are categorized by the bootstrapping of fine-tuned ResNet18 with Bootstrapping method which enhances the accuracy of identifying the skin disorder categories. Figure 1 portrays a schematic overview of this BF-SegClassNet model for epidermis disorders categorization.

3.1 Image acquisition and segmentation

Initially, the HAM10000 data-set are acquired from ISIC archive and accessible as <https://isic-archive.com/>. Which encompasses 10,015 skin images with 7 various kinds & contains only skin images with 505 of lesions being validated by pathology. Such 7 different kinds of skin disorder images are basal cell carcinoma, actinic keratosis, benign keratosis, dermatofibroma, melanoma, melanocytic nevus and vascular lesion. Then, cycle GAN is

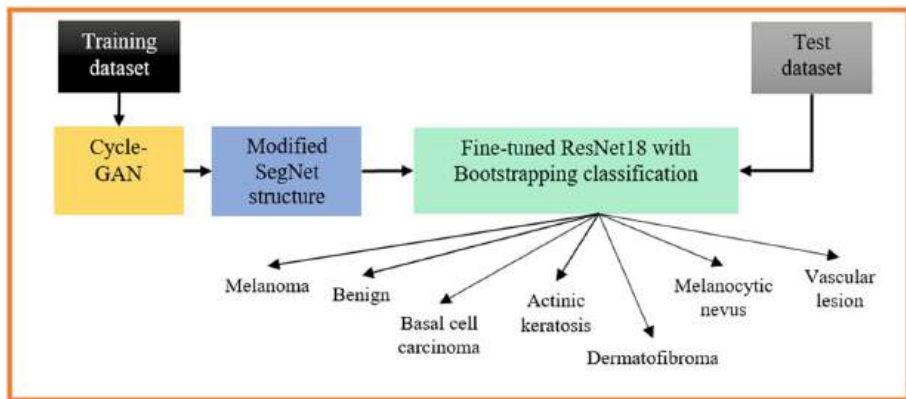


Fig. 1 Schematic overview of epidermis disorders categorization using BF-SegClassNet model

implemented for mapping the skin lesion qualities from input space to the feature space. These images are then given to the modified SegNet for splitting the diseased ROIs from every image. Once the ROIs are split, then DCNN such as ResNet18 with Bootstrapping is executed to classify the skin disorder categories. Figure 2 illustrates the structure of BF-SegClassNet model for epidermis disorders categorization.

3.2 DCNN with bootstrapping classification

Generally, the execution of DCNN directly on a skewed dataset results in ineffective categorization i.e., the prediction error rates during the convergent task may highly fluctuate or increase when applying DCNN on an imbalanced dataset. Since during learning, DCNNs partitions the training set into multiple batches. On the other hand, if partitioning an imbalanced dataset, few of such batches may include no positive sample but only

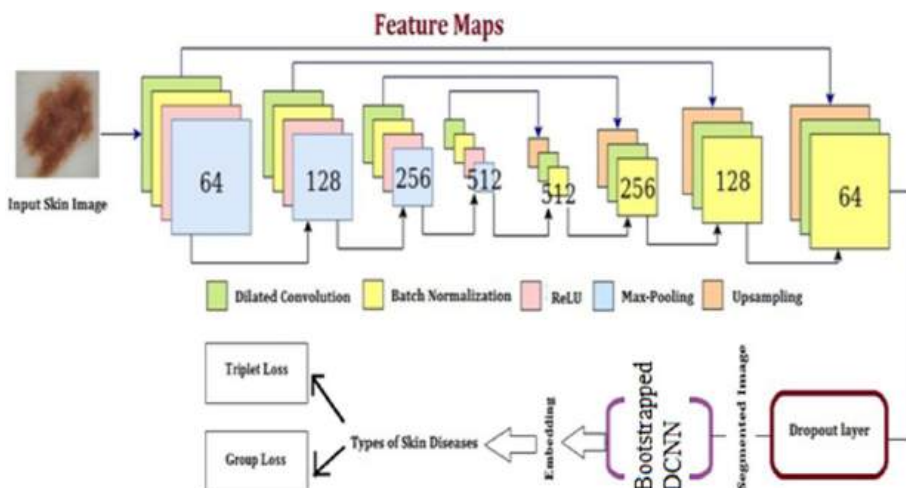


Fig. 2 Structure of BF-SegClassNet for epidermis disorder categorization

negative samples because of the skewed distribution of the training set. So, this trained DCNN execute weakly if applied to the testing set.

To combat this challenge, the DCNN is improved with the bootstrapping sampling scheme. In this model, the SegNet output i.e., the partitioned ROIs is utilized to bootstrap and initialize the skin disease related pixels (features) for training the DCNN model. Consider x and y are the amounts of negative and positive samples, accordingly, in the imbalanced training set with $x \gg y$. In this proposed model, every batch is generated with the equal dimension z ($z = z_x + z_y$) and the equal negative to positive rate u ($u = z_x/z_y$) where z_x and z_y are the amounts of negative and positive samples. Absolutely, B batches are created were,

$$B = \lfloor x/z_x \rfloor \quad (1)$$

In other terms, if z_x is not appropriately divisible by B , any leftover negative samples are discarded in the training task. Because the overall number of negative samples x in the training set is large and batch size z is commonly small (so z_x is small), the negative samples being discarded is insignificant than the ones applied in the training task. After, a positive sample is chosen randomly from y positive ones for z_y times and those are combined with z_x negative samples for all batches. This procedure is performed totally T times for creating batches in all training iterations. Such a random procedure guarantees that every positive sample has a same opportunity to be selected and learned with several negative samples to prevent overfitting. In all iterations, the bootstrapping task creates a pseudo balanced training set from the actual imbalanced image dataset. Further, this model is utilized for learning the DCNN (ResNet18) classifier to identify the epidermis disorder categories.

Consider the dimension of all inputs is $x * y$. A scenario of 4 mid-layer DCNN is illustrated in Table 1, where k_L is the number of neurons that apply on a small batch of inputs and $x_L * x_L$ is the dimension of all neurons in the L^{th} convolution layer. The outcome of L^{th} convolution layer is provided to the L^{th} pooling layer and is split into a group of non-overlapping rectangles of dimension $p_L * p_L$, where the pooling process is performed for down-sampling.

In this model, the low-level features are fed to the DCNN rather to highly decrease y value and to enhance the efficiency of categorization. Given the input image, the bootstrapping scheme is employed for creating B batches of balanced training images that are given to the CNN's first layer i.e., input layer regularly in iterations. Following the input layers, there are 2 convolutional layers. Every layer is preceded by its corresponding max-pooling layer. The initial convolutional layer uses $k_1 * x_1 * x_1$ neurons on the input and creates their inner product as the outcome. The outcome is considered as the input for the initial max-pooling layer. Its outcome is the input of the second convolutional layer, preceded by the

Table 1 Training parameters for DCNN

Layer	Layer dimension	Outcome dimension
Input ($x * y$)		
Convolution 1	$k_1 * x_1 * x_1$	$k_1 * (y - x_1 + 1) * (y - x_1 + 1)$
Pooling 1	$p_1 * p_1$	$k_1 * (y - x_1 + 1) / p_1 * (y - x_1 + 1) / p_1$
Convolution 2	$k_2 * x_2 * x_2$	Consider $y_2 = (y - x_1 + 1) / p_1$; $k_2 * (y_2 - x_2 + 1) * (y_2 - x_2 + 1)$
Pooling 2	$p_2 * p_2$	$k_2 * (y_2 - x_2 + 1) / p_2 * (y_2 - x_2 + 1) / p_2$
Outcome		7

max-pooling layer applying similar procedure but with various neuron dimensions. The dimension of the resultant DCNN outcome is the amount of skin disorder types i.e., 7 to which the image is categorized. Once each B batch is learned, the resultant convolution neurons and weights are utilized for categorization. The testing sample is allocated to the class with the maximum outcome score. Therefore, the efficiency is improved on testing set once completed the rounds of bootstrapping.

Consequently, the bootstrapped training sets are produced until the learning error converges to a minimum. But the error does not reduce on the test set and rather obtains a fluctuating efficiency at every bootstrapping round. To realize this fact, the error is averaged for similar samples that contributed towards the enhanced training in the initial bootstrapping iteration. Observe that such samples may be occurred in a various error bin at a dissimilar bootstrap iteration. This fluctuation nature is in agreement with different break-even points in the test set at various bootstrap iterations. This fact occurs since this model initiates to change the simple and complex samples at all iterations of the bootstrapping. If the real complex samples are utilized for learning during bootstrapping, the efficiency relapses to the enhanced state.

This scenario is experienced for the initial time after sampling from primary learning and observable at the second iteration of bootstrapping. Thus, the complex samples acquired after real learning handle the efficiency on the testing set.

Algorithm for the F-SegClassNet -Model:

Divide NEG into B batches, every batch with z_x negative samples;

for(1: T)

for(1: B)

for(1: z_y)

Choose a sample randomly from POS ;

end for

Merge the POS and NEG samples together;

end for

Train the fine-tuned ResNet18-based DCNN classifier;

end for

Categorize the varieties of epidermis disorders;

End

4 Experimental results

The performance of BF-SegClassNet-model is evaluated through implementing it in Python 3.7.8. From the HAM dataset [20], 70 percentage of the skin lesion visuals among all classes which are utilized by training and the remaining 30 percentage from all classes are utilized for testing. Also, the performance is evaluated with the classical models

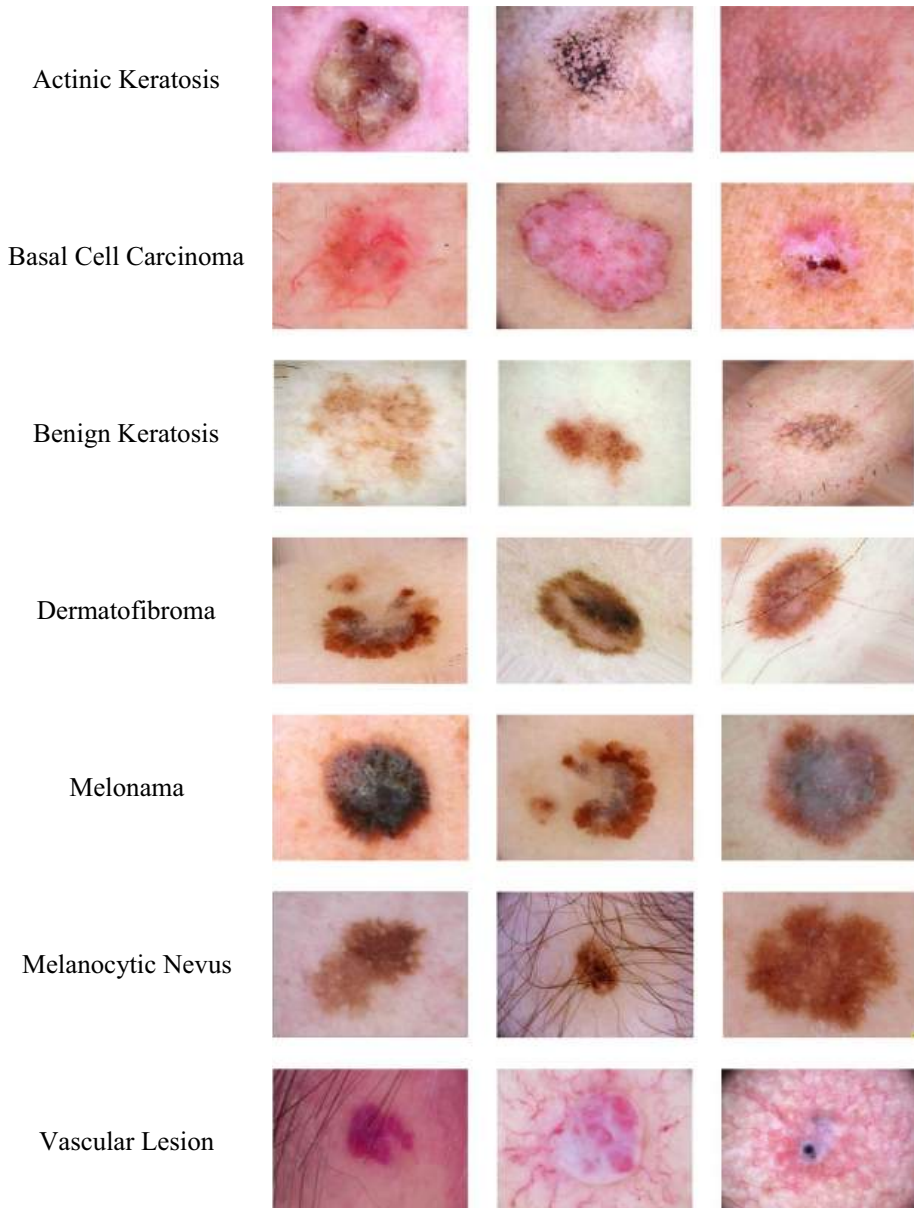


Fig. 3 Sample input images for various kinds of epidermis infections

depending on f-measure precision, accuracy and recall. The example of the input images from HAM dataset of all skin disorder categories are given in Fig. 3.

Precision is calculated as:

$$\text{Precision} = \frac{\text{No. of perfectly classified melanoma/benign images}}{\text{No. of perfectly classified melanoma/benign images} + \text{No. of imperfectly classified melanoma/benign images}} \quad (2)$$

Recall is calculated as:

$$\text{Recall} = \frac{\text{No. of perfectly classified benign/melanoma images}}{\text{Number of perfectly classified benign/melanoma images} + \text{Number of imperfectly classified benign images}} \quad (3)$$

“F measure” is calculated by

$$F - \text{measure} = 2 \times \frac{\text{Recall} * \text{Precision}}{\text{Recall} + \text{Precision}} \quad (4)$$

Accuracy is calculated as:

$$\text{Accuracy} = \frac{\text{True Negative (TN)} + \text{TP}}{\text{FP} + \text{TP} + \text{TN} + \text{FN}} \quad (5)$$

The comparison outcomes of precision, recall, f-measure and accuracy for ResNet-152 [9], SegClassNet [11], F-SegClassNet [12], Gabor wavelet-DCNN [18], GP-CNN [19] and BF-SegClassNet implemented on HAM dataset are listed in Table 2 and shown in Fig. 4.

This testing finding observes that the BF-SegClassNet-based categorization model provides a greater performance than various models. Epidermis disorder categorization model is concerned, BF-SegClassNet model is highly useful for accurateness.

5 Conclusion

Finally, BF-SegClassNet was presented by using the bootstrapping method integrated into the deep learner for enhancing the classification accurateness. First, the ROIs from input skin images were partitioned using the changed SegNet. Then, integrated from each ROI is mapped to the Euclidean space based on the bootstrapped ResNet-18 model. In this classification, the statistics across the entire training set was computed and a novel subset was created that retains the most essential image samples. Also, the collection of pseudo balanced training batches was generated to solve the imbalanced training sets challenge. As a result, the unique behavior of DCNN classification is enhanced

Table 2 Findings of various epidermis disorder categorization models on HAM dataset

Evaluation Metrics	Gabor wavelet-DCNN	ResNet-152	SegClassNet	GP-CNN	F-SegClassNet	BF-SegClassNet
Precision (%)	79.96	88.40	90.94	92.55	93.26	95.98
Recall (%)	80.62	88.68	91.22	92.64	93.31	96.03
F-measure (%)	80.33	88.56	91.04	92.60	93.28	96.01
Accuracy (%)	80.57	88.78	91.28	92.71	93.37	96.14

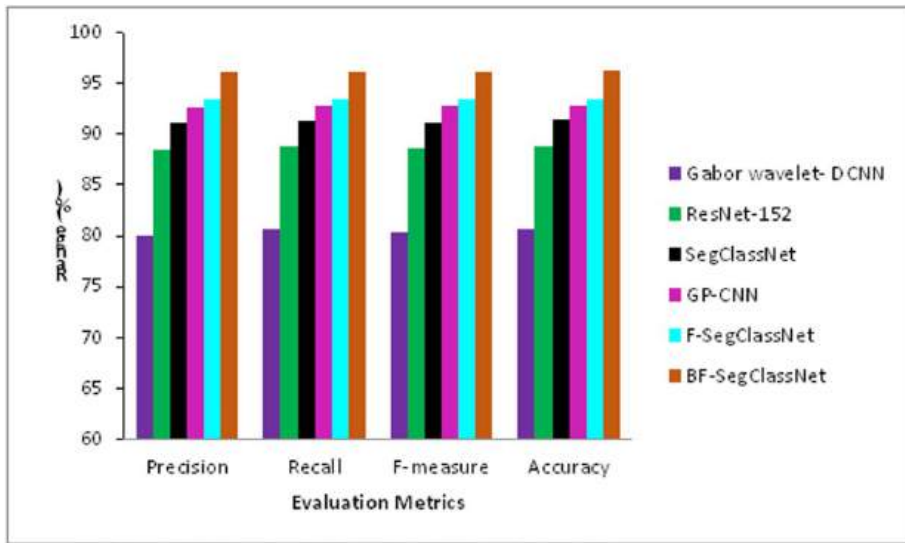


Fig. 4 Analysis of evaluation metrics on HAM10000 dataset

to categorize the epidermis disorder varieties. Eventually, the findings revealed that the BF-SegClassNet gains the accuracy rate of 96.14% for HAM dataset while average accuracy of Gabor wavelet-DCNN, ResNet152, SegClassNet, GP-CNN and F-SegClassNet are 80.57%, 88.78%, 91.28%, 92.71% and 93.37%, correspondingly. Although it solves the imbalanced dataset problem, the drawback of cycle-GAN becomes dramatic when the source domain varies greatly from the feature space. Therefore, the upcoming research will concentrate on finding the solution to the knowledge transfer in dynamic circumstances.

Declarations

Conflict of interest The authors declare that we have no conflict of interest.

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LUNGS SEGMENTATION AND CLASSIFICATION USING MACHINE LEARNING IN CHEST X-RAY IMAGES

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Abstract:

The identification and prediction of lung illnesses are increasingly vital and difficult. Image processing and machine learning techniques approaches are frequently used to detect early-stage of lung disease. Healthcare providers are still facing challenges in detecting cancer. The true origin of cancer and the complete treatment process remains a mystery. To identify the regions of the lungs affected by cancer, various image processing techniques are utilized. These techniques involve reducing noise, extracting features, detecting damaged regions, and comparing patient's medical history of lung cancer data. This research applies image processing and machine learning techniques to demonstrate accurate detection and prediction of lung cancer. The dataset of X-ray images used in the study was sourced from UCI repositories. To enhance the quality of the images, a local binary fitting mean filter was utilized during the image preprocessing stage. The K-means method was then applied to segment the images. This segmentation enabled the identification of the lung portion within the images. The data was classified using different machine learning algorithms, including RF, ANN, SVM and NB. The results revealed that the ANN model had the most accurate prediction of lung cancer. The main objective of the study is to segment the lungs portion and detect lung cancer with image processing and machine learning approaches.

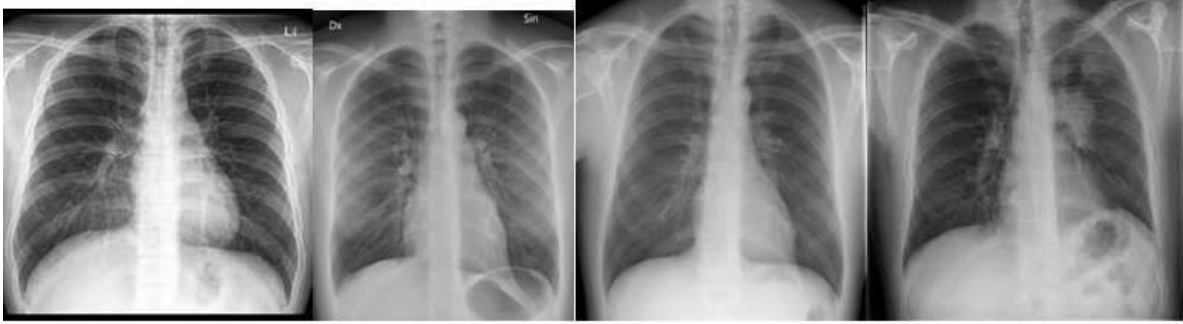
Keyword: Machine Learning, Lung Cancer, Median Filter, Segmentation, Chest x-ray images, Image processing

Introduction

Lung cancer, which is among the deadliest types of disease, causes approximately one million deaths every year. In the current state of medicine, it is essential to perform lung nodule detection on chest X-ray images. This is because lung nodules are becoming increasingly common and are the leading cause of this disease [1]. The images are transmitted into a computer, which then manipulates them to create a cross-sectional image of the body's internal organs and tissues [2]. The American Cancer Society assesses that a patient's likelihood of surviving lung cancer is 47%, if it is discovered at an early stage. It is extremely improbable that lung cancer in its early stages will be accidentally discovered on an X-ray image [6]. Lesions with a diameter of 510 millimeters or less that are spherical are notoriously difficult to find. Figure 1 displays an X-ray image of a normal and lung cancer.

In [3] developed a CAD approach with two experiments. In the first case, 300 X-ray images were used for computer simulation, while in the second, 888 X-ray images were used for patient-based ground truth. The method was developed using the LIDC-IDRI dataset, and images with wall thickness larger than 2.5mm were removed. The simulated pictures lung region was randomly implanted with spherical nodules of varied sizes. A 10-fold cross-validation method was used to analyze network hyperparameterization and generalization in order to evaluate the CAD technique. The detection sensitivities were assessed in relation to the average number of false positives per image. By evaluating the mean and standard error between predicted and actual values, localization and diameter estimates accuracy was evaluated. Results regularly exhibited superior detection accuracy.

In many industries, image processing plays a vital role and it is used in X-ray scans of the lungs to identify malignant growths. Various image processing techniques such as noise reduction, feature extraction, identification of damaged areas, and comparison with the patient's medical history of lung cancer are employed to detect cancerous portions of the lung. Typically, digital image processing involves combining different aspects of an image to form a coherent object. To focus on a specific element of the overall lung imaging, this study employs a novel method. The split region can be observed in many different ways, including from various angles and when lighted in various ways. One of the major advantages of using this technique is being able to distinguish between areas of an image that have been affected by cancer and areas that have not been affected by cancer by contrasting the intensity of the two sets of images [6,7].



Normal Lung Images

Cancer Lung Images

Figure 1: Chest X-ray image of lungs.

Lung cancer is the most common cause of cancer-related death since the majority of patients acquire their diagnosis at a more advanced stage. Regardless of a country's level of industrialization or development, lung cancer is constantly regarded as one of the deadliest types of the disease. Effective control of lung disease relies on two factors: early detection of cancer and improving survival rates for those already diagnosed [8, 9].

A review of numerous methods for the classification and detection of lung cancer using image processing and classification may be found in the literature survey section. In the methods part, machine learning and image processing-enabled technology are used to accurately classify and predict lung cancer. Images are first acquired from the kaggle dataset. The Local Binary fitting mean filter is used to preprocess the image and as a result, image quality is enhanced. The K-means technique is then used to segment the images. The region of interest can be found using this segmentation. Then, methods for machine learning classification are used. The dataset and the outcomes of several strategies are described in the result section.

Literature Survey

An active contouring model in Chest Radiology was proposed and implemented [1]. A variation level set function has been employed to segment the lungs. Proper segmentation of the lung parenchyma is essential for the diagnosis of lung disease. Significantly, the SBGF-New SPF function has been developed to segment X-ray lung images. This function is used to identify external lung limitations and to prevent errant expansion at the margins. Comparisons between the proposed algorithm and existing four different active contour models are being conducted. The results of these tests indicate that the strategy provided is robust and can be rapidly calculated [12].

Lung cancer was segmented by [13] using an active spline model for analysis. Through the application of this technology, segmentation of lung has been acquired using X-ray images. They employed a median filter to detect noise while preprocessing is being done. Additional K-means and fuzzy C-means clustering are employed for feature capture during the segmentation phase. The X-ray

image is segmented in this study before the final feature retrieval result is attained. The application of the SVM approach for classification led to the creation of the suggested model. MATLAB is used to simulate the results of the cancer detection system.

An IoT-based predictive model for predicting lung cancer using fuzzy cluster-based segmentation and classification was proposed by [11]. For accurate image segmentation, a fuzzy C-means clustering method was applied. The Otsu threshold approach was applied in this work to separate lung cancer images from transitional zones. To further enhance the segmentation representation, the right-edge picture is used with the morphological thinning technique. To accomplish incremental classification, we combine cutting-edge association rule mining (ARM), conventional decision trees (DT), and CNN with new incremental classification algorithms. The procedure was carried out using standard images from the database and current patient health data collected from IoT devices connected to the patient. The results of the research demonstrate that predictive model systems have improved in accuracy.

Developed a method for identifying the presence of lung cancer in an X-ray image using deep residual learning. The UNet and ResNet models were used to create a preprocessing pipeline by the researchers. The goal of this pipeline is to draw attention to and extract characteristics from malignant lung tissue. Predictions about the likelihood that aX-rayimage is malignant are gathered using an ensemble of XGBoost and random forest classifiers. The X-rayimage of malignant is calculated using the combined findings of the predictions made by each classifier. The LIDC- IRDI's accuracy is 84% greater than that of conventional methods [12]

In [14] developed an Optimal Deep Neural Network (ODDN) to improve the classification of lung X-rayimage by reducing the number of features. Their approach proved more precise than existing techniques, and an automatic categorization method for lung cancer now saves time and eliminates human error. The researchers found that machine learning algorithms are now much better at distinguishing between normal and pathological lung scans. Based on the study's findings, the classification of lung images was successful, achieving 94.56% peer specificity, 96.2% accuracy, and 94.2% sensitivity. The study also showed that enhancing the efficiency of cancer detection in CAT scans is feasible.

The development of early detection and accurate diagnosis of lung cancer using CT, PET, and X-ray imaging by [9] in 2016 has attracted a great deal of attention and enthusiasm. The use of genetic algorithms, which enable early detection of lung cancer lesions by diagnosis, may lead to optimization of findings. Accurate and rapid classification of different stages in cancer images required the use of both naive Bayes and genetic algorithms. This was done to avoid complexity in the generation process. The accuracy of this classification is up to 80% [15].

In [19] used a preprocessing strategy to remove unwanted elements that are not affected by using median and wiener filters. Data quality is improved. The K-Means method is used for X-rayimage segmentation. EK-Mean clustering is a way to achieve clustering. Fuzzy EK average segmentation is used to extract contrast, homogeneity, area, correlation, and entropy features from images. We perform classification using a backpropagation neural network [20].

Neural ensemble-based detection(NED) is an automated method of disease diagnosis used in the study of [21]was proposed. Feature extraction, classification, and diagnosis were used as his three main components in the proposed approach. Chest X-ray films taken at Bayi Hospital were used in this experiment. This method is recommended due to its high needle biopsy detection rate and low false-negative identification. This automatically improves accuracy and saves lives [12].

In [13] developed a new early cancer detection algorithm that is more accurate than previous methods. This program uses technology to process images. Elapsed time is one of the factors considered when looking for anomalies in a photo of interest. The original photo shows the location of the tumor very clearly. To achieve better results, watershed segmentation and Gabor filter techniques are used in the preprocessing stage. The extracted zone of interest produces three phases (eccentricity, area, and perimeter) that are useful for detecting different stages of lung cancer. These phases can be found in the extracted zones of interest. Tumors are known to occur in a wide range of areas. The proposed method can provide accurate tumor size measurements at an early stage [15].

A computer aided lung classification method developed using artificial neural network was presented by Jinsa [6]. The parameters are calculated after the entire lung is segmented from the X-ray image. The statistical parameters explained in this paper are used as features for classification. Different neural networks are used for the classification process. Thirteen training functions are employed for evaluating the performance of this system. The training function gives the highest accuracy rate.

In [7] proposed a lung cancer prediction system based on a deep learning technique called Google Net which shows better performance such as convergence rate, accuracy, sensitivity and specificity. Google Net is fine-tuned for the classification of lung cancer cells. This method used less training time and gave better results. Median intensity projection (MIPs) is also discussed in this paper which helps to learn features of cancerous and non-cancerous lung nodules that are compatible with the fine-tuned Google Net. This will increase the accuracy of the system when tested on the validation sets. After 300 epochs, accuracy of 81%, sensitivity of 84% and specificity of 78% are produced by the trained system which is better than other available programs.

Methodology

This section demonstrates how machine learning and image processing-based technology may accurately classify and forecast lung cancer. Gathering dataset is the first step. After that, the lung chest images were preprocessed using a local binary fitting mean filter. Quality of the image is enhanced. The images are then segmented using the K-means technique. This segmentation makes it easier to identify the area of interest. Following that, machine learning-based categorization techniques are used. Figure 2 shows how machine learning and image processing technology are used to categorize and predict lung cancer.

The classification of images representing illnesses is greatly influenced by the image preprocessing. Images from chest X-ray can have a wide range of deviations including noise. Image filtering techniques can be used to eliminate these noises. To reduce the amount of noise, a local binary fitting mean filter is used in the image pre-processing stage [15].

This is achieved by reducing the size of the initial data matrix by the use of a technique called linear discriminant analysis (LDA). Examples of parallel transformation methods include the PCA and LDA. The PCA is an unsupervised analysis technique, as opposed to the supervised LDA technique. Latent dynamic analysis (LDA), in contrast to principal component analysis (PCA), looks for a feature subspace that increases the likelihood of class restoration. By giving the class restoration of the data a higher priority than the cost of processing, overfitting can be avoided [16].

The segmentation technique is applied during the processing of medical images. An image's primary function is to distinguish between elements that are helpful and those that are detrimental. In light of this, it divides a image into various parts according to how much each element resembles the elements around it. By adjusting both the texture and the intensity, this effect can be produced. A segmented area of interest can be used as a diagnostic tool to obtain information rapidly that is relevant to the current

problem. The method known as "K-means clustering" is the one that is most frequently employed when segmenting medical images.

The chest x-ray image is separated throughout the clustering process into a number of distinct groups, also known as clusters. There is absolutely no connection between these clusters. There are a few recognizable clusters seen in this image. Every single one of them has a distinct set of reference points to which each pixel is mapped. The K-means clustering algorithm divides the available information based on k reference points, dividing it into k distinct groups [17].

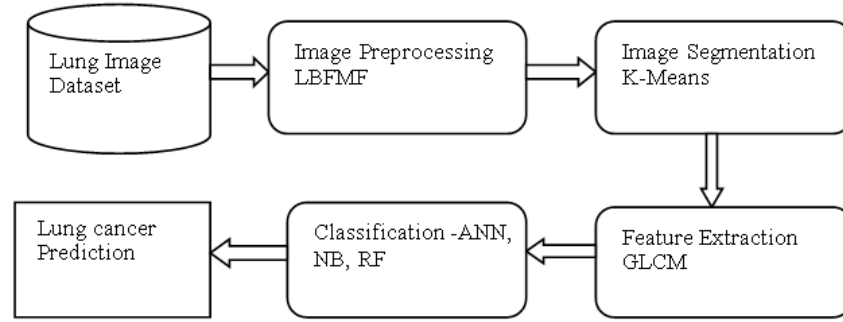


Figure2:Block Diagram of Classification and prediction of Lung Disease

In the medical field, artificial neural networks (ANN) are often used to sort medical images for disease detection. ANN works similar to the human brain when it comes to completing its tasks. By browsing a collection of already classified lung images, it is possible to obtain the necessary information to make an educated guess to which category the lung image belongs. This is possible by browsing the collection of classified images. All images in this image database are assigned to a category. Artificial neurons were designed to behave in the same way as their biological counterparts in the human brain make up an artificial neural network (ANN). Through connections, neurons can communicate with each other outside their bodies. Weights can be assigned to neurons and edges and can be changed at any time during the learning process.

There are three layers in an artificial neural network, namely the input layer, the hidden layer, and the output layer. This architecture is the most commonly used one. Though there are many different topologies that can be employed in artificial neural networks, the most popular ones include input, hidden, and final layers. There could be just one hidden layer, multiple hidden layers, or no hidden layers at all. All these possibilities are feasible. To achieve the desired output, the weights that need to be adjusted are hidden in a layer beneath the active layer [18]. The number of iterations and computing performance during ANN model training are closely linked. Having too few hidden layer neurons will decrease precision, while having too many neurons will increase training time.

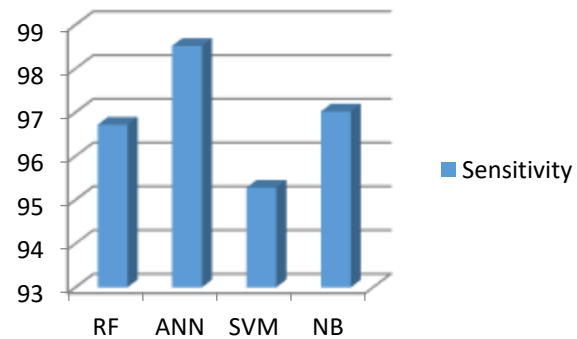
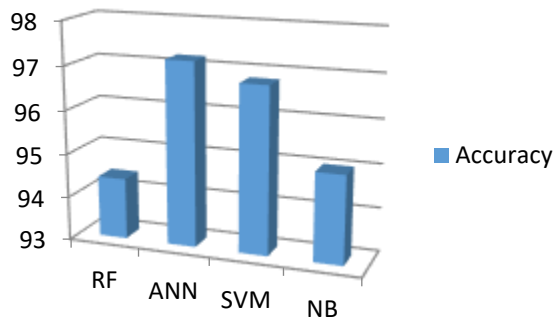


Figure 3:Accuracy of Machine Learning Techniques Figure 4: Sensitivity of Machine Learning Techniques

The KNN technique is the most commonly used ML strategy for learning about ML algorithms. It is a type of supervised learning that doesn't use any parameters. The k-training NN phase is completed much faster than other classifiers, but testing takes longer and requires more memory. Before using k-nearest neighbors to classify new data points, pre-arranged data in various categories is necessary. In each labeled dataset, the algorithm can create a connection between x and y based on the provided training observations (x, y). At this point, it is typical to halt processing and determine the KNN function. In classification and regression models, neighbouring contributions may be prioritized, resulting in higher scores for those who live in close proximity to one another compared to those living farther away[19].

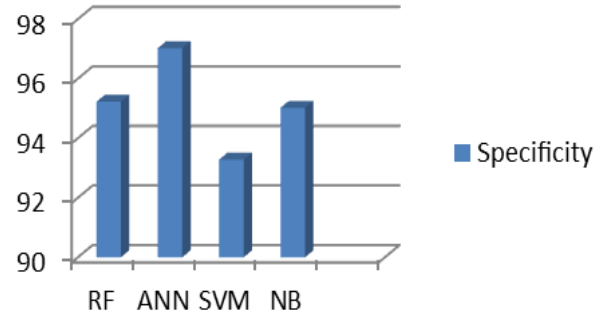


Figure 5: Specificity of Machine Learning Techniques.

During testing, KNN had acceptable precision, but it was slower and more expensive in terms of memory and time. It requires a lot of memory to store the entire training dataset for prediction. Also, the features in the dataset with high magnitudes always hold a higher weight than those with low magnitudes due to Euclidean distance's sensitivity to orders of magnitude. Finally, KNN is not suitable for datasets with high dimensions. Many people use the random forest approach to build predictive models. RF can be used to achieve various applications, including regression and classification. [17].

By modifying datasets, it is feasible to develop machine learning algorithms that can accurately predict outcomes [18]. This approach is more user-friendly compared to other algorithms and is highly favored by the general public. Using this technique, a group of decision trees can be created, each trained differently. The current collection of trees, which represents different multiple-choice answers, was constructed using this method. These were then integrated to produce even more accurate estimates [20].

Result Analysis

In our experimental study, chest X-ray image dataset were collected from the UCI archive and around 150 chest x-ray images was collected. The training set used 70% of images and 30% of images was used as testing data. To implement MATLAB 9.0 was used. To enhance the image quality, preprocessing the images using the Local Binary Fitting Median filter was employed. The output of the image was passed as input to the K-means technique was used to segment the images, to identify the region of interest (ROI). The output of the segmentation stage was passed as input to the machine learning classification methods to analyze the images.

For comparison of performance, the parameters used are accuracy, sensitivity, and specificity.

True positives (TP): These are cases in which we predicted yes (they have the disease), and they do have the disease.

True negatives (TN): We predicted no, and they don't have the disease.

False positives (FP): We predicted yes, but they don't actually have the disease.

False negatives (FN): We predicted no, but they actually do have the disease.

The formula for the calculation of the accuracy is the addition of true positive and true negative (TP+TN) divided with respectively addition of true positive, true negative, false positive, false negative (TP+TN+FP+FN).

$$TP+TN----- (1.1)$$

$$TP+TN+FP+FN----- (1.2)$$

$$Accuracy=equ1/equ2 ----- (1.3)$$

$$Accuracy= (TP+TN)/(TP+TN+FP+FN) ----- (1.4)$$

$$Sensitivity= (truepositives / allactualpositives) = (TP/ TP + FN) ----- (1.5)$$

$$Specificity= (truepositives / predictedpositives) = TP/ TP + FP. ----- (1.6)$$

ResultsofdifferentmachinelearningpredictorsareshowninFigures3, 4 and 5. TheaccuracyofANNisbetter.

Conclusion

Lung cancer is a highly fatal disease that claims the lives of approximately one million people each year. Early detection of lung cancer is critical, and this can be achieved through the adoption of chest X-rays. Image processing is a crucial activity in various economic sectors. It is used to identify any malignant growths that may have developed in the lungs during X-ray imaging. To accurately predict and classify lung cancer, various techniques such as noise reduction, segmentation, classification and identification of damaged regions were employed. medical dataset is collected from UCI repository. This process involves the use of machine learning and image processing techniques. The first step is to collect images which are then preprocessed with a Local Binary Pattern Median filter to improve image quality. Finally, the K-means method is used to segment the lung portion from the image. To improve the accuracy of systems that detect lung cancer, this study uses algorithms for classification based on machine learning. The study found that artificial neural networks (ANN) were more effective in predicting lung cancer. By using robust categorization and prediction methods, the precision of these systems can be improved. In addition, this study provides modern images based on machine learning approaches that can be used for implementation needs.

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PERFORMANCE ANALYSIS OF MACHINE LEARNING CLASSIFICATION TECHNIQUES TO PREDICT LUNG DISEASES

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Abstract: Lung disease is the third most disease in the world. Disease progression and response to treatment in lung diseases vary widely among patients. Accurate diagnosis is crucial in treatment selection and planning for each lung cancer patient. In detection of lung cancer, image processing algorithms have demonstrated superior performance. This study explains various classification approaches that are used to forecast lung cancer in its early stages. The classification of lung tumors as malignant or benign is performed using machine learning algorithms. Machine learning methods involve as: Support vector machine (SVM), Artificial neural network (ANN), Convolutional neural network (CNN), K-Nearest Neighbor (KNN), Multi-Layer Perceptron (MLP), Entropy degradation method (EDM) and Random Forest (RF) are extensively reviewed, and the performance of each is examined for accuracy, sensitivity, and specificity. In this analysis, SVM approach utilizing a short dataset gets the greatest results of 97% accuracy, whereas KNN gets the lowest accuracy 77.8%.

Key words: Lung cancer, ANN, benign, cancer, malignant, CNN, EDM, KNN, MLP

INTRODUCTION

Lung diseases remain the most burdensome manifestation of cancer in almost all countries. High mortality rates from lung diseases have a significant negative impact on the entire world's population. Researchers put forth CAD techniques that can be used to classify issues at an early stage in computed tomography (CT) images [1]. The majority of tests and treatments can be completed fairly quickly, although it could take days or even months, which is normal. Such a delay could lead to major issues for both patients and medical professionals, which would have a negative impact on the survival rate. Therefore, the diagnosis to treatment procedure should be completed extremely quickly in order to improve the patient's condition. The advancement of machine learning techniques has made early lung cancer prediction possible [2]. Some machine learning algorithms for predicting lung cancer are explored in this paper. Neural network is an effective tool for building an assistive Artificial Intelligence (AI) based cancer detection system which plays a major role in the classification of the cancer cells as normal or abnormal. An effective cancer treatment can be seen only when the tumor cells are identified from the normal cells. The machine learning based cancer diagnosis [3] mainly focuses on the classification of the tumor cells and training of the neural network which is very important in lung cancer research[4].This paper discusses different lung cancer classification algorithms such as CNN, SVM, ANN, MLP, KNN, ED, RF and their performances are evaluated.

RELATEDWORKS

Main contributions of some of the researchers who tried to develop a lung cancer prediction system analyzed using different classification algorithms are summarized below.

Sasikala et al. [5] proposed a convolutional neural network (CNN) based approach for classification of lung cancer tumors as benign and malignant. This system is trained by inputting the lung cancer tissue images of variant shape and size. CNN obtained high accuracy of 96% when compared with other conventional neural network systems which makes this method more efficient. In order to detect the cancer types of different size and shape, CNN will use large datasets for training in the forthcoming years. This paper concludes by suggesting a 3DCNN method that can be used for improving the performance of the system and also by improving the hidden neurons with deep network.

A computer aided lung classification method developed using artificial neural network was presented by Jinsa et al. [6]. The parameters are calculated after the entire lung is segmented from the CT images. The statistical parameters explained in this paper are used as features for classification. Different neural networks are used for the classification process. Thirteen training functions are employed for evaluating the performance of this system. The training function gives the highest accuracy rate.

Fang et al. [7] has proposed a lung cancer prediction system based on a deep learning technique called Google Net which shows better performance such as convergence rate, accuracy, sensitivity and specificity. Google Net is fine-tuned for the classification of lung cancer cells. This method used less training time and gave better results. Median intensity projection (MIPs) is also discussed in this paper which helps to learn features of cancerous and non-cancerous lung nodules that are compatible with the fine-tuned Google Net. This will increase the accuracy of the system when tested on the validation sets. After 300 epochs, accuracy of 81%, sensitivity of 84% and specificity of 78% are produced by the trained system which is better than other available programs.

Moitra et al. [8] aims to develop a 1D CNN model for the classification of non-small cell lung cancer (NSCLC). This model performs better than the conventional CNN methods. This method consumes less time and it detects the NSCLC tumors very accurately. It will thus help the researchers to provide new methods of automated cancer treatments.

A 3D multi-path visual geometry group (VGG) evaluated on 3D cubes is proposed by Tekade et al. [9]. The features are extracted from different sources which are available for free access. The proposed approach contains mainly 2 architectures. U-Net architecture is adapted for segmentation of lung nodules from lung CT scan images and 3D multipath VGG like architecture is proposed for classifying lung nodules and the prediction of their malignancy level. This is useful to predict whether the patient will have the cancer in next two years or not. Combining the two approaches gives a better result for predicting lung nodule detection and also further predicting malignancy level. An accuracy of 95.66% and dice coefficient of 90% is obtained using this approach.

METHODOLOGY

Lung Disease detection system (Fig. 1) [10] based on chest CT images using machine learning techniques such as CNN, SVM, ANN, MLP, KNN, EDM and RF are conferred as follows.

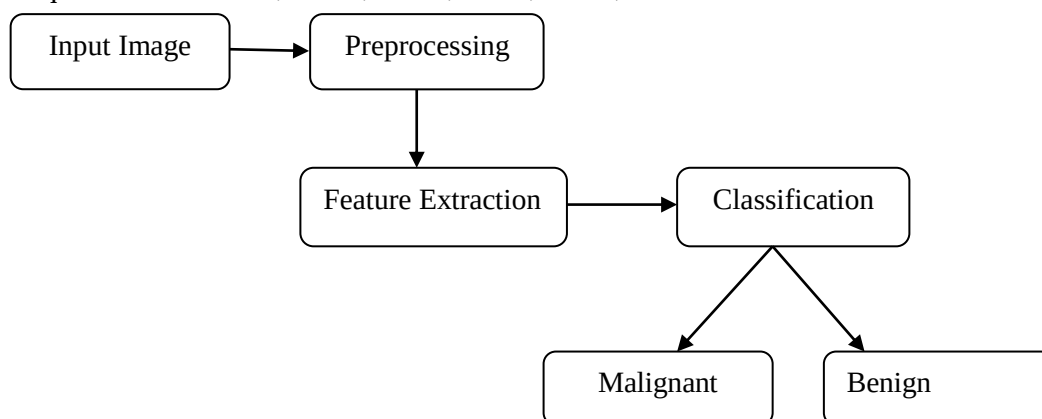
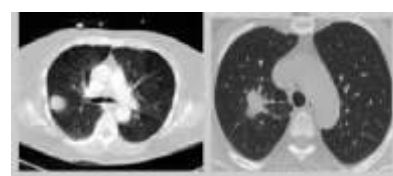


Fig.1.Block diagram of lung disease detection system

In the first stage, lung CT images are preprocessed by applying median filter which minimizes the degradation during acquisition. Then, from the CT image scans, lung regions are extracted. Segmentation of each slice is done to identify tumors. Segmented tumors are then fed as input to the classifier which decides whether the tumor present in a patient's lung is cancerous or non-cancerous [11]. Non-cancerous and cancerous lung images are depicted in Fig. 2. Median filtered



images are depicted in Fig.3.

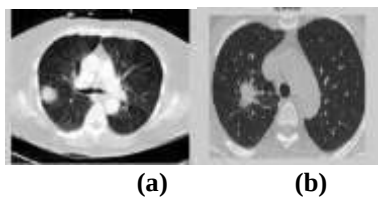


Fig.2. (a) Non-cancerous (b) Cancerous images

Fig.3. Median filtered images

A. Convolutional Neural Network(CNN)

A class of deep neural network called convolutional neural network (CNN) / ConvNets can be used in many applications such as image processing, face recognition, object detection etc. This type of neural network is mainly used to identify the cancerous or non-cancerous lung tumors. Among the pattern recognition and computer vision research area, convolutional neural networks (CNNs) models become popular because of their promising outcome on generating high-level image representations.

A CNN is type of neural network [12] composed of several kinds of layers such as convolutional layer, pooling layer and fully connected layers. In order to extract the features from an input image, convolutional layer creates a feature map .The pooling layer keeps the main information only and the other information are cut down. A fully connected input layer flattens the output from the pooling layer. A Soft Max activation function is used by the final layers [5] after passing through the fully connected layer. The final outcome is obtained from the fully connected output layer which helps in the classification of image [5].

Architecture of CNN proposed by Sasikala et al.[5] is shown in the Fig.4,an image of size $b \times b \times r$, where r is the number of the channels given as the input to a convolutional layer. There are k filter kernels of size $a \times a \times q$ where $a < b$, $q \leq r$ and may vary for each kernel in convolutional layer. In order to produce k feature maps, they are convolved with the input image. Mean or max pooling is used for the sub sampling of each map.

B. Support Vector Machine(SVM)

Vapnik [13] introduced SVM and received considerable recognition due to its high accuracy. An optimal separating hyper plane (OSH) is the basis of this method that separates the training data. The training data is labeled with the output lass called maximum margin classifiers by a supervised learning approach, such that empirical risk can be simultaneously minimized.

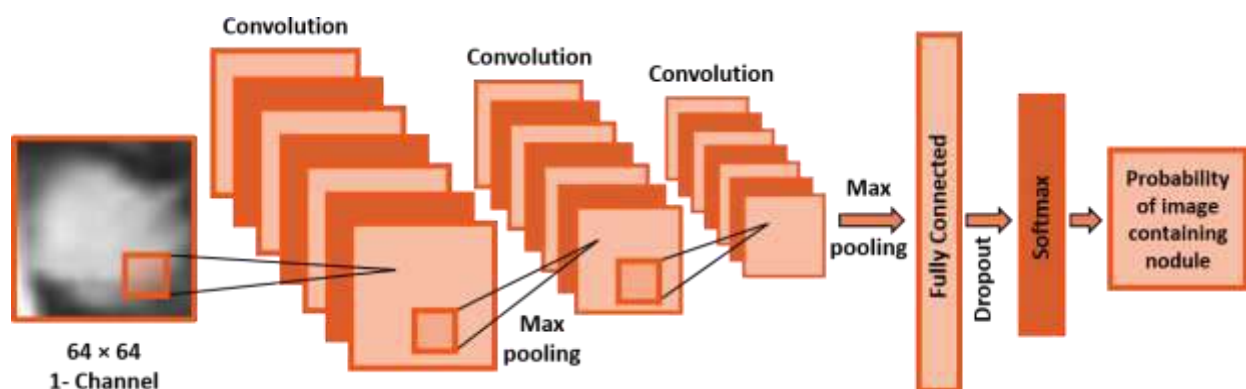


Fig.4.Architecture of CNN

The optimal hyperplane is determined by:

$$\{h \in \mathbb{H} | \langle w, h \rangle - w_0 = 0\} \quad (1)$$

And $\Phi(s_i)$ denotes the mapped data. Where, the inner product in space $\mathbb{H}$ is indicated as $\langle w, h \rangle$, w denotes the quadratic programming problem given as follows:

$$\min_{w, w_0, \xi_1, \dots, \xi_N} \left(\frac{1}{2} \|w\|^2 + C \sum_{i=1}^N \xi_i \right) \quad (2)$$

Subject to

$$y_i(\langle w, \Phi(s_i) \rangle + w_0) - 1 + \xi_i \geq 0, i=1, \dots, N \quad (3)$$

$$\xi_i \geq 0, i=1, \dots, N$$

Where, the number of training samples is denoted as N , ξ_i are slack variables, and C denotes a positive constant. The problem as given in (2) is solved by:

$$\max_{\alpha_1, \dots, \alpha_N} \left(\sum_{i=1}^N \alpha_i - \frac{1}{2} \sum_{i,j=1}^N \alpha_i \alpha_j y_i y_j K(s_i, s_j) \right)$$

Subject to

$$0 \leq \alpha_i \leq C, i=1, \dots, N \quad (5)$$

$$\sum_{i=1}^N \alpha_i y_i = 0 \quad (6)$$

Where, the kernel function is denoted as $K(s_i, s_j) = \langle \Phi(s_i), \Phi(s_j) \rangle$, and α_i are Lagrange multipliers. Support vector lies near to the OSH in the higher feature space [14]. The SVM learning approach [15] is shown in Fig. 5. In this approach, the support vectors help to maximize the margin of the classifier. Therefore, over-fitting between the classes can be reduced. An SVM classifier with Gaussian kernel is given as follows:

$$K(x_i, x) = e^{-\|x_i - x\|^2 / 2\sigma^2} \quad (7)$$

Where, x_i is the data used for training, x is the support vector and σ is the kernel width, and hyper-parameter of SVM. By applying SVM as in (7) with its specification to data obtained from the feature extraction process, the kernel checks whether the input data is mapped to a feature space of higher dimension. Benign and malignant cells are the two classes of separation. The main strengths of SVM are explained in [16].

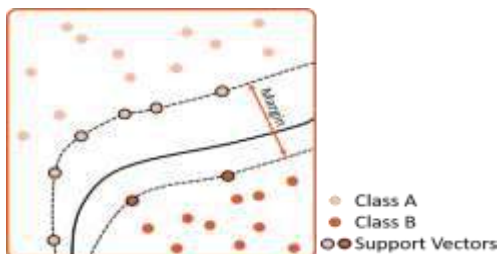


Fig.5.SVM learning approach

C. Artificial Neural Network(ANN)

In the field of medical image classification, Artificial Neural Network (ANN) [17] is used for classification, pattern recognition, decision-making, dimension reduction etc. which makes it one of the major approaches. Applications where data is not clear, data classification and pattern recognition, ANN can be used [18]. Fig. 6 depicts the ANN architecture which is mainly used in the field of cytology. The ANN works better in the range 0 to 1, therefore input data is taken in this range. A feed forward neural network [19] is used to determine the unknown function $y = f(x)$ for a given data set $\{x_i, y_i\} = 1N$. The network uses a back-propagation training function and a row vectors of M hidden layer sizes and a feed forward neural network is returned. The equation following determines the relationship connecting the input, output and hidden neurons given by $(x_i, i = 1, 2, \dots, n1)$, $(Y_k, k = 1, 2, \dots, N)$ and $(h_j, j = 1, 2, \dots, m1)$ respectively.

$$Y_k = [\sum_{m=1}^M w_{mj} (\sum_{i=1}^n w_{ji} x_i + \theta_{in1}) + \theta_{hid}] \quad (8)$$

Where, $g(z) = 1 / (1 + e^{-z})$. w_{kj} is the weight from j^{th} hidden neuron to the k^{th} output neuron, w_{ji} is the weight from the i^{th} input neuron to the j^{th} hidden neuron, a bias neuron in the input layer and hidden layer is denoted as θ_{in1} and θ_{hid} respectively. Furthermore, an activation function is used for processing of each neurons in the ANN which is given as follows.

$$O_{pj} = \frac{1}{1 + \exp(-\sum_i w_{ji} O_{pi} + \theta_j)} \quad (9)$$

Where O_{pj} is the output pattern and O_{pi} is the input pattern. The back-propagation function is used to minimize the weights between pairs of neurons. The adjusted weights are calculated initially as follows:

$$\Delta w_{ji}(k_1+1) = \eta \delta_{pj} O_{pi} + \alpha \Delta w_{ji}(k_1) \quad (10)$$

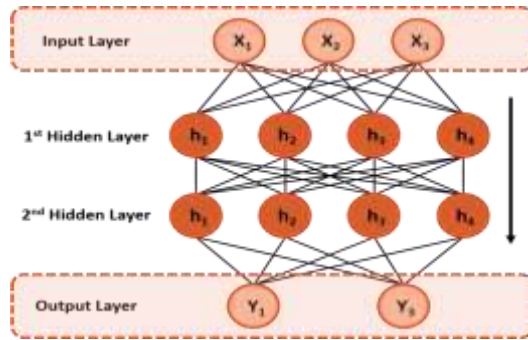


Fig.6. ANN Architecture

Where, the learning rate is denoted as η which is equal to 0.3, is the momentum term equal to 0.9, k_1 indicates the number of iterations, and δ_{pj} is the error between the desired and actual ANN output values. In ANN, the final weights can be calculated based on some Conditions such as δ_{pj} should become smaller than a threshold value or k_1 has reached another threshold value. Much care is taken when deciding the number of hidden layers. The number of epochs selected varies from 5 to 10 which will decide how much the number of hidden nodes is changed. Finally, for classification of CT images into normal and abnormal, the best trained ANN network [20] is used.

D. Multi-Layer Perceptron (MLP)

The architecture of the MLP classifier is shown in Fig.7 which consists of three layers namely: input, hidden and output layers. There are several neurons present in each layer. Direct learning process is used by the MLP classifier for generating different classes and the optimal weights are calculated by back propagation training process. The MLP model is trained by the following parameters such as number of hidden layers, alpha, learning rate and solver which is used for optimizing weight [21]. Back propagation neural network is used for enhancing the performance of the MLP.

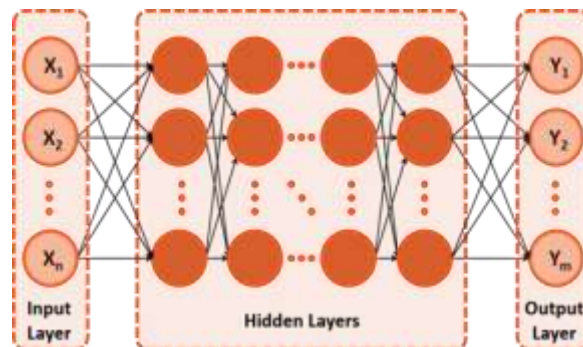


Fig.7. MLP architecture

E. K-Nearest Neighbor(KNN)

Datasets are classified based on their similarity with neighbors using the KNN algorithm. In this classification method, K denotes the quantity of data set. The test sample label determines the similarity among the K -nearest neighbors. In this algorithm, the distances between a test sample and database samples are found by using the Euclidean Distances(ED).

F. Entropy degradation method(EDM)

Entropy degradation method (EDM) proposed by Qing Wu et al. [22] is used to diagnose small cell lung cancer (SCLC) from CT images [23]. Data images used for training and testing of good quality are collected from the National Cancer Institute. A number of patient CT scans of high resolution are obtained from open source databases. Pathology diagnosis will provide them with ground truth labels. In this method, from the database, 12 lung CT scans are selected which consists of an equal number of healthy lungs and SCLC patient's lungs.

In order to train the model, 5 random scans from each group are selected and the remaining two scans are used for testing. Each CT images contain 100 to 500 axial slices of the chest cavity based on scan parameters. Then, labeling as cluster 1 and cluster 0 will help to identify the SCLC images and other, respectively. This is done because for SCLC patients, not all CT scans reveal cancer cells. Two additional CT images are used for testing; one for SCLC patient and one without are selected.

Non-cancerous and cancerous images are identified using the SCLC detection [24] of group 0 and group 1 respectively. From the training sets, many features are extracted [22]. The vectorized histogram from cancerous and non-cancerous lungs is fed into the neural network during the training process. Each training set is transformed by ED Min to a score [25] which are then converted into probability with the help of a logistic function. For testing, an input without any marking is used for testing which is fed into the neural network. In this case the output is calculated by using the probabilities associated with those scores. The final output will help to find the group to which the testing data belongs to, whether a cancerous or non-cancerous patient [20].

The estimated maximum entropy signals $Y = cd f(y)$ is used. Its value is calculated by function h , as given below,

$$(x,y)=\sum_{i=1}^n(X_i - Y_i)^2 \quad (11)$$

$$h = (d(\det(W)) + 1) \sum (\log(e+1-Y^2)) \quad (12)$$

Where, W denotes identity 5×5 matrixes.

$$W=W+ \eta \times (g) \quad (13)$$

Where, η is used to control convergence speed and the gradient matrix is defined as g .

G. Random Forest(RF)

Random forests are known for their high performance and generalizability. In order to perform the classification, RF model can be used where the dependent variable is categorical. Based on the rules, the data is divided by the tree. The dataset can be split into many regions by using these rules. Variable's influence to the homogeneity or cleanliness of the subsequent child nodes (X_2 , X_3) can be used to compute these rules. The variable X_1 becomes a root node because it leads to maximum homogeneity in child nodes. RF model have some other features which helps in the classification process such as Gini Index and Entropy.

RESULTS

A. Dataset

In the CNN approach [16] proposed by Sasikala et al. [5], a dataset consisting of 1000 CT scans are collected. These CT scans are having different nodule sizes. They are, nodule greater than or equal to 3mm, less than 3mm, and non-nodule greater than or equal to 3 mm. Among them, training sets consist of 70 images and testing set consists of 30 images. Lung cancer classification using SVM was proposed by Fenwa et al. [17] acquired a total of 80 images which consists of both Chronic Obstructive Pulmonary Disease (COPD) and Idiopathic Pulmonary Fibrosis (IPF). Training and testing are done using 48 and 32 images respectively. ANN machine learning algorithm proposed by Naresh et al. uses 111 CT images for stage1 and 73 samples for stage2 type of lung cancer. Nodules are described by using the structural and textural features. Among the

dataset obtained, 70% are used for training and 30% are used for testing. MLP and KNN algorithms proposed by Sujata et al. [21] uses python programming language for the implementation and the performances are evaluated on DICOM CT images of 1018 cases collected from LIDC-IDRI. In addition to the lung parts, some other parts such as aorta, vena cava, trachea, esophagus are also present in the CT scan images. Morphological opening and local thresholding method are used for extracting Region of Interest (ROI). The features are extracted from the segmented gray scale lung volume. The training set consists of 4877 normal, 36 benign and 53 malignant cases. The testing set consists of 1221 normal, 7 benign and 14 malignant cases. To evaluate the performance of the EDM algorithm, 100 CT scans are used which contains multiple axial slices (100 to 500 slices) of chest cavity depending on scan parameters.

Training set is obtained by randomly selecting 10 of them, where 5 of them will be healthy patients and other 5 SCLC patients. Training input is the extracted vectorized histogram. The remaining samples are taken as testing set. Total of 36 tests are done from these combinations. RF method proposed by Jaya raj et al. [8] also uses a dataset consisting of 1018 images with 512*512 pixel dimensions.

B. Performance evaluation

These above mentioned classifiers can be compared with the help of confusion matrix [11]. True Positive (TP), False Negative (FN), False Positive (FP), and True Negative (TN) [22] are used in representing the confusion matrix (Table I). Sensitivity, specificity and accuracy can be calculated using TP, FN, FP and TN. The correctly classified lung cancer images are given as true positive and the wrongly predicted as non-cancerous images are given as false positive. In CNN method [5], an input sample image is fed to the trained model which is followed by preprocessing, feature extraction and finally identifying the cancer spot. Implementation of this neural network is performed in MATLAB. Some parameters such as weight, learning rate, gradient moment and hidden neurons are also used for training. In order to improve the accuracy of this method, two convolution and subsampling layers are also used. This method shows an accuracy of 96%, sensitivity of 87.5% and specificity of 100%. SVM method [17] uses a total training time of 146.86s and total recognition time of 0.284s. This method is able to obtain an accuracy of 96%, sensitivity of 90% and specificity of 90%. While considering ANN approach [18], an accuracy of 92.68%, sensitivity of 55.26% and specificity of 100% can be seen. In the MLP and KNN methods [21], accuracy, sensitivity and specificity are almost same which is given in Table II. EDM algorithm [22] makes 10 FP predictions and it also misses 6 cases when the patients actually diagnosed with SCLC. It shows an accuracy of 77.8%, sensitivity of 83.33% and specificity of 72.22%. By using RF method, accuracy of 89.9%, sensitivity of 90.85% and specificity of 88.32% is obtained. Evaluation metrics showing the performances of all these methods are presented in Table II. Fig.8 shows the performance criteria of all methods. Accuracy of CNN, SVM, ANN, MLP, RF and EDM are high when compared with KNN. Sensitivity of CNN, SVM and RF is high. ANN, MLP and EDM are showing low sensitivity. CNN, ANN, MLP and EDM are having 100% specificity.

From these studies, SVM is proved to be a good classifier showing better performance by using a smaller dataset compared to other methods. SVM, MLP, RF and KNN are better compared to ANN and EDM [23]. EDM algorithm needs improvement because of many false positive predictions [24]. This can be rectified by using large datasets.

TABLE I: CONFUSION
METRIX

Parameters	SVM	CNN	ANN	MLP	EDM	KNN	RF
TP	8	15	17	1196	1200	30	600
TN	21	19	17	21	21	26	400
FP	0	6	0	5	1	10	8
FN	1	10	3	20	20	6	10

TABLE II EVALUATION METRICS

Author	Algorithms	Sensitivity	Specificity	Accuracy
Fenwa et al.[16]	SVM	86.5%	100%	97%
Sasikala et al.[5]	CNN	90%	90%	96%
Naresh et al.[28]	ANN	55.26%	100%	92.68%
Sujat aet al.[21]	MLP	51.2%	100%	98.31%
Qing et al.[22]	EDM	51.3%	100%	98.30%
Sujata et al.[21]	KNN	83.33%	72.22%	77.8%
Jayaraj et al.[8]	RF	90.85%	88.32%	89.9%

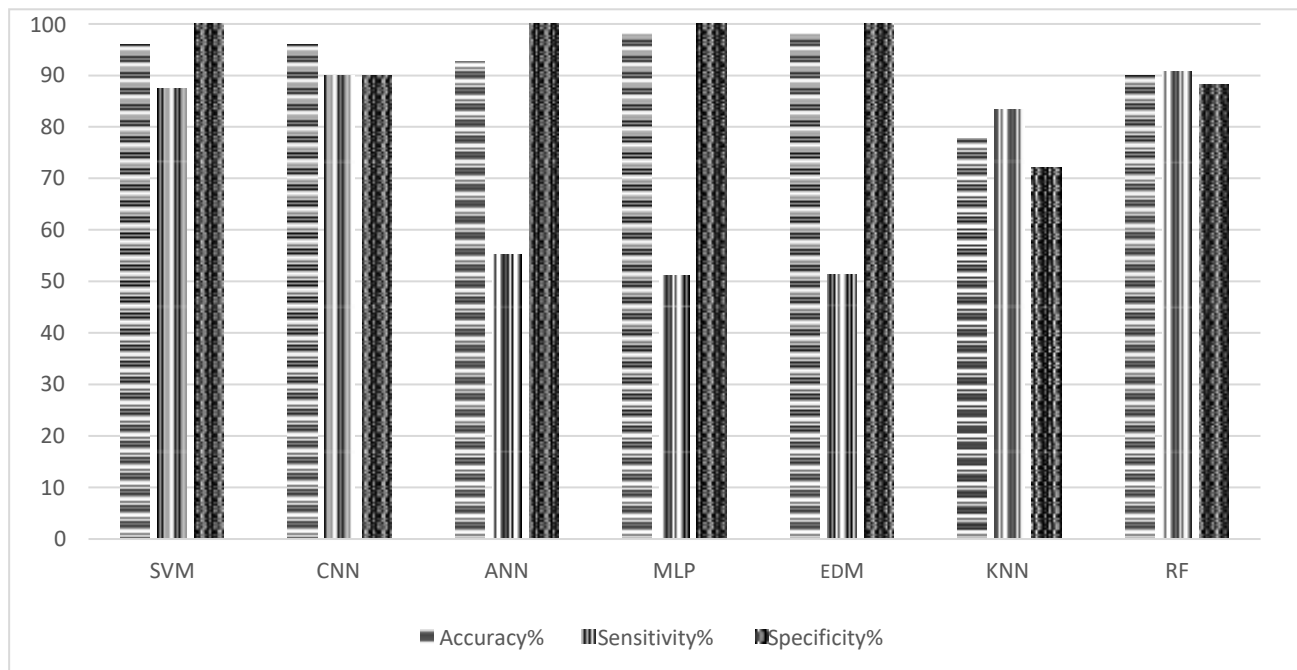


Fig.8. Bar chart for Performance Evaluation

CONCLUSION

In this paper, different machine learning techniques used in the classification of lung tumor such as CNN, SVM, ANN, MLP, KNN, EDM and RF are explained and their performances are evaluated in terms of accuracy, sensitivity and specificity. SVM classifier is able to classify the benign and malignant cells with high accuracy of 96% with a test data of 30 images. Sensitivity and specificity of the SVM based system are also compared to other techniques. SVM classifier also shows better accuracy of 97% with test data of 32 images, hence used for differentiating the pulmonary lung nodules into malignant and benign to assist the radiologist and for the future enhancement. ANN, MLP, EDM and RF are able to achieve high accuracy of 92.68%, 98.31%, 98.30% and 89.90% respectively with large datasets. The KNN method shows the least accuracy of 77.8%. KNN requires a large space for improvement. In order to enhance the performance, KNN method is combined with SVM, where large datasets and deeper network are used for training. Thus in CT lung imaging, this method can be used for various applications.

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DEVELOPMENT OF CROP YIELD PREDICTION MODEL IN AGRICULTURE USING IMPROVED EXTREME LEARNING MACHINE

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Abstract

The finest utility sector is agriculture, particularly in emerging nations like India. Utilizing historical data in agriculture may change the context of decision-making and increase farmer productivity. Approximately a part of India's population is employed in agriculture, however this sector contributes just 14% of India's GDP. This may be explained in part by farmers not making sufficient decisions on yield forecast. Increased agricultural yield is the outcome of accurate crop forecast. With this goal in mind, this work proposes the Improved Extreme Learning Machine (IELM) approach, which aims to forecast the best-yielding crop for a specific region by analyzing a variety of atmospheric factors, such as rainfall, temperature, humidity, etc., and land factors, such as soil pH and soil type, as well as historical data on crops grown. In this study, feature selection strategies are used to forecast crops using classification algorithms that recommend the best crop(s) for a given plot of land. After pre-processing the data to eliminate any undesirable information like NULL and other entries, this system is meant to forecast the best yield based on the dataset it has been given. Weak characteristics are eliminated using the Recursive Feature Elimination (RFE) feature selection approach until the necessary attributes are fulfilled. The IELM classifier beats the other learning strategies, according on the experimental findings.

Keywords – Agriculture, crop yield prediction, Improved Extreme Learning Machine, rainfall, temperature, humidity, land factors, feature selection and Recursive Feature Elimination

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1. INTRODUCTION

The agricultural industry is essential to human survival and the economy. Crop selection in traditional agricultural methods relied on farmers' rudimentary understanding. Most often, farmers want to choose the crop that is most popular in their locality or neighborhood. The fertility of soils is negatively impacted by a lack of scientific understanding about farming and a lack of crop rotation. Soil nutrients, groundwater level, and fertilizer type are major determinants of crop quality. A traditional farmer deals with ongoing difficulties. The improper crops chosen and insufficient soil nutrients may cause the acidity of the soil to grow [1]. The biggest element affecting crop quality and productivity is the unstable climate. For the best crop selection and the health of the crop, soil fertility is crucial.

The goal of the study is to identify issues that farmers have while trying to grow quality, robust crops. We provide a crop production prediction model based on an ML algorithm to address the aforementioned difficulties in agriculture. It aims to solve a few existing agricultural problems brought on by ineffective methods. As shown in Fig. 1, it takes into account metrological elements such as temperature, humidity, rainfall, CO₂ level in the air, soil pH, EC, and soil type. Plant development and output are directly impacted by metrological conditions [2].

Soil analysis is carried out to evaluate the soil's fertility. The macronutrients of soil, nitrogen, phosphorus, and potassium, are taken into account for soil analysis. These three essential elements are crucial for the health of plants and the prevention of illness. By regulating nutrient chemical reactions and forms, the soil pH controls soil nutrient available for crops and reveals how alkaline the soil.

The growth of the plant is impacted by higher and lower soil EC values. Additionally, it shows the soil's salinity, water quality, and fertility. The amount of CO₂ in the air has a significant impact on crop health. It is used during the process of plant dataynthesis. Both clay and loamy soil may be used with the suggested model. These kinds of soil contain the proper levels of moisture and humidity for most crops. The amount of rainfall is also crucial for crop health [3], since various crops may need varying amounts of water. Before planting the crop, knowing the season's normal rainfall is quite helpful. Although it is difficult to anticipate, machine learning systems have shown encouraging outcomes. Crop output may increase from 50% to 90% by switching to precision farming methods. Precision farming is a methodical approach to rational decision-making and efficient resource use [2]. By using this strategy, soil fertility may be maintained. IoT can play a significant role in enabling precision agriculture.

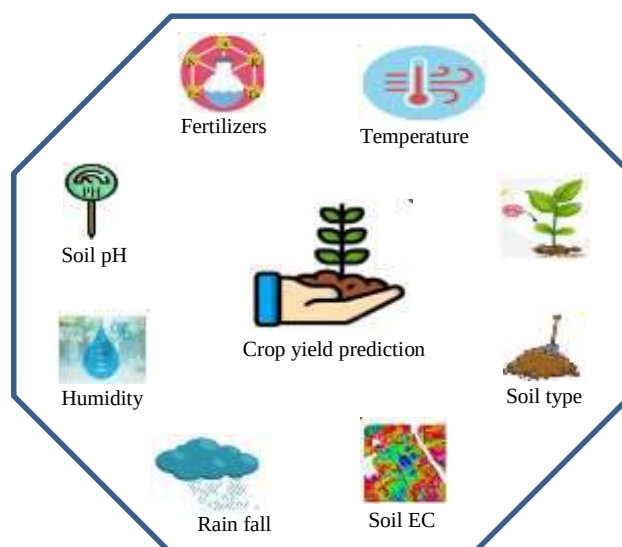


Fig. 1. SmartArt diagram for crop selection for yield prediction features.

An IoT-based agricultural system may provide efficient decision-making and steer clear of unpleasant circumstances. Smart agriculture uses automation systems, which are less costly than conventional agricultural methods yet more exact. Three layers make up the framework of IoT systems: perception, network, and application. Physical tools like sensors, RFID tags, and cameras are employed to gather data on the perception layer. Data transmission and forwarding are done at the network layer. IoT and a particular domain of use are combined via the application layer. [4].

A fascinating use of artificial intelligence is machine learning. It offers the opportunity to learn from encounters without the need of a formal curriculum [5]. The suggested strategy is built on simple, reasonably priced technology that farmers and agricultural officials may utilize to increase crop output. SCS model is tested after being trained by categorizing data. An ML classifier's effectiveness and accuracy are solely dependent on the kind and volume of the data [6]. In this research, I want to provide a classifier-based approach to agricultural production prediction. The three steps of the proposed agricultural yield prediction are pre-processing, feature reduction, and prediction. The input data is often inaccurate and missing specific

behaviors or patterns, contradictory, and/or insufficient. Pre-processing data is a tried-and-true way to fix these problems. A good data pre-processing takes less time and results in a better model. The suggested technique's subsequent step involves feature selection using RFE. Finally, the suggested technique employs a classifier to forecast crop production. The IELM is used as the basis for the forecast. Predictions correctness and error value are used to assess how well the suggested strategy performs.

The remainder of the essay is organized as follows. Briefly describe relevant works in Section 2. Explain the suggested system in Section 3. highlighted and reviewed the findings in Section 4. Section 5 draws findings and suggests more research.

2. RELATED WORKS

For quick decision-making, crop yield forecast is a crucial responsibility for decision-makers at the national and regional levels (such as the EU level). Farmers may choose what to produce and when to grow it with the aid of an accurate crop production prediction model. There are several methods for predicting agricultural yields. This review section has looked at the research on agricultural yield prediction using machine learning that has

been done in the literature. According to the study design, Patil et al. [7] suggested using a hybrid technique that combines logistic regression and random forest (LRRF) to forecast agricultural output based on yearly rainfall. Reinforcement Random Forest, a novel hybrid regression-based algorithm suggested by Elavarasan & Durai Raj Vincent [8], outperforms more well-known machine learning methods including random forest, decision tree, gradient boosting, artificial neural network, and deep Q-learning. The novel approach employs reinforcement learning at each choice of a splitting characteristic during tree building to make the most use of the samples that are available. The results showed that the suggested method works better with lower error measures and increased accuracy of 92.2%.

Guo & Xue [9] In this paper, a paradigm for modeling and predicting agricultural yields is provided. By addressing agricultural output and related variables as a non-temporal collection, it provides a complementing method to standard time series analysis on modeling and forecasting. In order to clean up the data and, if required, expand it for neural network training and testing, statistics are utilized to discover the highly linked factor(s) among various crop yield correlates. This incorporative technique is tested using the wheat production, related plantation area, rainfall, and temperature data from Queensland, Australia, over a 100-year period. To illustrate the advantages of regional agricultural output forecasting in Europe, Paudel et al. [10] created a general machine learning methodology. We anticipate crop yields for 35 case studies, nine of which are important producers of six crops, in order to assess the accuracy and utility of regional predictions.

With Wilcoxon p-values of $3e-7$ for 60 days before harvest and $2e-7$ at the end of the season, respectively, machine learning models at the regional level showed lower normalized root mean squared errors (NRMSE) and uncertainty than a linear

trend model. In 18 out of 35 instances, regional machine learning predictions aggregated to the national level, 60 days before harvest, showed lower NRMSEs than forecasts from an operational system, with a Wilcoxon p-value of 0.95 suggesting equivalent performance. To find the most crucial factors for forecasting coffee output and to determine how to balance the nutritional state of the plants, such as Mg, Fe, and Ca levels to maximize yield, de Carvalho Alves [11] suggested a random forest model. For calculating coffee production in the field, characteristics pertaining to the nutritional condition of the coffee were more crucial than remote sensing variables. The occurring more frequently of each machine learning algorithm modeling was used in terms of the benefits of each methodology's results synergic in favor of carefully identifying the finest approach and techniques for crop management, even though the random forest model (rf) had a greater precision for predicting coffee yield when comparison to the rpart1SE model.

Pant et al., [12] employed machine learning to forecast four widely-cultivated yields that are mostly grown in India. Once the crop yield for a certain location has been estimated, inputs like pesticides may be administered differently based on the anticipated crop and soil demands. In this paper, we create a trained model for crop forecasting using machine learning methodologies to find trends in the data. In this work, machine learning is used to forecast the yields of the four most widely grown crops in India. These crops include wheat, potatoes, paddy rice, and corn. For five crops—soft wheat, spring barley, sunflower, sugar beet, and potatoes—and three nations—the Netherlands (NL), Germany (DE), and France (FR), Paudel et al.[13] 's forecasted production at the regional level. We contrasted the results with a straightforward approach that lacked any predictive ability and projected either a linear yield trend or the mean of the training set. Additionally, we combined the

estimates to a national level and contrasted them with earlier MCYFS forecasts. By incorporating additional data sources, creating more predictive characteristics, and testing various machine learning methods, the baseline may be enhanced. The starting point will encourage the use of machine learning for extensive agricultural production forecasts.

Gong et al., [9] To identify the input weights and hidden biases of an extreme learning machine (ELM), two optimization techniques, swarm optimization (PSO) and genetic algorithms (GA)—were presented. Two innovative hybrid GA-ELM and PSO-ELM models were also constructed for ETo predictions with limited input data. 96 meteorology locations throughout China's diverse climates provided daily climatic data from 1994 to 2016 that was used to train and test the models utilizing a temporally and geographical technique that may prevent inaccurate or only partly correct findings. The findings showed that GA-ELM and PSO-ELM could measure ETo on a daily, monthly, and yearly time frame, with GA-ELM outperforming PSO-ELM in all environments. In order to create crop development and cultivating plans that are more production and wealth, Sakthipriya and Naresh [15] suggested a decision tree and a support vector machine approach that takes environmental factors, such as temperature and the nitrogen content of the soil, into consideration.

Pantazi et al., [16] Based on online multi-layer soil data and satellite crop growth parameters, forecast wheat yield within-field variance. By applying an unsupervised learning method, supervised self-organizing maps were created that are capable of managing data from various soil and crop sensors. For a single cropping season, the effectiveness of XY-fused Networks (XY-Fs), Supervised Kohonen Networks (SKNs), and counter-propagation artificial neural networks (CP-ANNs) were tested for forecasting wheat production in a 22 ha field in Bedfordshire, UK. To anticipate crop yields, Johnson et

al. [17] used MODIS-NDVI, MODIS-EVI, and NOAA-NDVI as predictors using multiple linear regression (MLR) and two nonlinear machine learning models: Bayesian neural networks (BNN) and model-based recursive partitioning (MOB). The cross-validated mean absolute error skill score (in relation to climatological predictions) was used to assess crop production forecasts generated using predictors from July and earlier throughout the period 2000–2011. For all three crops, MODIS-NDVI was determined to be the best predictor, however adding MODIS-EVI as a second predictor improved forecasting abilities.

Inference: When diverse input patterns are analyzed, the over-fitting issues with the conventional machine learning models might result in unexpectedly significant forecast failures. In this work, the ELM approach was really created to address the knowledge gaps and shortcomings of existing predictive modeling techniques. The ELM has been shown to be an effective method and a promising algorithm for resolving over-fitting issues. The shortcomings of both conventional and machine learning prediction modeling approaches are really addressed by the ELM's process. The ELM's method makes it possible to significantly reduce the chance of suffering over-fitting during training, leading to constant forecast performance for unanticipated input patterns. Additionally, the random projections approach used in parallel computing techniques enhances the likelihood of a good converging operation and reduces the amount of time required to reach the efficiency objective.

3. METHODOLOGY

Human face is a critical facet as far as social cThe precise yield prediction for the several crops included in the planning is a critical concern for agricultural planning intentions. Data mining methods are a critical component of any strategy for

achieving realistic and efficient solutions to this issue. Big data has a clear objective in agriculture. It is now more important than ever for farmers to utilize information and get assistance when making important agricultural choices because of changing environmental factors, soil variability, input levels, and commodity pricing. This effort focuses on the analysis of agricultural data and identifying the best settings to employ IELM to provide the highest crop yield possible. Optimizing productivity and strengthening agriculture's resistance to

climate change requires analyzing new, non-experimental data as well as mining the vast amounts of current crop, soil, and weather data.

3.1 Input dataet description

Crop production data: The information relates to production and crop covered area (Hectare) statistics broken down by district, crop, season, and year (Tonnes). the data collection that may be found at <https://data.world/thatzprem/agriculture-india>.

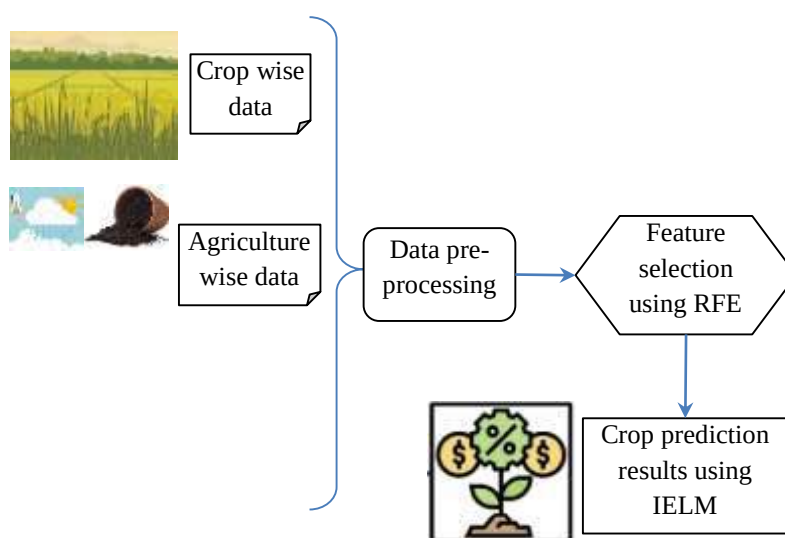


Fig. 2. General Framework diagram

The data is being utilized to research and analyze agricultural productivity, the importance of manufacturing to regions, states, and countries, the performance of agroclimatic zones, the order of high yielding crops, crop growth patterns, and crop diversification. The system is also an essential tool for developing crop-related plans and evaluating their effects. State Name, District Name, Crop, Year, Season, Crop, Cropclass, Area, and Production are the qualities.

Climate Link: The data is gathered from the official Indian website, Through the site collect minimum temperature ($^{\circ}\text{C}$), maximum temperature ($^{\circ}\text{C}$), average temperature ($^{\circ}\text{C}$), precipitation(mm), humidity (%), pressure, dew point $^{\circ}\text{C}$, wind. (m/s). The attributes are Max-Temp,

Min-Temp, Avg-Temp, Precipitation, Humidity, Dew points, wind and pressure.

The data in the proposed study is clustered based on districts with comparable temperature, rainfall, and soil type using a modified IELM technique. Based on these evaluations, we are determining the ideal crop production parameters, and the yearly crop output is predicted using the IELM approach. In this work, RFE used for feature extraction process.

3.2 Data pre-processing and RFE based feature selection

The BMI attribute in the retrieved dataset has null values, which must be eliminated. If these values are present, the model's correctness may suffer. Additionally, the

'LabelBinarizer' technique is used to encode the category values into numerical values since training is only possible on numerical values because it entails standardizing the characteristics. It is necessary to find the relevant aspects that have a strong and positive connection with features of interest for crop production prediction after calculating the missing values. Construction of a reliable diagnostic model is hindered by the elimination of unnecessary and worthless characteristics during the vector feature extraction process [18]. In this work, the most crucial elements

of a prediction were extracted using the RFE approach. Due to its simplicity of usage and setups, as well as its efficiency in picking characteristics in training datasets important to detecting goal parameters and removing weak characteristics, the Recursive Feature Elimination (RFE) method is particularly well-liked. By identifying strong connection among certain characteristics and the goal, the RFE approach is used to choose the most important features (labels). The following are the steps for:

Step 1: Train the models with all available characteristics.
Step 2: Analyse the accurateness
Step 3: Identify each feature's significance to the model.
Step 4: for each subset size S_i , $i = 1 \dots N$ do

- Keep the S_i most crucial characteristics
- Training the model using S_i features
- Analyze the model's precision

Step 5: Determine the precision profile throughout the S_i
Step 6: Choose the right amount of characteristics.
Step 7: Utilize the model that represents the ideal S .

Algorithm 1 RFE-based feature selection

3.3 Improved Extreme Learning Machine based crop yield prediction

Extreme Learning Machine, a learning algorithm that can pick up new information considerably more quickly than other learning algorithms, is employed as the classifier in the present work [19]. With this learning approach for feedforward neural networks, the greatest generalization efficiency is attained. This technique is a very effective learning algorithm for single-hidden layer feed forward neural networks, despite its simplicity (SLFNs). It is capable of selecting the input weights at random and without bias while making an analytical decision on the output weights of SLFNs. A common finding is that the ELM learning

method may be used to train SLFNs with a variety of non-differentiable and non-regular activation functions [32]. The output weights of a single-hidden layer feedforward network (SLFN) are analytically determined in the Extreme Machine Learning method utilizing the Moore-Penrose (MP) generalized inverse rather than an iterative learning technique [20]. Figure 3 shows the topology of an Extreme Learning Machine-based single-hidden layer feed-forward network. In here, lw_{1n} , lw_{2n} , and lw_{rn} are weights vector connecting the k th hidden neuron and the input neurons, w the weight vector between the k th hidden neuron with the

output neuron, and $af(\cdot)$ is the activation function.

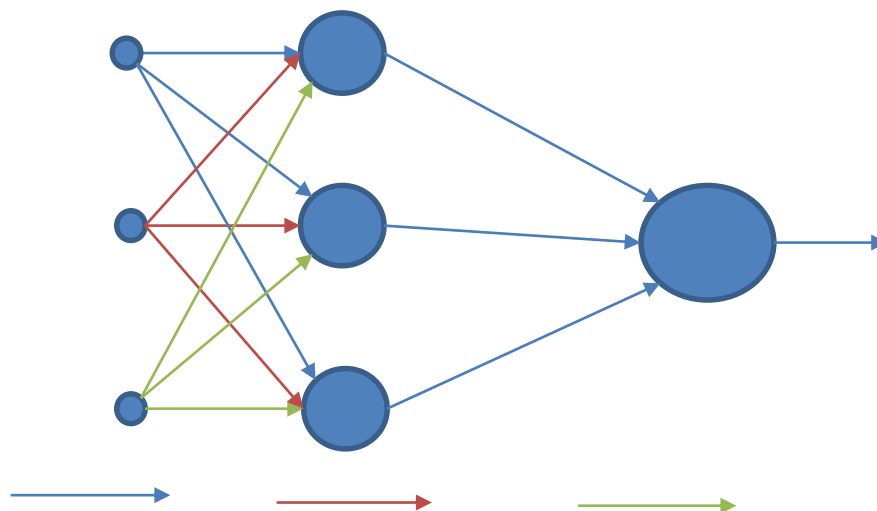


Fig.3. The structure of Extreme Machine Learning.

The most significant features of ELM: The learning rate in the ELM framework is really quick. As a result, ELM may be used to train a single hidden layer feedforward network. This results in the creation of an ELM learning approach, which is quicker than other traditional learning methods. Because the ELM learning method performs well for neural networks, the goal of utilizing it is to acquire less training error

and less weight norms. The ELM learning technique is employed in the single-hidden layer feed forward network's topology together with non-differentiable activation functions. To enter the ELM structure, the simple solutions are attempted [19]. The following are the outputs of an ELM with n neurons and an activation function generated with weight and bias b .

$$\text{out}_j = \sum_{i=1}^n \beta_i af(lw_i x_r + b_i)$$

Compared to traditional neural networks, the ELM learning algorithm offers a quicker learning rate. Additionally, it outperforms them in terms of generalization performance. Researchers who study ELM have become more prevalent in modern times [19]. The hidden layer's initial settings in the ELM learning

algorithm don't need to be adjusted. All nonlinear piecewise continuous functions are used as hidden neurons in the ELM method. Therefore, for N crop data samples $\{(r_j, m_j) | r_j \in Q^1, n_j \in Q^k, j = 1, \dots, N\}$, the output function in ELM by using k hidden neurons is

$$u_k(r) = \sum_{j=1}^k Sw_j v_j(r) = v(r) Sw$$

Where $v = [v_1(r), v_2(r), \dots, v_k(r)]$ when compared to the input crop data, is the

hidden layer's output vector r , $Sw = [Sw_1, Sw_2, \dots, Sw_k]$ the hidden layer of the

vector containing the output weights k both input and output neurons. Data is changed from input space to the ELM feature space using a vector [19]. To reduce the training

error in the ELM method, the output weights and training error should be decreased simultaneously. Thus, neural network adaptation efficiency improves:

$$\text{minimize } \|H_{out} \cdot Sw - E_{out}\|, \|Sw\|$$

This equation can be solved by using

$$Sw = H_{out}^T \left(\frac{1}{RC} + H_{out} \cdot H_{out}^T \right)^{-1} \times E_{out}$$

where RC , H_{out} , which represents the output matrix of the hidden layer, and E_{out} , which represents the anticipated output

matrix of the samples, are each given. As a result, the ELM learning algorithm's output function is as follows:

$$u(r) = v(r) \cdot Sw$$

If the feature vector $v(r)$ is unknown, it is possible to construct the kernel matrix of

ELM using Mercer's criteria MC as follows.:

$$KM = H_{out} \cdot H_{out}^T: k_{jz} = v(r_j)v(r_z) = b(r_j, r_z)$$

Thus, the Improved Extreme Learning Machine's (IELM) output function $u(r)$ may be expressed as follows:

$$u(r) = [b(r, r_1), b(r, r_2), \dots, b(r, r_n)] \left(\frac{1}{RC} + KM \right)^{-1} \times E_{out}$$

In there, KM and $b(r, g)$ is the Extreme Learning Machine's core operation. The linear kernel, polynomial kernel, gaussian kernel, and exponential kernel are a few

kernel functions that are suitable for the Mercer condition in ELM [19]. For the simulation and performance evaluation of IELM in this work, the wavelet kernel function is utilized:

$$b(r, g) = \cos \cos \left(\omega \cdot \frac{\|r - g\|}{x} \right) \exp \exp \left(-\frac{\|r - g\|^2}{y} \right)$$

According to the findings of these applicability tests, the wavelet kernel function indicated in $b(r, g)$ performs higher in training and assessment than the linear kernel, polynomial kernel, Gaussian kernel, and exponential classical kernel functions, respectively. For the effectiveness of ELM's training, the values of the configurable parameters x , y , and ω are crucial. In order to solve the issue, values for these parameters need be carefully calibrated. The number of hidden

neurons and the knowledge of the hidden layer feature mapping are not requirements for IELM methods. Additionally, the IELM learning algorithm outperforms the traditional ELM learning method in terms of adaptation efficiency. Additionally, it was shown that IELM is more stable than traditional ELM for predicting crop production.

4. EXPERIMENTS, RESULTS AND DISCUSSION

The performance of this work's suggested model is the main topic of this section. Compare IELM in the experiment to two widely used techniques for crop selection identification, LRRF [7] and CP-ANNs [16]. The experiment's findings demonstrate that the residual network with multidimensional feature comparison presented in this study outperforms conventional models. Performance criteria such as precision, sensitivity/recall, specificity, f-measure, and accuracy were used to assess the suggested model's performance. True Positives (TPs) are

accurately classified positive Crop, whereas False Negatives (FNs) are negatively classified Crop selection and crop yield prediction as shown in Fig.4. Negative Crop selection are referred to as TNs (True Negatives), whereas their classification as positive suggests that they are FPs (False Positives). The proposed method's qualitative results are precise in identifying the crops for yield prediction. In comparison to previous classification approaches, the contour's convergence rate is improved. The numerical value of proposed and exiting methods are shown in Table 1.

Table 1.The numerical value of proposed and existing methods

	LRF	CP-ANN	IELM
Accuracy	80.1000	85.2100	91.8879
Precision	79.8000	81.2341	84.1016
Recall	81.6000	83.6547	92.0292
E-Measure	80.2400	82.3241	87.8870

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	Crop	Yields
1	Rice	135.8499
2	Wheat	133
3	Coconut	132.0500
4	Coriander	132.0500
5	Garlic	128.2500
6	Sugarcane	128.2500
7	Potato	125.4000
8	Ragi	120.6500

Fig.4. Crop selection and yield prediction results

Recall: the proportion of true positive values that are accurately identified and computed as

$$\text{recall} = \frac{TP}{TP + TN}$$

Precision: Ratio of accurately identified positive samples to the overall positive sample count predictions on samples and calculated as

$$\text{Precision} = \frac{TP}{FP + TP}$$

F-measure: It represents the harmonic mean of recollection and accuracy, also called F_1 -score and calculated as

$$F - \text{measure} = \frac{2 * (\text{Recall} * \text{Precision})}{(\text{Recall} + \text{Precision})}$$

Classification Accuracy: Proportion of samples that were properly categorized to all samples count as

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}$$

The precision coefficient comparison findings for the suggested LRRF, CP-ANN and IELM are shown in Fig.5. When there are more data, the precision value increases linearly as the number of attributes increases.

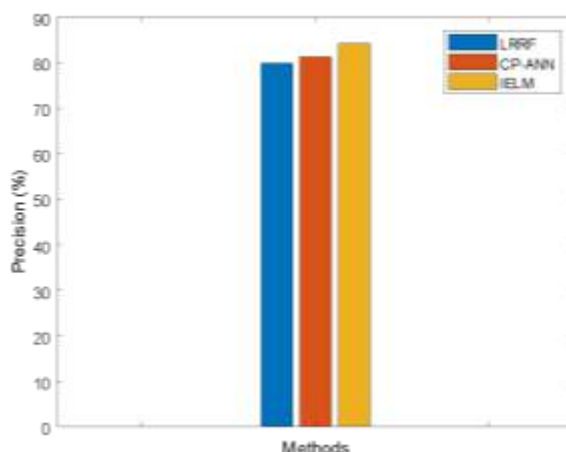


Fig.5. Precision Comparison Results between Existing and Proposed Method

This graph demonstrates that the proposed approach segments the crops with a high degree of precision of 84.1016%. Low precision of 79.8000% and 81.2341%, respectively, is produced by the LRRF and CP-ANN. As a result, the suggested method was applied to a particular data with known information and showed good results. It

was also successful when applied to natural data without any prior knowledge. This is due to the fact that the IELM model can extract more fine-grained characteristics from the crop data, and these fine-grained features are highly helpful to recognize crop selection.

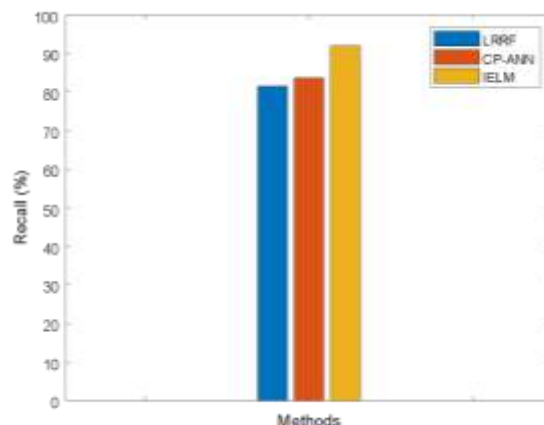


Fig.6: Recall Comparison Results between Existing and Proposed Method

The recall analysis of the methods for the number of attributes is shown in Fig.6. The techniques of the LRRF, CP-ANN and IELM were all applied. The LRRF and CP-ANN achieve recall values of 81.6000% and 83.6547%, respectively, whereas the proposed method's recall rate is 92.0292%. IELM may reportedly outperform the standard single residual networks model for categorizing crops for future crop production prediction since researchers often implement identification systems

using the model parameters that provide the best performance. It has therefore concluded from this finding that it can produce superior results for crop selection classification and yield prediction. As the number of epochs was enhanced, the correctness was enhanced to its highest level while the training loss reduced to its lowest level. According to the findings, the proposed method produced successful crop selection classification results because it was adaptable, precise, reliable, and quick.

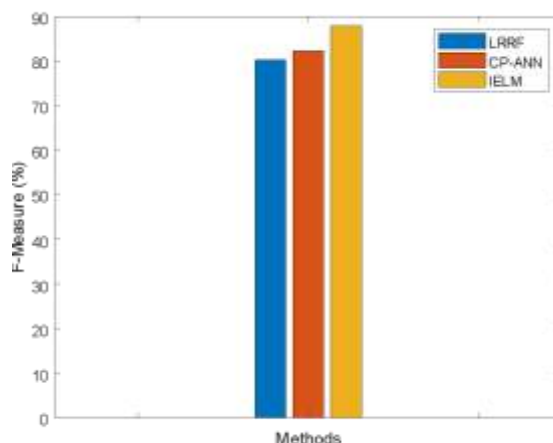


Fig.7: F-measure Comparison Results between Existing and Proposed Method

The F-measure findings of approaches for the number of attributes are shown in Fig.7. The techniques of the LRRF, CP-ANN and IELM were all applied. The suggested approach's F-measure rate is 87.8870%, while the F-measure rates for current methods like the LRRF and CP-ANN are

80.2400% and 82.3241%, respectively. It has concluded from the findings that it could improve crop selection classification results. This demonstrates that the method not only lowers the difficulty of model training and increases the program's training effectiveness, but also prevents the

outcomes' quality from deteriorating. These findings demonstrate that the crop yield identification accuracy of this algorithm is

the best, and the method's training effectiveness has not significantly decreased.

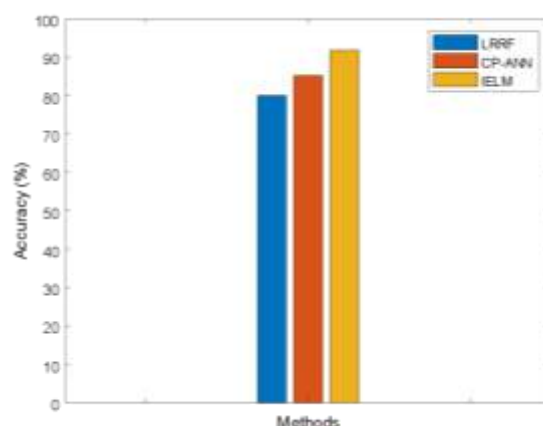


Fig.8: Classification Accuracy Comparison Results between Existing and Proposed Method

The classification accuracy results for the normalised graph cut method, GVF, and the suggested graph cut based on min-cut/max-flow approaches are compared in Fig.12. According to classification accuracy, the value decreases linearly as the quantity of qualities grows. This graph demonstrates that the suggested strategy predicts crop yield with a high level of 91.8879% accuracy. Low classification accuracy of 80.1000% and 85.2100%, respectively, is produced by LRRF and CP-ANN. According to the findings, the suggested is very suitable for efficient Crop selection classification and yield prediction.

5. CONCLUSION

An efficient face recognition method from face images called, GDC-SKEL is designed by exploring and inspecting the affinity points selected from the given dataset. To minimize the face recognition time and improve the face recognition accuracy therefore paving means for face recognition, Gravitational Center Loss-based Face Alignment is first applied to the selected face input image, focusing on occluded images. Second with the occlusion-removed face images provided as input salient features for further processing

are extracted using the Convolved Tikhonov Regularization function. Finally, with the extracted facial regions, Stacked Kernel Extreme Learning-based Classification is performed to obtain the final face image recognition output. For the experimentation, the Cross-Age Celebrity Dataset (CACD) dataset is used. The performance of the GDC-SKEL method is evaluated with different metrics such as face recognition accuracy, face recognition time, PSNR and False Positive Rate. From the result, it is clearly understood that the proposed GDC-SKEL method outperforms well in the face recognition process with higher detection rate and minimum time when compared to the state-of-the-art methods. In general, face recognition is only suitable for offline applications. In order to recognize human faces in online applications, a higher computing system is required. Thus, future work is developed for recognizing the human face in online applications

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An EWOA-WTDCNN Model: Effective Whale Optimization Algorithm Incorporating with Weight-Tuned Deep Convolutional Neural Network for Forecasting Indian Crop Yielding Process

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Abstract: Field-level crop yield prediction (CYP) is essential for quantitative and economic analysis when developing agricultural commodity plans for import-export strategies and raising farmer incomes. Crop breeding has traditionally been a time- and money-intensive process. To predict increased agricultural output, CYP was developed. This research suggests effective dimensionality reduction (DR) and deep learning (DL) techniques for CYP for Indian regional crops. The three phases of this paper were preprocessing DR and classification. The dataset is first used to gather information about South Indian agriculture. Data cleaning and normalization are then applied as preprocessing to the gathered dataset. Squashed exponential kernel-based principal component analysis (SEKPCA) is then used to perform the DR. CYP, which forecasts the high crop yield profit, is built on a weight-tuned deep convolutional neural network (WTDCNN) with an Effective Whale Optimisation Algorithm (EWOA). According to the simulation results, the suggested strategy achieves greater performance for CYP compared to existing methods with enhanced accuracy.

Keywords: Crop Yield Prediction, Deep Learning, Effective Whale Optimization Algorithm, squared exponential kernel-based principal component analysis

1. Introduction

People in the past were skilled at predicting weather conditions, and they chose their crops and had a chance to predict the yield before the harvest season based on the weather and monsoon of that particular year[1]. The practice of agriculture and the dissemination of its knowledge have considerably decreased over time. The farmers also turned their attention to automated systems and machinery[2]. Because agriculture can only be practiced with learning and knowledge, an automated system based on AI can be put into place in this situation[3]. In AI, this is possible using the deep learning methodology, which uses the neural network concept to simulate the workings of the human brain [4]. Researchers frequently use Deep Learning techniques to estimate agricultural yields based on the aforementioned variables[5]. The structure of this paper is organized as follows.

1.1 Organogram

An overview of agricultural yield prediction and the function of deep learning in this CYP is given in Section 1. The associated research used to perform the review is presented in Section 2. Implementations of the EWOA-WTDCNN algorithm are presented in Section 3, together with descriptions of the dataset, problem formulation, and Squared Exponential Kernel-based Principal Component-based Preprocessing. The findings and discussion are presented in Section 4, and the conclusions are presented in Section 5.

1.2 Crop Yield Prediction

Environmental parameters, such as climatic conditions, temperature, rainfall, vegetative index, soil type, texture, and nutrients, have a significant effect on crop production prediction. The prediction value from deep learning algorithms will be based on environmental parameters always be helpful[6]. Increased crop yield output is a workable answer to one of the most serious problems the world faces: hunger. According to the World Health Organisation, 820 million people worldwide still lack access to enough food. By 2030, the United Nations' Sustainable Development Goals aim to end hunger, achieve food security, and support sustainable agriculture. By 2050, there will be a 9.3 billion-person global population, which would increase the need for food by 60%, according to the Food and Agriculture Organisation (FAO)[7]. Therefore, crop yield forecasting can provide essential data needed for creating a practical plan to reach the goal and end hunger [8]. Numerous factors affect crop yield, making it challenging to develop a solid prediction model using conventional techniques[9][10]. However, with improvements in computer technology, it is now possible to create and train a unique approach for predicting crop yield. Consequently, crop yield forecasts can provide essential information needed for creating a practical approach to reach the goal and end hunger[11].

1.3 Deep Learning in Yield of a Crop Prediction

Artificial intelligence (AI) is a key component that includes deep learning, which simulates the structure and function of the human brain. The neural network that serves as the foundation for deep learning is processed using hidden layers to enhance learning. The different Deep Learning architectures available include, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Boltzmann Machine (BM), long-term memory (LSTM) Networks, Generative Adversarial Networks (GAN) and Forward Deep Networks (FDN) and Deep Belief Networks (DBN). CNN and RNN are the most widely used deep learning architectures that have been used in the yield of a crop Prediction.

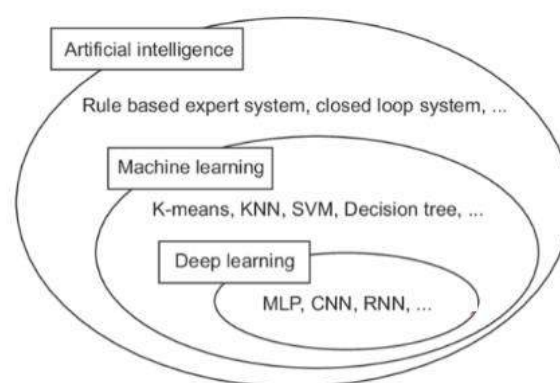


Figure 1: Artificial Intelligence Techniques

Due to its many data technologies and high-performance computers, deep learning is an important approach that is widely employed in the agricultural domain. A kind of machine learning known as "deep learning" uses numerous layers of neural networks to learn from unstructured, unlabeled data in a supervised, semi-supervised, or unsupervised fashion. Deep learning techniques emphasize learning abstract aspects of vast datasets, as pointed out by Sarker [12]. A primary understanding of the relationship between functional qualities and interacting

factors is necessary to accurately forecast crop production. Deep learning can be used to create large datasets and highly effective algorithms needed to analyze such connections.

2. Related Researches

While some traditional review articles on crop yield prediction and some Systematic Literature Review papers don't specifically focus on the use of deep learning in crop yield prediction (such as conventional machine learning in crop yield prediction), there are certain traditional review papers on crop yield prediction[13]. There are some Systematic Literature Review papers that focus on the application of deep learning in agricultural yield prediction (this work must distinguish shallow learning from deep learning). This is where the current study, which paves the way for thoroughly analyzing the state-of-the-art knowledge on the development of Deep Learning-based algorithms for agricultural production prediction, represents a pioneering effort.

Table 1: AI Related Researches in Crop Yield Prediction

S.No	Study	Methodology	Description
1	Van Klompenburg et al. 2020. [14]	Crop yield prediction with Machine Learning	Analysis of Machine Learning techniques for crop yield prediction in literature. Analysis of most used features for crop yield prediction with Machine Learning. Found that CNN is the most widely used Deep Learning algorithm.
2	Koirala et al. 2019. [15]	Fruit detection for yield estimation	Overviewed the application of Deep Learning in machine vision, fruit detection, and yield estimation. Recommended using common public image sets to allow the implementation of Transfer Learning.
3	Lee et al. 2019 [16]	Crop yield prediction using Deep Learning	Usage of weather and farm status information with crop disease diagnosis to predict crop yield. Experimented with several Deep Learning algorithms on the diagnosis of crop disease and the prediction of crop yield. CNN had the best performance for crop disease diagnosis. ANN with ReLU activation function showed the best accuracy for crop yield prediction.
4	Chlingaryan et al. 2018. [17]	Crop yield prediction and nitrogen status estimation with Machine Learning	Analyzed Machine Learning techniques for crop yield prediction and nitrogen status estimation. Concluded that technological development contributes to cost-effective and comprehensive solutions.
5	Zhang et al. 2020 [18]	Employing Deep Learning for dense	Analyzed the application of Deep Learning in agricultural dense scenes.

		scenes in agriculture	Reviewed application of Deep Learning in recognition, classification, detection, counting, and yield estimation tasks. Showed that Deep Learning outperforms dense scenes in agriculture.
6	Dharani et al. 2021 [19]	Crop Prediction Using Deep Learning Techniques	Analyzed the usage of Deep Learning techniques in agriculture, with a focus on crop yield prediction. Reviewed the application of different Deep Learning algorithms for crop yield prediction with both images and tabular data. They concluded that CNN outperforms other networks when image data are used RNN, LSTM, and hybrid networks outperform other networks on tabular data.
7	Farhat Abbas et al. 2020 [20]	CYP system using ML algorithms and proximate sensing	For the purpose of forecasting agricultural yields, the gathered data were trained on ML models including elastic net (EN), linear regression (LR), support vector regression (SVR), and k-nearest neighbor (KNN). In comparison to other current techniques, the SVR produced better results for all four datasets examined while having a lower RMSE.
8	Martin Kuradusenge et al. 2023 [21]	Many machine learning models for Crop Yield Forecasting	performed polynomial regression, support vector machine, and random forest analyses for CYP. Results showed that, with an RMSE of 510.8 and 129.9 on the tested datasets, the RF model outperformed the SVM and PR in forecasting the crop yields of maize and potatoes.
9	Liyun Gong et al. 2021 [22]	Recurrent neural networks and temporal convolutional networks are examples of hybrid DL methods for CYP.	The RNN was given the normalized data to process the normalized sequence data. For the collected datasets with lower RMSE, the technique produced superior results than the already used comparable schemes.
10	Dilli Paudel et al. 2021 [23]	An ensemble of machine-learning models for large-scale CYP	SVM, KNN, ridge regression, and gradient-boosted decision trees were among the ML classifiers employed for CYP.

3. Materials & Methods

3.1 Dataset Description

The public data source <https://data.world/thatzprem/agriculture-india> which includes State Name, District Name, Crop, Year, Season, Crop, Crop class, Area, and Production Yield, was used by the proposed system to gather the crop production statistics. Additionally, weather information is gathered from an Indian website and includes pressure, dew point, lowest temperature, maximum temperature, average temperature, precipitation, humidity, and wind speed (m/s).

3.2 Problem Formulation

Because calibration crop models execute faster, need less user expertise, and require less storage for data restrictions than simulation crop models, they are simpler to install than simulation crop models [24]. Agricultural production modeling rarely takes into account the spatial and temporal non-stationarity that is present in many geographical phenomena, despite the development of various ML models to improve prediction accuracy [25]. Since it is utilized to choose the best crop when numerous possibilities are available, DL has recently been used to build a variety of successful computations [26].

- By creating correlations between the input and response variables, this approach aims to make predictions. However, Deep Learning's reliance on hyper-parameters, which can be disregarded to increase the efficacy of the outcomes, presents a significant challenge.
- Deep Learning method experts look into issues as they hand-design previously offered architectures for predicting crop yields. Because they do not understand agriculture, they are unable to create optimal structures. Therefore, a realistic deep-learning technique with optimal hyperparameter tuning for Crop Yielding Prediction for Indian regional crops was proposed in this work.

3.3 Squared Exponential Kernel-based Principal Component-based Preprocessing

Since data are obtained from multiple sources, preprocessing or data preparation needs to be done. It is gathered in raw format, which makes analysis impossible. In order to increase the accuracy of the prediction, preprocessing is crucial before estimating crop production. The following is an explanation of the preprocessing procedures.

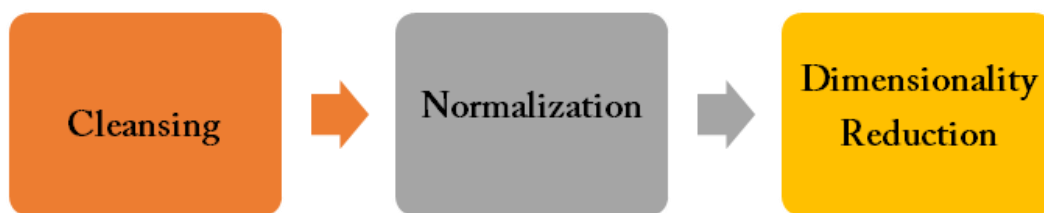


Figure 2: Squared Exponential Kernel-based Principal Component-based Preprocessing Flow

Where, $\vec{C}_{Norm}$ refers to the normalized data, $\vec{C}$ indicates the original data, $\vec{C}_{min}$ and $\vec{C}_{max}$ signifies the minimum and maximum value from the data set. The dataset values are between 0 and 1 using this min-max normalization.

$$\vec{C}_{Norm} = \frac{\vec{C} - \vec{C}_{min}}{\vec{C}_{max} - \vec{C}_{min}} \quad \dots \dots \dots (1)$$

After the normalization process, it is expected that the points with similar predictor values x_i , naturally have close response (target) values y_i . In Gaussian processes, the covariance function expresses this similarity[27]. It

specifies the covariance between the two taken hyper-parameters called $f(x_i)$ and $f(x_j)$, where both x_i and x_j are d -by-1 vectors. In other words, it determines how the response at one point x_i is affected by responses at other points x_j , $i \neq j$, $i = 1, 2, \dots, n$. The covariance function $k(x_i, x_j)$ can be defined by various kernel functions. It can be parameterized in terms of the kernel parameters in vector θ . Hence, it is possible to express the covariance function as $k(x_i, x_j | \theta)$. For many standard kernel functions, the kernel parameters are based on the signal standard deviation σ_f and the characteristic length scale σ_l . The characteristic length scales briefly define how far apart the input values x_i can be for the response values to become uncorrelated. Both σ_l and σ_f need to be greater than 0, and this can be enforced by the unconstrained parametrization vector θ , such that

$$\theta_1 = \log \sigma_l, \quad \theta_2 = \log \sigma_f. \dots\dots\dots (2)$$

The built-in kernel (covariance) functions *with the same length scale for each predictor* with Squared Exponential Kernel is one of the most commonly used covariance functions and is the default option for fitrgp. The squared exponential kernel function is defined as

$$k(x_i, x_j | \theta) = \sigma_f^2 \exp \left[-\frac{1}{2} \frac{(x_i - x_j)^T (x_i - x_j)}{\sigma_l^2} \right] \dots\dots\dots (3)$$

As per (3) Squared exponential kernel-based principal component analysis (SEKPCA), which converts higher-dimension data into a lower dimension, is used to create Dimensionality Reduction for the dataset. By calculating the principle components and adjusting the basis, PCA functions. In addition to greatly enhancing crop yield identification and diagnosis of high-dimensional data in the real production process, it resolves the variable's correlation. PCA is still only useful if the variables are all very dispersed. Furthermore, the PCA has trouble identifying nonlinear data models.

Algorithm 1: The SEKPCA algorithm

Input: Dataset 'DS', Features ' $F = \{F_1, F_2, \dots, F_m\}$ ', Data ' $D = \{D_1, D_2, \dots, D_n\}$ '.

Output: dimensionality reduced crop data samples ' $x \in DRCDS$ '

1: **Initialize** 'm', 'n', Feature Samples 'FS', 's'

2: **Begin Cleansing**

3: **For** each Data in Dataset 'DS' with Features 'F', Data 'D', Field with Kernel Function 'K' and Crop Data Samples 'CDS'

4: Formulate sample vector matrix as given in (1)

5: Measure probability of object similarity positioned in a field as given in (2)

6: Evaluate similarity reduction of the dataset or field as given in (3)

7: **Return** Dimensionality Reduced Crop Data Samples 'DRCDS'

8: **End for**

9: **End**

3.4 Crop Yielding Prediction with Weight-Tuned Deep Convolutional Neural Network and Effective Whale Optimization Algorithm

After DR, CYP is performed using a weight-tuned deep convolutional neural network (WTDCNN). Each layer in a DCNN consists of convolutional transforms that are computed before going on to nonlinearities and pooling1 operators. Backpropagation training in DCNN uses random weight and bias values, increasing the likelihood of suboptimal outputs and raising the prediction process' loss. To improve detection accuracy and lower network

loss, the weights and biases in the network must be properly tuned. In order to achieve the best results, the suggested approach uses an Effective Whale Optimization Algorithm (EWOA) to calculate the network's weights and bias values. This minimizes the network's vanishing gradient saturation and prediction loss for CYP.

Initializing step: N whales are randomly generated and distributed in the search space within the predefined range [LB, UB] using Equation (1).

$$X_{i,j}(t) = LB_j + (UB_j - LB_j) \times rand(0, 1) \dots\dots\dots(1)$$

where X_{ij} is the position of the i -th whale in the j -th dimension, LB_j and UB_j are the lower and upper bound of the j -th dimension, and the $rand$ is a uniformly distributed random variable between 0 and 1, respectively. The fitness value of whale X_i in the t -th iteration is calculated by the fitness function $f(X_i(t))$, and the whale with better fitness is considered as X^* , which is the best solution obtained.

Encircling prey using Levy motion: Whales update their position by considering the position of X^* and the Levy-based pace scale PSL by Equation (2),

$$X_{i,j}(t+1) = X_j^*(t) + 0.5 \times C \times PSL_{i,j}^L \dots\dots\dots(2)$$

where $X_j^*(t)$ is the j -th dimension of the best whale, C is a linearly decreased coefficient from 1 to 0 over the course of iterations, and $PSL_{i,j}^L$ is the j -th dimension of the i -th row of pace scale calculated by Equation(3)

$$PSL_{i,j}^L = M_{i,j}^L \times (X_j^*(t) \times M_{i,j}^L - X_{i,j}(t)) \dots\dots\dots(3)$$

$M_{i,j}^L$ is a randomly generated number based on Levy movement, which is calculated by Equation (4),

$$M = \frac{u}{|v|^{1/\beta}} \times 0.05 \dots\dots\dots(4)$$

The prey position X^* is updated after the whales' new location has been established, and their fitness has been determined. Up to the predetermined number of iterations (MaxIter) is reached, the search process is iterated. Algorithm 1 displays the suggested EWO's pseudo-code.

Algorithm 2: The EWOA algorithm

Input: N, D, MaxIter

Output: The global optimum (X^*)

- 1: Begin
- 2: iter = 1.
- 3: Randomly distribute N whales in the search space.
- 4: Evaluating the fitness and set X^* .
- 5: **While** iter $\leq$ MaxIter


```

6:      For i = 1: N
7:          Calculating coefficients a, A, C, and l.
8:      For j = 1: D
9:          If (p < 0.5)
10:             If (|A| < 1)
11:                 Perform  $PS_{ij}^L = M_{ij}^L \times (X_j^*(t) \times M_{ij}^L - X_{ij}(t))$ 
12:             Elseif (|A| ≥ 1) and (iter < MaxIter/3)
13:                 Perform  $M_{ij}^B \times (X_j^*(t) - M_{ij}^B \times X_{ij}(t))$ 
14:             End if
15:         End For
16:         Evaluating fitness and update X*.
17:         iter = iter + 1.
18:     End while
19:     Return the global optimum (X*).
20: End

```

To increase the output's nonlinearity, the final feature vector is then fed into the activation layer. If the input value is positive, ReLU is used as an activation function in the activation layer to output the input immediately. Otherwise, it will output zero. The output of the convolution layer with activation is fed into the pooling layer to decrease the input data size. The output is generated by sampling the rectangular boxes from the convolution layer's smaller rectangular boxes, which are used in the polling stages. The fully connected layer receives the polling layers' output to perform CYP, which use the SoftMax activation function to carry out the classification. The output of the classifier displays the production of various crops in Indian regions.

4. Results and Discussion

The experimental results of the suggested yield prediction for local crops in India using effective DL and DR approaches are examined in this part. In terms of classification metrics, the suggested methodology is contrasted with the ones for CYP that are already in place. Here, the suggested classification model's (EWOA-WTDCNN) results are contrasted with those of the existing classification frameworks, specifically with the Deep Belief Network (DBN), Extreme Learning Machine (ELM), and Random Forest (RF) models. Precision, recall, f-measure, and accuracy of the methods are compared. Table 2 provides an analysis of this performance. The methods are also contrasted using classification error measures such as MSE, RMSE, FPR, FNR, and FRR shown in figure 3.

$$\text{Accuracy} = \text{metrics.accuracy_score}(\text{original_instances}, \text{predicted_instances}) = \text{TP} + \text{TN} / \text{size of DB} \text{-----} (1)$$

$$\text{Precision} = \text{metrics.precision_score}(\text{original_instances}, \text{predicted_instances}) = \text{TP} / \text{TP} + \text{FP} \text{-----} (2)$$

$$\text{Recall} = \text{metrics.recall_score}(\text{original_instances}, \text{predicted_instances}) = \text{TP} / \text{TP} + \text{FN} \text{-----} (3)$$

$$\text{F1} = \text{metrics.f1_score}(\text{original_instances}, \text{predicted_instances}) = 2 \times \text{Precision} \times \text{recall} / (\text{precision} + \text{recall}) \text{-----} (4)$$

Table 2: Performance comparisons between EWOA-WTDCNN with Other DL Algorithms				
Techniques/Metrics (%)	Accuracy	Precision	Recall	F-Measure
Proposed WTDCNN	98.96	98.67	99.03	98.87
DCNN	96.98	96.27	97.03	96.78
DBN	94.43	94.16	94.66	94.35
ELM	90.34	90.02	90.46	90.27
RF	89.21	89.05	89.32	89.19

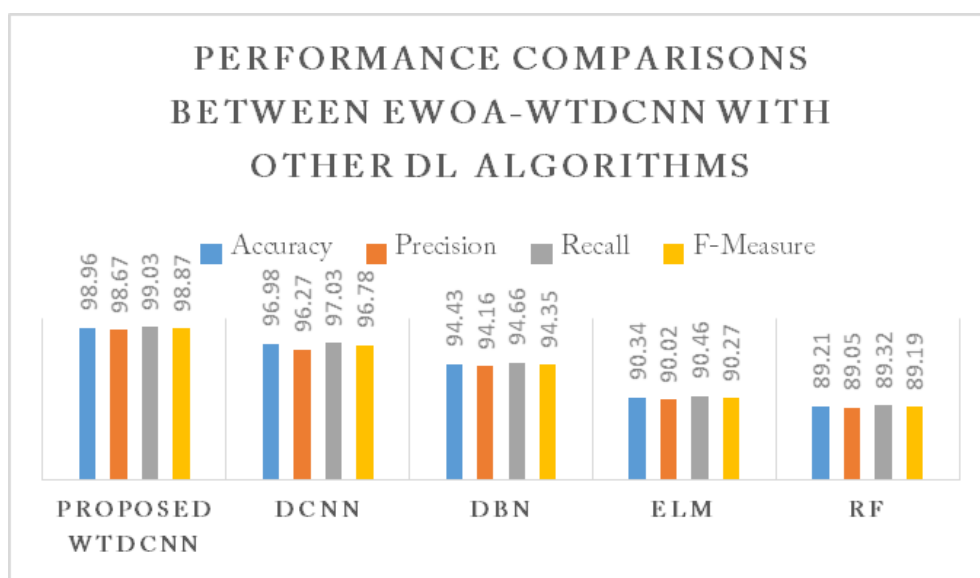


Figure 3: Performance Analysis of EWOA-WTDCNN for better Prediction of Crop Yielding

Our findings supported Table 2's assertion that DL can have a significant impact on CYP. Despite being based on crucial performance criteria, the results are contrasted with those of other cutting-edge approaches. The suggested EWOA-WTDCNN outperforms the current ones in terms of results. For instance, the current DCNN achieves 96.98% accuracy, 96.27% precision, 97.03% recall, and 96.78% f-measure, respectively. Additionally, the proposed RF achieves a maximum accuracy of 98.96% along with 98.67% precision, 99.03% recall, and 98.87% f-measure, whereas the existing RF only achieves minimal 89.21% accuracy, 89.05% precision, 89.32% recall, and 89.19% f-measure. This is similar to how the proposed strategy performs even better when compared to other existing ones (such as DBN and ELM). Thus, the results demonstrated that the suggested one

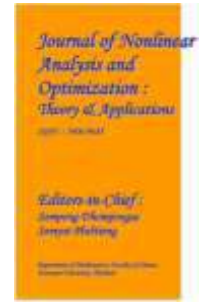
5. Conclusion

The proposed model has MSE, RMSE, FPR, FNR, and FRR of 0.034, 0.219, 0.029, 0.065, and 0.061, respectively. This shows more excellent performance than the existing methods. However, if the system has lower error levels, it is regarded as sound. Thus, it demonstrated that the suggested approach outperformed the earlier known schemes for accurate CYP. The outcomes of our superior EWOA-WTDCNN model show how the suggested work is new since it makes use of the appropriate data preprocessing techniques, architecture, and hyperparameter values. It is obvious that the suggested method effectively uses the DR method and preprocesses the dataset first before prediction. These methods are therefore more effective in making predictions.

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ENSEMBLE RANDOM FOREST WITH LSTM NEURAL NETWORK (ERF-LSTM) METHOD FOR CLASSIFICATION OF TWITTER SENTIMENT ANALYSIS

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Abstract - This study presents a novel approach for stock classification by harnessing the power of Yahoo Finance stocks data and Twitter data. We employ a fusion of the Random Forest Classifier and LSTM Neural Network to create an ensemble model capable of enhancing stock classification accuracy. Structured financial data from Yahoo Finance provides a solid foundation, while Twitter data contributes real-time sentiment insights. Weighted averaging optimizes the ensemble's performance by assigning different weights based on historical model accuracy. This approach empowers traders and investors with more reliable and timely stock classifications, facilitating informed decision-making in the ever-evolving world of stock trading.

Keywords: Stock Classification, Yahoo Finance, Twitter Data, Random Forest Classifier, LSTM Neural Network, Ensemble Model;

1. Introduction

In the age of information, financial markets are not only driven by traditional data sources but are also significantly influenced by the vast and dynamic landscape of social media. Among the plethora of social media platforms, Twitter has emerged as a prominent source of real-time financial information and sentiment. Traders, investors, and financial analysts actively engage with Twitter to gain insights into market trends, news, and public sentiment regarding various stocks. This intersection of finance and social media has paved the way for innovative research endeavors, one of which involves harnessing Yahoo Finance stocks' Twitter data for classification and analysis. Yahoo Finance, a renowned platform for real-time financial data and news, provides a rich source of structured data related to stocks, including historical prices, financial statements, and market news. Complementing this, Twitter serves as a treasure trove of unstructured data, filled with discussions, opinions, and news regarding stocks. Integrating these two data sources allows for a holistic understanding of the financial market's pulse, and this fusion has garnered significant attention from researchers, data scientists, and financial professionals alike.

This research embarks on a journey to explore the immense potential that Yahoo Finance stocks' Twitter data offers for classification tasks. The central objective is to leverage this data fusion to enhance research understanding of stock market dynamics and investor sentiment. To achieve this, the study employs a multifaceted approach, encompassing heuristic-based and supervised classifiers, as well as cutting-edge deep learning techniques such as recurrent neural networks (RNNs) specifically Long Short-Term Memory (LSTM) networks. The primary motivation behind this research is the recognition of the inherent complexity and nuances present in Twitter data. Unlike traditional financial data sources, Twitter is characterized by its brevity, informality, and the use of hashtag, mentions, and emojis, which can make sentiment analysis and classification a challenging endeavor. Moreover, Twitter is prone to the emergence of homonyms and collisions, where the same symbol or acronym is used to refer to both company tickers and cryptocurrencies. This ambiguity can lead to significant data distortion and misclassification if not properly addressed.

Twitter Data Feature Selection Using Enhanced Genetic Algorithm

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Abstract

Feature selection is a basic critical task in sentiment analysis, especially while analyzing Twitter data for stock market sentiment. This paper proposes an enhanced genetic algorithm (GA) for feature selection utilizing Finance Yahoo stocks data and openly accessible Twitter data. The objective is to distinguish the most relevant features that can successfully anticipate stock market sentiment. The proposed GA integrates methods to enhance the investigation and double-dealing capacities, empowering it to look through a bigger feature space and work on the nature of chosen features. The algorithm starts by introducing a populace of random binary chromosomes, with every chromosome addressing a feature subset. Wellness assessment is performed utilizing sentiment analysis strategies to survey the prescient force of each feature subset. Trial assessment utilizing Finance Yahoo stocks and Twitter data shows that the enhanced GA beats customary GA and PSO strategies concerning exactness and forecast performance. The proposed approach gives important experiences to sentiment analysis and feature selection with regards to stock market sentiment utilizing Twitter data.

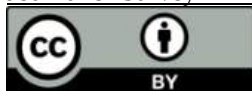
Keywords: Sentiment analysis, Twitter, Feature selection, Genetic algorithm, Chi Square;

I. Introduction

The widespread adoption of social networking platforms like Facebook, Twitter, Google, and similar platforms has reshaped the internet, turning it from a static repository into a dynamic arena where information is in constant flux. Within this dynamic online landscape, sentiment analysis plays a pivotal role in assessing public sentiment and enhancing user interfaces (UI). Amidst the myriad of available platforms, Twitter stands out as one of the largest social networks, boasting a user base of 326 million active users worldwide and generating a staggering 500 million tweets on a daily basis. The Twitter Dataset is widely acknowledged as a valuable resource for sentiment analysis due to its simplicity and easy accessibility. By employing a variety of machine learning techniques, sentiment analysis categorizes the emotions conveyed in tweet messages as positive, negative, or neutral.

Machine learning is a method that empowers computers to gain knowledge and make predictions within a given context. Among the numerous machine learning algorithms available, Naïve Bayes is renowned for its effectiveness and extensive use, particularly in classification tasks. The Chi-square algorithm, crafted for feature selection, can be smoothly incorporated with Naïve Bayes. This integration elevates the accuracy and efficiency of classification, surpassing the constraints of prior approaches and delivering an optimal solution for Twitter sentiment analysis.

Twitter, a widely recognized micro-blogging platform, serves as a digital arena where users communicate through concise status messages referred to as tweets. These tweets provide users with a means to convey their personal emotions, share viewpoints, and often incorporate elements such as hashtags, emoticons, or regular words to engage in discussions about various subjects, including events, movies, products, or celebrities. Sentiment Analysis (SA) frequently revolves around the task of categorizing these messages into



Twitter Sentiment Analysis For Feature Extraction Using Support Vector Machine (SVM) With TF-IDF

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Abstract - The goal of this research is to perform sentiment analysis on Twitter data by extracting relevant features using the Hybrid Support Vector Machine (SVM) with TF-IDF (term frequency-inverse document frequency) weighting scheme. Sentiment analysis involves analyzing the emotional tone of a piece of text, and in this case, is specifically interested in classifying tweets as positive, negative, or neutral. To achieve this, using a yahoo stock market dataset of tweets using the Twitter API and preprocess the data by removing stop words, special characters, and URLs. Proposed the SVM-TF-IDF to extract features from the preprocessed tweets calculates the importance of each word in a tweet by taking into account both its frequency within the tweet and its rarity across the entire stock dataset. The research aims to demonstrate the effectiveness of the SVM-TF-IDF for feature extraction in sentiment analysis tasks and to provide insights into the sentiment trends and patterns present in Twitter data.

Keywords: Stock Market, Machine learning technique, Twitter, Sentiment analysis, Feature extraction, Tweet annotation.

1. Introduction

The age of the web has had an impact on the manner in which people express their ideas. The social networking websites depend largely on the user-generated content. Typically, when people intend to purchase a product, they browse through a lot of websites to gain some information about the products before they make their purchase. They take into consideration the available reviews and ratings of these products on these websites before making purchases. The amount of data is inordinate for an ordinary individual to dissect it utilizing naive techniques. Hence, to make this interaction effective and to robotize it, a few opinion examination procedures are utilized. Symbolic techniques or knowledge based approach and machine learning procedures are commonly used to foster such models. In knowledge-based approach, research requires a comprehensive data set that contains pre-characterized feeling data and an efficient knowledge representation for identifying sentiments. Machine learning approach utilizes training informational index to recognize the feelings of each word accurately. Thus, this technique does not require the database of words like knowledge-based approach and therefore, is better. Using a mixture of both this techniques, predominantly machine learning technique; build a hybrid model which will be capable of analyzing sentiments of almost any text. A detailed overview of various techniques is discussed in this paper.

The Yahoo stock market dataset of tweets obtained through the Twitter API is a collection of text data that contains information about the sentiment of Twitter users towards Yahoo's stock prices. The dataset includes tweets that were posted during a specific period of time and contain keywords related to Yahoo's stock market performance. Preprocessing of this dataset is an important step in preparing the data for analysis. The preprocessing stage involves cleaning and transforming the data to remove any noise and make it suitable for further analysis. Some of the preprocessing steps that can be applied to this dataset include text cleaning, which involves removing stop words, punctuation marks, and other irrelevant characters. Tokenization is another important preprocessing step, which involves breaking the text data into individual words or tokens.

Twitter Sentiment Analysis

Due to increase in contents over social media such as Twitter, Facebook, and Trip advisor, express opinion about products, services, or any government policy among others. Twitter having 336 million¹ active users monthly is now a main source of feedback for government, private organization, and other service providers. On Twitter around 500 millions tweets are produced per day², generating huge measure of unstructured text information. Sentiment analysis (opinion Mining) is utilized to retrieve the knowledge data from the tweets posted by clients. Twitter sentiment is used to classify the tweets into neutral, positive, or negative. Many researchers have presented classification methods in sentiment analysis

With the advent of social media platforms, in the last 15–20 years, their popularity and the number of active users on these platforms are only increasing. And rightly so, after-all they provide efficient means to connect to family, friends, people care about, mentors, recruiters and everyone else on the platform, with access to internet. Now its noticeable phenomenon that when two or more people get together scope for crisis to arise. And here are talking about millions,

A Novel Hybrid Approach for Twitter Sentiment Analysis in Machine Learning

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Abstract- Sentiment analysis on social media platforms, like Twitter, assumes a vital part in figuring out open emotions and opinions. In this paper, we propose a clever half-and-half methodology called Deep Learning with Linguistic Knowledge (DLLK) for Twitter sentiment analysis. The proposed system consolidates the qualities of deep learning, move learning, and feature engineering. Our methodology includes sentiment-explicit preprocessing to hold emoticons, emojis, and shoptalk, a sentiment-explicit word inserting model, and move learning utilizing pre-prepared sentiment analysis models on related social media data. Additionally, we integrate emotion-explicit lexicons and sentiment design mining to improve tweet representations. The ensemble of deep learning models, lexicon-based classifiers, and sentiment-explicit features empowers a more nuanced and exact sentiment analysis. Experimental results demonstrate the viability of the DLLK approach in further developing sentiment figuring out on Twitter data.

Keywords- Twitter sentiment analysis, deep learning, transfer learning, social media, sentiment pattern mining

I. INTRODUCTION

Twitter sentiment analysis has earned huge attention in the fields of machine learning and natural language processing (NLP) because of the tremendous prevalence of social media platforms like Twitter. The capacity to fathom the sentiments communicated by clients at this stage has become significant for businesses, governments, and people as it gives important bits of knowledge into public opinion, brand perception, and moving points. Sentiment analysis includes the programmed classification of tweets into positive, pessimistic, or unbiased emotion classes. It presents a few difficulties because of the casual idea of tweets, the utilization of slang, abbreviations, emoticons, and restricted context. Nonetheless, it holds huge potential for understanding public sentiment on a large scale and in real-time.

The primary objective of this research paper is to conduct a comprehensive study of Twitter sentiment analysis using various machine-learning techniques. The goal is to develop an accurate and efficient model that can effectively classify tweets into sentiment categories. To achieve this, the proposed methodology leverages the latest advancements in NLP, deep learning, and feature engineering. The paper begins by conducting a thorough literature survey to explore the existing methodologies in the field of Twitter sentiment analysis. By analyzing previous research, the strengths and weaknesses of different approaches are identified, providing valuable insights into the current state of the art. The core of the approach lies in leveraging the power of deep learning, which has shown remarkable success in various NLP tasks. Deep learning models, such as recurrent neural networks (RNNs), long short-term memory (LSTM), and transformers, have proven to be adept at capturing sequential information and learning complex patterns from textual data.

To further enhance the model's performance, feature engineering techniques are employed. These techniques extract relevant features from the tweet text, such as n-grams, part-of-speech tags, and sentiment lexicons. These additional features provide the model with valuable contextual information, improving its ability to differentiate between sentiments. In addition to deep learning and feature engineering, transfer learning is also explored in the proposed methodology. Pre-trained language models, like BERT and GPT, are fine-tuned on large-scale Twitter sentiment datasets to leverage the knowledge gained from a related domain and improve the model's generalization capabilities. To evaluate the proposed methodology, extensive experiments are conducted on various benchmark datasets of Twitter data. The performance of the model is compared with state-of-the-art methods, and

A STUDY ON INNOVATIVE STRATEGIES ADOPTED BY SELECTED INSURANCE COMPANIES (WITH SPECIAL REFERENCE TO COIMBATORE DISTRICT)

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ABSTRACT

Universally the Insurance Industry has adored the business conditions for the past limited years but deteriorating view will likely pose some of the challenges over the year ahead. Though, Insurance company is said to be a matured / developed industry driving profitable part is quite difficult due to increase in competitors among global level and from other Insurance related sector too. This study aims to identify the various schemes suggested by Insurance companies to Insurance holders, factors influencing the innovative strategies and to investigate the innovative strategies adopted by Insurance Companies. The present research is descriptive in nature and brings out the significance difference in the Innovative strategies adopted by Insurance Companies. The data collection is done in Primary and secondary method considering the selected Insurance Companies inside Coimbatore City. The Study reveals about the most prominent innovative strategies adopted by Insurance Companies. The main statistical tools like Simple percentage analysis, Ranking Analysis and Chi-square analysis is used to test the variables as per the respondents collected. In summary, this research study appears to focus on the challenges and innovations in the insurance industry, with a particular emphasis on the strategies adopted by insurance companies in Coimbatore City. It suggests that embracing technology-based innovation can provide a competitive edge in a competitive and mature industry.

Key words: challenges, innovative strategies, profitable, technology-based, competitive.

1. Introduction

An innovation strategy is a commitment to a common innovation mission and a structured set of activities which aim to support the future growth of the organization. Advertising and promoting activities and practices are quite common to all Industries either it may be a Manufacturing Sector or Service Sector, these activities are intended to communicate their product and services related information with customers including with the Company idea and vision. The promotional strategy adopted by any company is informing, persuading, and influencing in a consumers decision making. Insurance business can broadly be classified into general and life/ long term. Despite this classification, the different classes of insurance businesses can be viewed as lines of business along the profit centre concept. The Survey revealed that the General insurance business is facing two major challenges. The first challenge is to come up with a solution for companies whose viability is threatened by their inability to meet policy holder claims. The second major challenge is how to generate growth for an industry that has significant potential for growing as a percentage of GDP but has been stagnant.

1.1 Statement of the Problem

Globally, the insurance industry has enjoyed strong business conditions over the last few years but worsening economic outlook will likely pose considerable challenges in the years ahead. These challenges will be especially pronounced in the property and casualty segment, where growing pricing pressure as the market softens will drive a need for cost-cutting and greater efficiency. In Present scenario, the Insurance Companies faces a number of Challenges Digitizing small commercial, Commoditization, Cyber Security etc..Most of the researchers focuses only on the innovation strategy introduced in bank sectors but most researcher have not focused on the innovative strategies introduced in Insurance Companies.

**MODERN BUSINESS CHALLENGES FACED BY FIRST GENERATION WOMEN
ENTREPRENEURS IN COIMBATORE CITY – WITH SPECIAL REFERENCE TO
APPAREL SECTOR**

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Introduction

As the First - generation women entrepreneurs do not have previous industrial experience, they carry on their industrial activities on trial-and-error basis involving wastage of time and energy, and material resources. It is evident from the experience of many first - generation women entrepreneurs that they fall sick in the take-off stage itself. (*Selvaraj N, 2016*). Entrepreneurship is a pivotal role trending term these days. It is defined as the process of thinking something innovative and converting these ideas into new business. Now this business typically begins with small businesses like that of a startup company. It is also explained as the tendency and willingness to develop, organize and manage a business or venture taking up any of its risk with a motive of making money. (*P. Balamurugan, 2021*) Despite the apparent benefits of women entrepreneurs to an economy, the full potential of the women entrepreneur's sector has not been unleashed. The women entrepreneurs are today at crossroads. The existing incentive system no more meets the needs of the sector and the challenges posed by the new economy. New incentives and support to women entrepreneurs are imperative to help them build capabilities and to stay ahead of competition, both locally and in overseas markets. In many economies governments seek to develop programmes to attract, retain and advance women thus it is hoped that the results of this research will be used to design and implement remedial programme strategies and ongoing research to support women entrepreneurs.

The important reasons for starting a new business are some of the most recognized individual motivation factors for entrepreneurship are the Independence, Market Opportunity, Challenge, Family Background, New Idea, and Challenge Dream and so on. "Earning better life, influence of success stories, personal satisfaction, desire to utilize own skills and talents, unfavourable present working environment, self-employment and employment for others.

The assurance of carrier and family security, fulfilment of the creative urge of the borrower's, experience in family business, self-confidence, non-availability of suitable job or work and advice of family members.

Review from the earlier studies

Many research studies have been conducted on the subject of generation apparel and entrepreneurs in respective areas. These studies have revealed that certain variables are consistently correlated with new generation of entrepreneurs in various sector. This segment presents a brief review of earlier literature relevant to the current study of "*Modern Business Challenges Faced by First Generation Women Entrepreneurs in Coimbatore City – With Special Reference to Apparel Sector*". The collection of reviews has been made from various studies undertaken by academic journals, magazines, publication, working papers, books and the like.

Study Conducted in India

A few reviews collected and presented on study conducted and measured on generation apparel and entrepreneurs in Indian context from the various academicians and experts.

Study Conducted in Abroad

A few reviews collected and presented on study conducted and measured on generation apparel and entrepreneurs in Outside of Indian context from the various academicians and experts.

Selvaraj N (2016), examine that the "*Marketing Problems Encountered by First Generation Entrepreneurs - A Study with Reference to Madurai in Tamil Nadu*", The main objective of the study is based on the marketing and location problems encountered by the first - generation women entrepreneurs. The primary data have been collected from the respondents



Impact of Covid-19 on Migrant Workers in Tiruppur District

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ABSTRACT

The inward transient laborers in India, notwithstanding being profoundly helpless as far as physical and psychological wellness, have stayed the foundation of the Indian economy. In any case, the new lockdown circumstance made by pandemic has placed them in a more tricky condition. On one hand, they have lost their positions and income, while on different; they needed more assets to get by at the spot of movement. Thus, the country saw mass migration, where people were seen getting back to their local puts by walking. This study is an endeavor to distinguish the situation with traveler laborers in India in the midst of lockdown and systems that might assist with moderating the circumstance. This concentrate additionally investigates the future game-plan that can work on transient specialist's way of life.

KEYWORDS: Lockdown-Covid-19-Migrant laborers - Impact

I. INTRODUCTION

The public authority of India sent off the Garib Kalyan Rojgar Abhiyaan drive to handle the effect of Corona virus on traveler laborers in India. It is a country public work plot which was sent off on 20 June 2020 with an underlying subsidizing of Rs.50,000 crore for 116 regions in 6 states. Because of the shaky idea of work occupations in India, numerous day by day workers, who are regularly travelers, lost their job because of lockdown. This has made issues including starvation, detachment from family and no elective types of work. The between state traveler labor force addresses the least paying and most unreliable positions, in key areas, for example, development, accommodation, materials, producing, transportation administrations and homegrown work. As lockdowns all over the planet increment joblessness, numerous weak specialists will be driven into more unstable circumstances and need insurance. Lack of work is probable in those areas, expanding the chance of double-dealing the leftover laborers, and what this will mean for transients before very long. Unfortunate wages, inconsistent business, dangerous work conditions and absence of fundamental

WOMEN INVESTOR SATISFACTION ON POST OFFICE SAVING SCHEMES

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ABSTRACT

Satisfaction is one of the fundamental measurements of success in any forms of business. (Copper and Artz, 1999). For more than 150 years, the Department of Posts (DOP) touches the lives of Indian citizens in many ways in form of delivering mails, accepting deposits under Small Savings Schemes, providing life insurance cover under Postal Life Insurance (PLI) and Rural Postal Life Insurance (RPLI) and providing retail services like bill collection, sale of forms, etc. In this backdrop, an attempt has been made in this article to ascertain the women investors level of satisfaction and the variables that determine the satisfaction of post office saving schemes. In order to ascertain the nature and quantum of relationship of variables with investor satisfaction on post office saving schemes, Correlation analysis is used. Out of twenty eight variables selected for Correlation analysis, thirteen variables are found to be significant. Occupation, Savings per month, Location of Post Office, Period of Investment, Monthly Investment, Method of Premium Paid, Mode of Payment, Aailed any Loan, Level of Awareness and Level of Preference are found to be significant at one per cent level. Educational Qualification and frequency of investment is found to be significant at five percent level.

Keywords:

Women Investors, Post Office Saving Schemes, Small Savings Schemes.

INTRODUCTION

A woman is the nucleus around whom the family, the society and the whole community move. Few decades back in India, women were considered only to look after their family and children. They were not allowed to work outside as it would ruin the reputation of the family and also they were not accepted by the society. Transformations in educational system, economic policies, political upliftments, cultural changes, technological enhancements, etc., have changed the role of women today and they have become not only a significant part of the family and society but also influence the course of social changes in the nation. At present, they are shining in every field thereby they enjoy both personal and professional life. Women not only earn but they invest the same for the future for varied reasons, such as children's education or marriage, house construction, regular income after retirement and the like. Women are more cautious when it comes to money and they are not ready to take high risk investment as men. A variety of investment avenues are available such as Bank Savings a/c, Fixed Deposits a/c, Post Office Saving Schemes, Government Securities, Corporate Bonds, Insurance Policies, Real Estates, Commodities, Shares and Mutual Funds, Chit Funds, Gold and Silver. So as above said the investment avenues in which Post Office Saving Schemes play a predominated role among women investors for their investment.

For more than 150 years, the Department of Posts (DOP) has been the backbone of the country's communication and has played a crucial role in the country's socio-economic development and act as a major partner in financial inclusion. Post Offices in India play a vital role in the rural areas. There are a number of attractive schemes, well designed to meet the individual requirements of different investors. Tax saving features of those schemes attracts the higher income groups more than small savers. The investment avenues provided by the Post Offices are generally marketable as they

**CONSUMER'S AWARENESS, PERCEPTION AND SATISFACTION TOWARDS
ONLINE MEDICINE BUYER'S-WITH SPECIAL REFERENCE TO COIMBATORE CITY**

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INTRODUCTION

The Internet has developed over the last decade into a first-line information source about all aspects of life for many people. Interest in purchasing products online has similarly increased, including medicines. Gallagher and Colaizzi asserted in 2000 that 'As Internet pharmacy has grown in the past year, it has become apparent to the major pharmacy chains that they must pursue the online route as well to prevent a loss of market share. An online pharmacy might fulfil any or all of a number of functions: (a) The sale or supply of medicines, including repeat prescription services, (b) The sale or supply of other healthcare products, (c) Providing information about medicines, (d) Providing advice about symptoms and hosting online support groups. Information or advice might be personalised (through personal email/message board/live chat contact) or general (hosted on static pages and as FAQs). (Nicola J Gray, 2011)

Consumer preference means an individual's subjective taste for a particular product. While buying a product a consumer analyzes various alternating brands, products. It is normally measured by their satisfaction with those. While studying consumer preference various factors like- offer/ discount, location, belief, thought, communication may affect the preference. The recent growth of e-commerce in India has attracted the customer to purchase medicine from online websites. The online drug store is one of the items which is going to encourage a gigantic interest in impending days. An online drug store is a web-based merchant of physician-recommended drugs. The sale of medicine through an online platform is not new. It has quite recently thrived in this internet age. In the late 1980s, drug stores started selling physician-endorsed meds employing mail requests in the US. Later this mail request business changed into the first web-based drug store, soma.com, in January 1999. Soon after that, the web drug store was dispatched in the UK. Assessments showed that there were more than 1000 sites selling medicines as of mid-2004. The retail drug store has so far stayed the greatest wellspring of medicines for the Indian populace. Maybe, since they don't know about the idea called online drug stores or the absence of fundamental prerequisites like the internet, a tremendous part of the Indian populace isn't buying medicine online. (Dipankar Dutta and Bedanta Bhattacharjee,2021)

REVIEW OF LITERATURE

Many research studies have been conducted on the subject of online-medicine and buyers in respective areas. These studies have revealed that certain variables are consistently correlated with online-medicine as well as buyers. This segment presents a brief review of earlier literature relevant to the study of "Consumer's Awareness, Perception and Satisfaction Towards Online Medicine Buyer's-With Special Reference to Coimbatore City". The collection of reviews has been made from various studies undertaken by academic journals, magazines, publication, working papers, books and the like.

(a) Study Conducted in India

A few reviews collected and presented on study conducted and measured on awareness and perception online medicine buyers in Indian context from the various academician and experts.

(b) Study Conducted in Abroad

A few reviews collected and presented on study conducted and measured on awareness and perception online medicine buyers in outside the Indian context from the various academician and experts.

**GROWTH AND SATISFACTION LEVEL TOWARDS ONLINE MEDICINE BUYER'S-
WITH SPECIAL REFERENCE TO COIMBATORE CITY**

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INTRODUCTION

India is one of the largest generic drug distributors in the world. Indian pharma industry fulfils the need of 40 percent of various vaccines globally. Moreover the 40 per cent of USA and 25 per cent of UK generic medicines demand is catered by the Indian pharma industry. India is recognized as the core pharmaceutical drug exporter worldwide. The country also has a large scale of scientists, researchers, pharmacists, manufacturers and technical engineers who have potential to push the industry few steps ahead from the current position. With the advent and propagation of globalization retail era it has become same tough to sustain for a longer period of time not only in the global marketbut also in the national market. The pharmaceutical industry is also one of the industries which is facing the harsh competition in global era as here, In the drug selling process In India takes place through two different modes: offline mode and online mode. In offline mode the medicines are sold out through physical counters such as retail shops, pharmacy, hospitals and mega malls but on the other hand there is an online mode which operates on the principle of mobile application, websites telecalling etc. Hence, these are the two different ways through which we get the required medicines. Nowadays pharmaceutical sector has widened its scope and is gradually acting as an advanced fast- moving consumer goods industry.

The consumers are getting everything under a single canopy whether it's fruits, vegetables, garments and now the medicines too. pharma industry is fulfilling the needs of worldwide population by exporting the branded as well as generic medicines and it also caters to the needs of Indian population by domestic distribution. In domestic distribution process, it is achieved through retail market and institutional market such as Sun pharma, Medlife, Himalaya, Dabur etc. Retail marketing further proceeds with the help of unorganised pharmacy (i.e.) local pharmacy stores or chemist shops. In India there is high number of such unorganised stores. Now when it comes to the point of distribution through organised stores, Religare pharmacy, Apollo pharma are the big tycoons in this particular segment. Online pharmacy is the new way of purchasing medicines online in Indian market.

i.e. Medlife, pharm etc. (Rajan Mishra and Pranav Mittal (et.al), 2019)

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REVIEW OF LITERATURE

Many research studies have been conducted on the subject of online-medicine and buyers in respective areas. These studies have revealed that certain variables are consistently correlated with online-medicine as well as buyers. This segment presents a brief review of earlier literature relevant to the study of ***“Growth and Satisfaction Level Towards Online Medicine Buyer’s-With Special Reference to Coimbatore City”***. The collection of reviews has been made from various studies undertaken by academic journals, magazines, publication, working papers, books and the like.

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FARMERS' VIEWS ON TRANSFORMING AGRICULTURAL LAND: A SURVEY-BASED STUDY

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Abstract

Agriculture is one of the oldest and most significant occupations of humankind. The transformation and development of agriculture are multi-dimensional. In recent years, there has been an increase in the proportion of agricultural landscapes being transformed into built-up land. This transformation has led to a loss of biodiversity and degradation of the ecological capacity of the landscape. Physical and socio-economic factors closely control farming activities and cropping patterns. The physical environment plays an essential role in agriculture.

In this study, 80 farmers were interviewed using purposive sampling techniques to analyze the factors responsible for agricultural land transformation and evaluate farmers' perceptions about changing land use decisions among farmers living in Coimbatore. The study aims to provide insights into the factors influencing agricultural land transformation and how farmers perceive these changes. The results of this study could help policymakers develop strategies to mitigate the negative impacts of agricultural land transformation on biodiversity and ecological capacity.

Keywords: agriculture, farmers, land transformation.

INTRODUCTION

The history of agriculture began thousands of years ago. After gathering wild grains beginning at least 105,000 years ago, nascent farmers began to plant them around 11,500 years ago. Pigs, sheep, and cattle were domesticated over 10,000 years ago. Plants were independently cultivated in at least 11 regions of the world. By 6000 BCE, most of the farm animals we are familiar with today had been domesticated. By 5000 BCE, agriculture was practised in every major continent except Australia. Agriculture has often been conceptualized narrowly in terms of specific combinations of activities and organisms—wet-rice production in Asia, wheat farming in Europe, and cattle ranching in the Americas. The development of agriculture about 12,000 years ago changed the way humans lived.¹

Farming in India dates back to the Indus Valley Civilization around 6000 BCE. The Indus Valley Civilization was an agricultural civilization that relied on the Indus River for irrigation. The Harappan people were skilled farmers and grew wheat, barley, peas, and cotton. They also domesticated cattle, sheep, goats, and pigs. Agriculture has been an integral part of Indian culture since ancient times. The Vedas mention agriculture as one of the main occupations of the people. The Mauryan Empire (321-185 BCE) was known for its agricultural reforms and irrigation systems.

India is a country with a population of about 1.3 billion people. Approximately 68% of India's population lives in rural areas where agriculture is the primary occupation. Indian agriculture is characterized by small farm holdings, with an average farm size of only 1.57 hectares. Nearly 93% of farmers have land holdings smaller than 4 hectares and cultivate almost 55% of the arable land. Agriculture is one of the oldest and most significant occupations of humankind. The development of agriculture is essential for the economy of any country because it is a primary sector of the economy that

¹ Agriculture & Agricultural Technology Portal | Britannica. <https://www.britannica.com/browse/Agriculture>

provides the vital ingredients for the existence of humankind. In India, agriculture is a significant source of the economy, contributing more than one-third of the national income and providing direct employment to about 70% of the total population in rural areas.²

The rapid rural land transformation has significantly impacted the people residing in the study area. Earlier, the livelihood of the residents was based on agricultural and dairy activities. With time, land use patterns changed, and economic activities also changed. The study has examined several reasons behind the transformation of agricultural land, and it was found that in recent times, the proportion of agricultural land transformation is more, and the number of people involved in agricultural activities is considerably reduced.

Changes in agricultural land use are often driven by economic incentives of farmers in addition to motivations for ensuring their survival. Empirical evidence also confirms that agricultural land use change can increase household incomes, for example, due to the intensification of swidden areas. Thus, the study attempted to identify the reasons for agricultural land transformation among Coimbatore farmers.

Hence, it is essential to note that rural land transformation can bring about positive changes in economic development and better living standards. However, it can also adversely impact residents and land. Therefore, it is essential to balance development and conservation efforts to ensure that future generations can access fertile agricultural land for sustenance.³

Agricultural transformation and its development are multi-dimensional. It includes a variety of aspects such as agricultural land utilization, cropping intensity, crop productivity, crop concentration, crop diversification, crop combination, commercialization of agriculture, nature of pastoral relationships, and maintenance of ecological balance. Agriculture is essential in the economic development of less developed countries like India. Agricultural development is an integral part of overall economic development. In India, agriculture is the primary source of national income and occupation. Agriculture and allied activities have contributed nearly 50% to India's national income. Approximately 68% of the working population is engaged in agriculture and related activities.⁴

As previously mentioned, the Indian economy is primarily based on agriculture and has been socioeconomically much behind many countries of the developed world. The development of agriculture is crucial for the overall economic development of India. The government has implemented various policies and programs to promote agricultural growth and development in the country. These policies aim to increase agricultural productivity, improve rural infrastructure, provide better access to credit and markets for farmers, and promote sustainable farming practices.

The government's efforts have significantly improved agricultural productivity and rural infrastructure. However, there is still a long way to go to achieve sustainable agricultural growth and development in India. The government needs to continue promoting sustainable farming practices and providing better access to credit and markets for farmers. Additionally, there is a need for more investment in research and development to improve crop yields and develop new technologies that can help farmers increase their productivity.

The drivers of agricultural transformation are multi-dimensional, interrelated, and change over time. However, they can be organized into categories to provide a better opportunity for pragmatic diagnostics and decision-making on national priorities. Although rural families often make their living

² Features, problems, and policies of agriculture explained - the niconomics. <https://theniconomics.com/what-are-the-features-problems-and-policies-of-agriculture-explained/>

³ Smith-Bateman Bill Replenishing Open Space Funds Clears Senate - NJ Senate Democrats. <https://www.njsendems.org/smith-bateman-bill-replenishing-open-space-funds-clears-senate/>

⁴ Indian agriculture and food security: problem and prospects Munich Personal RePEc Archive. <https://mpra.ub.uni-muenchen.de/33748/>

from many different types of work, improvements in farming have proved to be the path toward widespread poverty-reducing growth in the rural economy. Successful agricultural transformations have focused on the farming household, providing opportunities for farmers to earn a better income.

In order to achieve successful agricultural transformations, it is essential to focus on the farming household and provide opportunities for farmers to earn a better income. This can be achieved through various means, such as improving access to credit and markets, promoting sustainable agricultural practices, investing in research and development to improve crop yields and developing new technologies that can help farmers increase their productivity.

Urbanization, particularly the migration of people to cities, has increased exceptionally, particularly in developing countries. The urbanization process involves a transformation from traditional rural economies to modern industrial ones, and dynamic absorption of the population in the urban areas is immensely pervasive in India, the second-most populous country in the world after China. Land use for urban development has increased, although it has little impact on total crop production. Modernization and commercialization of agriculture increased the necessity for non-crop goods and services. Urban sprawl, a growing population of educated youth, social assistance policies, and factors such as poverty, unemployment, and frequent natural calamities like droughts and floods have pushed rural people to urban places chasing after copious non-farm occupations to enhance their earnings (Malek et al. 2019).

Changes in agricultural land use are often driven by economic incentives of farmers in addition to motivations for ensuring their survival (Van et al. 2012). Empirical evidence also confirms that agricultural land use change can increase household incomes, for example, due to the intensification of swidden areas. Thus, this study attempted to identify the reasons responsible for agricultural land transformation among Coimbatore farmers.

METHODS AND MATERIALS

The present study adopts a Descriptive Research Design for examining the basic profile of the farmers and the reasons that lead to the transformation of agricultural land. The researcher adopted purposive sampling techniques for the present study. In this study, 80 farmers were selected purposively to opine on the reasons for the transformation of agricultural land in Coimbatore. The study examined basic information on agricultural labourers, landholding and cultivation patterns, and various reasons for land transformation. The study aims to identify the causes responsible for land transformation.

RESULTS AND DISCUSSION

The collected data is coded into values and analyzed by using SPSS Software. The following Table 1 portrays the Socio-Economic profile of the respondents.

Table 1: Socio-Economic Profile of the Respondents

S.No	Variable	No. of Respondents	Percentage (N = 80)
1.	Age		
	Below 30 years	15	18.8
	31 - 40 years	18	22.5
	41 - 50 years	34	42.5
	Above 50 years	13	16.2
2.	Education		
	Illiterate	29	36.2
	No-formal Education	24	30.0
	School level	12	15.0
	College level	11	13.8
	Professional Degree	4	5.0

4.	Marital Status		
	Married	56	70.0
	Unmarried	24	30.0

Table 1 explains the personal profile of the respondents. It was understood that 42.5 per cent of the farmers are between 41-50 years of age, 36.2 per cent are illiterates, and the majority, 70 per cent of the respondents, are married.

Table 2: Major Reasons for Land Transformation

S.No	Significant Reasons for Land Transformation	Levels of Measurement					
		Low		Moderate		High	
		N	%	N	%	N	%
1	Fertility Decline	35	44	25	31	20	25
2	The decline in the quantity of water	11	14	42	53	27	34
3	Vegetation loss	21	26	55	69	4	5
4	River bank Erosion	9	11	43	54	28	35
5	Poor soil and crop management	24	30	39	49	7	9
6	Urbanization	9	11	55	69	16	20
7	Industrial activities and mining (Windmill)	20	25	47	59	13	16
8	Deforestation	22	28	39	49	19	24

Table 2 explains the levels of measurement on the significant reasons for Land Transformation opined by the respondents under eight divisions. The levels are measured with low, moderate and high levels of coping. Among the different reasons for Land Transformation, 44 per cent of the respondents opined that they have a low level of fertile decline. In contrast, all the other dimensions report that most of the respondents have a moderate level of reasons for Land Transformation for Decline in the quantity of water (53%), Vegetation loss (69%), River bank erosion (54%), Poor soil and crop management (49%), Urbanization (69%), Industrial activities and mining (Windmill) (59%) and Deforestation (49%). The value of fertile agricultural land is far less than the land developed for commercial activities. Residents of the area tend to transform land use from agricultural to non-agricultural due to this huge difference in land value. The land used for farming will yield less income to the owner than the land on which commercial shops are constructed. The process of selling their land to developers and property dealers started with the marginal land owners who were under constant pressure to sustain their land holdings but could not compete with the farmers having more extensive land holdings. The farmers with significant land holdings are the last to transform their land from agricultural to non-agricultural land use.

CONCLUSION

The rapid rural land transformation has significantly impacted the people residing in the study area. Earlier, the livelihood of the residents was based on agricultural and dairy activities. With time, land use patterns changed, and economic activities also changed. The study has examined several reasons behind the transformation of agricultural land, and it was found that in recent times, the proportion of agricultural land transformation is more, and the number of people involved in agricultural activities has been considerably reduced.

The transformation of rural land from agricultural to non-agricultural has been viewed on one side as the development process bringing better living standards, better employment opportunities, and increased sources of income. Still, at the same time, several forms of adverse impacts have manifested

among the residents and land. The large areas of fertile agricultural land were lost to this transformation which needs due attention for maintaining proper agricultural activities to avoid food scarcity.

In conclusion, it is essential to note that rural land transformation can bring about positive economic development and better living standards, it can also adversely impact residents and land. Therefore, it is important to balance development and conservation efforts to ensure that future generations can access fertile agricultural land for sustenance.

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ASPIRATIONS AND AMBITIONS: ANALYSING THE CAREER STRUGGLES AND ETHICAL STRUGGLES FACED BY CHARACTERS IN CHETAN BHAGAT'S WORKS

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Abstract

Chetan Bhagat is a popular Indian author known for his contemporary fiction novels that often revolve around the aspirations, ambitions, and challenges faced by young individuals in India. While analyzing the career and ethical struggles of characters in Chetan Bhagat's works, it's important to consider some of his well-known novels like *Five Point Someone*, *One Night @ the Call Center*, *Two States*, and *Half Girlfriend*.

Chetan Bhagat's works often reflect and explore the aspirations and ambitions of the characters, particularly the younger generation in contemporary Indian society. This article also explores the career and ethical struggles faced by the characters in Chetan Bhagat's works.

Keywords: Aspiration, Ambition, Ethical, Generation, Struggles

Chetan Bhagat is often regarded as a novelist who effectively captures the essence of the younger generation in India. His works resonate with readers, especially those in their late teens, twenties, and thirties, by addressing themes and issues that are particularly relevant to this demographic. Bhagat's novels delve into contemporary themes and issues that directly impact the lives of young Indians. Whether it's the pressure of academic expectations, career dilemmas, intercultural relationships, or the challenges of modern urban life, his works reflect the realities faced by the younger generation. Bhagat creates characters that readers can relate to on a personal level. His protagonists are often individuals dealing with relatable challenges and aspirations, making it easy for the younger generation to connect with the stories emotionally.

Bhagat's novels often revolve around the complexities of relationships, including friendships and romantic entanglements. He explores the dynamics of modern relationships, addressing issues such as communication gaps, societal expectations, and the pursuit of love. The aspirations and struggles depicted in Bhagat's works mirror the dreams and challenges faced by young Indians. Whether it's the desire for academic success, a fulfilling career, or navigating the complexities of love and family expectations, his novels capture the multifaceted nature of the younger generation's journey.

DIASPORIC CRISIS: LANDSCAPE AND IDENTITY IN UMA PARAMESWARAN'S MANGOES ON MAPLE TREE

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Abstract

Uma Parameswaran, a prominent Indo-Canadian author, skillfully captures the diverse dimensions of cultural pluralism in Canada during its third phase of expatriation. Residing in Manitoba, she keenly observes the Canadian government's bilingual policy. As an ethnic minority writer, Parameswaran navigates the 'third space,' a concept evident in her works. In her debut novel, *Mangoes on the Maple Tree* (2002), she delves into the lives of two families, the Bhaves and Moghes, who have migrated from India to Canada. The narrative unfolds the diasporic crisis faced by these families in a foreign land, shedding light on the ethnic challenges encountered. The novel intricately explores the tensions within the families and the broader societal tensions they confront as minorities. Beyond the impact of the Canadian landscape on daily life, Parameswaran emphasizes the significance of socially constructed landscapes such as individual property, houses, and land in shaping human experiences. This article aims to articulate the sense of rootlessness and uprooted identity, highlighting the struggle for group consciousness among oppressed minorities. The focus is on portraying the complex reality of immigrant life, navigating both the geographical and socially constructed landscapes that influence the lived experiences of these individuals.

Keywords: Ethnic Minority, Group consciousness, Uprooted Identity.

Jean Paul Sartre the well-known French philosopher uses the term 'engagement' to refer to the process of acceptability among individuals for their actions signifying a political consequence. The same concept of 'engagement' can be applied in Uma Parameswaran's novel *Mangoes on the Maple Tree* where the main character Sharad Bhave decides to leave his homeland to settle in a foreign place. As a result, the family experienced a sense of loneliness which made Sharad to realize of his wrong decision and finally to establish a 'collective solidarity' within themselves through mutual support. The feeling of uprooted identity, rootlessness is one of the major issues concerned in the life of diasporans which Parameswaran also rationally records. The isolation and interdependence the immigrant family faces there and

IDENTITY AND INDIVIDUALISM: TRACING THE PLIGHT OF INDIVIDUALS IN POST-INDEPENDENCE INDIA IN NAYANTARA SAHGAL'S WORKS

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Abstract

Nayantara Sahgal's works are known for their nuanced exploration of characters within the socio-political context of post-independence India. She addresses the complexities of identity formation, examining how personal choices, political events, and societal expectations intersect to shape the individual's sense of self. Her narratives often highlight the struggles of individuals who find themselves at the crossroads of tradition and modernity, personal desires, and societal pressures, providing readers with a rich tapestry of characters whose stories mirror the broader challenges faced by individuals in the evolving landscape of post-independence India.

Keywords: Identity, Tradition, Modernity, Desires, Landscape.

Nayantara Sahgal, a prominent Indian author, has made significant contributions to Indian literature with her insightful works that often explore social and political issues. Her novels reflect a keen understanding of the complexities of post-independence India, and the themes of identity and individualism are central to many of her writings. The novels of Nayantara Sahgal, not only constitute an impressive segment of the Indian English novel but also sum up the saga of India's struggle for freedom and the changes it has brought about in the traditional social set-up in India. Although Mrs. Sahgal is unique in her artistic sensibility as well as in the particular manner of possessing the resources of national experience in terms of imaginative projection, she also reflects, like the other Indian novelists in English, the consciousness of change, and the strange and sudden ways in which it has come to shape the character of individuals and the temper of the collective life as well as the competing structures of human values and human destiny.

The major legacy of cultural change in modern India has been the new historical sense, containing in itself a feeling for the past as well as an awareness of the future, as both dramatize themselves in the personality of the present. Sahgal's work has a certain dialectical quality which has been generalized into its wide cultural connotations in terms of social tradition and political

The Influence Of Social Media On Shaping Literary Trends And Reading Habits

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Abstract:

This article explores the significant role of social media platforms in shaping contemporary literary trends and transforming reading habits. In an age dominated by digital connectivity, social media has become a powerful force in promoting and disseminating literature, influencing what readers choose to read and how they engage with texts. Drawing on examples from various genres and mediums, this research examines the multifaceted ways in which social media platforms impact literary consumption patterns, book marketing strategies, author-reader interactions, and the overall landscape of contemporary literature. By analyzing the intersection of technology, culture, and literature, this study sheds light on the complex dynamics between social media and the literary world, highlighting both the opportunities and challenges posed by this digital phenomenon.

Keywords: Social media, Technology, Culture, Literature.

Introduction:

In recent years, the proliferation of social media platforms has revolutionized the way people communicate, share information, and consume content. From Twitter to Instagram, Facebook to Goodreads, these digital spaces have not only facilitated social networking but have also emerged as influential hubs for promoting and discussing literature. In this article, we delve into the dynamic relationship between social media and contemporary literature,

Feminist Perspectives in Modern Indian Writing: Voices of Empowerment

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Abstract

This research article explores the emergence and impact of feminist perspectives in modern Indian literature. It highlights how contemporary Indian writers have used their work to challenge traditional gender norms and empower women. Through analyzing key literary works and authors, this article examines the themes of identity, agency, and resistance that characterize feminist writing in India today. It also considers the role of literature as a tool for social change and how Indian writers are contributing to global feminist discourse.

Keywords: Feminism, Indian Literature, Empowerment, Gender, Social Change, Contemporary Writing

Introduction

The landscape of Indian literature has undergone significant transformations in recent decades, with feminist perspectives emerging as a powerful force. This article aims to delve into the role of feminist writing in contemporary Indian literature, examining how authors use their narratives to address gender inequalities and empower women. By focusing on modern writers and their works, we can understand how literature serves as a medium for social change and the advancement of feminist ideals.

The Historical Context of Feminist Writing in India

Early Feminist Voices

The roots of feminist writing in India can be traced back to pioneering authors such as Kamala Das, Ismat Chughtai, and Amrita Pritam, who broke societal taboos by exploring female sexuality and autonomy in their works. These writers laid the foundation for future generations, encouraging them to address issues of gender and identity more openly.

Transition to Contemporary Feminism

The shift from early feminist literature to contemporary narratives reflects broader societal changes. Modern writers build upon the legacy of their predecessors, exploring complex themes and embracing diverse perspectives to address the multifaceted nature of feminism in India.

Globalization And Cultural Hybridity In Twenty-First Century Literature

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Abstract:

This paper explores the complex interplay between globalization and cultural hybridity in twenty-first-century literature. As the world becomes increasingly interconnected through processes of globalization, literature reflects and responds to the dynamics of cultural exchange, migration, and diaspora. Drawing on a diverse range of literary texts from around the globe, this research examines how contemporary authors negotiate issues of identity, belonging, and cultural hybridity in the context of globalized societies. Through close analysis of novels, short stories, and poems, this study explores the ways in which literature both reflects and challenges traditional notions of national identity, cultural authenticity, and literary tradition in an era of unprecedented global mobility and transnational flows of people, ideas, and cultures.

Keywords: National Identity, Cultural Authenticity, Hybridity, Diaspora

Introduction:

The twenty-first century is marked by unprecedented levels of global interconnectedness, driven by advancements in technology, transportation, and communication. As borders blur and cultural boundaries dissolve, literature emerges as a vital site for exploring the complexities of globalization and cultural hybridity. This paper examines how contemporary authors navigate the shifting terrain of identity and belonging in a globalized world, exploring the ways in which literature reflects and responds to the diverse experiences of cultural exchange, migration, and diaspora.

Globalization and Cultural Hybridity:

Globalization, the process of increased interconnectedness and interdependence among countries, has significantly impacted cultures around the world. One of the notable outcomes of globalization is cultural hybridity, the blending and mixing of different cultural elements to create new and dynamic cultural forms. This phenomenon is particularly evident in literature, where authors often explore themes of identity, migration, and diaspora in response to the complexities of globalization.

Cultural hybridity in literature reflects the diverse experiences of individuals and communities navigating the challenges and opportunities of living in a globalized world. Authors draw from their own cultural backgrounds and experiences to create narratives that capture the complexities of cultural exchange and interaction. These narratives often highlight the fluidity and multiplicity of identities, challenging traditional notions of cultural authenticity and purity.

In addition to exploring individual experiences of cultural hybridity, literature also addresses broader social and political issues related to globalization. Authors may critique the

Dystopian Fiction: Reflections Of Contemporary Sociopolitical Concerns

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Abstract:

Dystopian fiction serves as a mirror reflecting the anxieties, fears, and aspirations of contemporary society. Through the portrayal of bleak, authoritarian futures, dystopian narratives offer a lens through which to examine and critique existing sociopolitical structures. This paper explores the thematic and narrative elements of dystopian fiction, analyzing how authors draw from current sociopolitical concerns to construct their imagined worlds. Drawing upon examples from seminal works such as George Orwell's "1984" and Margaret Atwood's "The Handmaid's Tale," as well as more recent contributions like N.K. Jemisin's "The Fifth Season," this paper demonstrates the enduring relevance of dystopian fiction in interrogating power dynamics, surveillance, environmental degradation, and social inequality. By engaging with these fictional worlds, readers are prompted to reflect on the trajectory of their own societies and the actions necessary to safeguard against dystopian futures.

Keywords: Dystopian, Bleak, Dynamics, Inequality, Degradation.

Dystopian fiction has long captivated readers with its dark imaginings of oppressive regimes, ecological collapse, and societal decay. Yet, beneath the surface of these fantastical narratives lie profound reflections of contemporary sociopolitical concerns. Authors of dystopian fiction often leverage the genre to critique existing power structures, warn against

Contemporary Novels

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Abstract:

Contemporary literature has seen a significant shift towards more diverse and inclusive representations of gender and sexuality. This paper examines the ways in which contemporary novels explore gender identity, representation, and queer narratives. By analyzing a selection of works from various genres and cultural backgrounds, including "Giovanni's Room" by James Baldwin, "Middlesex" by Jeffrey Eugenides, and "The Song of Achilles" by Madeline Miller, this paper explores how authors challenge traditional gender norms, depict LGBTQ+ experiences, and contribute to broader conversations surrounding identity and belonging. Through nuanced characterizations and empathetic storytelling, these novels offer readers a deeper understanding of the complexities of gender and sexuality in contemporary society.

Keywords: Gender, Queer, Sexuality, Identity, Cultural.

Introduction:

In recent years, the landscape of literature has undergone a profound transformation, with authors increasingly exploring themes of gender identity, representation, and queer experiences. From poignant coming-of-age stories to epic historical dramas, contemporary novels offer diverse perspectives on gender and sexuality, challenging traditional narratives and expanding the boundaries of literary representation. This paper examines the ways in which

**CONSUMER AWARENESS ON E MARKETING A STUDY WITH SPECIAL
REFERENCE TO POLLACHI TALUK**

Dr. G. Akilandeswari, Associate Professor and Head, Department of Commerce (Finance),
Nallamuthu Gounder Mahalingam College, Pollachi

Abstract

The introduction of internet has created a new market for both manufacturing and service providers. Internet has been used as a marketing channel with which the consumers were introduced to a new trading pattern. Present consumers are well aware about the economic surroundings due to the availability of information. E Marketing is the process of marketing a product or service using the Internet. It uses a range of technologies to help connect businesses to their Consumers. E-marketing is one of the latest and emerging tools in the marketing world. Electronic Marketing is convenient than the traditional marketing for both consumer and the marketer. The facility of E-Marketing has allowed customers to identify the different types of products available in the global market. Due to rapid globalization, all types of products are available on the internet .Goods and services, consumer durables, books, CDs and services like air ticket, train ticket, can also be purchased online. This study aims to identify the Consumer Awareness on E Marketing with special reference to Pollachi Taluk

Keywords:

Consumer, Internet, E-Marketing, Product, Service.

INTRODUCTION

The introduction of internet has created a new market for both manufacturing and service providers. Today's generation does not know a life without internet. Evolution of Internet made the world rest in our hands. Internet has been used as a marketing channel with which the consumers were introduced to a new trading pattern. Present consumers are well aware about the economic surroundings due to the availability of information.

E-marketing is the process of marketing a product or service using the Internet. It not only includes marketing on the Internet, but also includes marketing done via e-mail and wireless media. It uses a range of technologies to help connect businesses to their Consumers. Digital marketing is one of the latest and emerging tools in the marketing world .Electronic Marketing (E-Marketing) is also known as Internet Marketing, Web Marketing, Digital Marketing, or Online Marketing. The major advantages in E-marketing are it helps in extremely low risk, reduction in cost through automation and use of electronic media, can get universal accessibility. E-marketing is convenient than the traditional marketing for both consumer and the marketer. It offers large number of variety for the particular product relatively with lower prices.

The facility of E-Marketing has allowed customers to identify the different types of products available in the global market, Due to rapid globalization, all types of products are available on the internet .Goods and services, consumer durables, books, CDs and services like air ticket, train ticket, can also be purchased online.

REVIEW OF LITERATURE

Dr. Ravindra Borkar and Dr. Ajay Pethe (2022)in their study on customers' awareness towards online shopping reveals that , Most respondents believe that the advantage of online shopping is a time-saving, security and quality process. Most respondents prefer cash on delivery, home delivery and

FACTORS INFLUENCING THE ONLINE CONSUMERS BUYING BEHAVIOUR IN POLLACHI TALUK

Dr. G. Akilandeswari, Associate Professor and Head, Department of Commerce (Finance),
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ABSTRACT

Buying Behavior is the decision processes and acts of people involved in buying and using products. The new improvement of online business and the buyer's growing interest in purchasing over the internet has basically changed the nature of Indian retail market. Due to the rapid advancement in internet marketing, Buyers prefer online purchase instead of offline. Numerous organizations have begun use the web to reduce their expenses, and to create awareness about their products to the consumers. This research aims to identify the factors influencing the online consumers buying behavior in Pollachi Taluk.

Keywords: Consumer, Internet Marketing, Product, Buying Behavior.

INTRODUCTION

The new improvement of online business and the buyer's growing interest in purchasing over the internet has basically changed the nature of market. Today a large number of people around the world are using online shopping. Over the last few years, E-commerce has become an essential part of global retailing, and it has also undergone a number of changes and will keep changing according to the trends. Online Shopping is growing rapidly in India, predominantly driven by tremendous and substantial activities among millennial consumers. Due to the rapid advancement in internet marketing, Buyers prefer to purchase products through online instead of offline purchase. Numerous organizations have begun use the web to reduce their expenses, and to create awareness about their products to the consumers. In this era where competition is considered, marketing has become the keystone for competition. Online buying is becoming more popular and is attracting great attention because it has great potential for both consumers and sellers. The features of online shopping make it more successful and became an emerging trend among consumers. When all the companies are striving against one another, certain factors influence the buying behavior of consumers.

REVIEW OF LITERATURE

Dr. Vandana Sonwaney, Snehal Chincholkar (2019) , “Identifying the Factors Impacting Online Consumer Buying Behaviour”, concluded that family or friends do not influence online consumer buying behaviour but consumer may like to do online shopping to avoid sales person. In case of psychological factors convenience of doing shopping from anywhere and less time consuming are most important factors influencing consumers for doing online shopping.

Anurag Pandey, Jitesh Parmar (2019) in their study , Factors affecting consumer's online shopping buying behavior, there are seven factors affect consumers online shopping behaviour. These factors are ease of use, perceived risk, perceived usefulness, effect of website design, economic factor, availability of products, and customer satisfaction.

R. Ganapathi(2015), A study on factors affecting online shopping behavior of consumers in Chennai, reveals that Majority of consumers of online shopping are males and most of them belong to the age group of 31 – 40 years. Majority of consumers of online shopping are graduates and most of them belong to the annual income group of Rs.4, 01,000 – Rs.5, 00,000. The exploratory factor analysis shows that convenience, website features, security and time saving are the factors affecting online shopping behaviour of consumers.

ASTOUNDING PERFORMANCE OF WOMEN ENTREPRENEURS IN UNORGANISED SECTOR WITH SPECIAL REFERENCE TO POLLACHI

Dr. R.AMSAVENI Assistant Professor, Department of Commerce (Finance), Nallamuthu Goundar Mahalingam College, Pollachi.

ABSTRACT

Women who take responsibility to organize the resources of enterprises and bear all the risks in expectations of deriving profit can be termed as women entrepreneur. When a women or group of women embark on initiating, organizing and managing their enterprise, they are termed as women entrepreneur. Despite their efforts and expertise, women entrepreneurship often struggles a lot to make rough and get recognized within the business area. Hence, this study has assessed that astounding performance of women entrepreneurs in unorganised sector in Pollachi. The nature of this study is descriptive research design. The population of this study are women entrepreneurs and the sample size is 105. The required sample data are collected by approaching random sampling method. For collecting the astounding performance of women entrepreneurs through 5 points Likert scale method, a structured questionnaire has been administered and distributed among them. The researchers have utilized the MS-Excel software to preserve the collected data and performed the statistical methods namely percentage analysis, mean score, standard deviation and ANOVA. In addition, they framed the null hypotheses to examine the significant difference in mean astounding performance of women entrepreneurs. From the analysis, it is mentioned that maximum level of astounding performance is perceived by the women entrepreneurs who belong to 41-50 years of age category, qualified college level, sole proprietorship, textile garments and run business for 11-15 years.

Keywords: Astounding Performance, Women entrepreneurs, Unorganised sector, Collateral security, Finance support, Loan facility.

1. INTRODUCTION

Women Entrepreneur is a person who accepts challenging role to meet her personal needs and become economically independent. A strong desire to do something positive is an inbuilt quality of entrepreneurial women, who is capable of contributing values in both family and social life. Women entrepreneurship in India is still emerging. The representation of women as entrepreneurs is quite limited. Entrepreneurship is an area of research that has been of immense interest to researchers, academicians and policy makers. Entrepreneurship is significantly correlated to economic development of any economy by accelerating growth and prosperity, and. In the last few decades woman as entrepreneur are emerging both in developed and developing economies. It is evident that women entrepreneurs contribute immensely to improved poverty levels, increased per capita income and employment creation. Women entrepreneurship is instrumental for achieving economic and societal growth. Despite constituting around half of the total population of India, the economic participation of women is very limited. Women entrepreneurs of India are now emerging in non-traditional sectors. Women entrepreneurs are a heterogeneous segment having diverse demographic, economic and educational background. It is imperative that the policies and schemes cater to the unique needs of every segment.

2. REVIEW OF LITERATURE

In view of Rahabhi Mashapure et al. (2022) revealed that the inadequate support from government schemes, patriarchal societal structure of my community, lack of relevant entrepreneurial knowledge to manage the businesses, lack of collateral security to access funding, lack of market information, occurrence of disasters in the localities, time limitation or role conflict to balance family pressures negatively influenced women entrepreneurship. Interestingly interviews

**CHALLENGES OF WOMEN ENTREPRENEURS IN UNORGANISED SECTOR WITH
SPECIAL REFERENCE TO POLLACHI**

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ABSTRACT

Women entrepreneurs may be defined as a woman or a group of women who initiate, organise and run a business concern. Women Entrepreneurship implies a process in which a female initiate, lead, own and organize an enterprise or industry and give employment to others and also contribute in improving the standard of living of their families. Women engaging in entrepreneurship in unorganized sector face many challenges and their success in their businesses depends greatly on their ability to cope up with these challenges. They are affected by lack of entrepreneurial, managerial and marketing skills, difficulties accessing financial resources, discriminatory regulatory practices, inadequate intellectual property protection and cultural differences. So, this study has analyzed that the challenges of women entrepreneurs in unorganised sector in Pollachi. This study has adopted descriptive research and survey method. The population of this study have women entrepreneurs of unorganized sector in Pollachi and the sample size has included of 137 women entrepreneurs through random sampling method. The sample data of this study are collected by undertaking survey among population. A structured questionnaire has been developed and spread among them for collecting the demographic profile and challenges of women entrepreneurs with the help of 5 points Likert scale method. The researchers have approached MS-Excel software to maintain the collected data and carried out the statistical methods such as percentage analysis, mean score, standard deviation and ANOVA. Also, they developed the null hypotheses to examine the significant difference in mean challenges of women entrepreneurs in unorganized sector. The result from study depicted that most of women entrepreneurs are doing private limited company and doing handicrafts for above 20 years. Also, high level of challenges in unorganized sector is perceived by the women entrepreneurs belong to 41-50 years of age group, business with partnership, handicrafts sector and make business for 16-20 years.

Keywords:

Women entrepreneurs, Challenges, Unorganised sector, Lack of Entrepreneurial, Lack of Financial Resources and Cultural Differences.

1. INTRODUCTION

The increasing presence of women as entrepreneurs has led to significant business and economic growth in the country. Women-owned business enterprises are playing a prominent role in society by generating employment opportunities in the country, bringing in demographic shifts and inspiring the next generation of women founders. Entrepreneur is the nucleus of economic development. It is more important and influential in nourishing the process of economic development. Every country, both developed and developing countries aims towards economic development for success and betterment of society. So, the contribution of both men and women is important for building the economy of a nation. A few decades before, entrepreneurship was meant only for the male. But in recent years, the country has witnessed a titanic surge in the form of number of women entering into the entrepreneurial activity. The hidden entrepreneurial potentials of women have undergone a drastic change with the mounting sensitivity to the role and economic status in the society. Further, when compared to organised sector, the Indian economy's strength is highly witnessed with the growth of unorganised sector and the contribution of women entrepreneurs towards unorganised sectors in terms of manufacturing and trading activity is tremendously high. With a vision to promote the sustainable development of women entrepreneurs for balanced growth in the country, Startup India is committed towards strengthening women entrepreneurship in India through initiatives, schemes, creation of

**A STUDY ON COMMON TRANSPORTATION AND ITS USER PREFERENCES IN
POLLACHI REGION**

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INTRODUCTION

Passengers' preferences towards common transportation have always played a crucial role in shaping the transportation industry. Understanding what passenger's desire and value in their transportation experience is essential for transportation providers to meet their needs effectively. From convenience and affordability to comfort and sustainability, passengers have a wide range of preferences that influence their choice of common transportation modes. The comparison of passenger choice between public and private transportation is a trending area of study in the realm of urban mobility and transportation planning. Understanding the factors that influence individuals' decisions to use public transit or private vehicles is essential for developing effective, sustainable, and inclusive transportation systems. This introduction sets the stage for exploring the complexities of passenger preferences, considering aspects such as convenience, cost, environmental impact, accessibility, and individual preferences. By examining the dynamics of public versus private transportation choices, we can gain valuable insights into the diverse needs and behaviours of passengers, ultimately informing the development of transportation infrastructure and services that cater to a wide range of preferences and contribute to the overall efficiency and sustainability of urban mobility.

REVIEW OF THE STUDY

Juan de Ona, Esperanza Estevez and Rocio de Ona, etal (2021), has examined “Public transport users versus private vehicle users: differences about quality of service, satisfaction and attitudes toward public transport in Madrid”. In his study aims to further understand the main factors influencing the behavioural intentions (BI) of private vehicle users towards public transport to provide policymakers and public transport operators with the tools they need to attract more private vehicle users. Findings from this study can be used to develop policies and recommendations for persuading more private vehicle users to use the public transport services.

Karishma Maharani Raijaya, Chotib,etal (2020), has examined “The Dilemma of the Choice Between: Public Transportation or Private Transportation Case Study: Sarbagita Metropolitan Area” in his study to identify the probability of public transportation use by workers in the sarbagita region. The study uses sakernas 2018 data, using the binary logistic regression model. The results of that study are the use of public transportation depends on individual characteristics such as distance, sex, education, age, and marital status. One of the solutions to traffic congestion in Bali is to improve public transportation facilities and infrastructure, increase stopping points, and be more on time so that commuter workers can switch from private transportation to public transportation.

PROBLEM STATEMENT

To understand the factors influencing passengers' preference towards common transportation options and to identify the key drivers that determines their choice of transportation mode. This study aims to gather insights into passengers' preferences in terms of convenience, affordability, comfort, reliability, safety, and environmental sustainability. By analysing these preferences, transportation authorities and service providers can make informed to improve the quality of common transportation services and attract more passengers towards these modes, ultimately reducing traffic congestion and promoting sustainable urban mobility. As a part of International Business, the researcher was impulse to carry the study in Logistics field and focused on “Passenger's choice towards common transportation with special focus to pollachi region”

OBJECTIVE OF THIS STUDY

- To identify the most preferred common transportation options among passengers.

EXPORT PERFORMANCE OF COFFEE PRODUCTS DURING PRE AND POST-COVID PERIOD

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1.1 INTRODUCTION

The Coffee Board of India is an autonomous body, functioning under the Ministry of Commerce and Industry, Government of India. The Board serves as a friend, philosopher and guide of the coffee industry in India. Set up under an Act of the Parliament of India in 1942, the Board focuses on research, development, extension, quality up gradation, market information, and the domestic and external promotion of Indian coffee. In India, coffee is traditionally grown in the Western Ghats spread over Karnataka, Kerala and Tamil Nadu. Coffee cultivation is also being expanding rapidly in the nontraditional areas of AP and Odisha as well as in the North East states. Coffee is predominantly an export oriented commodity and 65% to 70% of coffee produced in the country is exported while the rest is consumed within the country. Indian coffee industry earns a foreign exchange to the tune of about Rs.4000 Crore. Indian coffee has created a niche for itself in the international market and the Indian Coffees are earning high premium, particularly Indian Robusta which is highly preferred for its good blending quality. Arabica Coffee from India is also well received in the international market. Coffee is an export product with low import intensity and high employment content. This is evident from the fact that more than six lakh persons are directly employed and an equal numbers of individuals get indirect employment from this sector. During 1940's, the coffee industry in India was in a desperate state due to the II World war resulting in very low prices and ravages of pests and diseases. At this time, the Government of India established the 'Coffee Board' through a constitutional act "Coffee Act VII of 1942" under the administrative control of Ministry of Commerce and Industry. The Board comprises 33 members including the Chairman, who is the Chief Executive and appointed by the Government of India. The remaining 32 members represent the various interests such as coffee growing industry, coffee trade interests, curing establishments, interests of labour and consumers, representatives of governments of the principal coffee growing states, and Members of Parliament. After pooling was discontinued in 1996, Coffee Board serves as the friend, philosopher and guide to the Coffee sector covering the entire value chain. The core activities are primarily directed towards research & development, transfer of technology, quality improvement, extending development support to growing sector, promotion of coffee in export and domestic markets. The activities of the Board are broadly aimed at (i) enhancement of production, productivity & quality; (ii) export promotion for achieving higher value returns for Indian Coffee and (iii) supporting development of Domestic market.

1.2 STATEMENT OF THE PROBLEM

In India, coffee is traditionally grown in the Western Ghats spread over Karnataka, Kerala and Tamil Nadu. Coffee cultivation is also being expanding rapidly in the nontraditional areas as well as in the North East states. Coffee is predominantly an export oriented commodity and 65% to 70% of coffee industry earns a foreign exchange nearly Rs. 4000 Cores per year. Indian coffee has created a niche for itself in the international market and the Indian Coffees are earning high premium, particularly Indian Robusta which is highly preferred for its good blending quality. Critical issues that plague Indian coffee Export at present are the knowledge deficit and infrastructure deficit, especially in the rural areas. Problems related to irrigation infrastructure, market infrastructure and transport infrastructure add significant cost to farmers operations. Another issue is lack of delivery mechanisms. The study on export performance of coffee, taking in to consideration the major coffee producing states, would bring out the importance of coffee exports. The study also identifies and analysis the processing of coffee in our country.



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Ensemble voting machine learning model for prediction of campus placement of the student ✓

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Ensemble Voting Machine Learning Model for Prediction of Campus Placement of the Student

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Abstract. Placements in campus interviews are the dream of every student in college. Placement in campus interviews is a vital measure of an educational institution's standards and student performance. Machine learning with the knowledge discovery process helps to forecast the student's performance in on-campus interviews. This paper suggested an ensemble model-based voting classifier with BayesNet and J48 is used to classify the student's academic data and forecast the placement opportunity. This work compares two ensemble stacking models and a voting-based classification model with J48 for obtaining an efficient model of placement prediction. Both ensemble stacking models use BayesNet and J48 classifiers as the base classifiers. The J48 classifier is used as the meta classifier in one stacking process and the voted perceptron is used in another. In the ensemble voting model, BayesNet and J48 are used as the base classifiers and the probability average of a class of base classifiers is used for the combination rule. The ensemble voting model gains high accuracy with a minimum error rate than other models. This model produced 91% of accuracy in the placement prediction. J48 and BayesNet classifiers are combined with probability average-based combination rules in the ensemble voting model.

INTRODUCTION

Indian higher education institutions provide the highest count of placements in the world. At the same time, the count of higher educational institutions is also very high. So, each and every institution needs to improve the quality of education and increase placement opportunities. Educational Data Mining (EDM) plays a vital role in improvising the quality of education, identification of learning difficulties, forecasting weak students and placement opportunities and updating educational settings. EDM creates a knowledge base for institutions and students by extracting hidden knowledge from educational data. Obtaining good scores in semester exams and getting a placement with a high package from premier organizations by the student are the most used evaluation pattern in college education. Every higher education institution needs to forecast placement opportunities for the students in campus interviews at an earlier stage. It facilitates tuning the students and improving their performance in campus placement interviews. In the forecasting of placement status, a high accuracy rate is necessary to group the students by the placement cell to provide more training and attention, so a better system is required for placement status forecasts with a high accuracy rate.

This paper presents an ensemble machine-learning classification model for the placement status forecasting process. Combined classification techniques are used in stacking and voting models to forecast the placement details. The performance of this ensemble model in the student data is examined and the best ensemble model for the further placement status forecasting process of the student data is selected.

LITERATURE SURVEY

S Dutta et al., [1] proposed an ensemble voting classifier for the campus placement forecasting process. Gradient boosting and Extra Tree classifiers are combined in this ensemble voting technique. In this process, existing data set from Kaggle is used and predicts the placement status with 86.05% accuracy.

B Sen et al., [2] analyzed placement test marks for the prediction process with C5, SVM, ANN, and Logistic regression. The C5-based decision tree algorithm produced high accuracy (95%) than the other three models. The author identified scholarship, GPA and previous test scores are important factors in the prediction of placement test marks.

Dech Thammasiri et al., [3] includes SMOTE for class imbalance with SVM to obtain the best accuracy in student attrition forecast and identified vital attributes for accuracy in prediction. 90.24% accuracy was obtained by this model and it's better than SVM, NN, LR, and decision tree classifiers.

V K Harihar [4] compared MLP with Tree-based logistic model and SVM classifiers in the UG students' placement possibilities. Different datasets and measures are used in the prediction process. RMSE, Accuracy, F1Score, and ROC performance metrics are used to analyze the classifier's performance. The tree-based logistic model predicts the possibilities of the placement for the students with 99.5% of accuracy.

Shreyas. H et. al., [5] proposed Naive Bayes and KNN for student placement prediction. Both are independently used to predict and compare the efficiency of Naive Bayes and KNN.

Neelam. S et. al., [6] analyzed the performance of previous-year students and predicted the placement opportunities for current-year students. This paper compares the Decision Tree and Random forest relevant to accuracy, recall, and precision. Finally, Random Forest gives better results.

Jai R and K David [7] attempted to stem a smart training data set from 4 dissimilar data sets and utilized it for the prediction process using ID3 and MLP. ID3 obtain high accuracy than MLP in all dissimilar data sets with 90% average accuracy. The obtained average accuracy of MLP is 70%. In the 4 dissimilar data sets, ID3 produced 88%, 96%, 100%, and 76% accuracy respectively and MLP produced 60%, 40%, 96%, and 84% respectively.

NT Nghe et al., [8], forecasts Undergraduate and Post Graduate students' academic level using Bayesian Network and Decision Tree. Bayesian Network works better with 3 to 12% higher accuracy than Decision Tree in different attempts like failed students and good and very good students in academics.

PROPOSED MODEL

This work proposed a voting-based ensemble model for placement prediction. This work compares the ensemble stacking and voting-based classification models with J48 for obtaining an efficient model of placement prediction. The proposed model is shown in the following Figure 1.

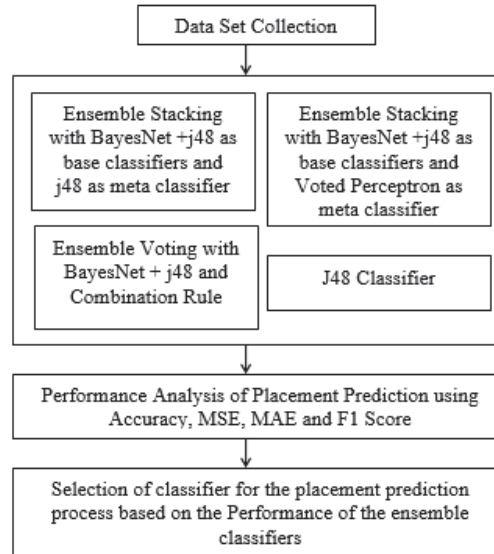


FIGURE 1. Proposed Model

Data Set collection

The data set is collected directly from the Nallamuthu Gounder Mahalingam College, placement cell, and also students. In the data set, misplaced and inappropriate data found instances are handled and define the dependent and independent attributes in the pre-processed phase.

TABLE 1. Attributes in the data set

Name	Specification	Possible Data
S No	Sequence No	Numeric Sequence
Reg No	Register No	Alphanumeric
Name	Student Name	Alphabets
Gender	Gender	{M – Male, F - Female}
Course	Name of the UG Course	{B.Sc. BCA, BCom, BA}
Year	Academic Year	{2017-2020, 2018-2021, 2019-2022}
Area of Living	Living Area of the student	{Rural, Urban}
Schooling	H.Sc. Studied School Type	{P – Private, G – Government}
Medium	Medium of study	{E-English, T-Tamil}
HSc	H.Sc. Percentage	{35% to 100%}
UG	UG Percentage	{40% to 100%}
Attendance	Attendance Percentage	{70% to 100%}
Interaction in Class	Interaction in the class hours	{Good, Average, Poor}
Paper Presented	Paper presented	{Y – Yes, N-No}
Placement Training	Placement Training Attended	{Y – Yes, N-No}
Certifications	Certifications	{Y – Yes, N-No}
CE Class Attended	Communicative English Class Attended	{Y – Yes, N-No}
Club Activities	Joined in Club Activities	{Y – Yes, N-No}
Placement	Placement Status	{Placed, Not placed}

Pre-processed data set is divided into the train (70%) and test (30%) data sets. The student placement training data set is used to fit the ML model and the test data set is used to evaluate the fitness of the ML model. Gender, course, area of living, school type and medium studied, the percentage of H.Sc., UG marks, attendance, interaction in class, placement training attended, certifications, activities of the student, and placement status is the key attributes of the student data set. The attributes handled in the student placement training and test data set are described in Table 1.

Both ensemble stacking models use BayesNet and J48 classifiers as the base classifiers. The J48 classifier was used as the meta classifier in one stacking process and the voted perceptron is used in another. In the ensemble voting model, BayesNet and J48 are used as the base classifiers and the probability average of a class of base classifiers is used for the combination rule. J48 is used to train the model individually.

Finally, above four models' classification results are compared to select the best model for placement prediction. Accuracy, MSE, MAE, and F1Score metrics are used to compare and analyze the models.

BayesNet

BayesNet is a probability-based graphical mode and is mainly utilized to calculate uncertainties using probability. A conditional probability measure is used in the BayesNet for placement prediction. Directed Acyclic graphs are used for uncertainties. BayesNet is a good one for taking an observed event and predicting the likelihood that any of the numerous known causes played a role. For example, BayesNet could reflect the probability correlations between placement status and academic data. Given a set of academic data of the students, BayesNet is used to calculate the likelihood of placement status.

J48

J48 is a tree-based classifier for machine learning and it's a very useful one to examine the category-wise and continuous data. It is a divide and conquer-based recursive strategy for determining the ideal attribute to split on at each and every stage. Information gain measure is used to select the ideal attribute at each stage. Same-class instances are treated as a leaf and labeled with the same class. IG is calculated for each attribute and used to select the best attribute to split. In the next step, entropy is calculated and finally, the best attribute will be chosen depending on the current selection parameter.

Ensemble Voting

Voting is an ensemble machine learning algorithm. In classification hard and soft voting is used. Hard voting ensemble predicts the class with the most votes by summing the votes for crisp class labels from other models. A soft voting ensemble predicts the class label with the largest sum probability by summing the predicted probabilities for class labels. In this work soft voting is used as a combination rule for an average of probability values of base classifiers J48 and BayesNet.

In this work, a voting ensemble is used to combine the predictions of J48 and BayesNet. The voting ensemble is used to enhance the performance of combined models. The average of predictions from both models is combined through the prediction of each label. Next, the majority of voted labels are selected. In the ensemble voting, both models are equally treated.

PERFORMANCE EVALUATION

In determining the best classifier and predictor model, performance evaluation metrics are needed to justify the model selection. The following metrics are used in this work to analyze and evaluate the performance of the J48, ensemble stacking, and ensemble voting models:

- Classification Accuracy
- Error Rate
- Mean Absolute Error
- Mean Squared Error
- F1 Score

Accuracy: It is a ratio of truly predicted instances over the total instances to use for prediction.

Error rate: It is a ratio of falsely predicted instances over the total instances to be used for prediction

Mean Absolute Error: It is the average value of all absolute errors. It calculates the average difference between calculated and actual values. It computes the errors between predicted values and actual values.

Mean Squared Error: It is an estimator measure based on the average squared difference between predicted values and actual values. MSE is relatively close to zero is better.

F1-Score: is a harmonic mean value of the precision and recall values.

$\text{Accuracy} = (\text{TP} + \text{TN}) / (\text{TP} + \text{TN} + \text{FP} + \text{FN})$

$\text{Recall} = \text{TP} / (\text{TP} + \text{FN})$

$\text{Precision} = \text{TP} / (\text{TP} + \text{FP})$

$\text{F-Measure} = (2 \times \text{Precision} \times \text{Recall}) / (\text{Precision} + \text{Recall})$

EXPERIMENTAL RESULTS

The experimental result of the J48 classifier on training data (70% instances from student data set) is described in the following Table 2.

TABLE 2. Performance of j48					
Accuracy	MSE	MAE	TP	FP	F1
87.5	0.3002	0.1279	0.875	0.263	0.884

The J48 classifier produced 87.5% of accuracy with a 12.5% of error rate and 0.884 as F1Score. The MSE rate is 0.3002 and the MAE rate is 0.128.

The experimental results of the ensemble stacking model with BayesNet and 48 as base classifiers and J48 as meta classifiers used for the student training data are described in the following Table 3.

TABLE 3. Performance of Ensemble Stacking1

Accuracy	MSE	MAE	TP	FP	F1
89.29	0.2966	0.1029	0.893	0.260	0.898

This ensemble stacking model produced 89.29% of accuracy with a 10.71% of error rate and a 0.898 F1 Score. The MSE rate is 0.2969 and the MAE rate is 0.1029.

The experimental results of the ensemble stacking model with BayesNet and 48 as base classifiers and Voted Perceptron as meta classifiers used for the student training data are described in the following Table 4.

TABLE 4. Performance of Ensemble Stacking2

Accuracy	MSE	MAE	TP	FP	F1
83.93	0.3958	0.1587	0.839	0.513	0.844

This ensemble stacking model produced 83.93% of accuracy with a 16.07% of error rate and 0.844 F1 Score. The MSE rate is 0.3958 and the MAE rate is 0.1587

The experimental results of the ensemble voting model with BayesNet and 48 as base classifiers and the probability average for the combination rule used for the student training data are described in the following Table 5.

TABLE 5. Performance of Ensemble Voting model

Accuracy	MSE	MAE	TP	FP	F1
91.07	0.298	0.1337	0.911	0.013	0.920

This ensemble voting model produced 91.07% of accuracy with an 8.93% of error rate and a 0.920 F1 Score. The MSE rate is 0.2988 and the MAE rate is 0.1337.

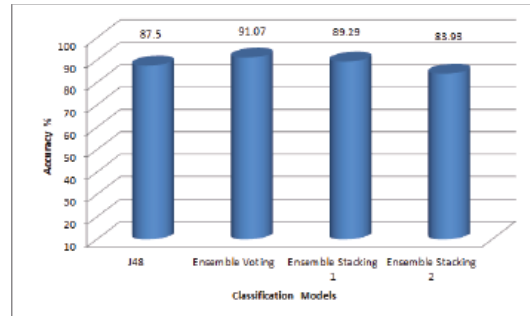


FIGURE.2. Classification Accuracy

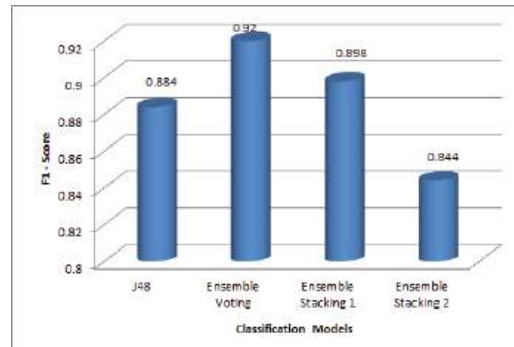


FIGURE 3. F1 –Score of classifiers

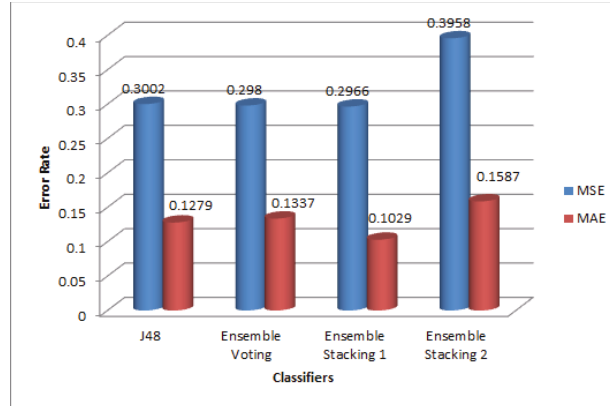


FIGURE 4. MSE and MAE of classifiers

The above figures (Figures 2 to 4) indicate that the proposed ensemble voting-based classifier (BayesNet + J48) with Average of probabilities as the combination rule for both classifiers outperforms the other ensemble stacking classifier models (BayesNet + J48 as the base and J48 / Voted Perceptron as the meta classifier).

CONCLUSION

Ensemble voting with (BayesNet+J48) is the most suitable model for student placement prediction. This model produces high classification accuracy (91.07%) and F1-Score (0.920) than different ensemble stacking models and the j48 classifiers. The proposed ensemble voting (BayesNet + j48) produces a lower error rate, lower mean absolute error (0.1337), and lower mean squared error rate (0.298) than the other two models. The proposed ensemble voting (BayesNet + j48) helps to use efficient measures for the suitable placement of students. However, integrating other constraints such as failures in the semester examinations, and student activity/behavior in the campus-related attributes are included in the classification to increase the performance of the proposed model.

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Poisson Wavelet Quantized Piecewise Regressive Distributed Coding for Image Compression and Transmission

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Abstract:- Image compression is the process of minimizing the size of a digital image file while attempt to preserve its visual quality as much as possible. This file size reduction process is achieved by eliminating redundant or unnecessary information in an image. Therefore image compression is essential for various applications, including reducing storage space requirements, improving data transmission efficiency, and enhancing the user experience in multimedia applications. The existing compression method faces most important challenges to enhance the quality of the reconstructed image with minimum time and higher compression ratio. A novel technique called Poisson Wavelet Quantized Piecewise Regressive Distributed Coding (PWQPRDC) technique for achieving higher compression ratio. First, the numbers of natural images are collected from the dataset. The PWQPRDC first performs the Camargo's indexive gamma map filtering technique to preprocess the input image and to remove the noisy pixels from input image. Then the PWQPRDC technique performs the image compression to obtain the storage efficiency and transmission. The image compression process includes three different process namely Poisson Wavelet Transformation, Dead-Zone Quantization and Absolute piecewise regressive Geometric Distributed Coding. In PWQPRDC techniques, Poisson wavelet transformation is used for decomposing the input image into low and high frequency coefficients. After that, Dead-Zone Quantization is applied to quantize the low frequency coefficients and effectively rounding to the nearest discrete value. Finally, the Absolute piecewise regressive Geometric Distributed Coding is applied for mining the size of the quantized image with higher compression ratio. This compressed image is transmitted through the network channel. The decompression is performed as a reverse process of the compression technique such as Decoding, Dead-Zone De-Quantization and inverse Poisson wavelet transformation. Experimental evaluation is carried out on factors such as peak signal-to-noise ratio (PSNR), compression ratio, compression time and Storage saved, with respect to image size. The analyzed results indicates that the superior performance of our proposed PWQPRDC techniques model when compared with existing methods.

Keywords: : Image compression, Camargo's indexive gamma map filtering, Poisson wavelet transformation, Dead-Zone Quantization, Absolute piecewise regressive Geometric Distributed Coding

1. Introductions

Image compression is the fundamental processes in the field of digital image transmission through the wireless channel. They play a crucial role in various applications, ranging from multimedia content delivery to medical

imaging and remote sensing. The compression process involves reducing the size of a digital image while preserving its essential visual information. The main aim is to reduce the data required to represent an image efficiently. This reduction in data size is achieved through various mathematical techniques and algorithms that exploit redundancies and eliminate redundant details in the image. Compressed images occupy less storage space and manage huge image collections more efficiently. Therefore, the smaller size of image files is transmitted over networks more quickly and reducing latency. Several compression methods have been developed.

An integration of Discrete Wavelet Transform (DWT) and Huffman coding was developed in [1] to enhance image compression and facilitate image transmission over a channel. However, the method did not incorporate machine learning algorithms to optimize the encoding process for minimizing image size. A simultaneous image fusion and compression scheme (SFC) was developed in [2] employing quantization and Huffman encoding to improve visual image quality. However, it did not achieve higher compression ratios and minimum storage consumption.

In [3], a Lifting Scheme (LS) was employed with a Fully Connected Neural Network (FCNN) to encode input images. However, a significant challenge was the need to minimize the time consumed during image compression. The Edge-Aware Extended Star-Tetrix Transform was introduced in [4] for the compression of raw camera images. However, this approach did not improve the peak signal-to-noise ratio performance.

A Deep Neural Network (DNN)-based image compression method was developed in [5] to partition an image into multi-scale sub-bands using the Laplacian pyramid technique. But, it failed to optimize the image compression model for a specific visual analysis task. An Arabic Unicode text was compressed using the Lempel-Ziv-Welch (LZW) technique was designed in [6] to achieve efficient compression. But the multi-level encoding scheme with other compression techniques was not applied to improve the overall compression ratio.

An end-to-end learnt lossy image compression approach was designed in [7] with higher peak signal to noise ratio. But the lesser compression time was a major issue. A reversible data hiding method was developed in [8] for efficient image compression. But the machine learning based encoding was not applied to further enhance the compression ratio. A learned multi-resolution image compression method was introduced in [9] to divide the latent representations into the high-resolution as well as low-resolution (LR) bands. But the complexity of the method was not optimized.

An optimized JPEG-Xt method (OPT_JPEG-Xt) was developed in [10] to achieve improved compression ratio of medical images using discrete cosine transform (DCT) coefficients. However, it failed to develop a novel compression approach to enhance the performance.

1.1 Major contributions

The major contribution of the proposed PWQPRDC technique is discussed in the following lines,

- A novel PWQPRDC technique is proposed to enhance compression by applying Camargo's indexive gamma map filtering, Poisson wavelet transformation, Dead-Zone Quantization, and Absolute piecewise regressive Geometric Distributed Coding

- To enhance the peak signal to noise ratio, Camargo's indexive gamma map filtering technique is employed in the PWQPRDC technique improve image quality.
- To improve the image compression ratio, wavelet transformation based image decomposition, dead-zone quantization, and absolute piecewise regressive geometric distributed coding are applied to the PWQPRDC technique.
- To minimize compression time, Poisson wavelet transformation is applied to decompose the input image, resulting in various range blocks.
- Finally, a number of quantitative tests are performed using the proposed PWQPRDC technique and existing compression algorithms along with different performance metrics.

1.1 Paper outline:

The paper is organized into different sections. Section 2 discusses related works. Section 3 briefly describes the proposed PWQPRDC technique for natural image compression with a neat diagram. Section 4 provides information on the experimental settings and implementation details. In Section 5, quantitative analyses are presented using different performance metrics. Finally, Section 6 concludes the paper.

Related Works

Binary Inpainting Network (BINet) was developed in [11] for improved patch-based image compression. However, binary error correction was not performed. A hybrid coding framework was developed in [12] that integrate entropy coding and deep learning for image compression. An autoencoder-based lossy hyperspectral image compression method was developed in [13]. However, the performance of storage-saving capacity was not analyzed.

A lossless and lossy compression of disparity (depth) images were evaluated in [14] with lower resolution. But it failed to improve the compression performance of the model due to reduced spatial correlation. Context-based convolutional networks (CCNs) were developed in [15] for improved and valuable entropy modeling. However, the rate-distortion performance in image compression was not minimized. A content-weighted encoder-decoder model was designed in [16] for deep image compression. Image compression was performed in [17] based on optimized Toeplitz sensing matrices. But it did not minimize the computational complexity efficiently.

An efficient technique was developed in [18] for image compression and quality retrieval using matrix completion. A bit-error-aware lossless image compression approach was introduced in [19] with the help of bi-level coding for grayscale images. A general generative model was developed in [20] for image compression using an optimization encoder.

3. Methodology

With advancements in digital technology, the image acquisition capacity of devices has significantly increased. These images possess specific characteristics, such as sufficient spatial information in each pixel, high dimensionality, rapid velocity, various scales, large volume, and temporal information. The extensive size of these images poses a significant risk to their practical use in real-time transmission due to the wealth of information they contain. Therefore, there is a crucial need to develop and enhance data compression techniques to reduce both storage space and transmission time over the network, without any loss of data. Motivated by

this, this paper introduces a novel PWQPRDC technique aimed at improving image compression performance with minimal time requirements.

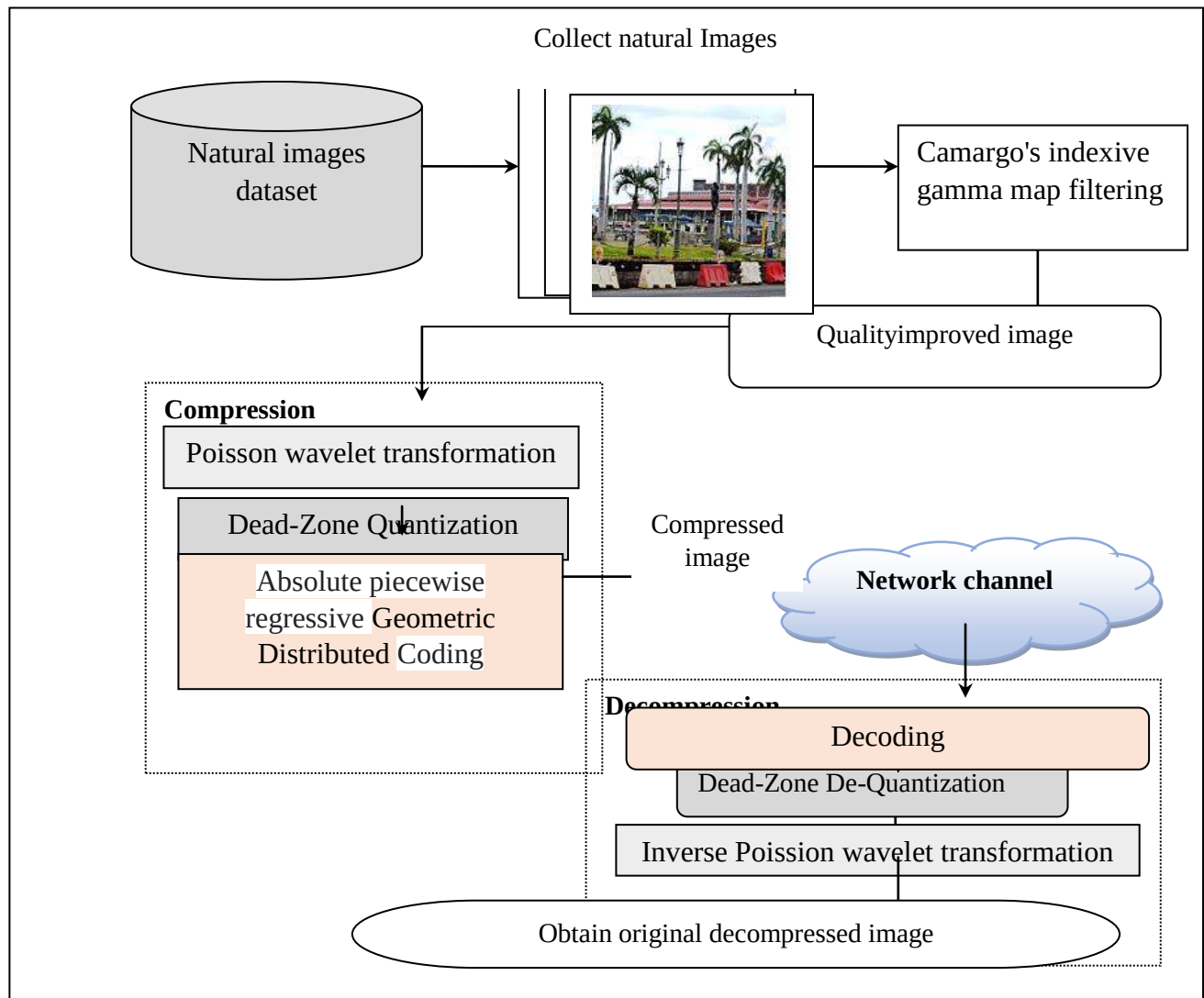


Figure 1 architecture of PWQPRDC technique for image compression and transmission

Figure 1 given above illustrates the architectural diagram of proposed PWQPRDC technique, which comprises five major processes namely image acquisition, preprocessing, transformation, quantization and encoding. As depicted in the figure, a number of natural images denoted as $NI_1, NI_2, \dots, NI_n$ are collected from the image dataset. After the image acquisition, proposed technique performs the preprocessing using Camargo's indexive gamma map filtering technique refers to a series of operations to enhance the quality of the image, remove noise. In the third process, Poisson wavelet transformation is carried out to decompose the images into the different sub blocks. Followed by, Dead-Zone Quantization is a technique used in image and data compression. It involves dividing a decomposed image or data into a family of data compression codes. This method is particularly useful for reducing the size of data while maintaining an acceptable level of quality. Geometric Distributed Coding (GDC) is indeed used for image compression with the aim of minimizing the overall size of the image while achieving a higher compression ratio.

The detailed explanation of different process of the proposed PWQPRDC technique is presented in the following sub sections.

3.1 Image preprocessing

Image preprocessing refers to a series of operations applied to an input image before it performs a specific task. The fundamental process of image preprocessing is to enhance the quality of the image by eliminating the noise artifacts. Therefore, the proposed PWQPRDC technique uses the Gamma map filtering technique to enhance the image quality.

Gamma map filtering technique is used to correct the brightness or contrast of images. It involves applying a nonlinear adjustment to the pixel values in an image.

Let us consider the natural images $NI_1, NI_2, \dots, NI_n$ and the pixels are denoted by $x_1, x_2, x_3, \dots, x_m$. These extracted pixel values are assembled in a filtering window based on the gamma distribution. A filtering window, also known as a kernel is a small matrix used in various image processing operations to apply specific transformations to an image.

$$P = \begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ x_{31} & x_{32} & x_{33} \end{bmatrix} \quad (1)$$

Form (1), 3×3 filter window or matrix ' P ', is designed in which the image pixels are positioned in terms of rows (i) and columns (j). The pixels are organized in the ascending order and find the center pixel in the filtering window. If any even number of pixels in the center, then take average of these two values are considered as center value. Then the Camargo's indexive gamma map filtering technique is applied to window for removing the noise pixels.

The gamma map filtering technique is applied that describes the relationship between the pixels using Camargo's index. Camargo's index is a qualitative method to measure the likelihood between the pixels

The Camargo's index function is formulated as follows,

$$CI = 1 - \sum_{j=1}^m \left(\frac{|x_j - x_c|}{m} \right) \quad (2)$$

Where, CI indicates an index function, x_j denotes a neighboring pixels in filtering window, x_c denotes a center pixels, m indicates a number of pixels. From the analysis, the pixels that deviated from the center value are filtered. This process enhances the quality of image. The algorithm of Camargo's indexive gamma map filtering technique based image preprocessing is illustrated as follows,

Algorithm 1 : Camargo's indexive gamma map filtering technique

Input: Natural Image Dataset, Number of natural images $NI_1, NI_2, NI_3, \dots, NI_n$

Output: preprocessed natural image

Begin

Step 1: Collect number of natural images $NI_1, NI_2, NI_3, \dots, NI_n$

Step 2: For each input natural images (NI_i)

Step 3: Assemble the pixels in an 3×3 filtering window

Step 4: Take the center pixel ' x_c '

Step 5: Compute the likelihood by applying Camargo's index using (2)

Step 6: Find noisy pixels

Step 7: Remove the **noisy** pixels from the filtering window

Step 8:End for

End

Algorithm 1 describes the preprocessing of natural images using Camargo's index-based gamma map filtering technique. Firstly, a set of natural images is gathered from the dataset. Subsequently, the individual image pixels are placed within a filtering window, and the central pixel is identified. The Camargo's index is then applied to evaluate the similarity between the neighboring pixels and the central pixel's value. Pixels that exhibit significant deviations from the central value are identified as noisy and subsequently removed from the image. Consequently, the preprocessing results are used to obtain the quality improved image.

3.2 Image compression

Digital image compression minimizes an image file's size without notably reducing the image's quality. Transmission of such compressed images through communication channels requires lesser resources. The proposed PWQPRDC technique performs three processes for image compression includes as follows,

- Poisson wavelet transformation based image decomposition,
- Dead-Zone image Quantization
- Absolute Moment Block Geometric Distributed Coding

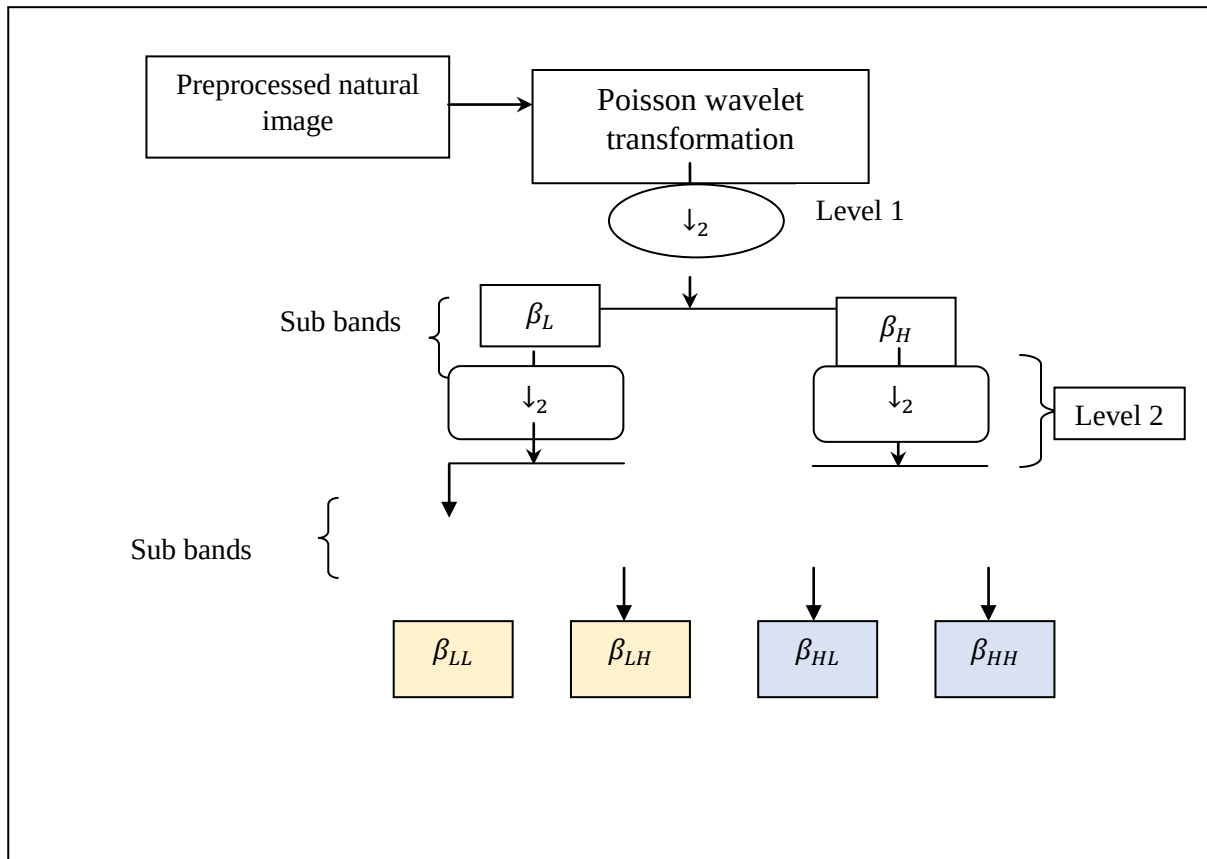
3.2 Image compression

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- Poisson wavelet transformation based image decomposition,
- Dead-Zone image Quantization
- Absolute Moment Block Geometric Distributed Coding

3.2.1 Poisson wavelet transformation based image decomposition

Image decomposition is a process of breaking down a given preprocessed natural image into its different subbands, typically to analyze or process them separately. The decomposition process involves splitting the input image into a sequence of low-pass and high-pass filtered iterations, often referred to as subbands, which represent various frequency components of the image. This decomposition process is repeated multiple times to create a multiresolution representation of the image. The most common wavelet transform is widely used to remove the high-frequency components of the image, which are less important for the human visual system. The remaining low-frequency components are then used for the encoding process, helping to minimize storage consumption.



transform is applied as follows,

$$Y_T = \frac{1}{\sqrt{s}} \sum NI(t) * \varphi(t) \quad (3)$$

$$\varphi(t) = \frac{1}{2\pi} (1 - it)^{k+1} \quad (4)$$

Where, Y_T denotes a wavelet transformed output, s denotes a scaling function, $NI(t)$ denotes a input preprocessed image at time 't', $\varphi(t)$ denotes a mother wavelet,

Based on the transformation process, the input preprocessed natural image are decomposed into sequence of two levels such as low (β_L) and high(β_H) pass filters in both horizontal and vertical directions. For next consecutive levels, downsampling (i.e. $\downarrow_2$) is carried out and the output of each level generates four sub-blocks $\beta_{LL}, \beta_{LH}, \beta_{HL}, \beta_{HH}$. As a result, the different sub band images are obtained after the image decomposition process. The output of the decomposition is given to the next quantization process.

3.2.2 Dead-Zone Quantization

Quantization in image processing is carried out after decomposition. It is an essential step in reducing the amount of data needed to represent the image. Once the decomposition is applied, the image is split into various frequency subbands, each represented by a set of wavelet coefficients. These coefficients are positive or negative and it has a wide range of values. Quantization involves mapping the continuous transformed

coefficients to a finite set of discrete values. This process aims to reduce the storage requirements during the transmission which directly impacts the perceived image quality in compressed images.

When a coefficient falls within a specific interval, it is mapped or quantized to the representative value of that interval. The main aim is to reduce the precision of the coefficients, effectively rounding them to the nearest discrete value within that interval.

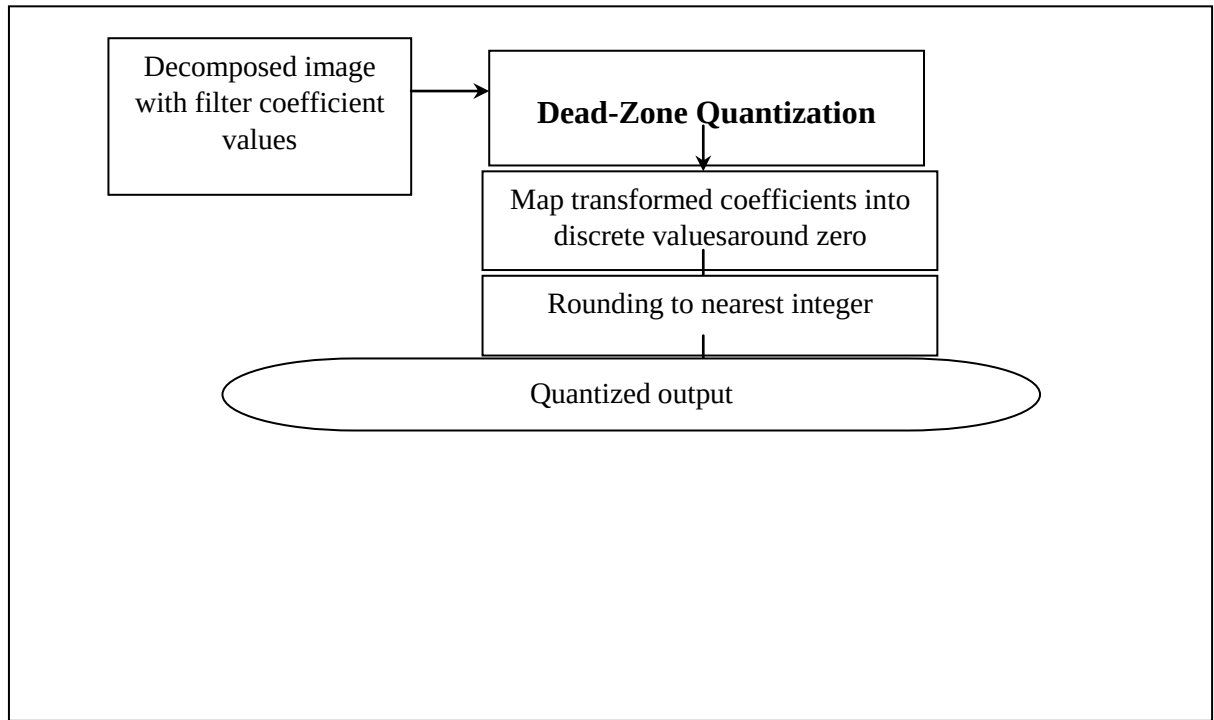


Figure 3 illustrates the block diagram of natural image quantization using Dead-Zone Quantization, wherein the coefficients' values are mapped into discrete values around zero. This process involves removing the high-frequency components of the image and quantizing the low-frequency components, which represent the image's general structure and major features.

$$Q_o = \vartheta_s(W(NI)) \cdot \max\left(0, \left\lfloor \frac{|W(NI)| - \left(\frac{\delta}{2}\right)}{\Delta} + 1 \right\rfloor\right) \quad (5)$$

Where, Q_o denotes a Quantization outcomes, ϑ_s denotes a sign function of the wavelet coefficients' $W(NI)$ ' as given below,

$$\vartheta_s = \begin{cases} -1, & W(NI) < 0 \\ 0, & W(NI) = 0 \\ +1, & W(NI) > 0 \end{cases} \quad (6)$$

From (), $\max$ represents the maximum allowable quantized value i.e. around '0', δ denotes a dead zone width, $\lfloor \cdot \rfloor$ symbol denotes a floor function used to give the output less than or equal to input coefficient value in the nearest round process, Δ denotes a quantization step size (i.e. $\Delta = 1$ for rounding to the nearest integer). In this way, the quantized outcomes are obtained

3.2.3 Absolute Moment Block Geometric Distributed Coding

Finally, the quantized coefficients are encoded to minimize the size of the images using Absolute Moment Block Geometric Distributed Coding. It is a types of lossy compression for grayscale images while maintaining the mean and deviation from the current pixels.

For each block the mean and standard deviation of the pixel values are computed. These analysis results are changes from block to block of original image. The compression is performed as follows:

$$f(x_{ij}) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{1}{2}\left(\frac{x_{ij}-M}{\sigma}\right)^2\right) \quad (7)$$

The piecewise regression is a machine learning technique for estimating the relationships between pixels and the mean. Based on relationship, the two possible outcomes (i.e. 0 or 1) are obtained by setting the breakpoint i.e. mean value. The breakpoint value is defined beyond or below which desired effect occurs.

$$Y_{com} = \begin{cases} 1, & x_{ij} > M \\ 0, & x_{ij} < M \end{cases} \quad (8)$$

Where, $f(x_{ij})$ denotes a Geometric Distribution between the mean ‘ M ’ of the pixels ‘ x_{ij} ’ in the quantized results. Y_{com} denotes a compressed outcomes, if the pixels values greater than mean value, then is assigned the value 1, otherwise 0. Finally, the compressed outcomes are obtained with lesser size. The algorithmic process of image compression is given below,

Algorithm 1: Image compression

Input: Natural image dataset, preprocessed images $NI_1, NI_2, NI_3, \dots, NI_n$

Begin

1. **Number of** preprocessed images $NI_1, NI_2, NI_3, \dots, NI_n$ **taken as** input

// Poisson wavelet transformation

2. **For each** image NI_i

3. Apply Poisson wavelet transform ‘ $W(NI)$ ’

4. Decompose the image into low and high frequency coefficients $\beta_{LL}, \beta_{LH}, \beta_{HL}, \beta_{HH}$

5. **End for**

// Dead-Zone Quantization

6. **For each** coefficients

7. Perform Dead-Zone Quantization process using (5)

8. Remove the high-frequency components

9. Quantize the low-frequency components

10. Rounding nearest integer value

11. **End for**

// Absolute piecewise regressive Geometric Distributed Coding

```

12.   For each pixels ' $x_{ij}$ ' quantized image
13.   Measure mean ' $M$ ' and deviation ' $\sigma$ '
14.   If ( $x_{ij} > M$ ) then
15.       Coded the binary value as '1'
16.   else
17.       Coded the binary value as '0'
18.   End if
19.   End for
20.   Return (compressed image)

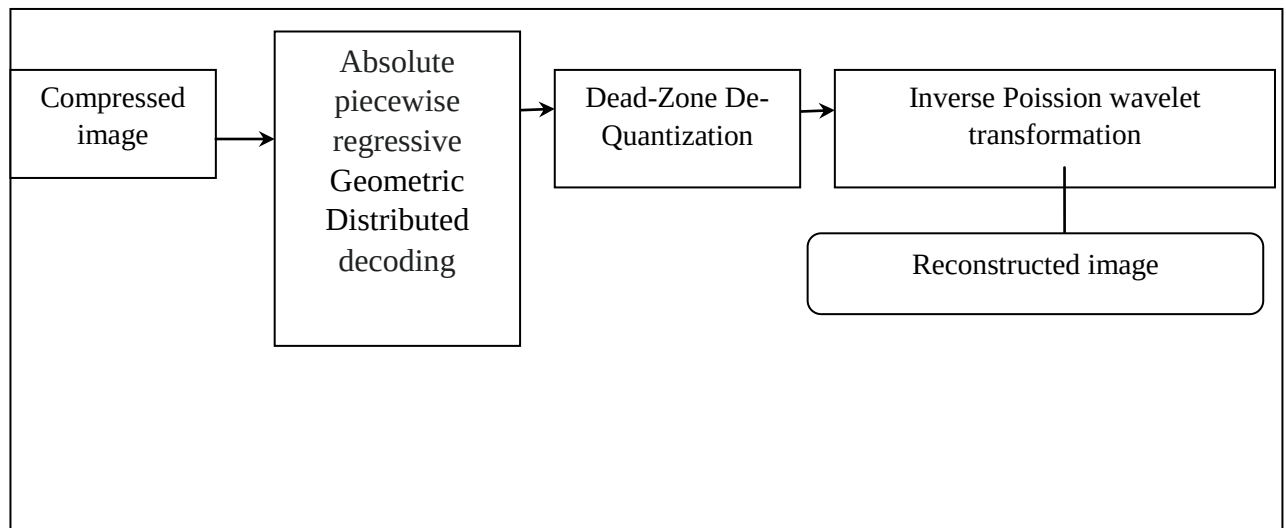
End

```

As depicted in algorithm 1, the image compression process consists of three steps, as outlined below. Firstly, the preprocessed image is taken as input and subjected to a Poisson wavelet transform to decompose the input image into its range subbands. Next, Dead-Zone Quantization is applied to quantize the low-frequency components while removing the high-frequency components. Finally, the Absolute Moment Block Geometric Distributed encoding is employed to encode the images, thereby reducing the overall size of the image. Consequently, compressed images are generated with a higher compression ratio.

3.3 Image decompression

In the proposed technique, image decompression is performed in order to obtain the reconstructed natural image. The image decompression is the reverse process of image compression.



taken as input.

3.3.1 Absolute moment block geometric distributed decoding

To reconstruct the image, elements assigned a 0 are replaced with the ‘ u ’ and elements assigned a 1 are replaced with ‘ v ’ value. First, absolute moment block geometric distributed decoding is performed as given below,

$$x_{ij} = \begin{cases} p, & Y_{com} = 0 \\ q, & Y_{com} = 1 \end{cases} \quad (9)$$

$$u = M - \sigma \sqrt{\frac{p}{m-p}} \quad (10)$$

$$v = M + \sigma \sqrt{\frac{m-p}{p}} \quad (11)$$

Where, x_{ij} denotes a pixels, σ indicates a deviation, m denotes a total number of pixels in the block, ‘ p ’ denotes a number of pixels greater than the mean ‘ M ’. The decoder's replaces 1's and 0's with the estimated value, while the encoder is additionally responsible for calculating the mean, standard deviation, and the two values for correction.

3.3.2 Dead-Zone De-Quantization

The dequantization refers to a process where quantized data is converted back into a high-frequency and low-frequency components. The general reconstruction of dead-zone quantizer is given blow,

$$D_Q = \vartheta_s(Q_o) \cdot \max\left(\frac{\delta}{2} + \Delta \cdot (|Q_o| - 1 + R_s)\right) \quad (12)$$

Where, D_Q dequantization results, ϑ_s denotes a sign function of the wavelet coefficients’ $W(NI)$, Q_o denotes a quantized outcome, δ denotes a dead zone width, Δ denotes a quantization step size, R_s denotes a reconstruction offset value in the range of 0 to 1 as a fraction of the step size.

3.3.3 Inverse Poisson wavelet transforms

The Inverse Poisson Wavelet Transform is a mathematical operation that involves reversing the Poisson wavelet transform. In order to get the original image

$$NI = \frac{1}{\varphi} \sum C_f(t) * \frac{1}{\sqrt{s}} \varphi(t) \quad (13)$$

Where, NI denotes a original preprocessed image, s denotes a scaling function, $C_f(t)$ denotes a Poisson wavelet coefficients obtained during the forward wavelet transform, φ denotes a constant, $\varphi(t)$ denotes a mother wavelet. In this way, the image decompression is obtained. The algorithmic process of Image Decompression is shown below,

Algorithm 2: Image decompression

Input: compressed natural images $CNI_1, CNI_2, CNI_3, \dots, CNI_n$

Begin

Step 1: compressed natural images $CNI_1, CNI_2, CNI_3, \dots, CNI_n$ taken as input

Absolute moment block geometric distributed decoding

Step 2: for each compressed image CNI_i

Step 3: Perform decoding using (9)

Step 4: Reconstruct the quantized image

Step 5: end for

Dead-Zone De-Quantization

Step 6: for each quantized image

Step 7: Perform **dequantization** using (12)

Step 8: Reconstruct the wavelet components

Step 9: end for

Inverse Poisson wavelet transforms

Step 10: for each wavelet components

Step 11: Perform **Inverse transform** using (13)

Step 12: Reconstruct the original preprocessed image

Step 13: end for

End

Algorithm 2 describes the process of image decompression to get original image at receiver end. The algorithm initially takes the input as a compressed natural image. Then it performs a decoding process for converting an encoded image into the original quantized image. Followed by, De-Quantization is performed to reconstruct the low and high frequency wavelet components. After that, the inverse Poisson wavelet transform is applied to reconstruct the original preprocessed image. As a result, the reconstructed quality improved natural image is obtained.

4. EXPERIMENTAL SETUP

This section describes the evaluation campaign of the proposed PWQPRDC technique and the existing DWT and Huffman coding method [1] and SFC scheme [2].

4.1 Implementation details

In this section, experimental assessment of the PWQPRDC technique and the existing DWT and Huffman coding method [1] and SFC scheme [2] and is implemented in Python. In order to perform the simulation, Nature Images dataset are collected from the <https://www.kaggle.com/datasets/prasunroy/natural-images>. The image dataset consists of Natural Scenes around the world. The numbers of images are taken from the training folder. In this folder, 14034 150x150 Images in seg_train folder for training spread evenly across 6

categories such as buildings' -> 0, 'forest' -> 1, 'glacier' -> 2, 'mountain' -> 3, 'sea' -> 4, and 'street' -> 5. For each categorizes contains the more number of images.

Table 1 image details in seg_train folder

S.No	categories	Number of images
1	buildings	2191
2	forest	2271
3	glacier	2404
4	mountain	2512
5	sea	2274
6	street	2382

5. Performance Evaluation Measures

This section provides reports the different performance metrics such as Peak signal-to-noise ratio, compression ratio, compression time, and storage saving.

Peak signal-to-noise ratio: it used as a metric for evaluating the compression capability of algorithms. It quantifies the quality of noise removal by assessing the mean square error (MSE), which is calculated as the difference between the pixel values in the original image and those in the accurately preprocessed image.

$$PSN = 10 * \left[\log_{10} \left(\frac{255^2}{MSE} \right) \right] \quad (14)$$

$$MSE = \sum (NI_{uc}(size) - NI_c(size))^2 \quad (15)$$

Where PSN denotes a Peak signal-to-noise ratio, MSE denotes a mean square error, $NI_{uc}(size)$ indicates original or uncompressed natural images, $NI_c(size)$ denotes the compressed natural images. The peak signal-to-noise ratio is measured in decibels (dB).

Table 2 Comparison of peak signal to noise ratio

Natural images	Original Image Sizes (KB)	Peak signal to noise ratio (dB)		
		PWQPRDC	DWT and Huffman coding method	SFC scheme
Image 1	11.09	65.85	60.52	58.88
Image 2	16.8	58.58	55.06	52.86
Image 3	23.3	60.17	56.30	53.32

Image 4	19.7	56.08	52.56	49.54
Image 5	18.46	58.30	54.87	48.48
Image 6	14.12	61.28	56.76	54.68
Image 7	12.72	63.52	58.30	55.87
Image 8	15.09	62.11	53.97	49.34
Image 9	13.76	59.18	55.06	52.42
Image 10	20.61	62.55	57	54.15



Figure 5 peak signals to noise ratio chart versus image size

Figure 5 illustrates the performance results of the peak signal-to-noise ratio concerning various sizes of input natural images, measured in kilobytes (KB) and collected from the dataset. Three methods have been applied for peak signal-to-noise ratio measurement such as the PWQPRDC technique, the existing DWT and Huffman coding method [1], SFC scheme [2]. Among these approaches, the PWQPRDC technique demonstrates higher performance to obtain the peak signal-to-noise ratio. This improvement in the PWQPRDC technique is achieved by the application of Camargo's indexive gamma map filtering technique. Initially, the natural image pixels are gathered within a filtering window. Camargo's index is then employed to compute the likelihood measure between the pixels and the central pixels, facilitating the removal of noise pixels and the enhancement of image quality. The average of ten results indicates that the performance of the PWQPRDC technique is enhanced by 8% compared to the existing [1] method and by 15% when compared to [2].

Compression ratio: This metric is determined by the ratio between the size of the original image and the size of the compressed image. It is mathematically calculated as follows,

$$CR = \left[\frac{NI_{UC}(size)(KB)}{NI_C(size)(KB)} \right] (16)$$

Where, CR denotes a compression ratio, $NI_{UC}(size)$ indicates original or uncompressed natural images, $NI_C(size)$ denotes the compressed natural images. Higher the compression ratio, the method is said to be more efficient.

Table 3 Comparison of compression ratio

Natural images	Original Image Sizes (KB)	Compression ratio		
		PWQPRDC	DWT and Huffman coding method	SFC scheme
Image 1	11.09	1.405	1.339	1.301
Image 2	16.8	1.222	1.144	1.126
Image 3	23.3	1.239	1.174	1.131
Image 4	19.7	1.331	1.164	1.138
Image 5	18.46	1.375	1.216	1.174
Image 6	14.12	1.440	1.227	1.201
Image 7	12.72	1.394	1.216	1.195
Image 8	15.09	1.418	1.265	1.220
Image 9	13.76	1.426	1.317	1.300
Image 10	20.61	1.284	1.25	1.226

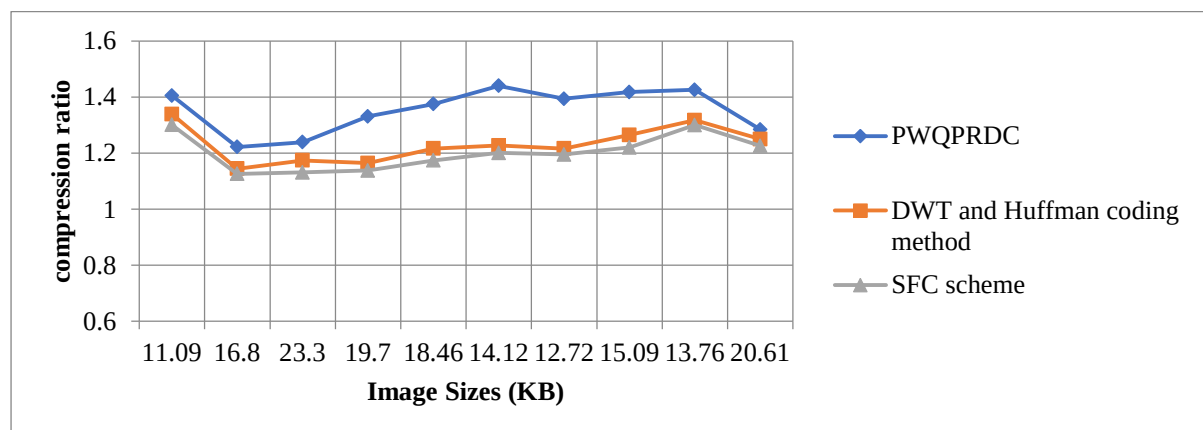


Figure 6 compression ratio chart versus image size

Figure 6 illustrates the performance results concerning compression ratios based on the sizes of natural images. The graph portrays the input image sizes on the 'x' axis and the corresponding compression ratio performance on the 'y' axis. These compression ratios were assessed using three distinct compression methods. Notably, the graph emphasizes that the employment of the PWQPRDC technique increased the compression ratios. This is because of effective execution of three different processes in generating compressed images: wavelet transformation, quantization, and coding techniques. The process begins with Poisson wavelet transformation, which decomposes the input image into various subbands containing both low and high-frequency components. Following this, Dead-Zone Quantization is applied to quantize the low-frequency components. Finally, the piecewise regression with encoding is utilized to encode the values, thereby reducing the image's size. As a result, the compression ratio increased by 10% and 13% when compared to the DWT and Huffman coding method [1], as well as the SFC scheme [2].

Compression time: It is measured by the time consumption of the image compression which includes three process namely wavelet transformation, quantization and coding. The formula for compression time is given below,

$$CT = time [T_w + Q_0 + Y_{cod}] \quad (17)$$

From (17), CT indicates a Compression time, ' NI ' indicates natural images, T_w denotes wavelet transformation, Q_0 quantization, Y_{cod} denotes a coding. The Compression time is measured in milliseconds (ms).

Table 4 Comparison of compression time

Natural images	Original Image Sizes (KB)	compression time (ms)		
		PWQPRDC	DWT and Huffman coding method	SFC scheme
Image 1	11.09	13.65	15.85	18.36
Image 2	16.8	18.25	20.36	22.85
Image 3	23.3	25.41	28.85	30.45
Image 4	19.7	22.3	26.65	28.11
Image 5	18.46	20.69	25.96	27.96
Image 6	14.12	16.52	18.12	20.85
Image 7	12.72	14.33	16.85	18.60
Image 8	15.09	18.96	20.2	22.85
Image 9	13.76	16.85	17.85	19.68
Image 10	20.61	24.74	26.52	28.68

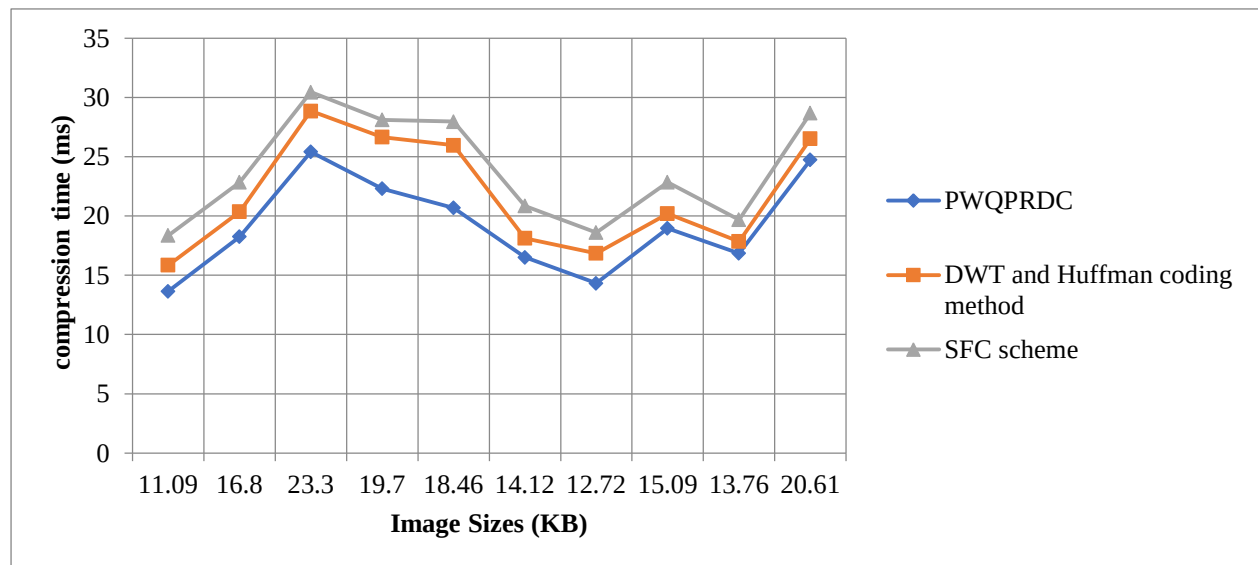


Figure 7 compression time chart versus image size

Figure 7 illustrates the relationship between compression time and the size of a natural image, measured in KB. A quantitative comparative analysis demonstrates a significant reduction in compression time when employing the PWQPRDC technique, in contrast to existing methods. Let's consider a statistical evaluation using an 11.09KB image size in the first iteration. Specifically, the PWQPRDC technique achieved a compression time of 13.65ms, while the other two methods referenced as [1] and [2] showed compression times of 15.5ms and 18.36ms, respectively. Similarly, various performance outcomes were obtained with different sizes of input image and results are compared. The results exhibit non-linearity due to variations in input image sizes. A comprehensive comparison of ten results reveals that the PWQPRDC technique reduces compression time by 12% and 20% when compared to [1] and [2], respectively. This reduction is achieved due to the application of image preprocessing using Camargo's indexive gamma map filtering technique before image compression. This preprocessing step helps minimize the time required for image compression. Furthermore, the proposed transformation and quantization, based on piecewise regression coding, further reduce the time needed to generate the compressed image.

Storage saved: Storage saved refers to the amount of storage space that has been conserved or freed up as a result of image compression. It quantifies the reduction in storage requirements achieved by compression, allowing for more efficient use of storage resources.

$$SS = NI_{UC}(size) - NI_C(size) \quad (18)$$

From (18), SS indicates a storage saved, ' $NI_{UC}(size)$ ' indicates original or uncompressed natural images, ' $NI_C(size)$ ' denotes the compressed natural images. It is measured in Kilobytes (KB).

Table 5 Comparison of storage saved

Natural images	Original Image Sizes	Storage saved (KB)		
		PWQPRDC	DWT and Huffman	SFC scheme

	(KB)		coding method	
Image 1	11.09	3.16	2.75	2.5
Image 2	16.8	3	2.06	1.82
Image 3	23.3	4.45	3.41	2.65
Image 4	19.7	4.8	2.7	2.3
Image 5	18.46	4.95	3.2	2.6
Image 6	14.12	4.25	2.55	2.29
Image 7	12.72	3.55	2.21	2.01
Image 8	15.09	4.39	3.06	2.57
Image 9	13.76	4.03	3.21	3.04
Image 10	20.61	4.52	4.05	3.71

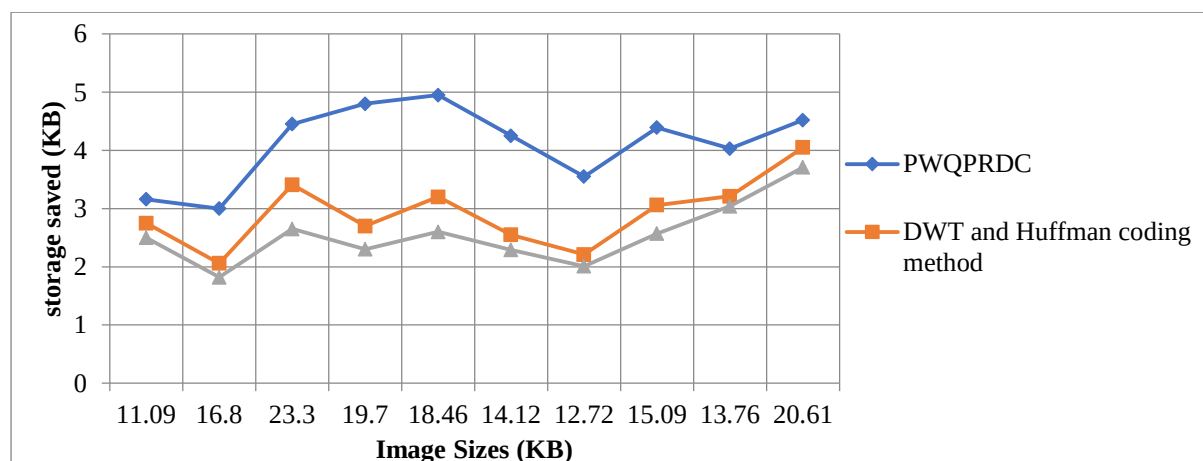


Figure 8 Storage saved chart versus image size

Figure 8 provides a comparison of storage savings achieved through three different methods: the PWQPRDC technique, the existing DWT and Huffman coding method [1], and the SFC scheme [2]. In this figure, the horizontal axis represents the sizes of natural images, while the vertical axis shows the storage savings performance measured in kilobytes (KB). As the image size varies, the storage savings results correspondingly increase or decrease. Among these three methods, the PWQPRDC technique demonstrates notably superior storage savings in comparison to the existing methods [1] and [2]. This enhancement is achieved through the implementation of the proposed Poisson wavelet quantized piecewise regressive distributed coding-based image compression and decompression technique. The overall performance data reveals that the PWQPRDC technique achieves a 43% improvement in storage savings compared to [1] and a 64% improvement compared to [2].

4. Conclusions

In this paper, a novel technique called PWQPRDC is developed to enhance the transmission and storage efficiency of natural images in a network. The process begins with efficient noise removal through filtering to enhance image quality before compression. Subsequently, the Poisson wavelet transform is applied to decompose the images, with a focus on quantizing the low-frequency components. Compressed images are generated using the piecewise regression-based coding technique. At the receiver side, the inverse compression process is carried out to recover the original image. Comprehensive experimental evaluations were conducted using a natural images dataset. The quantitative analysis results demonstrate that the PWQPRDC technique outperforms traditional compression methods, achieving higher peak signal-to-noise ratio, compression ratio, storage savings, and reduced time consumption.

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**STUDY ON MACHINE LEARNING AND CRYPTOGRAPHIC METHODS FOR IMAGE
COMPRESSION AND SECURED TRANSMISSION**

Authored by

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INVESTOR'S AWARENESS ON POST OFFICE SAVINGS SCHEMES

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ABSTARCT

“It’s not about how much money you make. It’s how you save it!” Is the famous quote. Now People are aware about savings and they are more willing to save than spending it. The society must consume less and save more of its current income Importance of savings for economic growth is highlighted in all economics textbooks. Capital investment is crucial to grow an Economy. Though the central and state government provides many options for savings, Post office saving is considered to be the most safest and preferable savings by the people. This study is focused on Investor’s awareness on post office savings schemes in Pollachi taluk. Primary data were collected from 60 investors who have savings in various schemes provided by the Indian Postal department. The study reveals that majority of the respondents are aware about the schemes available in Post Office.

Key Words: *Savings, Post Office schemes, Investors.*

INTRODUCTION

One of the most well-known and easily reachable savings accounts in India is a Post Office Savings Account. It is Considered to be a highly secure instrument to deposit funds into and offer the option of full or partial liquidation of funds at very short notice in case if the need arises. In October 1st 1854, the Indian postal system was created that is run by the Indian Government, and its main office is located in Dak Bhwan in New Delhi. The postal system in India is very important in giving many investment opportunities. Post offices now provide financial services in addition to postal and remittance services. For those living in remote areas without access to financial services, it is quite helpful. Post office savings holds various savings schemes which are ideal for senior citizens and people who are looking to earn a regular income without much risk. It provides various savings and investment schemes like Post Office Savings Accounts, Recurring Deposit Accounts, Term Deposit Accounts, Monthly Income Scheme Accounts, Senior Citizen Savings Plans, Public Provident Fund (PPF) Plans, National Savings Certificate (NSC) Plans, Kisan Vikas Patra Plans, and Sukanya Samriddhi Account Plans. These programmes provide investors a number of advantages, including tax exemption, risk-free investment, long-term return investment, etc. Even though Banks offer deposit plans, post office savings plans continue to grow in popularity in rural regions. This programmes aims to encourage rural residents’ attitudes about saving.

REVIEW OF LITERATURE

Chandru. N and M. Nithiya Devi [2023] finds that highly secured and availability of Post offices in all the areas are the main reason for the preference of savings.

Keerthana. T and D. Vijayakumar [2023] revealed that Post offices are offering best services as like banking and Post office saving is considered to be the best saving option among the public.

Naveen .M and D. Shanmugavel [2021] states that respondents are satisfied with the easy procedures followed with the Post office saving scheme and the amenities available in the Post office.

Benazir. A [2020] revealed that lack of adequate information made unaware about the various schemes available in Post office and the Post office department should conduct awareness campaigns for the public.

STATEMENT OF THE PROBLEM

Post office saving is one of the savings scheme introduced by Central Government. It is considered to be the safest one among all the other modes of savings. There are many savings schemes available in post office. Though there are many schemes available, some of the schemes are not



Job Stress Of Women Employee In It Industry With Reference To Coimbatore City

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ABSTRACT

Women are playing a vital role in the economic and social development of the nations all over the world. Working women have a whole set of problem involving both family and professional lives. Women have to play their role as a wife, a mother and an earner. They have to manage their career while maintaining traditional roles. The Means for working women it is two sets of overlapping responsibilities. Women are so busy that they do not take time to slow down long enough to think about how stress is negatively affecting them. Long term stress can lead to serious health problems. It seems to be common knowledge that women are generally busier and more stressed than men. It is widely believed that they have juggle more roles and balance their life especially for the women employee who working in IT Industry.

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Keywords: Women Overlapping Responsibility and Job Stress.

INTRODUCTION

The composition of the workforce has seen a gradual change during the past few decades. More and more women are working now a days and hence workforce has more working mother. As women are considered to be more responsible for maintaining the children and household chores, they face a lot of problem in retaining the balance between work and non-work life. Dealing with family issues as well as work issues has resulted in women dealing with an increasing amount of stress. Workplace stress is a condition that affects one's disposition, way of thinking, and feelings. The mismatch between the demands of the job and the resources at hand will lead to stress at work and a rise in negativity and unhappiness. In these situations, working from home could lead to role ambiguity, overwork, role conflict, and time pressure, all of which can reduce job satisfaction (Kim et al. 2019). Work stress is another crucial indication that has a considerable impact on job satisfaction (Hsu et al. 2019). The numerous data provided by Chao et al. (2015) show that work stress has a detrimental effect on job satisfaction.

WORK LIFE BALANCE AND JOB STRESS OF WOMEN EMPLOYEE IN IT INDUSTRY WITH REFERENCE TO COIMBATORE CITY

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ABSTRACT

Every sector and organisation in the world have been significantly impacted by the early 2020 corona virus (COVID-19) outbreak, which has also changed how people live and work. Several organisations have begun to develop a new way of working that includes teleworking or a work from home policy in order to effectively respond to these transformations. This study aims to fill any gaps by looking at a wide range of potential indicators of job satisfaction when working from home when affected by COVID-19, including work-life balance and work stress. 343 forced home-workers in the IT industry from all over India participated in a quantitative study, and SPSS was used to analyse the results. The study found that work stress, work-life balance, and working from home had a major impact on job happiness, both directly and indirectly. Working from home as a new pace of work aids Indian women IT employees in maintaining job satisfaction in their existing working environment. Given the collectivist climate, working from home can be a positive thing that the company should take into consideration.

Keywords: Work from home; Job satisfaction; Work stress; Work–life balance; IT; COVID-19.

1. INTRODUCTION

A global economic and social shock brought on by the coronavirus (COVID-19) outbreak that started in early 2020 is anticipated to have an effect on how businesses and industries function as well as how people live and work. One of the most noticeable changes as a result of the COVID-19 pandemic is in information technology (IT), telecommuting, or the policy of working from home across occupations (Kramer and Kramer 2020). In order to stop the virus from spreading while yet allowing for business as usual, the World Health Organisation advised governments and enterprises to utilise teleworking as a new workplace innovation. This entails a flexible working arrangement that is not constrained by time, place, or the preferred medium of technical communication. The possibility of working from home had always existed, but the outbreak made it necessary. This current global job norm is

ISSUES FACED BY WOMEN ENTREPRENEURS IN E-BUSINESS

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Abstract

The research paper aims at exploring the issues faced by women Entrepreneurs doing e-business in Pollachi Taluk. Data for study have been collected from 114 women entrepreneurs through questionnaire method by adopting convenience sampling technique. Simple Percentage and Chi-Square test have been used to analyze the data. The study reveals that majority of the women entrepreneurs are residing in rural area who are married and lives as nuclear family whereas most of the women entrepreneurs doing e-business have 1-3 years of experience. It is found that most of the women are strongly agree with issues faced by e-business like hiring right employees, time management. Also, majority of the women agree with issues faced by e-business like handling latest technology, competitors, network problems, security threads, unknown customers and return and refund policies, whereas most of the women disagree with marketing and lack of personal touch. It is also found that area, marital status, educational qualification, family income and experience in business have significant association with the level of issues faced by women entrepreneurs in e-business.

Keywords: Issues – Women – Entrepreneurs –E-business.

Introduction

Women entrepreneurs in e-business have a unique set of opportunities and challenges in today's digital economy. On the one hand, the rise of E-commerce and online marketplaces has made it easier than ever for women to start and grow their own business without the traditional barriers of physical retail spaces. On the other hand, there are still a number of challenges that women entrepreneurs face in the E-business world. Such as the gender bias and discrimination that persists in many industries and the need for specialized skills and resources to compete in a rapidly evolving digital landscape. Ravi Chaturvedi et.al (2018) found that challenges faced by Indian women entrepreneurs are balance between family and career, socio-cultural barriers, male dominated society, illiteracy or low level of education, dearth of financial assistance, lack of technical skills, lack of self-confidence and mobility constraints. So, in this study an attempt has been made to examine the level of issues faced by women entrepreneurs in e-business.

Review of Related Literature

Lakshmi Priya and Smilee Bose (2021) in their research entitled “A study on opportunities and constraints faced by women entrepreneurs in e-commerce” to determine the opportunities and challenges faced by women entrepreneurs in e-business. Data have been collected by using questionnaire to 60 women entrepreneur using random sampling method. Chi-square test has been used to analyse the data. The result of the study reveals that, there is significant relationship between education qualifications of women entrepreneurs in e-commerce. It is also formed that there is no significant relationship between experience and challenges faced by women entrepreneurs in e-business.

Nidhi Khatrani (2021) in their research entitled “A study on challenges faces by women entrepreneurs in Surat” to focus on the challenges faced by women entrepreneurs in India and problem faced by small scale women entrepreneurs in Surat. The data is collected from 141 women residing in surat using questionnaire. Paper mostly based on primary data using questionnaire method. Simple percentage has been used to analyze the data. The study reveals that majority of the women belong to the age group of 25-29 and 30-34 and they faces challenges like doubt of self-confidence, financial issues for

WORKING WOMEN PERCEPTION TOWARDS E-BIKE

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ABSTRACT

This research study aims at exploring working women perception towards e-Bike and variables associated with level of preference towards e-bike. Data for the study have been collected from 110 working women through issue of structured questionnaire by adopting convenience sampling method. Simple Percentage and Chi-square test have been used to analyze the data. The study reveals that majority of the working women are in the age group of 31 to 40 years and majority of them are undergraduates employed in non-government sector with an earning between Rs.20001 to Rs.40,000 per month and they are aware about E-Bike through self, friends, relatives and advertisement. The factors influence to purchase e-bike are Incentives/subsidies from government, durability, high performance, more storage space, inexpensive, can be used as external power, less maintenance, , eco-friendly, publicity, less dependence on fossil fuels, less pollution, no fuel cost, smooth driving and appearance of vehicle. Chi-square test reveals that age, type of family, monthly income, family income and period of usage are significantly associated with the level of preference for e-bike.

Keywords:

Working women- e-bike-preference.

Introduction

Indians prefer two wheelers because of their small manageable size, low pricing, maintenance, and availability of loans on liberal terms. Indian streets are full of people of all age group riding two-wheelers. Majority of Indians, especially the youngsters prefer motorbikes rather than cars. Capturing a large share in the two-wheeler industry, bikes and scooters cover a major segment. Large varieties of two wheelers are available in the market, known for their latest technology and enhanced mileage. Indian bikes, scooters and mopeds represent style and class for both men and women. India is the second largest producer and manufacturer of two-wheelers in the world. The face of auto industry that was redefined with the invention of fuel-efficient technology is all set to see dawn of a new era in two- wheeler industry. During the last few decades, environmental impact of the petroleum-based transportation infrastructure, along with the peak oil prices, has led to renewed interest in electric transportation infrastructure. Electric vehicles differ from fossil fuel-powered vehicles in that the electricity they consume can be generated from a wide range of sources, including fossil fuels, nuclear power, and renewable sources such as tidal power, solar power, and wind power or any combination of those. Global warming is becoming the major concern all around the world. There are several policies, promise and pledges with the ever-increasing emission of greenhouse gases. There is an increased fear of environment pollution at every step with modern technology and innovation. Transportation and communication have under gone paradigm shift along with this. In this regard the present study brief about working women perception towards e-bike.

Literature Review

Sheela Srivastava and Sivakoti Reddy (2011), in their study made an attempt to identify the customer perception on green brands of two wheelers and four wheelers in the state of Andhra Pradesh. The data for the study have been collected by issuing questionnaire to 200 respondents using interview techniques. The data have been analysed using simple percentage. The findings of the study shows that majority of the customers are satisfied with price and availability of spare parts in the local market

ROLE OF EDUCATIONAL INSTITUTIONS IN FOSTERING ENTREPRENEURSHIP

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Abstract

Entrepreneurs have been making a major impact in all segments of Indian economy. Entrepreneurship education is important part in developing entrepreneurial qualities in students. Accordingly, it becomes essential to study role of educational institutions in fostering entrepreneurship in Pollachi Taluk. Data for study have been collected from 104 students through questionnaire by adopting convenience sampling method. Simple Percentage and Chi-Square test has been used to analyze the data. The study reveals that majority of the students belong to the age group of 17-20 years residing in rural who lives as joint family whereas most of the students family income is between Rs.25001 between Rs.50000. It is found that majority of the students are aware of entrepreneurship. it is observed that majority of the students are strongly agree with initiatives taken by educational institutional like inspiring speeches by real life entrepreneurs, workshops on entrepreneurship, Courses related to entrepreneurship in curriculum, Students motivated by Entrepreneurship Development Cell and Mentorship beyond Formal Education. Also most of the students agree with initiative like Seminars (Personnel from Govt. Agencies like MSME, SIDBI) and Guest lecturer to develop ideas for new business. It is also found that Age, Area of Residence, Educational Qualification and Family Income have significant association with initiatives taken by educational institutions.

Keywords: Educational – Institutions– Role – Entrepreneurship - Development.

Introduction

India has been developing at great speed in the recent years, and is possible to the largest economy in the world by 2050. Entrepreneurship is getting more attention from policy makers and experts as it contributes to economic development by new ideas of budding entrepreneurs in to business venture. Educational institutions is playing significant role in business development. Skill required for development of entrepreneurship like technical, financial literacy, skill to engage in self-employment & employment in entrepreneurship can foster at institutional level. Hahn (2020) the universities can offer Entrepreneurship education courses to provide students with entrepreneurial skills and prepare them to engage in entrepreneurial activities. So, in this study an attempt has been made to explore the role of educational institutions in fostering entrepreneurship.

Review of Related Literature

Mitchell Dias and Seema Pereira (2020) in their article entitled “A Study on role of universities in fostering entrepreneurship- A study exclusively in Mangalore region” to identify the awareness of the students and steps taken by the educational institutions. Data have been collected from students using random sampling method. Simple percentage has been used to analyse the data. The finding of the study reveals that majority of the students are aware of the concept of entrepreneurship. It is also found the most of the respondents have only theoretical and practical training on subject of entrepreneurship. **Krzysztof Wach and Agnieszka Glodowska (2013)** in their article captioned “The role of university in the development of entrepreneurial intentions of younger generations: Selected Models” to know the role of universities and higher education in the creation, shaping and maintenance of entrepreneurial intentions among the youngest generations. The findings of the study shows that role models may be relevant to perceived self-esteem and desirability, and also boarder knowledge of entrepreneurial environment also implies its perception, which determine the individuals entrepreneurial process. **Leo-Paul Dana et al., (2021)** in their research entitled “Entrepreneurship education and training in Indian higher education institutions: a suggested framework” to evaluate the components of entrepreneurship education and training (EET) in India.

ANALYSIS OF HEART DISEASES DATASET USING NEURAL NETWORK APPROACH

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ABSTRACT

One of the important techniques of Data mining is Classification. Many real-world problems in various fields such as business, science, industry and medicine can be solved by using classification approach. Neural Networks have emerged as an important tool for classification. The advantages of Neural Networks help for efficient classification of given data. In this study a heart diseases dataset is analysed using Neural Network approach. To increase the efficiency of the classification process parallel approach is also adopted in the training phase.

Keywords: Data mining, Classification, Neural Networks, Parallelism, Heart Disease

1. INTRODUCTION

Data mining is the process of automating information (knowledge) discovery. Knowledge Discovery in Databases (KDD) is the process of getting high-level knowledge from low-level data. Data mining plays an important role in the KDD. Data mining is an interdisciplinary field.

Its main aim is to uncover relationships in data and to predict outcomes. Researchers are trying to find satisfactory solutions in a reasonable time through search techniques as many problems are difficult to be solved in a feasible time by analytically. Hence data mining got its importance. Data mining helps to extract patterns in the process of knowledge discovery in databases in which intelligent methods are applied. The emerging field of data mining promises to provide new techniques and intelligent tools which help the human to analyse and understand large bodies of data remains on difficult and unsolved problem. The common functions in current data mining practice include Classification, Regression, Clustering, Rule generation, Discovering association rules, summarization, dependency modelling, and sequence analysis. Classification is one of the important techniques of data mining. The input to the classification problem is a data-set called the training set having a

number of attributes. The attributes are either continuous or categorical. One of the categorical attributes is class label or the classifying attribute. The objective is to use the training set to build a model of the class label based on the other attributes such that the model can be used to classify new data not from the training data-set. Various data mining problems can be handled effectively by soft computing techniques. These techniques are fuzzy logic, neural networks, genetic algorithms and rough sets, which will lead to an intelligent, interpretable, low cost solution than traditional techniques.

Artificial Neural Network (ANN) is one of the most used data mining method to extract patterns in an intelligent and reliable way and has been greatly used to find models that describe data relationship [1-2]. In view of the above said significant characteristics of ANN, **Neural Network**

The technique is adopted in this study for data classification. Parallel processing is implemented at each node in different layers in the network.

Data mining techniques have been widely used in diagnostic and health care applications because of their predictive power. Data mining algorithms can learn from past examples in clinical data and model the oftentimes non-linear relationships between the independent and dependent variables. The resulting model represents formalized knowledge, which can often provide a good diagnostic opinion. In this study the neural network approach to generate efficient classification rules is proposed. To perform classification task of medical data, the neural network is trained using Back propagation algorithm. As the structure of neural network is convenient for parallel processing, the output at each neuron in different layers is calculated in parallel. The performance of the network is analyzed with various types of test data.

The overall organization of the paper is as follows. After the introduction fundamental issues of neural networks for classification are presented in Section 2. Section 3 presents the applications of neural networks in the medical field. In Section 4 a neural network approach to generate efficient classification rules is proposed and the performance of the network is analyzed.

2. Neural Networks

A Neural Network (NN) consists of many Processing Elements (PEs), loosely called “neurons”

and weighted interconnections among the PEs. Each PE performs a very simple computation, such as calculating a weighted sum of its input connections, and computes an output signal that is sent to other PEs. The training (mining) phase of a NN consists of adjusting the weights (realvalued numbers) of the interconnections, in order to produce the

desired output [5].

The Artificial Neural Network (ANN) is a technique that is commonly applied to solve datamining applications. Neural Network is a set of processing units when assembled in a closely

interconnected network, offers rich structure exhibiting some features of the biological neuralnetwork. The structure of neural network provides an opportunity to the user to implement

parallel concept at each layer level. Another significant characteristic of ANN is fault tolerance. ANNs are well suited in situations where information is noisy and uncertain. ANN are an information processing methodology that differs drastically from conventional methodologies in that it employ training by examples to solve problem rather than a fixed algorithm [3,4]. They can be divided into two types based on the training method: Supervised training and Unsupervised training. Networks that are supervised require the actual desired output for each input where as unsupervised networks does not require the desired output for each input.

A key feature of neural networks is an iterative learning process in which data cases are presented to the network one at a time, and the weights associated with the input values are adjusted each time [5]. After all cases are presented, the process often starts over again. During this learning phase, the network learns by adjusting the weights so as to be able to predict the correct class label of input samples. Once a network has been structured for a particular application, that network is ready to be trained. To start this process, the initial weights are chosen randomly. Then the training or learning, begins. The most popular neural network algorithm is back-propagation algorithm. Although many types of neural networks can be used for classification purposes [6], the focus is on the feedforward multilayer networks or multilayer perceptron's which are the most widely studied and used neural network classifiers. The feedforward, back-propagation architecture was developed in the early 1970's. This back-propagation architecture is the most popular, effective, and easy-to-learn model for complex, multi-layered networks. Its greatest strength is in non-linear solutions to ill-defined problems. Training inputs are applied to the input layer of the network, and desired outputs are compared at the output layer. During the learning process, a forward sweep is made through the network, and the output of each element is computed layer by layer. The difference between the output of the final layer and the desired output is back-propagated to the previous layers, usually modified by the derivative of the transfer function, and the connection weights are normally adjusted. This process proceeds for the previous layers until the input layer is reached [7].

The advantages of Neural Networks for classification are:

- Neural Networks are more robust because of the weights
- The Neural Networks improves its performance by learning. This may continue even after the training set has been applied.
- The use of Neural Networks can be parallelized as specified above for better performance.
- There is a low error rate and thus a high degree of accuracy once the appropriate training has been performed.
- Neural Networks are more robust in noisy environment

3. NEURAL NETWORKS IN THE MEDICAL FIELD

Neural networks are known to produce highly accurate results in practical applications. Neural networks have been successfully applied to a variety of real world classification tasks in industry, business and science [8]. Also they have been applied to various areas of medicine, such as diagnostic aides, medicine, biochemical analysis, image analysis, and drug development. They are used in the analysis of medical images from a variety of imaging modalities. Applications in this area include tumor detection in ultra-sonograms, detection and classification of micro calcifications in mammograms, classification of chest x-rays, and tissue and vessel classification in Magnetic Resonance Images. Artificial neural networks provide a powerful tool to help doctors analyze, model, and make sense of complex clinical data across a broad range of medical applications [9-21].

As the volume of stored data increases, data mining techniques assume an important role in finding patterns and extracting knowledge to provide better patient care and effective diagnostic capabilities. Neural networks can be used to extract rules from a disease classification. From the rules system so discovered, we can predict if someone will have a particular stage of a particular disease.

4. EXPERIMENT - CLASSIFICATION OF HEART DISEASES DATASET

In this experiment the medical data related to Heart diseases is considered. This dataset was obtained from Cleveland database. This is publicly available dataset in the Internet. Cleveland dataset concerns classification of person into normal and abnormal person regarding heart diseases.

Data Representation:

Number of instances: 414.

Number of attributes : 13 and a class attribute

4 Class:

Class0: Normal Person.

Class1: first stroke

Class2: second stroke

Class3: end of life

Attribute Description :

Attribute Description Range

Age Age in years Continuous

Sex (1=male; 0=female) 0,1

Cp --Value 1:typical angina 1,2,3,4

--Value 2: atypical anginal

--Value 3: non-anginal pain

--Value 4: asymptotic

trestbps Resting blood pressure(in mm Hg) Continuous

chol Serum cholesterol in mg/dl Continuous

fbs (Fasting blood sugar .120mg/dl) 0,1

(1=true; 0=false)

restecg electrocardiography results 0,1,2

--Value 0: normal

--Value 1:having ST-T wave abnormality

(T wave inversions and/or ST

Elevation or depression of>0.05mV)

--Value 2:showing probable or definite left

ventricular Hypertrophy by Estes' criteria

Thalach Maximum heart rate achieved Continuous

Exang Exercise induced angina(1=yes;0=no) 0,1

Oldpeak ST depression induced by exercise

relative to rest Continuous

Slope The slope of the peak exercise

ST segment 1,2,3

Value 1: up sloping

Value 2: flat

Value 3:down sloping

Ca Number of major vessels (0-3)

Colored by fluoroscopy Continuous

Thal Normal, fixed defect, reversible defect 3,6,7

Linear Data Scaling

Here each value is converted into the range between 0 to 1 using the following formulae

$$\Delta = X_{\max} - X_{\min}$$

$$Y = \text{intercept } C = (X - X_{\min}) / \Delta$$

$$\text{Slope} = m = 1 / \Delta$$

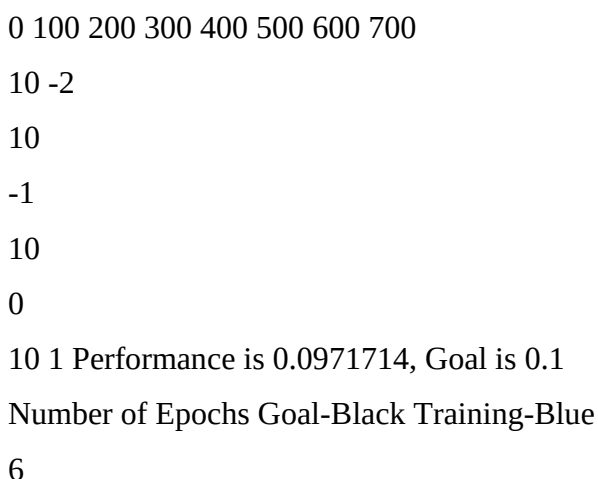
So we calculate Y for a given X as $Y = mX + C$.

4.1 Training the Neural Network

In this experiment the neural network is trained with Heart Diseases database by using feed forward neural network model and backpropagation learning algorithm with momentum and variable learning rate. The input layer of the network consists of 13 neurons to represent each

attribute as the database consists of 13 attributes. The number of classes are four: 0 – normal person, 1- first stroke, 2- second stroke and 3- end of life. The output layer consists two neurons to represent these four classes. The description of the backpropagation algorithm is specified in the above is used to train the neural network during the training process. Several neural networks are constructed with and without hidden layers, i.e, single and multi layer networks and trained with heart disease dataset. Relationship between the number of epochs and the sum of squares of errors during training process for various networks can be observed from the Figures 1-2.

Figure 1. Training the Single Layer Network with Heart Diseases Dataset



4.2 Performance of the Network

For testing the performance of the net various samples are collected as test data. The test data is given as the input to the trained network and the output of the net is calculated with the adjusted weights. The output of the net is compared with the target output to study the learning ability of the network for classifying the heart disease data. The results are tabulated in Table1.

Table 1: Experimental Results of Heart Diseases Dataset

Training

Samples Test Samples

Classification Efficiency

Single Layer Multi Layer

100 300 76% 82%

150 200 79.4% 83%

250 150 86.2% 89.3%

350 100 90.6% 94%

Conclusion

Classification is an important problem in the rapidly emerging field of data mining. Many problems in business, science, industry, and medicine can be treated as classification problems. Owing to the wide range of applicability of ANN and their ability to learn complex and nonlinear relationships including noisy or less precise information, neural networks are well suited to solve problems in biomedical engineering. In this study Neural network technique is adopted for classification of medical dataset. The experiment is conducted with heart disease dataset by considering the single and multilayer neural network modes. Backpropagation algorithm with momentum and variable learning rate is used to train the networks. To analyse performance of the network various test data are given as input to the network. Parallelism is implemented at each

0 100 200 300 400 500 600 700

10 -2

10 -1

10 0

10

1

10

2 Performance is 0.0907469, Goal is 0.1

Number of Epochs

Training-Blue

Goal-Black

neuron in all hidden and output layers to speed up the learning process. The experimental results proved that neural networks technique provides satisfactory results for the classification task.

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EMERGING TECHNOLOGIES FOR TRANSFORMING TEACHING AND LEARNING

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Abstract

The landscape of education is undergoing a profound transformation due to the rapid advancement of Information and Communication Technologies (ICT). These emerging technologies have the potential to revolutionize teaching and learning methodologies, fostering more personalized, engaging, and effective educational experiences. This paper explores some of the most promising ICT technologies and their implications for reshaping education. From Artificial Intelligence (AI) and Virtual Reality (VR) to Gamification and Learning Analytics, each technology's unique contributions to the educational sphere are examined.

Artificial Intelligence (AI) is revolutionizing the way students learn by providing personalized learning pathways. AI-powered educational tools can analyze individual learning patterns, identify strengths and weaknesses, and offer tailor-made content and assessments. Virtual Reality (VR) and Augmented Reality (AR) create immersive and interactive learning environments, enabling students to explore virtual worlds and conduct simulated experiments. Gamification, through its use of game elements, motivates and engages learners, making the learning process enjoyable and rewarding.

Internet of Things (IoT) devices in smart classrooms streamline administrative tasks and enable data-driven decision-making for educators. Blockchain technology ensures data security and transparency, particularly in credentialing and certification processes. Mobile Learning (m-Learning) enables flexible access to educational content anytime and anywhere, empowering learners with continuous access to knowledge.

Collaborative tools facilitate group projects and peer-to-peer learning, promoting critical thinking and teamwork skills. Learning Analytics, with its data-driven insights, helps educators identify areas of improvement and provide timely support to struggling students. Cloud Computing enhances accessibility to educational resources and facilitates seamless collaboration.

While these emerging technologies hold great potential for transforming education, their successful integration requires addressing challenges such as digital equity, data privacy, and teacher professional development. Striking a balance between technological innovation and preserving the human connection in education is vital. By harnessing the power of ICT responsibly, educators and learners can collaboratively create dynamic and inclusive learning environments, equipping students with the skills they need to thrive in the digital age.

Keywords: Artificial Intelligence, Virtual Reality, Information and Communication Technologies (ICT), Augmented Reality, Internet of Things (IoT)

Introduction

In recent years, the world has witnessed rapid advancements in Information and Communication Technologies (ICT). These innovations have profoundly impacted various sectors, and education is no exception. As traditional teaching methods are gradually being supplemented and transformed, educators and learners are exploring the potential of

emerging ICT technologies to enhance the teaching and learning experience. This paper explores some of the most promising ICT technologies that are reshaping the education landscape and their potential implications for future educational practices.

1. Artificial Intelligence (AI) in Education

AI is revolutionizing the education sector by offering personalized learning experiences to students. With the ability to analyze vast amounts of data, AI-powered educational tools can identify individual strengths and weaknesses, adapt content to meet specific learning needs, and provide real-time feedback. AI-driven virtual tutors and chatbots are becoming more prevalent, helping students with queries and guiding them through their learning journey. Moreover, AI-based assessment systems can accurately evaluate student performance, enabling educators to tailor their instruction accordingly.

2. Virtual and Augmented Reality (VR/AR)

Virtual and augmented reality technologies have opened up new possibilities for experiential learning. By immersing students in interactive and simulated environments, VR/AR can facilitate a deeper understanding of complex subjects. From exploring historical events to conducting virtual science experiments, these technologies bring abstract concepts to life and make learning more engaging and memorable. Additionally, VR/AR can support remote learning, allowing students to collaborate in virtual classrooms and access resources from anywhere in the world.

3. Gamification

Gamification is leveraging game elements, such as rewards, points, and challenges, in educational contexts. By integrating playful elements into the learning process, gamification can enhance student motivation, engagement, and retention. Students are encouraged to progress through levels, earning rewards and recognition along the way. Gamified learning platforms transform traditional content into interactive and enjoyable experiences, making education more enjoyable and fostering a sense of accomplishment among students.

4. Internet of Things (IoT)

The Internet of Things offers the potential to create smart, connected learning environments. IoT-enabled devices can automate routine tasks, such as attendance tracking and classroom management, freeing up educators to focus on teaching. Smart classrooms equipped with IoT devices can also collect data on student behavior, interactions, and preferences, providing insights to optimize the learning process. Moreover, wearable IoT devices can monitor students' physiological responses to learning, helping educators adjust their instructional strategies accordingly.

5. Blockchain in Education

Blockchain technology ensures data security, integrity, and transparency. In the context of education, blockchain can revolutionize credentialing and certification processes.

Academic records, certificates, and diplomas can be securely stored on a decentralized ledger, eliminating the risk of fraudulent credentials. This not only simplifies the verification process for employers and academic institutions but also empowers students to have greater control over their educational achievements.

6. Mobile Learning (m-Learning)

With the widespread adoption of smartphones and tablets, mobile learning has gained significant traction. Mobile apps and platforms enable learners to access educational content on-the-go, fostering a culture of continuous learning. Whether it's watching educational videos during a commute or completing quizzes during breaks, m-Learning provides flexibility and accessibility, making education more inclusive and learner-centric.

7. Collaborative Tools

Collaborative tools and platforms facilitate group projects and peer-to-peer learning, promoting active engagement and social interaction. Online collaboration spaces enable students to work together on assignments, share ideas, and provide feedback to one another, regardless of their physical location. This fosters teamwork, communication, and critical thinking skills, all of which are essential for success in the 21st-century workforce.

8. Learning Analytics

Learning analytics involves the collection and analysis of data on students' learning behaviors and performance. By leveraging this data, educators can gain valuable insights into student progress, identify areas of improvement, and adapt instructional strategies accordingly. Learning analytics can also help detect early signs of academic struggle, enabling timely intervention to support struggling students and improve overall learning outcomes.

9. Cloud Computing

Cloud-based services have transformed the way educational resources are stored, accessed, and shared. Cloud computing offers scalability, cost-effectiveness, and ease of collaboration. Educational materials can be uploaded to the cloud, making them accessible to students and educators from any device with an internet connection. Cloud-based learning management systems (LMS) facilitate seamless course administration, communication, and grading.

10. Natural Language Processing (NLP)

NLP technology enables computers to understand and process human language. In the realm of education, NLP can be used for language learning, automated essay grading, and language translation. Language learning apps with NLP capabilities can provide personalized language lessons; while automated essay grading systems can save educators valuable time and ensure fair and consistent assessment.

Conclusion

Emerging ICT technologies have the potential to revolutionize education by personalizing learning experiences, fostering engagement, and improving learning outcomes. While these technologies offer exciting opportunities, their successful integration into educational practices depends on various factors, including infrastructure, teacher training, data privacy, and ethical considerations. As we continue to explore and adopt these technologies, it is essential to strike a balance between innovation and maintaining the human connection that is at the heart of education. By harnessing the power of ICT in a thoughtful and responsible manner, we can create a more inclusive, dynamic, and effective learning ecosystem for generations to come.

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THIRD ORDER SUBLINEAR NEUTRAL DELAY DIFFERENCE EQUATION

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Abstract

We derive new sufficient conditions for oscillatory and asymptotic behavior of all solutions of third order delay difference equation with a sublinear neutral term. We have compared the third order difference equation into second order delay difference equation with some oscillation characteristics and obtained oscillation results. Examples are provided to illustrate our results.

Keywords: Oscillation, difference equation, third order, sublinear, neutral delay.

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On Hypersoft Semi-open Sets

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Abstract. A generalisation of soft sets called a hypersoft set incorporates a multiargument function. The major goal of this study is to provide appropriate examples for the introduction of hypersoft semi-open sets (SOS) and hypersoft semi-closed sets (SCS). Additionally, we investigate the definition and characteristics of hypersoft semi-open sets in hypersoft topological spaces (TS). The hypersoft semi interior and hypersoft semi closure of the hypersoft set are defined at the end.

Keywords: hypersoft set; hypersoft topology; hypesoft semi-open and closed set; hypersoft semi-interior; hypersoft semi-closure.

1. Introduction

Molodstov [14] established the concept of a soft set in 1999 to handle difficult problems in finance, technical education, and ecological science when no mathematical instruments could effectively address the many types of uncertainty. [13] constructed a number of soft set theory operators and carried out a more thorough conceptual analysis.

Numerous applications of topology, a subfield of mathematics, may be found in the computer and physical sciences. Soft topology is determined on soft sets in two different ways, one by Shabir [20] and the other by Cagman et al. [5].

Soft SOS and soft SCS were first presented in soft TS by Sasikala, V., E. and Sivaraj, D., [19]. Soft semi connected and soft locally semi connected characteristics in soft TS were



Generalized Semi Operators in Soft Multi Topological Spaces

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ABSTRACT

This paper's major goal is to investigate the properties of generalized semi soft multi course and generalized semi soft multi interior with the help of generalized semi closed soft multiset and generalized semi open soft multiset notions and to acquaint the conception of generalized semi soft multi neighborhoods.

AMS Subject Classification: 03E70,54A05,54B05

Keywords and Phrases: Soft multiset, soft multi topology, generalized semi closed soft multiset, generalized semi soft multi closure, generalized semi soft multi interior and generalized semi soft multineighbourhood.

INTRODUCTION

In 2013, Babitha and John [1] was acquainted the conception of soft multisets as a combination of soft sets and multisets. Then Deniz Tokat et al. [2,3] acquainted the concept of the soft multi topology and its basic properties. S. A. El-Sheikh et al. [4,5] acquainted the generalized closed soft multisets and generalization of open soft multisets and mappings in soft multi topological spaces. In 2022, Inthumathi et al. [6] acquainted the concept of generalized semi closed set in soft multi topological space. In this paper, we acquaint the conception of generalized semi soft multi closure, generalized semi soft multi interior and generalized semi soft multi neighbourhood and discuss few important attributes in detail.





Interval-Valued Intuitionistic Fuzzy Convex Optimization Techniques

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ABSTRACT

Optimization is a procedure of finding and comparing feasible solutions. Convex optimization is one of the fields among several fields of Optimization techniques. This article presents the definition of interval-valued intuitionistic fuzzy local maximum point and interval-valued intuitionistic fuzzy global maximum point and its characterizations.

Keywords: IVIF-convex set, TOPSIS, IVIF-convex objective function, IVIF-convex constraints

INTRODUCTION

In this paper, we introduced the interval-valued intuitive fuzzy local maximum point (abbreviated $IVIF^{LM}$ point) and the interval-valued intuitionistic fuzzy global maximum point (abbreviated $IVIF^{GM}$ point) of $convex_{IVIF}$ sets and its properties. Throughout this paper U as universal crisp set, I is the collection of all subintervals of the closed interval $[0,1]$ and I^U represents the family of all closed subintervals of $[0,1]$. with respect to the specified set U

Convex_{IVIF}-sets: Characteristics

Definition 2.1.

Let A be an on empty sub set of I^U . An element $x^p \in \text{supp}(A)$ is called an $IVIF^{LM}$ point of A if there exists $\epsilon > 0$ such that $[\underline{\mu}, \underline{\nu}]_A(x^p) \geq [\underline{\mu}, \underline{\nu}]_A(x)$ and $[\underline{\nu}, \underline{\nu}]_A(x) \leq [\underline{\nu}, \underline{\nu}]_A(x^p)$ for all $x \in B(x, r)$





Trapezoidal Intuitionistic Fuzzy Sequencing Problem

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ABSTRACT

This study examines various sequencing issues where the processing times are trapezoidal intuitionistic fuzzy numbers. Through the use of Graded Mean Ranking Methodology of Pascal's Triangle and the Zero Identifier method, an algorithm is shown for determining the ideal sequence, the minimum total time spent and the idle time for each machine. To demonstrate the viability of the sequencing problem, numerical examples have been provided.

Keywords: Trapezoidal Intuitionistic Fuzzy Number, Optimal Sequence, Total elapsed time, Idle time, Pascal's Triangle Graded Mean Ranking value.

INTRODUCTION

Operations Research assists us in making wiser judgements in difficult situations. Considered to be one of the most crucial applications of operations research is the Sequencing problem. When we are worried about the situation, where there is an option regarding how a number of activities can be done, job sequencing concerns occurs. Sequencing refers to a set of actions or tasks that must be carried out in a particular order. Johnson's method [1], which he provided in 1954 for production scheduling and which minimized the overall idle time of machines and the total production times of the jobs, is one of the most well-known works in this field still being used today. Later in 1967, Smith and Dudek created a general method for the flow shop's 'n' task on 'm' machines sequencing problem when the number of passing is permitted. In most cases, Processing times in sequencing problems are accurately





Third Order Semi-Canonical Nonlinear Difference Equations

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ABSTRACT

We provide some novel oscillation conditions for semi-canonical difference equations using the canonical transformation method. Our findings reinforce and improve certain earlier ones. Examples have been generated to highlight the relevance of the consequences.

Keywords: Semi-canonical, asymptotic, oscillatory, difference equation, nonlinear.

INTRODUCTION

Consider the third order difference equation in this instance.

$$\Delta(q(\varsigma)\Delta(r(\varsigma)\Delta\Psi(\varsigma))) = s(\varsigma)\Psi^{\kappa}(\varrho(\varsigma)), \varsigma \geq \varsigma_0 \quad (1.1)$$

where ς_0 is a positive integer. We assume the subsequent hypothesis

H1) $\{q(\varsigma)\}, \{r(\varsigma)\}, \{s(\varsigma)\}$ are positive real sequences;

H2) $\{\varrho(\varsigma)\}$ is an increasing sequence of positive integer with $\varrho(\varsigma) \geq \varsigma + 1$;

H3) κ is a real positive integer with $\kappa > 1$;

H4) the equation (1.1) is in semi canonical form, that is

$$\sum_{\varsigma=\varsigma_0}^{\infty} \frac{1}{q(\varsigma)} = \infty \text{ and } \sum_{\varsigma=\varsigma_0}^{\infty} \frac{1}{r(\varsigma)} < \infty. \quad (1.2)$$

A real sequence $\{\Psi(\varsigma)\}$ that satisfies (1.1) for any $\varsigma \geq \varsigma_0$ is referred to as a solution of (1.1). Nontrivial solutions to (1.1) are either oscillatory or non oscillatory depending on whether the final result is positive or negative.

Finding out the qualitative behavior of various types of second order difference equations has garnered a lot of attention in recent years. Despite the fact that discrete models are used in many other areas of mathematics, including economics, mathematical biology, and [1] and [2], difference equations have a wide range of applications in these fields.





Qualitative Behavior of Fourth Order Neutral Difference Equations

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ABSTRACT

"The goal of this paper is to illustrate the qualitative behaviour of a fourth order difference equation with neutral terms of the form

$$\Delta \left(s_1(\vartheta) (\Delta^3 q(\vartheta))^{\beta_1} \right) = s_2(\vartheta) y^{\beta_2} (\vartheta - n + 1) + s_3(\vartheta) y^{\beta_3} (\vartheta + n^*)$$

where $q(\vartheta) = y(\vartheta) - s_4(\vartheta) y^{\beta_4} (\vartheta - k)$ Here $\beta_1, \beta_2, \beta_3, \beta_4$ are the ratios of odd positive integers $\beta_1 \geq 1, s_1, s_2, s_3, s_4$ are positive sequences and $n, n^*, k \in \mathbb{N}$ are such that $n > 3, n^* > 3, k < n - 2$. With the help of comparison techniques, we are able to acquire some novel oscillations results. Examples are given to illustrate the importance of the discoveries.

Keywords : comparison techniques, fourth order, neutral terms, oscillation.

INTRODUCTION

Due to the fact that neutral difference equations are used in the study of economics, mathematical biology, and many other areas of mathematics, the issue of establishing oscillation phenomena for these equations has drawn a lot of attention in recent years [1],[2],[11],[12],[17]. The sources cited there as well as [4],[21],[22],[23] provide some fascinating new findings on the oscillatory behavior of second-order differential equations. A examination of the literature reveals that every conclusion made for fourth order difference equations with neutral terms ensures that each solution oscillates or monotonically approaches to zero. As far as we are aware, no conclusions have been drawn for fourth order neutral difference equations that suggest that all solutions are just oscillatory. This study's goal is to provide the equation some revised oscillation restrictions as a result.

$$\Delta \left(s_1(\vartheta) (\Delta^3 q(\vartheta))^{\beta_1} \right) = s_2(\vartheta) y^{\beta_2} (\vartheta - n + 1) + s_3(\vartheta) y^{\beta_3} (\vartheta + n^*) \quad (1)$$



Nonexistence of Kneser solution of neutral delay difference equation

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Abstract

By creating suitable standards for the nonexistence of so-called Kneser solutions, this study seeks to augment the third order neutral delay difference equations current oscillation results. The results of combining new and previous findings. All of the answers to the studied equations oscillate thanks to our work.

Keywords : Non-oscillation, difference equation, Kneser solution, neutral delay.

MSC:39A10

1. Introduction

In this paper, we look into the third-order neutral delay difference equation's Kneser solution.

$$\Delta(a_2(t)\Delta(a_1(t)\Delta y(t))) + c_1(t)x(\varsigma(t)) = 0, t \geq t_0 > 0, \quad (1)$$

where $y(t) = x(t) + \omega(t)x(\mu(t))$.

In this paper, we assume the following:

(A1) $\omega(t)$ and c_1 are positive real sequences, $0 \leq \omega(t) \leq \omega_0 < \infty$ and $c_1(t)$ does not vanish identically;

(A2) ς is a real valued increasing sequence with $\varsigma(t) < t$ and $\lim_{t \rightarrow \infty} \mu(t) = \infty$, μ is a real valued increasing sequence with $\mu(t) < t$ and $\lim_{t \rightarrow \infty} \mu(t) = \infty$;

(A3) The real sequences are $\{a_1\}$, $\{a_2\}$ which satisfy $\sum_{t_0}^{\infty} \frac{1}{a_1(t)} = \infty$; $\sum_{t_0}^{\infty} \frac{1}{a_2(t)} = \infty$;

NEW CRITERIA ON THE OSCILLATORY BEHAVIOUR OF SECOND ORDER NONLINEAR DIFFERENTIAL EQUATIONS WITH MIXED NEUTRAL TERMS

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ABSTRACT. The authors present some new criteria for the oscillation of second order nonlinear differential equations with mixed nonlinear neutral terms and mixed deviating arguments. The approach used is to linearize the equation under consideration and then to deduce the oscillation from that of the linear form. In so doing, the authors obtain new oscillation criteria via a comparison with the first order equations whose oscillatory behaviors are known. They illustrate their results with some examples.

1. Introduction

This paper is devoted to obtaining some new criteria on the oscillatory behavior of all solutions of the nonlinear second order differential equation with mixed neutral terms

$$\left(a(t)(y(t))^\alpha\right)' + q(t)x^\alpha(\tau(t)) + p(t)x^\alpha(\omega(t)) = 0, \quad (1)$$

where $y(t) = x(t) + p_1(t)x^\beta(\sigma(t)) - p_2(t)x^\delta(\sigma(t))$. We will assume that:

- (i) α, β , and δ are the ratios of odd positive integers with $\alpha \geq 1$;
- (ii) $p_1, p_2, a, p, q, c : [t_0, \infty) \rightarrow \mathbb{R}^+$ are continuous functions;

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Keywords: Oscillation, Second Order, Neutral, Mixed Arguments.



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Oscillatory and Property Conditions for Third Order Difference Equation with Negative Middle-Term

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This paper presents a detailed analysis of the oscillation and Property A conditions for third-order advanced difference equations with negative middle terms. The authors employ the generalized Riccati transformation technique and summation by parts to establish sufficient criteria for the solutions to be oscillatory or have Property A. The main results and their proofs are presented clearly and concisely. The difference equations have been a topic of interest in various scientific fields such as economics, physics, and mathematical biology. The results presented in this paper can be used to inform the development of more accurate models for real-world problems in various scientific fields. Additionally, this paper explores the economic theory of business cycles and its mathematical foundations, specifically Samuelson's model, which outlines five potential trajectories or trends that economic activity can follow based on different combinations of the marginal propensity to consume multiplier parameter(α) and the accelerator coefficient (β).

Keywords: Advanced equation, property A, oscillation criteria, Riccati transformation, semi-canonical.

1. Introduction

In this article, we will discuss the economic theory of business cycles and its mathematical foundations. Specifically, we will explore Samuelson's model, which outlines five potential trajectories or trends that economic activity can follow. These paths are determined by different combinations of the marginal propensity to consume (α) and the accelerator coefficient (β). Each combination results in a unique pattern of economic movement. We will examine the model in detail and highlight its key features, including the dynamic of economic cycles and their relationship to changes in consumption and investment.

The article will also delve into the mathematical foundations of the model, including second-order difference equations in the context of business cycles. We will explore the oscillatory behavior and Property A conditions for third-order difference equations, which have applications in economics, physics, and mathematical biology. The paper will highlight the connection between these equations and Samuelson's model, demonstrating how they can be used to gain insights into the behavior of economic cycles.

Finally, we will present practical examples to demonstrate the main results, providing to apply in real-world scenarios. This chapter aims to provide readers with a comprehensive overview of Samuelson's

Qualitative Behavior Of Second Order Difference Equation with Non Positive Neutral Term

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Abstract:

The oscillation of second order difference equations with a nonlinear nonpositive neutral component is the subject of this study. We come up with a sufficient condition that guarantees that all solutions to the examined equation are either oscillatory or going towards zero. Through examples, the improvement of our primary findings is demonstrated.

Keywords: Oscillatory, neutral term, non positive, second order.

MSC: 39A10.

1. Introduction

In this article, we study some oscillatory manners of a second order non linear non positive neutral delay difference equation of the form

$$\Delta(r(\wp)\Delta(z(\wp) - p(\wp)z^{\gamma_1}(\tau_1(\wp)))) + q(\wp)z^{\gamma_2}(\sigma_1(\wp)), \quad \wp \geq \wp_0 > 0. \quad (1)$$

subject to the restrictions outlined below :

(R1) γ_2 and $0 < \gamma_1 \leq 1$ are ratio of odd positive integers;

(R2) $\{r(\wp)\}$, $\{q(\wp)\}$ and $\{p(\wp)\}$ are positive real sequences such that $0 < p(\wp) \leq p < 1, \forall \wp \geq \wp_0$ and

(R3) σ_1 and τ_1 are positive integers with $\tau_1(\wp) \leq \wp, \Delta\tau_1(\wp) > 0, \sigma_1(\wp) \leq \wp, \Delta\sigma_1(\wp) > 0, \lim_{\wp \rightarrow \infty} \tau_1(\wp) = \lim_{\wp \rightarrow \infty} \sigma_1(\wp) = \infty$.

A real sequence $\{z(\wp)\}$ is said to be a solution of (1) if it is defined for all $\wp \geq \wp_0$. A nontrivial solution of (1) is called oscillatory if it is neither eventually positive nor eventually negative. Otherwise, the solution is said to be non oscillatory. An equation is oscillatory if all its solutions oscillate.

Since neutral type equations are prevalent in the study of economics, mathematical biology, and many other fields of mathematics, determining oscillation conditions for these equations has garnered a lot of attention in recent years. (see for example [1] – [9]). To the best of our knowledge, there are no results in the literature that guarantee that all solutions for the second order difference equation are just oscillatory. This conclusion is drawn from a review of the literature. All results ([10] – [14]) established for neutral type difference equations are guaranteed that every solution is either oscillatory or tends to zero monotonically. In order to define conditions for the oscillation of all solutions under the following condition, the authors considered (1) with $p(\wp) < 0$,

Generalized soft multi connectedness and compactness

V. Inthumathi ¹

Gnanasoundari ²

M. Maheswari ³

Abstract

The significance of connectedness and compactness plays a vital role in studying the properties of topological spaces. Numerous authors explored several characterizations of topological spaces using these notions. Researchers had attempted to generalize the concepts of connectedness and compactness in various generalized topological spaces like ideal topological spaces, soft topological spaces, fuzzy topological spaces etc. In the year 2013, Babitha and John studied the concept of connectedness in soft multi topological spaces. Since then the study of these concepts has created a gap in the literature. The uniosity about the generalizations of connectedness and compactness in soft multi topological spaces explored this article.

Keywords: Soft multiset, soft multi topology, generalized semi closed soft multiset, generalized semi soft multi connectedness and generalized semi soft multi compactness.

2020 AMS subject classifications: 03E70, 54A05, 54B05, 54A10. ⁴

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Research Article

The Characteristics of Circular Fermatean Fuzzy Sets and Multicriteria Decision-Making Based on the Fermatean Fuzzy t-Norm and t-Conorm

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When diverse decision makers are involved in the decision-making process, taking average of decision values might not reflect an accurate point of view. To overcome such a scenario, the circular Fermatean fuzzy (CFF) set, an advancement of the Fermatean fuzzy (FF) set, and the interval-valued Fermatean fuzzy set (IVFFS) are introduced in this current study. The proposed CFF set is a circle with a centre as association value (AV) and nonassociation value (NAV) with a radius at most equal to $\sqrt{2}$. It is built in such a way that it covers all the decision makers' opinion value through a circle. Due to its geometric structure, the CFF set resolves ambiguity and risk more accurately and effectively than FF and IVFF. FF t-norm and t-conorm are used to investigate the properties of CFF sets, subsequent to which the algebraic operations between them are defined. A couple of CFF distance measures between CFF numbers are introduced and used in the selection of an electric autorickshaw along with the CFF weighted averaging and geometric aggregation operators. The overview and comparison analysis of the generated reports exemplifies the viability and compatibility of the CFF set strategy for selecting the best choices.

1. Introduction

In 1965, Zadeh [1] pioneered the conception of the fuzzy set (FS) by employing AV that takes a value stretching from 0 to 1 instead of a characteristic function that concurs with the value of either 0 or 1 to address the consistency difficulties in real-life situations.

FS is capable of administering the AV. In reality, the NAV should be brought into consideration in many additional circumstances, and that is not essential that the amount of NAV remains the same as the AV reduced by one. As a consequence of this, Atanossav [2] proposed the intuitionistic fuzzy set (IFS) concept in 1986 that considers both AV and NAV into account, in which the NAV is not

obtained from the AV and that culminates in the concept of hesitation degree with the assumption that the sum of AV, NAV, and hesitation degree is 1.

Despite the reality that IFS has been used in several areas, there were challenges. In particular, the IFS lacks the capacity to handle such information when a decision maker provides it, but the total amount of AV and NAV is higher than 1. With regard to this, Yager and Abbasov [3] put forwarded the Pythagorean fuzzy set (PFS) theory in 2013 by means of manipulating IFS's perspective. PFS provides the additional feature that the sum of squares of AV, NAV, and hesitation degree is 1, which extends the acceptance range.

The FF set proposed by Senapati and Yager [4] has comparatively extensive range of acceptance to IFS and PFS

Picture Fuzzy Set with Disaster Management & Decision Making by Measures

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Abstract:

Picture fuzzy sets are extension of intuitionistic fuzzy sets. One method to ascertain the relationship between two picture fuzzy sets is to use the correlation coefficient of those sets. In this research, we introduce the refusal membership grade for picture fuzzy sets in the implementation of similarity measure, correlation coefficient and Distance based Similarity Measure in the application of disaster management. We will get the accurate value while considering refusal value in the utilization of picture fuzzy set. It has universal applications in numerous disciplines such pattern recognition, clustering analysis, and disaster management, among others. A picture fuzzy set can be used to convey the character of a decision-making problem, both positively and negatively and comparative study also made with the help of Distance measure, Similarity measure and Correlation coefficient.

Keywords: Picture fuzzy set, Distance Measure, Similarity Measure, Correlation coefficient, Disaster management, picture fuzzy operations.

1. Introduction

In 1965, Zadeh[34] presented the fuzzy set (FS) theory. Following that, FSs and their applications have drawn the attention of other authors, including Chen and Jong (1997)[8], Manoj et al. (1998) [21], and Singh et al. (2019, 2020) [28] [29]. The non-membership degree is automatically regarded as one-minus membership degree in the FS theory, which only takes an element's membership degree into account. As a result, knowing the membership degree of an element may undoubtedly be used to determine its non-membership degree. However since they are aware of the membership degree in real life, a researcher might not be as positive about the non-membership degree (Deschrijver and Kerre 2003) [11]. Atanassov (1986)[3] developed the idea of intuitionistic fuzzy sets (IFSs) employing membership and non-membership functions. In such a scenario, it is desirable to have both an independent non-membership function and a membership function.

Even though IFSs have been applied to many different fields, there are still some situations in daily life that they are not able to handle, such as voting, medical diagnosis, feature selection, personal selection, etc. Cuong and Kreinovich (2013)[6] introduced the concept of picture fuzzy set (PFS) to address these situations. It is an exact extension of Atanassov's (1986)[3] IFSs and Zadeh's (1965)[33] FSs. Every element in a PFS has three degrees: neutrality, non-membership, and membership.

On the other hand, the correlation coefficient is a commonly employed statistical instrument that holds significance in various domains such as data analysis, classification, pattern recognition,



Hypersoft Sets in a Game Theory-Based Decision Making Model

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Abstract

In this study, we offer a hypersoft set theory-based game model for handling uncertainties. The term "hypersoft game" refers to this newly suggested game. Four techniques of game solution are identified: hypersoft saddle points, hypersoft upper and lower values, hypersoft dominated strategy and hypersoft nash equilibrium. We build a two-person hypersoft game first. Additionally, we present real-world problems that the hypersoft saddle point approaches and hypersoft dominating strategy are used to tackle. In conclusion, we expand the hypersoft games from two players to n players.

Keywords: hypersoft set, two person hypersoft games, hypersoft payoff functions, hypersoft dominated strategies, hypersoft lower and hypersoft upper values, hypersoft nash equilibrium.

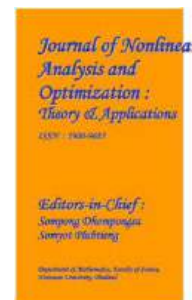
1 Introduction

Soft set theory was developed by Molodtsov^[18] as a generic Mathematical instrument for handling uncertainties. Soft sets have been widely employed to solve decision-making issues. A soft set application for decision-making problems was proposed by Maji et al.,^[17] Cagman and Enginoglu.^[10]

By replacing the function with a multi argument function specified in the cartesian product with a new set of parameters, Smarandache^[21] extended the idea of a soft set to a hypersoft set. Compared to soft sets, this idea is more flexible and more suited to problems requiring decision-making. The hypersoft sets were effectively employed in the COVID-19 decision-making approach by Inthumathi et al.^[11] In addition, they presented hypersoft matrices^[12] and their uses.^[13] They have introduced the concept of hypersoft semi-open sets.^[14]

The study of strategic decision-making is known as game theory. The two-person zero-sum game and its proof served as the foundation for contemporary game theory, which was first presented by Neumann and Morgenstern^[19] in 1944. Aliprantis and Chakrabarti^[2] provided decision-making games. The concepts of fuzzy sets have been embedded into several intriguing game theory applications. Numerous writers have examined the two-person zero sum games with fuzzy objectives and payoffs in game theory.^{[4][5][7][9][16][22]} Additionally, the max-min solution for the degree of attainment of a fuzzy objective has been examined. Soft games, as described by Irfan Deli and Naim Cagman,^[15] are applicable to challenges that involve ambiguity and uncertainty.

In this research, we develop a novel uncertainty-handling game model for games dubbed hypersoft games. This game is highly practical and easy to apply in practise since the hypersoft payoff functions of the hypersoft game are set valued functions and the solution of the hypersoft games acquired by applying the operations of sets.



SOME DISTANCE-BASED TOPOLOGICAL INDICES OF DOUBLE STAR STARBELL GRAPH AND PETERSENSTARBELL GRAPH

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Abstract:

A topological index is an analytically derived numerical index for the graph structure. In this paper, we study some distance-based topological indices, such as, Wiener index (W), hyper-Wiener index (WW), Harary index (H), Reciprocal Complementary Wiener index (RCW), Wiener Polarity index (W_P), Terminal Wiener index (TW), Reverse Wiener index (Δ) and Reciprocal Reverse Wiener index ($R\Delta$) of Double Star Starbell graph $BSS_{r_1, r_2, \dots, r_{m+n}}$ and Petersenstarbell graph $PS_{m_1, m_2, \dots, m_5}$.

MSC: 05C12, 05C76

Keywords:

Wiener index, Hyper-Wiener index, Harary index, Reciprocal Complementary Wiener index, Wiener Polarity index, Terminal Wiener index, Reverse Wiener index Reciprocal Reverse Wiener index, Double Star Starbell graph and Petersenstarbell graph.

1. INTRODUCTION

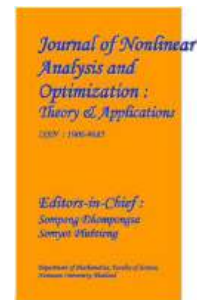
In this paper, we consider only finite, undirected, connected and simple graphs. For a graph $G = (V, E)$, the number of vertices and edges will be denoted by $|V(G)|$ and $|E(G)|$ respectively. If $u, v \in V(G)$, length of the shortest distance between u and v in G is denoted by $d_G(u, v)$, we simply denote it by $d(u, v)$ if there is no ambiguity in the graph under consideration. The eccentricity of a vertex u in a graph G is $e(u) = \max \{d(u, v) : v \in V(G)\}$. The radius (resp. diameter) of G is $r = rad(G) = \min \{e(v) : v \in V(G)\}$ (resp. $d = diam(G) = \max \{e(v) : v \in V(G)\}$). In a graph, a vertex of degree 1 is known as a pendent vertex or terminal node or leaf node or leaf. Definitions which are not seen here can be referred in^[1,2].

A topological index is an analytically derived numerical index for the graph structure. Indices are graph invariants used to study graph structure. Graph techniques have many applications in various fields such as Chemistry, Physics, Biology, Computer Science, etc. The Wiener index is the distance based topological index introduced by the chemist Harry Wiener in 1947^[3] and also known as the “Wiener number”^[4,5]. Wiener index which is widely used based on the chemical applications of graph theory which counts the number of bonds between pairs of atoms and sum the distance between all pairs by generating a distance matrix^[6]. The Wiener index is defined by the sum of distances between all unordered pairs of vertices of a graph G ,

$$W(G) = \sum_{u, v \in V(G)} d(u, v).$$

The hyper-Wiener index is the generalization of the Wiener index introduced by Milan Randić in 1993^[7] and is defined as follows:

$$WW(G) = \frac{1}{2} \sum_{u, v \in V(G)} [d(u, v) + d(u, v)^2].$$



THE GEODETIC NUMBER IN THE COMB PRODUCT OF GRAPHS

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Abstract

Let G and H be two simple, nontrivial and undirected graphs. Let o be a vertex of H , the comb product between G and H , denoted by $G \triangleright H$, is a graph attained by taking one copy of G and $|V(G)|$ copies of H and grafting the i^{th} copy of H at the vertex o to the i^{th} vertex of G . A set of vertices S of a graph G is a geodetic set, if all the vertex of graph G lies in at least one interval between the vertices of S . The minimum cardinality of the geodetic set in G is the geodetic number of G . In this paper, we determine an exact value of geodetic number in comb product of graphs.

1. Introduction

By a simple and connected graph $G = (V, E)$, we further assume that G has no isolated vertices. For graph theoretic terminology we refer to Chartrand and Lesniak [8].

The notions of distance in graphs is a well-studied topic with several practical applications. For any two vertices u and v of a connected graph G , the *distance* $d_G(u, v)$ is the length of a shortest $u - v$ path in G . The *eccentricity* of a vertex u of a graph G is the maximum distance between u and any other vertex of G . The *diameter* of G , denoted by $diam(G)$, is the maximum eccentricity of vertices in G , and the *radius* is the minimum such eccentricity. The *interval* $I_G[u, v]$ between u and v is the set of all vertices on all shortest $u - v$ paths. Given a set $S \subseteq V(G)$, its *geodetic closure* $I_G[S]$ is the set of all vertices lying on some shortest path joining two vertices of S ; that is,

$$I_G[S] = \{v \in V(G) : v \in I_G[x, y], x, y \in S\} = \bigcup_{x, y \in S} I_G[x, y]$$

A set $S \subseteq V(G)$ is called a *geodetic set* in G if $I_G[S] = V(G)$; that is, every vertex in G lies on some geodesic between two vertices from S . The *geodetic number* $g(G)$ of a graph G is the minimum cardinality of a geodetic set in G .

In chemistry [1], some families of chemical graphs can be measured as the comb product graphs. Let G and H be two connected graphs. Let o be a vertex of H . The *comb product* between G and H , denoted by $G \triangleright H$, is a graph obtained by taking one copy of G and $|V(G)|$ copies of H and identify the i^{th} copy of H at the vertex o with the i^{th} vertex of G . By the definition of comb product, we can say that $V(G \triangleright H) = \{(a, v) | a \in V(G), v \in V(H) \text{ and } (a, v)(b, w) \in E(G \triangleright H) \text{ whenever } a = b \text{ and } v, w \in V(H), \text{ or } ab \in E(G) \text{ and } v = w = o\}$. We consider two different vertices $a, b \in V(G)$ and a vertex $o \in V(H)$. We define $H(a) = \{(a, v) | v \in V(H)\}$, $G(o) = \{(v, o) | v \in V(G)\}$, and $P_G(a, b)$ is the shortest path from a to b in G .

We find main results. The first result is related to $G \triangleright H$ when G is a connected graph and H is the classes of graphs such as Path, Cycle, Completed Graph, Trees and Wheel Graph. In the literature, the problem of the geodetic number of a graph was initiated by Harary, Loukakis, and Tsouros in 1986 and their result appeared as a published paper in 1993 [10]. We collect the basic definitions in graphs and geodetic sets which are used in the subsequent chapters; for graph theoretic terminology we refer to the Chartrand and Lesniak [8] few basic results on the geodetic number of cartesian and strong product of graphs. These results are in Bresar et al. [3] and in Caceres et al. [5]

Lemma 1.1. [6] Every geodetic set of a graph contains its extreme vertices.

Lemma 1.2. [9] Let $deg : V(A) \rightarrow V(B)$ be an isomorphism between graphs A and B . The set S is a

Research Article

Modern Approach in Pattern Recognition Using Circular Fermatean Fuzzy Similarity Measure for Decision Making with Practical Applications

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The circular Fermatean fuzzy (CFF) set is an advancement of the Fermatean fuzzy (FF) set and the interval-valued Fermatean fuzzy (IVFF) set which deals with uncertainty. The CFF set is represented as a circle of radius ranging from 0 to $\sqrt{2}$ with the center at the degree of association (DA) and degree of nonassociation (DNA). If multiple people are involved in making decisions, the CFF set, as an alternative to the FF and IVFF sets, can deal with ambiguity more effectively by encircling the decision values within a circle rather than taking an average. Using algorithms, a pattern can be observed computationally or visually. Machine learning algorithm utilizes pattern recognition as an instrument for identifying patterns and also similarity measure (SM) is a beneficial pattern recognition tool used to classify items, discover variations, and make future predictions for decision making. In this work, we introduce the CFF cosine and Dice similarity measures (CFFDMs and CFFDSMs), and their properties are studied. Unlike traditional approaches of decision making, which emphasize a single number, the proposed CFFSMs observe the pattern over the circular region to help in dealing with uncertainty more effectively. We introduce an innovative decision-making method in the FF setting. Available bank loans and applicants' eligibility levels are represented as CFF set using their FF criteria and are taken as loan patterns and customer eligibility patterns. The loan is allocated to the applicant by measuring the CFFCSM and CFFDSM between the two patterns. Also, laptops are suggested to the customers by measuring the similarity between specification pattern and requirement pattern. The correctness and consistency of the proposed models are ensured by comparison analysis and graphical simulations of the input and similarity CFFNs.

1. Introduction

Pattern recognition is a developed but exciting field that keeps growing swiftly. It provides a platform for developments in associated disciplines notably computer vision, image processing, gene expression analysis, protein structure prediction, medical image analysis, text

classification, sentiment analysis, named entity recognition, speech recognition, gesture recognition, biometric identification, neural networks, and many more.

The nearest neighbor algorithm, initiated in 1967, is the origin of pattern recognition. Statistical pattern recognition methods, machine learning algorithms, and deep learning techniques are some of the pattern recognition methods.



Computing of Some Degree Based Topological Indices of $K_m \odot K_n$

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Abstract : In this paper, we study some degree-based topological indices, such as, first Zagreb index ($M_1(G)$), second Zagreb index ($M_2(G)$), third Zagreb index ($M_3(G)$), Hyper-Zagreb index ($HM(G)$), Sigma index ($\sigma(G)$), Sombor index ($SO(G)$), Forgotten index ($F(G)$), SK index, SK_1 index and SK_2 index of $K_m \odot K_n$

MSC : 05C07, 05C10.

Keywords: Zagreb Indices, Hyper-Zagreb index, Sigma index , Sombor index, Forgotten index, SK index, SK_1 index, SK_2 index and Corona product.

1. INTRODUCTION

The study of graphs, which are mathematical structures made up of vertices (also known as nodes) and the edges (also known as arcs) that link these vertices, is the focus of the field of graph theory. When utilizing graphs to explore molecule structures and their characteristics, chemical graph theory is an essential tool. It entails representing molecules as graphs, with chemical bonds acting as edges and atoms acting as vertices. In this study, we consider only simple, finite, undirected and connected graphs.

A graph G is an ordered triple $(V(G), E(G), \chi_{(G)})$ consisting of a nonempty set $V(G)$ of vertices, a set $E(G)$, disjoint from $V(G)$, of edges, and an incidence function $\chi_{(G)}$ that associates with each edge of G an unordered pair of

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Pharmacognostical Characterisation and Phytochemical Profiling of the Medicinal Plant, *Ehretia ovalifolia* Wight

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ABSTRACT

Pharmacognostical characterisation and phytochemical profiling is more important for a plant before the plant was utilized in the drug industry. The plant, *Ehretia ovalifolia*, belongs to family Boraginaceae is an important medicinal plant. The present investigation was carried out to evaluate the pharmacognostical, phytochemical studies to explore the characters of this plant. The organoleptic characters of stem and leaf expressed with some characteristic bitter taste, odour, with brown and deep green in colour forms. Morphologically the plant with 23cm of Girth, 6.5 cm leaf area with 5-8 pairs of veins. The reaction of stem powders with various chemicals were made and some of the powders were well reacted and it was observed under various light sources. Some the powders appeared to be black under UV light of 256nm from Dark green. Similarly the green coloured leaf powder was also appeared to be black in colour. The qualitative phytochemical study showed presence of important phytochemical component like alkaloids, saponins, terpenoids, coumarins, flavonoids, tannins and phenols. The chloroform extract also expressed the presence of important phytochemicals like phenols and flavonoids with other phytochemicals. The leaf study showed the presence of all studied phytochemicals except glycosides and whereas the steroids and terpenoids were absent. The GCMS analysis of methanol extract was detected with some 6 important compounds i.e Ethyl. alpha. -d-glucopyranoside n-Hexadecanoic acid and 3,4-Secodammar-4(28)-en-3-oic-acid,20,24-epoxy-25-hydroxy-, (24s)-. The total ash value of stem is 8% and water soluble as of 6.67% and 0.7% of acid soluble ash. The ash value of leaf is 17.6% with 17% of water



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soluble ash and only 8.7% of acid soluble ash. The study completely explain the characteristic features of the study plant *E.ovalifolia* which may useful for pharma companies during drug manufacture.

Keywords: organoleptic study, phytochemicals, GC –MS, alkaloids, flavonoids.

INTRODUCTION

India is known as botanical garden of the world. The plants that are founded with medicinal properties are used in the indigenous treatment practices such as ayurveda, unani, siddha and also in modern medicines. According to WHO 80% people prefer tradition medicines for their health care. Pharmacognosy is the study of the physical, chemical, biochemical and biological properties of drugs, drug substances of natural origin as well as the search for new drugs from natural sources. Modern Pharmacognosy involves the broad study on natural products from various product including plants, Bacteria, Fungi, and marine organisms. The phytochemicals are naturally available bioactive compounds derived from plants with potential disease curing capabilities. The secondary constituents consisting of alkaloids, flavonoids, tannins, terpenoids, steroids, saponins, and other phenolic compounds etc. the various phytochemicals are present in medicinal plants are alkaloids, tannins, saponins, steroid, terpenoids, flavonoids, glycoside. Medicinal plants are involved in the discovering and screening of the new phytochemical constituents which are very helpful for the manufacturing of new drugs. The modern chromatographical techniques such as GC-MS were used widely for profiling of phytochemicals Kirshnananda (2017).

These constituents have beneficial aspect in therapeutic value of human. Plants are being used as medicine since ancient periods because drugs obtained from plants are easily available, safe, and when its intake it possesses less side effects. The bioactive materials obtained from extraction and their quantitative and qualitative analysis is considered as pharmaceutical activity. The genus *Ehretia* with a 150 species belongs to family Boraginaceae. Many species of this family distributed in tropical Asia, Europe and North America. The parts of leaves, barks, roots, branches, heartwood are used in traditional medicine in Japan, India and China (Rajasekar and Saravana Ganthi (2019). These genus are may present the capability of curing capacities for anti- inflammatory, antibiotic and antibacterial activity. The present study was carried out on most widely distributed lesser known medicinal plant *Ehretia ovalifolia* for its pharmacognostical and phytochemical nature to understand and authenticate the species for drug making in Ayurveda, siddha and other indigenous way of treatment.

MATERIALS AND METHODS

The study material *Ehretia ovalifolia* was collected and characterized as is a small perennial tree growing to 12m with branches, leaves oblong or elliptic apex are obtuse, nerves are 6-8 pairs, pubescent in the nerve axis petioles are present. Inflorescence corymbs terminal and axillary flowers are white slightly pubescent pedicles. Tubular calyx corolla rotate filaments four, ovary four celled style two fused.

Collection of plant material

The leaves and stem of *Ehretia ovalifolia* were collected from the NGM campus, Pollachi Taluk, Coimbatore district, Tamil Nadu. The healthy parts were collected, shade dried and pulverized to powder, further the powder was stored in air tight container till further works to be carried out.

Preparation of Crude

Solvents *viz.*, chloroform and methanol were used to take the extract from leaves and stem powders according to Harborne (1998) method. The samples were sequentially extracted using a soxhlet apparatus and was subjected to



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further studies as mentioned by (Kokate,1994). The extract was allowed to evaporate the excess solvent at room temperature and the crude consistent was obtained.

Organoleptic Studies: (Aji et al., 2014)

Microscopic and macroscopic observations of the study plant were carried out like plant shape, size, surface and physical characters like texture, colour, odour, taste etc was noted.

Preliminary analysis of phytochemicals

The crude was dissolved in respective solvents for working consistency and screened for the presence of some important phytochemical such as alkaloids, tannins, flavonoids, saponins, glycosides, steroids, phenol, terpenoid, coumarins and glycosides.

Test for Alkaloids: (Mayer's test) (Aji et al., 2014)

To a few drops of the plant extract, two drops of the Mayer's reagent is added along the sides of the test tube. The appearance of white creamy precipitate indicates the presence of the alkaloids.

Test for Phenols: (Shreya et al., 2013)

Ferric chloride test: The 50 mg of the extract in 5 ml distilled water. To this few drops of neutral 5% ferric chloride solution are added. A dark green colour indicates the phenolic compound.

Test for Flavonoids: (Shreya et al., 2013)

An aqueous solution of the extract is treated with few drops of H_2SO_4 . Formation of orange colour indicates that the presence of flavonoids.

Test for Saponins: (Kokate, 1999).

The extract is dissolved with distilled water and make up to 20 ml. The suspension is shaken in a graduated cylinder for 15 minutes. A two cm layer of foam indicates the presence of the saponins (Kokate, 1999).

Test for Steroids: (Shreya et al., 2013)

The extract is treated with 2ml of chloroform and few drops of $Con.H_2SO_4$. Formation of reddish-brown ring indicate the presence of steroids

Test for Coumarin: (Yadav et al., 2014)

To 2ml of extract was taken 3ml of 10% sodium hydroxide was added. Appearance of yellow coloration indicates the presence of coumarins.

Test for Glycosides: (Keller-Killiani test) (Shreya et al., 2013)

To total of 1 ml of glacial acetic acid, few drops of ferric chloride solution and concentrated H_2SO_4 (slowly through the sides of the test tube) were added to the extract. Appearance of reddish-brown ring at the junction of the liquids indicated the presence of deoxysugar.

Test for Terpenoids: (Yadav et al., 2014).

To 2ml of extract 2ml of acetic acid was added. Then concentrated sulphuric acid was added. Deep red colour development showed the presence of terpenoids

Test for Tannin: (Braymer's test) (Edeoga et al., 2005 and Harborne et al., 1973).

To 1ml of extract was mixed with 2ml of water. To these, 2 drops of 5% ferric chloride solution was added. Appearance of dirty green precipitate indicated the presence of tannin.



**Anatomical study**

The study on anatomical characterisation with normal sectioning and the section treated with various reagents, solvents were used to study the ergastic substances and exudates of the plant.

The free hand sections were taken from the fixed specimen of the study plant are used for the present study.

Fluorescence Powder analysis: (Kokashi *et al.*, 1958).

Fluorescence powder analysis of leaf and stem were performed as per standard procedures (Kokashie *tal.*, 1958). A small quantity of the leaf powder was placed on the microscopic slide and 1-2 drops of freshly prepared reagents was added, mixed by gently tilting of the slide and waited for few minutes. Then the slide were placed in normal light, white light, and in the UV chamber (256 nm) were observed to determine the fluorescence characters and details of foreign particles/objects present in the powder.

Ash test: (Madhubala and Shanthi 2019).

The 3g of powder material was accurately weighed and placed in crucible. The material was spread in even layer at the temperature of 550°C until it was white indicating the absence of carbon.

Determination of water soluble ash:

The residual ash was allowed to cool, weighed ash material was washed with distilled water and filtered by Whatman filter paper and then it is dried.

Determination of alcohol soluble ash:

The dried powder is then filtered using concentrated hydrochloric acid and the substance that can extract from the acids are removed for the further process for the indication of heavy metals.

Gas chromatography (GC) and mass spectrometry (MS) analysis:

The chemical composition of the methanolic leaf extract of *E.ovalifolia* was analysed by GC-MS. The analytical work was carried using thermo GC-turbo mass version 5.4.2 coupled with thermo: MS DSQ11 instrument. The Clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethyl polysiloxane, 30 m × 0.25 mm ID × 250µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 mL/min. The injector temperature was set at 260°C during the chromatographic run. The 1µL of extract sample injected into the instrument the oven temperature was as follows: 60 °C (2 min); followed by 300 °C at the rate of 10 °C min⁻¹; and 300 °C, where it was held for 6 min. The mass detector conditions were: transfer line temperature 240 °C; ion source temperature 240 °C; and ionization mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST (2008) library.

RESULTS AND DISCUSSION

The pharmacognostical studies on medicinal plant considered to be more important to authenticate the species before preparing the herbal formulation. The present study was carried out on important tropical medicinal plant *Ehretia ovalifolia* of Boraginaceae. The morphological features of the study plant was observed as 23cm of GBH, Leaf surface area with 6.5 cm, Petiole length of 1.7 cm and internode length of about 0.4 cm and the veins of about 5-8 pairs in alternate pattern where tabulated in the Table: 2. The morphological features are very fundamental in all other activities regarding photosynthetic efficiency, Physiological perfection, The Table refers about powder characters and it is referred as organoleptic characters of the plant. This is first important characterisation made in pharmacognostical studies. The stem powders appeared generally as standard brown in colours since it is rich in tannins and have characteristic odour with bitter taste and have a coarse texture. Similarly, the leaf powder will be very fine in nature since there will be absence of fibres. The type of fruit is berry type and no. of seeds per fruit is 4 and weight per 10 seeds is observed as 1.6 g. The powder samples of stem were treated with some selected chemicals





like strong acids, strong bases, weak acids, and weak bases and with solvents. The stem powders when treated with KOH appeared to be yellowish green to brownish green in ordinary light sources and UV light source. The stem powder when added with FeCl₃ the powder appeared to be in Dark green in normal light sources and it was appeared to blackish green in UV light sources. When the stem powder was treated with normal distilled water it appeared as dark brown from light brown in colour. The concentrated sulphuric acid also changes the powder completely to black in colour. The importance of pharmacognostical evaluation gains its importance to authenticate the species before using it for making formulations (Pooja Sharma *et al.*, 2021).

The leaf powder of the study plant *Ehretia ovalifolia* showed characteristic change in appearance in various light sources. The powders when treated with Conc. HNO₃ it appears as deep brown which resemble the coffee brown in colour and in UV light sources it appeared as reddish brown in colour. The characteristic change was observed in by adding the KCL the colour appeared as reddish brown in colour in UV light sources. The powders treated with various solvents showed some changes and turns in reddish brown from green. The powder not reacted with water and remained as such. Hence drug manufacture and herbal formulation may be carried out using water in various forms. The results of qualitative phytochemical analysis were made on both stem and leaf powders with chloroform and methanol extract. Comparatively the methanol extract exhibited presence of major phytochemicals except steroids and glycosides. The phenolic and tannin compounds present comparatively more abundant than other phytochemicals. Similarly, the leaf extract also exhibited the presence of important phytochemicals except glycosides and flavonoids. The leaf also exhibited the presence of phenols and tannins. The other important phytochemicals also showed its presence in methanol extract. The above studies clearly suggests that the phytochemicals found to be more in the plant hence the study plant may use to prepare the medicines (Table: 7 and 8). The similar results were also proposed by many workers. The presence of polyphenols compounds may be responsible for antioxidants (Shahidi and Wanasundra, 1992). Similar to the above studies the presence of flavonoids was reported in methanol extract in the plant parts which is responsible for many important biological effects such as antioxidant, anti-inflammatory, hepatoprotective, antiulcer, antiallergic, antiviral and anticancer activities (Umamaheswari and Chatterjee, 2008).

The ash values of the *E.ovalifolia* nutrition qualities and to understand the presence of foreign particles. The ash values result clearly exhibited that leaf has more ash values with Total ash value was 17.6% but in stem only 8% of ash value has been observed. The lowest acid soluble ash values were observed with 0.7% and leaf 8.7% (Table: 9). The GCMS analysis of methanolic leaf extract showed the presence of important 6 compounds and its IUPAC names with molecular weight and Area % was found to be present. The medicinally important compound Ethyl alpha – D Glucopyranoside had 13.581 area percentage at 16.579 RT value. The compound used as anti-inflammatory was found to be present with area percentage of 6.951 at RT value of 2.984. The two medicinally important compounds having potential anti-cancer activity called pyridine was found to be at RT value 2.984 and high antioxidant compound N- Hexadecanoic acid at 20.02 of RT value with area percentage of 6.951 and 5.088 were observed receptively. Comparatively, the above compounds are found to be lesser but the compounds are medicinally more important were reported in the study plant species *Ehretia ovalifolia*. The above GCMS analysis clearly exhibited the presence of medicinally important phytochemicals. Many volatile compounds are reported previously by many workers similar to that of the results the aromatic phytoconstituents and its importance were clearly explained by the (Akitayo *et al.*, 2016)

SUMMARY AND CONCLUSION

The present study clearly exhibits that pharmacognostical properties of the plant *Ehretia ovalifolia*. The genus *Ehretia* a well-adapted plant species of Boraginaceae where the plant can found only at typical dry deciduous forest as influenced by heavy monsoon rain. The poor regeneration capacity of the plant, fruit formation and seed setting habit of the plant leads to have very poor population in natural habitat. The present study clearly gives an idea on morphological nature of the plant, Phytochemical profile, pharmacognostical characters and GCMS analysis made to



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understand the plant in various criteria. The present study helps to avoid unnecessary adulteration and misguiding or mismatching species to be added in the important medicinal formulation made in the indigenous system of medicine.

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Table.1: Showing the organoleptic characters of the study plant *Ehretia ovalifolia*

S.No	Part	Colour	Odour	Taste	Texture
1.	Stem	Brown	characteristic	Bitter	Coarse
	Leaf	Green	characteristic	Bitter	Fine

Table.2: Showing the results of Morphological parameters of the study plant *Ehretia ovalifolia*

S.No.	GBH (cm)	Leaf length (cm)	Petiole length (cm)	Internode Length (cm)	Veins	No. of seeds /Fruit(Berry)
1.	23	6.5	1.7	0.4	5-8 pairs	4

Table.3: Showing the characters of stem powder of the study plant *Ehretia ovalifolia*

S.NO	Treatment	Light	White light	UV Light (256 nm)
1	Powder + Con.HCL	Brown	Muddy Brown	Dark Brown
2	Powder + Dil.HCL	Light Brown	Muddy Brown	Brown
3	Powder + Con.H ₂ SO ₄	Black	Reddish Brown	Black
4	Powder + Dil.H ₂ SO ₄	Muddy Brown	Muddy Brown	Muddy Brown
5	Powder + Con.HNO ₃	Reddish Brown	Reddish Brown	Dark Brown
6	Powder + Dil.HNO ₃	Light Brown	Light Brown	Muddy Brown
7	Powder + CH ₃ COOH	Light Brown	Dark Brown	Deep Brown
8	Powder + NaOH	Dark Brown	Dark Brown	Black
9	Powder + KOH	Yellowish Brown	Yellow	Brownish Green



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10	Powder + FeCl ₃	Dark Green	Dark Green	Black
11	Powder + KCl	Muddy Brown	Light Brown	Brown
12	Powder + Acetone	Muddy Brown	Light Brown	Dark Brown
13	Powder + Pet Ether	Light Brown	Muddy Brown	Brown
14	Powder + Chloroform	Brown	Light Brown	Muddy Brown
15	Powder + Ethanol	Light Brown	Light Brown	Muddy Brown
16	Powder + Methanol	Muddy Brown	Dark Brown	Light Brown
17	Powder + Water	Light Brown	Light Brown	Dark Brown

Table.4: Showing the characters of leaf powder of the study plant *Ehretia ovalifolia*

S.NO	Treatment	Light	White Light	UV Light (256 nm)
1	Powder + Con.HCL	Green	Green	Black
2	Powder + Dil.HCL	Dark Green	Dark Green	Dark Green
3	Powder + Con.H ₂ SO ₄	Black	Dark Green	Black
4	Powder + Dil.H ₂ SO ₄	Dark Green	Light Green	Dark Green
5	Powder + Con.HNO ₃	Coffee Brown	Brown	Reddish Brown
6	Powder + Dil.HNO ₃	Dark Green	Light Green	Dark Green
7	Powder + CH ₃ COOH	Deep Green	Green	Black
8	Powder + NaOH	Green	Dark Green	Black
9	Powder + KOH	Green	Blackish Green	Black
10	Powder + FeCl ₃	Green	Blackish Green	Black
11	Powder + KCl	Dark Green	Dark Green	Reddish Brown
12	Powder + Acetone	Dark Green	Brown	Black
13	Powder + Pet Ether	Dark Green	Black	Green
14	Powder + Chloroform	Dark Green	Deep Green	Dark Black
15	Powder + Ethanol	Dark Green	Deep Green	Reddish Black
16	Powder + Methanol	Dark Green	Black	Black
17	Powder + Water	Dark Green	Light Green	Dark Green

Table.5: The Qualitative phytochemical analysis of the stem and leaves of study plant *Ehretia ovalifolia* using chloroform and methanol extract.

S.NO	Phytochemical Compounds	Stem		Leaf	
		Chloroform	Methanol	Chloroform	Methanol
1.	Alkaloids	+	+	+	+
2.	Steroids	-	-	-	+
3.	Saponins	+	+	+	+
4.	Terpenoids	+	+	-	+
5.	Coumarins	-	+	+	+
6.	Glycosides	-	-	+	-
7.	Flavonoids	+	+	+	+
8.	Phenols	+	+	+	+
9.	Tannins	+	+	-	-



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S.No	RT	Compound name	Mol wt.	Molecular formula	Area %	CAS.No	Medicinal Properties
1	2.984	Pyridine	79	C ₅ H ₅ N	6.951	110-86-1	Anticancer, antimicrobial
2	15.759	Diethyl phthalate	222	C ₁₂ H ₁₄ O ₄	10.001	84-66-2	-
3	16.579	Ethyl. alpha. -d-glucopyranoside	208	C ₈ H ₁₆ O ₆	13.581	900127-29-4	Anti-inflammatory
4	20.02	n-Hexadecanoic acid	256	C ₁₆ H ₃₂ O ₂	5.088	57-10-3	Anti-inflammatory, antioxidant
5	25.347	1,2-Benzenedicarboxylic acid, mono(2-ethylhexyl) ester	278	C ₁₆ H ₂₂ O ₄	38.279	4376-20-9	-
6	27.083	3,4-Secodammar-4(28)-en-3-oic-acid, 20,24-epoxy-25-hydroxy-, (24s)-	474	C ₃₀ H ₅₀ O ₄	26.101	56421-13-7	-

Table.7: The ash content of the study plant *Ehretia ovalifolia*

S.NO.	Ash type	% of Ash content	
		Stem	Leaf
1	Total ash value of powder	8	17.6
2	Water soluble ash	6.67	17
3	Acid soluble ash	0.7	8.7



Phytochemical Screening, GC-MS Analysis of Methanolic Extract of the Fern *Adiantum Caudatum* from Southern Western Ghats

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Abstract

The present study was to screen the presence of phytochemicals in the methanol extract of fern *Adiantum caudatum* species by composed with qualitative and quantitative screening methods. In qualitative analysis, the presence of pharmacologically active phytochemicals such as alkaloids, flavonoids, glycosides, steroids, tannins, terpenoids, saponins, phenols, volatile oils and resins were screened. GC-MS chromatogram analysis of the methanolic extract of *Adiantum caudatum* showed 12 peaks corresponding to 12 different compounds. The percentage of major bioactive compounds were 2-Hydroxymethyl-9-[Beta.-D-Ribofuranosyl] Hypoxanthine (17.995%), 2-Undecene,5-methyl- (33.497%), Penta-decane,2,6,10,14-Tetramethyl- (14.977%), Nonadecane (7.588%), Dodecane, 2,6,10-trimethyl- (1.421%), 3,7,11,15-Tetramethyl-2-Hexadecen-1-ol (2.825%), Nonadecane (7.855%). The identification of bioactive compounds is based on the retention time, peak area, molecular formula, and probability.

Keywords: Phytochemicals, Qualitative, *Adiantum Caudatum*, Methanol and GC-MS.

1. Introduction

It is impossible to imagine the survival of human race if the earth had no plants on it. The dependence of human beings on plants dates to the start of the human race. Medicinal plants are common sources of medicine. Solid evidences can be cited in favor of herbs being used for the treatment of diseases and for restoring and fortifying body systems in ancient systems of medicine such as Ayurvedic, Unani and Chinese traditional medicine. The innately desired purpose of the use of herbs was to obtain a positive interaction with body chemistry [01].

Traditional medicinal information is important not only for its potential contribution to the drug development as well as people's healthcare. According to the World Health Organization 80% of the world's population mostly individuals of developing countries depend on plant-derived medicines for their healthcare needs. Most of the aboriginal people are not well identified about the uses of Pteridophytes ever since it's not simply available like flowering plants. Pteridophytes are represented by 144 genera and about 1200 species distributed in India [02]. Pteridophytes are regarded as a facultative wetland plant and which can also adopt well in terrestrial habitat. They have a vital role in the earth's biodiversity [03].

Ferns have measurable indications that may reflect the effects of change in environmental factors. The ferns are not

only taxonomic oddities but those are plants with dynamic relationship to their environment [04]. Pteridophytes are of immense economic importance and there is a great need for their exploitation towards the economic utility in daily life [05]. Since prehistoric times, plants have been used as a source of treatment. The use of traditional medicine is increasing day by day due to high cost of the allopathic medicines and their potential side effects [06]. Several plants or their parts have been exploited for this purpose. The value of these plants is attributed to the presence of some chemical substances, which produce a definite physiological action. These chemical constituents. These non-nutritive plant chemicals have protective or disease preventive properties. They are nonessential nutrients, meaning that they are not required by the human body for sustaining life. It is well-known that plant produces these chemicals to protect them, but recent research demonstrates that they can also protect humans against diseases [07].

Considering the rich diversity of Indian medicinal plants including pteridophytes, it is expected that, the screening of plant extract for antibacterial activity may be beneficial for humans and plants diseases. The synergistic interaction among crude extracts or the active compounds may be useful in the preparation of improved herbal or drug formulations. The extensive survey of antibiotic activity among the ferns conducted and reported about a hundred species having such property. Traditionally people

used pteridophytes as medicine and antibacterial agents [08].

Since bioactive compounds occurring in plant material consist of multi-component mixtures, their separations and determination still creates problems. Practically most of them have to be purified by the combinations of several chromatographic techniques and various other purification methods to isolate bioactive compounds. Though, lot of studies have focused on the medicinal properties of Angiosperms, information on the medicinal potentialities of the pteridophytes are limited [09-12]. The present study focuses on the phytochemical screening and GC-MS analysis of the fern *Adiantum caudatum* L. a small fern belongs to the family Pteridaceae.

2. Materials and Methods

Collection and preparation of plant materials: The fern, *Adiantum caudatum* for the proposed study was collected from different areas in Valparai (latitude: 10°22'12"N and longitude: 76°58'12"E, 1050 m.a.s.l.), Coimbatore district, Tamil Nadu, India. The fronds of selected fern used for phytochemical screening were washed multiple times with tap water and further with distilled water to remove fine impurities. Leaves were shade-dried for 30 days to remove all the moisture content and to preserve maximum of the bioactive compounds. The dried fronds were cut down into small pieces of size up to 1-2 cm. The cut down parts were crushed using a laboratory blender and then sieved through a mesh size of 3 mm in order to remove the coarse materials. The fine powder was then packed in an airtight container, labelled and stored for further studies.

2.1 Extract Preparation: Organic solvent, Methanol was used to extract the powder sample of *Adiantum caudatum* according to the method described by [13]. The sample was extracted using a soxhlet apparatus at a temperature (40-50°C) and was subjected to detect the presence of different phytoconstituents.

2.2 Qualitative estimation of methanol extract: The tests performed for the phytochemical screening were alkaloids, glycosides, phenols, tannins, flavonoids, saponins, volatile oils, terpenoids, resins, steroids, anthraquinones.

• Tests for alkaloids

Mayer's test: To 1ml of extract, 2ml of Mayer's reagent is added. Formation of dull white precipitate indicates the presence of alkaloids [14].

• Tests for glycosides

Borntrager's test: To 1ml of extract, 1ml of benzene and 0.5ml of dilute ammonia solution were added. A reddish pink color indicates the presence of glycosides [13].

• Test for Phenols

To 1 ml of the extract, 2 ml of distilled water followed by 0.5 ml of sodium carbonate and 0.5 ml of Folin Ciocalteu's reagent were added. Formation of blue / green colour indicates the presence of phenols [15].

• Test for Tannin

To 4 ml of extract, 4 ml of FeCl₃ was added. Formation of green colour indicates the presence of tannin [16].

• Tests for flavonoids

To 3 ml of the extract, 4 ml of 1N NaOH was mixed in a test tube. Formation of dark yellow colour was observed which indicates the presence of flavonoids [15].

• Tests for saponins

Foam test: 1ml of extract was shaken vigorously with 20ml of distilled water for 5- 10 minutes in graduated cylinders. Formation of one-centimeter layer of foam indicates the presence of saponins

• Test for volatile oils

NaOH-HCl test: 2ml of extract solution was shaken with 0.1ml of dilute sodium hydroxide and a small quantity of dilute HCl. A white precipitate was formed with volatile oils, which confirms the presence of volatile oil.

• Tests for terpenoids

Trichloroacetic acid test: To 1ml of extract, 2ml of trichloroacetic acid was added. Formation of green coloured precipitate showed the presence of terpenoids.

• Tests for resins

Turbidity test: To 2 ml of extract 5 ml of distilled water was added. The occurrence of turbidity showed the presence of resins [14].

• Test for steroid

1ml extract was dissolved in 10 ml of chloroform & equal volume of concentrated H₂SO₄ was added from the side of test tube. The upper layer turns red and H₂SO₄ layer showed yellow with green fluorescence. This indicates the presence of steroid.

• Test for Anthraquinones

To 2 ml of extract, 3ml benzene was treated with 10% NH₃. Formation of violet colour indicates the presence of anthraquinones [16].

GC-MS Analysis of the Methanolic Extract of *Adiantum Caudatum*

Gas Chromatography (GC) analysis was carried at Vellore Institute of Technology (VIT), Chennai. It is one of the key techniques generally used for the screening/ identified of many groups of the plant phytochemicals. The high attainable separation power in combination with wide range of the detectors employing various detection principles to which it can be coupled makes GC an important, often irreplaceable tool in the analysis at trace level of plant phytochemical compounds. Gas Chromatographical study includes the important optimization process such as introduction of the sample extract onto the GC column, Separation of its components on an analytical column and detection of target analysis by using Mass Spectrometric (MS) detector.

The Clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5 % biphenyl 95 % dimethylpolysiloxane, 30 m × 0.25 mm ID × 250 µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 ml/min. The injector temperature was set at 260°C during the chromatographic run. The 1µL of extract sample injected into the instrument the oven temperature was as follows: 60°C (2min); followed by 300°C at the rate of 10°C min⁻¹; and 300°C, where it was held for 6m in. The mass detector conditions were: transfer line temperature 240°C; ion

source temperature 240°C; and ionization mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments size ranges from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST (2008) library.

The chemical composition of the *Adiantum caudatum* was analysed by GC/MS. Analysis of the *Adiantum caudatum* extract was carried out using therom GC-turbomass version 5.4.2. couple with therom MS DSQ11 instrument. The clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethylpolysiloxane, 30m×0.25mm ID×250µm df) and the components were separated using the helium as carrier gas at a constant flow of 1ml/min. The injector temperature was set at 260°C during the chromatographic run. The 1µl of extract sample injected into the instrument the oven temperature was as follows: 60/°C(2min); followed by 300°C at

the rate of 10°C min⁻¹; and 300° C, where it was held for 6 min. The mass detector conditions were transfer line temperature 240°C; ionisation mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST Library.

3. Results and Discussion

Qualitative estimation of methanol extract: The study was undertaken to evaluate the phytochemical constituents of the selected leaf extract to confirm the presence of bioactive compounds. The polar solvent methanol exhibited the presence of major phytochemicals such as alkaloid, resin, saponin, steroid, phenol, tannin and flavonoids. The preliminary phytochemicals of *Adiantum caudatum* was recorded and tabulated

Phytochemicals	<i>Adiantum caudatum</i>
Alkaloids	+
Volatile oils	-
Glycoside	-
Phenol	+
Tannin	+
Saponin	+
Terpenoids	-
Resins	+
Flavonoids	+
Steroids	+
Anthroquinones	-

Table 1.1 Qualitative Estimation of *Adiantum Caudatum* using the Methanolic Extract

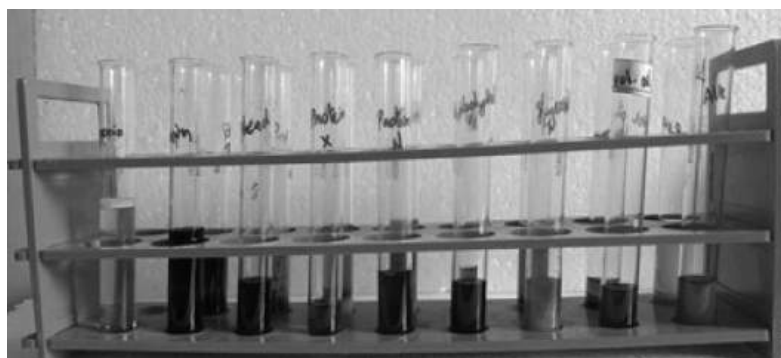


Figure 4.1: Qualitative estimation of *Adiantum Caudatum*

GC-MS Analysis of Methanolic leaf Extract of *Adiantum Caudatum*

GC-MS chromatogram analysis of the methanolic extract of *Adiantum caudatum* showed 12 peaks corresponding to 10

different compounds given in fig.4.2. Different compounds were identified by considering the retention time, molecular weight and formula, peak area percentage obtained in the chromatogram were tabulated and shown [17, 18].

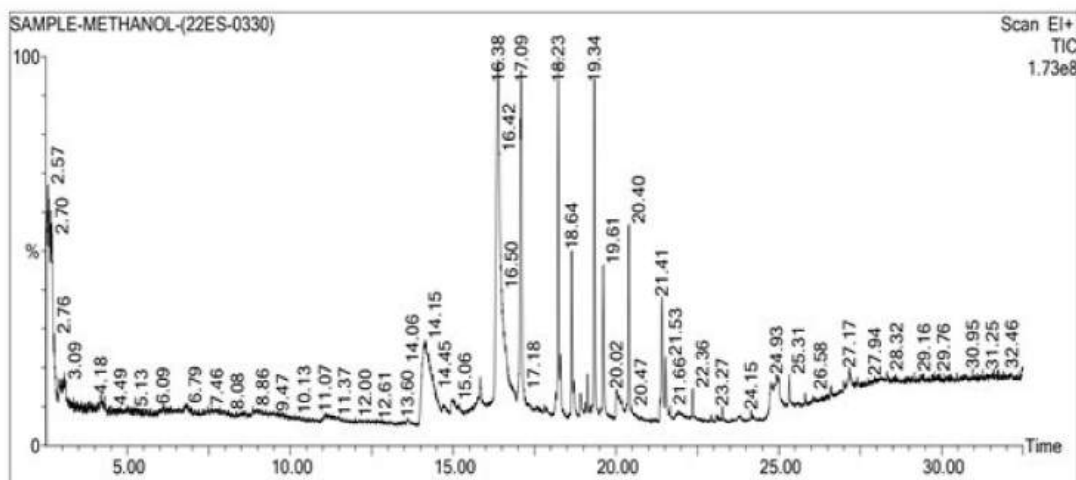


Figure 1.2: GC-MS analysis of methanolic leaf extract of *Adiantum caudatum*

RT	Compound name	Compound Structure	Molecular formula	Area %	Biological role
14.148	2-Hydroxymethyl-9-[.Beta.-D-Ribofuranosyl] Hypoxanthine	298	$C_{11}H_{14}O_6N_4$	17.995	-
16.389	2-Undecene,5-methyl-	168	$C_{12}H_{24}$	33.497	-
17.094	Pentadecane,2,6,10,14-Tetramethyl-	268	$C_{19}H_{40}$	14.977	Pathogenesis of rheumatoid arthritis and lupus.
18.230	Nonadecane	268	$C_{19}H_{40}$	7.588	Plant metabolite, volatile oil component.
18.305	Dodecane,2,6,10-trimethyl-	212	$C_{15}H_{32}$	1.421	-
18.645	3,7,11,15-Tetramethyl-2-Hexadecen-1-ol	296	$C_{20}H_{40}O$	2.825	Antimicrobial, anti inflammatory, anti diuretic, anticancerous.
19.340	Nonadecane	268	$C_{19}H_{40}$	7.855	Plant metabolite, volatile oil component.
19.610	Pentadecanoic acid,14-methyl-,methyl ester	270	$C_{17}H_{34}O_2$	3.556	Biomarker for mammalian metabolism
20.020	1,6;3,4-Dianhydro-2-deoxy-.beta.-d-lyxo-hexopyranose	128	$C_6H_8O_3$	1.541	-
20.395	Nonadecane	268	$C_{19}H_{40}$	3.948	Plant metabolite, volatile oil component.
21.411	7-Hexadecenal,(Z)-	238	$C_{16}H_{30}O$	3.449	Antiviral activity, organic fertilizer
21.526	Phytol	296	$C_{20}H_{40}O$	1.347	Cholinesterse inhibitory activity.
24.867	2-Isopropyl-5-Methylcyclohexyl 3-(1-(4-Chlorophenyl)-3-Oxobutyl)-C	524	$C_{30}H_{33}O_6Cl$		-

Table 1.2: Compounds identified in the GC-MS analysis of methanolic extract of *A. caudatum*

4. Conclusion

The present study was proposed to investigate the secondary

metabolites of *Adiantum caudatum*, a small sized fern which belongs to the family Pteridaceae. The Fronds of *A. caudatum*

were analysed for the presence of phytochemicals. Preliminary phytochemical screening reported the presence of alkaloid, resin, saponin, steroid, phenol, tannins and flavonoids in methanolic extract. GC-MS analysis of methanol extract revealed the presence of bioactive compounds such as 2-Hydroxymethyl-9-[. Beta.-D-Ribofuranosyl] Hypoxanthine (17.995%), 2-Undecene,5-methyl- (33.497%), Pentadecane,2,6,10,14-Tetramethyl- (14.977%), Nonadecane (7.588%), Dodecane, 2,6,10-trimethyl- (1.421%), 3,7,11,15-Tetramethyl-2-Hexadecen-1-ol (2.825%), Nonadecane (7.855%). Most of the compounds present showed the antimicrobial properties. Hence, further studies may conduct on the antimicrobial activity against harmful pathogens.

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Eco-Friendly Dyeing of Cotton Fabric from Aqueous Herbal Extracts and its Antibacterial Activity

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ABSTRACT

Natural dyes are found to be environmentally friendly and possess many advantages over their synthetic counterparts. Among various clothing, cotton may act as a nutrient, becoming a suitable medium for bacterial and fungal growth. Therefore, an attempt has been made to study the dyeing capacity and antibacterial activity of some plants like *Ocimum sanctum*, *Acalypha indica*, *Phyllanthus reticulatus*, *Impatiens balsamia* and *Clitoria ternatea* and the mordant used were *Terminalia chebula* and *Acacia sinuate* on cotton fabric. The work comprises the preparation of dye and mordant from the parts of different plants by means of aqueous extraction. The dyeing ability of *A. indica*, *O. sanctum*, *P. reticulatus*, *C. Ternatea* and *I. Balsamia* showed good results when the mordant *T. chebula* was used. Among the fabricated clothes, *O. sanctum* and *A. Indica* showed good antibacterial activity with the zone of inhibition 1.00 mm, 0.5 mm respectively. It can be inferred from this study that the naturally dyed clothes showed high compatibility with the environment, softer colour shades, naturalness, cost effective and antibacterial activity.

Keywords: Dye, Mordant, Fabrication, Antibacterial, Gram positive and Gram negative





INTRODUCTION

Medicinal plants are part and parcel of human society to combat diseases, from the dawn of civilization (Chaudhary *et al.*, 2010). Extracts of medicinal plants can be obtained from plant parts such as roots, berries, bark, leaves and wood. Many natural plant extracts have antimicrobial activity and wound healing properties. Antimicrobial agents either inhibit the growth (-static) or kill (-cidal) the microorganisms. The art of making natural dyes is one of the oldest practices and dates back to the dawn of civilization which does not cause any kind of pollution (Kannanmarikani *et al.*, 2015). Because of the excellent antimicrobial and eco-friendly dyeing properties exhibited by the plant extracts, these are used as textile finishing agents (Sarojyadav and Neelam M Rose, 2020). In India, there are more than 450 plants that can yield dyes. Clothing is our necessary thing which should be free from microbes to avoid many life threatening diseases. Over the last few decades, considerable research effort was made to produce antibacterial coatings on the surfaces of various objects such as garments and medical devices (Danese, 2002 and Lewis *et al.*, 2005). The current interest is to develop efficient, non-toxic, durable and cost effective antimicrobial finishing clothes with increased applications in medical, health care, hygienic products as well as protective cloth materials (Czajka, 2005 and Molloy *et al.*, 2008).

Cotton fibres are particularly suitable for manufacturing textiles for sports, non-implantable medical products and health care/hygienic products (Czajka, 2005). However the ability of cotton fibres to absorb large amount of moisture and act as nutrient which makes them more prone to microbial attack under certain conditions of humidity and temperature. (Gao *et al.*, 2008 and Gorensek *et al.*, 2007). Therefore, cotton fibres are treated with numerous chemicals to get better antimicrobial cotton textiles (Son *et al.*, 2006 and Tarimala *et al.*, 2006). Plant based antimicrobial compounds have great therapeutic potential as they have lesser side effects as compared with synthetic drugs and also little chance of development of resistance. Therefore, the present study has been carried out to investigate the dyeing capacity and antimicrobial activity of some medicinally important plants viz., *Ocimum sanctum*, *Acalypha indica*, *Phyllanthus reticulatus*, *Impatiens balsamina* and *Clitoria ternatea*.

MATERIALS AND METHODS

Mordant Selection and Preparation

Seeds of *Terminalia chebula* L. (Combretaceae) and *Acacia sinuate* (Lour.) Merr. (Fabaceae) (Fig.1) were selected for the present study which was used as mordant. The selected mordants were bought from herbal medicine shop in Pollachi. 50 grams of seed powder was added in 500 ml of water and allowed to boil for an hour. Then it was filtered, dried and stored for further use.

Collection of Plant Samples for Natural Dye Preparation

The leaf powder of *Ocimum santum* (Lamiaceae) and *Acalypha indica* L. (Euphorbiaceae) (Fig.2), fresh flowers of *Impatiens balsamia* L. (Balsamiaceae) and *Clitoria ternatea* (Fabaceae), fresh fruits of *Phyllanthus reticulatus* Poir. (Phyllanthaceae) were chosen for the present study due to its high dye yielding capacity and antimicrobial property.

Natural Dye Extraction

The collected leaf samples were shade dried and finely powdered using mixer grinder. 20 grams of the powdered sample was mixed with 200ml of water and boiled for an hour. The fresh flower and fruit samples were grinded by adding water in pestle and mortar and filtered using cotton cloth. The filtrates were stored for further use.

Preparation of Cotton Fabric

Pure and sterile cotton clothes (5x5cm) were used as substrate and soaked in both mordants separately for 7 hours. Dried cotton clothes were dyed with natural extract obtained from *Ocimum sanctum*, *Acalypha indica*, *Phyllanthus reticulatus*, *Impatiens balsamia* and *Clitoria ternatea*. The dye ability of soaked cloth was studied by increasing the time from 0 hour to seven hours.





Antibacterial Activity

The effectiveness of dyed clothes were tested for antibacterial activity against gram negative *Escherichia coli* and gram positive *Staphylococcus aureus*. Parallel streak method was adopted for the present study which is a qualitative test used to detect diffusible bacteriostatic activity on textile material. Muller-Hinton agar medium was used for parallel streak method.

RESULTS AND DISCUSSION

The naturally dyed cotton fabrics showed good dyeing ability at different time intervals (Fig.3). After washing the dyed fabric using mild detergent, it was subjected to antibacterial activity. A good antibacterial activity was shown by *Ocimum sanctum* dye with the zone of inhibition 1.0 mm and *Acalypha indica* dye with the zone of inhibition 0.5 mm when used *Terminalia chebula* as mordant. The flowers of *Impatiens balsamia* and *Clitoria ternatea* and fruits of *Phyllanthus reticulatus* showed less antibacterial activity (Fig.4). Hence from the present study, it is suggested that antibacterial activity was found in naturally extracted plant dyed cotton cloth. The raw materials for making this eco friendly dye are cheaper when compared to other chemicals, so the commercial production must be encouraged at industrial level. The extract of *Acalypha indica* showed good dyeing ability and exhibit effective antibacterial activity on five antibacterial pathogens (Saravanan, et al., 2013). Senthilkumar and Karthi (2018) studied the antibacterial activity on two pathogens such as *Escherichia coli* and *Staphylococcus aureus* and the zone of inhibition is 26 and 27 mm respectively. Sumithra (2017) reported the aqueous extract of *Tribulus terrestris* and *Leucas aspara* showed zero antibacterial activity. But, our present study showed antibacterial activity for *Ocimum sanctum* and *Acalypha indica* for aqueous extraction.

CONCLUSION

In the present study, Eco-friendly natural dyes were prepared from leaves of *Ocimum santum* (Lamiaceae) and *Acalypha indica* L. (Euphorbiaceae), flowers of *Impatiens balsamia* L. (Balsamiaceae) and *Clitoria ternatea* (Fabaceae), fruits of *Phyllanthus reticulatus* Poir. (Phyllanthaceae). In which, *Ocimum sanctum* dyed cotton fabrics showed high antibacterial activity when compared to dyed cotton fabrics. It can be inferred from this study that the naturally dyed clothes showed high compatibility with environment, softer color shades, naturalness, lower toxicity, cost effective and antibacterial properties.

Conflict of Interest

Authors have no conflict of interest.

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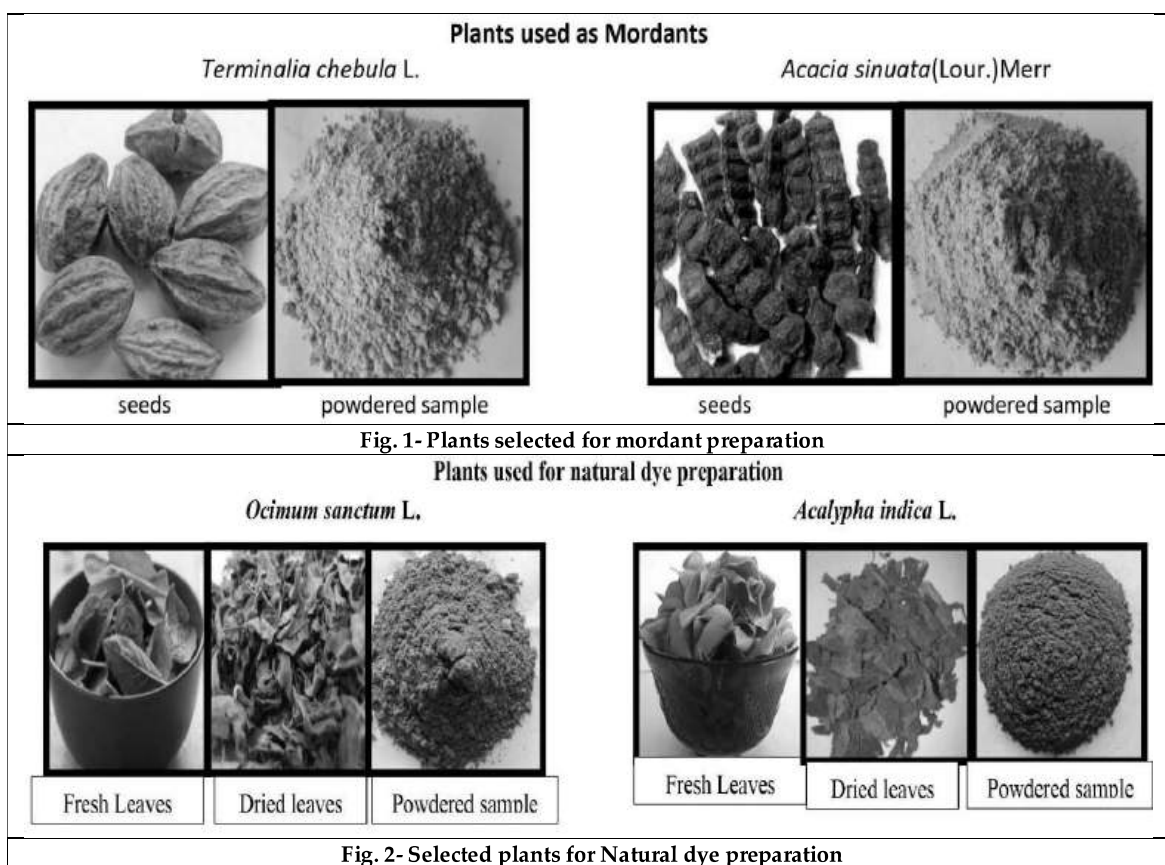
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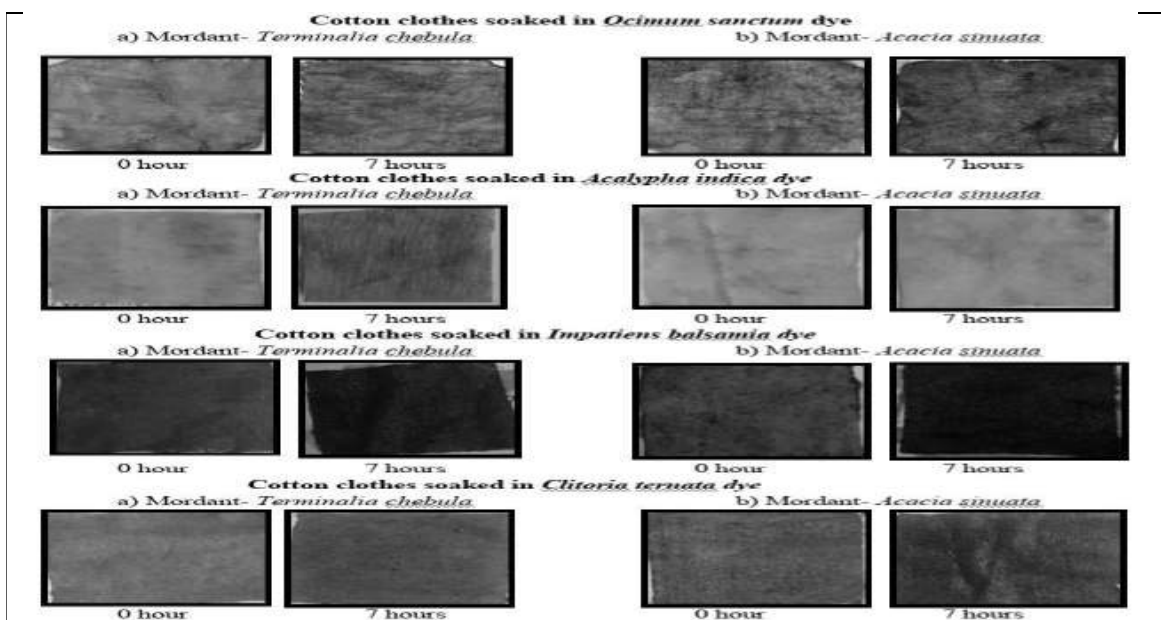


Fig. 3- Soaked cotton clothes in different natural dyes

Sample description	Zone of inhibition - Diameter in mm	
	<i>Staphylococcus aureus</i>	<i>Escherichia coli</i>
<i>Ocimum sanctum</i> Mordant- <i>Terminalia chebula</i>	B-1.0 mm; A-1.0 mm 	B-No zone; A-<0.5mm
<i>Ocimum sanctum</i> Mordant- <i>Acacia sinuata</i>	B & A - No zone 	B-No zone; A-<0.5mm
<i>Phyllanthus reticulatus</i> Mordant- <i>Terminalia chebula</i> Water Ground- Before & After	B & A - 0.5 mm 	B-No zone; A-<0.5mm
<i>Phyllanthus reticulatus</i> Mordant- <i>Terminalia chebula</i> Cloth Boiled- Before & After	B & A - No zone 	B-No zone; A-<0.5mm
<i>Phyllanthus reticulatus</i> Mordant- <i>Acacia sinuata</i> Cloth Dipped- Before & After	B & A - No zone 	B & A - No zone
<i>Acalypha indica</i> Mordant- <i>Terminalia chebula</i> Cloth Dipped- Before & After	B & A - 0.5 mm 	B- <0.5mm; A- 0.5mm
<i>Acalypha indica</i> Mordant- <i>Acacia sinuata</i> Cloth Dipped- Before & After	B & A - 0.5 mm 	B- <0.5mm; A- 0.5mm
<i>Impatiens balsamina</i> Mordant- <i>Terminalia chebula</i> Sample Ground- Before & After	B & A - 0.5 mm 	B- <0.5mm; A- No zone
<i>Impatiens balsamina</i> Mordant- <i>Acacia sinuata</i> Sample Boiled- Before & After	B & A - No zone 	B & A - No zone

Fig. 4- Antibacterial activity of soaked cotton clothes





Qualitative and Quantitative Analysis of the Unexplored fern, *Thelypteris meeboldii* from Southern Western Ghats, Tamil Nadu

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ABSTRACT

The present study was to screen the presence of phytochemicals in the petroleum ether, chloroform, ethyl acetate and methanol of fern *Thelypteris meeboldii* species by composed with qualitative and quantitative screening methods. In qualitative analysis, the presence of pharmacologically active phytochemicals such as alkaloids, flavonoids, glycosides, steroids, tannins, terpenoids, saponins, phenols, volatile oils and resins were screened. The methanol fern extract performed well to show positivity rather than other studied fern extracts. Methanol extract showed strong positivity for 6 phytochemicals out of 10 phytochemicals tested. In quantitative analysis the important secondary metabolites such as total phenols, total tannins, total alkaloids, total flavonoids, total saponins and total terpenoids content were quantified.

Keywords: phytochemicals, qualitative, quantitative, *Thelypteris meeboldii*, methanol.





INTRODUCTION

Pteridophytes are an old class of non-seed-bearing plants that are considered to be important in biogeography due to the abundance of extinct and endemic taxa they include. The pteridophytes are typically found in a latitudinal gradient, with the largest diversity occurring primarily in mountainous regions of the tropics (Kornas, 1993). They have a small distribution in temperate zones and are mostly found in tropical and subtropical climates (Pallavi *et al.*, 2011). Ferns have observable characteristics that could reveal how environmental changes have an impact on them. The ferns are plants with a dynamic link to their environment in addition to being taxonomically peculiar (Verma and Khullar, 2010). More than 2,000 years of human history have seen the use of plants as folk medicine and there is a wealth of literature on the therapeutic value of different fern species (Kirtikar and Basu, 1935; Nayar, 1957; Chopra *et al.*, 1958; Kumar and Roy, 1972; Watt, 1972). Seldom have systematic studies of fern's therapeutic uses been conducted that are not pharmacologically assessed (Kandhasamy *et al.*, 2008; Kaushik and Dhimian, 1995; Dixit and Bhatt, 1974; Manickam and Irudayaraj, 1992). There is a huge demand for exploitation of pteridophytes for their economic utility in day-to-day life because of their enormous economic importance (Benjamin and Manickam, 2007). Within the recent years, infections have increased to a great extent and the infection causing microbes developed resistance to therapeutics, such as antibiotics and antimicrobial drugs, has increased the demand for more effective antimicrobial agents. Various groups of medicinal plants have a potential to cure different disorders such as cuts, burns and skin diseases, which is due to their antimicrobial activities. The use of the extracts of these medicinal plants alone, or in combination with the available antibiotics, might contribute to more successful treatment of infections induced by multi drug resistant microorganisms. Recently, some fern species (Pteridophytes) have been identified to possess therapeutic potential, mainly due to the presence of various bioactive phytochemicals, such as phenolics and steroids (Ho *et al.*, 2010; Chai *et al.*, 2013; Antonysamy *et al.*, 2014, 2020). Therefore, it is of great interest to carry out a screening of the selected fern species in order to validate their use in folk medicine. Systematic screening of them may result in the discovery of novel active compounds.

MATERIALS AND METHODS

Collection and Identification of Plant materials

Healthy and matured plant material for the present study was collected from Valparai Hills, Western Ghats. The collected specimen was identified and authenticated by Dr. M. Johnson, Director, Centre for Biotechnology, St. Xavier's College, Palayamkottai, Trichy with reference no (CPB2095). The collected specimen was identified as *Thelypteris meeboldii* (Rosenst.) Holttum.

Preparation of sample

The fronds of selected fern used for phytochemical screening were washed multiple times with tap water and further with distilled water to remove fine impurities. Leaves were shade-dried for 30 days to remove all the moisture content and to preserve maximum of the bioactive compounds. The dried fronds were cut down into small pieces of size up to 1-2 cm. The cut down parts were crushed using a laboratory blender and then sieved through a mesh size of 3 mm in order to remove the coarse materials. The fine powder was then packed in an airtight container, labelled and stored for further studies.

Preparation of extract

Organic solvents in the increasing order of polarity (Petroleum ether, Chloroform, Ethyl acetate, Methanol) were used to extract the powder sample of *Thelypteris meeboldii* according to the method described by Harbone, 1998. The sample were sequentially extracted using a soxhlet apparatus at a temperature (40-50°C) and was subjected to detect the presence of different phyto constituents.



Sowmiya *et al.*,**Qualitative phytochemical screening**

Phytochemical screening of the extracts was carried out according to standard procedure. The Qualitative phytochemical analysis was carried out for the frond extract of *Thelypteris meeboldii* according to the polarity to identify the phytochemicals present in the different extracts. The tests performed were alkaloids, glycosides, volatile oils, steroids and resins (Shakoor *et al.*, 2013); phenols, flavonoids and saponins (Kalpana Devi *et al.*, 2014); tannins, anthraquinones and terpenoids (Shinde *et al.*, 2016).

Quantitative phytochemical screening

Alkaloids, Phenols, Tannins, Flavonoids, Saponins and Terpenoids reported in the methanolic extracts of *T.meeboldii* was quantified using the following standard procedures.

Determination of total alkaloids

5 g of the sample was weighed into a 250 ml beaker and 200 ml of 10% acetic acid in ethanol was added and covered and allowed to stand for 4 h. This was filtered and the extract was concentrated on a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitated was collected and washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed (Harborne 1973). Triplicate results were recorded.

Determination of total phenols

100 mg of the extract of the sample was weighed accurately and dissolved in 100 ml of triple distilled water (TDW). 1 ml of this solution was transferred to a test tube, then 0.5 ml 2N of the Folin-Ciocalteu reagent and 1.5 ml 20% of Na_2CO_3 solution was added and ultimately the volume was made up to 8 ml with TDW followed by vigorous shaking and finally allowed to stand for 2 hours after which the absorbance was taken at 765 nm. The results were expressed in mg of gallic acid equivalent (GAE) per g of dry weight of plant powders (Hagerman *et al.*, 2000).

Determination of total tannins

Tannin content of the methanol extract of the fern was estimated by following the standard procedure (Hagerman *et al.*, 2000; Fagbemi *et al.*, 2005). The 1 ml of methanol fern extract was mixed with Folin-Ciocalteu's reagent (0.5 ml), followed by the addition of saturated Na_2CO_3 solution (1 ml) and distilled water (8 ml). The reaction mixture was allowed to stand for 30 min at room temperature. The supernatant was obtained by centrifugation and absorbance was recorded at 725 nm using UV-Visible Spectrophotometer. Increasing concentrations of standard tannic acid was prepared and the absorbance of various tannic acid concentrations was plotted for a standard graph. The tannin content was expressed as mg tannic acid equivalent per 100 gram of the sample.

Determination of total flavonoids

The method is based on the formation of the flavonoids–aluminium complex which has an absorptivity maximum at 415 nm. 100 μl of the plant extracts in methanol (10 mg/ml) was mixed with 100 μl of 20% aluminum trichloride in methanol and a drop of acetic acid, and then diluted with methanol to 5 ml. The absorption at 415 nm was read after 40 minutes. Blank samples were prepared from 100 ml of plant extracts and a drop of acetic acid, and then diluted to 5 ml with methanol. Increasing concentrations of standard quercetin solution was prepared and the absorbance of various quercetin concentrations was plotted for a standard graph. All determinations were carried out in triplicates (Kumaran and Karunakaran, 2006).

Determination of total saponins

An amount of 10 g of each extract was taken and 50 ml of 20% aqueous ethanol was dissolved. The samples were heated and continuously stirred for four hours at 55°C under water bath. The mixture was filtered and the residue re-extracted with another 200 ml 20% ethanol. The combined extracts were reduced to 40 ml over water bath at about 90°C. The concentrate was transferred into a 250 ml separatory funnel and 20 ml of diethylether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process



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was repeated. 60 ml of n-butanol was added. The combined n-butanol extracts were washed twice with 10 ml of 5% aqueous sodium chloride. The remaining solution was heated in a water bath. After evaporation the samples were dried in the oven to a constant weight; the saponin content was calculated (Obdoni and Ochuko, 2001).

Determination of total terpenoids

Powder form of 10 g of each extract was soaked in alcohol for a day. Later on it was filtered and petroleum ether was used for purpose of extraction. The extracted material was calculated and considered as terpenoids (Sharma *et al.*, 2015).

RESULTS AND DISCUSSION

Qualitative phytochemical analysis

The study was undertaken to evaluate the phytochemical constituents of the selected fern extract of *T. meeboldii* to confirm the presence of bioactive compounds. The phytochemical test was conducted using different solvents based on the increasing order of polarity such as Petroleum ether, chloroform, ethyl acetate and methanol. The preliminary phytochemicals of *T. meeboldii* were recorded and tabulated. Panda *et al.* (2014) screened the phytochemicals of *Thelypteris interrupta* commonly found in Odisha using methanol and chloroform as solvent. Methanol extracts showed the presence of major phytoconstituents such as alkaloids, tannins, anthroquinone, steroids and terpenoids as compared to chloroform. Rekha (2017) did preliminary phytochemical analysis on the fern, *Christella dentata*. Aqueous and ethanolic extracts of leaves, petiole and rhizome of *Christella dentata* revealed the presence of various metabolites like ketose, carbohydrate, protein, cardiac glycosides, steroids, flavonoids, phenols, saponin, terpenoids, alkaloids, tannin, coumarin, acids and quinone. Occurrence of different secondary metabolites and their concentration was much lesser in the leaves. Rhizome revealed the presence of most of the metabolites analysed and at higher concentrations. Shubhangi *et al.* (2018) studied the phytochemicals of *Christella dentata* leaf using methanol as solvent. The phytochemicals such as alkaloids, flavonoids, phenols, phytosterols, saponins, tannins and mucilages were found to be present and terpenoids and steroids were found to be absent. Vijayakumari *et al.* (2022) evaluated the phytochemicals of aerial part of *Christella parasitica* using petroleum ether, ethyl acetate and distilled water as solvents. Steroids, tannins, quinones, terpenoids, phenols and phlobatannins were present in all the extracts. Alkaloids, saponins, flavonoids and glycosides were absent in distilled water. Similar result was recorded in our present study that the methanolic extract of *T. meeboldii* showed the presence of seven phytochemicals *viz.*, alkaloids, phenols, flavonoids, saponin, terpenoid, resin and steroid whereas ethyl acetate extract showed six phytochemicals, chloroform extract showed five and petroleum ether showed only four phytochemicals.

Quantitative phytochemical analysis

The amount of phytochemicals which were found in the methanol fern extract was quantitatively determined by following standard procedure. Among the six phytochemicals quantified, alkaloid content was highest followed by phenol and flavonoid (Table 2). Ahmed *et al.* (2015) studied the total phenolic content and total flavonoid content in the methanolic extract of *Adiantum caudatum*. The total phenolic content of the methanolic extract of *A. caudatum* was 27.7 µg of gallic acid equivalents/ ml and the total flavonoid content was 13.2 µg of rutin equivalents/ ml. As phenolics (including many flavonoids) contain polar phenolic hydroxyl group/s, their high extraction into methanol is quite reasonable. The TPC is higher than the TFC, supporting the fact that most flavonoids are also phenolics. Madhav and Meena (2020) studied the quantitative estimation of phytochemicals from *Ampelopteris Prolifera* using hexane, chloroform, ethyl acetate, methanol and 50 % aqueous methanol as solvents. The highest amount of phenolic was detected in 50% methanol extract (114.27±10.37 mg GAE/g). The highest amount of flavonoid was detected in ethylacetate extract (151.47±3.57 mg CE/g extract). The highest amount of hydrolyzable tannin was detected in 50% methanol extract (31.21±2.14 mg TAE/g extract). The highest amount of condensed tannin was detected in ethylacetate extract (337.50±5.00 mg CE/g extract) and the highest amount of sugar was detected in methanol extract (809.74±7.86 mg GE/g). The present study revealed that *T. meeboldii* contains maximum amount of phenol, flavonoid and tannins and least amount of alkaloids. Tannins are known to possess antioxidant property, which is essential in





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protecting cellular oxidative damage. It was described that tannins enhance glucose uptake activity and inhibit adipogenesis, thus being potential drugs for the treatment of non- insulin dependent diabetes mellitus (Muthusamy et al., 2008).

CONCLUSION

The present study was proposed to investigate the secondary metabolites of *Thelypteris meeboldii*, a small to medium sized fern which belongs to the family Pteridaceae. The fronds of *T.meeboldii* were analysed for the phytochemicals. Preliminary phytochemical screening reported the presence of maximum phytochemicals in methanol extract. Due to the presence of maximum phytochemicals in the methanol extract, it was further preferred for quantitative analysis. It showed highest amount of phenols followed by flavonoid and tannin followed with least content of alkaloid and saponin. This study is an output for further research in application of this fern extract for antioxidant and anticancer property because of holding higher phenolic and tannin content. Isolation and identification of the active compound from the selected fern using chromatographic and spectroscopic techniques are essential for bringing promising drug to cure dreadful diseases.

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CONFLICT OF INTEREST

Authors declare no conflict of interests.

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Table: Qualitative phytochemical analysis of fern extracts

Phytoconstituents	<i>T. meeboldii</i>				
	Petroleum ether	Chloroform	Ethyl acetate	Methanol	Water
Alkaloids	-	-	+	+	+
Glycosides	-	+	-	+	+
Phenols	-	-	-	+	+
Tannins	-	+	-	+	+
Flavonoids	-	-	+	+	+
Saponins	-	+	+	+	+
Volatile oils	+	-	-	-	+
Terpenoids	-	+	-	+	-
Resins	-	-	+	-	-
Steroids	-	-	+	+	-

Table 2: Quantitative analysis of phytochemicals of methanolic fern extract

Metabolites	<i>T. meeboldii</i>
Alkaloids (mg/g)	8.41 ± 0.16
Total phenols (mg/g)	15.61 ± 0.18
Total tannin (mg/g)	12.59 ± 0.12
Total flavonoid (mg/g)	15.17 ± 0.04
Total saponin (mg/g)	5.32 ± 0.09
Total terpenoids (mg/g)	11.37 ± 0.08





Edible Coating from Nontoxic Biomaterials for Extending Shelf Life of Fruits and Vegetables

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ABSTRACT

The present work has been designed to create ecofriendly edible coating from the isolated biomaterials. The biomaterials were extracted from the selected plants such as *Kappaphycusalvarezii* (Doty) Doty ex Silva (Solieriaceae), *Pancratiumtriflorum* Roxb. (Amaryllidaceae), *Terminaliacatapa* L. (Combretaceae) and *Cyanodondactylon* (L.) Pers. (Poaceae). These plants were frequently available biomass and are edible. The extracted biomaterials were mixed together with different ratios to produce the edible coating solution A, B, C, D and E. The colour, odor, pH, bubble, heating resistance, water content and water resistance of the coating solutions were recorded. The coating solution of composition (E) gives the positive result. The produced edible coating solution is colourless and has good stability, quality and shelf life may better alternative to chemical and wax based edible coating solutions. The results of microbiological studies revealed that the edible coating solution has decreased the fungal as well as bacterial contamination and no toxicity. The successfully produced edible coating solutions were applied to selected fruits and vegetables. The following parameters such as shelf life, sensory evaluation, weight loss, pH, shrinkage percentage, shrivelling percentage and decay percentage were analysed at regular intervals and recorded.

Keywords: Biomaterials, biofilm, edible coating, shelf life.





INTRODUCTION

Fruits and vegetables are essential in human's daily diet due to health and nutritional value associated with their intake. However, they are products with a relatively short postharvest life, as long as they are used for consumption, they are living tissues and may undergo physiological and biochemical changes that may have significant physical or pathological manifestations for economic loss [1, 2].

Postharvest treatments with conventional synthetic waxes or chemical fungicides have been used for many years to control postharvest decay and extend shelf life for fruits and vegetables. The continuous application of these treatments has caused health and environmental issues. Considering the growing interest in healthier, safer, more natural and environment-friendly natural coatings have been developed in recent years to avoid the use of synthetic waxes [3]. Hence the use of edible coatings has emerged as an effective and ecofriendly and also alternative to extend their shelf life and protect them from harmful environment [4].

In addition, coatings are able to act as a carrier of many functional ingredients such as antimicrobials, antioxidants, antibrowning agents, nutrients or flavouring and colouring compounds enhancing food stability, quality and safety [5]. The proposed study aims at the production of edible coating film from biomaterials from plants especially from non toxic sea weeds and plants with rich edibility particularly carrageenan, starch, mucilage, cellulose content, gelling agent and antimicrobial properties. Therefore, the present work is designed to create an ecofriendly edible coating from non toxic biomaterials isolated by plants to enhance the shelf life of fruits and vegetables. In order to separate biomaterials from plants the following species has been selected such as *Kappaphycusalvarezii*(Doty) Doty ex Silva (Solieriaceae), *Pancreatiumtriflorum*Roxb. (Amaryllidaceae), *Terminaliacatappa*L. (Combretaceae) and *Cynodondactylon*(L.) Pers. (Poaceae).

MATERIALS AND METHODS

Collection of Plant Materials

The production of edible coating for fruits and vegetables, the following plant materials were selected for the present study such as *Kappaphycusalvarezii*(Doty) Doty ex Silva, *Pancreatiumtriflorum*Roxb., *Terminaliacatappa* L. and *Cynodondactylon* (L.) Per. The selected study plant materials were obtained from various regions of Tamilnadu and Kerala. The seaweed *Kappaphycusalvarezii* were harvested from the coastal regions of Mandapam, Rameshwaram in Tamilnadu. The tubers of *Pancreatiumtriflorum* were collected from Karimkulam, Kerala. The *Cynodondactylon* leaves were collected from N.G.M College campus, Pollachi. The essential oil (Clove oil) and badam resins were purchased from the local market. In laboratory, the collected species were washed and cleaned under running tap water to remove salt, sand, dust particles and other impurities. The process was repeated with distilled water. The cleaned plant materials were kept for further studies.

Isolation of Biomaterials

Isolation of Carrageenan[6]

Dried sample of *Kappaphycusalvarezii* seaweeds were cut into small pieces (± 1 cm) and then weighed 50 grams. Samples are soaked with distilled water for 30 minutes. Then, it was extracted using NaOH with the ratio of seaweed to the solvent 1: 20 (g/ml). The extraction was done using a hot plate at 90°C. It was filtered using a muslin cloth when it was still hot. The filtered solution was taken in a separate container and 5 % KCl was added to stand for 15 to 20 minutes at room temperature until the gel formation. After the gel formation, they were washed with distilled water to reach the pH of ± 7 and filtered using muslin cloth. The isolated carrageenan gel was dried in oven at 60°C for 24 hours. The dried powder of carrageenan was weighed and stored for further use.





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Identification of Carrageenan

The carrageenan is determined by soluble in water at a temperature of 80° C, forming a viscous clear solution and insoluble in ethanol.

Isolation of Starch [7]

The fresh tubers of *Pancratiumtriflorum* were cut into small pieces and the samples were ground with distilled water. The ground slurry was then sieved and filtered using a coarse sieve and muslin cloth. Filtrate was allowed to settle for 2 hours, the resulting starch was washed three times with distilled water and allowed to settle for 21 hours. After 21 hours, supernatant was decanted, the starch (wet) was dewatered and then oven dried at a temperature of 55° C for 4 hours. Finally the dried starch was collected in a container for further use.

Identification of Starch

The iodine test is used to analysis the presence of starch. Add 2 ml of iodine solution in the sample. The colour turned to blue to black confirmed the presence of starch.

Isolation of Cellulose[8]

Cellulose isolation was carried out using the pulping technique consisting of four steps: (1) mild acid hydrolysis with 0.4% H₂SO₄ for one hour, and subsequent washing; (2) chlorination with 3.5% citric acid, stirring the solution in a water bath at 30° C to pH 9.2, washing with distilled water until neutral pH; (3) alkaline extraction with 20 % NaOH under stirring for 1 h, followed by a washing process; (4) bleaching with a solution of 0.5 % citric acid and continuous stirring for 1 hour, and a final wash to neutral pH. Then the material was manually shredded and placed in an oven for 24 hours at 60° C. The material was weighed to determine the total yield of the cellulose.

Identification of Cellulose

The cellulose was confirmed through iodinated zinc chloride solution. A small amount of sample was placed in a watch glass and dispersed with iodinated zinc chloride solution. The violet blue colour confirmed cellulose

Isolation of Mucilage

The shade dried plant materials were soaked with distilled water for 1 hour; fully soaked materials were boiled for 30 minutes and allowed to stand for 15 minutes. Then the material is centrifuged at 8000 rpm for 15 minutes to release mucilage. The supernatant is collected. The yield of isolated mucilage was weighed and stored for further use.

Preparation of Coating Solution

The coating solution was prepared from isolated biomaterials of study plants such as carrageenan, starch, cellulose, mucilage, resin and essential oil (Clove oil). The isolated biomaterials were combined together with different proportion to form a coating solution and to produce final transparent edible coating solution. A known quantity of isolated biomaterials such as carrageenan, mucilage, starch, cellulose, resin and essential oil were added in 100 ml distilled water. The mixture solution was stirred for one hour using magnetic stirrer at room temperature, followed by the solution was heated at 40° C for 10 minutes continuous stirring using glass rod. Then the solutions was autoclaved for 121° C at > psi for 15 minutes. The final volume of the solutions was kept under room temperature for 1 minute.

Processing of Coating Solution

The edible coating technology was tested for the following fruits and vegetables i.e. *Malusdomestica*Borkh (Apple), *Musa acuminata*Colla (Banana) *Capsicum annuum* L. (Chilly) and *Solanumlycopersicum* L. (Tomato) respectively. The testing samples were selected accordingly uniform size, colour and absence of damage and fungal contamination. The uncoated testing samples (Fruits and vegetables) were used as a control. The testing samples (fruits & vegetables) were capsulated with edible coating solution by dipping process according to Prasad *et al.*, 2018 [9]. The testing samples were soaked in 50 % sodium chloride solution for two minutes to remove all contaminants. Further the

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samples were submerged in coating solution container for few second. Then the samples were taken out to allow excess coating by drain until the uniform coating formation. Finally the samples were dried under ambient conditions. After drying, samples were stored at room temperature. The observations were performed on both control and coated fruits and vegetables for regular intervals of storage period.

Observations

The following parameters were tested for the present study.

Parameters for Edible Coating Solution

Sensory Evaluation [10]

For sensory evaluation, visual inception of color, odor, bubble and pH were observed.

Heat Resistance Analysis

The heat resistance capacity of prepared coating solutions are identified at 10, 30, 50, 70 and 1000 C temperatures.

Water Content Analysis [11]

Determination of water content was performed by drying method, the following formulae was used as follows.

$$\text{Percentage of Water Content} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100$$

Water Resistance Analysis [12]

1×1 cm of dried coating film was weighed and soaked for 10 seconds in distilled water. The final weight of the soaked film are weighed. Procedure of soaking and weighing were carried out back until final sample mass will constant.

$$\text{Water resistance (w)} = \frac{W - W_0}{W_0} \times 100$$

Where, W_0 - Initial sample mass, W - Final sample mass.

Microbial Analysis

The antimicrobial activity of coating solution was studied by streak plate method. The microbial inhibition were tested by the following microorganisms such as *Escherichia coli* (MTCC 77), *Staphylococcus aureus* (MTCC 96), *Klebsiellapneumoniae* (MTCC 3384), *Pseudomonas aeruginosa* (MTCC 424) and fungi like *Aspergillusniger* (MTCC 282). The organisms were purchased from PSG Hospitals, Coimbatore, Tamilnadu state in India. 100 mm sterile I - petri plates (2-section) were taken and the first section filled with freshly prepared nutrient agar medium and potato dextrose agar medium separately, followed by the second section filled with coating solution. The microbial strains were streaked on the both side of the plate. The inoculated petri plates were kept in incubator at 28°C for 24 hours. The microbial growth was observed and recoded.

Parameters for Treated Fruits and Vegetables

Shelf - Life Test

The shelf life assessment of testing samples of coated and non-coated fruits and vegetables was assessed by visual inception on daily basis.

Sensory Evaluation [13]

During storage, the sensory evaluation of stored testing samples were performed by a panel of five members on hedonic scale ranging from 0 to 5, where 1 = very bad, 2 = bad, 3 = medium, 4 = good and 5 = excellent. Color, aroma, appearance and overall acceptability were recorded.

Weight Loss [14]

Weight loss of the testing samples was performed for weekly intervals until the end of experiment. The weight loss (WL) percent was determined by using following the formula.





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$$WL = \frac{(A - B)}{A} \times 100$$

Where, A - Initial weight. B - Final weight

pH Measurement

The samples were cut into small pieces and homogenized in a grinder. 10 g of grounded samples were suspended in 100 ml of distilled water and then filtered. The pH of the samples was assessed using a pH meter.

Titrateable Acidity [15]

The titrateable acidity of samples was calculated by titration method. 50 ml of juice samples were titrated with 0.1 N NaOH, few drops of phenolphthalein was used as indicator. The titration done triplate till the concrete reading has been achieved.

$$\text{Percentage of Acidity} = \frac{0.064 \times \text{Normality of NaOH} \times \text{Titre Value}}{\text{Volume of Sample (ml)}} \times 100$$

Fruit Shrivelling Percentage [16]

Fruit Shrivelling Percentage (FSH %) of testing samples was evaluated based on a 4-score scale as: 1- very shrivelling, 2- low shrivelling, 3- normal and 4- very smooth.

Shrinkage Percentage [17]

The length and breadth of fruits and vegetables were measured as an index for shrinkage. The samples were measured by using Vernier calliper weekly interval during the storage period.

$$\text{Shrinkage percentage in terms of length} = \frac{\text{Initial length} - \text{Final length}}{\text{Initial length}} \times 100$$

$$\text{Shrinkage percentage in terms of breadth} = \frac{\text{Initial breadth} - \text{Final breadth}}{\text{Initial breadth}} \times 100$$

Decay Percentage [18]

The testing samples of fruits and vegetables were examined for mold growth during periods of storage. The sample was considered infected when a visible lesion was observed. The decay incidence was expressed as percentage of samples infected for all samples were used for measurement.

$$\text{Decay percentage} = \frac{\text{Initial Weight} - \text{Final Weight}}{\text{Initial Weight}} \times 100$$

Statistical Analysis

The collected data of results were analyzed statistically and carried out with the SPSS Software.

RESULTS AND DISCUSSION

Preparation of Edible Coating

The present study for the preparation of edible coating for fruits and vegetables the following biomaterials were extracted viz. carrageenan from *Kappaphycus alvarezii* (Doty) Doty ex Silva (Solieriaceae), mucilage and starch from *Pancratium triflorum* Roxb. (Amaryllidaceae) cellulose from *Cyanodondactylon* (L.) Pers. (Poaceae) and the resins were obtained from *Terminalia catappa* L. (Combretaceae) Fig. 1. The current work to produce eco-friendly edible coating from these combinations of biomaterials has a completely new record; previously no work has been published on these formulations. Biomaterials were extracted using different methods. The extracted biomaterials were combined at different ratios to form formulations A, B, C, D, and E. The volume of the final coating solution obtained, colour, pH, odor, heating resistance, water content and water resistance were recorded and tabulated (Table 1, 2 & 3 and Figure 2 to 4). Based on coating ability and quality the formulation E shown positive results, whereas the formulation A, B, C and D are exhibited negative results. Finally the formulation E is selected for the coating process on fruits and



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vegetables. The edible coating produces has good strength and stability, Therefore the replacement of chemical and synthetic wax based coatings make the basis for sustainable and ecofriendly edible coatings. Likewise many authors have extensively studied ecofriendly edible coatings from plants such as *Aloe vera* gel, neem, lemon grass, rosemary, tulsi, and turmeric. Usually herbs have antimicrobial properties including vitamins, antioxidants and essential minerals [19, 20, and 21]. Ginger, essential oil, clove bud oil; turmeric neem extract, mint oil, other essential oil and extracts are also used in edible coating of fruits and vegetables. Herbs are natural source of vitamins, minerals, antioxidants, beneficial for health act as a nutraceutical and medicines [23, 24].

Evaluation of physical and chemical parameters for edible coated fruits and vegetables during storage period

The prepared coating solutions were applied by dipping method on some selected fresh fruits and vegetables like apple, banana, chilly and tomato respectively. After the coating process it is observed the encapsulated coating looks transparent appearance. During storage period the following physical and chemical parameters were tested.

Sensory Evaluation

The sensory evaluation (color, aroma, appearance and overall acceptability) of the control and coated samples were examined at intervals of three days during the storage period. The edible coating enhances the sensory quality and extends the shelf life of coated samples rather than control samples. Some control samples are deteriorating and completely unacceptable but coated samples remain intact. Thus, the sensory evaluation revealed that the edible coating treated samples score high in hedonic scale than the control samples. At the end of the storage period, panellist members gave high score to edible coated treated samples (Table 4). The coated samples have no significant difference at the end of the storage period. It could be concluded that the maximum score can be related to the minimum water loss from the fruit surface and maintenance of better balance between sugars and acids of fruit juice [25] This study similar to Seehanamet al. [26] which said that the coated tangerine fruits showed higher gloss and better visual appearance results as compared with the non - coated fruit.

Weight Loss

The weight losses of coated samples are compared to the control samples during the storage period for all tested fruits and vegetables. Water transfer is restricted by coatings that act as barriers and protect fruit skin, thus delaying dehydration [27]. Thus, the control sample causes changes in morphology as well as fungal and bacterial contamination, while the coated sample has no changes in morphology and the absence of contamination (Table 6). Respiration and transpiration are a major cause of weight loss of fruits and vegetables. Hence the edible coating decreased the respiration and transpiration rate by acting as a semi permeable membrane on the surface of the fruits and vegetables. According to Perez-Gago, Serra and delRio [28], coatings of edible material applied as a thin layer can offer a possibility to extend the shelf life of fresh-cut vegetables by providing a semi permeable barrier for gases and water vapor, reducing, therefore, respiration and water loss and thus avoiding dryness and weight loss.

pH

The pH value of both control and coated test samples were increased gradually during the storage period. The pH value of coated samples was lesser when compared to control samples (Table 6). As the storage time passes, the senescence occurs in fruits during which there will be increase in the pH value [29]. It is also due to a decrease in acidity and an increase in TSS value as the fruits ripen at the storage time [30]. Coating reduces respiratory and metabolic rates, and thereby the lesser utilization of organic acids, reported by Baraiyaet al. [31]. The results showed that the coatings show better control on pH during the entire storage period compared to control samples.

Titrateable Acidity

The titrateable acidity of uncoated and coated samples was analyzed regularly during the storage period. The titrateable acidity level of both control and coated samples were gradually decreased over the storage period. Titrateable acidity was higher in coated samples compared with uncoated samples. The reason for fall in acidity level



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is the utilization of organic acid in the respiration and metabolic process[32] also suggested that the decrease in acidity has been attributed towards the conversion of organic acids into sugars and their further utilization in the metabolic process of the fruit (Table 7).

Shrivelling Percentage

The shrivelling percentage of the control and coated samples were examined at intervals of three days during the storage period based on a 4 - score scale. The control samples showed lowest score compared to coated samples (Table 8).

Shrinkage and Decay percentage

The shrinkage percentage of control and coated fruits and vegetables in terms of length and breadth were observed on weekly intervals. The maximum shrinkage percentage (length) for Banana and Tomato observed in control ranges from 88.56 at 0 day to 84.36 at 14th day of storage and 65.95 at 0 day to 62.17 at 21st day of storage respectively. The shrinkage percentage (length) of coated samples resulted minimum when compared to control; similarly other tested samples also reflected better result for coated samples (Table 9). The shrinkage percentage (breadth) of fruits and vegetables also reflected the minimum value in coated samples than the control (Table 10). It is clearly indicates that the coating biomaterials retard the activity of enzymes responsible for ripening, cell degradation was prevented and help to reduce moisture loss and lesser respiratory gas exchange, hence delay in senescence and lower the shrinkage percentage. Similarly the decay percentage of the coated samples also resulted better than the uncoated control (Table 11).

Microbiological Analysis

Microbiological analyses of edible coating solution were carried out on streak plate method. Two section petri plates were used to fill nutrient agar medium and edible coating solution respectively. After incubation period the streak plates were observed and the microbial growth was noted. Interestingly the result indicates that the first half of nutrient agar medium shows higher microbial population; meanwhile the second half of edible coating solution shows no growth for selected bacterial and fungal strains. It is indicates that the stronger antimicrobial ability of edible coating solution. It may due to the presence of natural antimicrobial compounds in edible coating solution. This edible coating solution has been suggested to as alternatives to synthetic coating ones for preserving fruits and vegetables quality, owing to their effectiveness against spoilage and food borne pathogens. Recently the use of edible coatings as polymeric matrices for the entrapment of natural antimicrobial agents has been investigated as a promising alternative to overcome these limitations by lowering the diffusion of active compounds onto food surfaces and hence maintaining their concentrations at a critical level for microbial growth inhibition over long periods of storage [33]. Moreover, edible coatings may act as a semi permeable barrier providing an additional protection for foods against moisture loss, solute migration, gas exchange, respiration, and oxidative reactions [34]. This in agreement with Natalia *et al.* [35] prepared edible antimicrobial coating using plant extracts showed that the extracts of clove, garlic and cinnamon are incorporated in coating to reduce the growth of *Pseudomonas fluorescens* and showed stronger antibacterial activities.

CONCLUSION

In this study, the coated fruits exhibited more shelf life period when compared with the control. The results showed that the edible fruits coating is an eco friendly approach and showed the less microbial growth in room temperature. The present study concluded for edible coating solution used for various fruits and vegetables but the problem is the materials do not resist to over moisture level.





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Table 1. Biomaterials isolation from non-toxic plant raw materials

S.No	Plant name	Biomaterial name	Initial weight (grams)	Final weight (grams)	Percentage of yield (%)	Colour	Texture
1	<i>Kappaphycusalvarezii</i>	Carrageenan	5	3.5	70%	White	Powder
2	<i>Pancratiumtriflorum</i>	Mucilage	50	20	60%	White	Colloid
3	<i>Pancratiumtriflorum</i>	Starch	5	3.5	70%	White	Powder
4	<i>Cyanodondactylon</i>	Cellulose	10	0.762	7.62%	White	Powder

Table 2. Formulations of edible coating solutions

S.No	Biomaterials name	Solution A (-)	Solution B (-)	Solution C (-)	Solution D (-)	Solution E (+)
1	Carrageenan	1.5	1.5	1.5	1.0	1.5
2	Mucilage	3.0	3.0	3.0	3.0	3.0
3	Starch	2.0	1.5	0.1	0.5	0.01
4	Cellulose	1.5	1.0	0.5	0.01	0.01
5	Resin	0.2	0.02	0.2	0.02	0.01
6	Essential oil (Clove oil)	0.005	0.005	0.005	0.005	0.01
7	Distilled water (ml)	100	100	100	100	100

+ Positive result, - Negative result

Table 3. Physical properties of edible coating solutions

Properties	Solution A	Solution B	Solution C	Solution D	Solution E
Colour	White	White	White	Colorless	Colorless
Odor	No specific	No specific	No specific	No specific	No specific
Ph	7.3	7.7	7.2	7.9	7.0
Bubble	High	High	Medium	Low	Low
Heating resistance	60	60	60	60	60
Water content	50	35	20	35	15
Water resistance	12.67	17.64	17.64	19.14	20.93

Table 4. Effect of edible coatings on sensory evaluation of fruits and vegetables during storage period

Sample	Treatments	Storage periods (days)							
		0	3	6	9	12	15	18	21
Apple	Control	5	5	4	4	4	3	2	2
	Coated	5	5	5	4	4	4	4	4
Banana	Control	5	3	3	2	1	-	-	-
	Coated	5	5	4	4	4	3	-	-
Chilly	Control	5	5	4	3	3	3	-	-
	Coated	5	5	5	4	4	4	3	3
Tomato	Control	5	5	4	4	4	3	3	2
	Coated	5	5	5	5	5	4	4	4

Hedonic scale ranging from 0 to 5, where 1 = very bad, 2 = bad, 3 = medium, 4 = good and 5 = excellent





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Table 5. Effect of edible coatings on weight loss of fruits and vegetables during storage period

Sample	Treatments	Storage period (Weight in grams)			
		0	7	14	21
Apple	Control	140.64±0.27	139.21±0.44	136.2±0.72	120.55±0.54
	Coated	143.52±0.75	140.75±0.58	129.76±0.91	128.19±0.62
Banana	Control	88.56±0.88	87.68±0.91	84.36±1.66	-
	Coated	84.11±0.92	83.7±1.47	81.55±0.97	-
Chilly	Control	12.15±1.27	8.38±0.75	8.12±0.43	-
	Coated	12.54±0.98	12.11±0.95	10.92±0.57	9.2±0.41
Tomato	Control	65.95±0.21	64.14±1.42	65.95±0.62	62.17±0.24
	Coated	60.02±0.34	59.11±0.97	57.56±0.71	56.43±0.39

Mean ± SD

Table 6. Effect of edible coatings on pH of fruits and vegetables during storage period

Sample	Treatments	Storage periods							
		0	3	6	9	12	15	18	21
Apple	Control	4.68±0.14	4.99±0.41	5.00±0.74	5.00±0.92	5.10±0.16	5.14±0.27	5.21±0.44	5.25±1.29
	Coated	4.68±0.25	4.68±0.38	4.97±0.65	5.08±1.21	5.06±0.29	5.11±0.11	5.17±0.75	5.21±0.94
Banana	Control	4.48±0.73	4.48±0.17	4.58±0.52	5.08±0.74	5.26±0.64	-	-	-
	Coated	4.48±0.61	4.50±0.26	4.52±0.47	5.09±0.83	5.29±0.42	-	-	-
Chilly	Control	5.64±0.09	5.50±0.44	5.54±0.66	5.68±0.07	5.71±0.77	5.86±0.45	-	-
	Coated	5.64±0.17	5.39±0.52	5.39±0.72	5.57±0.14	5.69±0.65	5.81±0.71	-	-
Tomato	Control	4.56±0.16	4.36±0.18	4.69±0.61	5.12±0.47	5.07±0.49	5.11±0.94	5.11±0.71	5.26±0.19
	Coated	4.82±0.11	4.90±0.24	5.05±0.58	5.07±0.63	5.11±0.44	5.18±1.28	5.19±0.82	5.20±0.27

Mean ± SD

Table 7. Effect of edible coatings on titratable acidity of fruits and vegetables during storage period

Sample	Treatments	Storage periods							
		0	3	6	9	12	15	18	21
Apple	Control	0.20±0.74	0.18±0.91	0.17±0.46	0.14±0.85	0.13±1.12	0.10±0.41	0.08±0.07	0.07±0.73
	Coated	0.21±0.78	0.21±0.27	0.20±0.24	0.18±0.74	0.16±0.36	0.12±0.41	0.12±0.85	0.10±0.76
Banana	Control	0.23±0.46	0.19±0.09	0.16±0.37	0.11±0.42	0.08±0.78	-	-	-
	Coated	0.22±0.23	0.21±0.17	0.17±0.29	0.14±0.47	0.13±0.11	0.12±0.78	-	-
Chilly	Control	0.27±0.14	0.23±0.84	0.20±0.45	0.18±0.94	0.15±0.65	0.09±0.45	-	-
	Coated	0.27±0.57	0.26±0.42	0.23±0.70	0.19±0.52	0.18±0.23	0.15±0.41	0.13±0.90	0.11±0.54
Tomato	Control	0.31±0.85	0.29±0.46	0.26±0.27	0.21±0.54	0.19±0.76	0.17±0.85	0.13±0.19	0.11±0.57
	Coated	0.32±0.54	0.31±0.86	0.28±0.91	0.26±0.67	0.25±0.74	0.24±0.82	0.23±0.63	0.21±0.98

Titratable acidity in percentage %

Mean ± SD

Table 8. Effect of edible coatings on shrivelling percentage of fruits and vegetables during storage period

Sample	Treatments	Storage periods							
		0	3	6	9	12	15	18	21
Apple	Control	4	4	4	3	3	3	2	2
	Coated	4	4	4	4	4	3	3	3





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Banana	Control	4	4	4	3	3	-	-	-
	Coated	4	4	4	4	3	2	-	-
Chilly	Control	4	4	4	4	3	2	-	-
	Coated	4	4	4	4	4	3	3	3
Tomato	Control	4	4	4	4	3	3	2	2
	Coated	4	4	4	4	4	4	3	3

4-score scale as: 1-very shrivelling, 2- low shrivelling, 3- normal and 4- very smooth

Table 9. Effect of edible coatings on shrinkage percentage (length) of fruits and vegetables during storage period

Sample	Treatments	Storage period			
		0	7	14	21
Apple	Control	98.64±0.47	96.21±0.85	94.2±0.92	92.55±0.42
	Coated	98.52±0.76	97.75±1.07	96.76±0.73	96.19±0.84
Banana	Control	88.56±0.99	87.68±0.92	84.36±1.06	-
	Coated	84.11±0.57	83.7±1.22	81.55±0.75	-
Chilly	Control	12.15±1.46	8.38±0.76	8.12±0.48	-
	Coated	12.54±0.31	12.11±0.19	10.92±0.73	9.2±0.42
Tomato	Control	65.95±0.49	64.14±0.45	65.95±0.94	62.17±0.56
	Coated	60.02±0.97	59.11±0.73	57.56±0.57	56.43±0.79

Shrinkage percentage %, Mean ± SD

Table 10. Effect of edible coatings on shrinkage percentage (breadth) of fruits and vegetables during storage period

Sample	Treatments	Storage period			
		0	7	14	21
Apple	Control	0	0.93±0.43	2.79±0.1.43	4.65±0.94
	Coated	0	0.47±0.31	1.90±0.82	2.85±1.55
Banana	Control	0	2.54±1.29	5.93±0.46	-
	Coated	0	1.69±1.46	4.23±0.37	-
Chilly	Control	0	4.41±0.93	13.23±0.51	-
	Coated	0	2.77±0.95	4.16±0.97	5.55±0.91
Tomato	Control	0	1.17±0.48	2.94±1.25	5.29±0.42
	Coated	0	0.62±0.29	1.87±0.96	3.75±0.35

Shrinkage percentage %, Mean ± SD

Table 11. Effect of edible coatings on decay percentage of fruits and vegetables during storage period

Sample	Treatments	Initial weight	Final weight	Decay percentage %
Apple	Control	140.64±0.94	120.55±0.88	14.28±0.61
	Coated	143.52±0.41	128.19±1.37	10.68±0.43
Banana	Control	88.56±0.34	84.36±0.48	4.74±0.97
	Coated	84.11±0.49	81.55±0.89	3.04±0.38
Chilly	Control	12.15±0.93	8.12±0.97	33.16±0.46
	Coated	12.54±0.53	9.2±1.14	27.48±0.93
Tomato	Control	65.95±0.83	62.17±0.92	5.73±1.27
	Coated	59.11±0.31	56.43±0.53	4.53±0.91

Decay percentage %, Mean ± SD





a. *Kappaphycus alvarezii* (Doty) Doty ex Silva



b. *Pancratium triflorum* Roxb.



c. *Cyanodon dactylon* (L.) Per.



d. *Terminalia catapa* L.

Figure 1. Photographs of study plant species



a. Carrageenan



b. Mucilage



c. Starch



d. Cellulose

Figure 2. Biomaterials isolation process





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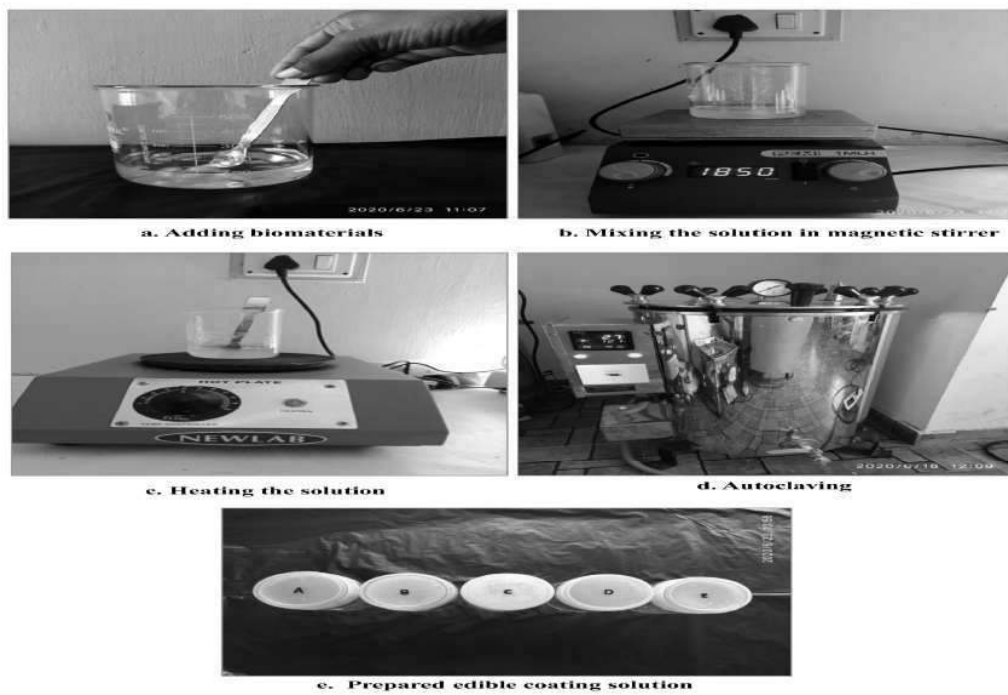


Figure 3. Showing the steps in coating solution preparation

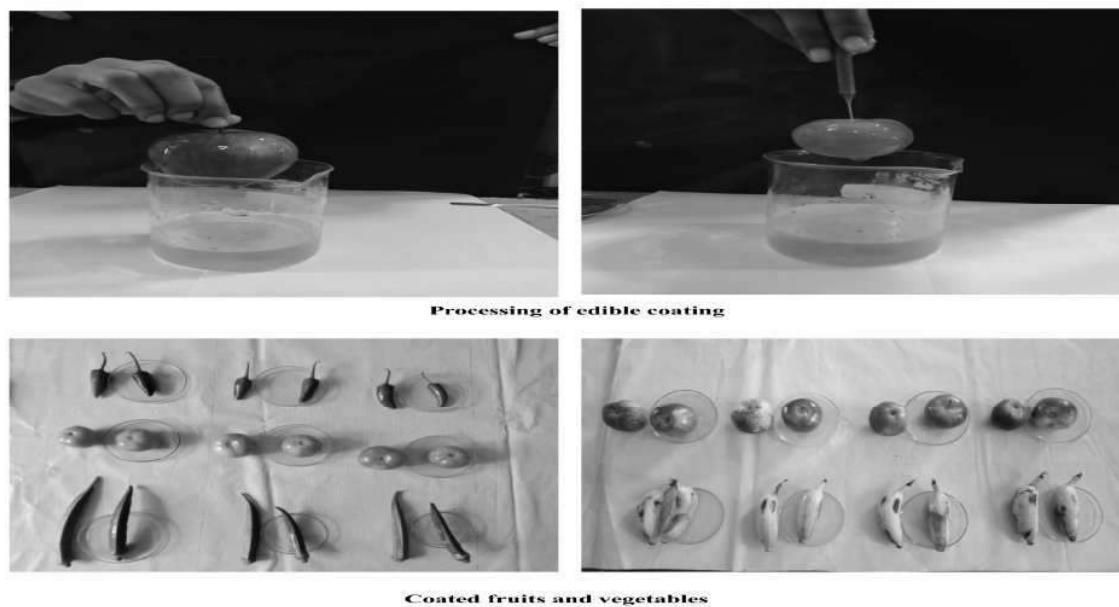


Figure 4. Processing of edible coating on fruits and vegetables





Effect of Synbiotics on Saliva in Completely Edentulous Patients- a Prospective Study

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ABSTRACT

Xerostomia in older individuals is one of the cause of failure of complete dentures due to lack of retention and stability of dentures. The treatment of choice for such patients is the use of salivary stimulants, topical agents, saliva substitutes, synbiotics and systemic sialogogues and prosthodontically by means of a salivary reservoir incorporated denture. To assess the effect of synbiotics on quantity and pH of saliva in completely edentulous individuals. The study prospectively reviewed pH and quantity of saliva from samples taken from completely edentulous individuals at baseline and after intervention in Control (Group 1) and Study group (Group 2) respectively. Synbiotics did show an increase in quantity of saliva, however, change in quantity and pH of saliva was not statistically significant ($P>0.05$) The





RESEARCH ARTICLE

Chemical profiling of fern *Cheilosoria mysurensis* (Wall. ex Hook.) Ching & Shing and its biological activity

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Abstract

Cheilosoria mysurensis (Wall. ex Hook.) Ching & Shing, a medicinal fern traditionally used to treat burns, throat pain and bone fracture. There is no any scientific report regarding anticancer studies of this species. The aim of the study was to find out the chemical components through GC/MS analysis with their antioxidant and cytotoxic activity. GC-MS analysis shows primary ingredients viz, Cis-9, 10-epoxyoctadecan-1-ol and Oxiraneundecanoic acid, 3-pentyl-, methyl ester, trans were present. High free-radical scavenging activity has been discovered in 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and showed the IC₅₀ value of 52.13±0.33. Furthermore, *C. mysurensis* also showed good cytotoxic effects against DLA and EAC cell lines with values of 72.9% and 79.5% at 200 µg/ml dose respectively. Overall findings suggested that the identified chemical compounds proved to be rich in antioxidant properties. Further, this fern can be a good resource for the pharma industry to produce novel anti-cancer drugs.

Keywords

Antioxidant, *Cheilosoria mysurensis*, cytotoxicity, GC/MS, medicinal fern

Introduction

Cheilosoria mysurensis (Wall. ex Hook.) Ching & Shing is commonly called as lip fern and belongs to family Pteridaceae. The genus *Cheilosoria* consists of about 874 species worldwide and 11 species are reported in Indian subcontinent (1). This fern is commonly found in dry, rocky places, plains and in foot hills (2). Traditionally the ash of the study fern mixed with coconut oil and applied topically on skin to fasten the healing of burns (3) to treat throat pain (4) and bone fracture (5).

Several diseases have become more prevalent in recent years. There is an immediate need for search of novel compounds to treat cancer and infectious diseases caused by microorganisms. Plant sources with diverse natural bioactive ingredients play an important role in curing deadful diseases (6). Many chemical compounds show impressive *in vitro* activity against pathogenic microorganisms resistant to recent allergenic drugs. Plants have a rich source of secondary metabolites (terpenoids, phenolics and alkaloids), that exhibit a broad spectrum of bioactivities including anti-tumor activity (7). The identification and characterization of above said molecules in terms of their biological activity on the spectrum, potency, toxicity and safety is most needed.

Previously the fern *C. tenuifolia* have reported with variety of biologically active compounds including polyphenols, flavonoids and other important phytochemicals responsible for its antioxidant and cytotoxic potential (8). *C. farinosa* has significant cytotoxic activity in the hepatoma cell line Hep 3B but not in the non-cancerous cell line RAW 264.7 (9). The most prevailing compounds reported in *C. farinosa* ethanolic extract are n-hexadecanoic acid, diplopene, 9 octadecanoic acid, n-tetracontane and 3, 7, 11 and 15 tetramethyl-2-hexadecane-1-ol. Hexadecanoic acid has biological activity such as antioxidants, hypocholesterolemic nematocides and pesticides (10). Recently, a few research reports are available on the genus *Cheilosoria*. Many Pteridaceae species are being studied for its possible uses and for the extraction of new active components. Till now there is no research articles published on the phytochemistry and pharmacology of *C. mysurensis*. The objective of the work is to identify the chemical compounds that are carried out through GC/MS analysis and to study on antioxidant and cytotoxicity activities of the fern *C. mysurensis* and this is the first report on this species.

Materials and Methods

Study area and Collection of plant materials

The fresh and healthy leaflet of the fern *C. mysurensis* was collected from Gopalaswamy Hills, located near to Anaimalai hills of 10° 13' and 10° 31' north Latitude and between 76° 52' and 77° 22' east longitude of Western Ghats, Tamil Nadu, India. The fern species was identified and authenticated by BSI, Southern circle, Coimbatore, Tamil Nadu. A voucher specimen was deposited as herbarium at the Department of Botany, Nallamuthu Gounder Mahalingam College, Pollachi.

Extract preparation

The fern leaflets were cut into small pieces and allowed to shade dried for 2-3 weeks. The shade-dried samples were ground to a fine powder using an electric grinder. The powder was then fed into the soxhlet apparatus using methanol as the solvent (11).

GC/MS Analysis

In this study, Clarius 680 GC was used. Components were separated using a fused silica column packed with Elite-5MS (5% biphenyl, 95% dimethylpolysiloxane, 30 m 0.25 mm ID, 250 m df) and helium as the carrier gas at a speed of 1 ml/min. The injector temperature was set at 260 °C during the chromatographic cycle. 1 µl of the extract was injected into the apparatus in the oven as follows: 60 °C (2 min); followed by 300 °C, where it was held for 6 min. The conditions of the mass detector were as follows: line temperature of 230 °C; ion source temperature of 230 °C; and electron impact in ionization mode at 70 eV, the scan time was 0.2 S and the scan interval was 0.1 S. The shards range in mass from 40 to 600 Da. Component spectra were compared with a database of known component spectra stored in the NIST GC/MS library (2008) (12).

In vitro Free Radical Scavenging activity

DPPH radical scavenging activity

About 1 mg of *C. mysurensis* extract was dissolved in 1 ml of dimethyl sulfoxide. Samples 125, 250, 500 and 1000 µg/ml were prepared and used for the assay. The free radical scavenging capacity of the evaporated sample of *C. mysurensis* extract was determined using Blois method (13). The DPPH solution was prepared in 95% methanol. Different concentrations (125-1000 µg/ml) methanol extracts of *C. mysurensis* were reacted with 3.0 ml of freshly prepared DPPH solution (0.1 mM) and incubated at room temperature. After 30 min, absorbance was measured at 517 nm using a spectrophotometer (Labman UV-Visible spectrophotometer). Ascorbic acid was used as standard. Standard ascorbic acid and extracts were treated similarly. The following formula was used to calculate the % of inhibition.

Percentage of DPPH radical scavenging activity =

$$\frac{A \text{ of control} - A \text{ of sample}}{A \text{ of control}} \times 100 \dots \dots \dots \text{eqn.1}$$

Where as, A- Absorbance

Determination of Cytotoxic activity

The sample was dissolved in dimethyl sulfoxide. The test compound was investigated for short-term *in vitro* cytotoxicity using Dalton's ascites (DLA) and Ehrlich ascites (EAC) carcinomas cell lines. Tumor cells were collected from the peritoneal cavity of tumor-bearing mice and washed three times with PBS or a normal cell line. Trypan blue exclusion was used to check cell viability (14). Viable cell suspensions were added to tubes containing various concentrations of test compounds and volumes were made up to 1 ml using a phosphate-buffered cell line (PBS). The control tube contains only the cell suspension. These test mixtures were incubated. The following formula was used to calculate the percentage of cytotoxicity.

Percentage of cytotoxicity (%) =

$$\frac{\text{No. of dead cells}}{\text{No. of dead cells} + \text{No. of live cells}} \times 100 \dots \dots \dots (\text{eqn. 2})$$

Results and Discussion

GC/MS Analysis

The GC/MS chromatogram of *C. mysurensis* methanolic extract displayed 12 peaks (Fig. 1), due to the presence of 12 compounds. (Table 1). Important major compounds were Cis-9,10-Epoxyoctadecan-1-ol (39.66%) and Oxiraneundecanoic acid, 3-pentyl-, methyl ester, trans (13.69%) and other minor compounds were 8,11,14-Eicosatrienoic acid, methyl ester and Tetradecanoic acid, 12-methyl-, methyl ester, (s)-and other trace compounds were shown in Table 1. Some of the GC/MS constituents are physiologically active metabolites. They have pharmacologic properties that may contribute to the plants ability to heal. Cis-9, 10-Epoxyoctadecan-1-ol is an alcoholic compound that has been shown to have antimicrobial properties (15). Compound 3-pentyl-, methyl ester, trans (13.69%) was confirmed to be present in other plants and exhibiting antioxidant effects (16).



Fig. 1. GC/MS chromatogram of methanolic extract of *Cheilosoria mysurensis*.

Table 1. Compounds identified in the methanolic extract of *Cheilosoria mysurensis*

RT	Name of the compound	Molecular formula	Molecular weight	Peak area %	Compound nature
18.019	3,7-Dimethyl-6-nonen-1-ol acetate	C ₁₅ H ₂₄ O ₂	212	8.923	Acetate (Acetate derivative)
18.365	1-Methylene-2b-hydroxymethyl-3,3-dimethyl-4b-(3-methylbut-2-enyl)-cyclohexane	C ₁₅ H ₂₆ O	222	2.993	Alcohol (Alcohol derivative)
19.100	Tetradecanoic acid, 12-methyl-, methyl ester, (s)-	C ₁₆ H ₃₂ O ₂	256	9.740	Ester(Ester derivative)
20.160	8,11,14-Eicosatrienoic acid, methyl ester	C ₂₁ H ₃₈ O ₂	320	10.379	Ester(Esterderivative)
20.405	Oxiraneundecanoic acid, 3-pentyl-, methyl ester, trans	C ₁₉ H ₃₆ O ₃	312	13.691	Ester(Esterderivative)
21.761	Cis-9,10-epoxyoctadecan-1-ol	C ₁₈ H ₃₆ O ₂	284	39.665	Alcohol (Alcohol derivative contain epoxy)
25.047	3-Nonanol, 1,2;6,7-diepoxy-3,7-dimethyl-, acetate	C ₁₃ H ₂₂ O ₇	242	3.959	Acetate (Acetate derivative)
25.843	1-Octadecanesulphonyl chloride	C ₁₈ H ₃₇ O ₂ ClS	352	1.968	Sulphur (Sulphur derivative)
26.798	Octadecane, 3-ethyl-5-(2-ethylbutyl)-	C ₂₈ H ₅₄	366	6.935	Alkane
27.963	1-Octadecanesulphonyl chloride	C ₁₈ H ₃₇ O ₂ ClS	352	1.748	Sulphur (Sulphur derivative)
29.519	Pseudoosarsapogenin-5,20-dien	C ₂₇ H ₄₂ O ₃	414		Ether (Ether derivative)
29.919	Stigmastan-6,22-dien, 3,5-dedihydro-	C ₂₉ H ₄₈	394		Steroid

DPPH radical scavenging activity

The radical scavenging activity of the methanolic extracts of *C. mysurensis* and standard ascorbic acid was shown in Table 2. At a dose of 100 µg/ml, the scavenging activity was 79.65 ± 0.78%, while at the same concentration, the standard ascorbic acid was 96.45 ± 0.41%. The Half-maximal inhibitory concentration (IC₅₀) value of the

methanol extracts of *C. mysurensis* was 52.13 ± 0.33 µg/ml. The IC₅₀ value of ascorbic acid (standard) was 32.85 ± 0.90 µg/ml.

Antioxidants are hypothesised to act on DPPH because of their ability to transfer hydrogen (17). Scavenging activities are critical for preventing the detrimental effects of free radicals in a variety of illnesses, including cancer

Table 2. DPPH radical scavenging activity of *Cheilosoria mysurensis*

Concentration (µg/ml)	12.5	25	50	100	IC ₅₀
Methanol extract (% of inhibition)	20.95±0.77	35.033±0.42	47.15±1.38	79.65±0.78	52.13±0.33

Concentration (µg/ml)	12.5	25	50	100	IC ₅₀
Ascorbic acid (% of inhibition)	35.20±2.67	47.01±1.52	60.42±1.51	94.59±1.08	32.85±0.90

(18). The DPPH radical scavenging method is widely used to assess the antioxidant potential of plant extracts. By adding the purple DPPH solution to the extract in a concentration-dependent manner, the extract is reduced to the yellow product, diphenyl picryl hydrazine. Because of its quick processing time, this approach is commonly employed to predict antioxidant activity. The methanolic extracts of *C. mysurensis* possess free radical scavenging activity equivalent to that of normal ascorbic acid, according to our findings. Jarial and his team (19) investigated the antioxidant activity of flavonoids isolated from the fern *Cheilanthes tenuifolia*. The flavonoids extracted with methanol displayed a high DPPH activity; with an IC₅₀ value of 39.10 µg/ml. *C. mysurensis* methanol extract was more active than *C. tenuifolia*.

Cytotoxicity assay

Extract toxicity studies were performed on Dalton's ascites carcinoma (DLA) and Ehrlich's ascites (EAC) cell lines. Trypan blue is an acidic colour with two azo pigment cell groups. Trypan blue cannot pass through the cell wall of the plant cells. Trypan blue is an important pigment that used to estimate the number of cells that can exist in a population (20). In this study, *C. mysurensis* inhibited the growth of DLA and EAC in a dose-dependent manner (10, 20, 50, 100 and 200 µg/ml). The trypan blue dye exclusion test results showed that *C. mysurensis* extract strongly inhibited the development of DLA and EAC cells in culture. A concentration of 200µg/ml showed a high degree of cytotoxicity to the DLA and EAC assays with cell death rates of 72.9% and 79.6%, respectively (Table 3, Table 4). This may be because of the higher alcohol derivatives that contain epoxy and ester derivatives in the methanol extract and thus the components may show positive synergistic effects against cancer cell lines.

Table 3. Cytotoxicity of the *C. mysurensis* by DLA assay

Drug concentration (µg/ml)	Total no. of Live cells	Total no. of Dead cells	Total no. of cells	Percentage of cell death
10	104	9	113	7.92 ± 1.5
20	90	16	106	14.8 ± 1.5
50	79	29	108	26.9 ± 1.6
100	55	52	107	48.8 ± 0.9
200	29	79	108	72.9 ± 1.6

± = value represents the mean standard deviation (n=4)

Reports are on the *in vitro* cytotoxicity activity of a methanolic extract from the leaves and fruit of *Zanthoxylum ovalifolium* against the cancer cell lines of DLA and

Table 4. Cytotoxicity of the *C. mysurensis* by EAC assay

Drug concentration (µg/ml)	Total no. of live cells	Total no. of dead cells	Total no. of cells	Percentage of cell death
10	101	7	108	6.48 ± 2
20	88	17	105	16.6 ± 2.1
50	70	31	101	30.6 ± 2.4
100	47	53	100	53.2 ± 2
200	20	80	100	79.6 ± 1.8

± = value represents the mean standard deviation (n= 4)

EAC (21). The results indicated that cytotoxicity studies on methanolic extracts from leaves and fruits of *Z. ovalifolium* had promising activity against both the cell lines. Both extracts inhibited cancer cell development in a concentration-dependent manner, however the leaf extract was more efficient against cancer cells than the fruit extract. The fruit extract at 200 µg/ml showed a significant increase of 80 and 82% in cell death for the DLA and EAC cell lines and 72 and 75% inhibition of tumor cells were observed in the fruit extract at 200 µg/ml for the DLA and EAC cell lines. The results of the methanol extraction of *C. mysurensis* also showed good cytotoxic effects against DLA and EAC cell lines with values of 72.9% and 79.5% at 200 µg/ml dose respectively.

Conclusion

The chemical composition, antioxidant and cytotoxicity activities of the methanol extract of *C. mysurensis* from the Western Ghats of India are reported for the first time in this study. The GC/MS analysis of methanolic extract showed that presence of alcohol derivatives that contain epoxy and ester derivatives. Cell death was evidenced by the cytotoxic effects of *C. mysurensis* methanol extract on DLA and EAC cell lines. Hence, these phytochemicals are responsible for several pharmacological activities, including antioxidant and anticancer effects. The overall finding suggests that the methanol extract of *C. mysurensis* leaflets provided positive initial data for future use as an anti-cancer agent.

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Authors contributions

For the Authors' contributions RR, AP and SD conducted the experiments, analysed the data statistically and prepared the manuscript. SP and AAM carryout the correction and revised the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors declare no conflict of interests.

Ethical issues: None.

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GC/MS Analysis of Methanolic Extract of *Pancratium triflorum* Roxb. bulbs

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ABSTRACT

This study presents the chemical composition of the methanolic extract obtained from *Pancratium triflorum* bulbs through gas chromatography and mass spectrometry analysis. Six distinct compounds were identified, namely 2,3-Anhydro-D-Galactosan, Triacntanoic Acid, Methyl Ester, 1-Hexadecyne, Eicosonoic Acid, Cis-9,10 Epoxyoctadecan-1-OL, and 2-Isopropyl-5-Methylcyclohexyl 3-(1-(4-Chlorophenyl)-3-Oxobutyl)-C. This comprehensive profiling provides insights into the molecular constituents of *Pancratium triflorum*, contributing to our understanding of its chemical composition and potential pharmacological applications. Further investigations into the biological activities of these identified compounds may unveil novel therapeutic possibilities associated with *Pancratium triflorum*.

Keywords: *Pancratium triflorum*, Bulb, GC-MS, Bioactive compounds, medicinal plant

INTRODUCTION

Pancratium triflorum. Roxb, a perennial herbaceous plant native to the Indian subcontinent, has a long-standing history of traditional use in various indigenous medicinal systems. Its cultural importance is underscored by its botanical nomenclature in which 'Pancratium' signifies 'all strength' and 'triflorum' refers to its characteristic three-flowered inflorescence [1]. In traditional practices, *Pancratium triflorum* is celebrated for its therapeutic attributes,





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including its anti-inflammatory, diuretic, and analgesic properties [2]. However, despite its well-documented ethnobotanical uses, there exists a paucity of comprehensive scientific investigations exploring the phytochemical constituents and biological properties of this plant. Recent advancements in analytical techniques have provided the means to scrutinize the chemical composition of medicinal plants, thus shedding light on their pharmacological potential. Gas Chromatography-Mass Spectrometry (GC/MS) stands out as a powerful tool for the identification of bioactive compounds within plant extracts. This study employs GC/MS analysis to decipher the complex phytochemical profile of *Pancreatium triflorum*. This research seeks to fill a significant knowledge gap and provide a solid foundation for further exploration of the medicinal and therapeutic potential of *Pancreatium triflorum*.

The Amaryllidaceae family, to which *Pancreatium triflorum* belongs, is well-known for the synthesis of alkaloids with diverse pharmacological properties. This is exemplified by the presence of lycorine, a prominent alkaloid known for its anti-inflammatory, cytotoxic, and antiviral activities, which is found in various Amaryllidaceae species [3]. Furthermore, the family Amaryllidaceae includes several species that have displayed notable antioxidant potential, which aligns with the increasing scientific interest in natural antioxidants as potential alternatives to synthetic antioxidants due to their lower toxicity and broader health benefits [4]. In light of the aforementioned, this research delves into the GC/MS analysis of *Pancreatium triflorum* to uncover its phytochemical constituents. The outcomes of this study could pave the way for further investigations into the therapeutic applications of *Pancreatium triflorum*. Roxb. and the development of antioxidant-based therapies.

MATERIALS AND METHODS

Plant Material and Extraction

Pancreatium triflorum. bulbs were collected from karimkulam, palakkad district kerala. The plant material was identified and authenticated by botanical Survey of India, Coimbatore, and a voucher specimen (NGMPGB/20) was deposited in a herbarium. The bulbs were cleaned, shade-dried, and powdered for extraction

Preparation of Plant Extract

Powdered plant material (50 g) was subjected to soxhlet extraction using methanol for 72 hours at room temperature. The extract was then filtered and concentrated under reduced pressure to obtain a crude methanolic extract of *Pancreatium triflorum*.

GC-MS Analysis

The GC/MS analysis was performed using the Clarus 680 GC was used in the analysis employed a fused silica column, packed with Elite-5MS (5% biphenyl 95% dimethylpolysiloxane, 30 m × 0.25 mm ID × 250µm df) and the components were separated using Helium as carrier gas at a constant flow of 1 ml/min. The injector temperature was set at 260°C during the chromatographic run. The 1µL of extract sample injected into the instrument the oven temperature was as follows: 60 °C (2 min); followed by 300 °C at the rate of 10 °C min⁻¹; and 300 °C, where it was held for 6 min. The mass detector conditions were: transfer line temperature 230 °C; ion source temperature 230 °C; and ionization mode electron impact at 70 eV, a scan time 0.2 sec and scan interval of 0.1 sec. The fragments from 40 to 600 Da. The spectrums of the components were compared with the database of spectrum of known components stored in the GC-MS NIST [5] (2008) library.

RESULTS AND DISCUSSION

The GC/MS analysis of the methanolic extract of *Pancreatium triflorum*. revealed the presence of bioactive compounds. A total of 6 compounds were identified (Table 1). Notable compounds included carbohydrate derivatives, fatty acid derivatives, aliphatic hydrocarbons, eicosanoid derivatives, and structurally complex compounds. The Gas Chromatography-Mass Spectrometry (GC/MS) analysis of the methanolic extract of *Pancreatium triflorum*. has unveiled a diverse array of bioactive compounds, contributing to the understanding of the plant's potential



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pharmacological properties. In this study, a total of six compounds were identified, major compounds were Cis-9,10 Epoxyoctadecan-1-OL (39.240%) and 2-isopropyl-5-methylcyclohexyl 3-(1-(4-chlorophenyl)-3-oxobutyl)-c (35.494%) and minor compounds were shown in figure 1, each possessing distinctive chemical structures and, possibly, associated biological activities. These compounds are integral components of the plant's phytochemical composition and merit further investigation for their potential therapeutic applications.

Eicosanoic Acid, Cis-9,10 Epoxyoctadecan-1-OL, is a derivative of eicosanoids, which are signaling molecules involved in inflammation and immune responses [6]. The presence of this compound suggests that *Pancreatium triflorum* may possess components with immunomodulatory properties. The compound 2-isopropyl-5-methylcyclohexyl 3-(1-(4-chlorophenyl)-3-oxobutyl)-c, a complex and structurally diverse compound, adds further intrigue to the phytochemical profile of *Pancreatium triflorum*. Its structure implies the potential for multifaceted pharmacological activities, which may encompass anti-inflammatory, antioxidant, or even cytotoxic effects. One of the identified compound, 2,3-anhydro-d-galactosan, is a carbohydrate derivative. While carbohydrates are not typically associated with bioactive compounds, their presence in plant extracts could indicate potential interactions with other bioactive molecules, and they may play a role in the overall medicinal properties of the plant. Triacanoic Acid, methyl ester, is a long-chain fatty acid derivative. Fatty acids and their derivatives are known for their various biological activities, including anti-inflammatory and antimicrobial properties [7]. This compound could contribute to the plant's anti-inflammatory potential. 1-Hexadecyne is an aliphatic hydrocarbon. Aliphatic hydrocarbons are commonly found in plant extracts and can exhibit diverse biological activities, including antioxidant properties [8]. This compound may contribute to the antioxidant potential of *Pancreatium triflorum*. While these compounds have been identified, their specific pharmacological properties and the potential synergistic interactions among them remain to be explored. Additionally, the concentrations of these compounds in the plant extract and their bioavailability are essential factors that need further investigation.

CONCLUSION

The GC/MS analysis of *Pancreatium triflorum*. revealed the presence of several bioactive compounds, including carbohydrate derivatives, fatty acid derivatives, aliphatic hydrocarbons, eicosanoid derivatives, and structurally complex compounds. This diverse range of compounds suggests the potential for a broad spectrum of pharmacological properties. Further research is required to elucidate the specific roles of these compounds and their potential for contributing to the medicinal and therapeutic properties of *Pancreatium triflorum*. Roxb.

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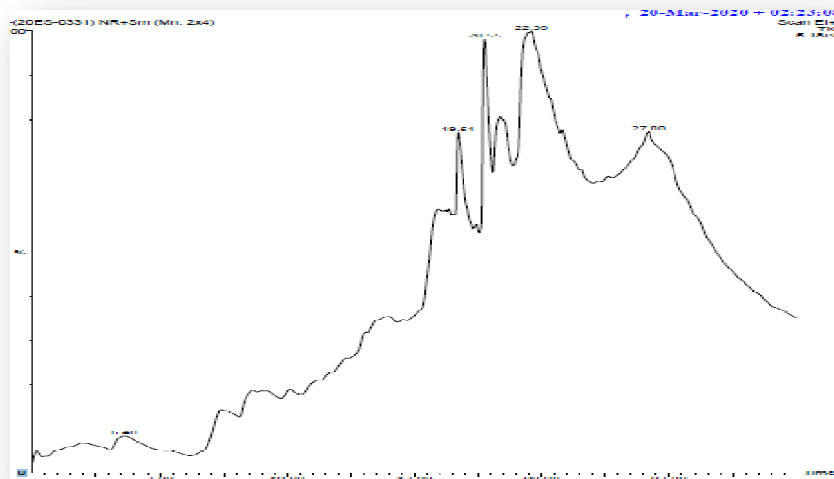


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Table 1: Compounds identified in the methanolic extract of *Pancratium triflorum*

RT	Name of the compound	Molecular formula	Molecular weight	Peak area %	Compound nature
18.765	2,3-ANHYDRO-D-GALACTOSAN	C ₆ H ₈ O ₄	144	5.567	Aldehyde
19.495	TRIACONTANOIC ACID, METHYL ESTER	C ₃₁ H ₆₂ O ₂	466	6.154	Fatty acid methyl ester
20.566	1-HEXADECYNE	C ₁₆ H ₃₀	222	5.774	Aliphatic hydrocarbon
21.171	EICOSANOIC ACID	C ₂₀ H ₄₀ O ₂	312	7.771	Unsaturated fatty acid
22.411	CIS-9,10-EPOXYOCTADECAN-1-OL	C ₁₈ H ₃₆ O ₂	284	39.240	Alcoholic compound
27.008	2-ISOPROPYL-5-METHYLCYCLOHEXYL 3-(1-(4-CHLOROPHENYL)-3-OXOBUTYL)-C	C ₃₀ H ₃₃ O ₆ Cl	524	35.494	Benzopyrone Antioxidant, antimicrobial and anti-inflammatory activity

**Figure 1 GC-MS chromatogram of methanolic extract of *Pancratium triflorum***

AI IN THE ENGLISH LANGUAGE CLASSROOM: TRANSFORMING TEACHING AND LEARNING PRACTICES

Dr. T. SuryaPrabha
Assistant Professor of English
NGM College, Pollachi

Abstract:

This article examines the transformative impact of artificial intelligence (AI) on teaching and learning practices within the English language classroom. AI technologies offer personalized learning experiences by analyzing students' individual learning styles and providing tailored content and activities. Additionally, AI enhances language instruction through virtual language assistants and interactive applications, making learning more engaging and immersive. Automated assessment tools powered by AI offer instant feedback to students, promoting continuous learning and skill development. Moreover, AI facilitates differentiated instruction by providing insights into students' learning profiles and adjusting task difficulty levels accordingly. While AI presents challenges such as data privacy concerns and algorithmic bias, its responsible integration can enhance the quality of English language instruction and prepare students for success in a digital world.

Keywords: Algorithmic bias, Data, Integration, Challenges, Instruction.

Introduction:

Artificial intelligence (AI) is revolutionizing various aspects of our lives, and education is no exception. In particular, AI has made significant strides in transforming teaching and learning practices within the English language classroom. This article explores the myriad ways in which AI is reshaping English language education, from personalized learning experiences to automated assessment tools.

Personalized Learning with AI:

One of the most significant benefits of AI in the English language classroom is its ability to provide personalized learning experiences. AI-powered platforms analyze students' strengths and weaknesses, adapt content to their individual learning styles, and offer tailored exercises and activities. For example, AI algorithms can identify a student's preferred learning modality—whether visual, auditory, or kinesthetic—and deliver content accordingly, thereby optimizing learning outcomes and engagement.

Enhanced Language Instruction:

AI technologies are also enhancing language instruction by offering innovative tools and resources for both teachers and students. Virtual language assistants powered by AI, such as chatbots and voice recognition software, provide students with opportunities for real-time language practice and feedback. Additionally, AI-enabled language learning applications offer interactive exercises, multimedia resources, and gamified activities, making language learning more engaging and immersive.

The Impact Of Technology On Narrative Structure In Contemporary Fiction

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Abstract:

This article explores the evolving landscape of narrative structure in contemporary fiction in response to advancements in technology. With the proliferation of digital platforms and interactive media, authors are experimenting with new narrative techniques and storytelling formats, blurring the boundaries between traditional and digital literature. Drawing on examples from diverse genres and mediums, this research examines how technology influences the construction of narrative in fiction, from nonlinear storytelling and hypertext narratives to augmented reality and interactive storytelling experiences. By analyzing the intersection of technology, narrative theory, and literary innovation, this study sheds light on the transformative effects of technology on the storytelling craft, challenging conventional notions of authorship, reader engagement, and the future of storytelling.

Keywords: Fiction, Augmented reality, Technology, Digital Literature.

Introduction:

The advent of technology has revolutionized every aspect of human life, including the way stories are told and consumed. In the realm of contemporary fiction, authors are harnessing the power of digital tools and platforms to experiment with narrative structure, pushing the boundaries of traditional storytelling conventions. This article explores the profound impact of technology on narrative form in contemporary fiction, examining how authors adapt to and embrace the possibilities afforded by digital innovation.



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Synergistic impact of cationic surfactants on the performance of ZTO for supercapacitor applications

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Abstract

Zinc stannate (ZTO) nanopowders are synthesized using different cationic surfactants (CTAB, EDA, TEA) via hydrothermal technique. The as prepared samples were then characterized for their structure and optical properties through XRD, FESEM with EDAX, UV-DRS and FTIR techniques. It has been observed, that the surfactant played a crucial role in modifying the morphology of the samples. The reduction in the crystallite size was found when TEA was used as a surfactant. The specific capacitances of the prepared electrode materials using the synthesized samples were evaluated through three electrode system and that the capacitance value increased from 32 to 41F/g at the scan rate of 5mV/s for TEA assisted ZTO nanopowder.

Introduction

Depletion of natural resources has encouraged the scientist to create and design technologies that will help meet the ever increasing energy demand. Over the past few years many flexible and environmentally benign energy conversion and storage systems have attracted much attention worldwide which necessitates the development of high performance, low cost and green electrochemical devices for efficient energy conversion which includes battery, fuel cells, etc.,. Among the different energy storage devices supercapacitors are considered to be the promising candidate due to its superior current density with excellent conductivity, high capacitance, high charging rates and longer life cycle with good stability [1]. Mixed metal oxides that are ternary metal oxide materials have captivated the interest of the research community more than their binary counterparts due to the tunable band gap and work function and the structural cum physicochemical properties by simply varying the composition. Oxides of metal undergo reduction reaction at high temperatures and at the specific equilibrium temperature, the reoxidation takes place which is so important for a supercapacitor especially for an EDLC capacitor [2], [3]. Among various metal oxides (CuMn_2O_4 , ZnWO_4 , NiCo_2O_4 , MnFe_2O_4), Zn_2SnO_4 (ZTO) has a feasible property towards a vast range of applications like photocatalysis, sensors, dye degradation, lithium-ion batteries, supercapacitors, solar cells, etc. Due to its special electrical property with the wide band gap value of 3.6eV, this n-type semiconducting metal oxide (ZTO) with



Exploration and study on the influence of Zinc substituted Barium Stannate (BaSnO_3) nano powders for ammonia sensing applications

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Abstract

In the present work, we report the results of the gas sensing performance of ternary Barium Stannate (BaSnO_3) semiconducting oxide material doped with zinc at the Barium site ($\text{Ba}_{1-x}\text{Zn}_x\text{SnO}_3$, where $x=0.0; 0.2; 0.4; 0.6; 0.8$ & 1.0). The samples are synthesized using a facile hydrothermal technique. The X-Ray Diffraction technique revealed that the synthesized samples are cubic structures with a preferential orientation along the (1 1 0) plane. In the exploration of the Field Emission Scanning Electron Microscope (FESEM), a structural deformation is observed for the doped samples and the material compositional information is witnessed through the EDAX spectrum for all the samples. The optical absorption spectra are carried out using UV-DRS and the calculated bandgap values are decreased for the Zn doped samples approximately to 0.7 eV compared to pristine BSO. Among various test gases, all the interdigitated electrode materials exhibited a fast response to NH_3 except $2\text{B}1-x\text{Zn}_x\text{SnO}_3$. Amidst these electrode materials (BZSO (0–10 wt%)), the 8BZSO exhibited good sensitivity to NH_3 at 5 ppm at room temperature. The similar response, recovery time (the 40s), and good cyclic repeatability of the 8BZSO electrode material clarify that this would be the most favourable electrode material for NH_3 gas sensing.

Introduction

A perfect gas sensor must be portable, cheap, rapid in detecting anticipated gases, smaller in size, ease of action, long life cycle most importantly it should be an impeccable factor in understanding the environment that would be set to measure the concentration of gases higher than the normal level. Monitoring and detection of lethal gases are so crucial because the presence of noxious gases directly affects the safety of lives. There are various types of toxic gases (CO , CO_2 , CH_4 , $\text{C}_2\text{H}_5\text{OH}$, CH_3SH , NH_3 , H_2S , SO_2 , NO_2 , NO_3 , N_2O_5 etc.,) present in the atmosphere which can cause different impact on lives and can also explode if its range exceeds a certain limit. To detect the presence of these gases in the atmosphere, scientists are in search of gas sensors which are durable, cost effective and quicker in response. For the past three decades, the advancement of

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CHALLENGES FACED BY FEMALE TRIBAL STUDENTS IN PURSUING HIGHER EDUCATION

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ஆன்மீக இயக்குனர்
தார்டுகோவொஸ்க்யும்



சமூகச் சிந்தனைகள்

முன்னுரை

சமூக அமைதி மனிதர்களின் கூட்டம் என்ற நிலையில் அவர்களிடையே நிலையும் வாழ்க்கையும் இருவேறு சமூகமாகக் கருதப்படுகின்றது. மக்கள் விடுதலையாகுபடு நினைதது காலகட்டத்தில் தங்கள் மக்களது உடலில் நிலைப்படுத்திக் கொள்ளத் தொடங்கிய பொழுது செல்வத்தர், செல்வம் அல்லாதவர் என்ற பாடுபாடு மக்களிடையே பெருகுபுரப்புகதை ஏற்படுத்தினது. செல்வத்தின் மதிப்பு உலரத் தொடங்கியது. கூண்டாள்-அடிமையர்,முலாளர் தொழிலாளர் என்ற பாடுபாடுகள் மக்களிடையே பெருகின. இதனால் சமூகத்தின் மனிதர்களின் மனநிலைகளில் மாறுபாடு ஏற்பட்டது. மேலும் சாதி, மத வேதங்கள் மக்களால் மீறிக் கொள்ளும் சூழ்நிலை சமூகம், மது குறித்துப் பல புதிதங்கள் எடுத்தியம்பப்பெள்ளின. அந்த வகையில் என். அர்ஜுனா அவர்கள் தனது புதிதங்களில் இப்போதெல்லாவது கட்டியதொரு சின்ன எதிர்ப்புறையான பக்கங்கள் அடையாது கட்டியிருப்பான எனத்தக்க கட்டியுள்ளார். எவ்வித வேறுபாடு இதைப் போதிலும் நிரூபணம் என்ற நிலையில் மக்கள் ஒன்றுபட்ட நிலையையும் புதிய செல்வங்கள் எவ்வகை ஆய்வுதரக் கூடியதெனக் கொள்ளப்படுகின்றது.

செல்வந்தின் இன்றியமையாதம்

மக்கள் பணம் மாற்று முறையில் வாழத்தான் காலம் மாற்ற வேண்டுகின்ற கொள்கை வளர்ப்பதில் சேஷத் தொடங்கியிருக்கின்ற செல்வத்தின் முக்கியத்துவம் பெருகத்தொடங்கியிருக்கின்ற செல்வம் வைத்திருப்பவன் உயர் வாக்கத்தினாலாகும். செல்வம் இல்லாத ஏழைகள் அடிமையாம் போன்றும் நடக்கும் நிலைமை உருவப்பெற்றது. எனவே செல்வத்தை ஈட்டுவதற்காக மக்களின் சிவன் நாமக் வாய்க்காததைப் போடத் தொடங்கினான். இதன் விளைவு உருவகங்களுக்கிடையே இருந்த அனாதை நிலை ஏற்பட்டது.

—தொழிலை வலுவைப் பெருளாகச் செய்பவன் பொருளையே இல்லை பெருளான்¹

என்ற பூரணக்கு இலங்க செல்வமாதான் ஒருவரது தகுதியைத் தீர்மானிக்கும் அளவுபோலாக அமைகின்றது. செல்வத்தையே முதிர்கோனாகக் கொண்டு கற்றித் தீர்வார்களின் பேச்சுக்கள் செல்வத்தை மையமிட்டதாவே இருக்கும். நாவில் கேணுரப் பஞ்சவயோதிலும் மணம் கழித்திருக்கும்.

“எமபொதி லீளக்கே அன்ன
மனதினூட் கறுப்பு வைத்தீ”

[illegible]

“தனது விட்டுக்கு குரையையன். சொத்து முழுதும் அவனுடைய தான். அவன் சொத்து எத்தனை என்று அவன் பொறுத்தபடிக்குத்தானோ. அந்த இப்பக்கையில் இருக்கான் என்று. இப்படி இருந்தான் என்று. ஏதாவதும் ஒன்றுதான் என்று விளக்கம் வேற எடுத்தாரா? அந்தக் கொழுக்கு மறுபேச்சு எதுவும் இரண்டாம். அதோட தீக்கா, இப்படி அநியாய முடிவு எடுக்க குத்துவான்”

மட்டுக்காள் முடிபெற்று திரிந்தபடியே வேற உருவாமிருந்தான். “என்ற கற்றறிந்தது குத்துவான். கற்றறிந்தது யாவரும் ஒப்புக் கொள்ளவேண்டிய அபி முடிவிற்கு. மேலும் மனநிர்மாணம் எதுவுமில்லை. தடைப்பட்டு இருக்க குத்துவான். செவ்வ பகாரம் என்ற கடை வண்ணத் தோள் இருந்தது.”

ஆனால், இந்த மனம் தென்காணின் அலகிப்பயரும் என்று கூறிய குஞ்சலு சொலந்தக் குடும்பத்தைச் சார்ந்தவர். ஆகவே அவனுக்கு ஏதோ ஒரு மறுப்பும் எழுப்பப்பட்டிருக்கலாம். இவ்வையாப்பிள்ளை வீட்டாசின் குரலாக இருந்திருந்தால் நிச்சயம் மெய்யுடையதா அல்லாது இருக்கும்.

சென்னைத்தைக் கவர்தல்
 "ஒருவர் பல முன்னிலையில் நல்லிதழாகப் பேசிப் பழகிப் போதும் அவர் மனம் செவ்வளைத் தவர்தலும் குறியாக இருப்பதைக் குறிப்பிடுவது புதினத்தில் பதிவு செய்யுமா?"
 "மனத்தோளை வாரிவைத்துத் தவர்தலும் அவனததரன்
 -சே.லீ.பிற்"

சுற்றிச் சென்றிருக்கிறார்கள். ஆனால் வங்கத்தில் தண்ணீரையும் மீட்டிலும் கொண்டு மக்கள் பழகுவதை ஆகிரியர் தவறுவதில்லை என்பது தெரியவில்லை.

[illegible]

“ஏற்கனவே நூதன பதிர ஆங்கு கூட்டட்டுப்
பொகாமலேயே, விடவாக் கூட்டை வந்தன
கையெழுத்தை வைத்துப் பதித்தத் பதித்த
எடுத்துக் கொண்டு, அதன்குநடைய ஆயிர
பாத்தவகு, “நானாகே கொளம் பதித்தனம்”

என்ற கூற்று தெளிவுபடுத்துகின்றது. இதிலிருந்து பனவே உறவுகளாகக் கூட நிர்வாகிக்கின்ற என்ற வயத்தக்கதை ஆகியவை பதிவு செய்கின்றார்.

நட்பு
இலக்கியங்களில் நட்கீற்று உதாரணமாகப் பலர் காணலாம். அரியாது தினலென்றது வரும் இழையில் செல்வம் நீட்சையாம். இத்தொகுதி உள்வாங்கும் நிலையை ஆறியப் பதிவு செய்கின்றார். பயனும் பத்தும் செய்யும் என்பதும் பழமொழி.

“தூள்பே கூடல்
என்கிறாது
காமம்
கூலும் தூளி
என்கிறது
நாபு”

என்ற அறிவுமதி அவர்களின் கவிதைப்படி நட்புறகு நெய்
வளரையறப்படுகின்றன. பாடி நட்புறகு எந்திரப்படுபதென்பது
இவ்வகை. ஆனால் செல்வத்தினால் நட்புறகு முற்றிச் செல்வம்
காலவந்த ஆகியிருந்தது பதினாறாவது நூற்றாண்டு. இது
தலைப்புகள் கொண்டு தொழில் தொடங்கி அதன் வரும் வாய்ப்பு
பலிபடுத்திக் கொள்ளும் நிலைப்படுவது காலவந்தங்களாக இருந்து
வரும் ஒன்று தான். அந்நேரத்தில் பாடி செல்வத்தின் போதனை
கரைப்பாடி பதினாறாவது நூற்றாண்டு தொடங்கி
வெள்ளையினரால். இவ்வகை செல்வத்தினால் இருந்தபோதிலும்
முதலிலே செல்வம் என்ற வரும்பொருது இருவருக்கும்
மற்றபுறமாக மனம் தெளிப்படுகின்றது. உடனே சந்திக்க முன்

“நம் பார்டீஸ்களில் நமது ஒரு தேர்தல் இலக்கு தான் பணம் போட வேண்டாம் என்று பணம் போடலாம் என்றே போதும். அப்படி பார்டீஸ்கள், எட்டுபிளி பிளா தாம் போல் வாங்குதோம், எட்டுபிளி அரை அரைக்கோம். ஆகவே போர்டுக்கு உலக வாங்குதல் அந்தேர்ப்பு பணம்தான்.”

மத்திய குமாருக்கு இந்த திட்டமும் ரொம்பவே பிடித்திருந்தது. எப்படியாவும் எங்கிருக்காப் பிடிவ லிஷயங்களை போகிக் குடிபுது என்று ஆசிரியர்க ளுடைய கைவிட்டுந்து காக போட வேண்டாம். ஆனால் பதிலாய் ஒரு தொழில். முன்னால் போனால் சொல்வது இன்னால் வந்தால் உணக்காது உடனே சரி சொல்வது. வந்தால் தவ் பணத்தையே வேறு ஒரு தனயரிடம் வாய்ப்புதான் சொல்லி முகந்தி வேய் சுவல் மனை திட்டிட்டிருந்தது. வட்டிக்கு வட்டியுமாக. பக்குரார்துமும் அந்தமும் வேறு.”

[illegible]

“சதுஜக போளால் போளாய்”
என அதுவல் போளால் போளால்
தளவமுறை ஒருகோடி களவ

நிழ்நெடவை ஆடும்
என்றார் பாதிதான். ஆவனகூறக்க வந்தான் வீண சபு
எனவடத்தில் மயப் பெரிசாகப் போய்தும் ஒரு வாங்கித்
துணை. அவை அவிப்பதானிருந்தால் எஜம்பொருளும் உடனே
விற்பனையாகிவிடும் என்ற மனநிலை விற்பனையாளிகளிடமும்
ஆளாகப் பொருளுக்கும் செல்து தாம் தான் பணம் கட்ட
வேண்டும் என்ற நிலை அறிபாத வாடிக்கையாளர்களிடமும் இருக்கும்
காலகட்டம் இது. ஆகவே என்ற பெயரில் பஸ் சொடுத்த
மக்களையாற்றிடுகின்றனர் என்பது தாம் அறிந்தே. அநியல்
கூட ஆவனகளை நம்பத் தான் இருக்கின்றன. ஆனால் புதித
ஆகியப் புதிய கலையோடத்தான் இளை வளையடுத்த
இன்றார். ஒரு கம்பெனி கட்டுவதற்கு உமானப் பொருட்டின்
மேல் அளவுக அளவுகள் பொருது, அவர்களையிடுகியோக.

[illegible]

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அரியமா நோக்கு

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மொழி, திரைப்படம், கலை, பண்பாடு, வரலாறு, மெய்யியல், அறிவியல்சார் பன்னாட்டுக் காரணம்முதல்
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எஸ். அர்ஷியாவின் புதினங்களில் புலனாகும் நடப்பியல் அரசியல்

க. சரவணன்

(முனைவர் பட்ட ஆய்வாளர்
(பகுதி தேரம்)

முனைவர் து. பரமேஸ்வரி

நெறியாளர், இணைப்பேராசிரியர் & துறைத் தலைவர்,
தல்லமுத்துக் கௌண்டர் மகாலிங்கம் கல்லூரி,
பொள்ளாச்சி

முன்னுரை

உலக வரலாற்றில் வள்ளுவர், பிளேட்டோ, அரிஸ்டாட்டில், கௌடில்யர் போன்ற மேதைகள் அன்று ஆட்சி முறையில் ஏற்றுக் கொள்ளப்பட வேண்டிய பல கொள்கைகளையும் தத்துவங்களையும் சொல்லி வைத்தார்கள். "அரசாங்கம் நோன்றுவதற்குக் காரணங்கள் எவையாக இருந்தாலும், தொடக்கத்தில் மன்னராட்சியும் அந்த மன்னர்கள் பலவீனம் அடைந்த போது பிரபுக்கள் ஆட்சியும் பிரபுக்களின் பிடிப்பு வலுவடைந்த போது, அதிலிருந்து விடுதலையாக வேண்டும் என்ற விருப்பத்தின் விளைவாக இன்றைய ஜனநாயக ஆட்சியும் ஏற்பட்டது என்பது உண்மை" என்று கூறும் இலக்குமணப் பெருமாள். "இது ஜனநாயகமும், அதனால் மக்களுக்குக் குறைந்த அளவு உட்பாடுபாடுகளோடு நிறைந்த அளவு உரிமைகள் வழங்கப்பட்டுள்ளன" இராசம்பத் புதுக்கவிதையில் இலக்கிய இயக்கம் பற்றி என்றும் கூறுகின்றார். முடியாட்சி முறைகள் ஒழிக்கப்பட்டு மக்களுக்காக மக்களே ஆளுகின்ற முறையே மக்களாட்சி எனப்படுகின்றது. மக்களால் தேர்ந்தெடுக்கப்பட்டு ஆட்சியாளர்கள் தேர்ந்தெடுக்கப்படும் இம்முறையின் நன்மையை கவிஞர் தமிழன்பன்,

முடியரசு ஆட்சிக்கு முத்தாய்ப்பு வைத்து
முடித்து வந்த தல்லாட்சி முன்னேற்றம் காண

விடியரசு நோன்றிலின் விளைத்து வந்த நன்மை

விர்வாக்கும் எண்ணிக்கையில் விளங்கிவிடப் போமோ

என்ற கவிதை வரிகளில் திருவள்ளூர் கரையேறுகின்றன, தமிழன்பன் ப.58) குடியாட்சி பற்றிக் கூறுவதோடு "அரசியல் முறைமை தன்னில் அணிநிதிட வேண்டும் தீபம்" திருவள்ளூர் கரையேறுகின்றன, தமிழன்பன் ப.22) என்ற வரிகளின் மூலமும் வெளிப் படுத்துகின்றார். மேற்கண்டவாறு வரையறை கொடுக்கப்பட்ட அரசியல்

அரிமா நோக்கு 181 ஏப்பிரல் 2024

தன் இலக்கண முறைப்படி இல்லை என்பதை படைப்பாளர் எஸ். அர்ஷியா தனது படைப்பில் பல இடங்களில் பதிவு செய்துள்ளார். அவ்வாறு எடுத்துரைக்கும்படி நடப்பு அரசியல் நிகழ்வுகளை பலவாறு சாடியுள்ளார். இதை நாம் மீமெய்ம்மைக் கண்ணோட்டம் எனலாம். இத்தகு நிகழ்வுகளைக் குறித்து ஆய்வதாக இந்த ஆய்வுக் கட்டுரை அமைகிறது.

கட்சிப் பரப்புரை

தலைவர்கள் மீது உண்மையான அன்பு கொண்ட தொண்டர்கள் செயல்களின் அடிப்படையில் தான் கட்சியின் வளர்ச்சி அமையும். தொண்டர்களே தலைவர்களின் சிறப்பினை உலகநியச் செய்யும் பணியைச் செய்கின்றனர்.

தொண்டர்கள் தலைவர்களின் மீது கொண்டிருக்கின்ற அளவில்லாத பற்று அவர்களுடைய பெயர்களைப் பச்சை குத்திக்கொள்வது, தம் குழந்தைகளுக்குத் தலைவர்களின் பெயர்களைச் சூட்டுவது என்று தொடங்கி கூட்டத்தோறும் கொள்கைப் பரப்புச் செயலாளராகச் செயல்படுவது என்று அவர்களது பணி விரிந்து தலைவர்களுக்காகத் தொண்டர்

கள் தன் வீடு, குடும்பம், வேலை என அனைத்தையும் மறந்து பரப்புரை செய்கின்றனர். இப்படியான உண்மை பரப்புரையாளர்களின் செயலினை எஸ். அர்ஷியா தனது சொட்டாங்கல் எனும் புதினத்தில் கட்டிக்காட்டியுள்ளார்.

"வெளியே தர்ஹாவிலிருந்து தேரே சென்று வடக்கேயும் தெற்கேயுமாய் பிரியும் சாலைமையப் பார்த்தபடி எதிர்க் கட்சியின் பிரச்சாரக் கூட்ட மேடை அமைக்கப்பட்டு, பாடல்கள் ஒலித்துக் கொண்டிருந்தன. அக்கட்சித் தலைவரின் வாழ்க்கை வரலாறு, பிரிக்கப் பட்ட பல

கூட்டங்களாய் கனத்த, கரகரத்த குரலில் இலக்கியமாய் இளகி வழிந்தது. மரித்த பின்பும் நினைவில் திரும்பும் குரலாய் அது இருந்தது. மினாராக்களில் அடைந்திருந்த புறாக்கள் அக்குரலில் கவனம் பெற்று வெளியே வந்து சிறகடித்தன. பரிதவித்துத் திரிந்தன. பிறகு அக்கட்சியின் தலைவர், தனது தலைவரின் இறப்பில், 'இரவலாய் இதயத்தைக் கேட்டு, தான் வரும்போது, அதைத் திருப்பித் தந்து விடுவதாய்' 'பிராமிசி நோட்' வாசித்த கடன் கவிதை

இரைச்சலுடன் ஒடிவது. நாற்பது ஆண்டுகளுக்கும் மேலாக தேய்த்தேய ஒட்டப்பட்ட கழல் தட்டிலிருந்து குறுவட்டாகி இப்போது பெண்டிரைவிறும் அதே குரல்" (சொட்டாங்கல் ப. 28)

எனும் வரிகள் மூலம் எஸ். அர்ஷியா அரசியல் கட்சிப் பரப்புரைகளில் ஈடுபடும் தொண்டர்களை அடையாளங் காட்டியுள்ளார்.

தொண்டர்கள் தங்கள் தலைவர்கள் மீது கொண்ட அத்தப் பற்று காரணமாக மேடையில் பேசும் பொழுது எதிர் கட்சியினரின் கொள்கைகளைத் தாழ்த்திப் பேசுகின்றனர். தங்களது பேச்சால் தன் கட்சி சார்ந்த சிறப்புகளையும் எதிர் கட்சி சார்ந்த குறைகளையும் கட்டிக் காட்டும் தன்மை காணப்படுகிறது. ஒரு சில பேச்சாளர்கள் தங்களது சிறப்பு களை எடுத்துரைப்பதைக் காட்டிலும் எதிராளியைக் குறைபாடுவதை மட்டுமே குறிக்கோளாகக் கொண்டு செயல் படலாயினர். காலம் செல்லச்செல்ல மேடை நாகரிகம் என்பதை அரசியல் பேச்சாளர்கள் கைவிட்டனர் எனலாம். கண்ணியமாக மேடைக்கு வருதல் என்ற நாகரிகமும் மாறிப்போயிற்று என்ற தனது ஆதங்கத்தை எஸ். அர்ஷியா தனது சொட்டாங்கல் புதினத்தில் பல

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பணக்கிருகங்கள் எனக்கு ரொம்ப மதுரை - த. கிருட்டிணன் வழக்கு
கட்டாயத்து போலீஸ் இன்டிவிஜ்வலா மே, 20, 2003 அன்று முன்னாள்
ஆகடபண்ண முடியல தில அகரீப்பு நெடுஞ்சாலைத்துறை அமைச்சர் பம்
தான் பிபி இங்கே குடியிப் பிரச்சனை பொன் த. கிருட்டிணன் கொலையில்
பா இருக்கு அதுக்கு பெகப்பாணா முகிய சதிகாரராக அரசியல் பிரமுத
இருக்கு ரவுடிமலமக்கத் பேரல் குரவர் குற்றம் சாட்டப்பட்டார். தி
அடராடிப் போலீசிகள், போலீஸ் கிருட்டிணன் மதுரை. கே.கே. திரு
ஆயா போலீஸ் இந்த அடராடியை உள்ள அவரது இல்லத்திற்கு அரு
வாத்தாத்து பிபி ரவுடி குரு காவை நடைபயிற்சிகு நென்றோ
பததாய்களோளி வந்தாது, அவல் அடையாளம் தெரியாத தங்கராக
கை இவறுதுக்கு எல்லாக் கட்சின் வெட்டிக் கொல்லப்பட்டார். அது
வழிக்கு சப்பிராப் பண்ணிக்கிட்டு நாளே உட்கட்சிப் பூசல் காரணம்
ஆ வழக்கு (சொட்டாங்ஸ் ப224) கொலைக்குச் சதி செய்ததாகக் குற்
வந்து மதுரை மாநகம் கலக்காரர் சாட்டப்பட்ட அரசியல் பிரமு
கின் கூடாரமாக மாறுவதற்கும் துரவர் நைது செய்யப்பட்டார். ம
பட்டபயலில் நடுத்தெருவில் கொலை குற்றவாளிகளான அதே கட்சி
த்யயதற்கு ஆதரவாக அரசியல் சேர்த்த சில பிரமுகர்கள் குற்
கட்கின் இன்று உடந்தையாகச் சொலை, துண்டுவ ஆகிய பிரிவு
செயல்படுவதன் என்பதை எல் முகியக் குற்றவாளிகளாகக்
அன்பு வாருத்ததுடன் தனது செய்யப்பட்டனர். இந்த வழக்கு ஆ
பட்டபயல் பதிவு செய்துள்ளார்.

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என் அர்ஷியா தனது பொய்கைக் கட்டித்துக் காட்டியுள்ளார். கட்சிக்கு உண்மையாக உழைத்த தொண்டனுக்கு, கட்சியின் மூணையாக இயங்கியவர்களுக்கு, கட்சியின் வெற்றிக்கு அடித்தளம் மீட்டவர்களுக்கு முதல் மரியாதை வழங்குவது வழக்கம். மாறாக இங்கு கொலை நிகழ்ந்தது. அவரது குடும்பமும் சிதைக்கப்படுகிறது.

முடிவுரை

கட்சித் தலைமை சார்ந்த ஒரு சாரர்தான் தள்ளை நிலைநிறுத்தச் சில செயல்கள் செய்வது இருத்தலியல் எனும் நடப்பில் செய்வது இருத்தலியல் எனும் நடப்பில் ஆகும். இத்தனைமேல்கு மதுரைக்குக் குக்கிய அரவியல் பின்னணி உடையவராக செயல்களை எஸ். அர்ஷியா தனது புள்ளங்களில் ஒப்பட்டுள்ளார். இவ்வாறு சொல்லி வைக்கின்ற நிகழ்வு, தனது அறிவுமிகிறது.

ஆள சார், என்னமோ 'வாக்கிங் பீரெல்ஸ்' என்று பொலம்பிட்டே போனான் சார்' என்னது, வாக்கிங் ஸ்காசொன்னான்? அவருக்கு வியர்த்து விட்டது. 'வாக்கிங்' என்ற சொல்லுக்கு, மதுரைப் பேரே அர்த்தம் எடுத்துக் கொள்ளப்படுகிறது. அண்ணனுக்கு ஆகாத அமைச்சர் ஒருவரை அவர் வாக்கிங் போகும்போது, அடிப்பொடிகள் போட்டுத்தள்ளியிருந்தது. நினைவில் தேவையில்லாமல் வந்த போது கால்களில் லோசாக நடுக்கம் தோன்றியது. (பொய்கைக்கரைப்பட்டி ப.157) என்று மதுரை பிரமுதர் அவர்களது நட்டப் புட்டம் அவரின் தொண்டர்களின் கொடூரக் கொடும் பாடுகள், யார் சொத்து வாங்கியாலும் எனக்கு தரகுப் பங்குத் தொகை கொடுக்க வேண்டும் என்ற வன்முறைச் செயலாடுகின்ற அனைத்தையும் எஸ். அர்ஷியா அவர்கள் தனது பொய்கைக் கரைப்பட்டி புதினத்தில் படம் போல மூலப்பகுதிக்குள்ளேயே முக்கிய அரசியல் தலைவரின் நடைபயணங்கள், சிந்தாமணி டாக்டர் விவகாரம், திருங்கலம் இடைத்தேர்ப்பு, நவம்பர் 8, 2016 நிழல் (பன்னிப்பிழை) தமிழக அரசியல்வாதிகள் செயல்கள், ஊழல், அரசு அலுவலகங்கள் அரசுக்கேனும் அரசியல் அலுவலரை நடப்பியல் சிந்தனைகளோடு பிடி செய்துள்ளார் எஸ். அர்ஷியா.

மாக்கிஸ் கார்னியின் தாய், டாலன்டாயின் போகும் அமைதியும், ஹெய்மியலேயின் கடலும் பிழையும், வாடல்டர் ஸ்காட்டின் ஐயம் ஹோ முதலியன சிறந்த மொழி பெயர்ப்பு புதினங்களாகும். தாகூர், பகதீ சந்திரர், சரத் சந்திரர் ஆகியோர் வந்த நாவல்களும், தகுதி சிவசக்தி பிள்ளையின் செம்மீன் என்ற மலையாள நாவலும் தமிழில் மொழி பெயர்க்கப்பட்டுள்ளன.

அறிமுக நோக்கு 18:1 ஏப்பிரல் 2024

NAME OF THE DEPARTMENT: DEPARTMENT OF TAMIL (AIDED)

1.Publication of Research Papers at the state / National / International Levels

S.NO	Type	Author	Co- Author	Title of the paper	Journal Name with ISSN	Volume No.Issue No.	Year of Publication
1	International Level	Dr.P. Maheswari & V.Murugeswari	-	So.Dharmanin Soozh Navalil Iyarkai	Ungal Noolagam, NCBH. ISSN : 2394-7535	-	Jan - 2023
2	International Level	Dr.P. Maheswari & Narmatha Devi	-	Mullainilaththin Vaazhviyal	UngalNoolagam, NCBH. 2394-7535	-	Jan - 2023
3	International Level	Dr.P. Maheswari & B.Dineshkumar	-	Naaladiyaaril Aramsaar Iyarkai Soozhaliyal	IJTLLS (UGC Care) ISSN : 2581-7140	-	Oct - 2023
4	International Level	Dr.K.Dhanalakshmi & Sowmiya	-	Kootru Nokkil Aingurunootru Paadalkalum Karuththu Pulappaatu thiranum	Puthupunal ISSN : 2278-1641	-	April-2023
5	International Level	Dr.K.Dhanalakshmi & Vijayalakshmi	-	Udhayasankar Padaippukalum Ulaviyalum	Puthupunal ISSN : 2278-1641	-	Aug - 2023
6	International Level	Dr.A.Mahalakshmi & N.Tamilarasi	-	Pillaithamizhil Iyarkai Vaazhviyal	Ungal Noolagam, NCBH. ISSN : 2394-7535	-	Jan - 2023
7	International Level	Dr.A.Mahalakshmi & S.Pavithra	-	Bharathiar Kavithaikalil Iyarkai	Ungal Noolagam, NCBH. ISSN : 2394-7535	-	Jan - 2023
8	International Level	Dr.A.Mahalakshmi & N.Tamilarasi	-	Bharathiar Paadalkalil Pillaithamil Koorukal	IJTLLS (UGC Care)	-	June - 2023

					ISSN : 2581-7140		
9	International Level	Dr.A.Mahalakshmi & S.Pavithra	-	Bharathiar Kavithaikalil Penniyam	IJTLLS (UGC Care) ISSN : 2581-7140	-	June - 2023
10	International Level	Dr.A.Mahalakshmi & N.Tamilarasi	-	Perungarunaiaimmai Pillaithamizh Koorum Avinashi Thiruthalaththin Sirappukalum Vazhipaattu Muraikalum	IJTLLS (UGC Care) ISSN : 2581-7140	-	July - 2023
11	International Level	Dr.P.Maheswari		Mahakavi Bharathiyin Penn Viduthalai	Kalanijiyam E-Journal, NGM College		July-2023
12	International Level	Dr.P.Maheswari		Pazhamozhi naanootril Aram	Kalanijiyam E-Journal, NGM College		Oct-2023

2.Participation and presentation of papers by faculty in Congress / Conferences / Seminars / Workshops, Symposium, etc.

S.NO	Name of the Faculty	Congress / Conference / Seminar / Workshop and Venue	Title of the paper	From
13	Dr.P. Maheswari(HoD)	Seminar - Swami Vivekanandharum Mahakavi Bharathiarum NGM College	Bharathi Endroru Kavikkuyil	April-2023
14	Dr.K.Dhanalakshmi	Seminar - Swami Vivekanandharum Mahakavi Bharathiarum NGM College	Mahanum Mahakaviyum	April - 2023
15	Dr.K.Dhanalakshmi & R.Baladharani	Seminar - Swami Vivekanandharum Mahakavi Bharathiarum NGM College	Swami Vivekanandharin Vettri Sinthanaikal	April - 2023

16	Dr.A.Mahalakshmi & N.Tamilarasi	Seminar - Senganthal Vazhipaadu	Pillaitamil Koorum Vazhipaattu Muraikal	2023
17	Dr.A.Mahalakshmi & S.Pavithra	Seminar - Senganthal Vazhipaadu	Bharathiar Kavithaikalil Vazhipaadukal	2023
18	Dr.B.Aruljothi	Seminar - Swami Vivekanandharum Mahakavi Bharathiarum NGM College	Bharathiarum Vivekanandharum	April- 2023

3.Publication of Books

S.NO	Author	Co-Author	Name of the Book	ISBN	Publisher/Place	Year
19	Dr.P.Maheswari(HoD)	-	Thamizharuvi	978-81-2344-576-2	NCBH,Chennai	Dec-2023
20	Dr.K.Dhanalakshmi	-	Swami Vivekanandharum Mahakavi Bharathiarum	978-81-2344-448-2	NCBH,Chennai	April-2023
21	Prof.R.Suriya	-	Ilakkiyanathi	978-81-2344-490-1	NCBH,Chennai	July-2023

4.Publication of Book Chapters

S.NO	Author	Title of the Chapter	Title of the Book	Editors	Publishers	Page No.	ISBN	Year
22	Dr.P.Maheswari(HoD)	Aattrupadai Noolkalil Aarupadaikalin Sirappukal	Ilakkiyanathi	Tmt.R.Suriya	NCBH,Chennai.	51-56	978-81-2344-490-1	July-2023
23	Dr.K.Dhanalakshmi	Kaatril Mithantha Paadalkal	Ilakkiyanathi	Tmt.R.Suriya	NCBH,Chennai.	84-90	978-81-2344-490-1	July-2023
24	Dr.A.Mahalakshmi	Pathinenkeezhkanakku Noolkalil Illaramey Iyarkaiaram	Ilakkiyanathi	Tmt.R.Suriya	NCBH,Chennai.	57-63	978-81-2344-490-1	July-2023
25	Dr.B.Aruljothi	Thiruvaasakaththil Manikkavasakaran Bakthineri	Tamil Solai	Dr.A.Mahabobu	NCBH,Chennai		978-81-2344-577-9	Dec-2023
26	Dr.B.Aruljothi	Sanga Ilakkiyaththil Suttru Soozhal	Tamizharuvi	Dr.P.Maheswari	NCBH,Chennai	75-80	978-81-2344-576-2	Dec-2023
27	Prof.R.Suriya	Thirukkural Kaattum Aalumaithiran	Tamil Solai	Dr.A.Mahabobu	NCBH,Chennai	81-86	978-81-2344-577-9	Dec-2023
28	Prof.R.Suriya	Ithgazhkalil Ulagalaaviya Sinthanaikal	Tamizharuvi	Dr.P.Maheswari	NCBH,Chennai		978-81-2344-576-2	Dec-2023

5. b) Co-curricular (Sports / Cultural & Others)

Name of the Student	Name of the Exam / Event	Position (JRF / Winner / Runner/etc.)
Veda Thirumagal.A.M.	Essay Writing Competition	1st Prize
Karpaga subhashree.M.	Quiz	1st Prize
Swathi.S	Quiz	3st Prize

**DEMOGRAPHIC FACTORS AND THEIR IMPACT ON STOCK MARKET
PREDICTIONS: A STUDY ON RETAIL INDIVIDUAL EQUITY INVESTORS**

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ABSTRACT

This article explores the art of investment, focusing on the stock market as a volatile but potentially rewarding avenue. It emphasises the importance of diversification and risk analysis in pursuing financial growth. The study investigates the demographics of 117 investors and their influence on stock market predictions. Statistical tools such as simple percentages,

t-tests, and ANOVA were employed to analyse the data. The results indicate that gender, occupation, residential area, and annual income do not significantly impact investors' predictions or future investment plans. Interestingly, age was found to be the sole determinant influencing future investment plans, although it did not affect stock market predictions. This research provides valuable insights into the dynamics of investment behaviour and the role of demographics in financial decision-making.

Keywords: Stock market, demographics, prediction, plan.

1.1 Introduction

Investment involves allocating surplus funds into assets that yield income over time. Various forms of financial investments exist, including fixed deposits, post office deposits, precious metals like gold and silver, real estate, insurance, equities, and mutual funds.

These investments can be broadly categorised into low-risk or no-risk investments and high-risk investments. Individuals who prefer less risk tend to opt for fixed deposits, post office savings, insurance, and similar options. Conversely, those willing to take on more risk may choose more volatile assets like equities. The selection of investment avenues depends mainly on the expected rate of return and the investor's risk tolerance. It is understood that higher risks are associated with higher potential rewards. The stock market is one such high-risk, high-reward investment avenue.

Since its establishment, the SENSEX indicated the stock market has grown 560 times. The primary goal for most people who invest their money is wealth accumulation. However, investment decisions are influenced by a multitude of factors. Investors must ensure that their investment choices align with their age, income, and other demographic factors. Therefore, demographic variables significantly influence investment decisions, particularly among Indian investors. Geetha and Ramesh (2012), in the study "A study on the relevance of demographic factors on investment decision", determine whether these demographic variables influence investors' market predictions and future investment plans.

1.2 Review of Literature

Rawal and Chowdhury (2018) conducted a study to understand the association between psych demographics and the trading patterns of retail investors. The data of 300 respondents were analysed using the chi-square technique. The study found an association between demographic profiles, such as age, gender, and annual income, and the trading behaviour of retail investors.

Patel & Modi (2017) undertook a study to identify the factors influencing investment decisions, to examine the association between various demographics and investment objectives, and to determine the most preferred investment avenue among the investor community. Data were collected from 100 respondents. Independent sample t-tests and ANOVA were used to analyse the data. The findings revealed that demographic variables like age, gender, and income significantly impact investors' decision-making.

DETERMINANTS OF CUSTOMERS LEVEL OF AWARENESS ABOUT ONLINE FOOD ORDERING AND DELIVERY SERVICES – WITH SPECIAL REFERENCE TO COIMBATORE DISTRICT, TAMILNADU.

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Abstract

This paper aims to identify the customer's level of awareness about online food ordering & delivery services in Coimbatore district. The study is based on the primary data which are collected for the period of one month from 1st June 2023 to 30th June 2023 through questionnaire method. The collected data have been used for analysis with the help of statistical tools namely, percentage analysis and ANOVA. The primary data for the study have been collected from a sample of 75 customers based on convenient sampling method. Finally, the study concludes that the variable gender has a significant relationship with the awareness index.

Keywords:

Online food delivery, Awareness level, social media advertisement

Introduction

Now a days, dining habits of food among customers have changed tremendously. Because of fast growth in technology development and high usage of smartphone. Online food delivery platforms recast the way people access enjoy food, better convenience, broad range of outlet options, effective doorstep delivery. The concept of food delivery in India has a durable history, with traditional home-made meals and local restaurants gives limited distribution services. Yet, the incoming of the internet and the uptrend of mobile apps has revised this skill practice, introducing an excellent and adequate system that caters to the fast-paced lifestyles of dwellers.

The first Online Food delivery app Foodie Bay established in July 2008 by Deepinder Goyal and Pankaj Chaddah. The website started as a restaurant-listing-and-recommendation portal. They renamed the company's name Zomato in 2010. After, this they expanded their services within and outside India. In August 2014 Swiggy online food ordering and delivery service company launched by Sriharsha Majety, Nandhan Reddy, and Rahul Jaimini headquarters located in Bangalore, India. ZOMATO and SWIGGY play major role in Online Food Delivery industry in India. Many Online Food Delivery Apps are still running in big cities like Chennai, Mumbai, Delhi, Kolkata, Pune, Ahmadabad etc., in the name of Food Panda, Uber Eats, Domino's, Faasos, Deliveroo, Grubhub, Dunzo, etc., Not only big cities have these types of services regional based food delivery services running in small towns.

In this paper an attempt has been made to study about the customers level of awareness about Online Food ordering & Delivery Services in Coimbatore district.

REVIEW OF LITERATURE

Munavver Azeem Mullapally Kayam Kulath (2019)¹, has conducted a study entitled **"CUSTOMER PERCEPTION TOWARDS ONLINE FOOD DELIVERY SERVICES WITH SPECIAL REFERENCE TO CALICUT DISTRICT"** with the objective to understand the customers' awareness about online food delivery services. Data have been collected from 100 respondents through questionnaire. Convenience sampling technique is used in this study. The author finds that respondents are highly aware of the benefits of online food delivery services and offers and discounts available in

PREFERENCE OF CUSTOMERS TOWARDS VARIOUS BRANDS OF TELEVISION

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Abstract:

People nowadays depend more on television to spend their leisure time to watch different shows, news, or movies, matches likewise. The people feel tiresome to get ready, put mobile in silent, even to applaud as an encouragement for the participants in the program in a public show, dramas, and theatres and prefer mostly to be in home stiff and stun to sit in before television and watch whatever is telecasted. This lead to availability of different brands of television in the market. Here, in the present day we have undertaken to know the preference and satisfaction of customers towards different brands available in the market. The invention of the television was the work of many individuals in the late 19th century and early 20th century. Individuals and corporations competed in various parts of the world to deliver a device that superseded previous technology.

Key Words: Television, Customers, Brand Preference, Satisfaction

Introduction:

Television came to India on September 15, 1959 with experimental transmission from Delhi. It was a modest beginning with a make shift Studio, a low power transmitter and only 21 community television sets. All India Radio provided the engineering and programme professionals. A daily one-hour service with a news bulletin was started in 1965. In 1972 television services were extended to a second city-Mumbai. By 1975 television stations came up in Calcutta, Chennai, Srinagar, Amritsar and Lucknow. In 1975-76 the Satellite Instructional Television Experiment brought television programmes for people in 2400 villages in the most inaccessible of the least developed areas through a satellite lent to India for one year.

Doordharsan is a public broad cast terrestrial television channel run by prasar bharati, a board formed by the government of India. Television programs were first transmitted in black-and-white. Scottish inventor John Logie Baird demonstrated the world's first colour television transmission on July 3, 1928 using a mechanical process. In present day, the market situation and its outcome are becoming increasingly uncertain. In the light of this scenario, the organizations are becoming more and more desperate to hold the customers, to retain the market share and to survive. The scenario in the home appliances industry is equally challenging. The leading companies like Samsung, Videocon, Sony, LG and others by introducing brands at various price points have effectively segmented the market which has resulted in faster market expansion and penetration. Product differentiation and innovative marketing efforts have resulted in attracting more and more customers to their brands.

Review of Literature:

- Nidhi Rani, Vikas Sharan (2016) is their study entitled "Impact on Television Commercial on Purchasing Behavior of Masses." Both the primary and secondary data was collected from the study. The sampling data was collected from 250 respondents by using structured method. The tools that have used in the study is simple percentage method. The finding of the study is reversed that adults have strong belief that Television commercial has considerably influenced their buying behavior.
- P. Jayasubramanian, P. Kanagaraj, K. Mahendran (2015) in their study entitled "A Study of Consumer Satisfaction towards LED Technology With Reference To LED TV Coimbatore of Tamilnadu". The secondary data was collected from related websites and books. The survey was conducted from 50 respondents by using questionnaire method. The selection of sample is convenient sampling method. The finding from then study reveals that LED Technology has made a great change in the world of Television.
- A. Dharmaraj (2014) in his study entitled "A Study on Customer Satisfaction Selective LG Product with Special Reference to Gobichettipalayam". Both the primary and secondary data was collected from the study. The sampling data was collected from 100 respondents by using questionnaire method. The analytical tools applied for this study is simple percentage analysis and chi-square test. The finding from the study is that customer satisfaction on LG product is based on sales promotion and advertisement.
- H. S. Adithya (2013) in his study entitled "Customer Satisfaction towards and Preference of Color TV Brands with Special Reference to Bangalore City". Primary data was collected personally and individually. The data was collected from 100 respondents by using questionnaire method. The

selection of sample is random sampling method. The conclusion of the study is to increase the sales volume of LG TV.

Statement of the Problem:

The main aim of this study is to find out the customer's preference and satisfaction towards different brands of television available. It will help us to find out the customer's choice and expectations on different brand and whether they are satisfied while purchasing.

Objectives of the Study:

To know the socio - economic profile of the respondents

- To ascertain the preference of respondents over different brands of television

Methodology:

Source of Data:

Primary data: The primary data were collected through questionnaire method.

Sampling Method:

The convenient sampling is used.

Sample Size:

The size of sample is 100 and convenient sampling methods have been adopted for the selection of respondents for the present study.

Statistical Tools:

The tools used in this study are,

- Simple percentage calculation
- Chi-square test of independence

Sample Unit:

The research was conducted in Pollachi Taluk. These are the different brands of television for which consumers preference are known,

- LG
- Panasonic
- Samsung
- Sharp
- Sony
- Tcl
- Onida
- Oled Tv

Analysis and Interpretation:

As though we have undertaken the study to know the students savings habit, in the above said paragraph we have studied whether there is any relationship between students savings habit and the economic profile. Which in turn concluded that in certain cases there is a relation between savings habit of students and the demographic future or vice-versa

Table: Simple Percentage Calculation

Brand Preference	No. of Respondents	Percentage
Age		
Up to 18	09	09.67%
18-25	32	34.41%
26-40	28	30.11%
Above 40	24	25.81%
Total	93	100%
Gender		
Male	39	41.94%
Female	54	58.06%
Total	93	100%
Marital Status		
Married	61	65.59%
Unmarried	32	34.41%
Total	93	100%
Educational Qualification		
Illiterate	04	4.30%
SSLC	26	27.96%
HSC	11	11.83%
UG	28	30.11%
Total	93	100%
Type of family		
Joint	27	29.03%
Nuclear	66	70.97%
Total	93	100%
No. of Members in a Family		
2-4	70	75.27%
4-8	17	18.28%
Above 8	06	6.45%
Total	93	100%

No. of Earning Members		
Up to 2	84	90.32%
3-4	08	8.60%
Above 4	01	1.08%
Total	93	100%
Residential Area		
Rural	34	36.56%
Urban	36	38.71%
Semi urban	23	24.73%
Total	93	100%
Occupation		
Agriculture	07	7.53%
Business	18	19.36%
Home maker	14	15.05%
Salaried	29	31.18%
Professional	16	17.20%
Others	09	9.68%
Total	93	100%
Monthly Income		
Below Rs 15000	36	38.71%
Rs 15001-30000	42	45.16%
Rs 30001-45000	12	12.90%
Above Rs 45000	03	3.23%
Total	93	100%

Above table depicts that out of 93 respondents, 32(34.41%) of customers belongs to age group of 32 and 54(58.06%) are female who possess ug degree 28(30.11%) and belongs to nuclear family 66(70.97%) that possess upto 2 earning members 84(90.32%) belongs to salaried class 29(31.18%) and earns a monthly income of Rs.15,001-30,000 who loves to possess Sony television 29(31.18%) and even ready to spend only Rs.20,000/- to purchases new brand of television or any accessories required with picture quality 47(50.54%) as main feature mostly purchased with family entertainment as main reason 68(73.12%).

Satisfaction towards Various Brands Based on Appearance of Television:

Hypothesis:

The following hypothesis has been framed to find out relation between customer satisfaction towards different brands of television and socio-economic profile of students.

- H₀: There is no relationship between age and customer's preference towards the branded television.
- H₀: There is no relationship between gender and customer's preference towards the branded television.
- H₀: There is no relationship between educational qualification and customer's preference towards the branded television.
- H₀: There is no relationship between type of family and customer's preference towards the branded television.
- H₀: There is no relationship between earning members and customer's preference towards the branded television.
- H₀: There is no relationship between Occupation and customer's preference towards the branded television.
- H₀: There is no relationship between monthly income and customer's preference towards the branded television.
- H₀: There is no relationship between brand possessed and customer's preference towards the branded television.
- H₀: There is no relationship between amount spend to purchase television and customer's preference towards the branded television.
- H₀: There is no relationship between amount purpose to purchase different brand of television and customer's preference towards the branded television.

Table 2: Customer Satisfaction towards Different Brand of Television

S.No	Variable	Statistical Test	Value	Significance (@ 5% level)
1	Age and Satisfaction level of Customers	Chi-Square Test	1.151	Not significant
2	Age and Preference level of Customers	Chi-Square Test	8.96	Not significant
3	Age and Preference level of Customers	Chi-Square Test	4.873	Not significant
4	Age and Preference level of Customers	Chi-Square Test	4.873	Not significant

5	Age and Preference level of Customers	Chi-Square Test	2.191	Not significant
6	Age and Preference level of Customers	Chi-Square Test	4.977	Not significant
7	Age and Preference level of Customers	Chi-Square Test	7.383	Not significant
8	Age and Preference level of Customers	Chi-Square Test	4.853	Not significant
9	Age and Preference level of Customers	Chi-Square Test	11.928	Significant**
10	Age and Preference level of Customers	Chi-Square Test	15.978	Significant**
11	Age and Preference level of Customers	Chi-Square Test	15.978	Significant**

Source: Primary data * - 10% level of freedom ** - 5 % level of freedom

From the above table it is found that there is a significant relationship between the Term Of Investment and overall awareness level of savings behavior , Period of Savings and overall awareness level of savings behavior.

Findings:

- Most of students are from rural area.
- Majority of the students were in the age group of 18 to 20 years.
- Most of the students were female.
- Most of the students were under graduates.
- At most the student respondents belong to nuclear family,
- Majority of the students have below 4 earning members in their family.
- At most of the students have pocket money as their source of income
- Most of the students prefer to save less and spend more.
- Most of the students prefer short term investment.
- Most of the students done their savings less than one year only.

Suggestions:

- Majority of the students suggest their savings plan to friends
- The students should think rationally before spending the money and should be more aware about various savings and investment avenues available in the market.
- The students must use money at proper way, don't let the savings in idle.
- This is correct time to save money for future needs.
- The students can get savings and investment knowledge from various sources.
- They should utilize it.
- They should avoid unwanted expenses.

Conclusion:

In this study, the relationship between different variables defined is associated or not is concluded, which helps to identify it any variables affecting the savings habit of respondents. The different variable like the gender, age, educational qualifications, family members, earning members, area, source of income, and savings and spending ratio of the individual respondents has been analyzed by showing a relationship with different satisfaction and awareness level like putting money aside for future, following budgeting method, reducing unwanted expenditure, achieve goals, discussing with parents, comparing and discussing with friends and having money in hand availed for emergency situation and schemes of post office, bank accounts, gold and shares as awareness level.

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EMOTIONAL WELL-BEING OF NON RESIDENT INDIANS: ROLE OF SELF- ESTEEM AND LIFE SATISFACTION

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Abstract:

A person with good emotional well- being is more likely to have a positive self-esteem and greater sense of life satisfaction .This ability leads to practicing self-awareness, adopting positive coping strategies, nurturing healthy relationship with society, setting goals and engaging in activities that ring more joy and fulfilment in life. This study has demonstrated the emotion well-being of Non-Resident Indians. The objective was to assess the factors influencing to be an NRI status and challenges faced by them and also the relationship between self-esteem and life satisfaction of NRIs. A sample of 105 Non-Resident Indians were included for this study to collecting quantitative data. The collecting data was analysed by weighted average rank analysis, Friedman rank test and chi-square test. The finding reveals that, the main reason for going abroad was for enlarging knowledge and updating skills and the racism will be most challenging element for their survival. The NRI have average level Self-Esteem and Level satisfaction. It was also found that, NRI self-Esteem has a positive impact on Life satisfaction.

Key Words: Emotional Well-Being, Fulfilment in Life, Self-Esteem, Life Satisfaction.

Introduction:

Emotional well-being refers to the overall emotional state of a person's health and happiness. It encompasses the ability to effectively manage and navigate one's emotions, cope with stress and challenges, and experience a sense of contentment, fulfillment, and positive mental state. Emotional well-being encompasses various dimensions of an individual's emotional life and is closely linked to psychological and mental health. The emotional well-being of Non-Resident Indians (NRIs) is a complex and multifaceted aspect of their lives, shaped by a delicate interplay of cultural identity, social dynamics, and the challenges inherent to living in a foreign land. As individuals who have ventured beyond their home country in pursuit of various opportunities, NRIs face a unique set of emotional experiences that deserve exploration and understanding. The emotional well-being of Non-Resident Indians (NRIs) can be influenced by a variety of factors, including their cultural background, social support networks, and the challenges they face while living abroad. Leaving behind familiar surroundings, family ties, and cultural norms, NRIs embark on a journey that often entails not only geographical distance but also emotional and psychological shifts. This process of adaptation and adjustment can evoke a range of emotions, from excitement and anticipation to nostalgia, homesickness, and even feelings of isolation. The delicate balance between maintaining connections to one's roots while assimilating into a new culture adds another layer to the emotional landscape.

On the other hand, the NRI experience also offers opportunities for personal growth, self-discovery, and the forging of new relationships across cultural boundaries. The ability to adapt to diverse environments, embrace novel perspectives, and build a global network can contribute positively to one's emotional well-being. Understanding and addressing the emotional well-being of NRIs requires a nuanced approach. It involves acknowledging the complex interplay of emotions, fostering a sense of belonging in both the host and home countries, and providing avenues for social support and mental health resources. By recognizing the unique challenges and strengths of the NRI experience, we can work towards nurturing emotional well-being and enabling NRIs to thrive as they navigate the intricate tapestry of their lives between cultures.

Review of Literature:

Muzamil Jan and Tasia Masood (2008) made a study on life satisfaction of women. The main purpose of the research was to evaluate life satisfaction among women and to analyze the influence of socio-personal characteristics of women with their life satisfaction. 120 samples were collected from women in jammu and Kashmir using questionnaire method. The data was analyzed by using percentage analysis, chi-square test, ANOVA, Karl Pearson's co-relation. The study reveals that, women have average level of life satisfaction irrespective of the age whereas the personal and family income increases the level of life satisfaction can also be increased.

Sampeet Mahanty et al.(2015) has investigated the relationship between self-esteem with life satisfaction of university students from Utkal university and Ravenshaw university. A total of 120 samples has been collected 60 males and 60 females. Coopersmith's self-esteem inventory and Diner's satisfaction with

scale was used to collect data. The collected data were analysed by using pearson's r and two-way ANOVA. The results revealed that there exists significant relationship between self-esteem and life satisfaction.

Statement of Problem:

Emotional well-being is a dynamic and evolving aspect of human experience that can vary from person to person and across different life stages. It is influenced by genetics, upbringing, life experiences, social and cultural factors, and the individual's own efforts to cultivate a healthy emotional state. Taking proactive steps to enhance emotional well-being can lead to a more satisfying and fulfilling life. In general some of the valuable reasons to become Non-Resident Indian are better career opportunities, high standard education, getting chances to learn new things, better income, healthcare and higher standard of living in the country they are living in. On the other hand, the Non-Resident Indians are also having downsides of their living, they are adjusting in new culture, missing of friends and families, having the sensation of being alone and far away from all family events. By understanding the complicate relationship between these variables with emotional well-being was addressing by to raise the following questions,

- Why Indian people are migrated to abroad?
- What are all the challenges faced by NRI in host country?
- Is there a relationship exist between self-esteem of NRI with respect to life satisfaction?

Objectives of the Study:

In order to give answer to these questions following objectives has been framed.

- To know the reason for going abroad and
- To identify challenges faced by NRIs
- To find out the relationship between Self- Esteem and Life satisfaction of Non-Resident Indians

Methodology:

The primary data has been collected by issuing well-structured questionnaire through Microsoft Forms. A sample of 105 data was collected from NRIs residing various countries. The weighted average rank analysis for reason for going abroad, challenges faced by NRI the Friedman rank test and the relationship between Self-esteem and life satisfaction was examined with the help of Chi-Square test. For the need the study the scales of The Rosenberg Self-Esteem Scale for measuring Self-esteem and Ed Diener, Rong Su and Loui Tay Comprehensive Inventory Thriving scales assessing Life Satisfaction of NRIs.

Analysis and Interpretation:

Reason for Going Abroad:

There are many reasons why people become NRIs. Some people choose to move to another country for better job opportunities, while others seek a better quality of life. Still others move to be closer to family or to pursue their education or business interests. In this objective has examined the exact factors influencing to become an NRI.

Table 1: Reason for Going Abroad

Reasons	SA	A	DA	WAS	Rank
To enlarge my knowledge and to update my skills	64	38	03	271	1
Getting job based on my qualifications and skills	60	43	2	268	2
To provide better life to my family	56	44	05	261	3
My job gives me the opportunity to work independently	57	37	11	256	4
Proper attention to staff complaints and grievances	47	47	11	246	5
My salary is adequate for my living expense	43	53	9	244	6
To attainment of Passion on my career	30	72	03	237	7
All necessary fringe benefits are provided in my job	39	51	15	234	8
There is more job security	37	55	13	234	8
Minimum government law procedures & rules	24	73	08	226	9
To payoff home country debts	33	47	25	218	10

From this table 1 it is inferred that, the factors influencing to become an NRI. There are many reasons behind to go for abroad. Based on the weighted average analysis, the most influencing factor was for enlarging knowledge and updating skills as secured first rank followed by getting job based on qualifications and skills ranking Two. To payoff home country debts was ranked as last. From this study, most of the NRI going for abroad will be personal growth, better career opportunities and proper work allocation. Whatever the reason, becoming an NRI can be a challenging but rewarding experience. NRIs face many unique challenges, such as adjusting to a new culture and learning a new language. However, they also enjoy many benefits, such as access to better education and healthcare, and the opportunity to contribute to the development of their home country.

Challenges Faced By NRI:

If an individual becoming NRI, it is important to be aware following of the challenges that everyone should face. However, it is also important to remember that many NRIs are able to overcome these challenges

and build successful lives for themselves for the survival of new environment. The following Table 2 has been prepared to identify the challenges faced by NRI in host country with the help of Friedman Rank Test.

Table 2: Challenges Faced

Problems	1	2	3	4	5	6	7	8	9	10	Mean	Rank
Home sickness	40	23	14	11	11	6	0	0	0	0	5.05	4
Loss of friends	9	35	27	10	8	3	8	4	0	1	5.40	5
Less availability of authentic Indian food	9	6	15	19	11	17	13	5	3	7	6.25	8
Less number of holidays	4	4	11	24	18	13	5	5	8	13	6.85	10
High cost of living- rent, insurance, health, maintenance of car and home	14	9	14	11	18	22	9	8	0	0	5.45	6
Job in security	9	4	10	6	22	14	12	25	3	0	6.75	9
Weather condition	13	12	9	13	11	13	20	14	0	0	5.80	7
Language problems	5	26	21	22	0	6	7	3	8	7	4.95	3
Racism	0	0	2	0	0	11	12	19	38	22	5.05	1
Non-payment of proper salary and wages	0	4	0	4	0	6	4	4	27	56	4.45	2

From the above table 2, it is inferred that, most of the NRIs have faced Racism, like people inequalities of judging and treating badly in their host country ranked as first followed by the employers have not been paying proper salary or wages for the work ranked as two. They also felt language problems as third most important problem followed by home sickness as fourth. The least factor of challenges was less number of holidays given by the company which means many people to go abroad for some commitment to improve them so that they may not have serious problem in number of holidays in host country. Despite, the above challenges, many NRIs are able to successfully adjust to their new lives in foreign countries. They are able to find jobs, make friends, and build new lives for themselves for their well-being in host country.

Relationship between Self- Esteem and Life Satisfaction:

To evaluate the relationship between Self-esteem and Life satisfaction of Non-Resident Indians chi-square analysis has been applied. Rosenberg Self-Esteem scale of 10 items with four point likert scale ranges from four to one was used to allot all answers. Thus, the maximum score was 40. The scores obtained by each respondent called Self-Esteem Index. Based on this index, the mean ($\bar{x}$) 68.59 and SD 6.24 has been calculated. The low level of Self-Esteem was 68.59-6.24 who are nine respondents, whereas high level of Self-Esteem, 68.59+6.24 of 18 respondents and remaining 78 respondents lays in medium Level of Self-Esteem between 74.82 to 62.35.

Ed Diner et al. have developed Comprehensive Inventory of Thriving scale for assessing Life satisfaction. This scale contains seven variables, Relationship, engagement, mastery, meaning in life, optimism and subjective well-Being. Each variable has separate scaling questions. A total of 54 items with five point likert scaling technique was used to collect the data. In this study Subjective well-being questions of 9 items were incorporated. The total score would get by a respondent is 45. These scores are called Subjective well-being index. The mean ($\bar{x}$) value is 70.54 and SD 9.31 has been calculated. By this the Low level of Subjective well-being is 70.54-9.31 of those with 15 respondents, those with high level of Subjective well-being is 70.54+9.31 of 18 and medium level of Subjective well-being between 79.84-61.24 of 72 respondents.

Table 3: Level of Self-Esteem with Level of Life Satisfaction

Level of Self-Esteem	Level of Life Satisfaction			Total
	Low	Medium	High	
Low	2	6	1	9
	22.2%	66.7%	11.1%	8.57%
Medium	8	59	11	78
	10.3%	75.6%	14.1%	74.29%
High	5	7	6	18
	27.8%	38.9%	33.3%	17.14%
Total	15	72	18	105
	14.3%	68.6%	17.1%	100.0%

Df:4

Table value @ 5%: 9.49

Calculated Chi-Square Value: 9.83 Table value @ 1%: 13.28

Above Table inferred that, the relationship between Self-Esteem and Life satisfaction. Level of Self Esteem has significantly associated with Life Satisfaction. It means Non-Resident Indian who are being self - esteemed persons have more satisfied life. The calculated Chi-Square value (9.83) is greater than table value at 5% of 9.49. There exists an association between self-esteem and life satisfaction.

Conclusion:

In summary, the emotional well-being of NRIs is a rich tapestry woven from the threads of cultural identity, family ties, personal aspirations, and societal expectations. Recognizing the intricate interplay of these factors and providing tailored support systems can empower NRIs to navigate their emotional journey with resilience and authenticity, fostering a sense of well-being that spans continents and cultures. This study have identify the emotional well- being in relation to reason for going abroad and challenges faced by NRI and also examine the relationship between Self-Esteem and Life satisfaction. In this study have a different perspective of assessing the life of Non-Resident Indians in Aboard with respect to Self-Esteem and Life Satisfaction. The most influencing reason to go for abroad was enlarging present knowledge and keeps on updating the present skills and capabilities. On the other objective was the most predominant problem of NRI has met Racism, which is inequality. Finally the relationship between Self-Esteem with Life satisfaction of NRIs also found to be significant at 5%, which means Self-esteem has positively affected the Life Satisfaction of NRIs, there exist a strong relationship between them. This study concluded that, the life of an NRI are different in working country, they have also medium level of self-esteem as well as medium level of Life satisfaction.

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ECONOMIC WELL-BEING OF NON RESIDENT INDIANS

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Abstract:

There are huge number of people residing out of India for earning more and lead a well-sophisticated life for their family, such people are called NRIs. In terms of finance the Non-Resident contribution was enormous in number and also they are being the main source of increasing Foreign Exchange reserve in India. But on the other hand, their life style was different and also met with many challenges to live in. In this study, has analyzed the NRIs' Economic well-being. The main purpose was to assess employment details, financial stability, earning capacity and spending behaviour of NRIs. A total of 105 samples have been collected from NRIs residing various countries through snowball random sampling method. The collected samples were analyzed by using simple percentage and chi-square. The results showed that, majority of NRIs are permanent Employees working in IT field of eight hours of work. They are recruited by means of interview method. They have permanent visa and have more than five years of experience in current position and organization. They are most satisfied with their salary and they visit home country whenever need arise. Their spending behaviour has significantly associated with Income and Cost of living in host country.

Key Words: Contribution, Perception, Economic Well-Being, Spending Behavior

Introduction:

There are 272 Million International migrants in the world and Indians make up 6.4% of the world's total immigrant or expat population, as per the United Nations Data. According to the Income Tax Act of 1961, an Indian citizen settled in a foreign country for employment who is not physically present in the country for more than 240 days in a financial year is regarded as a Non-Resident Indian (NRI).

NRI (Non-Resident Indians) contributes to the Indian economy significantly large in number. It aids the Indian economy at a large-scale specifically generating employment internally by strengthening national savings, capital accumulation, investment, and so on. On the small-scale, the remittance received by the family members is used to meet their basic needs, and open up opportunities for investing in education, health care, and so on. The huge Indian diaspora is responsible for a significant amount of money inflows to the country. Such money inflows are called remittances, which is the money sent by migrant workers back to their home country. Every dollar transferred to India adds to the country's foreign exchange pool. Remittances to India are also one of the significant contributors to the foreign exchange reserve and makeup nearly 25 percent of total foreign exchange reserves in the country. There was a 50 to 80 percent growth in remittance inflows from several nations including the United States, Canada, UK, and the Gulf countries.

Economic well-being refers to financial background of every individual's life encompassing their financial security, wealth, employment opportunities and overall living condition. It plays a predominant role in deciding overall well-being and quality of life and it directly influences an individual ability to meet basic needs, future opportunities and achieving their personal goals in life. The economic well-being of Non-Resident Indians (NRIs) stands as a significant and evolving area of study within the broader landscape of global migration and economic development. NRIs, individuals who have chosen to live and work in foreign countries, often experience unique economic dynamics influenced by their dual connection to both their host country and their country of origin.

In recent years, the advent of digital technology and easier cross-border financial transactions has further transformed the landscape of NRI economic interactions. The way NRIs manage their finances, invest, and contribute to the economies of both their host and home countries has evolved significantly. Exploring the economic well-being of NRIs provides insights into the broader impact of global migration on economic systems and sheds light on how individuals navigate the complexities of financial decisions in a transnational context. By delving into this subject, we can gain a deeper understanding of the factors that contribute to the financial stability and prosperity of NRIs, and in turn, identify strategies to enhance their economic well-being and facilitate meaningful economic engagement between countries.

Review of Literature:

Richard H Adams J (2008), made an attempt to identify the Determinants of international remittances in developing countries: In this study addresses factors influencing for remittance by using new data on such

variables as the skill composition of migrants, poverty, and interest and exchange rates to examine the determinants of remittances. It finds that the amount of remittances sent was influenced by factors such as their present income, the distance between migrant people and their family, and the economic conditions in both countries.

Anu Abraham (2019) Determinants of International Remittance: Evidence from Kerala, India, This study investigates the determinants of international remittance flow into the Kerala state. It explores the influence of socio-demographic and migration-specific characteristics of the migrant and the migrant-sending (remittance receiving) households on the amount of remittance transfers. Using data from the 2011 Kerala Migration Survey, employed Heckman selection correction model and Tobit model for the analysis. The results suggest that the migrant's individual characters have a strong influence in the remittance-sending behaviour while the characteristics of the remittance-receiving household have a weaker influence. The migration-specific characteristics the duration of migration, destination country and presence of dependents abroad significantly affect the amount of remittance sent.

Mahammand Tauseaa P and Dr. Niyaz Panakaje (2021) was undertaken a study on NRI's perception towards work environment in overseas. The main objective was to analyses the preference and perception of work environments in Gulf. There are 200 descriptive samples were collected. Simple percentage and one way ANOVA test has been used to analyses the data. The results showed that, there is need for technical education to get better salary in Gulf. Many of the NRIs perceive that providing better education to their children because of having job in Gulf. It has significantly associated with gender.

Statement of the Problem:

In General perspective, Non-Resident Indians plays an important role in shaping and developing the financial, social and economic conditions of the country. Non-Resident Indians have begun integrating into various activities in India over the last few years, including business growth such as outsourcing, technology transfer, tourism, and other contributions, especially in political and significant information flows. But the reality is the life style of Non-Resident Indian can vary depending upon the individuals and their life requirements. While seeking better economic prospects, NRIs often encounter challenges related to job security, income parity, and navigating foreign financial systems. Some Non-Resident Indians decide to live abroad permanently, while others split their time between their host country and the country of origin. Additionally, the remittance of funds to support families and investments in both their host and home countries adds layers of financial responsibilities. Exploring the intricacies of economic well-being among NRIs is essential for devising strategies that ensure financial stability, income and expenditure behaviours, and overall prosperity for this globally dispersed population. In this study have demonstrates the Economic well- being of NRI through their Income and expenditure behavior in host country.

Objectives of the Study:

- To measure the Employment profile of Non-Resident Indians
- To analyses Income and Expenditure Behavior

Methodology:

For the purpose of the study the snowball random sampling method was used to collect the data Microsoft forms. The employment profiles are in the first part, followed by income and expenditure pattern. A sample of 105 responses has been collected. The collected samples were interpreted using Simple percentage analysis, Chi-square.

Analysis and Interpretation:

Employment Profile:

To find out the employment details of Non-Resident Indians from collected sample simple percentage analysis has been applied.

Table 1: Employment Profile of NRI

S.No	Particulars	Numbers (N=105)	Percentage to Total (%)
1	Designation		
	Employer	27	25.71
	Employee	78	74.29*
2	Mode of Recruitment		
	Interview	68	64.76*
	Test only	03	02.86
	Test Followed by Interview	34	32.38
3	Occupation		
	Businessman	12	11.42
	Construction Field	03	02.86
	Industrial Worker	10	09.52
	Medical Field	09	08.57
	Academician	14	13.33

	IT field	57	54.29*
4	Nature of work		
	Contractual	29	27.62
	Permanent	76	72.38*
5	Visa Status		
	Work	45	42.86
	Permanent Resident	60	57.14*
6	Average working hours per day		
	8 hours	63	60.00*
	10 hours	28	26.67
	12 hours	03	02.86
	More than 12 hours	11	10.47
7	Overtime facility		
	Yes	47	44.76
	No	58	55.23*
8	Perception on Salary		
	High Satisfied	36	34.29
	Satisfied	64	60.95*
	Not satisfied	5	04.76
9	Experience in Current position		
	Within one year	09	08.57
	1-3 Year	07	06.67
	3-5 year	14	13.33
	More than Five year	75	71.43*
10	Experience in current organization		
	Within one year	25	23.81
	1-3 Year	16	15.24
	3-5 year	20	19.05
	More than Five year	44	41.90*
11	Frequency of visiting home country		
	Yearly once	44	41.90
	Occasionally	13	12.38
	Whenever need arise	48	45.71*

From the above Table 1, majority of the NRI people working as an employee's 74.29%. They are recruited by interview 64.76% method. Majority of 54.29% are in IT field and they are permanent 72.38% employees. Majority 57.14% has permanent resident visa. Majority of 60% having eight hours of working they are not having 55.23% overtime facility. Majority of Non-Resident Indians felt satisfied 60.95% with their salary. Majority of 71.43% experience in current position is more than five years and also 41.90% have more than five years in current organization. Most of the 45.71% are visiting their home country whenever need arise.

Income & Expenditure and Spending Behaviour:

In order to find the income, expenditure and spending behaviour of NRI the following table has been prepared. In this simple percentage and Chi-square analysis has been used to the significant level between income and expenditure and spending behavior.

The most burden expenses of Non-Resident Indian have been measured by giving score to answers the questions related to expenses. Twelve expenses have been include under the questions such as House rent, food/Hotel food, Clothing, Income Tax, Medical expenses, conveyance for work, entertainment & vacations, personal grooming expenses, mobile bills, grocery needs, education and travelling. The answer to the questions has been rated on five point Likert scale. The scores allotted to the answers of each questions ranges from one to five. Thus, the maximum score a respondent would get is 60. The scores obtained by each respondent called Spending Index. Based on the spending index ranging up to index arrived by deducting standard deviation (SD) from mean ($\bar{x}$)(65.79-12.73)are termed as those with below 52.86 Low level of spending behavior, those 65.79+12.73 are termed as those with 78.72 and above have High level of spending behavior and those who are in between 52.87 to 78.71 medium level of spending behavior. The level of confidence chosen for Chi-square test is one percent and five percent.

Table 2: Income & Expenditure Behaviour

S.No	Particulars	(N=105)	Percentage (%)	D.F	Chi-Square Value	Significant / Not Significant
1	Income Per month Up to One Lakhs	09	08.57	6	15.01	Significant @ 5% Level

	One – Two Lakhs	30	28.57			
	Two-Three Lakhs	08	07.62			
	More than Three Lakhs	58	55.24			
2	Spending for Cost of Living					
	Up to 20%	10	09.52			
	20% to 40%	56	53.33	6	25.01	Significant @ 1% Level
	40% to 60%	14	13.33			
	Above 60%	25	23.81			
3	Affordability of SOD					
	Managed with Earnings	53	50.48			
	Sacrifice wants & Needs	19	18.09	6	8.03	Not Significant
	Managed with Over Time work	17	16.19			
	Not at all managed	16	15.24			
4	% of Remittance					
	40%	59	56.19			
	50%	29	27.62	6	10.14	Not Significant
	70%	10	09.52			
	Above 70%	14	13.33			

From the Table 2, majority of Non-Resident Indian monthly earnings is more than three lakhs (55.24%). Their percentage of spending for cost of living is 20%-40% (53.33%). Majority of 50.48% people can able to afford their minimum standard of living with normal earnings. Majority of 56.19% have made 40% (56.19%) remittance to India.

The above table inferred that, the calculated Chi-Square value of income (15.01) per month and cost of living (25.01) are greater than the table value at five percent and one percent level. There exist an association between Level of Spending Behavior and income and cost of living. It means income and cost of living is significantly influenced by the Spending behavior.

Conclusion:

The NRIs contributed to the Indian economy for growth and development by way of foreign remittance and increasing foreign reserve. Their financial contributions are the key source for the upliftments of the Indian economy. The employment details of selected samples of designation, occupation, visa status, mode of recruitment, nature of work, overtime facilities, experience in current position as well as organization, frequency of visiting home country has been explained. Their income and expenditure behavior with respect to spending behavior has also been described. The spending behavior of NRIs presents a dynamic and multifaceted challenge influenced by a combination of cultural influences, financial obligations, lifestyle preferences, and socio-economic factors. While residing in their host countries, NRIs often navigate the complexities of managing expenses, investments, and remittances both abroad and in their home country. The interplay between their desire for financial stability, maintaining connections with their homeland, and adapting to the consumption patterns of their host culture shapes their spending habits. From this study, the spending behaviour was based on Income earned per month and cost of living in abroad. It was significantly associated with spending behavior of NRIs. The overall economic well-being of NRI was depending on their income stability and cost of living in abroad.

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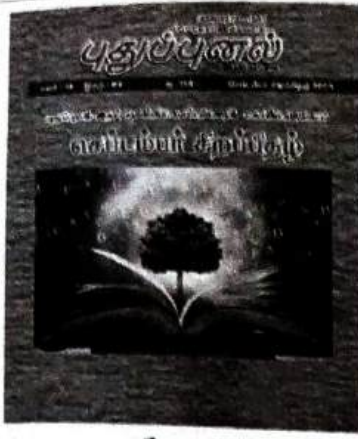
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முனைவர் ச.செல்வக்குமார்

உதவிப்பேராசிரியர்

தமிழ் இலக்கியத்துறை

நல்லமுத்துக் கவுண்டர் மகாலிங்கம் கல்லூரி

பொள்ளாச்சி

கோயம்புத்தூர்

முன்னுரை

தமிழில் தோன்றிய சங்க இலக்கியங்கள் வழி அக்கால மக்களின் காதல், வீரம் ஆகியவற்றோடு அவர்களின் நம்பிக்கைகள், வழிபாடுகள், பழக்கவழக்கங்கள், வாழ்க்கை தொடர்பான மதிப்பீடுகள், வரலாறுகள், மனித இயல்புகள் போன்றன பற்றியும் அறிந்துகொள்ளமுடியும். சங்கஇலக்கியத் தொகுப்பில் பண்டைய தமிழகத்தின் பல்வேறு பகுதிகளில் வாழ்ந்த புலவர்களின் பாடல்கள் இடம்பெற்றுள்ளன. புலவர்களின் அறிவாற்றல், அனுபவத் தன்மைகளுக்கேற்ப பாடல்கள் அமைந்துள்ளன. அவை, காலந்தோறும் படிப்போர்க்குப் பல வகைகளில் பயனளிக்க வல்லனவாக உள்ளன. பண்டைய தமிழகப் பிரிவுகளில் ஒன்றாக இருந்தது கொங்குப்பகுதியாகும். கொங்குப் பகுதியில் அமைந்திருந்த கருவூர் என்னும் ஊரின் பெயரைத் தங்கள் பெயர்களுக்கு முன்கொண்டுள்ள புலவர்கள் எழுதிய பாடல்கள் சங்க இலக்கியத் தொகுப்பில் இடம்பெற்றுள்ளன. மயிலை.சேனி.வேங்கடசாமி இவர்களைக் கொங்குநாட்டுப் புலவர் பெருமக்கள் என வகைப்படுத்துவார். (மயிலை.சேனி.வேங்கடசாமி, ப.170) சங்க காலத்தைச்சார்ந்த, தமிழகத்தின் ஒரு குறிப்பிட்ட நிலவியலுக்குட்பட்ட புலவர்களின் பாடல்கள் வெளிப்படுத்தும் செய்திகளை ஆராயும் நோக்கில் இக்கட்டுரை அமைகிறது.

கருவூரின் சிறப்பு

கருவூர்க்குப் பல சிறப்புகள் உள்ளன. இது ஆன்பொருநை என்னும் அமராவதி ஆற்றங்கரையில் அமைந்துள்ளது. அதாவது, இப்போதுள்ள கரூர் பகுதி. கருவூர் என்பதே கரூர் என மருவியதாகக் கருதப்படுகிறது. இது சங்க காலத்தில் சேரர்களின் தலைநகராக இருந்துள்ளது. சேரர்கள் கொங்கு நாட்டைக் கைப்பற்றிய பிறகு சேரநாட்டின் தலைநகரமான கருவூரின் பெயரையே இதற்கு இட்டதாகச் சொல்லப்படுகிறது. இதற்கு வஞ்சி என்ற வேறுபெயரும் உண்டு. சேரர்கள் வழிவந்த இரும்பொறை அரசர்கள் இங்கிருந்து ஆட்சிசெய்துள்ளனர். சேரர்களிடமிருந்து இதைக் கைப்பற்ற சோழர்களும் பாண்டியர்களும் போர் செய்துள்ளனர். பிறகு, பாண்டியர்களின் ஆட்சிக்கும் அதன்பிறகு நாயக்கர் ஆட்சிக்கும் உட்பட்டு இருந்துள்ளது.

கருவூர்ப்புலவர்கள்

கருவூர் என்ற ஊரின் அடையொடு தங்கள் பெயர்களைக் கொண்ட புலவர்கள் பின்வருமாறு: கருவூர் ஓதமானியார், கருவூர்க்

கண்ணம்பாளனார். கருவூர் கதப்பிள்ளை, கருவூர்க் கண்ணம்புல்லனார், கருவூர்க் கலிங்கத்தார், கருவூர்க்கிழார், கருவூர் சேரமான்; சாத்தன், கருவூர் நன்மார்பனார், கருவூர் பவுத்திரனார், கருவூர் பூதஞ்சாத்தனார், கருவூர் பெருஞ்சதுக்கப் பூதனார் ஆகிய புலவர்கள் ஆவர்.

கருவூர்க் கண்ணம்பாளனார்

மகளிரின் சோலை விளையாடல், ஆறலைக்கள்வர் செயல்கள், வஞ்சி மாநகரை ஆளும் சேரனின் சிறப்பு, உடன்போக்கில் சென்றுவிட்ட மகளை நினைத்து வருந்தும் தாயின் நிலை, பொருள்தேடச் செல்லும் தலைவன் தன் தலைவிக்கு மென்மொழியால் ஆறுதல் கூறிச்செல்லும் பாங்கு ஆகியன இவருடைய பாடல்கள் (அகநானூறு-180,263), நற்றிணை(141) வெளிப்படுத்தும் செய்திகளாக இடம்பெற்றுள்ளன. சோலையில் விளையாடும் பெண்களுள் ஒருத்தியைக் கண்டு காதலுற்ற தலைவன் ஒருவன் தான் அவளை விரும்புவதை வெளிப்படுத்த அவளுக்குப் குவளைப்பூக்கள் கொண்டு கட்டிய மாலையை அவளின் தலையிலிருந்து முதுகுப்புறம் வரை தொங்கும்படி குட்டிவிட்டுச்சென்றதை,

தன்கயத்து அமன்ற ஒண்பூங் குவளை

அரும்பு அலைத்து இயற்றிய கரும்பு ஆர் கண்ணி

பின்னுப்புறம் தாழக் கொன்னே குட்டி

நல்வரல் இளமுலை நோக்கி, நெடிது நினைந்து

நில்லாது பெயர்ந்தனன் ஒருவன் (இரா.செயபால்,2004)

என்ற பாடலடிகள் வாயிலாகக் கூறுகிறார். (அகம்.180) இதனால் குவளைப் பூக்களை அன்று மாலையாகக் கட்டும் வழக்கம் இருந்ததையும் ஆண்கள் தாங்கள் விரும்பும் பெண்ணுக்கு மலை குட்டித் தன் விருப்பத்தை வெளிப்படுத்தும் வழக்கம் இருந்ததையும் காணமுடிகிறது.

வில்லாற்றல் மிக்க ஆறலைக்கள்வர்கள் என்போர் பாலை நிலவழிச்செல்வோரை யாமரத்தின் உச்சியில் ஏறியிருந்து கிளைகளை தாங்கள் மறைவதற்கு இடமாகக்கொண்டு தாக்கும் இயல்புடையோர் என்பதை,

ஆறுசெல் வம்பலர் வருதிறம் காண்மார்

வில்வல் ஆடவர் மேல்ஆள் ஒற்றி

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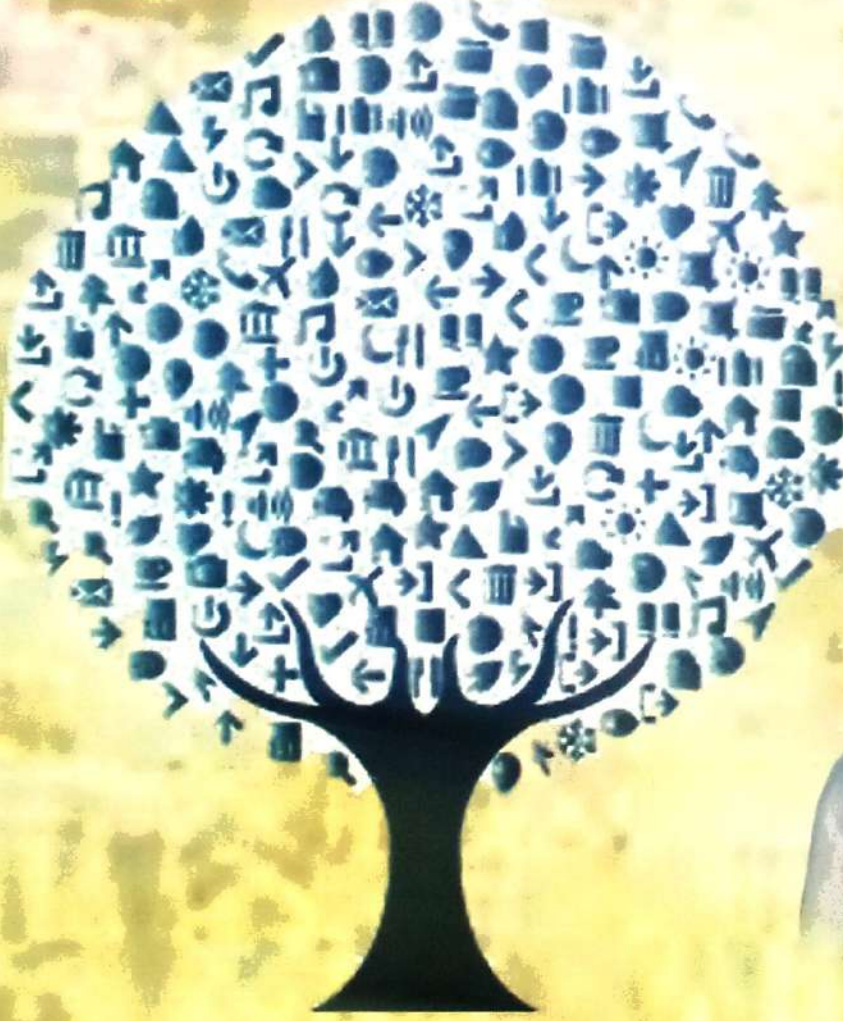
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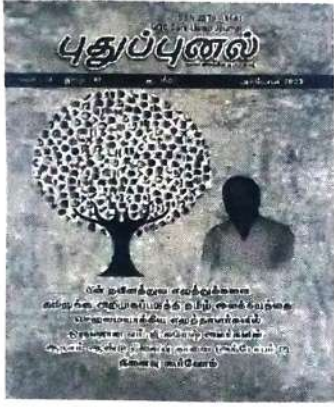
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இர. இரவிச்சந்திரன்

நிர்வாக ஆசிரியர்

சாந்தி ரவிச்சந்திரன்

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வெளிநாட்டு
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புதுப்புனல் வளர்ச்சிக்கான
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இந்தியன் ஒவர்ஸிஸ் வங்கி
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காசோலையாகவோ

கீழ்க்காணும் முகவரிக்கு

அனுப்புக.

புதுப்புனல்

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சென்னை - 600 005. (ரத்னா பேப் எதிரில்)

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சங்க இலக்கியத்தில் சூழலியல்

Seedmoney க்காக வறப்பட்ட நிதி நல்கையில் எழுதப்படும் கட்டுரை

ஆய்வாளர்

வெ. பரிமளம்

உதவிப்பேராசிரியர்

தமிழ் இலக்கியத்துறை

நல்ல முத்து கவுண்டர் மகாலிங்கம் கல்லூரி

பொள்ளாச்சி

சூலியல் என்பது தாவரங்கள் விலங்குகள் உள்ளிட்ட அனைத்து உயிரினங்களையும் அவை ஒன்றோடு ஒன்று கொண்டுள்ள தொடர்பையும் குறிக்கும். மனித வாழ்வும் சூழலும் ஒன்றோடு ஒன்று பின்னிப்பிணைந்தவை. அதை உணர்ந்த சங்க தமிழர்கள் சூழலைத் தன்னில் இருந்து வேறாகக் கருதாமல் அதனோடு ஒன்றிணைந்து வாழ்ந்தனர். சூழல் குறித்த விழிப்புணர்வு அதிகம் இருக்கும் இக்காலகட்டத்தில் சங்கத் தமிழர்களின் சூழலியல் அறிவைப் பற்றி அறிந்து கொள்வது தேவையாக இருக்கின்றது.

சூழலியல்

சூழலில் என்பது மனிதனுக்கும் இயற்கைக்கும் இடையிலான உறவை ஆராய்வதாகும். இதைத் தற்பொழுது Ecology என்பர். நிலம், நீர், காடுகள், கடல், கனிமங்கள் காலநிலை, நிலவியல் போன்ற அனைத்தையும் உள்ளடக்கியது. புவியின் இயற்கை நிலைகள் அனைத்தும் சுற்றுச்சூழல் என்பதில் அடங்குகிறது. உயிரினங்கள் வாழும் பகுதியில் உள்ள காற்று, நீர் போன்றவை அடங்கிய இயற்கை நிலையே சுற்றுச்சூழல் என்று (கிரியாவின் தற்காலத்தமிழ் அகராதி ப-462) கூறுகிறது. சூழல் மண்டலத்தில் உள்ள உயிரற்ற காற்று, நீர், வெப்பம், ஒளி இன்னபிறவும் உயிருள்ள தாவரங்கள், உயிரினங்கள் போன்றவற்றையும் உள்ளடக்கியதே சுற்றுச்சூழலாகும். (சுற்றுச்சூழல் பாதுகாப்பு ப-401) என்றும் சுற்றுச்சூழல் என்பது மனிதனுக்கும் இயற்கைக்கும் உள்ள நுண்மையான சமன்படுத்தப்பட்ட மென்மையான உறவாகும். (மேலது ப-415) என்றும் கூறுகிறது. சூழலைச் சார்ந்தே மனிதன் இயங்குகின்றான். மனித வாழ்வு என்பது பிறரையும் பிற பொருளையும் சூழ்ந்த வாழ்வாகும்.

சங்க இலக்கியமும் சூழலியலும்

சங்கப் புலவர்கள் இயற்கையைப் பேணினர். இயற்கையால் அமைந்ததே உலகு என்னும் கொள்கையைக் கொண்டவர்கள். நிலம், நீர், தீ, வளி, விசும்பு ஆகிய ஐந்தும் சேர்ந்தது தான் இயற்கை என்கிறது தொல்காப்பியம். நிலம், நிலம், பறவை, செடி, கொடி, மரம், உயிரினங்கள் ஆகிய அனைத்தையும் உள்ளடக்கிய இயற்கையை முதற்பொருள், கருப்பொருள், உரிப்பொருள் என மூன்றாகப் பகுத்தனர். இது பண்டைத் தமிழரின் சூழலியல் பார்வையில் இன்றியமையாத கூறாகும். நிலம், நீர் அவற்றை ஆதாரமாகக்

கொண்ட காலநிலை, அதன் இயக்கம் ஆகியவற்றை உள்ளடக்கிய நிலமும் காலமும் முதற்பொருள் ஆகும். உயிரினங்களை பற்றி கூறுவது கருப்பொருளாகும் இதை

முதலெனப்படுவது நிலம் பொழுது இரண்டின்

இயல்பு என மொழிப

தொல்காப்பியம் அகத்திணையியல் நூற்பா -5

தெய்வம் உணாவே மா மரம் புள் பறை

செய்தி யாழின் பகுதியொடடு தொகை இ

அவ்வகைப் பிறவும் கருவென மொழிப

தொல்காப்பியம் அகத்திணையியல் நூற்பா -30

என்கிறது தொல்காப்பியம்.

நிலமும் சூழலும்

மனிதர்கள் உள்ளிட்ட உயிரினங்கள் வாழக்கூடிய இடம் நிலமாகும். தட்பவெப்பம், மழை போன்ற காரணங்களை அடிப்படையாகக் கொண்டும் புவியியல் வேறுபாட்டின் அடிப்படையிலும் அக்காலத்தில் நிலங்களை பகுத்திருந்தனர். மேலும் அந்தந்த நிலத்தில் உள்ள மரம், பூ ஆகியவற்றை அடிப்படையாகக் கொண்டே குறிஞ்சி, முல்லை, மருதம், நெய்தல், பாலை என நிலங்கள் பெயர் பெற்றிருக்க வேண்டும். ஒவ்வொரு திணையும் ஒவ்வொரு சூழல் தொகுதியாகும். காடுறை உலகம், மைவரை உலகம், பெருமணல் உலகம் என தொல்காப்பியர் நிலங்களால் ஆன சூழல் தொகுதியை குறிப்பிடுகிறார். இந்த அடிப்படையிலேயே சங்கஇலக்கியங்கள் பாடப்பட்டுள்ளன. அகத்திணை பாடல்கள் அனைத்தும் இயற்கையோடு இணைந்து எழுதப்பட்டவை ஆகும். அவை முழுவதும் சூழல் மண்டலத்தை விளக்கும் விதமாகவே அமைந்துள்ளன. நிலத்தை வைத்து உருவாக்கப்பட்ட சூழல் தொகுப்பில் வாழ்ந்த மக்கள் அந்நிலத்தில் கிடைத்த தாவரங்கள், விலங்குகள், பழங்கள் ஆகியவற்றையே உண்டு வாழ்ந்தனர். குறிஞ்சி நில மக்களுக்கு திணை, கிழங்கு, வேட்டையாடி கிடைத்த உணவுகள் போன்றவையும் கடலோர நெய்தல் நில மக்கள் உணவில் மீனும் மருதநிலத்தில் நெல் உணவும் தவிர்க்க முடியாத ஒன்றாகும். முல்லை நில மக்கள் கால்நடை வளர்ப்பு, விவசாயம் ஆகியவற்றால் தங்கள் உணவுத் தேவையை பூர்த்தி செய்தனர். அவர்களின் உணவு முறை நிலம் சார்ந்தே அமைந்து இருந்தது. அது மட்டுமன்றி குடியிருப்பு, உயிரினங்கள், தாவரங்கள்

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ILLUMINATING BRAIN TUMOR IN MRI METAPHORS BY USING A HYBRID MODEL OF FASTER R-CNN AND CNN

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Abstract:

In this study the problem of fully computerized brain tumor classification and segmentation, in Magnetic resonance imaging (MRI) containing both Glioma and Meningioma types of brain tumors are considered. This paper proposes a Convolutional Neural Network (CNN), for classification problem and Faster Region based Convolutional Neural Network (Faster R-CNN) for segmentation problem with reduced number of computations with a higher accuracy level. This research has used 218 images as training set and the systems shows an accuracy of 100% in Meningioma and 87.5% in Glioma classifications and an average confidence level of 94.6% in segmentation of Meningioma tumors. The segmented tumor regions are validated through ground truth analysis and manual analysis by a Neurologist.

Keywords:

Convolutional Neural Networks, Brain Tumor, Magnetic resonance imaging, Segmentation, Classification, Computer Vision

INTRODUCTION

Brain tumor is the advancement of unusual tissues in the cerebrum and distinguishing something very similar at a beginning phase can be dealt with appropriately. By and large, brain tumor can be delegated in excess of hundred kinds in light of the area and development of growth. Specialists have named mind tumor in stages as Grade I, II, III and IV as per the development and side effects of cerebrum growth. The significant brain growths are harmless and Threatening where harmless have some consistency in shape and non-dynamic, yet dangerous doesn't have consistency in shape and dynamic. The image processing techniques used to identify the brain tumor are Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET) and Computed Tomography (CT). By comparing all these three imaging techniques, MRI is good quality medical imaging for detecting brain tumor. In this study, four types of brain tumor are used namely benign- slow growing tumor, malignant, which are most commonly seen in infants and children called PNE, glial-astrocytic tumor

ILLUMINATING BRAIN TUMOR IN MRI METAPHORS BY USING SVM CLASSIFIER

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Abstract:

The field of medical imaging is gaining importance with an increase in the demand for automated, reliable, fast and efficient diagnosis which can provide insight to the image better than human eyes. Brain tumor is the second leading cause for cancer-related deaths in men in age 20 to 39 and fifth leading cause cancer among women in same age group. Brain tumors are painful and may result in various diseases if not cured properly. Diagnosis of tumor is a very important part in its treatment. Identification plays an important part in the diagnosis of benign and malignant tumors. A prime reason behind an increase in the number of cancer patients worldwide is the ignorance towards treatment of a tumor in its early stages.

Key words: Benign, Malignant, SVM, Image Segmentation

INTRODUCTION:

This project discusses such an algorithm that can inform the user about details of tumor using basic image processing techniques. These methods include noise removal and sharpening of the image along with basic morphological functions, erosion and dilation, to obtain the background. Subtraction of background and its negative from different sets of images results in extracted tumor image. Plotting contour and c-label of the tumor and its boundary provides us with information related to the tumor that can help in a better visualization in diagnosing cases. This process helps in identifying the size, shape and position of the tumor. It helps the medical staff as well as the patient to understand the seriousness of the tumor with the help of different color-labeling for different levels of elevation. A GUI for the contour of tumor and its boundary can provide information to the medical staff on click of user choice buttons. The SVM classifier algorithm can be implemented in four major steps as shown in Fig1. First step is pre-processing & Image acquisition of given MRI image in MATLAB then second is filtering the image to reduce the noise and third is image resizing and finally fourth step is tumor extraction using SVM classifier. The aim of the project is tumor identification in brain MRI images. The main reason for detection of brain tumors is to provide aid to clinical diagnosis. The aim is to provide an algorithm that guarantees the presence of a tumor by combining several procedures to provide a foolproof method of tumor detection in MRI brain images. The methods utilized are filtering, contrast adjustment, negation of an image, image subtraction, erosion, dilation, threshold, and outlining of the tumor. The focus of this project is MRI brain images' tumor extraction and its representation in simpler form such that it is understandable by everyone. Humans tend to understand colored images better than black and white images, thus, we are using colors to make the representation simpler enough to be understood by the patient along with the medical staff. The objective of this work is to bring some useful information in simpler form in front of the users, especially for the medical staff treating the patient. Aim of this project is to define an algorithm that will result in extracted image of the tumor from the MRI brain image. The resultant image will be able to provide information like size, dimension and position of the tumor, plotting contour and c-label of the tumor and its

ILLUMINATING BRAIN TUMOR IN MRI METAPHORS BY USING A HYBRID MODEL OF FASTER R-CNN AND SVM

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Abstract:

Brain tumors are considered as most lethal growths. To diminish the gamble of death, early distinguishing proof of the disorder is required. One of the top accessible techniques to assess mind growths is Attractive reverberation Illustration (MRI). Cerebrum growth discovery and division are solid as mind cancers might change in size, figure and area. That makes manual discovery of cerebrum growths by investigating the MRI a monotonous work for radiologists and specialists. So a mechanized mind growth finding and division is required. This work recommends a District based Convolution Neural Network (RCNN) approaches for robotized mind growth discovery and division utilizing MR image, which settles the troubles of cerebrum cancer distinguishing proof effectively and precisely.

Keywords:

Brain Tumor, MRI Preprocessing, Metaphors segmentation, BrainTumor localization, SVM & RCNN

INTRODUCTION

In the current investigation audit, the MRI portrayal isolated to perceive the advancement region and request these areas into being and dangerous. Significant learning is solid areas for an actually has been used comprehensively on portrayals request. Subsequently, Quick R-CNN is a superior significant slanting method and with a blend of the Assist Vector With machining model has been executed through the Open CV library in this learns. It shows that cross breed Faster R-CNN and SVM give in a precision of 98.8%. notwithstanding, the finding of past investigations that utilized various techniques got exactness (R-CNN-92%, CNN and RBF based SVM-92%, RELM-94.3%, KNN-96.6%, CNN-97.5%), In the interim, the proposed mixture model with thought of benefits of Fast R-CNN and SVM, shows huge turn of events.

LITERATURE REVIEW

The determination of a growth locale because of the complicated design of the cerebrum is an intense errand [1]. Attractive reverberation imaging MRI is one of the most usable strategy in clinical image, particular in cerebrum cancer it give excellent and one of a kind similitude to picture the delicate hankie with longitudinal and different goal [2]. In cerebrum growth identification the principal task is to name similitude through allegories division procedures [3]. As such to direct this condition, various allegories examination calculations, and AI strategies utilizing MRI representations by scientists have been carried out. Among various investigations on illustrations handling, content-based similitudes recovery (CBIR) strategies and edge based are exceptionally normal. For instance, ZarNawab et.al utilized CBIR and profound convolution brain organization (DCNN) procedure on MRI analogies to take advantage of the element and track down how much the correspondence among the elaborate representations to the documented illustration; the result shows 96.1% precision [4].

In another work, Point in Yang et.al used the area matched plan (LBP) to takeout the similarities surface information, and besides thickness Cerebrum Association (CNN) to gain the ground and split the restriction of PC vision, it uses two sorts of CNN models Exception and moreover Thick Net to stretch out the rightness to take out the huge highlights [5]. Makers Abdu Gumaiei et.al, proposed a cross variety slanting machine of frontal cortex dangerous development request using Regularized

**MAIZE LEAF DISEASE IDENTIFICATION AND CLASSIFICATION BASED ON
MULTISCALE CONVOLUTION NETWORK, BACTERIAL FORAGING OPTIMIZATION
AND PARTICLE SWARM OPTIMIZATION**

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Abstract

The responsibility of plant is exceedingly important for both human life and environment to feed. Plants also suffer from various diseases like human beings and animals. So there calls for a method to make certain accurate and efficient outcome of plant diseases to minimize adverse effects in production of yield. This paper proposes a various neural network models in recognition of maize plant leaf disease diagnosis. Deep learning approaches gives incredible results compared to machine learning approach. In this, various deep learning approaches like Multiscale Convolution Neural Network (CNN), Bacterial Foraging Optimization (BFO) using Recurrent Neural Network (RNN) and Particle Swarm Optimization (PSO) using Convolution Neural network are discussed. A novel Multiscale CNN is used to learn features from training data along with Rectified Linear Units [ReLU] to produce output without loss of information. Next an improved BFO have been used for assigning optimal weights to RNN for increasing accuracy and speed of network. The searching and grouping of seed points have been done with region growing algorithm. Next an improved PSO along with graph cut segmentation helps for searching and grouping of seed points to generate feature set. The network over fitting issues can be eliminated by Rectified ReLU activation function.

Index terms

Multiscale Convolution Neural Network, Bacterial Foraging Optimization, Particle Swarm Optimization, Identification, Classification.

1. Introduction

Maize is one of the most nourishing crops for humans and animals. However numerous diseases effect frequently on a large scale in Maize production, thereby causing mislay in economy. Therefore, early and effective detection of maize leaf diseases is crucial for assuring healthy development of maize production and has become research hotspot in the field of agricultural production. Traditionally, an improved DMS-Robust Alex net [1] was proposed to identify maize leaf diseases with accuracy of 98.62%. The recent Deep Forest [2] model performs with high efficiency than traditional deep learning models. As shown in [3], Bacterial foraging optimization can be efficient and powerful tool to initialize weight to radial basis functional neural network for identifying affected regions on plant image leaf. One of the established machine learning approach Support Vector Machine helps to classify images based on linear, Non linear and Multiclass of Tomato images are shown [4]. Along with grey level histogram, Otsu method performs a segmentation process based on texture feature analysis for Maize plant diseases image [5]. Apart from machine learning approach, deep learning helps for identification and classification based on Multiscale Convolution Neural Network [6] that produces good results in terms of Dice coefficient, sensitivity and specificity for Maize plant samples. In Quantum Particle Swarm Optimization [7] is applied to find the precise parameters and then to identify the threshold values. In the majority of cases leaf was not successfully segmented if the markers do not contribute



Big Data in Data Mining Techniques – A Survey

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Abstract

Big data processing presents itself as a novel and promising analytical field for extracting useful information from enormous databases. It is used to handle vast volumes of knowledge sets, usually large, sparse, incomplete, uncertain, complex, or dynamic information set from various and autonomous sources, in time-sensitive applications such as social site data processing and medical applications. In order for the user to easily obtain the main strategy and answers to their questions from the mined results, massive data processing also handles the storage structure of the mined results. Information slicing is done to break up the associations between columns while keeping the associations within each column. There are several types of information slicing: quasi-static, amorphous, simultaneous dynamic, quasi-static, and dynamic. Another fundamental duty in the huge information mining process is clustering, which is used to find patterns and identify information for use in large-scale processing applications. In addition to discussing the benefits and limitations of these strategies, this study examines huge data processing, information slicing, and clustering techniques. Information slicing and clumping approaches, mining platforms, and large data mining algorithms are discussed along with their quality and performance.

Keywords: Big Data Mining, Cloud Computing Technique, Clustering Techniques, Collaborative filtering, Data Mining and Data Slicing.

1. Introduction

Our capacity to collect data in several formats from a wide range of sensors, devices, and independent or linked applications has significantly increased in recent years. The volume of information has increased faster than our ability to handle, evaluate, store, and interpret these datasets. Important obstacles arise while attempting to make use of the vast amount of knowledge. In order to explore vast amounts of data, the mining process looks for consistent patterns or systematic correlations between the variables. The findings are then validated by applying the patterns found to the newly discovered data set. Because of the quality of the information and the increase in computing time, this is frequently an incredibly challenging assignment.

One emerging example that supports the development of connected information centre computer code and infrastructure growth is big information. Massive data could be a computation-focused approach that emphasizes the cloud system's storage capacity. By utilizing massive information processing and storage resources under strict administration, cloud computing technology aims to provide large-scale information applications with fine-grained computing capabilities. As a result, the rise of information also quickens the development of cloud computing, which offers comprehensive options for handling and storing large amounts of data.



Activities of Primordial Radionuclides in the tobacco cultivated fields of Dindigul and Erode districts (Tamil Nadu, India)

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KEYWORDS

Primordial tobacco
field Uranium
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ABSTRACT:

Present study is a novel attempt to estimate the activities of primordial radionuclides such as ²³⁸U (Uranium-238), ²³²Th (Thorium-232) and ⁴⁰K (Potassium-40) in the soil samples collected from tobacco plantations in Dindigul and Erode Districts. Radioactivity concentrations of the collected soil samples were determined with the aid of a NaI gamma-ray detector, which ranged from BDL (2 Bq/kg) to 20.3 Bq/kg for ²³⁸U, 5.1 to 156.5 Bq/kg for ²³²Th and 87.1 to 712.5 Bq/kg for ⁴⁰K respectively with mean value of 6.41, 54.34 and 296.96 respectively. Frequency distribution of the radionuclides showed the leptokurtic, platykurtic and mesokurtic for ²³⁸U, ²³²Th and ⁴⁰K respectively. The average activity concentrations of primordial radionuclides in the tobacco field soils of Dindigul and Erode Districts were compared to the published global average values. The estimated primordial activity concentration from the current work is lesser than that of the average global values.

1. Background

Primordial radionuclides are released from the terrestrial radiation sources such as earth's crust, rocks, soil, air and water [1]. Radiations are the spontaneous emission of energy from unstable atoms [2]. Natural and anthropogenic radionuclides are a crucial requirement for the evaluation and control of public exposures [3]. Cosmogenic radionuclides arise as a result of the interaction of cosmogenic radiation with elemental substances in the atmosphere [4]. Anthropogenic activity can also be considered as a ubiquitous source of radioactivity which contributes to the background radiation level [5-6]. Natural gamma radiation that occurs in the environment is created by primordial radionuclides from the sky and on Earth [7]. Naturally occurring radionuclides in the soil significantly increase the population's background radiation exposure [8]. The

primary external source of irradiation in humans is gamma radiation, which is emitted by naturally occurring radionuclides that are deposited on the ground.

Distribution of natural radiation level depends upon multiple factors such as the place, elevation, latitude as well as the higher abundance of radioactive minerals [9]. The primary sources of naturally occurring radioactivity in soil are the ²³⁸U, ²³²Th decay series and natural ⁴⁰K respectively [10-11]. The uranium and thorium series, which are respectively descended from the ²³⁸U and ²³²Th series [12] have average continental crust levels of 2.7ppm and 9.6ppm, respectively [13]. ²³⁸U and ²³²Th are fission products produce 12 and 11 daughter products and ⁴⁰K is non fission product [2]. The presence of Uranium and Thorium due to fertilizers enhances the natural radiations [14]. U, Th, and K are released into the soil by the progeny of U and Th as well as by the



weathering of bedrock, which is the main repository of the primordial radionuclides. Three isotopes of potassium exist in nature (^{39}K , ^{40}K and ^{41}K). Only ^{40}K , exhibits gamma radioactivity, and it makes up 0.012% of all potassium in nature. The daughter isotopes ^{40}Ca and ^{40}Ar are produced during the decay of ^{40}K , along with beta and gamma radiations. One of the reasons for the presence of high activity in soil is the presence of potassium-containing fertilisers, which have a significant impact on radionuclide concentrations [15]. The present study focused on the distribution of natural radioactivity levels in the surface soils of tobacco cultivated fields which absorbed external gamma radiations from the soil sample of selected stations.

2. Methods

2.1. Location of Study

Location of the study includes Dindigul ($11^{\circ}30.870'\text{N}$, $077^{\circ}57.722'\text{E}$) and Erode ($10^{\circ}32.256'\text{N}$, $077^{\circ}57.039'\text{E}$) districts, Tamil Nadu (India) (Fig. 1). 23 different sites of tobacco cultivated fields comprised of 5000 hec are selected for this study (Table 1). The distance between each site is kept as 3-6 km.

Table 1. GPS Coordinates of the sampling locations

No.	Location	GPS Coordinates	
		Latitude	Longitude
S1	Vedachandur	$077^{\circ}57.039'\text{E}$	$10^{\circ}32.256'\text{N}$
S2	Lashmanampatti	$077^{\circ}57.582'\text{E}$	$10^{\circ}32.740'\text{N}$
S3	Kalanampatti	$077^{\circ}57.988'\text{E}$	$10^{\circ}32.730'\text{N}$
S4	Idyakottai	$077^{\circ}53.523'\text{E}$	$10^{\circ}31.436'\text{N}$
S5	Puliyurnatham	$077^{\circ}50.025'\text{E}$	$10^{\circ}32.002'\text{N}$
S6	Javathupatti	$077^{\circ}51.053'\text{E}$	$10^{\circ}31.350'\text{N}$
S7	Odaipatti	$077^{\circ}47.095'\text{E}$	$10^{\circ}35.232'\text{N}$
S8	Thangachiammapatti	$077^{\circ}42.025'\text{E}$	$10^{\circ}29.232'\text{N}$
S9	Mylambaddi	$077^{\circ}40.722'\text{E}$	$11^{\circ}30.870'\text{N}$
S10	Kuruchi	$077^{\circ}41.564'\text{E}$	$11^{\circ}34.031'\text{N}$
S11	Poonachi	$077^{\circ}39.397'\text{E}$	$11^{\circ}36.294'\text{N}$
S12	Olagadam	$077^{\circ}41.633'\text{E}$	$11^{\circ}33.740'\text{N}$
S13	Kalpavi	$077^{\circ}38.471'\text{E}$	$11^{\circ}34.151'\text{N}$
S14	Alukuzhi	$077^{\circ}21.379'\text{E}$	$11^{\circ}26.751'\text{N}$
S15	Karattupalayam	$077^{\circ}21.353'\text{E}$	$11^{\circ}26.906'\text{N}$
S16	Kurumanthur	$077^{\circ}20.874'\text{E}$	$11^{\circ}24.815'\text{N}$
S17	Nambiyur	$077^{\circ}19.313'\text{E}$	$11^{\circ}21.679'\text{N}$
S18	Elathur	$077^{\circ}18.430'\text{E}$	$11^{\circ}23.293'\text{N}$

S19	Varapalayam	$077^{\circ}13.958'\text{E}$	$11^{\circ}22.344'\text{N}$
S20	Kavillipalayam	$077^{\circ}13.885'\text{E}$	$11^{\circ}23.186'\text{N}$
S21	Karapaddi	$077^{\circ}12.057'\text{E}$	$11^{\circ}22.741'\text{N}$
S22	Nallur	$077^{\circ}08.377'\text{E}$	$11^{\circ}30.870'\text{N}$
S23	Puliyampatti	$077^{\circ}57.039'\text{E}$	$10^{\circ}32.256'\text{N}$

2.2. Soil collection and processing

Soil samples (1000-2000 g) of tobacco cultivated fields was collected from the surface regions (0-5 cm depth) during the tobacco cultivated seasons (December to April). Collected soils dried at room temperature for 48 hours and then stored in black polythene bags. Before processing, the samples are again dried at 110°C using hot air oven, to destroy inorganic and organic compounds and moisture. Then the samples were stored in plastic containers ($9 \times 6.5\text{cm}$). After four weeks, samples are attained secular equilibrium between R-226 and its short-lived daughter products. The net weights of the samples are determined before counting.

2.3. Gamma ray spectrometry

The concentration of primordial radionuclides (^{232}Th , ^{238}U and ^{40}K) in soil samples is measured using a gamma ray spectrometer with a NaI (TI) detector. The energy resolution (2.0 Kev) with 33% relative efficiency at 1.33 Mev and the counting time 20000 seconds were always ensured prior to the analysis following the calibration with AERB approved sources. A computer programme is used to calculate the activity concentration ^{232}Th , ^{238}U and ^{40}K from the counting spectra. The peak corresponds to 1400Kev (K-40) for ^{40}K , 1764.54 Kev (Bi-214) for ^{238}U and 2614.5Kev (Th-232) for ^{232}Th are considered in arriving at the activity levels (Bq/kg).

2.4. Radium Equivalent Activity

Since the activity concentrations of the primordial radionuclides such as ^{238}U , ^{232}Th and ^{40}K in the soil samples, are not uniform and range vary widely, there is some practical difficulty for comparing the gamma radiations emitted from primordial radionuclides from soil samples of various locations. Therefore, the concept of Radium Equivalent (R_{eq}) was introduced [16-17]. The total exposure to gamma radiation from the primordial radionuclides has been defined in terms of R_{eq} activity in Bq/kg. It is calculated on the assumption that 370 Bq/kg ^{226}Ra or 259 Bq/kg ^{232}Th or 4810 Bq/kg of ^{40}K produce same gamma dose rate. Therefore, R_{eq} of any



sample can be calculated using the following formula [18].

$$Ra_{eq} \text{ (Bq/kg)} = A_{Ra} + 1.43A_{Th} + 0.077 A_K$$

Where A_{Ra} , A_{Th} and A_K are the specific activities of ^{226}Ra , ^{232}Th and ^{40}K respectively. The safe value of Ra_{eq} in any environmental matrix is reported to be less than 370 Bq/kg in order to limit the annual effective dose to 1 mSv for the general public [19].

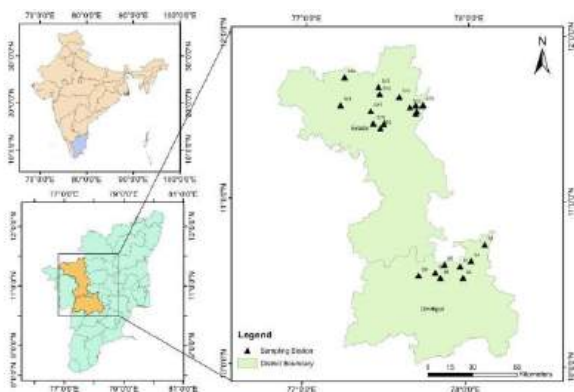


Fig. 1 showing the sampling locations (tobacco cultivated fields)

2.5. Determination of Absorbed Dose Rate

The absorbed gamma dose rate (D), is defined as the amount of energy deposited in a unit mass in human tissue or other media. It is expressed by the SI unit as Gray/kg (Gy/kg) and 1 Gray= 1 Joule. The absorbed dose rate (D) in nGy/h due to terrestrial gamma radiation at 1 m above the ground surface has been computed from the specific activities of ^{226}Ra , ^{232}Th and ^{40}K respectively [20].

$$D \text{ (nGy/h)} = 0.462A_U + 0.604 A_{Th} + 0.0417A_K$$

Where 0.462, 0.604 and 0.0417 nGy/h per Bq/kg are the dose conversion factor for ^{238}U , ^{232}Th and ^{40}K , respectively and A_U , A_{Th} and A_K are the activity concentration of ^{226}Ra , ^{232}Th and ^{40}K respectively.

2.6. Determination of Annual Effective Dose Rate

Effective dose is defined as dose equivalent weight to express the equivalent sensitivity of different human organs to radiation exposure. The unit for effective dose is Sievert (Sv).

$$\text{Effective dose rate (mSv/y)} = D \text{ (nGy/h)} \times 8760 \text{ (h/y)} \times 0.2 \times 0.7 \text{ (Sv/Gy)} \times 10^{-6}$$

To estimate the annual effective dose rate, the conversion coefficient from absorbed dose in air to effective dose 0.7 Sv/Gy and the indoor occupancy factor of 0.8 and the outdoor occupancy factor of 0.2 were used [20].

2.7. Radiological Hazard Indices (H_{ex} and H_{in})

Beretka and Mathew [19] described two types of hazard index namely external hazards index and internal hazard index. The external hazards index indicates whether the absorbed gamma radiation exceed the permissible limit of unity (<1). Similarly, the internal hazard index is useful in assessing whether alpha radiation from ^{238}U and its progenies exceeds the maximum permissible limit of unity (<1). The external hazards index is obtained from Ra_{eq} expression.

$$H_{ex} = C_U/370 + C_{Th}/259 + C_K/4810 \leq 1$$

$$H_{in} = C_U/185 + C_{Th}/259 + C_K/4810 < 1$$

2.8. Statistical analysis and spatial mapping

Statistical analysis is performed for the obtained results using the SPSS software (Version 17.0). Skewness, kurtosis, frequency distribution and histogram are used to analyse the results. Spatial analysis of the obtained results was conducted by means of IDW (Inverse distance weighted) interpolation technique and Arc GIS Desktop software (Version 10.5) is used for spatial mapping.

3. Results

3.1. Primordial Radionuclides

The concentrations of primordial radionuclides such as ^{238}U , ^{232}Th and ^{40}K in the tobacco cultivated soils of Dindigul and Erode districts varied very widely. The ^{238}U concentration ranged from Below Detection Limit (BDL) to 20.3 Bq/kg, ^{232}Th from 5.1 Bq/kg to 156.6 Bq/kg and ^{40}K from 87.1 Bq/kg to 712.5 Bq/kg and mean values of ^{238}U , ^{232}Th and ^{40}K were 6.4 Bq/kg, 54.3 Bq/kg, and 296.9 Bq/kg respectively. Puliurnatham (S5) registered maximum level of three primordial radionuclides ^{238}U (20.3 Bq/kg), ^{232}Th (156.3 Bq/kg) and ^{40}K (712.5 Bq/kg) whereas the minimum levels of ^{238}U (BDL Bq/kg) and ^{232}Th (5.1 Bq/kg) were recorded in Nambiyur (S17) and Kurumanthur (S16) registered minimum level of ^{40}K (87.1 Bq/kg). Spatial distribution of primordial radionuclides confirmed non-uniform distribution (Figure 2-4).

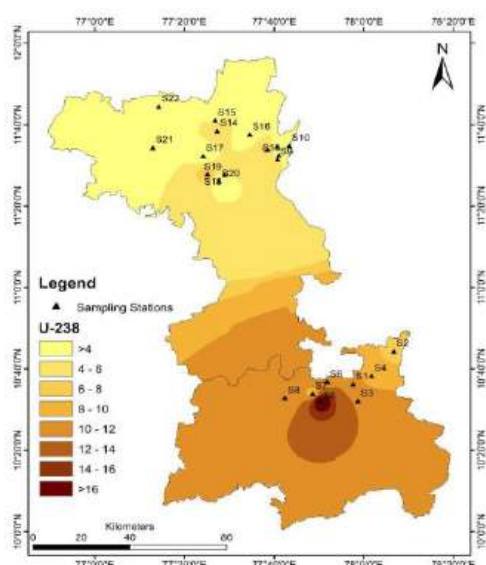


Fig. 2: ^{238}U in tobacco cultivated fields soil samples

In Figure 5, histogram with positively skewed (1.164) kurtosis with leptokurtic curve showed for the concentrations of ^{238}U whereas for ^{232}Th , histogram with positively skewed (0.845) kurtosis with platykurtic curve were observed and histogram with normally skewed (0.639) kurtosis with mesokurtic curve for ^{40}K were observed.

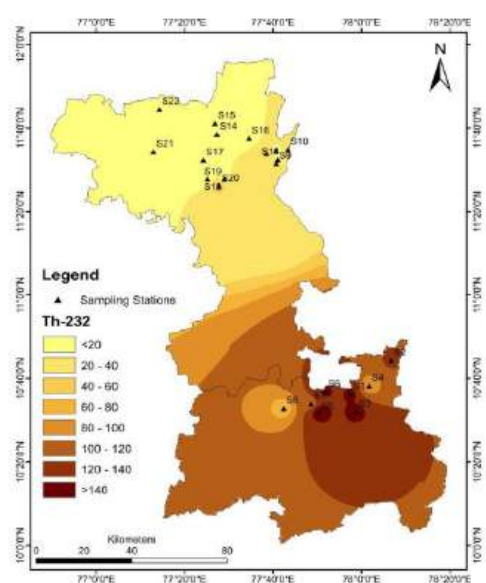


Fig. 3: ^{232}Th in tobacco cultivated fields soil samples

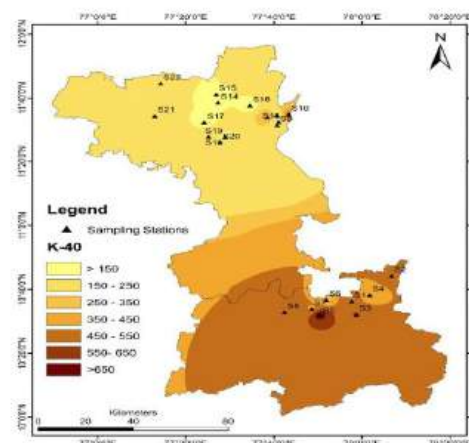


Fig. 4: ^{40}K in tobacco cultivated fields soil samples

3.2. Radium Equivalent Activity

The data on the radium equivalent activities in 23 soil samples are presented in Table 2. The maximum Ra_{eq} activity was recorded (298.9 Bq/kg) in Puliurnatham (S5) in Dindigul district and minimum of 13.6 Bq/kg was found in Nambiyur (S17). It was observed that the mean Ra_{eq} activity in Dindigul district (222.1 Bq/kg) was about 5 times higher than the mean Ra_{eq} activity in Erode district (45.6 Bq/kg).

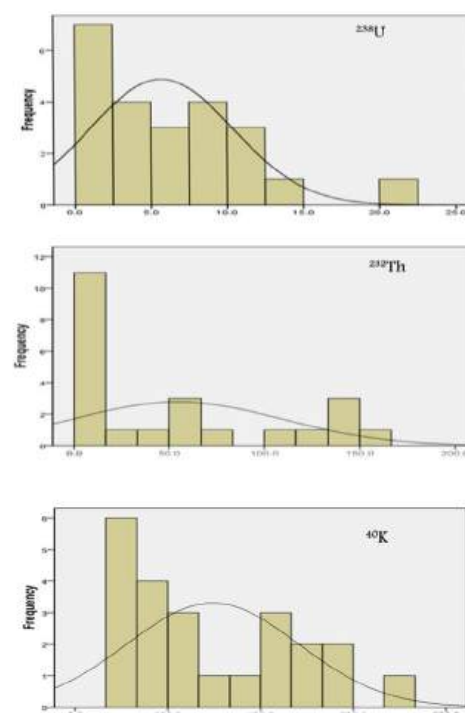


Fig. 5: Frequency distributions of the radionuclides



3.3. Absorbed Dose Rate, Radiological Hazard Indices

The data on absorbed dose rate, annual effective dose rate and hazard indices (External and Internal Hazard) are presented in Table 2. The absorbed dose rate calculated for 23 sampling stations ranged from 8.9 nGy/h to 133.8 nGy/h with mean values of 48.5 nGy/h. The maximum absorbed dose rate was recorded in the sampling station, S5 (Puliyurnatham) in Dindigul district. Conversely, and the minimum absorbed dose rate in the sampling station S17 (Nambiyur) in Erode district. The same trend was observed with reference to annual effective dose rate. The maximum annual effective dose rate of 0.1 mSv/year was registered in several sampling stations of Dindigul district. However, most of sampling stations in Erode district registered annual effective dose rate of about 0.01 mSv/year. The mean annual effective dose rate for all the sampling stations was 0.04 mSv/year. Both the external hazard and internal hazard indices ranged from 0.05 to

0.86 with mean value of 0.3. It was also observed that the hazard index did not exceed unity in any of the sampling station.

4. Discussion

The activity concentrations of primordial radionuclides such as ^{238}U , ^{232}Th and ^{40}K were measured in soil samples from Dindigul and Erode districts of Tamil Nadu as the tobacco plants are largely cultivated in these areas. The measurements of radioactive substances in the tobacco cultivated soil assume importance to evaluate the accumulation of radionuclides in tobacco leaves which go into the manufacturing of chewing tobacco and bidis for smoking. Further the measurements are important in the assessment of population exposure to gamma radiation from the soils. Since radiation from natural sources constitutes 96% of total radiation dose to the world population [11, 21], knowledge of concentration of primordial radionuclides becomes essential for the assessment of possible radiological risk to human health.

Table 2. Activity Concentrations of ^{238}U , ^{232}Th and ^{40}K and Radium Equivalent Activity (R_{eq}), Absorbed Dose Rate, Annual Effective Dose Rate, External Hazard (H_{ex}) and Internal Hazard (H_{in}) in Soil Samples from Tobacco Field

Sampling Station	Concentration of Radionuclides (Bq/kg)			Ra _{eq} (Bq/kg)	Absorbed Dose Rate (nGy h ⁻¹)	Annual Effective Dose Rate (mSv y ⁻¹)	Hazard Indices	
	²³⁸ U	²³² Th	⁴⁰ K				External Hazard (H _{ex})	Internal Hazard (H _{in})
Dindigul District								
S1	11.7±3.8	146.1±8.9	541.8±33.7	262.3	116.4	0.1	0.709	0.739
S2	6.9±3.7	122.6±8.6	491.2±33.4	220.0	97.86	0.1	0.594	0.613
S3	12.0±3.7	147.0 ±8.6	555.1±32.5	265.5	117.63	0.1	0.716	0.751
S4	8.2±3.5	82.3±7.9	363.9±31.7	153.8	68.76	0.08	0.416	0.151
S5	20.3±4.0	156.5±9.2	712.5±35.8	298.8	133.81	0.1	0.807	0.862
S6	11.3±3.9	143.8±9.1	316.7±34.0	241.2	105.37	0.1	0.658	0.682
S7	8.4±3.6	107.8±8.3	433.6±32.0	195.8	87.2	0.1	0.529	0.558
S8	10.5±3.5	65.8±7.8	460. ±32.6	139.9	69.91	0.08	0.378	0.406
Range	8.2-20.3	65.8-156.5	316.7-712.5	139.9-298.8	68.76-133.81	0.08-0.1	0.378-0.807	0.151-0.862
Mean	11.2	121.4	484.3	222.16	99.62	0.095	0.601	0.623
SD±	4.15	33.3	123.1	55.8	23.30	0.009	0.151	0.306
Erode District								
S9	4.9±3.5	25.9±7.6	217.7±33.0	57.3	27.04	0.03	0.159	0.172
S10	3.9±3.2	36.2±7.1	521.6±31.4	95.7	45.56	0.05	0.259	0.459
S11	BDL	10.4±7.7	102.9±33.0	24.2	11.33	0.01	0.066	0.071



S12	8.0±3.6	51.7±7.9	435.5±33.8	115.4	53.2	0.06	0.212	0.332
S13	BDL	8.3±6.9	101.1±30.2	20.2	10.0	0.01	0.058	0.062
S14	5.3±3.6	16.6±7.8	132.6±33.8	39.2	18.02	0.02	0.106	0.121
S15	3.7±2.9	11.7±6.9	133.7±27.5	30.6	14.37	0.01	0.082	0.089
S16	BDL	8.2±7.2	87.1±31.1	19.9	9.2	0.01	0.053	0.058
S17	BDL	5.0±4.1	119.8±27.1	13.6	8.92	0.01	0.050	0.055
S18	8.7±3.9	6.7±4.9	234.0±36.7	36.2	17.87	0.02	0.098	0.122
S19	4.3±3.2	13.2±6.9	117.2±29.8	33.02	14.87	0.01	0.087	0.099
S20	BDL	54.9±7.38	194.9±29.8	95.1	42.11	0.05	0.258	0.263
S21	BDL	9.7±7.7	153.6±32.9	27.5	12.94	0.01	0.073	0.078
S22	BDL	10.6±7.9	192.7±34.7	31.9	15.36	0.01	0.086	0.090
S23	7.0±3.5	9.0±7.6	211.5±33.7	36.08	17.54	0.02	0.098	0.117
Range	2-87	5-54.9	87.1-521.6	13.6-115.6	8.92-53.2	0.01-0.06	0.05-0.259	0.055-0.459
Mean	3.84	18.54	197.6	45.6	21.222	0.022	0.116	0.146
SD±	2.49	16.25	124.4	31.47	14.218	0.017	0.0714	0.117
Over all Range	BDL-20.3	5.1-156.5	87.1-712.5	13.6-298.8	8.92-133.81	0.01-0.1	0.050-0.807	0.055-0.862
Mean±SD	6.41±4.73	54.34±55.10	296.96±185.7	106.7±95.1	48.49	0.039	0.285	0.303

Gamma radiation levels are inversely correlated with cosmic ray activity and radionuclide concentrations in soil samples from tobacco cultivation [22]. The primordial radionuclides are long lived radionuclides are such as ^{238}U uranium, ^{232}Th thorium and ^{40}K potassium present in the environment factor such as soil, rocks, sediment [10]. The average primordial radionuclides levels in the present study were found as 87.0 ± 4.0 , 98.0 ± 4.0 and $1254.00\pm62.0\text{Bq/kg}$ for ^{238}U , ^{232}Th and ^{40}K respectively. Due to the heterogeneous soil properties, present study has recorded differed ^{40}K activity and is varied greatly between 200 and 854 Bq/kg. Activity concentrations of ^{238}U , ^{232}Th and ^{40}K in soil samples from the different parts India and world over were reported by several investigators. The data generated in the present study are compared with results of other investigators (Table 3). The generated data on the analysis of primordial radionuclides indicated that the distribution of ^{238}U , ^{232}Th and ^{40}K was not uniform and ranged widely. In general, the concentration of ^{40}K was distinctly higher than that of both ^{238}U and ^{232}Th . But the concentration of ^{232}Th was always higher than that of ^{238}U , in all soil samples. When the activity concentrations of primordial radionuclides are converted in to Radium Equivalent (R_{eq}) value, a distinct variation in the distribution of the primordials in the soil of Dindigul and Erode districts was observed. It was evident from radium equivalent data that the mean radium equivalent activities in Dindigul district

(222.Bq/kg), was about 5 times higher than the mean radium equivalent activity in Erode district (46 Bq/kg).

Table 3. Comparison of Concentration Radionuclides ^{238}U , ^{232}Th and ^{40}K in Soil Samples from Different Parts of the World and India

Nation/ State	Concentration of Radionuclides (Bq/kg)			Reference
	^{238}U	^{232}Th	^{40}K	
Dindigul and Erode districts (Tamil Nadu)	6.41	54.34	296.96	Present study
Ireland	26.0	37.0	350.0	[24]
Turkey (Istanbul)	21.0	37.0	342.0	[25]
South Africa	26.4	32.2	115.0	[26]
Turkey	16.52	17.38	209.0	[27]
China	40 .3	59.6	751.2	[28]
Jordan	284.5	16.5	146.5	[29]
Hong Kong	21.33	21.16	290.0	[30]
Nigeria	39.70	46.81	603.62	[31]
World average	35.0	45.0	420.0	[20]
Indian studies				
Tiruchirappalli (Tamil Nadu)	6.50	61.7	380	[32]
Perambular (Tamil Nadu)	13.2	66.0	340	[33]
Western Ghats	36.3	107.8	231	[34]



(Tamil Nadu)				
Punjab and Himachal Pradesh	56.7	87.4	143	[35]
Sirsa (Haryana)	27.9	72.5	286	[36]
Kotagiri (Tamil Nadu)	48.8	102	229	[37]
Kalpakkam Coast (Tamil Nadu)	16.0	119	40 6	[38]
Ramanagara and Tamkur (Karnataka)	33.7	77.4	791	[39]
Visakhapatnam (Andhra Pradesh)	38.0	230	520	[40]

The level of natural background radiation in a soil sample is influenced by geological and geographic factors, uranium mineralization and leaching within the earth crust, and chemical and biochemical patterns of uranium, thorium, and their decay products [19]. Another significant factor is the contribution of rocks with high thorium and uranium concentrations [20].

It was observed that higher concentrations of ^{238}U and ^{232}Th were found in the Oddanchitram taluk of Dindigul district. Similarly, in Gobhichettipalayam taluk of Erode district registered higher concentration of ^{238}U and ^{232}Th as compared to other taluks. As regards to ^{40}K , the distribution was found to be uniformly higher than ^{238}U and ^{232}Th in both districts. However, Dindigul district registered an elevated level of primordial radionuclides than the Erode district. The higher level of the primordial radionuclides in Dindigul district may be attributed to the rocky environment of the district. Rocks are primary sources of radioactive substances and soil was formed by the weathering of rocks. The geomorphology and lithology characters of Dindigul district may have a bearing on the elevated levels of primordial radionuclides. Dindigul district is naturally enriched with granite rocks (igneous rocks) having higher activity of primordial radionuclides. The enriched of monazite in igneous rocks, which was the source of ^{232}Th , was responsible for the higher radioactivity level [23].

The data on activity concentration ^{238}U , ^{232}Th and ^{40}K in the soil samples of Dindigul and Erode districts were

used for the calculation of gamma radiation dose of hazard indices. The mean absorbed gamma dose rate for the soil samples analyzed was found to 48.5 nG/h which is comfortably less than world average of 54 nGy/h. The mean annual effective dose calculated for the soil was found to be 0.04 mSv/year which is well within the safety limit 0.07mSv/year [20]. Similarly, the mean external hazard index (0.29) and internal hazard index (0.30) registered for the soil samples are very well below permissible level unity (< 1). From the analysis of data, it is evident that the gamma activity levels from the soil of Dindigul and Erode districts did not provide any radiological risk to human population of two districts and these results supports our earlier findings [41-42].

4. Conclusion

As a novel attempt, the activity concentration of ^{232}Th , ^{238}U and ^{40}K in Dindigul and Erode districts have been evaluated from the soil samples collected at various tobacco cultivated fields. The activity concentration of ^{232}Th in soil has found to be 6 times lower than the average world concentration (30 Bq/kg) and the activity concentration of ^{40}K has found to be 0.7 times lesser than the average world concentration (400 Bq/kg) and for ^{238}U is found to be 6 times lesser than the world average (35 Bq/kg). Present study concluded that the concentrations of ^{232}Th , ^{238}U and ^{40}K in all sampling stations are low in level and are found below the World's and India's average values.

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Biosynthesis and Characterization of Silver Nanoparticles Using *Barleria cuspidata* Leaves Extract and Mechanism of Antimicrobial Action of Selected Human Pathogens

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Nanoscience and nanotechnology are concerned in the invention and appliance of nanoparticles that can be used in diverse field. Silver nanoparticles (AgNPs), among other nanoparticles, have received considerable thought because of their inimitable properties.

Objective: The intention of the current study was to quickly synthesize silver nanoparticles (AgNPs) using *Barleria cuspidata* leaf extract. The nanoparticles obtained have been characterized with a variety of characterization methods resembling UV-Visible Spectrum Analysis, Fourier Transform (FT) Infrared Spectrometry, Scanning Electron Microscopy, X-Ray Diffraction and tested against selected human pathogens.

Results: Spectral studies confirmed the UV-Visible absorption spectrum of the Ag-NPs at a wavelength of 470 nm and a good crystalline nature with a face-centered cubic crystal structure using XRD spectrum. Surface topography and the presence of Silver in the prepared sample have been confirmed from SEM and EDX measurements. Various functional groups present in the sample have been examined using FT-IR spectroscopic analysis. A homogeneous dispersion of oval form nanoparticles with a usual size of 10µm was confirmed by visualization using SEM EDX. In addition, the biological activities of Ag nanoparticles showed significant results against anti-bacterial (*E.coli*, *Staphylococcus aureus*), and antifungal activity (*Aspergillus niger*, *Candida albicans*).

Conclusion: *Barleria cuspidata* being a crucial medicinal plant widely used in the treatment of diabetic agent, the present study shows that the plant can be used as finest resource for synthesis of AgNPs for further research in the medical field.

Keywords: Biosynthesis; *Barleria cuspidata*; SiNPs; characterization; human pathogens.

1. INTRODUCTION

The revolution in nanotechnology has marked a significant turning point in history. Nanotechnology involves the manufacturing, manipulation, and imaging of nanostructures with sizes ranging from 1 to 100 nm [1]. Nanoparticles possess diverse physio-chemical properties such as optical, magnetic, catalytic properties [2], and biological applications in antimicrobial [3, 4], antioxidant, anti-inflammatory, antiviral, cardiac protection, wound dressing and anti-cancerous activities [5]. Nanoparticles (NPs) result in superior chemical reactivity, biological activity, and catalytic behaviour than their own larger particles [2, 6]. They are employed in major industries like food, chemical, feed, health, space, cosmetics etc. The industries preferably employ green synthesized nanoparticles for manufacturing its products [2, 7]. Now in the 21 st century, AgNPs are used in broad range of applications, such as biomedical engineering, drug delivery, food industries, antimicrobial, textile industries, agriculture, water treatment (as an antioxidant), anticancer agent, larvicides, cancer cell therapy, component of ointments etc. [8]. Among the reported antimicrobial properties of different metal NPs, it was found that AgNPs exhibited prominent bactericidal and fungicidal activity [9, 10]. Top-down and bottom-up approaches can be used for the synthesis of AgNPs. The top-down approach involves

breaking down a bulk material into nano-sizes using techniques such as laser ablation and puttering. In contrast, the bottom-up approach refers to building nanoparticles using smaller entities, such as chemical and biological methods [11]. Biological processes, known as green synthesis, primarily conducted via medicinal plants, offer advantages over chemical and physical methods because they are cost-effective, eco-friendly, and readily available. Here, the present manuscript reviews the modern development in green synthesis, optimization conditions, mechanisms, and characterization techniques for AgNPs, particularly using medicinal plant extracts, and discusses the effects of different parameters on green synthesis. Standard characterization techniques include UV-Visible Spectrophotometry, Fourier Transform Infrared Spectroscopy, Scanning Electron Microscopy-Energy Dispersive X-Ray Analysis, X-Ray Diffraction (XRD), and Antimicrobial Analysis.

2. MATERIALS AND METHODS

Collection of *Barleria cuspidata* Leaves: The fresh leaves of *Barleria cuspidata* (Acanthaceae) were collected from the Gangaikondan Reserve Forest, Tirunelveli District, Tamil Nadu, India. Taxonomic attributes were verified using references such as the 'Flora of Presidency of Madras' [12] and the 'Flora of the Tamil Nadu Carnatic' [13].

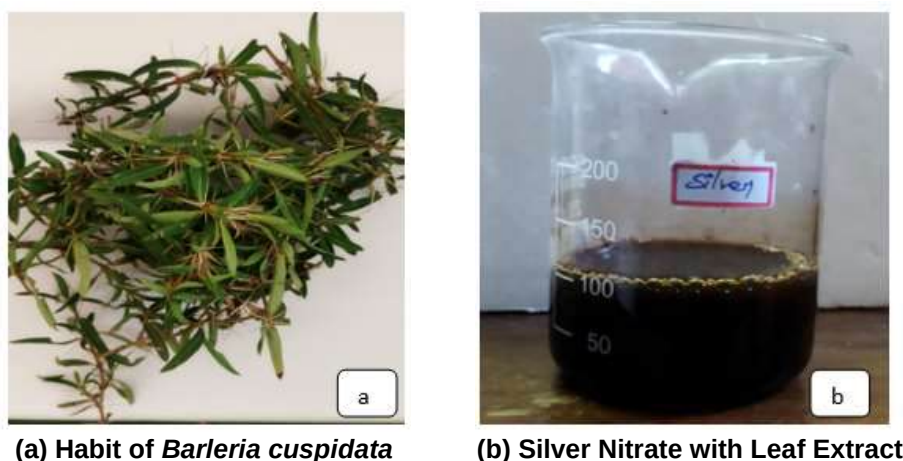


Fig. 1. Green Synthesis of silver nanoparticles using the leaf extract of *Barleria cuspidata*

Isolation of Nanoparticles: Fresh and healthy *Barleria cuspidata* leaves were carefully gathered and thoroughly cleaned with tap water followed by distilled water to eliminate any dust or visible impurities. Consequently, 10 gms of fresh leaves were boiled in 100 milliliters of double-distilled water, and the resulting extract was filtered through Whatman no.1 filter paper, collecting the filtrate in a conical flask. This obtained extract was utilized for the synthesis of various nanoparticles.

Preparation of Silver Nitrate Solution: 1mM silver nitrate solution is prepared by the concentration of 0.0169 g in 100 ml double distilled water and stored.

Metal-Plant Extracts Interaction: 90 ml of silver nitrate solution was placed in a conical flask, to which 10 milliliters of the leaf extract were added. The AgNO_3 solution undergo a color modify from light green to brownish green. The conical flask was subjected to light exposure for a 72-hours incubation period.

Characterization: UV-spectrophotometer analysis, around 1 ml of the sample suspension was transferred into a quartz tube. The sample was then diluted with 2 ml of distilled water to facilitate monitoring of nanoparticle synthesis. UV-Visible spectra scans were conducted in the wavelength range of 200-900 nanometers using a UV-visible spectrophotometer (Shimadzu UV 1800, Germany). For FTIR measurements, the synthesized silver nanoparticles solution was centrifuged at 10000 rpm for 30 minutes. The pellet was washed thrice with 5 ml of deionised water to get rid of the free proteins or enzymes that are not capping the silver nanoparticles. The pellet was dried by using vacuum drier. It was

analyzed by FTIR. To characterize the purified synthesized nanoparticles, freeze-dried powder samples were employed for XRD analysis, which was conducted at 40 kV/20 mA using continuous scanning in 2 theta mode. The nanoparticle solution was first purified through repeated centrifugation at 5000 rpm for 20 minutes, followed by redispersion of the nanoparticle pellet into 10 milliliters of deionized water. In addition, SEM analysis was carried out using a TESCAN VEGA3 SBH. The pellet was subjected for SEM analysis. Thin films of the sample were prepared on a carbon coated copper grid by just dropping a very small amount of the sample on the grid; extra solution was removed using a blotting paper and then the film on the SEM grid was allowed to dry for analysis.

Antimicrobial Activity of Silver Nanoparticles: The efficiency of leaves extracts from *Barleria cuspidata* against the growth of various human pathogens was evaluated using the Agar well diffusion method in a clinical laboratory (Scudder Diagnostic Centre, Nagercoil). The Kirby-Bauer method was employed to assess the antibacterial activity of isolated plant extraction pellets. Overnight grown cultures of the respective bacteria and fungi were inoculated onto Nutrient agar, Sabouraud's Dextrose Agar (SDA), and Potato Dextrose Agar (PDA) plates. Wells were created in all plates, including those designated for controls. Antibiotics (Amikacin) at the same concentration were used as control. Bacterial plates (*E.coli*, and *Staphylococcus aureus*) were incubated at 37°C for 24 hours, while fungal plates, Nystatin used as control (*Aspergillus niger* and *Candida albicans*) were incubated at 35°C for 48 hours. The diameter of the inhibition zone was measured in millimeters.

3. RESULTS AND DISCUSSION

Synthesis and Characterization of Nanoparticles: The leaves of *Barleria cuspidata* when exposed to Silver Nitrate in aqueous solutions, exhibited distinct color changes, signifying the formation of three distinct types of nanoparticles. These nanoparticles were subsequently confirmed through spectral studies involving UV-Visible Spectroscopy, FT-IR, X-Ray Diffraction, SEM EDX Analysis, and they were employed in various biological activities. The meticulous control of starting materials is imperative for ensuring the reproducible quality of herbal products. Consequently, recent years have seen a heightened emphasis on the standardization of medicinal plants with therapeutic potential. Despite the availability of modern techniques, the identification and evaluation of plant-based drugs through pharmacognostical studies remain a more reliable, accurate, and cost-effective approach.

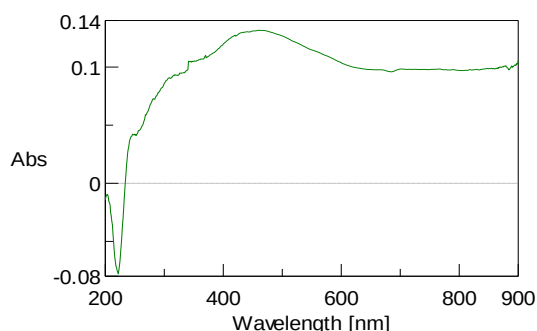


Fig. 2. UV-Visible spectrum of *Barleria cuspidata* extracts and synthesized Ag-NPs

UV-Visible Analysis: The colorless reacting solution of silver nitrate and plant extract turned to light brown in the beginning and completely transformed to dark brown after 75 min, which suggested the synthesis of AgNPs. The solution's colour remained unchanged after 2 hours, showing that the total amount of silver salt in the solution had been reduced. From Fig. 2, the UV-Visible spectrum analysis, it is found that green synthesized AgNPs are monodispersed in nature and broad surface plasmon resonance (SPR) peak was also observed at 470 nm with high intensity for the increasing time, which indicates the formation of AgNPs and their stability. SPR peak is sensitive to the size and shape of the nanoparticles, amount of extract, silver nitrate concentration, and the type of biomolecules present in the leaf extract [14,15]. Additionally, SPR peaks of the same wavelength,

obtained using UV-Vis spectroscopy indicate that the stability of green synthesized AgNPs can be maintained for several months [16].

FT-IR Analysis: Fig. 3 showed that the FTIR spectrum of Ag-NPs. The peaks positioned at wave numbers 3136, 1703, 1629, 1400, 1274, 1192, 1078, 1021, 865, 813, 768, 668, 534 and 465 cm^{-1} are attributed to $-\text{OH}$ (alcohol), $>\text{C}=\text{C}$ (alkenes), $=\text{NH}$ (amines) of flavonoids and amines groups, respectively. The peaks between 3136 cm^{-1} correspond to the phenolic hydroxyl groups and secondary amines. The peaks from 1703 to 1400 cm^{-1} are due to $\text{C}=\text{O}$ stretching vibrations of the carbonyl groups, while the peaks at 1274 - 1192 cm^{-1} were amide peaks. Aromatic ring or $\text{C}=\text{C}$ existence was confirmed by 1400 cm^{-1} band. Stretching mode $\text{C}-\text{O}-\text{C}$ is observed from 465 to 1078 cm^{-1} by an aromatic ether linkage. A comparison between the FTIR spectrum of a medicinal plant extract and that of the biosynthesized AgNPs can reveal the functional groups that are involved in the surface coating and effective stabilization of the produced nanoparticles [17].

XRD analysis: The size and structure of synthesized silver nanoparticles was studied using XRD pattern. Fig. 6 showed six different diffraction peaks of the 2θ values of 9.837, 10.910, 13.690, 19.372, 21.157 and 22.889 was assigned to 29.12, 46.17, 26.76, 168.99, 429.46 and 148.04 planes respectively. The corresponding "d" spacing value of silver nanoparticles were measured by 8.99Å, 8.10Å, 6.46Å, 4.58Å, 4.19Å and 3.88Å (Table.1). The working principle of XRD is Bragg's law, which helps determine the Bragg reflection of AgNPs. XRD patterns reveal remarkable peaks such as the (111), (200), (220), (311), (331), and (222) crystallographic planes that are specific for AgNPs [18].

SEM-EDX Analysis of Silver Nanoparticles: The surface morphology and particle size of the green synthesized AgNPs were determined using a scanning electron microscope (SEM). A typical scanning electron micrograph recognizes that AgNPs are oval shape. Fig. 5(a) shows that the average particles size was found to be 10 μm . In connection the purity and composition of the AgNPs, as analysed by EDX, showed high characteristic signals of elemental Ag in AgNPs at approximately 0.10, 3, and 3.5keV (Fig. 5b). The EDX spectrum confirms the presence of Ag elements, which was identical with an earlier report [19].

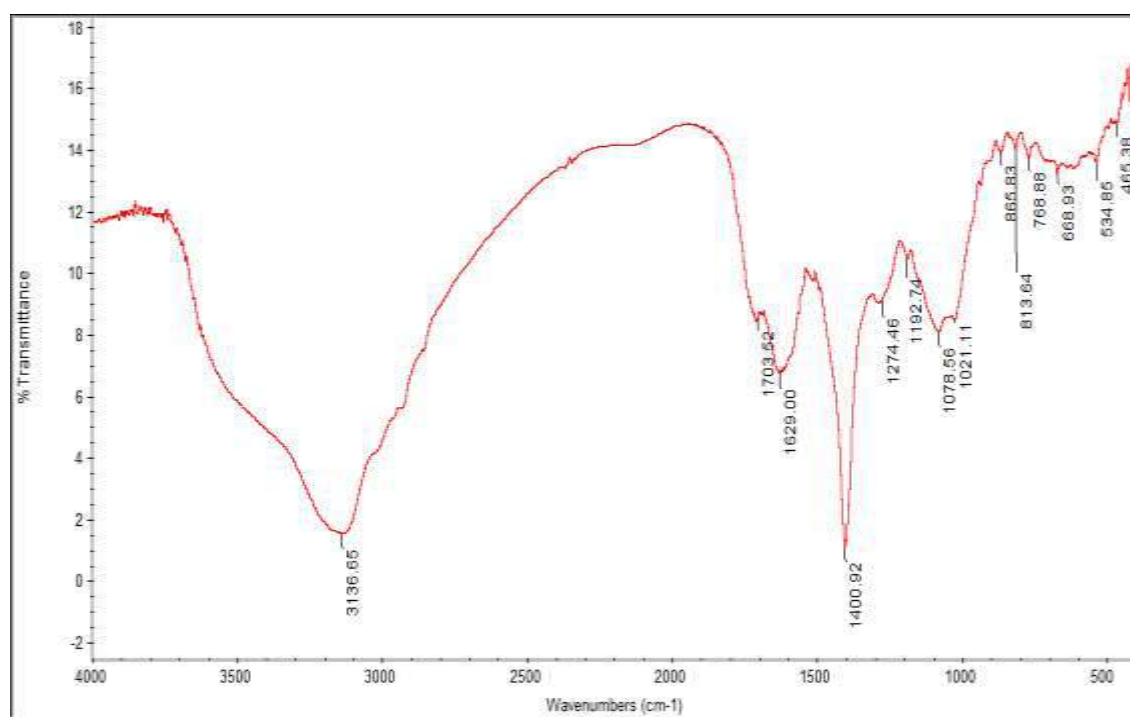


Fig. 3. FTIR spectrum of silver nanoparticles synthesized by using the leaf extract of *Barleria cuspidate*

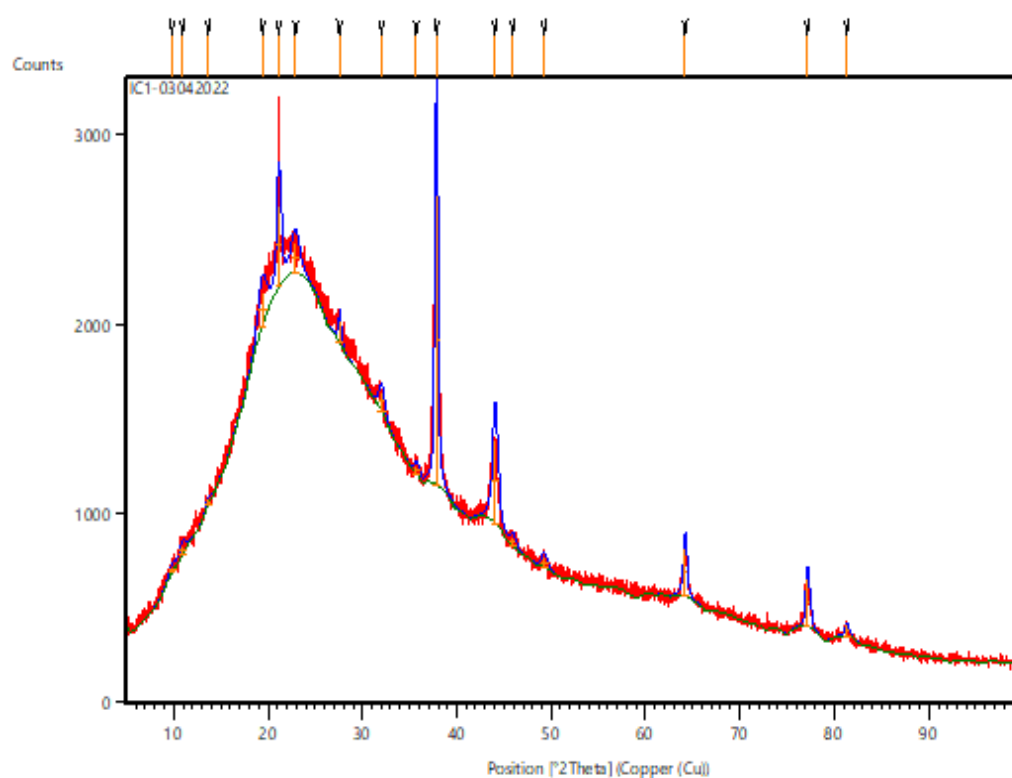


Fig. 4. XRD pattern of silver nanoparticles synthesized using *Barleria cuspidate* leaf extract.

Table 1. XRD pattern of silver nanoparticles synthesized using leaf extract of *Barleria cuspidata*

Pos.[°2Th.]	Height [cts]	FWHM Left [°2Th.]	d-spacing [Å]	Rel. Int. [%]
9.837	29.12	0.8659	8.9908	1.90
10.910	46.17	0.6927	8.1092	3.01
13.690	26.76	0.5196	6.4683	1.75
19.372	168.99	1.0391	4.5819	11.02
21.157	429.46	0.5196	4.1994	28.01
22.889	148.04	1.0391	3.8854	9.66

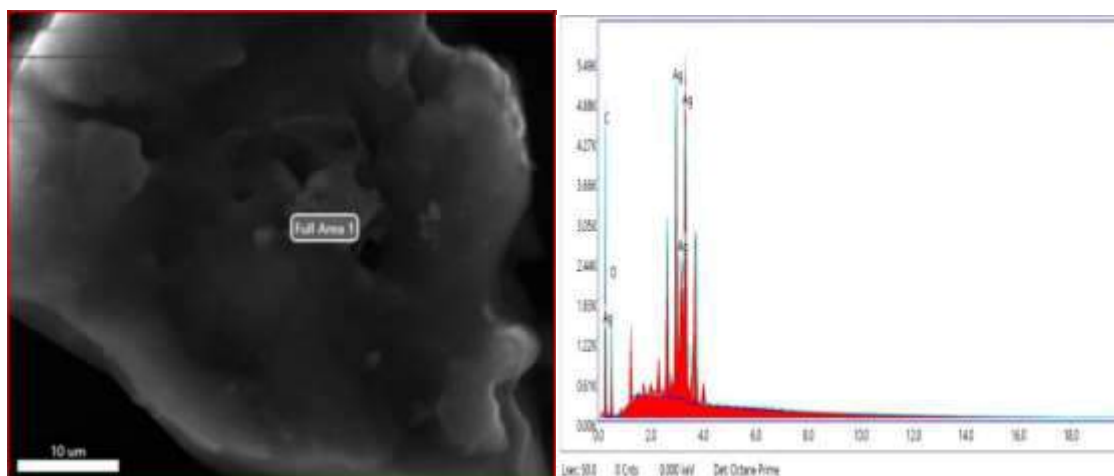


Fig. 5. SEM-EDX of silver nanoparticles synthesized by using the leaf extract of *Barleria cuspidata*

Antimicrobial Activity: The antimicrobial property of green synthesized AgNPs, leaf extract, amikacin and Nystatin were tested against human pathogens such as *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus niger* and *Candida albicans*. This was quantified by the minimum inhibitory concentration (MIC) assay, wherein the zone of inhibition was acquired by plating the organisms on a Muller-Hinton agar plate and performing the disc diffusion method. The AgNP of *Barleria cuspidata* extract, amikacin and Nystatin are exhibited significant antimicrobial activity against tested pathogens in

a dose dependent manner and the results were summarized in Table 2. The present investigation we observed the highest zone of inhibition present at a maximum inhibitory concentration of AgNPs on *E.coli* (19.2 ± 0.3) followed by *Staphylococcus aureus* (16.4 ± 0.2). In addition the fungus maximum inhibitory concentration of AgNPs on *Candida albicans* (17.2 ± 0.2) and *Aspergillus niger* (16.4 ± 0.3). As well as some studies information, that green synthesized AgNPs initiate continuous oxidative stress on the bacterial cell wall, it may lead to bacterial cell death [20].



Fig. 6. Antimicrobial activity of Ag-NPs against selected human pathogens
(a) *E.coli* (b) *Staphylococcus aureus* (c) *Aspergillus niger* (d) *Candida albicans*

Table 2. Antimicrobial activity of synthesized silver nanoparticles from *Barleria cuspidata*

S. No	Pathogens	Antimicrobial activity - Zone of Inhibition (mm)	
		Silver Nanoparticles (AgNO ₃)	Control (Amikacin)
1.	<i>Escherichia coli</i>	19.2 ± 0.3	22 ± 0.2
2.	<i>Staphylococcus aureus</i>	16.4 ± 0.2	18 ± 0.3
		Silver Nanoparticles (AgNO ₃)	Control (Nystatin)
3.	<i>Candida albicans</i>	17.2 ± 0.2	15 ± 0.3
4.	<i>Aspergillus niger</i>	16.4 ± 0.3	15 ± 0.2

± Standard Error, + Present, - Absent

4. CONCLUSION

In the present investigation plant-based synthesis of metal nanoparticles is a talented loom in nanoparticle synthesis because this technique is easier and more competent than the other methods. The synthesized silver nanoparticles showed competent antimicrobial activities against both *E. coli* and *C. albicans*. Benefits of using plant extract for synthesis is that it is energy efficient, cost effective, protecting human health and environment leading to lesser waste and safer products. This eco-friendly method could be a competitive alternative to the conventional physical/chemical methods used for synthesis of silver nanoparticle and thus has a potential to use in biomedical applications and will play an important role in optoelectronics and medical devices in near future.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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A COMPARATIVE STUDY OF VARIOUS DTH SERVICE PROVIDERS

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ABSTRACT

Direct-to-Home (DTH) defines as Transmission of digital video channel to the subscribers at their Home directly through dish. It was created a revolution in the Television Industry through Digitalisation. DTH directly compete to the cable operators and keep away them by providing the best picture quality by facilitating direct broadcast to consumer. Direct-to-Home (DTH) is one of the recent addition and has become an effective medium of an entertainment through attracting everyone.. DTH players concentrate more on value added services to get market advantage.

The Indian Media and Entertainment (M&E) industry is a sunrise sector for the economy and is making high growth strides. By proving its resilience to the world, the Indian M&E industry is on the cusp of an intense phase of growth, backed by rising consumer demand and improving advertising revenues. The industry is primarily driven by increasing digitization. The mass media in the present era have assumed vital importance in daily life. Television is one of the major mass media of India and is a huge industry and has thousands of programs in all the [states of India](#)

Keywords: Consumer demand, Digitization, subscription, Mass Media

INTRODUCTION

The Government of India has supported M&E industry's growth by taking several initiatives such as digitising the cable distribution sector to attract more significant institutional funding, increasing FDI limit from 74 per cent to 100 per cent in cable and DTH satellite platforms. Also, granting industry status to the film industry for easy access to institutional finance (www.ibef.org). So this study made an attempt to know the Comparative study of various DTH services in Coimbatore District.

REVIEW OF LITERATURE

Irinsudha and Jayanthi (2013) carried out a study on 'Comparative Study on the Various Direct-To-Homes Service Providers in Chennai'. The study attempted to compare the services offered by several DTH service providers. Hence, the data consisted of a sample of 300 respondents. Several statistical tools, such as Chi-square, ANOVA, were applied to the collected data. In summary, the study concluded that there is an association among the reasons for going for DTH and the factor that more channels, transparent payment, interactive service, and superior video quality add value to the service.

Tiwari (2014) in the study entitled "A Comparative Study of Sales Promotion Strategies of DTH Service Providers". The study aimed at identifying the sales promotion strategy, which was the critical factor in a customer choosing the service provider. The extent of spread and popularity of DTH was limited to several groups. Also, the impact of DTH services and adds on among several groups of subscribers and the role of technology in the selection of service provider was highly appreciable. The total numbers of questionnaires distributed to the respondents were 400. Out of which 230 had been chosen for the study. Furthermore, two-fold questionnaires were designed to collect data from Direct-To-Home service subscribers and potential subscribers. The satisfaction level of the users was measured on three and five-point Likert Scale. From the study, it was found that the interactive services, number of channels, and price of the DTH services were the factors considered by subscribers for the selection of the DTH service provider. Dish TV and Tata Sky were the top two DTH service providers which were preferred by the respondents. Overall, the

monthly tariff plan was the most preferred tariff plan amongst the respondents covered under the study.

Raj (2019) conducted a study on ‘A Comparative analysis between Airtel Digital TV & Tata Sky DTH Services in Nagpur, Maharashtra’. The study attempts to compare the customer’s perceptions, quality and number of channels offered by Airtel Digital TV and Tata Sky in the study area. Also, the study also compared market range, viewership and sales growth of Airtel Digital TV and Tata Sky. A simple random sampling technique was used. A Sample of 120 users of Airtel Digital TV and Tata Sky were equally collected. The collected data were analyzed to use chi-Square test, a comparative table of the market range, viewership and sales growth and customer’s perceptions, quality content and number of channels for Airtel Digital TV and Tata Sky. Furthermore, the study found that gender, marital status, monthly income and place of residence had not influenced the level of satisfaction of the respondents towards product features of Airtel Digital TV and Tata Sky services. Moreover, the study revealed that Airtel Digital TV was better than Tata Sky in almost every area. Also, hardware and software are the same in both DTH services. Overall, the user interface is also the same, but Airtel Digital TV has some plus points such as universal remote and more TV channels which make Airtel DTH better than Tata Sky.

STATEMENT OF THE PROBLEM

The biggest changes have occurred in consumer a product by new & innovative technology has used to satisfy the consumers. More models have been introduced by various manufactures in this content. This study is taken up in the various DTH which have considerable share in the market. This study will help to find out about the Comparative analysis of various DTH services, its advantages, features etc. and also suggestions to improve the product.

OBJECTIVES

1. To Show the growing preference of various DTH service providers.
2. To compare the various DTH service providers.

Hypothesis

1. All the respondents, irrespective of their personal profile give positive opinion on the satisfaction construct
2. Constructs are positively correlated.

SAMPLE SIZE

The study was carried out in the Coimbatore city. The respondents were the customers of DTH users. Total 342 customers were interviewed.

DATA COLLECTION

A well structured questionnaire was developed under able guidance of research supervisor and experts to collect relevant data.

TOOLS USED

The following tool is used to analyses the data

- i. Cross tabulation

ANALYSIS AND INTREPRETATION

Cross Tabulation

Cross Tabulation finds the relationship between service facilities offered by DTH provider and DTH subscriber’s opinion towards the service providers. In this technique, the DTH subscribers were asked to give an opinion about the given attributes.

Table 1

Friendly Customer Service Offered by DTH Service Provider and DTH Subscribers Opinion (Cross Tabulation)

DTH Service Providers		Friendly Customer Service					
		HDS	DS	N	S	HS	Total
Dish TV	Count	0	0	26	58	0	84

	% of Total	0.0%	0.0%	7.6%	17.0%	0.0%	24.6%
Sun Direct	Count	0	0	0	63	16	79
	% of Total	0.0%	0.0%	0.0%	18.4%	4.7%	23.1%
Big TV	Count	0	0	0	10	9	19
	% of Total	0.0%	0.0%	0.0%	2.9%	2.6%	5.6%
Airtel	Count	4	0	0	31	0	35
	% of Total	1.2%	0.0%	0.0%	9.1%	0.0%	10.2%
Videocon	Count	0	4	0	29	0	33
	% of Total	0.0%	1.2%	0.0%	8.5%	0.0%	9.6%
Tata Sky	Count	0	0	0	29	63	92
	% of Total	0.0%	0.0%	0.0%	8.5%	18.4%	26.9%
Total	Count	4	4	26	220	88	342
	Percentage of Total	1.2%	1.2%	7.6%	64.3%	25.7%	100.0%

Source: Computed Data *multiple responses

HDS-Highly Dissatisfied DS-Dissatisfied N-Neutral S-Satisfied HS-Highly satisfied

Table 1 shows the Cross-tabulation of the Service provider of DTH and Opinion on service facility offered by DTH provider. It reveals that friendly customer service offered by the ‘Dish TV’ DTH service providers 58 (17%) are satisfied. DTH Subscribers, who are using ‘Sun Direct’ 63 (18.4%), have given a satisfying opinion. Big TV 10 (2.9%), DTH subscribers are also satisfied. Airtel 31 (9.1%) and Videocon 29 (8.5%), DTH subscribers are satisfied and Tata Sky 63 (18.4%), DTH subscribers are highly satisfied with friendly customer service. Tata Sky 63 (18.4%), DTH subscribers are highly satisfied with friendly customer service.

Table 2
Response to Complaints by DTH Service Provider and DTH Subscribers Opinion (Cross-Tabulation)

DTH Service Providers		Response to Problem				
		DS	N	S	HS	Total
Dish TV	Count	0	80	4	0	84
	% of Total	0.0%	23.4%	1.2%	0.0%	24.6%
Sun Direct	Count	0	32	43	4	79
	% of Total	0.0%	9.4%	12.6%	1.2%	23.1%
Big TV	Count	5	0	10	4	19
	% of Total	1.5%	0.0%	2.9%	1.2%	5.6%
Airtel	Count	0	35	0	0	35
	% of Total	0.0%	10.2%	0.0%	0.0%	10.2%
Videocon	Count	0	29	4	0	33
	% of Total	0.0%	8.5%	1.2%	0.0%	9.6%
Tata Sky	Count	4	26	58	4	92
	% of Total	1.2%	7.6%	17.0%	1.2%	26.9%
Total	Count	9	202	119	12	342
	Percentage of Total	2.6%	59.1%	34.8%	3.5%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of the Service provider of DTH and opinion on service facility offered by DTH providers' response to complaints reveal that the DTH subscribers who are using 'Dish TV' 80 (23.4%), Airtel 35 (10.2%) and Videocon 29 (8.5%), opinion is Neutral in service facility offered by DTH provider for a response to the complaint. Customers who are using 'Sun Direct' 43 (12.6%), 'Tata Sky' 58 (17.0%), have a satisfied opinion. Big TV-10 (2.9%), DTH subscribers are also satisfied. DTH Subscribers are highly satisfied with the response to complaints. 'Tata Sky' 58 (17.0%), customers are satisfied with the response to complaints.

Table 3

**Quality of Audio and Video Offered by DTH Service Provider and DTH Subscribers Opinion
(Cross Tabulation)**

DTH Service Providers		Quality of Audio and Video					
		HDS	DS	N	S	HS	Total
Dish TV	Count	0	0	4	80	0	84
	% of Total	0.0%	0.0%	1.2%	23.4%	0.0%	24.6%
Sun Direct	Count	4	32	4	4	35	79
	% of Total	1.2%	9.4%	1.2%	1.2%	10.2%	23.1%
Big TV	Count	0	0	0	10	9	19
	% of Total	0.0%	0.0%	0.0%	2.9%	2.6%	5.6%
Airtel	Count	0	0	0	31	4	35
	% of Total	0.0%	0.0%	0.0%	9.1%	1.2%	10.2%
Videocon	Count	0	0	4	29	0	33
	% of Total	0.0%	0.0%	1.2%	8.5%	0.0%	9.6%
Tata Sky	Count	0	0	0	59	33	92
	% of Total	0.0%	0.0%	0.0%	17.3%	9.6%	26.9%
Total	Count	4	32	12	213	81	342
	Percentage of Total	1.2%	9.4%	3.5%	62.3%	23.7%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of Quality of audio and video of the service facility offered by DTH provider and DTH Subscribers Opinion towards the service providers reveals that 'Dish TV' 80 (23.4%), 'Big TV' 10 (2.9%), 'Airtel' 31 (9.1%) and 'Tata Sky' 59 (17.3), 'Videocon' 29 (8.5%) satisfied, 'Sun Direct' 35 (10.2%) dissatisfied the quality of audio and video.

Tata Sky 59 (17.3) and Dish TV 80 (23.4%) DTH subscribers are satisfied with the quality of audio and video.

Table 4

Channel Availability Offered by DTH Service Provider and DTH Subscribers Opinion (Cross Tabulation)

DTH Service Providers		Channel Availability				
		DS	N	S	HS	Total
Dish TV	Count	26	0	54	4	84
	% of Total	7.6%	0.0%	15.8%	1.2%	24.6%
Sun Direct	Count	0	4	59	16	79
	% of Total	0.0%	1.2%	17.3%	4.7%	23.1%
Big TV	Count	5	5	5	4	19
	% of Total	1.5%	1.5%	1.5%	1.2%	5.6%

Airtel	Count	0	4	31	0	35
	% of Total	0.0%	1.2%	9.1%	0.0%	10.2%
Videocon	Count	4	0	29	0	33
	% of Total	1.2%	0.0%	8.5%	0.0%	9.6%
Tata Sky	Count	0	4	59	29	92
	% of Total	0.0%	1.2%	17.3%	8.5%	26.9%
Total	Count	35	17	237	53	342
	Percentage of Total	10.2%	5.0%	69.3%	15.5%	100.0%

Cross-tabulation of channel availability of the service facility offered by DTH provider and customers' opinion towards the service providers reveal that 'Dish TV' 54 (15.8%), Airtel 31 (9.1%) and Tata Sky 59 (17.3), Videocon 29 (8.5), 'Sun Direct' 59 (17.3%) satisfied the quality of audio and video. 'Dish TV' 54 (15.8%), 'Tata Sky 59' (17.3%) and 'Sun Direct' 59 (17.3%) DTH subscribers are satisfied on the 'channel availability'.

Table 5
Educational Interactive Channel Offered by DTH Service Provider and DTH Subscribers
Opinion (Cross Tabulation)

DTH Service Providers		Educational Interactive Channel					
		HDS	DS	N	S	HS	Total
Dish TV	Count	26	0	28	30	0	84
	% of Total	7.6%	0.0%	8.2%	8.8%	0.0%	24.6%
Sun Direct	Count	0	0	36	31	12	79
	% of Total	0.0%	0.0%	10.5%	9.1%	3.5%	23.1%
Big TV	Count	5	5	0	0	9	19
	% of Total	1.5%	1.5%	0.0%	0.0%	2.6%	5.6%
Airtel	Count	0	0	35	0	0	35
	% of Total	0.0%	0.0%	10.2%	0.0%	0.0%	10.2%
Videocon	Count	0	0	0	29	4	33
	% of Total	0.0%	0.0%	0.0%	8.5%	1.2%	9.6%
Tata Sky	Count	0	0	26	4	62	92
	% of Total	0.0%	0.0%	7.6%	1.2%	18.1%	26.9%
Total	Count	31	5	125	94	87	342
	Percentage of Total	9.1%	1.5%	36.5%	27.5%	25.4%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of the interactive educational channel and video of the service facility offered by DTH provider and DTH Subscribers opinion towards the service providers reveals that 'Tata Sky 62' (18.1) 'Big TV 9' (2.6%) Highly satisfied, 'Airtel 35' (10.2%) 'Sun Direct' 36 (10.5%) Neutral, 'Dish TV' 30 (8.8%), 'Videocon 29' (8.5%) satisfied, with the Educational interactive channel. 'Tata Sky 62' (18.1), 'Big TV 9' (2.6%) DTH subscribers are highly satisfied with an interactive educational channel.

Table 6
Matrimonial Services Offered by DTH Service Provider and DTH Subscribers Opinion (Cross Tabulation)

DTH Service Providers		Matrimonial Services					
		HDS	DS	N	S	HS	Total
Dish TV	Count	26	0	32	26	0	84
	% of Total	7.6%	0.0%	9.4%	7.6%	0.0%	24.6%
Sun Direct	Count	0	4	27	36	12	79
	% of Total	0.0%	1.2%	7.9%	10.5%	3.5%	23.1%
Big TV	Count	5	0	0	5	9	19
	% of Total	1.5%	0.0%	0.0%	1.5%	2.6%	5.6%
Airtel	Count	0	4	31	0	0	35
	% of Total	0.0%	1.2%	9.1%	0.0%	0.0%	10.2%
Videocon	Count	0	0	0	33	0	33
	% of Total	0.0%	0.0%	0.0%	9.6%	0.0%	9.6%
Tata Sky	Count	0	0	0	56	36	92
	% of Total	0.0%	0.0%	0.0%	16.4%	10.5%	26.9%
Total	Count	31	8	90	156	57	342
	Percentage of Total	9.1%	2.3%	26.3%	45.6%	16.7%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of matrimonial services offered by DTH provider and DTH Subscribers opinion towards the service providers reveal that ‘Big TV 9’ (2.6%) Highly satisfied, ‘Videocon 33’ (9.6%) ‘Sun Direct’ 36 (10.5%) ‘Tata Sky 56’ (16.7%) satisfied, ‘Airtel 31’ (9.1%) ‘Dish TV 32’ (9.4%) feel Neutral about the matrimonial services.

‘Big TV’ 9 (2.6%) highly satisfied, and ‘Videocon’ 33 (9.6%) ‘Sun Direct’ 36 (10.5%) ‘Tata Sky’ 56 (16.7%) satisfied, DTH subscribers are highly satisfied with the matrimonial services.

Table 7
Special Channel for Children Offered by DTH Service Provider and DTH Subscribers Opinion (Cross Tabulation)

DTH Service Providers		Special Channel for Children				
		HDS	N	S	HS	Total
Dish TV	Count	0	26	28	30	84
	% of Total	0.0%	7.6%	8.2%	8.8%	24.6%
Sun Direct	Count	0	63	8	8	79
	% of Total	0.0%	18.4%	2.3%	2.3%	23.1%
Big TV	Count	10	0	4	5	19
	% of Total	2.9%	0.0%	1.2%	1.5%	5.6%
Airtel	Count	0	4	31	0	35
	% of Total	0.0%	1.2%	9.1%	0.0%	10.2%
Videocon	Count	0	0	29	4	33
	% of Total	0.0%	0.0%	8.5%	1.2%	9.6%
Tata Sky	Count	0	29	4	59	92
	% of Total	0.0%	8.5%	1.2%	17.3%	26.9%

Total	Count	10	122	104	106	342
	Percentage of Total	2.9%	35.7%	30.4%	31.0%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of Special channel for children and video of the service facility offered by DTH provider and DTH Subscribers opinion towards the service providers reveal that ‘Dish TV’ 30 (8.8%) ‘Tata Sky’ 59 (17.3%) highly satisfied, ‘Airtel’ 31 (9.1%), ‘Videocon’ 29 (8.5%) Satisfied, ‘Sun Direct’ 63 (18.4%) neutral and ‘Big TV’ 10 (2.9%) are highly dissatisfied in special channel for children.

‘Dish TV’ 30 (8.8%) ‘Tata Sky 59’ (17.3%) DTH subscribers are highly satisfied with a special channel for children.

Table 8
Special Channel Service for Elders Offered by DTH Service Provider and DTH Subscribers Opinion (Cross Tabulation)

DTH Service Providers		Special Channel for Elders					
		HDS	DS	N	S	HS	Total
Dish TV	Count	26	0	26	32	0	84
	% of Total	7.6%	0.0%	7.6%	9.4%	0.0%	24.6%
Sun Direct	Count	0	32	31	4	12	79
	% of Total	0.0%	9.4%	9.1%	1.2%	3.5%	23.1%
Big TV	Count	0	0	0	9	10	19
	% of Total	0.0%	0.0%	0.0%	2.6%	2.9%	5.6%
Airtel	Count	0	0	4	31	0	35
	% of Total	0.0%	0.0%	1.2%	9.1%	0.0%	10.2%
Videocon	Count	0	0	0	29	4	33
	% of Total	0.0%	0.0%	0.0%	8.5%	1.2%	9.6%
Tata Sky	Count	4	0	0	84	4	92
	% of Total	1.2%	0.0%	0.0%	24.6%	1.2%	26.9%
Total	Count	30	32	61	189	30	342
	Percentage of Total	8.8%	9.4%	17.8%	55.3%	8.8%	100.0%

Source: Computed Data *multiple responses

Cross-tabulation of the special channel for elders and video of the service facility offered by DTH provider and Customers’ opinion towards the service providers reveal that ‘Big TV 10’ (2.9%) Highly satisfied,’ Videocon 29’ (8.5%), ‘Airtel 31’ (9.1%), ‘Dish TV’ 32 (9.4%), ‘Tata Sky 84’ (24.6%) satisfied, and ‘Sun Direct’ 32 (9.4%)- dissatisfied with the Special channel for elders.

Big TV 10 (2.9%) highly satisfied, Videocon 29 (8.5%), Airtel 31 (9.1%), Dish TV 32 (9.4%) Tata Sky 84 (24.6%) DTH subscribers are highly satisfied on a special channel for elders.

FINDINGS

Friendly Customer Service Offered by DTH Provider and DTH Subscribers’ Opinion towards the Service Providers

Friendly customer service offered by the DTH service providers who are using ‘Dish TV’ 58 (17%) satisfied in opinion about the service facility offered by DTH provider for friendly customer service. DTH subscribers who are using ‘Sun Direct.’ 63 (18.4%), have given a satisfying opinion. BigTV 10 (2.9%), DTH subscribers are also satisfied. Airtel 31 (9.1%) and Videocon 29 (8.5%), DTH subscribers are satisfied and Tata Sky 63 (18.4%), DTH subscribers are highly satisfied with

Response to Complaints by DTH Provider and DTH Subscribers' Opinion

DTH subscribers who are using 'Dish TV' 80 (23.4%), Airtel35 (10.2%) and Videocon 29 (8.5%), opinion is neutral in service facility offered by DTH provider for a response to the complaint. DTH subscribers who are using 'Sun Direct' 43 (12.6%), TataSky58 (17.0%), have a satisfied opinion. Big TV10 (2.9%), DTH subscribers are also satisfied. DTH subscribers are highly satisfied with the response to complaints. **'Tata Sky' 63 (18.4%)**, DTH subscribers are highly satisfied with the response to complaints

Quality of Audio and Video Offered by DTH Provider and DTH Subscribers' Opinion

'Dish TV', 80 (23.4%)', Big TV10 (2.9%), Airtel 31 (9.1%) and Tata Sky 59 (17.3%), Videocon29 (8.5%) satisfied, 'Sun Direct'35 (10.2%) dissatisfied with the Quality of audio and video. **Tata Sky59 (17.3%) and Dish TV 80 (23.4%)** DTH subscribers are satisfied with the quality of audio and video.

Channel Availability Offered by DTH Provider and DTH Subscribers' Opinion

'Dish TV'-'54 (15.8%)', Airtel 31 (9.1%) and Tata Sky59 (17.3), Videocon 29 (8.5), 'Sun Direct'59 (17.3%) satisfied the quality of audio and video. 'Dish TV' 54 (15.8%), 'Tata Sky'59 (17.3%) and 'Sun Direct'59 (17.3%) DTH subscribers are satisfied on the **'channel availability'**.

Educational Interactive Channel Offered by DTH Provider and DTH Subscribers' Opinion

'Tata Sky' 62(18.1%), 'Big TV'9 (2.6%) DTH subscribers are highly satisfied with Educational interactive channel.

Matrimonial services Offered by DTH Provider and DTH Subscribers Opinion

'Big TV 9' (2.6%) highly satisfied, and 'Videocon 33' (9.6%) 'Sun Direct.' 36(10.5%) 'Tata Sky 56' (16.7%) satisfied; DTH subscribers are highly satisfied with the **matrimonial services**.

Special Channel for Children Offered by DTH Provider and DTH Subscribers' Opinion

'Dish TV' 30(8.8%) 'Tata Sky' 59 (17.3%) DTH subscribers are **highly satisfied** with **creating** a unique channel for children.

Special Channel service for Elders Offered by DTH Provider and DTH subscribers' opinion

Big TV10 (2.9%) Highly satisfied, Videocon29 (8.5%) Airtel 31 (9.1%), Dish TV32 (9.4%) **TataSky84 (24.6%)** DTH subscribers are highly satisfied with creating a Special channel for elders.

SUGGESTIONS

After conducting this research in Comparative study of various DTH Service providers, the following are some vital suggestions offered to the DTH industry for maintaining and improving their customer satisfaction and for capturing more market share. The DTH industry is gaining popularity very fast, and the DTH subscribers are also ready to adopt this technology which is helping the companies to gain market share. However, this thing is to be equally kept in mind that the DTH subscribers are easily swayed away by the costs. The focus should be on providing value for money to the consumer with more brands in the economy segment. DTH Subscribers are expecting more special channel for children and elders. Therefore, the DTH service providers may concentrate on increasing the number of channels according to the age group of the family members.

CONCLUSION

This paper has made an attempt Comparative study of various DTH services. Customer behaviour was changing from time to time and influenced in different angles of bifurcating from purchasing decision of DTH product. Demand continued development of DTH, and it provides the wide thinking of rural people which helps to develop the culture of society DTH connects to every part of the country and provides desire information communication, education and entertainment to next level with just a click of a button. Technology is the most critical determinant of the structure of the organisation. Technology has acted as the prime factor to determine the structure of the broadcasting industry. Through DTH services, the service sector has facilitated enormous benefits in terms of quality service and stress less life. The reason for this high growth in DTH subscriber base can be attributed to the fact that the quality of service delivered by DTH is superior compared to cable or any other medium.

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EVALUATING CUSTOMER SATISFACTION WITH DIGITAL BANKING SERVICES IN INDIA

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ABSTRACT

This study aims to evaluate the level of usage and awareness of digital banking services and facilities among customers in India and examine the impact of these services on customer satisfaction. This study used a well-structured questionnaire to collect data from Canara Bank, The Federal Bank Ltd., and HDFC Bank customers. The data collected from 200 respondents were analyzed to gain insights into their experiences with digital banking services. This study found that customers of different banks have varying levels of satisfaction with other factors, such as their account type and expertise with digital banking services. Several factors influence customer satisfaction, including prompt handling of calls, courteous and professional manner, and ease of use and navigation. This study provides valuable insights into customer satisfaction with digital banking services in India. It can help banks improve their services to meet their customers' needs and expectations.

Keywords: digital banking, customer satisfaction, facilities offered

1.1 Introduction

After India's independence, one of the government's central tasks was to focus on the country's economic development. In the 1990s, several developments led to significant changes in the structure of banking products. The digital economy is increasing, and all parts of the economy, including commerce, financing, and logistics, require next-generation solutions. The banking industry in India plays a significant role in the country's development. Banks in India are transitioning from conventional banking to digital banking. Digital banking involves high service levels through a digital platform, eliminating paperwork such as cheques, pay-in slips, and demand drafts. This means that all banking activities are available online. The Indian banking sector is moving towards digitalized banking. This research aims to evaluate customers' usage and awareness of digital banking services and facilities and examine the impact of these services on customer satisfaction.

1.2 Review of Literature

Several studies have been conducted on customer satisfaction with digital banking services.

Sathiskumar & Rajaraman (2021) surveyed 300 respondents in Coimbatore city and found that the majority were happy with the performance of ICICI bank's ATMs. Still, many were not satisfied with the bank's grievance settlement system.

Drigă & Isac (2014) surveyed 300 people and found that 65% were aware of e-banking services. The study, titled "E-banking services – features, challenges and Benefits," provides an overview of electronic banking services and highlights aspects of e-banking. The authors note that although e-banking offers many advantages to corporate and individual clients, it is not without certain challenges and issues regarding security and customer interest.

Tandon et al. (2016) studied the responses of 450 consumers in the Delhi/NCR regions using a 5-point Likert Scale. They found that e-banking is the preferred delivery channel for banks and is gaining widespread acceptance among consumers.

Dhanya (2021) conducted a study to identify the factors influencing consumers' adoption of Internet banking services in Chennai. The study also aimed to examine the relationship between the adoption of these services and the demographic characteristics of consumers. This research provides valuable insights into the factors that drive consumer adoption of Internet banking services and can help banks improve their services to meet their customers' needs and expectations. The study found

that customers are ready to adopt Internet banking as it provides value and benefits and saves time and effort.

Rajput (2015) studied customer satisfaction with online banking services and their impact on banks. The study found that customers are adopting e-banking services such as ATMs, home banking, and payment cards, with around 45% of people having a positive perception and being satisfied with e-banking. The most frequently used e-banking services were ATMs, bill payments, and obtaining bank statements.

1.3 Objectives

1. This research aims to evaluate the usage and awareness of digital banking services and facilities among customers.
2. To examine the factors influencing digital banking services and their impact on customer satisfaction.

This involves assessing the digital banking services and facilities offered by banks and their effectiveness in meeting the needs and expectations of customers. By understanding customers' experiences with digital banking, banks can improve their services and enhance customer satisfaction.

1.4 Source and Methodology

This study used both primary and secondary sources to collect data. Primary data were gathered through an online and offline survey using a structured questionnaire. Secondary data were obtained from articles, magazines, journals, the internet, and research websites. This approach allowed for a comprehensive topic analysis by combining firsthand information from survey respondents with existing research and literature on the subject.

1.5 Analysis and Interpretation

This study was conducted using a well-structured questionnaire to collect data from customers of Canara Bank, The Federal Bank Ltd., and HDFC Bank. The questionnaire was distributed online and offline to 100 customers of Canara Bank, 50 of The Federal Bank Ltd., and 50 of HDFC Bank. The data collected from these 200 respondents were then analyzed to gain insights into their experiences with digital banking services.

Table 1 Nature of Account of the Customers (Multiple Accounts)

Bank	Canara Bank	The Federal bank	HDFC bank
Type of Account			
Savings a/c	30	3	14
Savings and Current a/c	14	18	7
Savings and Loan a/c	36	10	11
Savings and Demat a/c	10	5	4
Salary A/c.	10	14	14
Total	100	50	50

According to Table 1, 14% of Canara Bank customers, 36% of The Federal Bank customers, and 14% of HDFC Bank customers have a current account. Additionally, 36% of Canara Bank customers, 20% of The Federal Bank customers, and 22% of HDFC Bank customers have a loan account. Furthermore, 10% of Canara Bank customers, 10% of The Federal Bank customers, and 8% of HDFC Bank customers have a Demat account.

In conclusion, most respondents who have accounts with these banks opened them for savings and loan purposes. This suggests that customers value accessing financial services from their banks, including savings and loan products.

Table 2 Level of Usage or Familiarity with the Internet for Digital Banking Services

Bank	Canara Bank	Federal Bank	HDFC bank	Total
Duration				
Expert User	33 (33%)	11 (22%)	12 (24%)	56 (28%)
Advanced User	12 (12%)	18 (36%)	7 (14%)	37 (18.5%)
Average User	8 (8%)	4 (8%)	4 (8%)	16 (8%)
Beginner	19 (19%)	12 (24%)	15 (30%)	46 (23%)
Basic	28 (28%)	5 (10%)	12 (24%)	45 (22.5%)
Total	100	50	50	200

Source: Computed from primary data

According to Table 2, 33% of Canara Bank customers, 22% of Federal Bank customers, and 24% of HDFC Bank customers are expert users of digital banking services. Additionally, 19% of Canara Bank customers, 24% of Federal Bank customers, and 30% of HDFC Bank customers are beginners in digital banking services. Furthermore, 12% of Canara Bank customers, 36% of Federal Bank customers, and 14% of HDFC Bank customers are advanced users.

In conclusion, most respondents are expert users of digital banking services.

Table 3 Canara Bank: Factors Influencing Tele-Banking / Digital Banking

Factors	Extent of satisfaction					Likert scale	Rank
	SA	A	N	NA	SD		
The call was handled promptly and not kept on hold	52	23	0	-4	-2	69	I
Courteous and professional manner	14	38	0	-8	-2	42	II
Quickly connected to the right person	18	13	0	-10	-10	11	III
Problem handled up to your satisfaction	14	20	0	-25	-6	3	V
Speed of counting operation	16	14	0	-13	-40	-23	VI
Understanding and replying to queries correctly	20	15	4	-12	-22	5	IV
Communication	16	14	0	-15	-24	-9	VIII
The general assessment of the service	26	8	0	-15	-40	-21	VII

Source: Computed from primary data

Table 3 shows the extent of customer satisfaction with factors reported by bank customers. The highest-ranked factor for selecting a bank is “calls being handled promptly and not being kept on hold.” The second most important factor is “courteous and professional manner,” followed by “quickly being connected to the right person” in third place. The fourth-ranked factor is “understanding and replying to queries correctly,” while the fifth is “problems being handled to the customer’s satisfaction.” The sixth-ranked factor is “speed of counting operation,” followed by “general assessment of the service” in seventh place.

Table 4 Canara Bank - Internet Banking Services Level of Satisfaction

Factors	Extent of satisfaction			Likert scale	Rank
	Highly satisfied	Satisfied	Dissatisfied		
Page set-up/ menu flow	44	0	-4	40	I
Ease of use/navigation	21	0	-4	17	III

Speed of page loading	22	0	-26	-4	VI
Variety of transaction	36	0	-11	25	II
Visual design	19	0	-19	0	IV
A general assessment of the service	17	0	-36	-19	V

Source: Computed from primary data

Table 4 shows the extent of customer satisfaction with factors reported by bank customers. The data were analyzed using the Likert attitude scale. The highest-ranked factor for selecting a bank is “the page set up/menu flow.” The second most important factor is “variety of transactions,” followed by “ease of use/navigation” in third place. The fourth-ranked factor is “visual design,” while the fifth and least important factor is “general assessment of the service.”

Table 5The Federal Bank: Factors Influencing Tele-Banking / Digital Banking

Factors	Extent of satisfaction					Likert scale	Rank
	SA	A	N	NA	SD		
The call was handled promptly and not kept on hold	22	7	0	0	-4	25	IV
Courteous and professional manner	12	25	0	-4	-4	29	III
Quickly connected to the right person	44	7	0	-2	-8	41	I
Problem handled up to your satisfaction	10	22	0	-5	-6	21	V
Speed of counting operation	38	7	0	-3	-10	32	II
Understanding and replying to queries correctly	20	17	4	-6	-10	25	IV
Communication	28	12	0	-10	-12	18	VI
The general assessment of the service	4	8	0	-6	-18	-12	VII

Source: Computed from primary data

Table 5 shows the extent of customer satisfaction with various factors reported by bank customers. The highest-ranked factor for selecting a bank is “quickly being connected to the right person.” The second most important factor is “speed of counting operation,” followed by “quickly being connected to the right person” in third place. The fourth-ranked factor is “understanding and replying to queries correctly,” while the fifth is “problems being handled to the customer’s

satisfaction.” The sixth-ranked factor is “speed of counting operation,” followed by “general assessment of the service” in seventh place. The least important factor is “communication.”

Table 6 shows the extent of customer satisfaction with factors reported by bank customers.

Factors	Extent of satisfaction			Likert scale	Rank
	HS	S	DS		
Page set-up/ menu flow	14	0	-2	12	I
Ease of use/navigation	14	0	-14	0	IV
Speed of page loading	13	0	-9	4	II
Variety of transaction	9	0	-5	4	II
Visual design	7	0	-10	-3	V
The general assessment of the service	9	0	-7	2	III

The data were analyzed using the Likert attitude scale. The highest-ranked factor for selecting a bank is “the page set up/menu flow.” The second most important factor is “speed of page loading and variety of transactions,” followed by “general assessment of the service” in third place. The fourth-ranked factor is “ease of use/navigation,” while the fifth and least important factor is “visual design.”

Table 7HDFC: Factors Influencing Tele-Banking / Digital Banking

Factors	Extent of satisfaction					Likert scale	Rank
	SA	A	N	NA	SD		
The call was handled promptly and not kept on hold	30	9	0	-3	-4	32	III
Courteous and professional manner	28	12	0	3	-2	41	I
Quickly connected to the right person	26	16	0	-4	-2	36	II
Problem handled up to your satisfaction	18	15	0	-4	-4	25	IV
Speed of counting operation	12	8	0	-10	-2	8	VI
Understanding and replying to queries correctly	8	8	4	-7	-4	9	V
Communication	6	6	0	-10	-14	-12	VII
The general assessment of the service	12	5	0	-7	-22	-12	VII

Table 7 shows the extent of customer satisfaction with factors reported by bank customers. The data were analyzed using the Likert attitude scale. The highest-ranked factor is “courteous and professional manner.” The second most important factor is “speed of counting operation,” followed by “calls being handled promptly and not being kept on hold” in third place. The fourth-ranked factor is “problems being handled to the customer’s satisfaction,” while the fifth-ranked factor is “understanding and replying to queries correctly.” The sixth-ranked factor is “speed of counting operation,” the seventh and least important factors are “communication and general assessment of the service.”

Table 8HDFC Bank - Internet Banking Services Level of Satisfaction

Factors	Extent of satisfaction			Likert scale	Rank
	HS	S	DS		
Page set-up/ menu flow	9	0	-2	7	II
Ease of use/navigation	15	0	-2	13	I
Speed of page loading	9	0	-2	7	II
Variety of transaction	9	0	-5	4	IV
Visual design	9	0	-4	5	III
The general assessment of the service	5	0	-8	-3	V

Table 8 shows the extent of customer satisfaction with factors reported by bank customers. The highest-ranked factor is “ease of use/navigation.” The second most important factor is “page set up/menu flow,” followed by “visual design” in third place. The fourth-ranked factor is “variety of transactions,” while the fifth and least important factor is “general assessment of the service.”

1.6 Findings

- This study found that 14% of Canara Bank customers, 36% of The Federal Bank customers, and 14% of HDFC Bank customers have a current account.
- Additionally, 36% of Canara Bank customers, 20% of The Federal Bank customers, and 22% of HDFC Bank customers have a loan account. Furthermore, 10% of Canara Bank customers, 10% of The Federal Bank customers, and 8% of HDFC Bank customers have a Demat account.
- Regarding expertise with digital banking services, this study found that 33% of Canara Bank customers, 22% of Federal Bank customers, and 24% of HDFC Bank customers are expert users.
- Additionally, 19% of Canara Bank customers, 24% of The Federal Bank customers, and 30% of HDFC Bank customers are beginners in digital banking services. Furthermore, 12% of Canara Bank customers, 36% of Federal Bank customers, and 14% of HDFC Bank customers are advanced users.
- This study also examined the factors influencing customer satisfaction with digital banking services. The data were analyzed using the Likert attitude scale. The highest-ranked factor for selecting a bank is “calls being handled promptly and not being kept on hold.” The second most important factor is “courteous and professional manner,” followed by “quickly being connected to the right person” in third place. Other important factors include “understanding and replying to queries correctly,” “problems being handled to the customer’s satisfaction,” “speed of counting operation,” and “general assessment of the service.”

1.7 Recommendations

By implementing the following recommendations, banks can enhance customer satisfaction with their e-banking services and provide a better overall customer experience.

- Ensuring that calls are handled promptly and customers are not kept on hold for long periods.
- Training customer service representatives to be courteous and professional in their customer interactions.
- Improving the ease of use and navigation of e-banking platforms to make it easier for customers to access the services they need.
- Ensuring customers are quickly connected to the right person when they need assistance.
- Ensuring that customer queries are understood and replied to correctly.
- Handling customer problems effectively and to their satisfaction.
- Continuously assess and improve the overall quality of e-banking services.

Conclusion

This study found that banks' customers have varying satisfaction levels with other factors, such as their account type and expertise with digital banking services. This study also identified several factors influencing customer satisfaction, including prompt handling of calls, courteous and professional manner, and ease of use and navigation. In conclusion, this study provides valuable insights into customer satisfaction with digital banking services in India. It can help banks improve their services to meet customers' needs and expectations.

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EXPLORING THE RELATIONSHIP BETWEEN DIGITAL BANKING SERVICE QUALITY AND CUSTOMER SATISFACTION

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ABSTRACT

As a result of economic reforms, the banking industry underwent deregulation and increased competition. Indian banks have leveraged technology to introduce a range of digital banking products and services. This study examines consumers' usage of these digital banking products and services and analyses their awareness and satisfaction. Out of a sample of 200 customers, this study found that nearly 41% of bank customers use digital banking services for all their transactions, including funds transfer, paying bills, and checking their balance as needed. Additionally, this study found that overall satisfaction with digital banking services is the same for male and female customers and does not differ significantly. The availability of staff members and computerised counters in the bank was given the least importance by customers, as they primarily use digital banking services on their mobile devices or computers. These findings highlight the growing importance of digital banking in the modern financial landscape and the need for banks to continue investing in technology to meet customer needs.

Keywords: digital banking, customer satisfaction, facilities offered

1.1 Introduction

The banking industry underwent deregulation and increased competition due to economic reforms. In the post-reform period, new products, delivery channels, and processes were introduced, along with increased sophistication due to the more discerning nature of banking service users. To succeed in this sector, players must understand their customers, fulfil their needs, and achieve high customer retention levels by leveraging technology, knowledge, and human resources to provide quality products and services while managing risk and returns. Indian banks have introduced a range of digital banking products and services by leveraging technology. This study examines consumers' usage of these digital banking products and services and analyses their awareness and satisfaction.

1.2 Review of Literature

Ashok and Selvakumar (2006) conducted a study titled "Customer Satisfaction in Banks" to understand the feasibility of physical facilities and elicit customer opinions on their satisfaction with selected branches. The findings showed that service delivery and customer delight are among the most debated issues in the banking industry in India.

Sandip et al. (2010) conducted a study titled "Impact of Service Quality on Customer Satisfaction, Loyalty, and Commitment in the Indian Banking Sector" to examine the association between service quality and customer satisfaction, loyalty, and commitment.

Amer (2010) studied individual consumers' perception of Pakistan's Islamic banking products and services. The study explored the perception of individuals responsible for financial affairs. It examined the usage of Islamic banking facilities and respondents' understanding of the Islamic banking system on various aspects of the selection criteria.

Vidyapriya and Mohanasundari (2012) studied customer responsiveness to banking technology products in rural South India. The study aimed to measure customer knowledge of banks' technology products in rural Tamil Nadu. The research would help bank branches understand the responsiveness level of rural customers towards technology products and take necessary steps to improve.

Elavarasi and Surulivel (2012) studied customer awareness and preference towards e-banking services offered by banks, focusing on SBI. The data analysis showed that age, educational qualification, occupation, and income level are significant factors determining banks' usage of e-banking services in the study area.

1.3 Objectives

1. To determine the socio-economic characteristics of banking customers.
2. To examine the reasons for choosing the banks by the customers.
3. To identify the digital banking services and facilities availed by the customers and their impact on customer satisfaction.

1.4 Source and Methodology

This study was conducted using both primary and secondary sources of data. Primary data were collected through a survey conducted online and offline using a structured questionnaire. The questionnaire was designed to gather information from respondents about their experiences and opinions regarding the banks' digital banking services and facilities. Secondary data were collected from articles, magazines, journals, research websites, and internet searches. These sources provided valuable insights into the current state of digital banking and its impact on customer satisfaction. By combining the primary and secondary data, this study aimed to comprehensively analyse the topic.

1.5 Analysis and Interpretation

This study was conducted using a well-structured questionnaire to collect data from customers of Canara Bank, The Federal Bank Ltd., and HDFC Bank. The questionnaire was distributed online and offline to 100 customers of Canara Bank, 50 of The Federal Bank Ltd., and 50 of HDFC Bank. The data collected from these 200 respondents were scrutinised and analysed to provide insights into the topic.

Table1
Socio-Economic Profile of Bank Customers

Socio Economic Variable	No. of Customers	Percentage(%)
Gender		
Male	127	63.5
Female	73	36.5
Age		
Up to 25 years	63	31.5
26-35	69	34.5
36-45	34	17.0
Over 45	14	17.0
Edu. Qualification		
Upto School level	57	28.5
UG	94	47.0
PG	32	16.0
Professional Course	17	8.5
Marital Status		
Married	114	57.0
Unmarried	86	43.0

Socio Economic Variable	No. of Customers	Percentage(%)
Occupation		
Agriculture	42	21.0
Private Employee	69	34.5
Govt employee	54	27.0
Business	35	17.5
Area		
Rural	79	39.5
Semi-urban	95	47.5
Urban	26	13.0
Monthly Income		
Below ₹7500	35	17.5
₹7501-₹15000	59	29.5
₹15001-₹22500	77	38.5
Above ₹22500	29	14.5

Table 1 presents the socio-economic profile of a sample of 200 banking customers. The data shows that the majority of the customers are male (63.5%), aged between 26-35 years (34.5%), and have an undergraduate degree (47%). Regarding occupation, 34.5% are private employees, and most reside in semi-urban areas (47.5%). The most common monthly income range is ₹15001-22500 (38.5%).

The data also shows a relatively even distribution of customers across age groups, with 31.5% aged up to 25 years, 34.5% aged between 26-35 years, and 17% aged between 36-45 years. Regarding educational qualification, the majority have an undergraduate degree (47%), 28.5% have completed up to school-level education, and 16% have a postgraduate degree.

In terms of marital status, the majority of customers are married (57%). The data also shows a diverse range of occupations among the customers, with 21% working in agriculture, 34.5% being private employees, 27% being government employees, and 17.5% being business owners.

Most customers reside in semi-urban areas (47.5%), while 39.5% live in rural areas and 13% reside in urban areas. In terms of monthly income, the most common range is ₹15001-22500 (38.5%), followed by ₹7501-15000 (29.5%) and below ₹7500 (17.5%).

Table 2

Type of Digital Banking Services Availed

Reason/ Bank	Canara Bank	The Federal Bank	HDFC Bank	Total
Funds Transfer	10 (10%)	18 (36%)	4 (8%)	32 (16%)
Online Purchase	15 (15%)	3 (6%)	5 (10%)	23 (11.5%)
Checking Bank Balance	13 (13%)	9 (18%)	15 (30%)	37 (18.5%)
Paying Bills Online	12 (12%)	5 (10%)	5 (10%)	22 (11%)
Doing all the Transactions	50 (50%)	15 (30%)	21 (42%)	86 (43%)
Total	100	50	50	200

		Canara Bank		The Federal Bank		HDFC Bank	
	Services	Mean rank	Rank	Mean rank	Rank	Mean rank	Rank
a)	Near to my Residence	16.05	I	9.38	I	6.11	V
b)	Recommended by Friends / Employers	14.22	II	7.58	II	7.44	I
c)	Purpose of Getting Loan	13.05	III	7.02	III	2.80	VIII
d)	Better Services	11.94	V	4.72	VII	4.77	VII
e)	Interest Rate (Low-Interest Rate for Loans)	11.38	VII	5.27	V	6.13	IV
f)	Availability of Services of Staff Members	11.55	VI	3.83	VIII	4.97	VI
e)	Availability of services at Computerised Counters	8.22	VIII	5	VI	6.86	III
f)	Digital Banking Service Quality	12.33	IV	6.80	IV	7.38	II

According to Table 2, 50% of Canara Bank customers, 30% of Federal Bank customers, and 42% of HDFC Bank customers use digital banking services for all their transactions, including funds transfer, online purchases, checking bank balances, and paying bills online.

Table 3**Reasons for Choosing The Bank (Friedman's Test)**

Table 3 shows that for Canara Bank and Federal Bank customers, the primary reason for choosing their bank is its proximity to their residence. However, for HDFC Bank customers, the top reason for choosing their bank is that friends or employers recommended it. The quality of

digital banking services is ranked second by HDFC Bank customers, while Canara Bank and Federal Bank customers prefer these banks for obtaining loans. All customers gave the availability of staff members and computerised counters in the bank the least importance, as they primarily use digital banking services on their mobile devices or computers.

Analysis of Variance (ANOVA)

ANOVA finds out if there is any significant difference between gender and overall satisfaction gathered on bank customer satisfaction.

The null hypothesis...

a) The overall satisfaction is the same for all customers, i.e., male and female.

b) Males and females do not differ concerning overall satisfaction.

Table 4**Gender and Overall Satisfaction (Canara Bank)**

Gender	Overall satisfaction					Total
	Highly satisfied	Satisfied	Neutral	Dissatisfied	Highly dissatisfied	
Male	8	11	35	8	4	66
Female	3	7	18	3	3	34

Total	11	18	53	11	7	100
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a) For $V_{4,4}, F_{0.05} = 6.39$

The null hypothesis is accepted since the calculated value (0.106) is less than the table value (6.39). **It is concluded that Gender and Overall satisfaction do not differ significantly.**

Now let us compare the gender variance with the residual variance.

$$F = 18.9/102.4 = 0.184$$

b) For $V_{1,4}, F_{0.05} = 224.6$

The null hypothesis is accepted since the calculated value (0.184) is less than the table value (224.6). **Hence there is no significant difference in the gender as far as overall satisfaction is concerned.**

The overall satisfaction is the same for all customers, i.e., male and female.

Table 5
The Federal Bank

Gender	Overall satisfaction					Total
	Highly satisfied	Satisfied	Neutral	Dissatisfied	Highly dissatisfied	
Male	3	16	8	2	2	31
Female	6	4	5	2	2	19
Total	9	20	13	4	4	50

$$F = 18.9/178 = 0.72$$

a) For $V_{4,4}, F_{0.05} = 6.39$

The null hypothesis is accepted since the calculated value (0.72) is less than the table value (6.39). **It is concluded that Gender and Overall satisfaction do not differ significantly.**

Now let us compare the gender variance with the residual variance.

$$F = 18.9/102.4 = 1.14$$

b) For $V_{1,4}, F_{0.05} = 224.6$

The null hypothesis is accepted since the calculated value (1.14) is less than the table value (224.6). **Hence there is no significant difference in the gender as far as the overall satisfaction is concerned.**

The overall satisfaction is the same for all customers, i.e., male and female.

Table 6
HDFC Bank

Gender	Overall satisfaction					Total
	Highly satisfied	Satisfied	Neutral	Dissatisfied	Highly dissatisfied	
Male	5	5	18	1	1	31
Female	4	6	7	2	1	19

Total	9	11	25	3	2	50
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$$F=18.9/178=0.472$$

$$\text{For } V_{4,4}, F_{0.05}=6.39$$

The null hypothesis is accepted since the calculated value (0.472) is less than the table value (6.39). **It is concluded that Gender and Overall satisfaction do not differ significantly.**

Now let us compare the gender variance with the residual variance.

$$F=18.9/102.4=0.32$$

$$\text{For } V_{1,4}, F_{0.05}=224.6$$

The null hypothesis is accepted since the calculated value (0.32) is less than the table value (224.6). **Hence there is no significant difference in the gender as far as the overall satisfaction is concerned.**

The overall satisfaction is the same for all customers, i.e., male and female.

1.6 Findings

- Out of the 200 customers surveyed, the majority were male (63.5%), aged between 26-35 years (34.5%), and held an undergraduate degree (47%). Additionally, 34.5% were private employees residing in semi-urban areas (47.5%), with a monthly income of ₹15001-22500 (38.5%).
- This study found that nearly 86% of customers use digital banking for all their transactions, including funds transfers, checking balances, and paying bills online. It was also found that the bank's availability of staff members and computerised counters was given the least importance by customers, as they primarily use digital banking services on their mobile devices or computers.

1.7 Recommendations

- It is essential for banks to continuously update and improve their software to make it more user-friendly so that all customers can access and use digital banking services. This will enhance the customer experience and increase the adoption of digital banking among customers.
- Additionally, since many customers prefer to open their accounts at banks near their residences, banks should conduct surveys to identify areas with a high demand for banking services and open new branches as part of their financial inclusion strategy. This will help banks reach out to more customers and provide them with convenient access to banking services.

1.8 Conclusion

In conclusion, banks need to remember that the growing population, increasing levels of education, and rising living standards have created a greater demand for banking services. As such, the banking sector's future belongs to the customers, and banks must focus on digitalising their services to attract and retain customers with better and more secure services. To achieve this, banks should provide proper training and awareness programs for their customers through various media channels. This will help customers understand how to use digital banking services effectively and safely while increasing their trust in the bank's ability to protect their financial information. Banks can ensure their continued success in an increasingly competitive market by prioritising customer needs and investing in digitalisation.

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A STUDY ON CUSTOMER ATTITUDE AND PREFERENCE ON DTH SERVICE PROVIDERS

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ABSTRACT

A recent development in marketing theory centers around the effects of technology on marketing products. Social networking is a relatively new form of communication, when people discuss a product via email, Face book pages, Twitter accounts and other electronic means, a product may “go viral,” or start to sell more units with no direct advertising, public relations or promotions on the part of the company. This is why more companies are participating in social networking sites hoping consumers will then take their goods or services viral. And every human being holds thousands of attitudes, including those about family and friends, political figures, abortion rights, terrorism, preferences for music, and much more. Each of our attitudes has its own unique characteristics, and no two attitudes come to us or influence us in quite the same way. Research has found that some of our attitudes are inherited, at least in part, via genetic transmission from our parents (Olson, Vernon, Harris, & Jang, 2001). Hence this study tries to find out the Attitude and preference level of service facility of DTH.

Keywords: Technology, Attitude, Direct advertising, consumer preference.

INTRODUCTION

DTH (Direct- To- Home) service is the decoding of satellite, encoded with a small personal dish at very user's premises. DTH service is basically a satellite service that provides the subscribers to enjoy the infotainment services through satellite transmission anywhere. DTH provides strong signals with lesser service break downs. DTH provides high picture and sound quality. A customer's behavior is affect by the perception and beliefs that he holds of. This study has to understand the opinion and beliefs of the customers about the DTH services

REVIEW OF LITERATURE

Senthil and Nagarajan (2012) conducted a study on ‘Subscriber Attitude towards DTH Service’. The study attempted to examine the subscriber level of satisfaction and the problems faced by the subscribers. In connection with this study, sample data was collected from 150 respondents. Furthermore, percentage, rank correlation, chi-square test were applied to the collected data. The study concluded that the satisfaction level of the subscribers leads to brand loyalty. Overall, most of the respondents were highly satisfied with the number of channels and picture quality. Also, the subscribers were also satisfied with the sound effect and rate.

Kumar (2013) carried out a study entitled ‘Factors Motivating Customers towards DTH Service in Andhra Pradesh’. The study discussed the factors that customers put forward in buying a DTH. The data were obtained from 500 DTH users based on convenient random sampling technique descriptive. Also, the chi-square test was applied in this study. Consequently, it was found that the reason for preferring DTH Service were price, channels, picture clarity, uninterrupted services, and sound effect.

Muthukumar (2008) in his article “Consumer satisfaction towards DTH services in New Delhi”, has revealed that the availability of Direct to Home (DTH) service has brought down cable subscription fees. DTH has made the market more competitive, compelling the Local Cable Operators

(LCO) to charge less from their subscribers, says a survey conducted by the Telecom Regulatory Authority of India (TRAI) on Cable TV.

Myilsamy (2010) in his research study consumer brand preference towards using DTH services has found that majority of the respondents were using DTH services because of more channels. He has found the majority of them were using Big TV because of 900 services. He has suggested that DTH providers have to increase various awareness programmes to create brand image through attractive advertisement.

Joteswari et al. (2014) conducted a study entitled, 'Awareness, Perception about DTH Services in Kanchipuram'. The data consisted of a sample of 240 DTH users. The sample was done by non-probability convenience sampling, and the technique which is used is the descriptive research design tool, used for analysis. In conclusion, the study reveals that the DTH service brand should increase the awareness of DTH services. Moreover, outlets and help the customer believe the DTH services are cost-effective. This perception would change into a belief than to demand and finally to loyalty.

OBJECTIVES

1. To understand the attitude of the customers.
2. To evaluate the performance of the DTH service.
3. To know about the expectations of the customers.

SAMPLE SIZE

The study was carried out in the Coimbatore city. The respondents were the customers of DTH users. Total 342 customers were interviewed.

DATA COLLECTION

A well structured questionnaire was developed under able guidance of research supervisor and experts to collect relevant data.

TOOLS USED

The following tool is used to analyses the data

WEIGHTED AVERAGE and CHI-SQUARE TEST

ANALYSIS AND INTREPRETATION

FACTORS CONSIDERED WHILE CHOOSING DTH SERVICE (WEIGHTED AVERAGE)

The weighted average is a calculation that takes into account the varying degrees of importance of the numbers in a data set. In calculating a weighted average, each number in the data set is multiplied by a predetermined weight before the final calculation is made. A weighted average can be more accurate than a simple average in which all numbers in a data set are assigned an identical weight.

Table 1.1

Factors Considered While Choosing DTH Service

Particulars	ML	L	M	DL	MDS	Total Score	Weighted Average	Rank
Percentage Position	5	4	3	2	1			
Choice of Channel	49	137	96	60	-	1021	2.98	1
	245	548	288	120	-			
Features	31	97	104	47	63	1012	2.95	2

	155	388	312	94	63			
Service Quality	27	102	82	39	92	959	2.80	3
	135	408	246	78	92			
Clarity	64	79	13	63	123	924	2.70	4
	320	316	39	126	123			
Value for Money	27	34	127	117	37	923	2.69	5
	135	136	381	234	37			

Source: Primary Data

ML-Most like L-Like M-Moderate DL-Dislike MDS-Most Dislike

Tables 1.1 reveals the rank assigned to the factors considered while choosing DTH service. Based on a 5 point scale, the weight is assigned, and the weighted average is computed. ‘choice of channel’ with an average score of 2.98, which is the highest factor, is considered while choosing DTH service. It is followed by ‘features’ (2.95), ‘service quality’ (2.80), ‘clarity’ (2.70), and ‘value for money’ (2.69) are the least factor considered while choosing DTH service.

In conclusion, the ‘choice of channel’ (2.98) is the highest factor considered for choosing a DTH service.

Table 1.2
Factors Considered While Purchasing a DTH Service

Particulars	HI	I	N	LI	NI	Total Score	Weighted Average	Rank
Percentage Position	5	4	3	2	1			
Video Quality	188	138	16	-	-	1540	4.50	1
	940	552	48	-	-			
Price	224	39	79	-	-	1513	4.42	2
	1120	156	237	-	-			
Continued Service	170	123	49	-	-	1489	4.35	3
	850	492	147	-	-			
Ease of Purchase	133	189	16	-	4	1473	4.30	4
	665	756	48	-	4			
Ease of Payment	120	210	12	-	-	1476	4.31	5
	600	840	36	-	-			
Number of Channels	136	168	33	-	5	1456	4.25	6
	680	672	99	-	5			
Sound Quality	226	108	4	4	-	1582	4.25	6
	1130	432	12	8	-			
Educational Interactivity Channels	149	151	12	30	-	1445	4.22	7
	745	604	36	60	-			
Helpline	131	145	61	-	5	1423	4.16	8
	655	580	183	-	5			
Quick Response to Complain	136	135	59	12	-	1421	4.15	9
	680	540	177	24	-			
Record Program	183	55	39	61	4	1298	3.79	10
	915	140	117	122	4			
Special Channels for Elderly	87	155	57	12	31	1281	3.74	11

people	435	620	171	24	31			
Special Channels for Children	56	167	63	30	26	1223	3.57	12
	280	668	189	60	26			

Source: Primary Data

HI-Highly Important I- Important N-Neutral LI –Less Important NI-Not at all Important

Table 1.2 reveals the rank assigned to the essential factors considered while choosing DTH service. Based on a 5 point scale, the weight is assigned. The weighted average is computed. 'video quality' with an average score of 4.50 is the highest important factor considered while choosing a DTH service. It is followed by 'price' (4.42), 'continued service' (4.35), 'ease of purchase' (4.30), 'ease of payment' (4.31), 'Number of Channels and 'sound quality' (4.25), 'educational interactivity channels' (4.22), 'helpline' (4.16), 'quick response to complain'(4.15), 'record program' (3.79), 'special channels for elderly people' (3.74), 'special channels for children' (3.57) is a least important factor consider while choosing DTH service.

In conclusion, 'video quality' (4.50) is the highest factor considered for choosing a DTH service.

CHI-SQUARE TEST

Chi-square test is applied to test the significant difference between observed and Expected values. i.e. to find on which item or factor under study, the majority of the Respondents have given their preference or opinion. In this research, data were collected from the DTH users on different aspects, Service provider offer add on services, Promotion scheme attracted by customers and so on. Hence chi-square is applied to find out the opinion of the DTH users on the certain aspects.

SERVICE PROVIDER OFFER ADD ON SERVICES

The value-added or interactive services are multiple entertainment options and expansion of DTH .it compelled to offer services ranging from music, movies, gaming and learning that make them stand out.

Add-on is to engage the customer. At this point, an attempt is made to find out the service provider offer add on services to sustain the customer. By applying Chi-square technique opinion given by the majority of the customers is found.

Null Hypothesis (H0): service provider offer add on services chosen for this study are equally consider by the DTH users.

Alternative Hypothesis (H1): service provider offer add on services chosen for this study are not equally consider by the DTH users.

Table 1.3 - services offered by service provider

Particulars	Observed N	Expected N
Movies on demand	51	57
Live telecast	126	57
Games facility	18	57
Extra news and edutainment channels	117	57
Extra radio channels	16	57
Video games	14	57
Total	342	

Table 1.3(a) Test Statistics - services offered by service provider

Chi-Square	291.757^b
df	5

Sig.	.000
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Table 1.3 and Table 1.3 (a) Reveals the aware of the customers about the services offered by the service providers and the chi-square result for given data respectively. The table significance value is (0.000) which is less than the level of significance (0.05) the null hypothesis is rejected. Which means services offered by add on service are not equally considered by the respondent By comparing observed and expected values it is concluded that the majority of the respondents respond that “**Live telecast**”.

PROMOTION SCHEME ATTRACTED BY CUSTOMER

Promotion is a key element in putting across the benefits of product or service to the customers. Well-designed marketing and promotional strategies ensure long-term success, bring in more customers and ensure profitability for businesses. Promotion is the voice of business which send out brand's message loud and clear to the audience. Various ways can be used to promote brand. At this point, an Endeavour is made to find out the promotion scheme is attracted by customer. By applying Chi-square technique opinion given by the majority of the customers is found.

Null Hypothesis (H0): Promotion scheme attracted by customer chosen for this study are equally consider by the DTH users.

Alternative Hypothesis (H1): Promotion scheme attracted by customer chosen for this study are not equally consider by the DTH users.

Table 1.4 - Promotion Scheme Attracted By Customer

Particulars	Observed N	Expected N
Discount	117	85.5
Motional offers	73	85.5
Service package	73	85.5
Brand image	79	85.5
Total	342	

Table 1.4 (a): Test Statistics - promotion scheme attracted by customer

Chi-Square	15.754^c
df	3
Sig.	.001

Table 1.4 and Table 1.4(a) disclose the promotion scheme attracted by customer and the Chi-square results for given data respectively. Since the table significance (0.001) is less than the level of significance (0.05) the null hypothesis is rejected which means all reasons for promotion scheme attracted by customer are not equally considered. By comparing, the observed and expected values, it is concluded that “**Discount**” is the major promotion scheme is attracted by customer.

FAVOURITE INTERACTIVE SERVICE

It may attract viewers, and it may reason to retain customer. But these value-added services, , can help players increase their ARPU (Average Revenue per User) moderately to significantly. And with it is a good consumer base. At this point, an attempt is made to find out the Favorite interactive

services for customer. By applying Chi-square technique opinion given by the majority of the customers is found.

Null Hypothesis (H0): Favorite interactive services chosen for this study are equally considered by the service providers.

Alternative Hypothesis (H1): Favorite interactive services chosen for this study are not equally considered by the DTH users.

Table 1.5- Favorite interactive services

Particulars	Observed N	Expected N
Movies on demand	110	85.5
Learning lifestyle	172	85.5
Games	43	85.5
Serial storage	17	85.5
Total	342	

Table 1.5(a): Test Statistics - Favorite interactive services

Chi-Square	181.139^e
df	3
Sig.	.000

Table 1.5 and Table 1.6(A) Reveals the Favorite interactive services and the Chi-square results for given data respectively. Since the table significance (0.000) is less than the level of significance (0.05) the null hypothesis is rejected which means all reasons for Favorite interactive services are not equally considered. By comparing, the observed and expected values, it is concluded that “**Learning life style**” is Favorite interactive services for customers.

RECOMMENDATION TO COMPANY

Consumers perceive a product's quality relative to competing products. Understanding customers is the key to giving them good service which in turn results into strong customer relationships and new sales through positive word-of-mouth recommendation. Therefore, an attempt is made to find out the recommendation to company by the customers. By applying Chi-square technique opinion given by the majority of the customers is found.

Null Hypothesis (H0): All the reasons of recommendation to company chosen for this study are equally consider by the DTH users

Alternative Hypothesis (H1): All the reasons of recommendation to company chosen for this study are not equally consider by the DTH users

Table 1.6 - Recommendation to company

Particulars	Observed N	Expected N
Improve their customer care	29	85.5
Intro new scheme	80	85.5
Find new way to advertise	119	85.5

Intro new service like internet	114	85.5
Total	342	

Table 1.6(a): Test Statistics - Recommendation to company

Chi-Square	60.316^c
Df	3
Asymp. Sig.	.000

Table 5.12(a) and Table 5.12(b) States the Recommendation to company and the Chi-square results for given data respectively. since the table significance (0.000) is less than the level of significance (0.05) the null hypothesis is rejected which means all reasons are not equally considered for recommendation to company chosen for this study. By comparing the observed and expected values it is concluded that majority of the customers recommended that **“Find New Way to advertise”**.

FINDINGS

Factors Considered While Choosing DTH Service (Weighted Average)

‘Choice of channel’ with an average score of 2.98, which is the highest factor, is considered while choosing DTH service. It is followed by ‘features’ (2.95), ‘service quality’ (2.80), ‘clarity’ (2.70), and ‘value for money’ (2.69) are the least factor considered while choosing DTH service.

Important Factors While Purchasing a DTH Service

The rank assigned to the essential factors considered while choosing DTH service. Based on a 5 point scale, the weight is assigned. The weighted average is computed. **‘video quality’** with an average score of 4.50 is the highest important factor considered while choosing a DTH service. It is followed by ‘price’ (4.42), ‘continued service’ (4.35), ‘ease of purchase’ (4.30), ‘ease of payment’ (4.31), ‘the number of channels and ‘sound quality’ (4.25), ‘educational interactivity channels’ (4.22), ‘helpline’ (4.16), ‘quick response to complain’ (4.15), ‘record program’ (3.79), ‘special channels for elderly people’ (3.74), ‘special channels for children’ (3.57) is a least important factor consider while choosing DTH service.

CHISQUARE TEST

The aware of the customers about the services offered by the service providers and the chi-square result for given data respectively. The table significance value is (0.000) which is less than the level of significance (0.05) the null hypothesis is rejected. Which means services offered by add on service are not equally considered by the respondent By comparing observed and expected values it is concluded that the majority of the respondents respond that **“Live telecast”**.

Promotion scheme attracted by customer and the Chi-square results for given data respectively. Since the table significance (0.001) is less than the level of significance (0.05) the null hypothesis is rejected which means all reasons for promotion scheme attracted by customer are not equally considered. By comparing, the observed and expected values, it is concluded that **“Discount”** is the major promotion scheme is attracted by customer.

Favorite interactive services and the Chi-square results for given data respectively. Since the table significance (0.000) is less than the level of significance (0.05) the null hypothesis is rejected which means all reasons for Favorite interactive services are not equally considered. By comparing, the observed and expected values, it is concluded that **“Learning life style”** is Favorite interactive services for customers

The Recommendation to company and the Chi-square results for given data respectively. since the table significance (0.000) is less than the level of significance (0.05) the null hypothesis is rejected

which means all reasons are not equally considered for recommendation to company chosen for this study. By comparing the observed and expected values it is concluded that majority of the customers recommended that **“Find New Way to advertise”**.

CONCLUSION

Increasing consumer awareness and expectations make it challenging to satisfy the consumer. The consumer always prefers high quality for a lesser amount of money. Only attractively priced and feature-rich packages will sell. The final winner cannot be a DTH player but a convergent player who offers all in one to the value-conscious, price-sensitive Indian consumer looking at the pace of growth, they will overtake the US within the first three months of next calendar year. There are entertainment taxes that differ from state to state Partnerships with movie distributors, combined retail of LCDs and DTH connection along with technological Though DTH has certain advantages such as better picture sound quality, better customer service. Hence, in today's competitive environment, service providers will have to strive to attract and retain subscribers by introducing products, enhancing the quality of subscriber service and marketing a variety of products through diverse channels targeted at specific subscribers group.

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RURAL ENTREPRENEURSHIP THROUGH MAKING OF PAKKUMATTAI BOX

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Abstract:

Pakkumattai plate making industry provides self-employment opportunities, reduces unemployment problems, generates income, alleviates poverty, improves the standard of living of the people, contributes industrial production, GDP and market share, earns more valuable foreign exchange, utilizes the available natural and human resources and thereby avoids wastages of resources. Pakkumattai plates have great demand in both domestic as well as overseas markets due to conversion of wastage of pakkumattai into value added products. Therefore, making of pakkumattai plate is most suitable to the people for undertaking industry activity and promoting rural entrepreneurship.

Keywords: *Investment, Employment, Production, Cost, Net Profit and ROI*

INTRODUCTION

Pakkumattai plate making industry is one of the micro industries in India. It plays a significant role in growth and development of our country's economy. Pakkumattai is used as wastage in the ancient period but now-a-days they are very valuable and useable for multipurpose and thereby they create more demand in both domestic as well as overseas markets. Further the uses and needs of the pakkumattai plates are increasing day-by-day because they are