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MODELING AND ANALYSIS OF A TWO STORAGE INVENTORY MODEL WITHVARIABLE DEMAND AND EXPONENTIAL BACKLOGGING

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A deterministic inventory models is developed for deteriorating items with timedependent exponential demand under the effect of inflation and also used the conceptof LIFO dispatching policy. For both warehouses, deterioration rate is linear functionof time. In these models, demand rate is taken as the exponential increasing functionof time. We have also taken the rate of production is demand dependent which isrealistic for newly launched products in the market. Shortages are allowed ininventory with partial backlogging. Backlogging rate is exponential decreasingfunction of time.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation

A PARTIAL BACKLOGGING TWO-WAREHOUSE INVENTORY MODELS FORDECAYING ITEMS WITH INFLATION

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We considered an order level inventory model for decaying items with inventory level dependent demand rate. We have considered two cases: first is, model started with no shortages and second is model started from shortages. We have also taken the concept of inflation in this study. Finally, a numerical example for illustration is provided with sensitivity analysis.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation

A PRODUCTION INVENTORY MODEL WITH TIMEDEPENDENT DEMAND, PRODUCTION AND DETERIORATIONOVER A FINITE PLANNING HORIZON WITH TWO STORAGES

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A production model is developed for deteriorating items with two-storage facility and inflation under finite planning horizon. We assume that the deterioration rates of the items stored are different in the two warehouses due to the difference in the environment conditions or preserving conditions. We assume that demand rate, production rate and deterioration rates all are functions of time. Shortages are not allowed in this model. We have also used the technique of cost minimization. Keywords: -Two-Warehouse, inventory model, deteriorating items and inflation.

Keywords: Two-Warehouse, inventory model, deteriorating items, inflation

AN INFLATIONARY INVENTORY MODEL FOR DETERIORATING ITEMS UNDER TWO STORAGE SYSTEM

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Two-Warehouse inventory model for non-deteriorating items under conditionally permissible delay in payment and inflation is being discussed in this chapter. Since inflation and trade-credit financing both play an important role in the business and therefore effect of both, together on total inventory cost becomes essential to discussed and therefore we have proposed this model for non- deteriorating items considering the effect of inflation and permissible delay payment.

Keywords: Two-Warehouse; inventory model; deteriorating items; inflation

EFFECT OF INFLATION ON A TWO WARE-HOUSE INVENTORY MODEL FOR DETERIORATING ITEMS WITH TIME VARYING DEMAND AND SHORTAGES

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The "Two warehouse inventory model with ramp type demand and partial backordering for weibull distribution deterioration" has been presented in this chapter for ramp type demand rate. The deterioration rate is considered to follow two parameter weibull distributions with allowable shortages and an amount of shortages inventory is partially backlogged at the next replenishment cycle atconstant rate. The cases under two warehouse system and single warehouse system are discussed and corresponding mathematical model is developed separately and results are compared.

Keywords: Two-Warehouse; inventory model; deteriorating items; inflation

TWO WAREHOUSE INVENTORY MODEL WITH RAMP TYPE DEMAND AND PARTIAL BACKORDERING FOR WEIBULL DISTRIBUTION DETERIORATION

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This chapter deals with "A fuzzy based two-warehouse inventory model for non-instantaneous deteriorating items with conditionally permissible delay in payment". In the fuzzy environment the conditionally permissible delay period has been provided to retailer by suppliers to make payment of purchased cost. During the permissible delay period no interest will be charged and beyond this period interest will be charged. This model specially deals with non-instantaneous deteriorating items and shortages are not permitted. Different rate of deteriorating has been considered in both warehouses.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation

TWO-WAREHOUSE INVENTORY MODEL FOR DETERIORATING ITEMS WITH RAMP-TYPE DEMAND RATE AND INFLATION

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Two-storage inventory model is developed for decaying items with ramp type demand and the effects of inflation. The owned warehouse (OW) has a fixed capacity of W units; the rented warehouse (RW) has unlimited capacity. Here, we assumed that the inventory holding cost in RW is higher than those in OW. Shortages in inventory are allowed and partially backlogged and it is assumed that the inventory deteriorates over time at a variable deterioration rate. Cost minimization technique is used to get the expressions for total cost and numerical example is also used to study the behavior of the model.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation.

APPLICATION OF ICT IN UNIVERSITY LIBRARIES OF MEGHALAYA: A SPECIAL REFERENCE TO USTM

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University of Science & Technology Meghalaya (USTM) is one of the prominent PrivateUniversity in Northeast India which is accredited as "A" by NAAC. The Central library is knownas Maulana Azad Central Library (MACL). The aim and objective of USTM Library is tosupport the teaching, learning and research activity of the University. MACL is to offer freebooks reading facilities to all, to grow healthy readership at all levels and to disseminateknowledge on all subjects and topics to collect and preserve all documents having research valueand local importance.

Information Communication and Technology (ICT) is one of the most important applications ineach work field including libraries to support the day to day activity through its hardware andsoftware that enables society to create, collect, consolidated and communicate information inmultimedia format for various purpose. ICT in libraries are now applicable in the Library likelibrary automation, library management, e-library, digital library etc.

Maulana Azad Central Library is fully automated through Koha LMS software, DSPACE, RFIDsystems, CC TV camera, bar-coding machine, reprographic facilities etc. ICT tools is using inoperations like acquisition of books, data entry, issue return of books, digitization, documentpreservation and user communication. The ICT application makes the library services faster,quicker and accurate.

Keywords: Information Communication and Technology, ICT, University Libraries, USTM, Meghalaya

A TWO-WAREHOUSE INVENTORY MODEL FOR DECAYING ITEMS WITH EXPONENTIAL DEMANDAND VARIABLE HOLDING COST

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This chapter presents a two warehouses inventory model for deteriorating items. Itis assumed that the inventory costs (including holding cost and deterioration cost) in RWare higher than those in OW. Demand is taken exponentially increasing with time.Holding cost is taken as variable and it is linear increasing function of time. Shortages areallowed in the owned warehouse and the backlogging rate of unsatisfied demand isassumed to be a decreasing function of the waiting time. Profit maximization technique isused in this study.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation

SUPPLY CHAIN NETWORK MANAGEMENT AND IMPLEMENTATION AND RECOMMENDATIONS FOR DEFENSE INDUSTRY: A LITERATURE SURVEY

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Supply chain network Management has been utilized in different enterprises to increment efficiency. This article aims to investigate the advantages of carrying out Total Productive Maintenance (TPM) in different businesses and give proposals to be used in the defense industry. This article is a literature survey, which is a survey by understanding, collecting, and dissecting in different modern areas and the defense industry. The various articles are analyzed, which had been collected and afterward searched for likenesses and contrasts and afterward examined to reach a conclusion. Supply chain management is recommended to be used in the defense industry based on the literature review.

Keywords: Supply chain, Defense Industry, Total Productive Maintenance(TPM)

AN INVENTORY MODEL WITH PARTIAL BACKORDERING, WEIBULL DISTRIBUTION DETERIORATION UNDER TWO LEVEL OF STORAGE

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This chapter present "An Inventory Model with Partial Backordering, weibull Distribution Deterioration under Two Level of Storage" in which a theoretical model is developed under constant demand rate with two parameter weibull distribution deterioration and shortages amount of inventory is backlogged at fraction of constant rate. The holding costs in both ware houses are taken to be linear time dependent.

Keywords: Two-Warehouse, inventory model, deteriorating items and inflation

SELECTION OF FOREIGN PLAYERS IN T20 CRICKET LEAGUE USING MULTIPLE CRITERIA DECISION MAKING (MCDM) TECHNIQUES

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Cricket is most popular sport among every age group of people and T20 cricket is the new dimension added in international cricket. From all three formats T20 format is becoming popular. Every team in any T20 league want to selects the best foreign players in their squad to win the match. Team management and coach want to analyze the performance of players to select the best one. This research uses the application of Multi Criteria Decision Making (MCDM) techniques to rank the foreign players as per their performances. Analytical Hierarchy Process (AHP)and integrated method of AHP and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) named as AHP-TOPSIS methods are used for ranking of six foreign batsmen for the selection. The experimental results after applying AHP and AHP-TOPSIS methods reveals that batsmen C, F and A have achieved first, second and third rank respectively.

Keywords: Multi Criteria Decision Making (MCDM), Analytical Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method.

IMPLEMENTATION OF BLOCK CHAIN IN WEB 3.0

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Today's generation can scarcely consider existence without the web. The World Wide Web (WWW) is the biggest worldwide data media through which clients can write, read, and share information through PCs associated with the web. This study presents the connection between current innovations Web 1.0, and 2.0 and the third era of the web which is Web 3.0. Web 3.0 is the last advancement of the web that requires Web 2.0 innovations, semantic web and artificial intelligence. The Web 3.0 innovation is a framework that incorporates Web 2.0 advancements (that provide good content and seamless interaction between users), semantic web technologies (which attempt to comprehend and decipher the information) and basic artificial insight (which gives the capacity to think to the machines like a person). Web 3.0 advances are supposed to be carried out in education, search engines and decision-making processes shortly. Blockchain can change our lives by carrying another aspect of the web that we use today. Web 3.0 brings a whole new perspective to the way the web is seen today. In this paper, we will discuss some features heading to contemplate the future web called the decentralized web. To upgrade the web, our primary concern should be about taking care of the issues that we have and the issues that these social media platforms have made. The decentralized web is centered around creating protocols and hidden advancements that are not seen by end-users. It gives an outline of the difficulties in the ongoing web 2.0. It portrays the decentralized web, and what are the advancements that are being developed at this point. The main aim of this research is to provide a deliberate writing review of blockchain-based applications across numerous spaces. The point is to examine the present status of blockchain innovation and its applications and to feature how explicit qualities of this troublesome innovation can change "the same old thing" rehearses.

Keywords: Blockchain, Web 3.0, Decentralization

EARLY PREDICTION OF BREAST CANCER USINGRANDOM FOREST MACHINE LEARNING TECHNIQUE

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Breast Cancer is one of the most frightful diseases and is a potential cause of death in women. Delay in the prediction of Breast Cancer may greatly reduce the survival chances and as a solution to that the automatic disease detection system aids the medical field to diagnose and analyze, which offers rapid response, reliability, and effectiveness as well as decrease the risk of death. In this paper, a very sophisticated machine learning prediction technique named Random Forest Classifier has been explained. This classifier structures the data into numerous decision trees and obtains a final result i.e., whether a person is at risk of having breast cancer or not. This methodology will be very helpful in the framing of effective health policy regarding the detection, prevention, and treatment of breast cancer.

Keywords: Breast Cancer, Machine Learning, Random Forest Classifier, Prediction, ROC, AUC, Confusion Matrix

BLOCKCHAIN AND FINANCIAL TECHNOLOGY: A SYSTEMATIC REVIEW AND CASE STUDIES IN BANKING SECTOR

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Blockchain, the technology underpinning Bitcoin (Satoshi Nakamoto, 2008) has potential to transform organizations, governments, markets, and society at large. Blockchain offers unique capabilities such as data immutability, transparency, security, reliability and has the capacity to alter fundamentals of organizational operations by providing a trustless ecosystem with no intermediaries. In this context, it is important to ask a simple question. Why are Blockchain and Financial Technology (Fintech) attracting attention of scholars mainly from information systems and finance domain scholars and practitioners? The simplest possible answer to this important question is their potential to change the functioning of banking sector across the globe. Through a systematic review and cases studies in the banking sector, this study presents potential applications, business value and the critical challenges of blockchain and financial technology (Fintech). This research also presents prominent research methods adopted during this type of research. We have developed classification framework on the basis of 92 research articles from top three academic databases namely ABI/INFORM Complete, Emerald Journals, and ScienceDirect. This study helps in evaluating the existing knowledge on blockchain and financial technology (Fintech) in banking sector. The findings of this study reveal that blockchain and financial technologies (Fintech) are evolving and banks are using these technologies to gain competitive advantages. Thus, organizations in banking sector need to leverage systematic research on blockchain and financial technology (Fintech) to better understand these emerging technologies, optimize their business strategies, and develop critical insights for decision-making.

Keywords: Blockchain; Fintech; Banking Sector

E-COMMERCE PROJECT FOR SRIMANTA SANKARADEVA KALAKSHETRA, GUWAHATI. A DATABASE APPROACHES USING MYSQL & PHP.

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The business to consumer aspect of electronic commerce (e-commerce) is the most visible business use of the Word Wide Web. The primary goal of an e-commerce site is to sell goods and services online. This project is a web based shopping system for an existing shop. The project objective is to deliver the online shopping application. This project is an attempt to provide the advantages of online shopping to customers of a real shop. It helps buying the products in the shop anywhere through internet by using a web site. Thus the customer will get the service of online shopping and home delivery from this shop. This system can be implemented to srimantasankaradevakalakshetra society. If shops are providing an online portal where their customers can enjoy easy shopping from anywhere, the shops won't be losing any more customers to the trending online shops such as amazon or flip kart. Since the application is available in the given site it is easily accessible and always available. Specialty of the websites are responsive, fast load times, effective search, easy checkout.

Keywords: Ecommerce, B2C, Payment Gateway, customer, vendor, LAN.

DIGITIZATION OF STATE ANNUAL BUDGET UNDER: DIRECTORATE OF AGRICULTURE, KHANAPARA

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The current century we live in is defined as the information age. Because of this, information has become a valuable resource for all organizations. Collecting, storing and accessing information has achieved major importance in organizations' development processes. The innovations in computer technology and the demand for information have shown a continuous improvement in the aspect of storing and processing information. The traditional method of storing data has long gone. All organizations are now intensely upgrading their methods of storing the data. This paper will aim to show how a traditional storing process can be digitized and the effect of this approach on the organization. In this paper, we will try to digitize the state annual budget. Digitization of the state annual budget will be a system that will transform the current method of storing budget-related data into a more convenient way. Currently, the storing of data is done in an Excel workbook which sometimes becomes hectic for the user. This system will try to minimize the work for the user and will provide a better UI for a better user experience and the documents are recorded digitally and save the data in database in an organized manner.

Keywords: Digitization, Budget, Public accessibility, User Interface

MACHINE LEARNING BASED ANALYSIS OF SCHIZOPHRENIA DISEASE THROUGH MOTOR ACTIVITY DATA

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Schizophrenia is a psychosis, have an effect on 20 million humans globaly, however it is notas unusual place as many different intellectual disorders. A sort of metallic sickness thatinfluences how someone thinks, feels, and behaves. People with schizophrenia might alsoadditionally revel in hearing, hallucinations (seeing), feeling matters that aren't there.Wandering aimlessly, mumbling, giggling to self, self-forget about and impaired cognitiveability. In this paper, we classify the Schizophrenia and non-Schizophrenia patient throughPsykose dataset which are collected using ACTi-watch. Data are pre-processed as 1-hour, 3-hour and 6-hour on the basis of various parameter extracted from the time dependant featuresof the database. Nine different algorithms, have been applied and performance have beenevaluated on the basis of various performance measures. Empirical results show that XGBoostis performing better than others with 99.53% accuracy with only 3 features.

Keywords: Schizophrenia, Active Graph, Machine Learning, XGBoost, Decision Tree,Feature Extraction.

A STUDY ON DICKSON POLYNOMIALS AND ITS APPLICATIONS INCRYPTOGRAPHY

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Dickson polynomials are one of the most important topics of study for many years and havewide applications in cryptography. Dickson polynomials are of fundamental importance inthe theory of permutation polynomials and related topics. The permutation and involutionproperties are mostly used in the context of cryptographic applications. In this paper we studysome properties and applications of Dickson polynomials in public key cryptography.

Keywords: Dickson polynomials; Dickson cryptosystem; Permutation polynomial; involution; fixed point; Public key cryptography.

CLASSIFICATION OF AUTISTIC SPECTRUM DISORDER WITH SELECTED FEATURES

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The Autistic Spectrum Disorder (ASD) is a group of Neuro-developmental disabilities disorders that cannot be cured but may be ameliorated by early detection with the help of data mining. In this paper, feature selection technique (FST) namely Chi-Square (CS) has been used for feature selection. The filter based CS is a ranking method. The FST key goals of improving classification efficiency and reducing feature counts. Naive Bayes (NB), K-Nearest-Neighbour (K-NN) and Support Vector Machine (SVM) with RBF kernel considered the classification methods on Autistic Spectrum Disorder (ASD) children dataset. Comparison to the non-reduced features and reduced feature of ASD datasets the reduced feature give up enhanced results in all classifiers NB, K-NN and SVM. Finally, minimum feature with high accuracy based classification model is proposed.

Keyword: Autistic Spectrum Disorder, Chi-Square (CS), Classification, Feature selection technique (FST), Naive Bayes (NB)

A REVIEW ON CLASSIFICATION TECHNIQUES OF MACHINE LEARNING

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Classification is the method used for the prediction from the value of a categorical target or categorical class variable. It can be applied in any type of statistical data. Now a days classification techniques are commonly used for image classification, Predictive modeling, data mining technique etc. The main purpose of supervised learning is to build a simple and unambiguous model of the allocation of class labels in terms of predictor features. The classifiers are then used to classify class labels of the testing instances where the values of the predictor features are known, to the value of the class label, which is unknown. In this paper, we have discussed different classification techniques with advantages and their limitations.

Keywords: Classification, supervised, machine learning, pattern recognition.

DIGITAL PAYMENTS IN INDIA WITH PERSPECTIVE OF CONSUMER'S ADOPTION

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The demonetization resulted in tremendous growth in digital payments. With the government initiative such as Digital India and increased use of mobile and internet are means to exponential growth in use of digital payment. This transformation towards digital payments benefits in more transparency in transactions which empowers the country's economy. In recent days many changes took place in the payment system like digital wallets, UPI and BHIM apps for smooth shift to digital payments. The objective of this research paper is to study the positive impact that Digitization of payment system. We focus on the analysis of the adoption level of these digital payment systems by mainly in the rural areas where people still not using the Digital Payment System. People are no need to go to the Bank or ATM once they adapt digital payment system.

The Information Technology (IT) has revolutionized in our lives; particularly it has provided an easy way to go for digital payments than cash payment. During the Demonetization period, the Government of India forced the people directly or indirectly to do all commercial transactions via Digital mode. The common people started to move from traditional payment system towards Digital Payments systems which ensured safe, secure and convenience. With giant technological leaps in the smart phone and easy internet access has led Indian market to accept Digital Payments. The percentage of the digital payments through other modes is also increasing in a significant speed. As a result that in 2015-2016, a total of 4018 billion has been transacted through mobile banking when compared to 60 billion in 2012-13.

India is going to became cashless. Indian government launched digital India Campaign to reduce dependency of Indian economy on cash and prevent from money laundering. To making cashless India and increasing trends in using digital payment system various Payment methods are emerging and developing. India is a developing country and maximum area is rural and shocking is computer literacy is only 6.5% then question arises that implementation of digital payment system. The research paper is

making focus on the problems of digital payment system in India and effects of the system in people and economic system of India. We are focus to aware people to adapt digital payment instead of the traditional way of payment mainly in the rural areas where literacy is not that huge and most of them are also don't know about how this work and how it's more secure than cash transaction.

Keywords: Digital Payment, Cashless, E-Payment, Online Payment.

COUNTERING FRAUD AND PHISHING IN CYBER SECURITY USING ARTIFICIAL INTELLIGENCE

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Now a days, technology is our pillar of prosperous life using the best one not onlyrecognized success of an individual, it also recognized success of a country. Technology isnow upgraded day by day in modern world. i.e. from telephone to smart phone, from the gasand coal engine to pollution less electric engine, even now watches are also become smart.For example, in monetary system, beginning of 21st century people used to visit ATM'sinstead of standing hours in banks. Using debit card instead of passbook for withdraw moneyis easier and less time consuming. After sometime, point of sale machine is invented and itmakes monetary system easier even now we have e-banking for transaction of money and wecan have money in no-time. The matter of concern is the adopted security mechanism. Withthe advancement technology, counter effects are also becoming advance too. According to aRBI report, India became the victim of 229 banking frauds in 2021, amount of Rs. 1.38 lakhcrores. And Govt get to recover 1031.31 crore only, about 1% of the whole amount. Becauseof human's greed and through OTP, people hacked all these money from the common people.This paper is to provide some solutions of counter measure from cyber fraud. Pros and consof different technology used in e-business are discussed and probable phishing techniqueswill be highlighted. In this study prospect of applications of Artificial Intelligence (AI) willbe used.

Keywords: Phishing, Sniffing, Cyber security, Digital Transaction, Artificial Intelligence

USE OF IOT IN REDUCING AGRICULTURAL LOSSES

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The demand for the agriculture products has increased but the farmers always have to incur losses due to the sudden changes of climate. The main aim of this paper is to discuss the usage of IoT (Internet of Things) in Agriculture. IoT in agriculture targets the farming to meet the increasing demands and decrease the production loss. IoT can be used in agriculture to save water, to reduce the production cost and to improve the quality of the product. Most importantly, it can reduce the time to work and can provide us with a good outcome. IoT in agriculture can use robotics to plant seeds, monitor environment, soil analysis, watering, harvesting etc. Drones with image processing to determine the vegetation indices, Canopy measurement, irrigated land mapping etc. with greater accuracies. Remote sensors to determine the soil moisture quantity and hence the type of crop that can be grown in the soil in the right time. The two big problems that farmers face in agriculture while cultivating are Flood and Drought. It takes about minimum of 6 months hard work in crop cultivation but due to the flood all the crops get damaged. Even after the flood waters recede, crops can continue to suffer damage and yield resulting losses. Flood just not only weakens plant defenses, but the soil and water conditions prevalent during flooding favor the development of many plant pathogens, so crops suffer increased disease problems after floods. Drought has a direct and negative impact in agricultural production. It reduces the production of agriculture. So, to overcome the flood and drought problem in agriculture.
IoT can play a major role in reducing the damage occurring due to flood by using water level sensors to measure the water level and automatically release the water to a self-made water tank and when the water level gets low in a crop field it will automatically bring back the water to the field by the indication of soil moisture sensor using motors.

Keywords: Internet of Things, IoT, agriculture, sensor, robotics, drone

AN APPROACH TO HOME AUTOMATION (SMART HOME) SYSTEMS USING IOT

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This topic aims at discussing on how can we developed a Smart Home by integration of Internet of Things (IOT). Smart Home systems have achieved great popularity in recent times as they have increased the quality and comfort of life as well as it is very energy efficient. Most smart home systems are controlled by smartphone and microcontrollers. Using smart phone, we can monitor our home and home appliances. And with the integration of IoT systems, cloud computing and embedding intelligence into sensors and detectors into a smart home we can prevent all kinds of accidents that can cause in a home. By using smart cloud computing and smartphone wirelessly it will be easy to access our home appliances from different locations of the world. Using image processing camera in a smart door system we can identify whoever came to our home and we can communicate or send a message from different locations using the embedded door speaker function. At the same time, we will also be notified through our smart phone if any movement is detected through the camera as well as by the motion detector. If someone sneaks in or break into our home the image processing system will detect the threat and will notify the owner and accordingly, he/she can take action.

Smoke detectors will help in detecting all kinds of smoke that can catch fire and issues an alarm to alert and to prevent from the threat. In the morning, when the wake-up alarm will buzz, the integrated IOT sensors in a smart home can open up the window blinds, turn on the coffee brewer and can even turn on the geyser and many other things as we want to be done in the morning. Rain detectors can detect the rain and send notification to the owner's smartphone which can help you remind things like in case you forgot your cloths outside you can bring them back in time. Temperature sensors will automatically maintain the temperature of the room. Smart gardening which will help in making the garden healthier like if the weather is too hot or dry the integrated sensors can water the whole garden with the owner being notified. Water leak detection will help in avoiding the wastage of water using master water valve sensor.

Keywords: Smart Home, IoT, Cloud Computing, Image processing, Detectors, Sensors.

SEMANTIC ANALYSIS OF TWITTER DATA USING NATURAL LANGUAGE PROCESSING (NLP) APPROACH

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COVID-19 effects almost everyone's life economically as well as socially. In this study, we develop a predictive model for semantic analysis of twitter data based on COVID-19 using natural language processing (NLP) approach. In this study, we have worked with three models: Bernoulli Naive Bayes, SVM (Support Vector Machine and Logistic Regression. These models predict the positive and negative impact of this pandemic in people life by using their views, they share in twitter. The findings based on this public opinion suggested that model with Logistic Regression gives the best performance for semantic analysis of twitter data.

Keywords: COVID-19, Natural Language Processing (NLP), Twitter, Semantic analysis.

IDENTIFICATION AND CLASSIFICATION OF PHISHING WEBSITE USING MACHINE LEARNING TECHNIQUE

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Phishing is the process of attempting to acquire sensitive information such as usernames, passwords, credit card, and debit card details by masquerading as a trustworthy entity using bulk email which tries to evade spam filters. The problem of phishing is widespread and there is no particular single solution available to effectively reduce all vulnerability, so many techniques are often used to reduce certain attacks. The main aim of this research work is to develop a robust machine learning-based model that is able to detect and classify URL-based phishing data.

In this paper, we have proposed a new ensemble model that is a combination of Random Forest (RF), Gaussian naive Bayes (GNB), and Extreme Gradient Boosting (xgboost) using the voting ensemble technique. The proposed ensemble model compared with other individuals classifiers like decision tree (DT), K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Random Forest (RF), Gaussian Naive Bayes(GNB), Logistic Regression(LR) techniques, and ensemble classifiers like Extreme Gradient Boosting (XgBoost), Adaptive Boosting (AdaBoost), and Bagging algorithms where our proposed algorithm achieved remarkable performance of 98.57% accuracy using 10-fold cross-validation. Finally, machine learning is one of the most feasible methods to approach this situation, as it can handle the dynamic nature of phishing techniques and provide an accurate method of classification.

Keywords: Phishing, Classification, Machine Learning, Ensemble Model, K-fold Cross-Validation.

SECURITY CHALLENGES IN IoT COMMUNICATION

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The result of IoT failures can be severe, therefore, the study and research insecurity issues in the IoT is of great significance. The main objective of IoT security is topreserve, privacy, confidentiality, ensure the security of the users, infrastructures, data anddevices of the IoT, and guarantee the availability of the services offered by an IoT ecosystem.Thus, the research on IoT security challenges has recently been gaining much momentum withthe help of the available simulation tools, modellers, and computational and analysis platforms,In this paper we have tried to presents the details overview of IoT security research by differentauthors and publishers with appropriate analysis.

Keywords: IoT, Network attack, Security System.

A SUSTAINABLE SMART MULTI-BIOFUEL PRODUCTION UNDER FLEXIBLE GENERATION WITH THE OPTIMUM ENERGY UTILIZATION

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Biofuel production from a renewable source is an important alternative to fossil fuels through asmart production system, which helps to minimize dependability on conventional fuel and decreasecarbon emanations. The traditional production of biofuel systems can be converted into a smartsustainable production framework by employing efficient labor, smart machines, and minimizedenergy utilization. The existing conventional demand for fuel can be replaced by biofuel. Thisstudy aims to produce pure biofuel with fewer carbon emanations and energy utilization througha smart multi-biofuel production framework, where the demand for biofuel is price-dependent. Tominimize energy consumption and carbon emissions, a two-stage inspection cost with a variableproduction rate is considered to make the production process flexible such that the amount ofimpure biofuel is minimized. Though a random manufacturing rate is utilized through a smartproduction system, still contaminated biofuel is produced. The impure biofuel is regeneratedthrough refining just after the well-planned manufacturing ends. In this model, the multi-deliverytechnique is used. To validate the model's usefulness, a numerical observation is studied. Theresult shows that by utilizing the said procedure, the percentage of impure biofuel can be trulydecreased through minimized energy consumption. Also, numerical results assist to getting themaximum profit and the optimum selling price of biofuel globally.

Keywords: Production; Sustainability; Energy; Optimization; Biofuel

INFLUENCE OF ADVERTISEMENT TO INCREASE PROFIT FOR A FLEXIBLE PRODUCTION SYSTEMN UNDER A LOW-CARBON SUPPLY CHAIN MANAGEMENT

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This research introduces a supply chain for a sole supplier, a sole manufacturer, and multiple retailers, where therequirement is responsive to sales and advertising expenses. These combined effects will assist companies in acquiringtemporary funding and reducing carbon emissions to produce a cleaner environment. A low-carbon supply chain withsmart production under the impact of remanufacturing is studied to diminish the supply chain cost and achieve themaximum profit by calculating the variable transportation cost and including the carbon emissions based on thenumber of shipments. To realize additional sales of any brand, supply chain members must use a few strategies toensure that thecorresponding profits are always maximum. It is demonstrated that advertising generates more salesthan any relevant policies, such as trade deals and various types of discounts. Advertising is a vital tool that modernbusinesses adopt. It is important to understand whether forms of environmental billing or advertising are the mosteffective in diminishing the contradictory impact of the company and its brands on the surroundings. The demand fora product will increase if it is dependent on the retail price reduction and advertising expenditure.

Keywords: Production; Advertisement; Low carbon emission; Optimization; Supply ChainManagement

AN IMPROVED LOGISTIC SYSTEM UNDER THE SINGLE-SETUP-MULTI-UNEQUAL-DELIVERY STRATEGY WITH THE PREMIUM FUEL QUALITY

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Customers have different expectations of their demanding products. For fulfilling theserequirements, several industries have improved the transportation system to distribute theready-to-sell products to the other players. Very often, an unexpected disturbance may ariseduring road transportation due to bad fuel quality. For the smooth mileage of the road vehicle,it is needed good quality fuel material. The aim of the model is how to reduce the mileagedisruption of road vehicles as well as more emitted carbon during the transportation period. Inthe model, two players, a single vendor and multiple buyers are considered, and the finalproducts are delivered from the vendor to buyers through a single-setup-multi-unequal-delivery(SSMUD) policy. Initial setup cost is also reduced, and lead time is controlled to decrease theholding cost. A premium cost technique is introduced to attract the players' attention to thefinal products. The total supply chain profit can be maximized even though the better quality(power fuel) is used for road transportation. The graphical representation and the sensitivityexperiment show the impact of every parameter on the whole cost of the research paper.Numerical results assist in getting the minimum cost. Sensitivity analysis and managerialinsights are given to show the model's applicability.

Keywords: Logistics; SSMUD policy; Premium fuel; Optimization; Supply Chain Management

ARE ALL INFORMATION FROM SUPPLY CHAIN PLAYERS ALWAYS RELIABLE?

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In any supply chain management, retailers play a vital performance since they are the ones who deal directlywith consumers. Through these consumers, retailers can income their profit and obtain information regardingsupply chain management. Now, retailers may cover the whole statistics of the entire system and may notdisclose this data to the manufacturer. Because of this conspiracy, there may generate an asymmetry in dataall over the system. To prohibit this type of asymmetry from the whole system, the manufacturer adopts avendor-managed inventory (VMI) contract in coordination policy. The main motive of this proposed researchis to prevent unreliability in the entire system. Moreover, one more policy is incorporated in this research: thecap and trade (CAPT) policy. This policy restricts the manufacturer from emitting carbon within a certainlevel. Finally, the numerical discussion provided that the manufacturer succeeds in saving profit and thesupply chain management (SCM) collaboration.

Keywords: Supply chain management; Vendor-managed inventory; Cap-and-trade policy; Carbon tax; Information asymmetry

EFFECT OF COMPLEMENTARY PRODUCTS IN A SUSTAINABLE SUPPLY CHAIN MANAGEMENT

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Sometimes, it becomes quite difficult for the supply chain managers to decide the sales strategiesfor the fixed lifetime deteriorating complementary products. Based on this premise, a sustainablesupply chain management is developed, where two manufacturers produce two complementaryproducts and sell them to the end consumer through a common retailer. The primary aim of thisstudy is to optimize the system's total profit by finding a suitable sales strategy. In this study, thedeterioration of the product is taken as the function of time. Also, under a flexible productionsystem, the finished products are delivered to the retailer following SSMD policy. The systemprofit is optimized by acquiring the optimal values of the retail price, cycle time of the retailer,production rate, and the number of shipments. To validate this model, a numerical experiment isalso done. The result shows that the profit will be maximum for low negative cross-price elasticityof demand, i.e., for two less dependent products. Also, it is obtained from the result that theincrease in cycle time will increase the product deterioration rate. While adapting the SSMDstrategy decreases retailer cycle time and increases system profit by 10%.

Keywords: Production; Sustainability; Complementary products; Optimization; Supply chain management

SKIN DISEASE CLASSIFICATION USING DEEP LEARNING TECHNIQUE

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Skin disease among human is the most common disease, millions of the people aresuffering from different kind of skin viruses, fungal infection, bacteria or allergy.Most of the people are usually hide their skin disease to feel ashamed but thehiding skin disease is danger to them which lead to lose not only lack of selfconfidencebut they also go into psychological depression and it is very harmful tothem because they lead to a risk for skin cancer also. The medical technology andDermatologica of the skin it give us more quickly and accurately result. But thecost of such type of diagnosis is very expensive and non-available to anywhere. So,for the resolution of the various problems, we have used deep learning techniques.We proposed an image processing-based framework includes deep learningtechniques such as CNN architecture with three different predefined activationfunctions like TANH, RELU or SIGMOID. Our proposed approach is simple, fastand not required expensive dermatological equipment. This research work usedskin disease dataset that contain two kind of skin variation like malignant andbenign type of cancer or non-cancer skin decease. Our proposed model provides84.28 % of accuracy in case of skin disease classification using Convolutionalneural network which is better as compared to another dermatologist.

Key words: Skin Cancer, Convolutional Neural Network, Machine Learning,
Deep Learning, Classification.

A STUDY OF INTERNET OF THINGS (IOT) SOLUTIONS FOR SMART HEALTHCARE: LATEST TECHNOLOGIES, CHALLENGES, AND OPPORTUNITIES

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The Internet of Things (IoT) has emerged as a hot topic in the technological study. It is essentially the interconnection of gadgets over the internet. Apart from its broad use in autonomous vehicles and smart homes, some of the top IoT applications in the realm of health care monitoring are worth highlighting. In recent years, the Internet of Things (IoT) has gotten a lot of press as a solution to relieve the load on healthcare systems brought on by an aging population and a rise in chronic sickness. IoT has given us some very important application that has helped us to connect with various medical device sensors and health care professionals to provide us with various medical services. This technology has also aided in improving the safety and accessibility of healthcare services for patients, as well as increasing the efficiency of the healthcare business and lowering healthcare expenses. Moreover, some challenges are also seen regarding those IoT and seeking measures to improve them that would help them in providing hassle-free services to the patients. Because standardization is a major roadblock to growth in this field. The prospects and challenges for IoT in attaining this vision of the future of health care are highlighted in this study. This paper examines several smart healthcare trends that have altered the traditional healthcare system by increasing the efficiency of health management through their applications.

Keywords: Smart Healthcare, Internet of Things, IoT_Challenges, IoT security.

CAMPUS VEHICLE DETECTION THROUGH IMAGE PROCESSING

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This paper signifies the importance of capturing an image, image processing tomodify and enhance the image. There are many applications for Image Processinglike surveillance, navigation etc.The ultimate aim in a large number of image processing application is to extract important features from image data, from which a description, interpretation, orunderstanding of the scene can be provided by the machine. Image Processing canbe defined as, the processing or altering an existing Image in a desired manner. Thissystem allows the user to store screen image into the disk file using file format (bmp,jpeg, jpg, gif, png). Image processing in general form pertains to the alternation andanalysis of pictorial information. We find instances of image processing occurring allthe time in our daily lives. Probably the most powerful image processing system isthe human brain together with the eye. The system receives, enhances and storesimages at enormous rate of speed.The objective of image processing is to visually enhance or statistically evaluatesome aspect of an image not really apparent in its original form. The basic principleof Image Processing carried out will assist us in a greater perception and vision butdoes not add any information content. This objective is carried out throughdevelopment and implementation of processing means necessary to operate uponimages. For heavy traffic in entry gates of the university campus, delay is the commonscenario during university hours. There is a need of an intelligent system that willrecognize the vehicles number plate, which reduces the amount of time and effort ofthe security guards stationed at the university gates. Proposed system of vehicledetection automation using Automatic Number Plate Recognition (ANPR) designed toensure steady flow of traffic. The ANPR algorithm works on steps like extraction ofnumbers processing via filtering, segmentation and character recognition. We willstore the data of vehicles in university Database, for every entry and exit of thevehicle. The performance of algorithm is checked on real images with parameters liketitled position of the number plate. Further, this system can be utilized forinvestigation of stolen vehicles. Also, this system can be utilized for calculating theparking space available inside the campus.

Keywords: Surveillance, Navigation, ANPR, Extraction, Segmentation, OpticalCharacter Recognition.

EVENT MANAGEMENT SYSTEM

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Computer Software has become a part of life for accessing almost any kind of information and working on its intel. Life in the 21st century is full of technological advancements and this technological age is very difficult for any organization to survive without utilizing technology. The Event Management System contributes greatly to the creation of ever functioning system software. It can also be used as a mechanism to share information or store data. Management softwares have been reported as equivalent to information keeping and maintaining records within an organization. It is equivalent in terms of internal reliability and completion rates. The benefits of online management softwares are that they save time are cost effective and can be accessed quickly by people from any location. Therefore, we made an system software that store all the implementations regarding the events to be held or already held in the organization. In this system, the admin will provide all the details regarding the criteria of organizing an event at the premises and the users can access it and register and login through online mode to organize any event/events inside the premises of the organization. This software can help all the users to know about all the details of SrimantaShankardev Kalakshetra and their available areas for organizing any events and can book online accordingly.

Keywords: Management Software, Event Management

BAYESIAN INFERENCE ANALYSIS OF RANDOM OCCURRENCE OF IDLE SERVERS OF MARKOVIAN QUEUEING MODELS

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The paper focuses on the study of random occurrence of idle servers which is an imperative phenomenon connected with queueing models. Such a kind of study leads to proper utilization of servers' working time in the system. Various analytics related to Bayesian approach to single and multi-server Markovian queueing models have been proposed to figure out and discuss in the paper. Bayesian inferential analysis has been so far attracted insufficiently by researchers engaged in this field despite being versatile, potential and appropriate method to effectively deal with uncertainty environment embedded with queueing models wherever estimation of parameters involved in probability distributions is intended. R software has been used to compute and perform the analytics of highest posterior density, credible interval and detection of random occurrence of idle server related to Bayesian inference of random occurrence of idle servers of the Markovian queueing model under study.

Keywords: Markovian queue, Bayesian inference, random occurrence of idle servers, highest posterior density, credible interval

RELIABILITY ANALYSIS OF PLASTIC PIPE MANUFACTURING PLANT

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The goal for any plant is to increase overall production reliability and decrease failure rate . Plasticpipes are utilised in a wide range of pipeline applications, from water transportation to drainageand modern fire-sprinkler systems.The purpose of this paper is to calculate Reliability analysisof a the plastic pipe manufacturing plant's. Hopper, extruder, size reducer, temperature reducer,cooling bath, pulling pushing off, cutter, and size measurement machine all are subsystems ofa plastic pipe production facility.When the failure rate follows an exponential and Weibull timedistribution, the plastics pipe manufacturing plant's reliability has been assessed.The mean timeto failure, which is another important characteristic of reliability, has also been analysed. In thispaper Boolean function technique is used to solve the model and at last some particular cases aretaken and solve them using Matlab tool.

Keywords: Boolean Function Technique , Reliability, Cost, MTTF, Matlab Tool.

A SUSTAINABLE PRODUCTION-INVENTORY MODEL CONSIDERING PARTIAL OUTSOURCING AND VARIABLE DEMAND

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A sustainable production system is much more important from social, economic andenvironmental points of view. It is widely observed during the Covid-19 pandemic situation.The demand for essential goods in the business sector is always changing due to unavoidableconditions. The proposed study introduces variable demand for controlling the fluctuatingdemand. However, reworking produced defective products makes the production model moreprofitable. Partial outsourcing of the good quality products has made the production systemmore popular and profitable. Separate holding cost for the reworked and produced productsare very helpful for the proposed model. Moreover, energy consumption for various purposesis considered here to make the model more realistic. A separate green investment makes themodel more sustainable and eco-friendly. The model's main focus is to find the maximumprofit by considering the decision variables such as lot size quantity, average selling price,and green investment. The classical optimization technique is utilized here for optimizing thesolution numerically and theoretically. The model is rendered more realistic through concave3D graphs, different examples, and sensitivity analyses. Furthermore, managerial insightsfrom this study can be used for industry improvement.

Keywords: Sustainability; Production; Inventory; Outsourcing; Variable demand

MUTUAL IMPACT OF INFECTION, HARVESTING, AND MARKET DEMAND IN A BIOECONOMIC MODEL

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Parasitic infection and drastic harvesting are tremendous stress on the global fishery. Overexploitation is one ofthe most esoteric factors of such pressure. Significant maintenance and scientific understanding of fisherydynamics is a footstep in a long-term sustainable fishery. This work elaborates on a qualitative study of abioeconomic fishery model in the presence of infection. The model explores four rate equations: the susceptiblefish, infected fish, harvesting effort, and market price. Fish harvesting follows the traditional catch per unit effort(CPUE) hypothesis, and the market price varies with the demand-supply phenomenon of the open market. Thelocal and global stability analyses are implemented by applying Routh-Hurwitz and high-dimensional Bendixsoncriteria. The single and two parameters bifurcation result describes various regime shifting, including disease-free,endemic and harvesting-free states. In the disease-free steady state, the total amount of harvested fish is superior to the endemic constant state under increasing transit rate. However, the consequence is contrary under thrivingenvironmental carrying capacity. The simulation result reveals that the infection can invade a host at a higher levelif demand decreases. The fisherman's earnings are maximum in a disease-free state when the demand issignificantly high.

Keywords: Bioeconomic model; Harvesting; Infection; Variable demand; Price

A HYBRID CHANNEL IN A TWO-ECHELON SUPPLY CHAIN MODEL UNDER CORPORATE SOCIAL RESPONSIBILITY

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Nowadays, industries are passionate about global warming and producing green products to save the environment. Atwo-echelon supply chain model is investigated in the study where green products compete with substitutable regularproducts. Firm 1 and Firm 2 produce green and traditional products, respectively. Firm 1 and Firm 2 sell their productsthrough three different channels, namely online, online, and buy- online-pickup-in store (BOPS), with three differentselling prices. A hybrid channel policy is studied here to maximize the total profit with considering corporate socialresponsibility. The study is analyzed in a decentralized and centralized system. A numerical analysis shows that thecentralized system gives a better result to the firm. A classical optimization technique is applied here to find out theoptimum result of procurement cost, selling price, and green level development cost.

Keywords: Selling mode; green product; regular product; price competition; corporate social responsibility.

A REVERSE SUPPLY CHAIN MANAGEMENT OF ELECTRONIC PRODUCTS FOR NULLIFYING E-WASTE

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The material structure of E-waste is complicated, encompassing both environmentally hazardous chemicals and valuablevital raw resources. The framework of reverse logistics (RL) for e-waste/ waste electronic equipment is essential tominimize the impacts of their inappropriate disposal. The current study focuses on the nullification of e-waste generatedafter the end-of-life (EOL) of a product. The proposed mathematical model consists of multielectronic products, multimanufacturers,and multi-retailers and after the end-of-life of the product, the reverse supply chain network collects theE-waste and repair and recycle it. The equipment which is not repaired/recycled is sent to the secondary manufacturer asraw material, resulting in the nullification of e-waste. An algebraic technique is used to find the model's global optimumsolution. The proposed model minimizes the total supply chain cost. The proposed policy suggests the e-wastenullification strategy, which might be a useful tool for managers in ensuring long-term sustainability.

Keywords: Reverse logistics, E-waste, Supply chain management, Waste nullification, EOL-products

BRAIN TUMOR MR IMAGES CLASSIFICATION USING DEEP LEARNING TECHNIQUES

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Brain tumors are very hazardous for a patient whether it's a malignant or benign syndrome, which drags to a minutely minuscular life cycle to the highest degree. So, the treatment is a very consequential way to boost the life of expectancy. Brain tumor classification is a very critical step after detection of the tumor to be able to attain an effective treatment plan. A brain tumor occurs owing to the uncontrolled and rapid growth of cells. If not treated at an initial phase, it may lead to death. Despite many significant efforts and promising outcomes in this domain, accurate segmentation and classification remain a challenging task. A major challenge for brain tumor detection arises from the variations in tumor location, shape, and size. So, Early detection not only helps to come up with better medications, but it can also save a life in due time. This paper aims to increase the level and efficiency of MRI machines in classifying brain tumors and identifying their type of brain cancer. We classify brain cancer using different types of CNN and Deep learning algorithms. We have trained our brain tumor dataset using CNN (Convolutional Neural Network using ReLU activation function), ResNet50, and Vgg16. The F1-scores measure unseen images at almost 96%. This accuracy has a positive impact on the early detection of tumors before the tumor causes physical side effects, such as paralysis and other disabilities.

Keyword: Brain Tumor, Artificial Intelligence, Deep Learning, Biomedical Informatics, Brain MRI Classification, CNN.

EVOLUTION OF NEO-BANKING IN INDIA

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A neobank is a fintech firm that provides digital services like payments, debit cards, money transfers, lending, and more. Fintech (financial technology) is the term used to describe any technology that delivers financial services through software, such as online banking, mobile payment apps, or even cryptocurrency. The term “digital bank” and “neo bank” are sometimes used interchangeably, but “digital bank” is often the online-only subsidiary or strategic business unit, on the other hand, a neo-bank exists either in partnership with traditional banks or independently online without any physical branches. The concept of Neo banks has been materialized between the years 2013-2015. However, the term neo banking has been coined in the year 2017. In India, the concept has been relatively new. The forerunners of neo-banking were from the UK (Monzo) and Germany (N26). Neo banks in India do not have a license of their own therefore the neo bank start-ups have partnerships with traditional banks. An example would be Fi- Secure digital banking Services which is partnered with federal bank. In recent years, COVID-19 has accelerated the transformation of banking systems all over the world, and India with its 2nd largest base of internet subscribers offers a large market in digital banking. Currently, neo banking in India is at a budding stage, the precondition for the success will depend on how innovative the fintech companies will get in creating new revenue streams and acquiring users with high lifetime value.

Keywords: Neo Bank, Fintech, partnership.

AI-ENABLED AGRO-ALLIED TRADE REORIENTATION IN SRI LANKA

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External sector resilience is crucial in a free market because it can create a significant rippleeffect on macro-economic balance, similar to the exceptional crisis in Sri Lanka. When the island regained its freedom from the Britons, it used to be an agrarian society. Tea, rubber, and coconut used to form nearly 90% of the total export value. Unfortunately, this industry issequentially losing ground. It's time to reclaim its former glory. To sustain the risk associatedwith global conditions exporters must ensure development as well as diversificationapproaches. Such as value addition to food, beverages, spices, or concentrates. This researchaims to locate agro-allied fields that can be promoted in an international setting. We areusing Sri Lankan Central Bank Annual Reports, various global trade online databases to explore agro-food trade possibilities. We present a distinctive two-stage hybrid forecastingframework centered on wavelet transformations and K-means algorithms model. Here, theappropriate data has been identified based on the wavelet transform. Upon sorting the dataset,it uses the k-means technique to compute clusters from the agriculture sectors. Therefore byapplying a hybrid AI model we uncover agro-allied fields' trade perspective that can raise itsshare in Sri Lankan GDP.

Keywords: Agro - allied Trade, Wavelet Transformations, K-means, GDP

SUBLUMINAL PROPAGATION OF LIGHT IN QUANTUM DOTS

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In this article we present a theoretical investigation of subluminal propagation of light in a three-level quantum dots system under electromagnetically induced transparency (EIT). A weak probe laser pulse is made to interact with a strong control laser beam through ladder-type excitation configuration to form an EIT window. The EIT facilitates the quantum dot system with lowering of linear absorption and reduction of group velocity of the weak probe beam as low as 105 m/s. The intensity of control laser field is found to have a great control on lowering of the group velocity which can be shifted at any desired probe frequency. This investigation may have potential applications in optoelectronic and photonics devices.

Keyword: Quantum Dot, Electromagnetically Induced Transparency, Slow Group Velocity.

PHASE DEPENDENT KERR NONLINEARITY IN SEMICONDUCTOR QUANTUM WELLS

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The large Kerr nonlinearity arising due to the interaction of optical fields with semiconductor quantumwells are intensively studied because of their potential applications in nonlinear optics. In this study of the third-order nonlinear susceptibility leading to the Kerr nonlinearity has been investigated in a three-level asymmetric semiconductor double quantum well with ladder type closed loop excitation scheme under the regime of electromagnetically induced transparency. The existence of large third-order susceptibility of the order of 10−11 $m2/V2$ has been identified in this system. The magnitude of the Kerr nonlinearity varies with the variation of the relative phase between the probe and control laser fields, and by tuning the relative phase, the Kerr nonlinearity can be shifted to any desired value with respect to the probe frequency. These results may have potential applications in nonlinear optics.

Keywords: Semiconductor Quantum Wells; Electromagnetically Induced Transparency; Kerr nonlinearity; Relative Phase.

DISCONNECTED EVEN SUM GRAPHS

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A graph G is called an even sum graph(ESG) if there is a labeling η of its vertices with distinct non – negative even integers, so that for any two distinct vertices a and b, ab, is an edge of G if and only if η(a) + η(b) = η(c) for some vertex c in G. The minimum number of isolated vertices required to make a graph G, an even sum graph is called the even sum number of G and is denoted by γ (G).

Keywords: star graph, path, corona, comb, cycle.

APPLICATION OF TRANSPORTATION PROBLEM

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In any kind of business, minimizing the cost of transport is not easy. In this study, we deal withthe cases of minimizing the total transportation cost from different sources to differentdestinations. An application of Operation Research cracks this type of cost complexity facedduring transportation. This application is Transportation problem and is a special case of LinearProgramming Problem. Transportation Problem minimizes the total cost of transport of a singleproduct from different origins to different destinations e.g. warehouses, shops, stores, etc., andnot of any single warehouse or shop. The objective is to determine about how many units totransport such that the total cost is minimum. The study is by default based on the condition thatthe total demand of the product in different destinations is equal to total availability of theproduct in different destinations. Also, we consider that the cost of transporting one unit ofproduct from various sources to various destinations is known previously and also it is constantfor all origins. The applications of transportation are mainly in the field of import and export,airline industry, Research and Development, transshipment, etc.

Keywords: Demand, Supply, Availability, Destination, Cost

FINANCIAL INCLUSION AS PANACEA TO ECONOMIC PROBLEMS: A SYSTEMATIC LITERATURE REVIEW

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This study examines the phenomena that the concept of financial inclusion is indispensabletool for solving economic problems in the world economy. The systematic literature review(SLR) approach and Prisma model method are used to collect the evidences that how financialinclusion proved to be as panacea for economic problems like: poverty, unemployment,economic growth & Development, Gender discrimination, Income inequalities etc. fromvarious economies around the world. The Scopus database is used for selecting the literatureon different aspects of a countries economy from the year 2002 to 2022.The Government/policy makers or researchers in every country are suggesting measures toincrease financial inclusion in their country so that Sustainable development goals (SDGs)agenda 2030 could be achieved where eight out of seventeen Sustainable development goalsare based on financial inclusion levels only. This study also outlines how to measures thefinancial inclusion levels across the world and also suggests that all formal financial servicesother than banking services should be considered while measuring the financial inclusion inany country.This study helps us to ascertain that how to measure the financial inclusion by using variousmethodologies, dimensions and indices of financial inclusion, what factors affect the levels offinancial inclusion in a country and how increased levels of financial inclusion are providingsolutions to the economic problems in a country.

Keywords - Financial inclusion, Banks, Financial services, Economic growth, Incomeinequality.

AN ONTOLOGY AND NATURAL LANGUAGE PROCESSING BASED AI FRAMEWORK FOR ANALYZING THE MEDICAL RESEARCH LITERATURE

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Reviewing medical research literature is a crucial step in the scientific process of determining the cause, genesis, andtherapy options for a condition. For novel disorders, such reviews of research work in literature are hardly available.In such circumstances, researchers devote a significant amount of time to locating, classifying, and analyzing datafrom multiple sources. Massive amounts of heterogeneous data, natural language processing tools, and linked medicalcondition ontologies have just been available and giving analysts and researchers new options. In this paper, we presentan ontology-driven framework based on natural language processing that can adapt and integrate multiple advancedmachine learning techniques, provide a detailed review of user query-based selection of the research title, filtration of corresponding detailed research abstract, and identifying the relations in the text based on ontologyand user queries. Our methodology and approach can be used to construct a comprehensive framework for analyzingmedical research literature using ontology and natural language processing, which has the potential to reduceresearcher workload.

Keywords: Medical Research, Literature Review, Ontology; Identifying Relations; Machine Learning; NaturalLanguage Processing.

INVENTORY MODEL FOR DETERIORATING ITEMS WITH FIXED SHELF LIFE USING LINEAR DEMAND IN FUZZY ENVIRONMENT

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In this inventory model for deteriorating model we study model having shortages under partialbacklogging using linear demand and fixed shelf life in fuzzy environment. The aim of present study is to minimize the optimal cost function in fuzzy environment using three methods namely, graded mean representation method; signed distance method and centroid method are used to defuzzify the total cost function. Later on defuzzification of the total cost is carried out with the help of triangular fuzzy numbers. In the last section, numerical is carried out and sensitive analysis is done

Keywords: inventory, partial backlogging, fixed shelf life, triangular fuzzy numbers, graded mean representation method, signed distance method and centroid method

ROOT HAIR ALGORITHM (SI)

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Swarm Intelligence (SI) is a group direct search algorithm which are developedby observing the intelligence present in nature. There are several SIalgorithms developed in the field of soft computing such as particle swarm algorithm(PSO), Honey Bee Optimization (HBO), Cuckoo Search Algorithm(CSA), etc. In this paper, we made an attempt to develop a SI algorithminspired from the root hair searching underground water. In order to validatethe algorithm, 15 experimental problems are selected and the result obtainedin each of the problem are compared with the solution obtain by Genetic Algorithm(GA), Particle Swarm Algorithm (PSO), Differential Evolution (DE)vand Ant Colony Algorithm (ACO).

Keywords: SI, Root Hair Algorithm (RHA), PSO, ACO, GA, DE

APPLICATION OF FIXED POINT IN FUZZY THEORY

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In 1965, Zadeh introduced the concept of fuzzy sets. The concept of fuzzy sets is being usedextensively by economists, biologists, engineers and many others who use mathematicalmethods in their work. Ponsard discussed the application of fuzzy metrics to the problems ineconomics. Indeed, imperfect, and imprecise information is a part of many real-worldproblems, and human effort to model this information is leading to develop new analysis.Intuitionistic approach to fuzzy sets appears as a new trend in analysis to encompassuncertainties and deal with imprecision rather more successfully.

Keywords: fuzzy sets, imprecise information, fuzzy metrics

CLASSIFICATION OF COVID-19 DISEASE USING DEEP NEURAL NETWORK

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The corona virus was spreading rapidly around the word that is very serious problem for human being. It effectsthe public health, daily life of people and global economic of world. It is very big challenges for doctors andmedical students to detect the positive cases as soon possible and prevent the further spread of covid19 disease.In this research work, we have used deep learning technique for classification of covid19 disease with chest Xrayimages. The deep learning technique plays very important role to develop the robust model for classificationof the covid19 disease with chest X-ray Images. This research work proposed special type of deep learningtechnique that is convolutional neural network (CNN) to classify the covid19 disease with chest X-ray images.We have analyzed the CNN model with different tuning parameter and compared the performance of proposedCNN with Relu, Sigmoid and Tanh activation function. The proposed CNN model achieved satisfactory accuracy with Relu activation function in case of 100 epochs.

Keywords: Deep Neural Network, Convolutional Neural Network (CNN), Classification, Activation Function,Covid19 Disease.

A REVIEW OF MACHINE LEARNING AND DEEP LEARNING ALGORITHMS ON IMAGE PROCESSING IN MEDICAL DIAGNOSTICS

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In medical science, identification of the stage of severe disease will help the doctor for the besttreatment of the patient. Reports of the blood sample are a common way to find facts about the status of the disease. In the recent world, the use of CT-Scan, MRI, and images of blood samples is highly referred by doctors because analysis of medical images improves the prediction accuracy. In the research domain, several researchers have suggested multiple Machine Learning (ML) and Depp Learning (DL) techniques for image processing to achieve higher accuracy in images processing. Multiple authors used ML and DL techniques, for the classification, analysis, and prediction of image processing, implemented in Python Software. Some authors suggest an ensemble model by integrating feature selection and classification techniques for improved prediction. In this paper, we are reviewing ML and DL-based multiple research articles used for image processing, especially in medical diagnostics.

Keywords: Classification, Deep Learning, Machine Learning, Image Processing, Medical Diagnostics.

MANAGEMENT OF MUNICIPAL SOLID WASTE WITH REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)

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The majority of municipal solid waste comes from households, which is an inevitable component of daily living. With rapid expansion in population and urbanization over the last few years, the matter of solid waste production has escalated, particularly in developing countries. The municipal authorities struggle with some of the most arduous environmental issues, including the management of urban solid waste. Managing solid waste is a key element of resolving this challenge at economic, social, and environmental levels. So far, as much research is done, the word “efficient” seems to be missing from a majority of the Municipalities' run management and solutions. The handling of Municipal Solid Waste is a collaborative task that subsumes a myriad of elements like segregation of trash on-site, storage in waste bins, waste collection, transfer of waste, processing, waste-to-energy recovery, and disposal to a dumpsite, ultimately. Each element's efficacy is reliant on the efficacy of the chain's other components. The poor management of all the elements and discarding the waste in an unplanned way ultimately leads to environmental damage and a threat to human health. All these factors are not necessarily to work efficiently, however using Remote Sensing and Geographical Information System; the system could be optimized up to a higher extent in all aspects. The application of geographic information systems has been beneficial to boost the efficiency, cost-benefit, and time-saving capabilities of the system while reducing the workload. It also serves as a tool for making decisions about how to manage Solid Waste in cities.

Keywords: Environmental problem, Municipal solid waste management, Remote sensing, GIS, Global challenge

A COMPARISON OF FORECASTING ACCURACY OF THE BOX-JENKINS ARIMA, NEURAL NETWORKS VERSUS HIGHER ORDER MARKOV SERIES MODELS FOR PREDICTION OF ANNUAL RAINFALL

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This paper examines the forecasting performance of the Autoregressive Integrated Moving Average (ARIMA) model, artificial neural networks (NNs) and Markov chain model via fuzzy time series for annual rainfall in Tamil Nadu, India, over the period 1981-2020. The Box-Jenkins method of fitting the ARIMA is widely regarded as the most popular time series forecasting technique. However, like many traditional techniques for time series predictions, ARIMA assumes that the series are generated from linear processes and as a result might be inappropriate for most real-world problems. On the other hand, artificial neural networks (ANNs) have been found to be very efficient in predicting both linear and nonlinear time series. In particular, the neural networks (NNs) method is a data driven approach which is trained to map past values of a time series based on weaker assumptions, i.e., without prior knowledge of the system being modelled. For comparison, Higher-order Markov Markov chain model via fuzzy time series is also considered. In fitting time series data, if the correct order of a Markov chain model is determined the model should predict with greater accuracy. . Estimation of all the model parameters is via the maximum likelihood method. The forecast accuracy of the three models is performed using the mean squared errors (MSE) criteria. Empirical results obtained reveal that the NN model provides the highest accuracy in forecasting rainfall compared to the ARIMA and Higher-order Markov chain models.

Keywords: Rainfall, Time series forecasting, ARIMA, Neural Networks, Higher-order Markov chain Chain

A MARKOVIAN QUEUEING INVENTORY SYSTEM M/M/1/N UNDER (r, Q) POLICY AND IMPATIENT CUSTOMERS

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A Markovian queueing inventory system (QIS) that is, M/M/1/N operates on a policy of ordering (r, Q). An inventory warehouse is attached to the single server and limited capacity M/M/1/N service facility. Placing an order is triggered when the number of shares drops to 'r < Q' for a fixed number of Q units. Order replenishment time (i.e., delivery time) are all equally and exponentially distributed at a rate of γ, and queue discipline follows the "first come, first served (FCFS)" rule. For each customer request, one unit (from non-empty stock) is sold. This QIS unconditionally acknowledges the customer's impatience and does not allow the customer to join the queue when (i) finds N (full capacity) customers in front and ii) the warehouse is empty. Each client chooses a deadline time such that the relative deadline period follows an exponential distribution with the rate 'α' and a QIS exit is possible even during the period of its ongoing service. The times between successive arrivals and the service times of customers are assumed to follow independent exponential distributions with the parameters λ and μ respectively. Expressing a sequence of queue lengths observed at time 't' in terms of X(t) and another sequence of observed on hand inventory level at time 't' in terms of Y(t), we show that general process $\mathbf{Z} = (\mathbf{X}, \mathbf{Y}) = \lim_{t\to\infty}(\boldsymbol{X}(t), \boldsymbol{Y}(t))$ forms a Markov process on the state space Ω = {(n, j) ; n = 0, 1,…, N, j = 0, 1,…, Q}. Then the steady-state distribution of process **Z** is obtained by the method of matrix analysis. An optimization problem is formulated including ordering cost, maintenance cost and waiting time cost and the same problem is solved to find the optimal value of Q that minimizes the total expected cost. Finally, we also numerically compare the optimal policy studied with those that ignore the customer's impatience.

Keywords: Queueing inventory system, impatient customer, queue length process, inventory process, joint process Z, Optimization problem, total expected cost

A BIRD EYE REVIEW ON SOFT COMPUTING AND OPTIMIZATION TECHNIQUES FOR PATTERN RECOGNITION

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The word “pattern” consists of various types of the data’s like : audio files, video files, image files, character file, digit files, voice or speech files, handwritten characters file, handwritten digits file etc., and the term pattern recognition is collectively used for recognition of any one of the type of data. There are lots of soft computing techniques that have been used for recognition of different type of patterns. Soft computing techniques like Machine Learning (ML) and Deep Learning (DL) play important role for classification and prediction. Some researchers also applied optimization techniques for optimizing the features of patterns. In this paper, we have reviewed more than 50 papers in the field of pattern recognition using ML and DL. We have also reviewed some of papers where integration of feature selection, optimization and classification techniques is applied for pattern recognition to achieve higher recognition rate.

Keywords: Deep Neural Network (DNN), Machine Learning (ML) and Deep Learning (DL), Pattern Recognition.

ACCIDENT- AVOIDANCE SYSTEM DUE TO SOMNOLENCE ANDALCOHOL FOR SAFE DRIVING

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As transported by trucks or other heavy- duty vehicles on long roads (mainlythrough the night), the effects of insufficient sleep can be a major concern for many vehicledrivers engaging in continuous driving, adding to serious crashes leading to increased lifedeathcircumstances. We recommend an innovative system to decrease such incidents. Ourbuilt model will minimize the chances of car accidents induced by drowsiness or drunkdriving. Our device will use the requisite sensor along with other electronic components,RASPBERRY Pi board and ARDUINO NANO. Through placing the corresponding deviceon the driver's wheel or elsewhere closely monitoring the driver's breath, the driver's breathmay be monitored constantly. This machine tracks driver's eye movement. If it suspects thedriver has fallen asleep, then an alarm is prompted in the form of a sound to get the individualback into focus and if the driver is seen driving being drunk, our device can sense it and alertthe driver as well as shut down the vehicle's engine using relay module thus Lowering theaccident chances.

Keywords: Alcohol detection, RASPBERRY Pi, alcohol sensor, DC motor, relay module.

COMPARATIVE STUDY OF MACHINE LEARNING CLASSIFIERS FOR THE PREDICTION OF RICE PLANT DISEASE

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The climate change causes much impact in plants, crops and herbs. Due to that, many crops are susceptible to different types of diseases. Rice crops have emerged as one of the most important energy sources for resource creation in recent decades. In the future of agriculture, it is thought that rice plant diseases will play a larger role in societal, economic, and agricultural losses. For the past 12 years, researchers have been considering how to identify plant diseases using image processing methods. In a wide range of crops, a number of rice disease detection, identification and quantification approaches have been developed and implemented. This research compares and analysed the performance of commonly used machine learning classifiers such as support vector machine (SVM), twin SVM (TWSVM), k-nearest neighbour (k-NN), logistic regression, random forest, decision tree, extreme learning machine (ELM), naive bayes classifier, and stochastic gradient descent (SGD). The experimentations are performed using rice leaf diseases data set. Classifiers were compared using various evaluation metrics: accuracy, F1-score, precision, recall, and receiver operating characteristic curves.

Keywords: support vector machine, rice disease, extreme learning machine.

A NOVEL HYBRID ENSEMBLE BASED MODEL FOR FORECASTING EARTH SKIN TEMPERATURE USING DEEP AND MACHINE LEARNING TECHNIQUE

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Earth Skin Temperature (EST) is the physical temperature of the earth's surface. The EST is considered an essential variable for various applications such as agriculture and energy harvesting. Therefore, there is a need for accurate prediction of EST for proper utilization of solar resources. This research proposes to analyze the earth's skin temperature in three stations of Odisha (an eastern state in India) namely- Puri, Bhubaneswar, and Cuttack with 42 years of daily EST data by using a new model of design called XGBoost- Conv1D-GRU-Conv1D-LSTM Ensemble network (XCCENet). The XCCENet is a hybrid ensemble network which is a combination of XGBoost, convolutional 1D bidirectional gated recurrent unit (1-Conv1D-2-BiGRU), and convolutional 1D-bidirectional long short-term memory (1-Conv1D-2-Bi-LSTM). Further comparing the proposed XCCENet with other models such as XGBoost, Conv1D-Bi-GRU, and Conv1D-BiLSTM network. This study analyzes the reliability of selected models with the help of various evaluation parameters. The outcomes of this research suggest that the proposed XCCENet performs the best for accurate prediction of EST.

Keywords: Earth Skin Temperature; Deep learning; XGBoost; Conv1D Bi-LSTM; Conv1D-Bi-GRU

A SURVEY: LEAF DISEASE RECOGNITION

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The identification of leaf disease is a crucial as well as important task as it is directly related to agricultural and economic prosperity. We have gone through several research papers from June 2010 to July 2022 and summarize various machine learning based models such as Support vector machine (SVM), variation of SVM such as twin support vector machine (TWSVM), decision tree (DT), random forest (RF) to obtain successful classification result of infected leaves. Moreover, two variations of SVM and TWSVM models have been implemented by introducing universum data such as USVM and UTWSVM to observe classification outcomes. In this paper we describe each and every step of leaf disease detection technique such as image acquisition, image resizing, image segmentation, feature extraction or feature selection and image classification techniques that knowledge has been gathered from previous studies. Models using U-TWSVM, USVM, TWSVM and SVM have shown significance results for their powerful capabilities and values lie closer to measured value. Performance of those algorithms are evaluated by applying various performance parameters namely accuracy, precision, recall, f-score etc. This review becomes significant and beneficial resource to readers who want to work on this research field. This survey work focused on the researches between June 2010 to July 2022.

Keywords: Leaf disease, SVM, TWSVM, machine learning

PARAMETRIC OPTIMIZATION IN THE MACHINING COMPOSITES USING ANN

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The quality of the machining process depends on cutting conditions, workpiece material and machinability. Aluminum boron composites with higher boron carbide particle size with the addition of strontium were processed by the stir casting method. The influence of turning parameters like cutting speed, feed, and depth of cut on cutting force and surface roughness were investigated in this current research. Multimodal fine grain polycrystalline diamond insert was used machine the composites with medium duty lathe. The prediction of responses was carried out by the ANN technique using MATLAB software. The functions like LOGSIG and PURELIN are effectively used to approximate any function. The algorithm uses the gradient descent technique and reduces the mean square error between actual network outputs with desired output pattern. The performance of ANN is indicated by producing a mean square error and regression plots. The ANN model consists of a multi-layer feed-forward, trained by a back propagation Levenberg–Marquardt algorithm. ANN effectively predicted the optimum conditions for responses with very less MSE values. The less error between the predicted and experimental shows the model is more accurate. ANN predicted the optimum conditions for surface roughness and cutting force effectively with MSE 0.00677 and 0.05799 respectively. The overall regression coefficient obtained from the ANN model is 0.9832. Hence the prediction performance of the model by the ANN technique was highly accurate. The results of the ANN model developed indicate clearly that ANN can be used successfully for predicting the prediction of cutting force and surface roughness. Also, optimal cutting conditions are suggested for machining.

Keywords: MMC, Machining, DOE, Optimization, ANN, BPNN.

AN ANALYTICAL STUDY OF THE CHANGES IN THE BUYING BEHAVIOUR IN POST COVID-19

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The upheaval caused by the COVID-19 pandemic has been once in a century kind of event that has disrupted every aspect and realm of life, infecting millions and killing droves of people. The buying behavior has not been an exception to the same. Buying behavior can be understood as a psychological strand that refers to the customers' personalities and their way of purchasing. The concepts of lockdown, social distancing, and isolation became the new normal in the changed scheme of things, which have affected buying behavior in a decisive manner. For conducting the research work, the online survey method was resorted to capture the opinion of the target audience. The results indicated that the pandemic has brought about many changes in buying behavior. The two major changes include- the migration of the customers to the online platforms and secondly, a deep & strong sense of social responsibility on the part of the customers drove them to prefer purchasing online to avoid the spread of possible infection associated with physical movement to the retail shops.

Keywords: Digital, Buying Behaviour, Responsibility, Online Shopping, Social Distancing

MANAGEMENT OF MUNICIPAL SOLID WASTE WITH REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)

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The majority of municipal solid waste comes from households, which is an inevitable component of daily living. With rapid expansion in population and urbanization over the last few years, the matter of solid waste production has escalated, particularly in developing countries. The municipal authorities struggle with some of the most arduous environmental issues, including the management of urban solid waste. Managing solid waste is a key element of resolving this challenge at economic, social, and environmental levels. So far, as much research is done, the word “efficient” seems to be missing from a majority of the Municipalities' run management and solutions. The handling of Municipal Solid Waste is a collaborative task that subsumes a myriad of elements like segregation of trash on-site, storage in waste bins, waste collection, transfer of waste, processing, waste-to-energy recovery, and disposal to a dumpsite, ultimately. Each element's efficacy is reliant on the efficacy of the chain's other components. The poor management of all the elements and discarding the waste in an unplanned way ultimately leads to environmental damage and a threat to human health. All these factors are not necessarily to work efficiently, however using Remote Sensing and Geographical Information System; the system could be optimized up to a higher extent in all aspects. The application of geographic information systems has been beneficial to boost the efficiency, cost-benefit, and time-saving capabilities of the system while reducing the workload. It also serves as a tool for making decisions about how to manage Solid Waste in cities.

Keywords: Environmental problem, Municipal solid waste management, Remote sensing, GIS, Global challenge

IMPACT OF ENTERTAINMENT TECHNOLOGY ON PUBLIC AND PRIVATE SECTOR EMPLOYEES

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The use of social technology is becoming more common in a few organisational activities, as well as human resource management. We will look at some of the advantages and disadvantages of entertainment and social behaviour in general. Many debates have taken place over the good and negative effects of entertainment technology on human behaviour; as a result, we shall concentrate on the positive aspects of entertainment technology. The beneficial impact of entertainment technologies on public and private sector employees is the primary focus of this research. It is the purpose of this article to provide and discuss a first basic overview of the positive effects of entertainment technology on employees. In this research, an observational plan is used to track the behaviour of representatives, with entertainment technology serving as the autonomous variable and the representative's conduct objective or execution serving as the dependent variable. Segregation variables include elements such as age, gender, orientation, public and private areas, and lengthy periods of employment. In order to choose samples, specified irregular inspecting was used in conjunction with a normalised apparatus, which collected information from 440 public and private entities in Karnataka. In order to explore the material, spellbinding and inferential insights were used. The findings revealed that entertainment technology had a favourable impact on the execution expectations and exertion expectations of representatives from both the commercial and public sectors. The administrative repercussions of the findings are discussed, as well as suggestions for future examinations,

Keywords: Demographic profile, Entertainment technology, Public & private sectors

ON A NOVEL COMPLEMENTARY DUAL OF FUZZY ENTROPY

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Fuzzy entropy is a measure of ambiguity/vagueness contained in a fuzzy set whereas fuzzy knowledge measure acts as the complementary dual of fuzzy entropy and quantifies the amount of precision in a fuzzy set. A fuzzy knowledge measure produces better computational results to capture the linguistic precision in a fuzzy linguistic knowledge-base. In this paper, we axiomatically derive a knowledge measure for a fuzzy set establish its relationship with fuzzy similarity and distance measures. We also verify the valuation property; investigate the performance of the proposed measures for weight computation of attributes in multi-attribute decision making (MADM) problem and in ambiguity computation of fuzzy sets. The proposed measure exhibit the encouraging and better performance than the conventional fuzzy entropy measures in certain situations

Keywords: Fuzzy set, Fuzzy Entropy, Fuzzy Knowledge measure, Linguistic hedges, MADM

DISTANCE MEASURE BASED ON SINGLE-VALUED NEUTROSOPHIC SETS AND ITS APPLICATION TO PATTERN RECOGNITION

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As an extension of fuzzy sets and intuitionistic fuzzy set, single-valued neutrosophicsets (SVNSs)considered as a powerful tool for dealing with uncertain and indeterminate information. Distance measure, entropy measure, divergence measure and similarity measure are prevalent notions to compare the two vague or uncertain frameworks. In this paper, we propose a new distance measure based on SVNSs and also study some theoretical properties. There are numerous applications of distance measure in SVNSs such as in multi-criteria decision-making problems (MCDM), pattern recognition and medical diagnosis etc. We discuss the application of our proposed measure in pattern recognition. The empirical comparative assessment shows the encouraging performance of the proposed SVN distance measure.

Keywords: Fuzzy sets, Intuitionistic Fuzzy set, SVNSs, Pattern recognition, Distance measure

A NOVEL INTUITIONISTIC DUAL PROXIMITY MEASURE FOR INTUITIONISTIC FUZZY SETS

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This paper derives a new intuitionistic valued dual proximity measure for an intuitionistic fuzzy set. The novel measure receives output in the form of an intuitionistic type, in which the first value is similarity and the second value is dissimilarity. We call this measure an intuitionistic type because the sum of the similarity and dissimilarity is less than or equal to one. To derive such a measure, we first extend the notion of restricted equivalence functions into intuitionistic restricted equivalence functions. We obtain a group of intuitionistic restricted equivalence functions by investigating several general results. The aggregation of intuitionistic restricted equivalence functions leads to the formation of such measures. Such a measure inspects some ignored concepts of similarity and dissimilarity together and may provide better results in real-life problems.

Keywords: Intuitionistic fuzzy set, Intuitionistic restricted equivalence functions, Dual proximity measure

A REVIEW OF CHITIN AND CHITOSAN APPLICATIONS IN BIOMEDICAL AND AGRICULTURAL INDUSTRIES

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Chitin has received much attention in recent decades, and its applications in industry and basic science have been thoroughly researched. Chitin is a polymer that is non-toxic, biocompatible, and biodegradable. Furthermore, unlike proteins and nucleic acids, it has no immunogenic or carcinogenic properties (Kim, 2014). Moreover, the Food and Drug Administration has approved chitin as a safe food and drug substitute, making it a very appealing and promising food science polymer (Kim, 2014; Gupta, 2011; Dutta, 2016; Kritchenkov et al., 2021). Because of its antibacterial and antifungal properties, chitin can be used to manufacture edible food films and coatings (Khattak et al., 2019; Kritchenkov et al., 2021). Furthermore, chitin and chitosan have been utilized in a wide range of applications such as wastewater treatment (Liang et al., 2015; Yong et al., 2013), agriculture (Huang et al., 2020; Wang, 2012), fabric and textiles (Negm et al., 2020), cosmetics (Prabaharan and Mano, 2006; Tanida et al., 1998), nutritional enhancement, and food processing (Muzzarelli et al, 1997). The goal of this review is to dig deeper into the uses of chitin and chitosan. This intriguing subject's new and prospective techniques are thoroughly described based on current research and existing products. The purpose of this study is to learn more about the applications of chitin and chitosan. This fascinating area's new and future techniques are clearly presented based on current research and actual products.

Keywords: Chitin, Chitosan, Biomedical, Agricultural

TEXT PREDICTION TECHNIQUE IN INDIAN LANGUAGE USING MACHINE LEARNING APPROACH

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Text prediction is a most challenging task in Natural Language Processing. This challenge becomes more complicated when a user dealing with an Indian Language. Indian languages are coded with Unicode in 16-bit format, and they are more inflectional in nature whereas English is coded with ASCII code in 7-bit structure. In text prediction system, while users are typing a word or sentence, some probable combinations of words are suggested by the system making the sentence simpler and time saving. The aim of this paper is to introduce different methods (specially Hidden Markov Model) of text prediction by making a large dictionary of probable combination of Assamese words.

Keywords: Text prediction, Natural Language Processing, Machine Learning, HMM

ROLE OF BLOCKCHAIN TECHNOLOGY IN GROWTH OF E-COMMERCE: EVIDENCE FROM INDIA

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Nowadays blockchain technology is considered a new innovation in the technical world. In simple terms, blockchain means a different block that is connected with a chain and no one can interrupt this chain. These blocks stores data and information. Blockchain technology is a highly secured technology in the web area. The focus area of this paper is the potential implications of blockchain technology in E-commerce. The study will emphasize the role of blockchain technology in the growth of E-commerce. Blockchain technology adopted due to many reasons like cost-saving, faster transactions, better consumer experience, and many more. Blockchain will be an integral part of E-Commerce in near future.

Keywords: Financial Technology, Blockchain Technology, Decentralized Technology, E-commerce

AUCTION GAME OF AGRO-PRODUCT UNDER COBWEB PHENOMENON OF SUPPLY AND DEMAND

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Auction of agro-product between buyers and a farmer deal with first-price auctions in the situation of the price convergent cobweb model of supply and demand. The first price bidding auction lies in the neighborhood of a balanced price of the indivisible agro-product. The selection of bid price holds the Weibull probability density function. We measure the available agro-product at the balance point of demand and supply which is associated with the balanced price. And a new computational approach has been employed to obtain the optimum expected bidding value to get the win as well as the expected revenue earned by the farmer in the first price auction of agro-product under cobweb nature price fluctuations.

Keywords: Agro-product, Cobweb phenomenon, First-price auction, Weibull distribution, Inventory level

THE IMPACT OF NON-TRADITIONAL TEACHING AND LEARNING AT A MINORITY INSTITUTION

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Flipped classrooms has gained significant momentum in higher education including Historically Black Colleges and Universities. There appears to be a disparity in studies done at HBCU's that explore the efficacy of flipped pedagogy. This research proposes to explore the current practice of flipped pedagogy in classrooms at a HBCU. The overarching goal is to explore the overall impact of the flipped classroom's teaching strategies among undergraduate instructors. This study engages a phenomenological qualitative research methodology. Data was collected from a faculty focus group and faculty interviews. A qualitative method was used to explore the faculty perceptions on teaching and the impact of teaching and learning in a flipped learning environment. The consensus among the faculty was that the flipped pedagogy classroom is a beneficial instructional strategy that impacts student learning out comes positively. The faculty agreed that the flipped learning classroom offers students the opportunity to actively engage in the learning process. The study also revealed in the flipped learning environment that active learning occurs and it gives instructors an opportunity to work with their students more intimately and provide individualized instructions as they identify at risks students. This study also revealed faculty concerns of returning to the classroom setting after Covid-19. Future research to examine the implications of Covid-19 and its impact to the flipped pedagogy classroom in STEM at a minority institution is needed.

Keywords: Flipped Learning, Meta-analysis, Cognitive learning, Active Learning

ANALYSIS OF LINEAR FEEDBACK SHIFT REGISTERS AND CHAOS-BASED TECHNIQUES FOR MEDICAL IMAGE ENCRYPTION.

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Image encryption is not new. Several different encryption algorithms have been used. Some of the algorithms are based on random sequences generated using chao theory and DNA sequencing and others are based on compression. Others are based on Linear Feedback Shift Registers. This paper focuses on research solutions for securing medical images. Medical images are important and are generally regarded as sensitive in nature. In the research, higher order linear feedback shift register are obtained using combination of lower order LFSRs by suitable clocking and the ciphers generated are utilized to encrypt medical images. Our analysis involves using suitable metrics to compare the chaos based and LFSR based stream ciphers.

Keywords: Linear Feedback Shift Registers, Chaos Encryption, Image Encryption

EVOLUTION OF FULLY HOMOMORPHIC ENCRYPTION AND ITS APPLICATIONS

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Fully Homomorphic Encryption dates back to the 1970s, but for about thirty years after it was first considered, the idea of fully homomorphic encryption was thought to be impossible. The ability to perform additive and multiplicative computation on encrypted data such that the decrypted result would still be same as when it was plainly computed is discussed in this paper. The pros and cons of each generation of the FHE, the improvements that the schemes have undergone over the years and the areas they are being applied is looked at in this paper.

Keywords: Fully Homomorphic Encryption; Asymmetric Encryption; Learning with Error

CONTEMPORARY ANALYSIS OF MACHINE LEARNING APPLICATIONS IN MEDICAL INDUSTRY

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In today's world, artificial intelligence besides machine learning have been adopted intensely or progressively in numerous industries, specifically medicine as it designates computational curriculums which are mimicking apart from simulating anthropological intellect, taking an instance, an individual's conduct in terms of resolving difficulties apart from developing wisdom aptitude. Additionally, machine learning forms a subsection of artificial intelligence as it excerpts arrays of varied patterns from unprocessed data spontaneously. The ultimate objective of this manuscript is to help budding academicians to achieve an appropriate considerate learning machine learning apart from its applications in healthcare industry. Here, a cataloguing of machine learning centered systems in healthcare industry is discussed which are classified depending on information preprocessing procedures involving cleaning, erudition procedures which includes all kind of learning. The manuscript discourses some of the machine learning solicitations in terms of wellbeing following the latest and upcoming exploration on ML solicitations in medication besides knowing their encounters and restrictions.

Keywords: Artificial Intelligence; Machine Learning; Identification; Cure; Medicinal Learning

FOG COMPUTING AND ITS ROLE IN THE INTERNET OF THINGS: A SURVEY

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With the massive and escalated expansion of the Internet of Things (IoT) technologies, Cloud Computing model is experiencing various issues such as high bandwidth, network instability. Fog Computing tries to address these issues by bringing the cloud closer to IoT devices. The principle of Fog Computing is that instead of transferring data to and fro into the cloud, it stores the data in IoT devices. Fog computing enables better service quality and faster feedback to varied IoT clients. As a result, fog computing may be considered the optimal solution for IoT to provide productivity and security to a large number of IoT users. Internet of Things (IoT) applications are quickly expanding. However, current fog-centric IoT systems are unable to meet the stability criteria. Fog computing challenges or problems for IoT applications must be analyzed and synthesized regularly. This paper covers fog computing's integration with the internet of things by discussing its characteristics and function in IoT. It also discusses many opportunities and challenges that must be examined in the context of fog computing, as well as future research goals.

Keywords: Cloud Computing, Fog Computing, Internet of Things, Benefits, Challenges

A FRAMEWORK FOR PANDEMIC'S BIOLOGICAL WASTE MANAGEMENT

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Biological waste production is increasing rapidly on a daily base, which leads eventually to an increase in the Biological hazards that result in affecting Healthcare employees' wellness. Moreover, the waste disposal protocols were not followed strictly by healthcare workers and the public. This led to the spread of infection, hence spreading COVID-19 along with the facility and increasing the fatality rate. This requires a mechanism for properly utilizing the waste usage life cycle before discharge. Before dumping waste, it is critical to examine all of the waste's potential environmental and health implications and to ensure that these impacts are minimized, if not totally eradicated. Medical waste is used as an example of hazardous waste in this paper which focuses on the statistical data on medical waste created in the emirate of Abu Dhabi, India, and globally. It also presents information about the country's medical waste legislation and regulations. The study briefly discusses the existing trash management practices and the modern technologies that have been used to ease the discharge plans. Furthermore, the article emphasizes the increase in medical waste output as a result of the COVID-19 pandemic and the existing automated plans.

Keywords: Biological hazards, Biological waste, waste management, COVID-19 pandemic, pandemic solid waste

ANALYZING THE COMBINATORIAL EFFECT OF FACTORS DRIVING ADOPTION OF E-LEARNING IN HIGHER EDUCATION: FINDINGS FROM FUZZY SET QUALITATIVE AND COMPARATIVE ANALYSIS

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This study aims to investigate the factors driving acceptance and use of e-learning among students in higher education. In this study, we used factors of the unified theory of acceptance and use of technology (UTAUT) and the DeLone and McLean information systems success (D and M-ISS) model. Moreover, the drivers may not have a symmetrical relationship with the outcome. The data collected from a premier higher education institution in India will be analyzed using fuzzy qualitative and comparative analysis (fsQCA) to evaluate the configurational influence of these factors. Unlike previous studies on e-learning adoption in higher education, the proposed research extends UTAUT to investigate the configuration influence of basic constructs of UTAUT, and three DeLone and McLean information systems success (D and M-ISS) model constructs, namely, service quality (SEQ), system quality (SQ), and information quality (IQ). The fsQCA will explore comprehensive, asymmetrical, and insightful conjunctions of causal factors leading to the desired outcome, continuous intention to use (CIU) of e-learning in higher education. Finally, this is arguably the first study to employ the fsQCA in the UTAUT context to broaden the literature on e-learning adoption in higher education. The findings of the study include both theoretical and practical implications. It can help the higher education institutions in India that intend to adopt an e-learning system to recognize the factors having a significant configurational influence on e-learning adoption.

Keywords: fsQCA, e-learning, UTAUT, information systems, higher education

A COMPARATIVE ANALYSIS OF MALWARE CLASSIFICATION BASED ON PE HEADER FEATURES

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Malware classification is a very important aspect of information security, this is because of the threats posed and the continuous evolving changes and attack of malwares on computer systems and domains. Keeping this consideration, this paper, presents a comparative analysis of malware classification as benign or malicious application based on portable executable (PE) header features. Our experiment uses four machine learning algorithms which are Random Forest, Support Vector Machine, K-Nearest Neighbor and Decision Tree and thereafter ensemble learning method (bagging) is used to improve the performance of the algorithms. On comparison, the results shows that bagging ensemble learning method does improve machine learning algorithms with careful feature engineering which is important for highly efficient classification of malwares.

Keywords: Malware, PE headers, Random Forest, Decision Tree, Support vector machine, K-Nearest Neighbor, Ensemble Bagging

RELIABILITY AND MTTF ANALYSIS FOR A REVERSE OSMOSIS MACHINE SYSTEM IN WATER PURIFICATION BY USING BOOLEAN FUNCTION TECHNIQUES

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In the time of science and technology, many problems have arisen in front of us, one of which is the problem of pure water. In view of this problem, we have tested the reliability in our proposed work and tried to find out that how truthful is the RO performance. The working of RO has been divided in multiple section on the basis of functioning component. A mathematical model of RO has been evolved and enumeration for various reliability specifications such as Reliability and MTTF have been carried out. In this paper, the author has been used Boolean function technique to find the reliability of the system, used Weibull and exponential time distribution. Graphical design with a numerical calculation has been enclosed at the end to highlight important results of this study

Keywords: Reliability, Weibull time distribution, MTTF, Exponential time distribution

PREDICTION OF INFECTIOUS DISEASE SPREAD USING STATISTICAL MODELING

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In this paper, we will examine three alternative statistical modelling and prediction approaches, namely Distribution Fitting, Time Series Modelling, and Epidemiological Modelling, for several infectious diseases, including the recent COVID-19 epidemic. Distribution fitting, time series modelling using predictive monitoring approaches, and epidemiological modelling are all examples. The best-fitted distribution for predicting disease transmission is derived by fitting the normal distribution in general and several theoretical distributions where the epidemiological data is sufficient to fit. As infectious diseases evolve over time, different time series models are fitted, and predictions are generated using the best-fitting model. More biological properties are incorporated into epidemiological models, and disease transmission estimates are made using the fitted compartmental model. The best policies and most appropriate strategies to control the spread of infectious diseases can be established and implemented using data obtained from various methods for assessing and predicting infectious disease spread.

Keywords: Distribution Fitting, Time Series Regression, Epidemiological Modeling

IMPROVED ESTIMATION OF POPULATION MEAN USING KNOWN AUXILIARY PARAMETERS

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In this paper, we have suggested two ratio type estimators for improved estimation of population mean of average production of sugarcane. We have studied the bias and Mean Square Errors (MSE) of the suggested estimator up to an approximation of order one. The optimum values of the characterizing constants are obtained and the minimum values of the MSEs of the proposed estimators are obtained for these optimum values of characterizing scalars. The suggested estimators are compared both theoretically as well as empirically with the competing estimators. It has been observed that the suggested estimators are more efficient than the competing estimators. Thus, the suggested estimators should be used for improved estimation of population mean in different areas of applications.

Keywords: Primary Variable, auxiliary Variable, Estimator, Bias, MSE, Simulation

ON THE DETERMINATION OF SAMPLE SIZE FOR THE BEST REPRESENTATION OF POPULATION

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The main aim of this paper is giving a mathematical justification and approximation for the sample size determination using multivariate approach. At the same time, it stops the application of the various sampling techniques namely convenience sampling, random sampling, cluster sampling and so on. The research proposes that any method of data collection and giving a rapid algorithm to find the best sample representation for the population parameters. This author uses his own indigenous multivariate algorithm to check the sample size of the best sample. It is concluded that Whatever sample size collected by whatever method of the researcher should satisfy the above-mentioned algorithms, then it can be considered as the best sample for the representation of population parameters. This research profoundly states that the support of powerful computers and multivariate statistical techniques are able to eliminated the whole primitive domain called sampling techniques or methods

Keywords: Sample size, Multivariate statistical tools, population parameters

SEQUENCING, ACTIVITY ESTIMATION AND COMPARATIVE ANALYSIS OF SUPEROXIDE DISMUTASE GENE AND PROTEINS OF THREE TURTLE SPECIES OF NORTHEAST REGION, INDIA

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Superoxide dismutase (SOD) is the prominent antioxidant that effectively catalyzes the superoxide radical's dismutation. Enhanced SOD level significantly influences the longevity of animal. Reports of structural and functional characterization of SOD in turtles, a rare group of animal was/were very scanty. An attempt was made to characterize the sequences of SOD (SOD1 and SOD2) and their structural and functional attributions on the data obtained from three known Soft-Shelled turtle of Northeast India, namely Nilssonia hurum, Nilssonia gangetica and Lyssemis punctata (SOD1: PM0082199, PM0082198, and PM0082197; SOD2; PM0082202, PM0082201 and PM0082200 respectively). A comparative analytical evaluation was drawn with the available data of 5 different turtle species, notably, Terrapene carolina triunguis, Chelonia mydas, Chrysemys picta bellii, Pelodiscus sinensis and Mauremys reevesii. Characterization of SOD gene and protein sequences were carried out using bioinformatics tool like CLC workbench 3.0 as well as the "homology" models were predicted and analyzed using Discovery studio Suite. Multiple sequence alignment results suggested that the respective SOD genes had minor variations in composition and properties, while the SOD of Chelonia mydas were recorded with the longest sequence. Nucleotide analysis of all the SODs were A (Adenine) and T (Thymine) rich with minor variation in melting temperatures, Adenine being the dominant residue in both the SODs. RNA secondary structures indicated that the SODs were within the acceptable range with Chelonia mydas and predicted as the most stable SODs. 3D homology modeling, their comparison and validation suggested that all the SODs were within the validated range and had the potential to be used for further aging related studies. SOD is enriched with highly conservative sequence in the protein chain to maintain a common structural framework, might be responsible for both the stability and catalytic activity, could well be supported with the present findings.

Keywords: SOD, Turtles, MSA, RNA secondary structure, Homology Modeling

ISSUES AND CHALLENGES IN SUPPLY CHAIN MAMAGEMENT OF PADDY CROP IN CHHATTISHGARH STATE

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Paddy passes through a chain of purchase procedures; in this procedure first paddy comes from the farmer, service co-operative society, collection center and millers. Farmers register themselves in the government and sell their paddy at the minimum support price of the government. The service co-operative society does the work of buying paddy from the farmers based on contract by the government, it is mandatory for the farmers to be registered in the service co-operative society, only then they can sell their paddy. After purchasing paddy, they are stored by making a stack, but if the storage capacity is exceeded, there is a provision of transportation for the 72 hours by the collection centers. But this provision is not followed properly, Due to this reason the committee has to face financial, physical and mental problems, millers are lifting paddy after issuing delivery orders from district marketing association. It is not able to lift it due to the limited storage capacity. Due to this, the quantity of paddy is reduced by dryness, rain, insect pests, rats and theft. The purpose of this research paper is to make the government aware of the issues and challenges coming from supply management so that beneficiaries benefit by finding a proper solution.

Keywords: Farmers, service co-operative society, collection center, purchase, paddy.

MULTIBAND FRACTAL ANTENNA FOR WIFI, WIMAX AND DSRC

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Antennas are important devices in the world of telecommunications. Each of them has different shapes and sizes that characterize and model their operation. The present work proposes the design and construction of a fractal antenna with hexagonal geometric shape, using the dielectric material FR4 with a permittivity of 4.4 and a thickness of 1.6 mm. The fractal antenna is based on the design of a simple hexagonal patch where three interactions were performed in which smaller geometric shapes were added resulting in frequencies of 2.4 Ghz, 3.05 Ghz for the first interaction, 3.27 Ghz for the second interaction and 5.86 Ghz in the final interaction to obtain the 4 bands, i.e., resulting in a multiband fractal antenna.

Keywords: WiFi, WiMax, Fractal, Microstrip, DSRC

AN INVENTORY MODEL FOR DETERIORATING ITEMS UNDER INFLATION AND PERMISSIBLE DELAY IN PAYMENTS BY GENETIC ALGORITHM

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Inventory models are crucial in analyzing a wide range of realistic situations that arise in places such as vegetable markets, food markets, oil industries, chemical factories and so on. In this paper, we build an inventory model for deteriorating items with changing prices due to inflation and delays in a given situation, In the model, the demand rate is assumed to be stock-dependent, and the rate of deterioration is assumed to be zero and each item that comes under deterioration follows to the Weibull distribution. And the model is created under various circumstances which depends on the condition of credit period that if it is greater than the life cycle of that item or less than the life cycle of that item.

Keywords: EOQ, Inflation, Stock-dependent demand, genetic algorithm.

INTRODUCTION TO ROBOTICS REMOTE/VOICE CONTROLLED CAR

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This report specifies the details of a paper in the field of Robotics, a branch of computer science and engineering. As many may know, the field of Robotics can be an intimidating subject to tackle for a beginner. The purpose of the paper is to gain an understanding of this field and to create an introduction to the robotics world as a whole. For this aim, we built a remote and voice-controlled car that implements all the basics of robotics, both hardware and software, that a beginner will need to interact with. After conducting thorough research on the intricacies of this field, the components needed, source code, and procedures to build the car, we have successfully implemented the robotic car. This was a challenging endeavor as the integration of functions through code to control certain hardware components was a trial-and-error process; despite much work existing in this field, most components of our code had to be adapted for suitable use with the low-cost hardware components our team selected for this report. Furthermore, the code had to be simple and straightforward to accommodate the primary goal of this paper. Despite these challenges, our team successfully presented a functioning voice and remote-controlled car, that can sense its surroundings and alert the user of an impending collision. This report explains in detail how this paper was designed and completed from start to finish, the planning behind it, and our evolutionary plans for the future.

Keywords: Mobile robotics, Automated Vehicles, Mobile Applications, Remote Control, Educational Tools.

HYBRID SARIMA-ANN MODEL FOR FORECASTING MONTHLY WHOLESALE PRICE AND ARRIVAL SERIES OF TOMATO CROP

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A hybrid model has been considered an effective way to improve the forecast accuracy. This paper proposes the hybrid model of the linear seasonal autoregressive moving average (SARIMA) and the non-linear Artificial neural network (ANN) in estimation and forecasting the monthly wholesale price and arrival series of tomato crop in Gurugram market. The goodness of fit of the model is measured in terms of Akaike information criteria (AIC), root mean square error (RMSE) and mean absolute percentage error (MAPE) while the post-sample forecast accuracy in terms of mean absolute Error (MAE), RMSE, MAPE and percent standard error of prediction (SEP). The study clear reveals that hybrid (SARIMA-ANN) models are more appropriate forecasting for monthly wholesale price and arrival series of tomato crop in Gurugram market. The analysis is carried out using the R (4.1.3)-software.

Keywords: SARIMA, SARIMA-ANN, Price and arrival forecasting, MAE and SEP

AUTOMATIC SHORT ANSWER GRADING USING DEEP LEARNING: A SURVEY

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Evaluation is a key element in teaching and learning process. Evaluating students answers for the purpose of grading using computers is an emerging area of research. This automatic evaluation of student answers known as Automatic Short Answer Grading (ASAG) is gaining popularity with the growing need of online based courses like MOOCs, SWAYAM and also due to the online education during the recent pandemic. These student answers can be short or essay type answers which can be graded using various approaches. This paper attempts to summarize the work done in automatic short answer grading in rennet years using state-of-the-art deep learning techniques. The paper also mentions the various datasets used for the purpose, and discusses few challenges in automatic short answer grading which would help researchers working in this area.

Keywords: ASAG, Datasets, Deep Learning

DESIGN AND ANALYSIS OF ELECTRIC VEHICLE SPEED LIMIT CONTROL USING WIRELESS NETWORK

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Road mishap is most unwanted thing to happen to a vehicle user, however they happen regularly. Main causes of accidents are due to human faults. The most common causes of accidents due to over speeding of the vehicles. High speed vehicle are more liable to mishap than the slow speed vehicle and the cruelty of accident will also be more in case of high speed vehicle. Higher the speed of vehicles, greater the risk of mishap, So to stay away from such kind of accidents, it is necessary to alert the driver and to control the speed of vehicle automatically. The main objective of this proposed work is to develop signal unit to indicate the type of zone to the vehicle and to control the vehicle speed. Every zone which having speed limit sign board like school, highway and etc may have a transmitter tag to transmit the zone information by RF signal. This signal should be received by the vehicles and accordingly changes the speed limit of the vehicle. As practically, an actuator may be used to control the throttle of the vehicle. It is based on the idea of vehicular speed monitoring and control system. The speed of the vehicle is automatically lowered and locked to a particular limit as it enters the restricted area and is unlocked or relieved as it exits the restricted area, so it is acting as an automatic speed limiter and reliever)

Keywords: Speed Limit Sign Board, Transmitter Tag, Vehicular Speed Monitoring and Control System, Throttle Speed Limiter And Reliever

VEHICLE PRICE PREDICTION APPLICATION USING MACHINE LEARNING

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In today's world, everyone is looking for vehicles that do not add to their liability, but instead will add comfort to life. So, here we are with the smart, unique, and digital solution "Smart Deals". This App ication programming Interface -based "Smart Deals" model provides the best and most genuine price of second-hand vehicles with an accuracy of 90% at which one can buy or sell second-hand vehicles and which can ultimately add immense comfort to the life of the users. The model is trained using data from Kaggle with the help of Machine Learning algorithms. It has two modes in which one predicts the price of a Car, and the other predicts the price of a Bike. The prediction is done based on data provided by the user. And this whole process is referred to as the process of Predictive Analysis.

Keywords: Machine Learning, Artificial intelligence, WebApp, Flask, Predictive Analysis, Random Forest Regression, Linear regression, Android App, Data Analysis, FastAPI.

2-DIMENSIONAL LINGUISTIC INTUITIONISTIC FUZZY POWER AGGREGATION OPERATORS TO MULTI-CRITERIA DECISION MAKING

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The 2-dimension linguistic intuitionistic fuzzy variables (2-DLIFVs) are very flexible and efficient tools to model the cognitive information of experts in complex decision-making situations with considering the reliability of the evaluation results. The power average (PA) operators provides an aggregation tool allowing exact arguments to support each other in the aggregation process. In this work, we extend the idea of power aggregation operator in the setting of 2-DLIFVs. First, the work defines a novel aggregation operators called generalized 2-dimension linguistic intuitionistic fuzzy power average (G2-DLIFPA) operator to aggregate a finite collection of 2-dimension linguistic intuitionistic fuzzy variables. Some mathematical properties and special cases are also discussed. Finally, we discuss the application of the proposed aggregation operator to multi criteria decision-making in the context of supplier selection and illustrate it with the help of a numerical example.

Keywords: Multiple attribute decision making, linguistic intuitionistic fuzzy variables, Power

OPTIMIZING ATTRIBUTE PRECEDENCE LEVELS IN NAÏVE-BAYESIAN DRIVEN RECOMMENDER-CUM-RANKING SYSTEMS

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The current piece of work is an extension to ongoing research on Feature Extraction (FE) Modeling using Educational Data Mining (EDM) techniques. The past FE modeling experiments used attributes precedence relations of fitness for ranking the contribution (degree of involvement) of the attributes for enhancing the students‟ results in predictive mode during their forthcoming examinations. Amidst the above, attribute precedence of unfitness evaluations were also obtained as part of intermediate results. Hence, the authors sought an opportunity to repeat the experiments with precedence relations of unfitness. They were convinced with robustness of their FE approach, having obtained better modeling accuracies, this time using optimal precedence relations of fitness after manipulations upon fitness / unfitness precedence sequences.

Keywords: Feature Vector, Feature Extraction model, Machine learning, Naïve Bayesain learning, Optimal Attribute Precedence Relations, RELIEF Feature-extraction model

EXPLORING THE ROLE OF CROWDFUNDING IN INDIA

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Early-stage companies and entrepreneurs are constantly facing challenges with startup funding. Entrepreneurs want to raise capital without good credit scores, collateral securities, and major complainces. Crowdfunding is the process of raising funds for a project or venture from a large number of people who contribute a small amount, usually via online. In this paper researcher identify how crowdfunding is different from bank financing and how it works. Analyze the different models of crowdfunding in India. To explain the rules and regulations of SEBI for crowdfunding in India. To explore the different successive crowdfunding platforms in India, their sectors, fees, fundraising strategies, contributions and future plans. For this study researcher used secondary data collected from different websites. Crowdfunding is not much popular in India and not use in all sectors of business ventures. The campaign should be run for awareness of crowdfunding in India and more focus on regulations and complaince by the government for crowdfunding in India.

Keywords: FinTech, Crowdfunding, BankFinancing, OnlinePlatforms, Regulations India.

A SURVEY ON THE PREDICTION OF AGRICULTURE CROP YIELD USING MACHINE LEARNING TECHNIQUES

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India's economy is largely based on agriculture and it is the foremost factor for our survival. Predicting crop yield is important for the farmers and planners for policy making. Machine Learning Techniques predict the future value based on the existing datasets. Supervised Machine Learning Techniques such as Random Forest (RF), Support Vector Machine (SVM), k-Nearest Neighbour (kNN) and unsupervised machine learning methods like DBSCAN, C4.5 are widely used for predicting crop yield with accuracy. Many researchers have predicted crop yield using various Machine Learning Techniques by considering input datasets like temperature, rainfall, humidity, area etc and have compared the techniques for their accuracy. This paper attempts an elaborated survey on the various Supervised Learning Techniques with their accuracy in predicting agriculture crop yields.

Keywords: k-NN, RF, SVM, Agriculture Crop Yield, DBSCAN

DIMENTIONS OF RURAL TOURISM IN CHHATTISGARH

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The development of tourism in tribal areas seems like an economic booster among indigenous people. The Chhattisgarh state has a large forest-occupied region where nature blessed overwhelming scenery and biodiversity along with stunning waterfalls and attractive hilly areas. The present study emphasizedthe potentialities, problems, andprospects of rural tourism in Chhattisgarh. The tourist satisfaction level of the tourist places of Chhattisgarh wasevaluatedby field survey method in the year 2015 with 100 samples. The TSI revealed that a maximum of 80% of touristswere satisfied with public convenience, and 60% of the tourist were with transportation facilities. Notably, 40 % of the tourist were highly satisfied and 52 % were satisfied with the behavior of local people. It seems to be an opportunity to attract tourism because behavior does matter the most. The cleanliness is satisfactory but the security aspect and availability of tour guide need to be improved. Conclusively, the overall tourism prospective in Chhatisgarh state seems to be appreciable.

Keywords: Chhattisgarh State, Rural Tourism, Tourist satisfaction,

GENERALIZED FAMILY FOR ELEVATED ESTIMATION OF POPULATION MEAN USING KNOWN AUXILIARY PARAMETERS

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The present research introduces enhanced estimation of population mean using known information on an auxiliary variable. The suggested estimator's Bias and Mean Squared Error (MSE) are calculated up to the first order of approximation. The minimum MSE and the Bias values are achieved by optimizing the characterizing scalar. The MSE of the recommended estimator has also been compared both conceptually and empirically with the MSEs of current estimators. Real and Simulated data sets are adopted to verify the theoretical prerequisites for the suggested estimator's greater efficiency over competing estimators.

Keywords: Population Mean, Main Variable, Auxiliary Variable, Bias, MSE

WORKPLACE SPIRITUALITY: A REVIEW OF LITERATURE AND BIBLIOMETRIC ANALYSIS

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This review paper aims to present an outline of the research previously done in the area of Workplace spirituality, specifically in the management domain. The systematic literature review is done to identify the pattern and current status of the topic and also to identify the gaps for further advancement in topic-specific research. This paper has used the Scopus database to collect the relevant research papers using the major keywords like "Workplace Spirituality" or "Spirit at work" or" "Spirituality at work" or "Organizational spirituality" and then the dataset of 415 papers is further analyzed using bibliometric analysis software VosViewer and co-citation and network analysis is done to create a network based on keywords and citations.The study has identified six clusters based on keywords and major research gaps are highlighted using the keyword analysis. The study is showing a major contribution in terms of citations of the documents done by the USA and India. There are a few Indian authors who can get a portion of citations and a lack of studies from other Asian countries can also be seen. The review-based studies on the topic of workplace spirituality are only a handful because the concept itself is only three decades old and significant work done in this area is mostly quantitative or empirical. This review paper is a valuable contribution to the existing knowledge in the field of workplace spirituality.

Keywords: Workplace spirituality, management, bibliometric analysis,

CONTRIBUTION OF INTERNET DIGITAL MARKETING IN THE MARKETING PROCESS OF HANDLOOM KOSA WEAVERS OF CHHATTISGARH STATE

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Handloom cocoon and silk has been providing the basis for the economic development of India and livelihood of the beneficiaries engaged in this industry since ancient times. In the rural economy, handloom weaving and sericulture have an important contribution in terms of providing self-employment. The handloom cocoon industry is a pollution free decentralized cottage industry. A huge amount of foreign exchange is being earned by exporting the goods made from handloom cocoon and silk industry abroad, due to which it is also contributing in the development of the economy. The handloom weaving and silk cloth weaving art of the state of Chhattisgarh is well known at the national and international level. Weaver artists of Chhattisgarh state are getting awards every year at the state - national level for their superior weaving art.

Keywords: Handloom, Whipping, Cocoon, Kosa, Weaver

PHYTOCHEMICAL ANALYSIS AND ANTIBACTERIAL ACTIVITY OF CLERODENDRUM CHINENSE FOUND IN CHHATTISGARH REGION

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Plants from Clerodendrum genus had been widely used by locals for traditional healing purpose. Clerodendrum chinense a plant native to south Asia now introduced to the rest of the world is a perennial shrub with triangular ovate shaped leaves. Present study involves the phytochemical analysisis and antibacterial property of Clerodendrum chinense. Phytochemical analysis of plant extract shows the presence of active phyto-constituents like protein, carbohydrate, sterols, alkaloids, tannins, saponins. TLC analysis revealed the presence of β sitosterol in the extract which is an important phytosterol. Antibacterial activity shows characteristic inhibition against two different strains i.e., e coli and pseudomonas, which suggests the plant might show promising results in the field of antibiotics. The above result might also help in further research of the species for other medicinal purpose.

Keywords: Clerodendrum chinense, phytochemical analysis, antibacterial activity

TIME SERIES PRICE FORECASTING USING HYBRID SEASONAL ARIMA AND ARTIFICIAL NEURAL NETWORK TECHNIQUE

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Time series price forecasting is an important area of forecasting in which past observations of the same variable are collected and analyzed to develop a model describing the underlying relationship. In this paper, two-phase procedure in the hybrid seasonal ARIMA and ANN technique. In the first phase, the most appropriate seasonal ARIMA technique is used to model the linear patterns in all India wholesale monthly average price time series of tomato crop and the residual obtained from this linear model will contain only the nonlinear patterns. In the second phase, the Artificial Neural Network technique is used to model the nonlinear patterns of the residuals. This hybrid technique which combines of seasonal ARIMA and ANN technique, is used to examined the univariate price time series and to predict the future values, is proposed to take advantage of the unique strength of Seasonal ARIMA and ANN technique in linear and nonlinear modelling. Empirical results indicate that hybrid technique is effective way to improve the forecasting performance for all India wholesale monthly average price of tomato crop on the basis least value of error measure such as RMSE, MAPE and MAE. The analysis is carried out using the R (4.1.3)-software.

Keywords: Seasonal ARIMA, Hybrid, time series price forecasting, linear and non-linear patterns.

ANALYZING BOF TECHNIQUES ON DIFFERENT DATASETS FOR IMAGE RETRIEVAL

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Image retrieval is steadily progressing and becoming one of the much-needed paradigms of image processing. The ever-increasing demand of knowing the source and similar images in the multimedia database is potentially high, especially in social media platforms. Image searching operation is in great demand. A lot of research has done over a period of time on retrieval of images, from text-based retrieval to content-based retrieval. Text based research is replaced by content based because the results are based on text annotators. Therefore, retrieval performance is subjected to the entered labels and become biased. To overcome this big pitfall of image retrieval the content present within the image become the key factor to get genuine results. The content present in the images is called features and the whole criterion of searching depends upon it. These days' computer vision and image processing focuses on automatic feature extraction scheme like creating a Bag of different features present with in an image. In Bag of feature (BOF) an image is subjected to a process in which small patches of similar types are grouped together and quantized into clusters. The cluster center from each one is collected and histograms are formed for features known as visual words. Hence, a visual vocabulary came into existence will be used for retrieval. This paper address different types of content-based images retrieval systems of BOF and analyze them over two different Datasets namely WANG and CALTECH. These systems could be categorized on the basis of type of features. The implementation is done using MATLAB 2021a.

Keywords: Bag of Feature (BOF), Visual Vocabulary, Codebook, Feature Detection and Extraction.

ENTROPY-BASED FUZZY KERNEL RIDGE REGRESSION CLASSIFIER FOR CLASS IMBALANCE PROBLEMS

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To improve the classification performance ability of the popular kernel ridge regres-sion (KRR) model, we propose a novel entropy-based fuzzy KRR (EFKRR) model for binary classification. In EFKRR, a fuzzy membership is added to the training samples so that each sample can contribute differently to learning. Therefore, the proposed model not only improves the classification ability but also can efficiently address the class imbalance issue. The key advantage of the model is that it solves a system of linear equations rather than solving a QPP which reduces the computation cost. We have carried out experiments on a few interesting real-world datasets using the Gaussian kernel. The classification accuracies of EFKRR are compared with support vector machine (SVM), twin SVM (TWSVM), KRR and intuitionistic fuzzy KRR (IFKRR) models. It is observed that the proposed EFKRR shows comparable or better perfor-mance than the other reported models.

Keywords: Machine learning, kernel ridge regression, binary classification, least squares

DUAL ACCESS CONTROL STRATEGY FOR PREVENTING EDOS ATTACK ON CLOUD DATA

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Data owners can distribute protected data utilizing cloud storage of legal person with maintaining accessibility control rules concealed using the Ciphertext-Policy Attribute-Based Encryption approach with a confidential access security strategy. Moreover, a technique to restrict clients from gaining subsequent data and provides the owner's limited amount of data on objects that create a dispute of interest or someone whose pairing is critical is still to be investigated. In this research, examine the fundamental relationships between these specific data items, establish the idea of the confidential documents set restriction, and suggest CP-ABE access control system for the confidential data set restriction with concealed properties. This approach entails a somewhat concealed, extendable restriction strategy. To improve protection, the responsibilities of implementing the access control mechanism and the restriction strategy are split into 2 autonomous units in proposed design, thanks to the clearly defined responsibilities concept. After the scheme has been established, the data holder can substantially update the personal data collection restriction design using the concealed restriction strategy.

Keywords: Data Security, Ciphertext, Confidential Data, Cloud Storage, Data Owner

A NEW IMPROVED RATIO TYPE ESTIMATOR OF POPULATION MEAN

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The sample size in the current work has been used as information to more accurately estimate the population mean of the primary variable under investigation. In a variety of socioeconomic and agricultural surveys, sample size is a crucial component for estimating population parameters. The population mean has been estimated using a generalized ratio type estimator. The bias and mean squared error of the proposed estimator's large sample properties have been obtained to within one order of precision. The ideal mean squared error-minimizing value of the characterizing scalar has been found, and the ideal mean squared error-minimizing value of the proposed estimator has also been found. The suggested estimator has been compared to mean. The proposed estimator has been compared to mean per unit estimate and other popular population mean estimators. A numerical analysis is also done to compare the efficiencies of proposed and existing population mean estimators.

Keywords: Sample Mean, Population Mean, Bias, Mean squared error, Efficiency

STUDY OF ESRGAN BASED MODEL FOR STYLE TRANSFER ON IMAGES

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Generative adversarial networks (GANs) have been widely studied since 2014 as an advance approach to generative modeling using neural networks. GANs trains a generative model under adversarial learning idea with two submodels a generator and a discriminator. The generator is trained to model a new example and the discriminator models to discriminate the real (original) and the fake one (generated). They achieve this through deriving back propagation signals through a competitive process involving a pair of networks. GANs have been widely studied due to their enormous prospect for application in speech and language processing, image and vision computing, etc. In this work, we have studied the methods of image super-resolution with style transfer using deep neural network. Alternative generator architecture has been used for generative adversarial networks, borrowing from style transfer literature. A low-resolution image is passed through an Enhanced Super-resolution Generative Adversarial Network (ESRGAN) to obtain a high-resolution image. The final goal of the work is to improve the perceptual loss by style transferring and to provide stronger supervision for clarity and texture recovery. The studied work is found to achieve consistently better visual quality with more realistic and natural textures.

Keywords: GAN, ESRGAN, Image Super-resolution, Style transfer, Perceptual Loss.

A SMARTPHONE-BASED SYSTEM TO REGISTER AND TRACK ROAD COMPLAINTS IN OMAN

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The main objective of this research is to reduce the accidents caused by road damages by tracking road complaints and speeding up the response time of road maintenance. There are many ways to improve the communication between the government and the citizens regarding road damages. However, determining the severity of the damage is not easy. An application that provides an option to register complaints with proof of the road damage and location details will help the government to speed up the process of maintenance. While assessing the road maintenance request, the application must evaluate the road usage rate and the seriousness of the damage. The expected outcome of this research is a mobile application to register and track road complaints in real-time. The citizens can register the complaints and upload photos of the road condition and the location to help the administration to verify the actual condition. The citizens can also track the status of their complaints using the same application and they will be notified once the service request is accomplished.

Keywords: Road Complaints, Complaint Registration, Bubble.io, Road Usage, Mobile Application.

ENTREPRENEURIAL LEADERSHIP: A LITERATURE REVIEW OF THREE DECADES

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In this article, we review papers concerning entrepreneurial Leadership. We reviewed about 217 papers published from 1991 to 2021. The findings from the literature reveal that entrepreneurial leadership is a powerful leadership style that is increasingly in demand. Entrepreneurial leaders can identify undiscovered and uncharted business prospects in today's dynamic markets.

Keywords: Entrepreneurship; Leadership; Entrepreneurial Leadership

MEASURING THE APPLICABILITY OF ENTREPRENEURIAL LEADERSHIP TEST (EAT) DEVELOPED BY TJAN, HARRINGTON & HSIEH AMONG INDIAN ASPIRING STUDENT ENTREPRENEURS

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The claim of testing entrepreneurial aptitude by the scales designed by Anthony K. Tjan, Richard J. Harrington, Tsun-Yan Hsieh on the scales of the leadership driven by heart (metamorphic use for compassionate leadership), smart (for logic driven leadership), gut (for courageous leadership) and luck (for network leadership) isn't sufficient to measure the entrepreneurial aptitude of Indian students aspiring for playing potential business leadership roles. The test prematurely measures only the aspects of a compassionate leadership indicator. The scale indicates false positive delta for the leadership by compassion and leadership by networking).

Keywords: EAT, Entrepreneurial Aptitude, Entrepreneurship Leadership, Entrepreneurial Aspirations.

IMPACT OF 720 DEGREE PERFORMANCE APPRAISAL ON ORGANISATIONAL PRODUCTIVITY OF INDIAN IT COMPANIES

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The IT Industry of India is one of the largest employers of IT peasants across the world. The industry itself iterates its staffing practices to optimise its talent resource. 720-degree performance appraisal is one such iterated industry practice which has closed a few loose strings of 360-degree performance appraisal system. In this paper, those strings of 720-degree performance appraisal systems are studied for its impact on organisational productivity in different CMM levels of IT companies of India. The study currently includes IT companies having units in Bangalore City. Total 600 IT professionals living and working in Bangalore city have been included in the study. The organisational productivity of the companies where these professionals are employed have been sourced from the announcements, disclosures, financial success and expansions. The study reveals that 720-degree performance appraisal system implicates important measures in talent pool retention thus adds significantly on organisational productivity.

Keywords: IT Industry, 720 Degree Performance Appraisal System, Organisational Productivity

IMPACT OF EMPLOYEE TURNOVER INTENTION UPON THE OVERSEAS STAFFING SOLUTIONS OUTSOURCED TO INDIAN MARKET

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Working remotely for the staffing solutions of the US market. The trend of offshoring staffing operations has only been increasing for factors like cost effectiveness, efficient staffing and quality staffing. However the practice has added challenges of managing employee turnover because of emerging turnover intentions. The enhanced organisational empathy has created a room for employees to address their need of seeking job satisfaction, reduce stress and seek a conducive environment for working. In this study, responses of executives working in the overseas staffing companies operating for the US market remotely from India have been recorded. A generic factor obtained is that almost all of these executives have worked at least twice for the same resource over a period of three years. These experiences address the requirement of the emerging talent acquisition market and its impact on employee turnover intentions.

Keywords: Employee Turnover Intention, Organisational Empathy, Staffing Solutions, Job Stress, Job Satisfaction, Work Environment

CUSTOMER PERCEPTION ON IMPACT OF MOBILE COMMERCE

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Mobile commerce involves using wireless handheld devices like cell phones and tablets to conduct commercial transactions online, including the purchase and sale of products, online banking and paying bills, customers' perception and opinion about mobile commerce activities play a very vital role in their success. In the last few years, the mobile telecom market has witnessed a substantial growth and rapid changes globally, as well as in India. Customer satisfaction is a critical issue in the success of any business system. Hence, mobile commerce developers and practitioners need to understand customers' perception of mobile commerce applications in order to better design and improve its services. The main aim of this research study is to validate the concepts of customer perception on impact of mobile commerce adoption and to ascertain the influence of demographic variables in creating awareness and adopting mobile commerce services, changes in customer behavior and the problems faced by the mobile commerce users. The research is descriptive in nature and the area of research study is Guwahati City. The purposive sampling technique is used to collect the required data.

Keywords: Mobile commerce, Customer Perception, Services, Charges, Success

ADMISSION CONTROL OF QUORUM QUEUE WITH BERNOULLI VACATION AND MULTI-PHASE SERVICES

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This paper investigates an r-quorum queueing system with multi-phase service requirement under N-policy. If the number of customers in the system at a service completion epoch is larger than r, then the server starts processing a group of r customers but if it is smaller than r, then the server remains idle and waits for the queue size to enlarge up to N, (N r). Once the queue size reaches to N, the server provides l phases of service in succession to the customers in a batch of size r. A busy period is always initiated with a set-up time. After each service completion, the server takes vacation according to Bernoulli schedule. In addition the admission control policy is proposed to control the queue length by rejecting some of the incoming arrivals according to specified rule. The queueing analysis has been provided for both discrete and continuous times. The queue size distribution at departure epoch and at arbitrary instant of time and some performance measures are obtained by using embedded Markov chain analysis. Some special cases have been deduced by setting appropriate parameters to validate our results with already existing results available in the literature. In order to examine the effect of different parameters on system performance, numerical results are given by taking suitable illustrations.

Keywords: Quorum model, Batch arrival, Bulk service, N-policy, Embedded Markov chain, Phase-service, Bernoulli vacation schedule, Set-up

BRAIN TUMOR DETECTION AND MULTI-CLASSIFICATION USING DEEP LEARNING

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Diagnosis and Classification of brain tumor relies on MRI and histopathological analysis. This current method is not only time-consuming but also prone to manual errors. Deep learning-based techniques provides much fast, accurate and automated method for multi-classification of brain tumors. This paper aims to propose a model for multiclassification of brain tumors for the early diagnosis purposes using Brain MRI image. Brain tumor detection is achieved with 97% accuracy using CNN, that techniques can classify the brain tumor into four brain tumor types as, glioma, meningioma, pituitary and non-tumor cases. The proposed model is compared with other popular pretrained models such as AlexNet, Xception, ResNet-50, VGG-19 and GoogleNet.

Keywords: Brain tumor image classification, MRI, Deep Learning

SOME DISCUSSION ON PROPERTIES OF PARTIAL WRONSKIAN

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In this paper, the authors discuss the fundamental solution of partial differential equation by wronskian method. We investigate the linear dependence and independence solution of a partial differential equation using partial Wronskian. We introduced some properties of partial wronskian and verified the results. Furthermore, we establish a theorem and investigate the result on a linear partial differential equations using partial Wronskian.

Keywords: Wronskian, Partial Wronskian, partial differential equation, determinant of a matrix

COMPARATIVE ANALYSIS OF GMDH NEURAL NETWORK MODEL OVER HOLT'S AND ARIMA MODELS FOR FUTURE PREDICTION OF BIRTH RATE IN INDIA

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The goal of this study to compare the Group method of data handling (GMDH) neural network model to Holt's and ARIMA models. Time series data on the birth rate was obtained for this study from 1949-50 to 2021-22 (72 years). To determine the most accurate model for future prediction the Birth rate in India, three distinct models were used: GMDH, Holt's, and Autoregressive integrated moving average (ARIMA). Forecasting errors namely mean absolute error (MAE), mean absolute percentage error (MAPE), mean square error (MSE), root mean square error (RMSE), coefficient of determination (R2), were utilized as model selection criteria. The study reveals the better performance and accuracy of GMDH model over two other considered models namely Holts and ARIMA model with the lowest values of MAE = 0.008962, MAPE= 0.090468, MSE = 0.001790, RMSE = 0.042312, (R2) = 0.999989.

Keywords: GMDH type ANN, ARIMA, Holt's method

THE UTILIZATION OF KNOWN CONVENTIONAL LOCATION PARAMETERS IN SAMPLING THEORY

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The efficient linear regression ratio type estimators are developed for estimating the population mean in sampling theory by using the auxiliary information of quartile deviation and deciles. The suggested estimators are shown to have smaller mean squared errors than the Kadilar and Cingi and Subzar et al. estimators. The Percent relative efficiencies of the suggested estimators for various sample sizes are involved in simulation studies for given natural population data set.

Keywords: Auxiliary information, Ratio estimator, Mean squared error (MSE), Percent Relative efficiency(RE(%)).

AN ELECTROCARDIOGRAM BASED SELF-REGULATING VERIFICATION SYSTEM USING VIDEO-PASSWORD

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In traditional authentication systems, most of the applications were using text and image-based passwords. These passwords can be easily tricked and spoofed by intruders. With the advent of the attacks, the efficient and robust authentication system becomes the need of the hour. The recent developments in the technologies have diverted the interest of researchers from the traditional methods to biometric-based methods for authentication purposes. In recent researches, the electrocardiogram (ECG or EKG) is investigated as a significant biometric feature for the identification or verification of an individual. Therefore, the authors proposed a novel video-password based verification system using EKG. The present paper introduces a new class of authentication scheme called "Video-Password using ECG". This paper deals with the detection of the QRS complex of the ECG signal using the Pan Tompkins algorithm. First, the system captures the ECG signal of the user and calculates the QRS complex of the captured ECG signal. Then, the detected QRS complex is utilized for the division of the video frames that are used for the matching of the stored frames for the authentication process. The authors conducted the experiments by using the ECG signals available in the MIT-BIH Arrhythmia Database <http://www.physionet.org/physiobank/database/mitdb/>.

Keywords: Electrocardiogram (ECG or EKG), Video Password, Verification, QRS Complex, Authentication.

E-SHAKTI: AN INNOVATIVE WAY TO DIGITALIZE SELF HELP GROUPS

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In line with Government of India's "Digital India" mission, E-Shakti, a pilot project for digitisation of SHGs was launched by NABARD in the year 2015. E-shakti solve the problems like quality of book keeping, multiple membership of SHG participants, patchy credit histories and provides grading document of any SHG primarily based on its monetary and non-monetary records, at the doorstep of all stakeholders. The USP of the E-Shakti project is 'one-click' availability of the social and financial information of the Self Help Groups maintaining Saving Bank accounts with the banks. The research methodology includes tabulation of data, diagrammatic presentation of data, measures of percentages. The project has received positive response from stakeholders and as on 31 March 2021, project E-Shakti is being implemented in 281 districts in the country. The progress of digitization over the years . Beginning with 8000 SHGs in 2016 project E-Shakti now covers 12.33 lakh SHGs. Despite the various Covid pandemic related challenges and compared to 2019-20 we also see an 88% increase in SHGs digitized as on 2020-21.

Keywords: Digital, Stakeholders, NABARD, USP

POSSIBILITY OF CASHLESS ECONOMY IN INDIA

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In present era with the development of technology many things are made digital throughout the world. With these changes there is also a change in the concept of money transactions. Hence, money transactions not changed but its concept has been changed. Many people accepted these changed concepts of digital transactions of money because it made their life easier and comfort. So this research "Possibility of cash less economy in India" will help to see the possibility of digital India. The focus of this paper is to promote the digital transactions in India because of these many problems regarding black money; tax evasion, immediate payment etc. have been solved.

Keywords: Cashless, Economy, UPI, Digital, Demonetization, Pandemic.

AN IOT-ASSISTED SMART HOME AUTOMATION SYSTEM WITH INTERACTIVE USER-INTERFACE DESIGN

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Smart and intelligent systems are required to improve the standard of living either in our homes or at our workplace. This can be possible using different technologies such as IoT, Machine Learning, Cloud services, etc. The comforts experienced by human beings are categorized into thermal comfort and visual comfort. The thermal comfort records and manages the temperature and humidity while visual comfort is related to the light, colors, and ease of use. The visual comfort manages client experience in communication with the smart home framework. Furthermore, the User Interface (UI) plays a significant role in directing various sorts of individuals like a youngster or grandparents. User interaction with a legitimate interface assists the framework with gathering the information and investigating it to pursue keen choices. We have many use-cases to manage the user interaction with the smart automated home framework. In the proposed research, the authors focused on the Home Automation space of IoT and recorded the different ways to deal with IoT-Home Automation. The research is also concentrated on the UI approaches that are being utilized. This paper additionally depicts the methodologies for the dashboards or applications for IoT-based detecting and observing framework for shrewd Home Automation Systems (HAS).

Keywords: Internet-of-Things (IoT), Home Automation System, User Interface, User Experience, Interactive

STUDY OF INVENTORY MODEL FOR PERISHABLE ITEM UNDER PARTIAL BACKLOGGING AND PERMISSIBLE DELAY IN PAYMENT

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It is often seen that perishable of material is one of the biggest issues in every inventory model. This paper develops an inventory model with differing cost of perishable and partial backlogging cost under the condition of permissible delay in payment. The existing literature on topic generally deals with condition where payment of an order is produced on the receipt of product by the inventory system and scarcity are either totally backlogged nor totally off-track, assuming the backlogging cost to the inversely proportional to the mark time for upcoming recovery. The suggested model through numerical example and sensitivity analysis is described.

Keywords: Inventory, perishable item, Permissible delay, Partial backlogging

METAVERSE IN REAL WORLD: A COMPREHENSIVE REVIEW

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Metaverse platforms are becoming a more popular way for virtual worlds to collaborate. Users can utilize such platforms to create virtual worlds that can be used to imitate real-life experiences through various social activities. Metaverse not only permits new forms of engaging telepresence, but it also has the potential to make required chores more straightforward. Different domains, such as education, healthcare, consumption, and entertainment, are increasingly facilitated by such technologies. There is a need for comprehensive bibliometric analysis in this domain to better characterize and comprehend Metaverse literature research. The goal of this study is to characterize the research literature over the last five years (2018-2022). A bibliometric analysis is conducted using Scopus data, which includes 71 research publications. Significant areas linked with the current research subject Metaverse have been identified as Virtual reality, augmented reality, Machine learning and mixed reality. Researchers can gain an overview of the examined field and contribute to the advancement of this subject by reading this publication. This article provides an overview of Metaverse's current state of development. This study also describes the social character of the Metaverse and addresses some of the issues. The development of the Metaverse is the focus of this article. This paper also address a number of critical challenges that help to construct and sustain the Metaverse from a technology and ecosystem standpoint.

Keywords: Metaverse, Virtual reality, augmented reality, Machine learning, mixed reality.

MULTI-STAGE STOCHASTIC MODEL FOR TRANSMISSION DYNAMICS OF HIV/AIDS

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A mathematical framework for analytical and numerical solution of the multistage Markov model for AIDS epidemic is developed. A system of differential equations is formed for individuals in three-stages for the transmission of HIV/AIDS epidemic. It is assumed that the transition probabilities between the stages of the model are both time and state dependent. To illustrate the analytical results and numerical algorithm developed based on Runge-Kutta fourth order method, we compute various characterizing indices.

Keywords: Markov Model, Transmission Dynamics, HIV, AIDS, Runge-Kutta method, Public Health. three-stages model

DIFFERENTIAL EVOLUTION ALGORITHM FOR MULTI-ITEM SUPPLY CHAIN MODEL WITH ADVANCE PAYMENT AND SALES EFFORT DEPENDENT DEMAND

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The collaborative and non-collaborative policies for an advance payment of multi-item two echelon supply chain with single manufacturer and retailer is investigated in this study. Indexation is the technique of adjusting financial outcomes to account for changes in the general price level to maintain consumer buying power. In this paper, the consumer pricing index (CPI) at the retailer has skyrocketed and the wholesale price index (WPI) at the manufacturer has plummeted. Price and sales team tactics dependent demand is considered to evaluate the variation of optimal gross profit, production rate, manufacturer's cycle duration, retailer's cycle duration, selling price, and initiatives of sales team. The profitability of the concerned supply chain is examined by using world bank data of index number. To demonstrate how to apply the suggested model, numerical results are computed and compared using two different metaheuristic approaches for optimization namely differential evolution algorithm and PSO

Keywords: Supply Chain, Collaboration policy, Backlogging, Wholesale price index (WPI), Consumer price index (CPI), Prepayment

EFFECTS OF MEMORY ON INVENTORY CONTROL AND PRICING POLICY OF IMPERFECT PRODUCTION WITH REWORK PROCESS

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Fractional calculus is a pertinent way to consider memory in a mathematical model of a dynamical system. Inventory control is also a memory-dependent system. An inventory model with imperfect production and a price-sensitive demand is modelled by using a fractional order differential equation. The Caputo fractional derivatives and integrals are used to consider memory effect. The defective units in the manufacturing process are repaired by doing the rework process. Optimal pricing and production policies are suggested by using a quasi-Newton optimization technique. A numerical illustration along with sensitivity analysis is presented to get managerial insights into the proposed study.

Keywords: Inventory, Memory effect, Fractional calculus, Imperfect production, Price sensitive, demand, Rework

A COMPARATIVE ACCOUNT OF ORGANIC- AND CHEMICAL-FERTILIZED AGRICULTURAL FIELDS OF THE KOTA REGION OF BILASPUR DISTRICT

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The soil is a vital part of a living ecosystem that serves the plants, animals, and microbes to sustain. The soil fertility is often maintained by organic and synthetic fertilizers. The organic fertilizers are generated from the natural digestion of biomass i.e., manures. While the chemical fertilizer consisted of artificially synthesized minerals and chemicals. Chemical fertilization is widely used around the globe to enrich fertility soil due to its rapid effect but the excessive use of chemical fertilizer in agriculture results in soil acidification and soil crust which leads to the depletion of organic content, humus, and soil symbiotic species, altering of pH and so on. The organic fertilizers contain small decomposed organic materials bound to soil particles to make biologically active soil aggregates and remain a stable part of the soil structure. Stabilized soil can store more water and act as drought resilience. Therefore, the present work was focused on the comparative account of organic- and chemical- fertilized agricultural fields of the Kota region. The present study concluded that organic fertilizers are more potent in long-term soil quality and Eco-friendliness while chemical fertilizers are absorbing quickly and manifest rapid nourishment to the plants. The controlled use of chemical fertilizers also induces soil microbes.

Keywords: Soil fertility, Chemical fertilizer, Organic fertilizer, decomposed organic materials, agriculture fields, Kota.

DELAY ANALYSIS OF MR-1 MULTIPROCESSOR

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We study an alternative MR-1 architecture for shared - memory multiprocessors in which the processors are grouped into clusters. We facilitate the concerned literature of multi-processor system. We provide the complete description of the entire working environment for MR-1 architecture that is divided into three levels of storages. For each processor, the first, second and third levels of storage are considered as local cluster and global memories respectively. We outline the notations and assumptions related to the system. We develop queuing model having finite capacity to analyze the MR-1 multiprocessor. The flow aggregation technique is used to derive various performance characteristics such as the average delays of local, cluster and global memories, throughput etc. Numerical results are provided to examine the effect of system parameters on various performance induces obtained analytically. We discuss some important aspects of the queuing model developed to predict performance measures of MR-1 multiprocessor.

Keywords: MR-1 Multiprocessor, Flow aggregation technique, memory multiprocessors

CONFORMAL KILLING P-FORM WITH THE OPERATORS FOR COMPACT KAHLERIAN MANIFOLD

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In the present paper, our main emphasis is to facilitate some outstanding results for conformal killing p-form by introducing a new operator for compact Kahlerian manifold. The basic outline and definitions of killing p-form and conformal killing p-form are presented for a crystal clear outlook for investigation. Moreover, the basic equations of a conformal killing p-form are also explicitly mentioned. We provide the equations related with the operators for differential forms in Kahlerian manifold. Further, we formulate the identities for a conformal killing p-form mathematically which are illustrated by the algorithms. Finally, some important results are derived in the form of theorems which lead to a remarkable attension for investigation of killing p-form for compact Kahlerian manifolds.

Keywords: Compact Kahlerian manifold, killing p-form, conformal killing p-form, operators

Q8 VET APPLICATION

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The purpose of this paper is to research the idea of developing an application that will assist pet owners in navigating through the different vet clinics in Kuwait and book appointments on their own, as part of this Capstone project at the College of Engineering & Applied Sciences at the American University of Kuwait. This paper begins by addressing the importance of having a platform that have different vet clinics so life would be easier for both pet owners and veterinarians. Moreover, we examine the different features will add to our application so users can have the best experience. Thus, our project will help pet owners take the best care of their pets without having to worry about finding clinics or how to book appointments.

Keywords: Veterinary, Veterinary clinic, Veterinary Application, Pets Application, Pets

DYNAMICS OF SPATIO-TEMPORAL DEVELOPMENT IN UTTAR PRADESH: A STATISTICAL ANALYSIS

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The three major sectors linked to any flourishing economy are agriculture, infrastructure & socio-economic sector, however, in certain cases, regional disparities in these sectors, hinder economic growth. The present paper outlines a method to assess Spatio-temporal development disparities in these sectors at the district level in Uttar Pradesh for three different time periods viz Period-I (2000-01), Period-II (2010-11) & Period-III (2017-18). In order to observe the net influence of all these three sectors to the overall development of the state sector-wise composite indices of development, weighted mean development index and Spearman rank correlation coefficient have been calculated. In order to examine the statistical significance of changes in the level of development over the different time periods with respect to all the three sectors, the Kruskal-Wallis H test has been used. Analysis reveals that wide regional disparities have been observed among the districts of Uttar Pradesh and the districts of G. B. Nagar, Ghaziabad, and Lucknow are top-ranked districts in the latest time period viz 2017-18 in overall economic development and are classified into a highly developed category with about 2.02 percent of the state area and a population about 4.80 percent. While the districts of Sonbhadra lagged much behind to all these districts and falls under the category of least developed districts. The study also reveals that about 59.33 percent of the state area and 60.67 percent of the state population is occupied by those districts which are classified under the developing category and 31.30 percent of the state area and 25.51 percent of the state population resides in the less developed districts. The proposed analysis may be useful, and robust enough to be tested in reducing the regional disparities in Uttar Pradesh.

Keywords: Regional disparities, Spatio-temporal Development, Weighted mean development index, Kruskal-Wallis H Test, Uttar Pradesh

TALENT ACQUISITION STRATEGIES IN TEXTILE INDUSTRIES FOR NATION BUILDING

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The textile industry has served as a symbol of India's cultural legacy, bringing people together and playing a vital part in their economic interests. Men, material, money, and the market all play a role in the successful operation of every industry including textile industries. Among all of these criteria, manpower is the most important. Strength of any industry is its employees. As a result, human resource management methods in administration must be adopted by every firm. Human resource management in the textile business is examined in this paper.

Keywords: Textile industries, talent acquisition, Human resource department

DIVERSITY & SEASONAL PREVALENCE OF THE FUNGI OF WHEAT CROP FIELD IN THE AREA OF MUNGELI C.G.

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Numerous microorganisms live in the plant phyllosphere; fungi are among the more prevalent ones. The goal of the current experiment was to distinguish distinct fungus species from wheat crop gathered from three separate Mungeli sites. Using wheat plant leaves, ten distinct isolates namely Mucor sp., A. flavus, A.terreus, A. nidulans, Alternaria alternate, Helminthousporium sp., Penicillium sp. and Rhizopus nigricans were gathered. The fungal isolates were identified based on the structural characteristics by microscopic examination. The diversity of fungi were observed in terms of structure and functional aspects of cell morphological characterization.

Keywords: Phyllosphere, wheat, Bacteria, Characters & Identification

WEATHER DATA ANALYSIS BASED ON DATA MINING CLASSIFICATION ALGORITHMS

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The weather conditions are changing continuously and the whole world is affected by the weather change. So that the correct weather observation and prediction is required. Weaidther forecasting has great impact in many fields such as Air Traffic, Agriculture, Forestry, Military, and Navy etc.This paper discuss about different data mining classification algorithms, apply those algorithms in weather dataset and find which algorithm is best for weather prediction. This experimental work is done by using machine learning tool WEKA. Classification algorithms SVM, Naive-Bayes, C4.5, k-NN and Random Forest are used to forecast weather data. The weather dataset has been collected from Bilaspur Meteorological department for year 2018-19. Dataset contains 730 instances having 6 attributes. Decision tree C4.5 achieves best performance then other algorithms.

Keywords: Machine Learning, Data Mining, Classification, Algorithm, Dataset.

IMPACT OF EMOTIONAL INTELLIGENCE ON CUSTOMER LOYALTY TOWARDS ONLINE FASHION STORES IN INDIA

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Customer loyalty towards a brand or a product has been measured. Historically customers have been loyal to the shops or the shopkeepers of the localities where they live. Buying goods from specific shops or shopkeepers based upon personal relationships has been a part of the cultural mellowing of many societies across the world. The disruption caused by the online stores to this cultural mellow have been considerable so far. However, the social norms don't fade away in the event of technological disruptions. It only transforms subject to the availability of new space and emerging situations. Online web stores have also created a brand personality to engage with their customers emotionally. In this research paper, the brand personalities of these online fashion stores have been measured using the established scales to measure the emotional intelligence of the online fashion customers and the brand personalities of the online fashion stores. The paper establishes a relationship between EI and BP through various factors which bypasses the limitations of geographical presence and interpersonal relationship of the shopkeepers.

Keywords: Brand Loyalty, Emotional Intelligence, Customer Loyalty, Brand Personality, Online, fashion Stores

DEMOGRAPHIC DIVIDEND OF THE TRIBAL POPULATION DEPENDENT UPON THE FOREST PRODUCE UPON THE PROVISIONING OF PROTECTED AREAS

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raditionally the tribal population has been dependent upon forest produce. Tribals across the world have been the part of forest ecology until recently when the urban and tribal population has increased the interactions and transactions due to increased population and emerging conflicts of land ownership, citizen rights and land use etc.This study contributes to the undergoing research upon the roles and benefits of tribal population by the preservation and enlarged provisioning of forest produce by including the urban and rural consumptions.The scope of this research is the tribal areas in and around Golaghat and Nagaon district of Assam. The periphery of Kaziranga National Park.The outcome of the paper is assessment of the demographic dividend of the tribal population living around Kaziranga National Park engaged in provisioning of the forest produce.

Keywords: Forest produce, Demographic Dividend, Tribal Population

A SENTIMENT ANALYSIS MODEL FOR COLLEGE FACULTY COMMENT EVALUTION BY UTILISING COLLECTIVE MACHINE LEARNING TECHNIQUES

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The methodical process used in Higher educational institutions to assess how well professors are performing in a leacture hall. It strives to offer helpful cristism for professors which enhances college students' education. The college students provide unstructured textual comments for the evaluation process. These comments are based on the subject matter comment, teaching approches, course content and learning experiences of the professor. The college student comments will be analysed by using sentimen analysis Random Forest, Decision Tree, Logistic Regression and Naive Bayes algorithms will be applied for these evaluations. This research helps to improve the quality of higher education.

Keywords: Sentiment Analysis, Machine Learning.

FRUIT DETECTION FOR OPEN ORCHARD USING DEEP LEARNING APPROCH

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Agriculture plays an important role for people in both abstinence and social sectors. Fruit production is one of the basic requirements of all households. Nowadays, artificial intelligence plays an important technological tool that is used to achieve good results in today's society. Correct fruit detection is still a difficult task in vision based predictive analysis area. Deep Learning has challenging applications because of its capabilities to map patterns based on image inputs. Convolutional Neural Networks (CNNs) provide a deep learning approach for image classification. The objective of this paper is to build intelligent detection systems to improve tree fruit detection, fruit counting and yield estimation in agricultural applications, as well as to aid smart farming practices among fruit growers. The main goal is to implement a vision-based system which can detect and quantify fruits in open fields to predict yield in an open orchard.

Keywords: Deep Learning · ConvNets · Machine Learning · Fruits Classification · Fruits Detection · Yield Estimation

DUAL ACCESS CONTROL STRATEGY FOR PREVENTING EDOS ATTACK ON CLOUD DATA

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Data owners can distribute protected data utilizing cloud storage of legal person with maintaining accessibility control rules concealed using the Ciphertext-Policy Attribute-Based Encryption approach with a confidential access security strategy. Moreover, a technique to restrict clients from gaining subsequent data and provides the owner's limited amount of data on objects that create a dispute of interest or someone whose pairing is critical is still to be investigated. In this research, examine the fundamental relationships between these specific data items, establish the idea of the confidential documents set restriction, and suggest CP-ABE access control system for the confidential data set restriction with concealed properties. This approach entails a somewhat concealed, extendable restriction strategy. To improve protection, the responsibilities of implementing the access control mechanism and the restriction strategy are split into 2 autonomous units in proposed design, thanks to the clearly defined responsibilities concept. After the scheme has been established, the data holder can substantially update the personal data collection restriction design using the concealed restriction strategy.

Keywords: Data Security, Ciphertext, Confidential Data, Cloud Storage, Data Owner

REVIEW ON ENERGY OPTIMIZATION USING ANT COLONY OPTIMIZATION: MANET

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In MANET here are scores of proposed algorithm which are inspired by the behavior of nature's species likely by ants, bee, birds due to there decentralization and subjective configuring route search for food. Mobile Ad-hoc network (MANET) is a automatic configuring network which forms an unforeseeable network of mobile nodes. In the MANET accordance to the need of communication of the data from one node to another node without any centralized control, all the nodes are movable and that can be connected dynamically. MANET is defined as a collection of wireless mobile nodes and it routing depends on the mobility of nodes. In this paper we have extensive review on ant colony inspired OLSR (ACOLSR) which has been proposed to determine the optimum route to transfer data from source to destination to reduce energy spent by each node. It is inspired by genetic behavior of ant to seek for food. Our discussions address in this paper heuristic component while calculating pheromone concentration is also added to deterministic proposition using ETX metric of the link to further alleviate the performance of the network. Therefore, it has found that packet delivery ratio (PDR) has been improved significantly in the proposed routing protocol because best path has been chosen over other paths considering lossless transmission in a wireless scenario. Ant colony inspired OLSR's studies demonstrate that it mitigate delays and energy consumption better than others.

Keyword- MANET, OLSR, Ant Colony Optimization, Energy Consumption.

AN ANALYTICAL STUDY ON EDISTRICT PROJECT OF ASSAM GOVERNMENT USING MACHINE LEARNING TOOLS

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The main goal of this work is to analyze the eDistrict Project related cumulative data available in the eDistrict portal and the data of three Districts of Assam, namely Kamrup Metropolitan, Kamrup (Rural) and Nalbari, for the calendar years 2018, 2019, 2020 & 2021 that have been collected. This study will help us not only to evaluate the effectiveness of the various services being offered under this project, but also it will provide necessary helps to the district administrations of the different districts to plan their resources to offer the services more effectively.The Python programming language has been used to analyze these data. It is also well known for making the predictions on basis of machine learning. We are using this language due to its versatility, speed limitations, ease of learning, and vast libraries (Pandas, Numpy, Matplotlib, SciPy, Scikit-learn, TensorFlow, Keras, OpenCV, AgentPy, etc.).

Keywords: eDistrict, eGovernance, Regression, Machine-Learning

CLOUD COMPUTING CHALLENGES AND SOLUTIONS

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ABSTRACT

Cloud computing is one the major innovations in technology. It has the ability to exponentially increase technological services and delivery at great speeds. It has limitless resources like storage, raw computing power, A.I., machine learning framework and networking components. Cloud computing can solve many business problems such as network upgrades, mobility, ability for the businesses to easily scale, maintain flexibility and reduce costs. One of the many challenges involved with cloud computing is load balancing, security, service outages, upkeep and many other problems. Proper load balancing maximizes availability of resources, reduce costs and enables scalability. Secure encryption algorithms and classification of data can help improve security. Efficient task scheduling algorithms that can also focus on network bandwidth can reduce execution time and also cost. Efficient mining processes of BigData can help to quickly achieve new knowledge on economic growth and technical innovations. This paper is a study on the different types of algorithms that can tackle these challenges faces by Cloud Computing services including challenges of finding the root causes of service outages and how on resolving them can further improve the services delivered by various businesses.

Keywords: Cloud Computing, Cloud service Providers, Internet of Things.

AUTHENTICATION IN CLOUD ENVIRONMENT: CHALLENGES AND SOLUTIONS

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Due to increasing use of cloud services as well as increasing numbers of cloud users, cloud security is an important issue. Many authors are working on various authentication protocols to secure data in cloud environment. The protocols proposed by the authors need to be analysed not only in terms of security they provides but in terms of computationally efficient also. There are many methods of authentication protocol like certificate method, key based method and even Blockchain method, these methods can be utilized in combination also. There are many challenges related to cloud security in terms of efficient authentication protocol and its solutions. Image based authentication of cloud security is one of the latest development which need to be explored for cloud security.

Keywords: Cloud security, Authentication protocol, Image based authentication,

IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN TEACHING-LEARNING: AN ANALYSIS OF CHHATTISGARH STATE OF INDIA

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Information and Communication Technology (ICT) play important role for improving academic performance of students in Teaching-Learning process and need to be analyzed. Learning topic through ICT and without ICT and Learning topic from ICT competent and non-ICT competent teachers are the two objectives considered for the current research work. Data are collected through questionnaire consisting various details as per the objective of the research. Since environmental study is one of the compulsory subject as foundation course at the UG level in the state of Chhattisgarh, therefore impact study was done on the basis of this subject as academic achievement. Out of total 566 samples collected through questionnaire, 332 samples are from UG level out of which 264 students had studied environmental study during the period of collecting data through questionnaire. Academic score of the concerned students were collected from the students itself through E-mail. The two hypothesis framed as per the objective reveals that ICT has its impact on academic improvement of a student, means students studying with ICT are getting more marks than students studying without ICT.

Keywords: Information and Communication Technology (ICT), Impact analysis, Environmental study.

A MATHEMATICAL ASSAY ON PRAXIS SOLICITATION OF GAME THEORY: WHO IS WORTH MORE, KNIGHT OR BISHOP?

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Chess is a 2 - dimensional board game, which in its general form is played between 2 players. The Game consists of a board of 64 squares, 16 black pieces, and 16 white pieces. The White is allowed to play the first move. Amongst 16 pieces of each player, there are 6 suites, namely 8 Pawns, 2 Bishops, 2 Knights, 2 Rooks, 1 Queen, and 1 King. The relative values of pieces are 1 for Pawns, 3 for Bishops and Knights, 5 for Rooks, 9 for Queen, and ∞ for King. We have found that the relative value of the bishop is greater than that of the Knight with Mathematical Rigor. Our justifications provide a concrete aptness of the result and we have proved that the relative value of Bishop is $\frac{5}{3}$ times the relative value of Knight.

Keywords: Probability, Chess, Bishop, Knight, Combinatorics

1. INTRODUCTION (Level 1: First Section)

Chess is a dual-player board game. It is sometimes called Western chess or international chess to distinguish it from related games such as Xiangqi and Shogi. The game's current form originated in southern Europe in the late 15th century and evolved from chaturanga, a similar but much older game of Indian origin. Today, chess is one of the most popular games in the world and is played by millions of people worldwide (*Shibut, 2004*). Chess is an abstract strategy game and contains no hidden information (*Trautman, 2015*). It is played on a square chessboard with 64 squares arranged as 8×8 grids. First, each player (one white and one black) controls 16 pieces (King, Queen, 2 Rooks, 2 Bishops, 2 Knights, 8 Pawns). The object of the game is to checkmate the opponent's king. Each player tries to reach the zenith. There might be numerous scenarios, where the game ends in a draw. Organized chess began in the 19th century (*Saariluoma,1995*). Chess competitions are now governed internationally by FIDE (International Chess Federation). Wilhelm Steinitz, the first world chess champion to be recognized worldwide, won the title in 1886. Magnus Carlsen is the current world champion. A huge amount of chess theory has evolved since the game's inception. Aspects of art are reflected in the composition of chess, and chess has influenced Western culture and art, with connections to other fields such as mathematics, computer science, and psychology. One of the goals of early computer scientists was to develop a machine that played chess. In 1997, Deep Blue became the first computer to beat the reigning World Champion in a match when he defeated Garry Kasparov (*Jeremy, 1998*). Today's chess engines are far more powerful than the best human players and have greatly impacted the development of chess theory. Figure 1, shows a typical 8×8 chessboards.

Figure 1: A Typical Chessboard.

2. HISTORY

The earliest documentation of the origins of chess dates back to the early 7th century. Three are written in Pahlavi (Middle Persian) *(Antonio (1999))* and one is Harshacharita in Sanskrit *(Andreas (1999))*. One of these texts, Chatrang-namak, is his one of the earliest written descriptions of chess. The narrator, Bozorgmer, explains that Chhatran, a Pahlavi word meaning chess, was introduced into Persia by "Dewasaam, the great ruler of India" during the reign of Khosrow I *(Warner, (2000))*. The oldest known chess manual written in Arabic dates back to 840 AD and was written by the famous Arabic chess player al-Adli ar-Rumi (800–870), Kitab ash It is entitled -shatranj (The Chess Book). This is a lost manuscript but is referenced in later works. Again, Al-Adri attributes the origins of Persian chess to India with the 8th-century fable Kalilawa his Dimna. By the 20th century, substantial consensus had been formed on the origins of chess in northwestern India in the early 7th century. More recently, this consensus has come under further scrutiny. An early form of Indian chess was known as chaturanga (Sanskrit: चतुरङ्ग) four divisions of the army - infantry, cavalry, elephants, and chariots - which later became modern pawns, knights, bishops, or towers. Chaturanga was played on his 8×8 unchecked board called Ashtāpada. From there it spread east and west along the Silk Road. The earliest evidence of chess was found around 600 AD in nearby Sassanid Persia, where the game became known as chatlan. Chatran was assimilated into the Islamic world after its conquest of Persia (633–51), where it was called Shatranji, and most of the works retain the Persian name. In Spanish, "Shatranj" was rendered as Ajedrez ("al-Shatranj"), in Portuguese as Xadrez, in Greek as ζατρίκιον (Zatrikion, directly from Persian Chatran), but in other European Regional versions of the Persian word shah ("king") from which the English words "check" and "chess" are derived. The word "checkmate" comes from the Persian word shamaat ("the king is dead") *(Douglas et al. (2012))*. An antique Indian chess game made of sandalwood. Here, riders on elephants, horses, and camels represent the work, which European predate his Stanton designs. Knights Templar playing chess, Libro de Los Juegos, 1283. Xiangqi is the most famous form of chess in China (*Tamburro, 2010*). The eastward migration of chess to China and

Southeast Asia is even less documented than the largely speculated westward migration (*Robbins, 1996*). The term Xiangqi has been used in China to refer to the game since at least 569 AD, but it has not been proven that the game is directly related to chess *(Peter, (1997))(Jim et al., (2016))*. The first references to Chinese chess appear in a book entitled Xuán guaì lù GENKAI ("Mysterious and Strange Record") from the 800s. It is believed to have originated from one of its predecessors, but this has been denied. Chess historians Jean-Louis Cazeau and Rick Knowlton argue that the unique properties of Shang-Chi made it easier to construct an evolutionary path from China to India/Persia than the other way around *(Banaschak, 2013)(Vale, 2001)*. Chess The oldest archaeological relic of the ivory statue was unearthed in ancient Afrasiab (now Samarkand) in Uzbekistan in Central Asia and dates to 760 AD. *(Caraux et al. (2017))*. Remarkably, almost all discoveries of the oldest works along the Silk Road have been made from the former regions of the Tarim Basin (now Xinjiang, China), Transoxiana, Sogdiana, Bactria, and Gandhara to Iran at one end (*Tarasch, 1987)*, which was discovered in India via Kashmir. other. The game reached Western Europe and Russia via at least three of his routes, the earliest being in the 9th century. By 1000, it had spread to both Muslim Iberia and Latin Europe, and his late 10th-century Latin poem called de scachis is extant in the Einsiedeln Abbey (*Steinitz et al., 2004*).

3. MATHEMATICAL RIGOR

Problem Statement: *Given a* $n \times n$ *matrix,* $\mathcal{M}_{n\times n} = \begin{bmatrix} \mathfrak{C}\langle 0|0\rangle & \cdots & \mathfrak{C}\langle 0|n-1\rangle \\ \vdots & \ddots & \vdots \\ \mathfrak{C}\langle n-1|0\rangle & \cdots & \mathfrak{C}\langle n-1|n-1\rangle \end{bmatrix}$*. Let us define a dynamical system,* $\mathfrak{B}(i,j)$ *that can move diagonally in 4 directions, and another dynamical system,* $\mathfrak{K}(i,j)$ *that can move in L (2: 1) based dynamics. For any* $(0,0) \leq (i,j) \leq (n-1, n-1)$*,* $\frac{\mathcal{I}(\mathfrak{B}(i,j))}{\mathcal{I}(\mathfrak{K}(i,j))} = \lambda n^{\mu}$*. The tuple* (λ, μ) *is to be found, where* $\mathcal{I}(P)$ *is the influence function, and* $\mathfrak{C}\langle i|j\rangle$ *denotes the content of the* $i'th$ *row and* $j'th$ *column.*

We will have to encounter for the best, worst, and the average case scenarios. A state space of the $n \times n$ matrix, $\mathcal{M}_{n\times n} = \begin{bmatrix} \mathfrak{C}\langle 0|0\rangle & \cdots & \mathfrak{C}\langle 0|n-1\rangle \\ \vdots & \ddots & \vdots \\ \mathfrak{C}\langle n-1|0\rangle & \cdots & \mathfrak{C}\langle n-1|n-1\rangle \end{bmatrix}$ is said to be the *Best – Case Situation*, if the tuple $\big(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\big)$ attains it's maxima, but if it attains it's minima it's bound to be called as *Worst – Case Situation*, while any positional request apart from these two situations are declared to be under *Average – Case Situation*.

Case I: $\boldsymbol{\big(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\big) = max\big(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\big)}$

Firstly, we would consider the scenario, when $\big(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\big) = max\big(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\big)$. It is quite obvious from the dynamics, that the Best $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{B}(i,j)$ will always be the Best $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{K}(i,j)$. The Best $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{B}(i,j)$ are $\mathfrak{C}\left\langle \left|\frac{n-1}{2}\right| \middle| \left|\frac{n-1}{2}\right| \right\rangle$, $\mathfrak{C}\left\langle \left|\frac{n-1}{2}\right| \middle| \left|\frac{n}{2}\right| \right\rangle$, $\mathfrak{C}\left\langle \left|\frac{n}{2}\right| \middle| \left|\frac{n-1}{2}\right| \right\rangle$, and $\mathfrak{C}\left\langle \left|\frac{n}{2}\right| \middle| \left|\frac{n}{2}\right| \right\rangle$, if $n = 2k$, $k \in \mathbb{Z}$, and $\mathfrak{C}\left\langle \left|\frac{n}{2}\right| \middle| \left|\frac{n}{2}\right| \right\rangle$ if $n = 2k \pm 1$, $k \in \mathbb{Z}$. The Best $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{K}(i,j)$ are $\mathfrak{C}\langle i|j\rangle \; \forall \; (2,2) \leq (i,j) \leq (n-3, n-3)$. For each of these Best $\mathfrak{C}\langle i|j\rangle$ of $\mathfrak{B}(i,j)$, as well as $\mathfrak{K}(i,j)$,

$\mathcal{I}(\mathfrak{K}(i,j)) = 8$, and $\mathcal{I}(\mathfrak{B}(i,j)) = 3 \times \left\lfloor \frac{n-1}{2} \right\rfloor + \left\lfloor \frac{n}{2} \right\rfloor$ if $n = 2k, k \in \mathbb{Z}$, and $\mathcal{I}(\mathfrak{B}(i,j)) = 4 \times \left\lfloor \frac{n}{2} \right\rfloor$ otherwise.

So,

$$\frac{\mathcal{I}(\mathfrak{B}(i,j))}{\mathcal{I}(\mathfrak{K}(i,j))} = \begin{cases} \frac{3 \times \left\lfloor \frac{n-1}{2} \right\rfloor + \left\lfloor \frac{n}{2} \right\rfloor}{8} & n = 2k, k \in \mathbb{Z} \\ \frac{4 \times \left\lfloor \frac{n}{2} \right\rfloor}{8} & n = 2k \pm 1, k \in \mathbb{Z} \end{cases}$$

Case II: $\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) = min\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right)$

Now, we would work on the discussion, accordingly with scenario when, $\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) = min\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right)$. It is quite obvious from the dynamics, that the Worst $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{B}(i,j)$ will always be the Worst $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{K}(i,j)$. The Best $\mathfrak{C}\langle i|j\rangle$ for $\mathfrak{B}(i,j)$ are $\mathfrak{C}\langle n-1|n-1\rangle$, $\mathfrak{C}\langle n-1|0\rangle$, $\mathfrak{C}\langle 0|n-1\rangle$, and $\mathfrak{C}\langle 0|0\rangle$. For each of these Best $\mathfrak{C}\langle i|j\rangle$ of $\mathfrak{B}(i,j)$, as well as $\mathfrak{K}(i,j)$, $\mathcal{I}(\mathfrak{K}(i,j)) = 2$, and $\mathcal{I}(\mathfrak{B}(i,j)) = n-1$. So, $\frac{\mathcal{I}(\mathfrak{B}(i,j))}{\mathcal{I}(\mathfrak{K}(i,j))} = \frac{n-1}{2}$, with the Worst – Case Scenario will be independent of the Parity of n.

Case III: $min\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) < \left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) < max\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right)$

Now comes the most complicated, yet interesting part of the Problem, $min\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) < \left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right) < max\left(\mathcal{I}(\mathfrak{K}(i,j)), \mathcal{I}(\mathfrak{B}(i,j))\right)$,

$\mathcal{I}(\mathfrak{B}(i,j)) =$

$$\begin{cases} \left(\frac{2\times(2n-1)\times(n-1)+2\times(2n-3)\times(n+1)+2\times(2n-5)\times(n+3)+2\times(2n-7)\times 3\times\left\lfloor\frac{n-1}{2}\right\rfloor+\left\lfloor\frac{n}{2}\right\rfloor}{16\times(n-2)}\right) & n = 2k, k \in \mathbb{Z} \\ \left(\frac{2\times(2n-1)\times(n-1)+2\times(2n-3)\times(n+1)+2\times(2n-5)\times(n+3)+2\times(2n-7)\times 4\times\left\lfloor\frac{n}{2}\right\rfloor}{16\times(n-2)}\right) & n = 2k \pm 1, k \in \mathbb{Z} \end{cases}$$

and

$\mathcal{I}(\mathfrak{K}(i,j)) = \left(\frac{4\times 2+8\times 3+4\times(n-3)\times 4+4\times(n-4)\times 6+(n-4)^2\times 8}{4+8+4\times(n-3)+4\times(n-4)+(n-4)^2}\right)$.

So, for a $n \times n$ matrix,

$$\frac{\mathcal{I}(\mathfrak{B}(i,j))}{\mathcal{I}(\mathfrak{K}(i,j))} = \begin{cases} \left(\frac{\left(\frac{2\times(2n-1)\times(n-1)+2\times(2n-3)\times(n+1)+2\times(2n-5)\times(n+3)+2\times(2n-7)\times 3\times\left\lfloor\frac{n-1}{2}\right\rfloor+\left\lfloor\frac{n}{2}\right\rfloor}{16\times(n-2)}\right)}{\left(\frac{4\times 2+8\times 3+4\times(n-3)\times 4+4\times(n-4)\times 6+(n-4)^2\times 8}{4+8+4\times(n-3)+4\times(n-4)+(n-4)^2}\right)}\right) & n = 2k, k \in \mathbb{Z} \\ \left(\frac{\left(\frac{2\times(2n-1)\times(n-1)+2\times(2n-3)\times(n+1)+2\times(2n-5)\times(n+3)+2\times(2n-7)\times 4\times\left\lfloor\frac{n}{2}\right\rfloor}{16\times(n-2)}\right)}{\left(\frac{4\times 2+8\times 3+4\times(n-3)\times 4+4\times(n-4)\times 6+(n-4)^2\times 8}{4+8+4\times(n-3)+4\times(n-4)+(n-4)^2}\right)}\right) & n = 2k \pm 1, k \in \mathbb{Z} \end{cases}$$

The tuple, (λ, μ) could be concluded accordingly.

4. APPLICATION

Now, in this section we will scrutinize and develop some relation between the relative values of the Bishop and the Knight, taking in account of the mathematical model developed in the Section 3. Though, in many planes, even in classical games, the relative value of both Knight and the Bishop are considered same.

The bishop is a 2'nd order piece in the game that can move along the diagonals

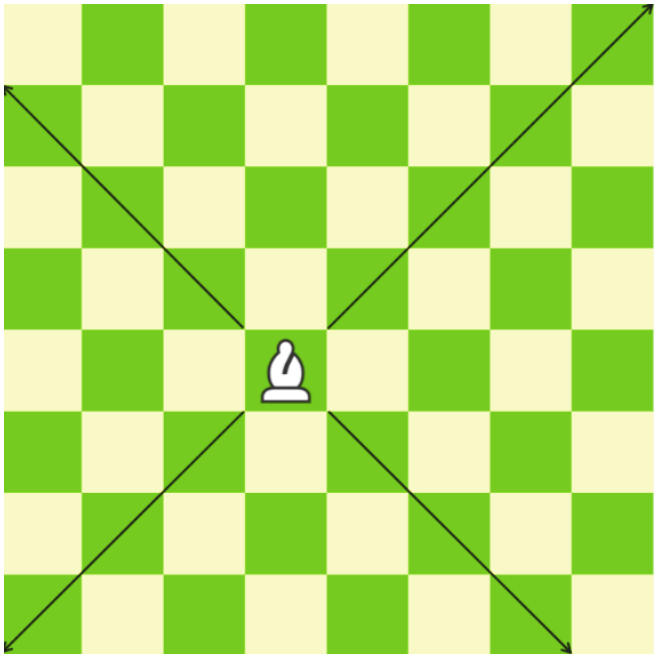

Figure 2: Bishop's Trail

The knight is a 2'nd order piece in the game that can move in 8 directions shown in the diagram below

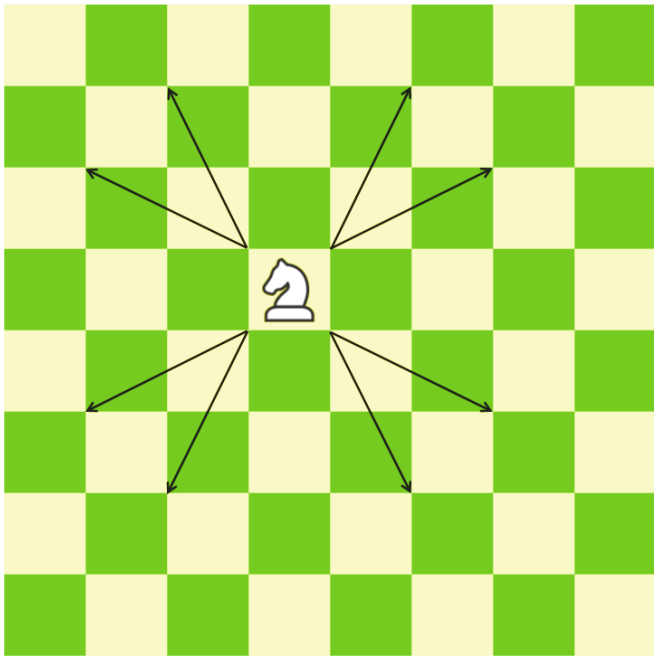

Figure 3: Knight's Trail

Now, depending on the placement of the bishop and the knight, they will influence different number of squares.
Based on the placements, we can have 3 cases:

1. Best Case
2. Average Case
3. Worst Case

Best Case will be the scenario where, the pieces will have an influence on maximum number of squares. Worst Case will be the scenario where the pieces will have an influence on the minimum number of squares. The Cases apart from the Best and Worst Case will be termed as Average Case.

4.1 Best Case Analysis

The Best case common for both the bishop and the knight will be the 4 squares of the center.

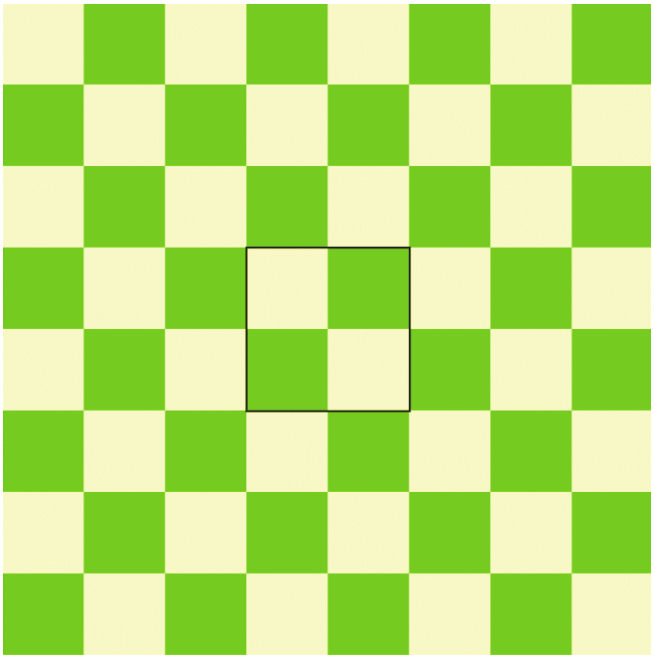

Figure 4: Best Case Squares (Common to Bishop and Knight)

But in accordance to the Best Case common to both the pieces - Bishop and Knight, the Knight has a greater domain of Best Case.

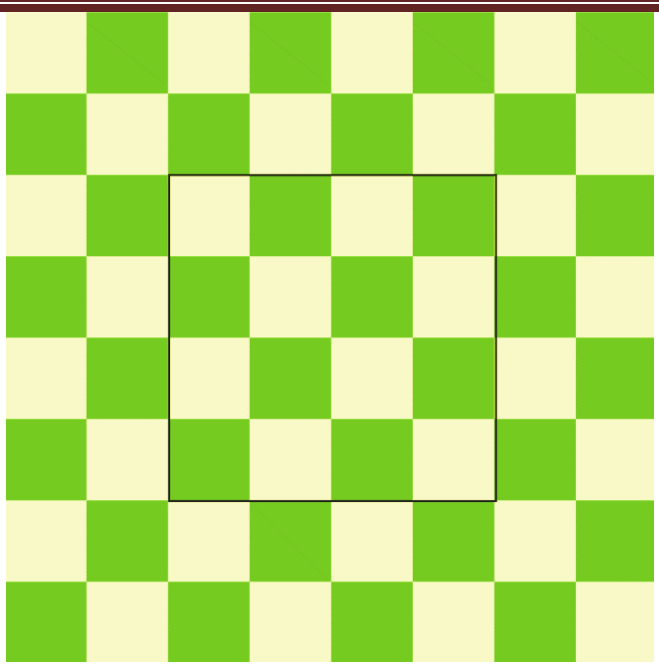

Figure 5: Best Case Squares for Knight

In best case, the bishop will have influence on 13 squares (ignoring the square where the piece is kept) that are situated in diagonal manner with respect to the square where the bishop is placed.

In best case, the knight will have influence on 8 squares that are situated in $2\frac{1}{2}$ squares with respect to the square where the knight is placed.

Relative Piece Value $= \frac{\mathcal{I}(Bishop)}{\mathcal{I}(Knight)}\Big|_{Best} = \frac{13}{8}$

where $\mathcal{I}(P)$ is the influence function.

4.2 Worst Case Analysis

The Worst case for both the bishop and the knight will be the 4 squares of the corner

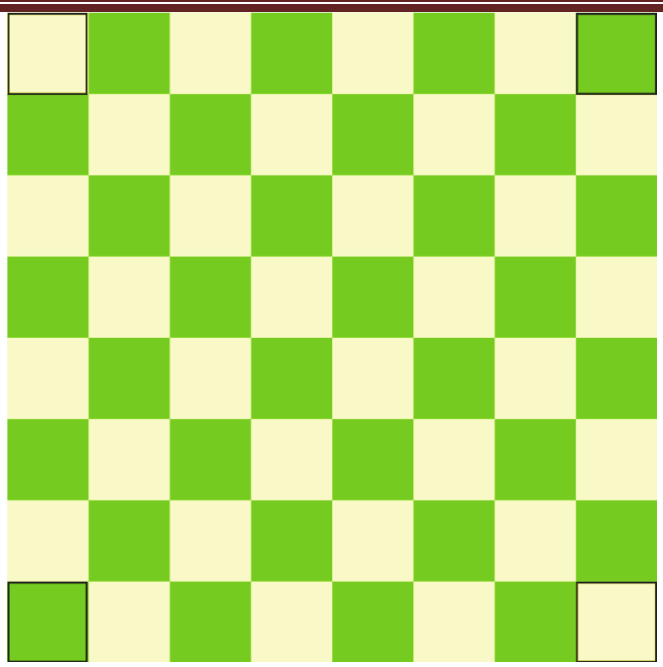

Figure 6: Worst Case Squares

In worst case, the bishop will have influence on 7 squares (ignoring the square where the piece is kept) that are situated in diagonal manner with respect to the square where the bishop is placed.

In worst case, the knight will have influence on 2 squares that are situated in $2\frac{1}{2}$ squares with respect to the square where the knight is placed.

Relative Piece Value $= \frac{\mathcal{I}(Bishop)}{\mathcal{I}(Knight)}\Big|_{Worst} = \frac{7}{2}$

where $\mathcal{I}(P)$ is the influence function.

4.3 Average Case Analysis

The squares other than the 4 squares of the center (for Bishop and Knight) and the 4 squares of the corners will correspond to the Average Case.

In average, the number of squares, under the influence of Bishop will be of the form $7 + 2\mathscr{b}\ \forall \mathscr{b} \in \{0, 1, 2, 3\}$

In average, the number of squares, under the influence of Knight will be of the form $8 - \mathscr{k}\ \forall \mathscr{k} \in 0,2,4,5,6$

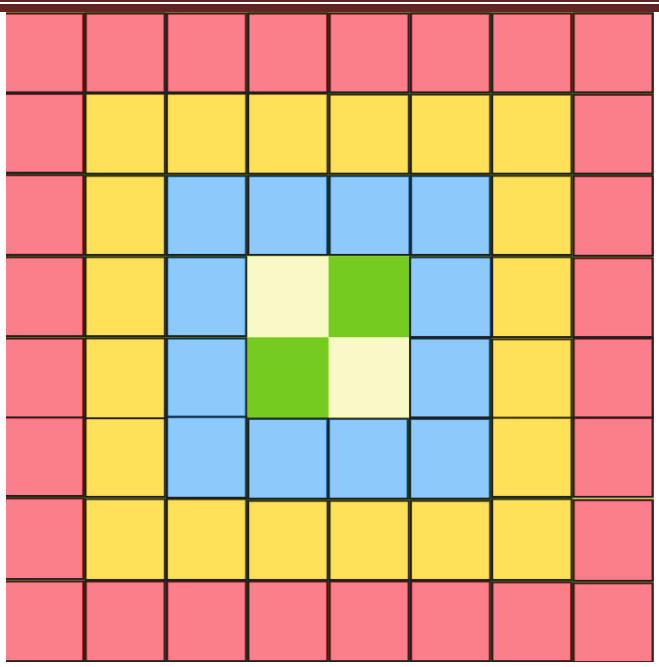

Figure 7: Influence Mapping for the Bishops (Red maps to 7 squares, yellow maps to 9 squares, blue maps to 11 squares, Rest maps to 13 squares)

$$\mathcal{I}(Bishop)|_{avg} = \frac{28 \times 7 + 20 \times 9 + 12 \times 11 + 4 \times 13}{28 + 20 + 12 + 4} = \frac{98 + 90 + 66 + 26}{32} = \frac{280}{32} = \frac{35}{4}$$

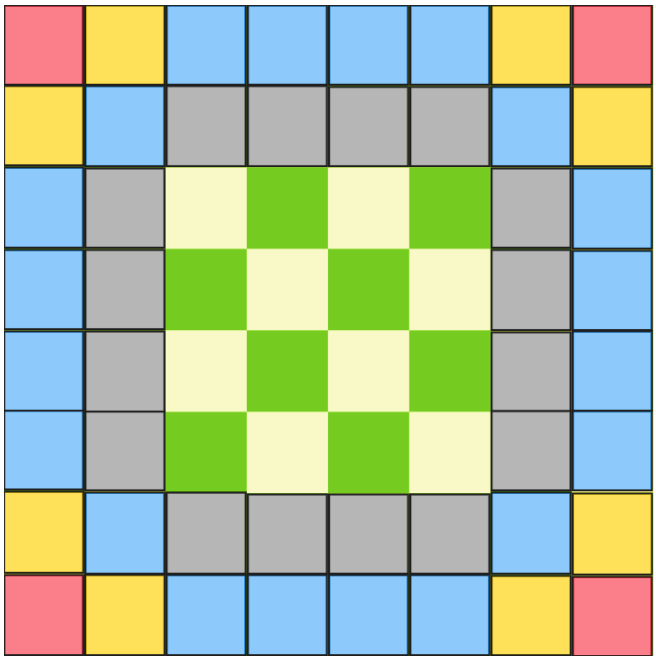

Figure 8: Influence Mapping for the Knights (Red maps to 2 squares, Yellow maps to 3 squares, Blue maps to 4 squares, Grey maps to 6 squares, Rest maps to 8 squares)

$$\mathcal{I}(Knight)|_{avg} = \frac{4 \times 2 + 8 \times 3 + 20 \times 4 + 16 \times 6 + 16 \times 8}{4 + 8 + 20 + 16 + 16} = \frac{8 + 24 + 80 + 96 + 128}{64} = \frac{336}{64}$$
$$= \frac{21}{4}$$

Relative Piece Value $= \frac{\mathcal{I}(Bishop)}{\mathcal{I}(Knight)}\Big|_{avg} = \frac{\frac{35}{4}}{\frac{21}{4}} = \frac{5}{3}$

where $\mathcal{I}(P)$ is the influence function.

5. CONCLUSION

Though in numerous scenarios, the relative piece value of Bishop and Knight is considered the same, but mathematically, it can be proven that the relative piece value of Bishop is greater than that of the Knight. This fact has also been mentioned on the masterpiece creation - "Bobby Fischer Teaches Chess", but insufficient justification was added from his side. This fact can also be utilized in various humanoid chess engines by training their model using ML and AI. Our justifications provide a concrete aptness of the result and we have proved that the relative value of Bishop is $\frac{5}{3}$ times the relative value of Knight.

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A REVIEW OF DIFFERENT MACHINE TRANSLATION TECHNIQUES OF VARIOUS LANGUAGES

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The term "machine translation" refers to the use of automated computing to translate between two natural languages. Filling the linguistic gap between two different groups of people is the primary goal of individuals, groups, or nations that speak various languages. Since there are so many different languages, dialects and scripts in India, there is a great need for language translation. In this research article, we concentrate on the state of machine translation research in India and across the globe right now. We examined a number of significant Machine Translation Systems (MTS) and provided a preliminary assessment of their key methodologies.

Keywords: Machine Translation, Rule based, Statistical, Neural, Hybrid.

1. INTRODUCTION

As India is a large multilingual country, different states have different regional languages; hence for proper communication there is a need of machine translation. But in India the earliest efforts starts from the mid 80s and early 90s Dwivedi et al.(2010). Information Retrieval (IR) is the process of locating and assessing the data from document repositories Wang et al.(2018). When a user requires information, they must make a request in the form of a natural language query. The IR system will then be used to get the output relevant to the information Madankar et al.(2015).

A branch of computational linguistics called Machine Translation (MT) studies the use of computer software to translate text or speech from one natural language to another**.** Dictionary-based and rule-based techniques to machine translation are two of the many options. Translation in Dictionary-Based Machine Translation is derived from a language dictionary's entries. The translation is created using the word's equivalent. Rule-based machine translation takes into account the morphology, syntax, and semantics of the source and target languages. It makes use of grammatical principles and multilingual dictionaries. It employs a number of different methodologies, including the Direct Approach, Transfer Based, Knowledge Based, Corpus Based, Context Based, and Example Based Gehlot et al.(2015). The most fundamental function of MT is the straightforward translation of words from one natural language into another. The translation of literary works into native languages from any language requires the use of machine translation systems. The translation is done once the literary work is fed into the MT system. By enabling global access to literature-rich sources, such MT systems can help people overcome language obstacles. Only 3% of people can understand English, which is the language used for most information. Due to the resultant "digital gap," only a tiny portion of the population is able to comprehend content that is delivered in digital form. MT can assist in bridging the digital divide in this way.

Document translation from one language to another is highly demanded in a vast, multilingual culture like India. There are 22 languages recognized under the constitution that are recognized as official in various states. Various groups speak roughly 1650 distinct dialects. The Indic scripts number ten. These are all highly developed languages with a wide range of vocabulary. Their scripts and grammars are comparable. Similarly, the alphabetical order is used. Common script is used by some languages, particularly Devanagari.

2. STRATEGIES FOR MACHINERY TRANSLATION

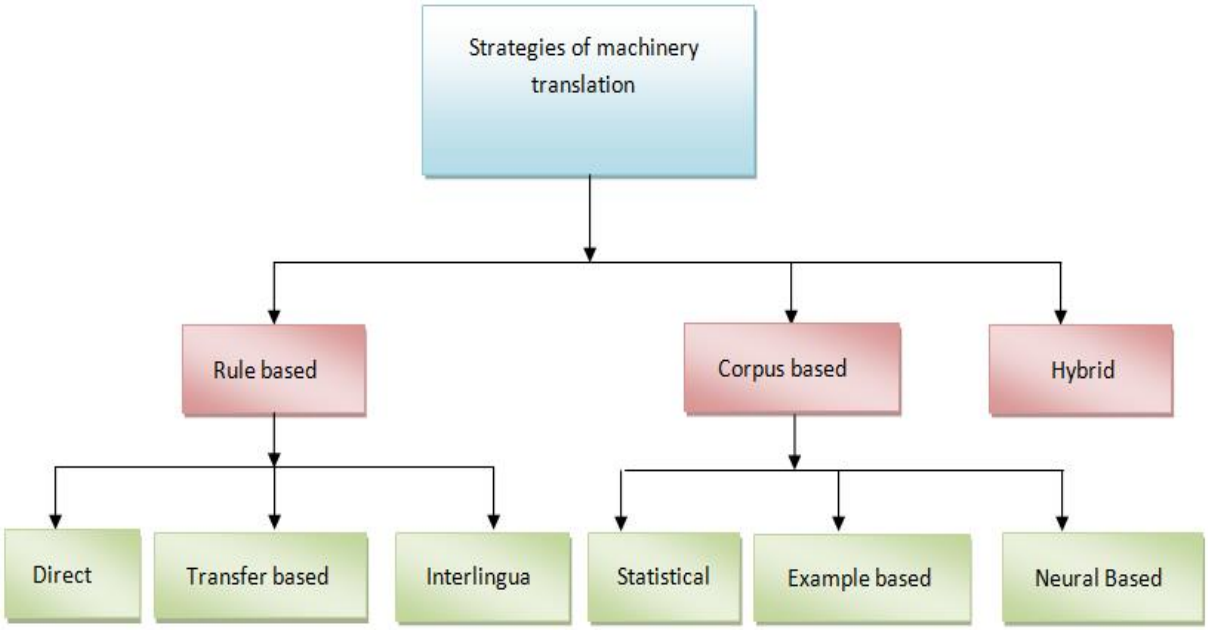

Figure 1: Various machine translation Techniques

As in figure 1 there are various strategies of machine translation system. Which we are going to discuss in the following section:

2.1 Rule Based Machine Translation

Another term for RBMT is "Knowledge Based Machine Translation (KBMT)" Anugu et al.(2020), the earliest commercial machine translation systems were rules-based machine translation (RBMT) systems, which are based on linguistic principles that allow words to be placed in multiple contexts and have varied meanings dependent on those contexts. In three distinct phases—analysis, transfer, and generation—RBMT technology is used to massive sets of linguistic rules. In order to comprehend and map the laws between two languages, programmers and human language specialists have expended significant effort. In order to enhance the translation, RBMT uses manually compiled translation lexicons, some of which may be modified and improved by users.

The author Bhadwal et al.(2020) has presented here for “Hindi to Sanskrit” rule based machine translation system in which a total of 50 randomly selected sentences and 100 tokens (Hindi words or phrases) were used for system assessment, and the findings were obtained in the form of two confusion

matrices. An accuracy of 94 percent is obtained from the semantic assessment of 100 tokens, whereas an accuracy of about 86 percent is obtained from the pragmatic analysis of 50 phrases.

2.1.1 Direct Machine Translation

One of the most straightforward approaches to machine translation is direct translation. With the use of a bilingual dictionary, the input source is translated directly word-for-word in direct machine translation. This is followed by certain syntactical rearrangements. As it is denoted in figure 2.

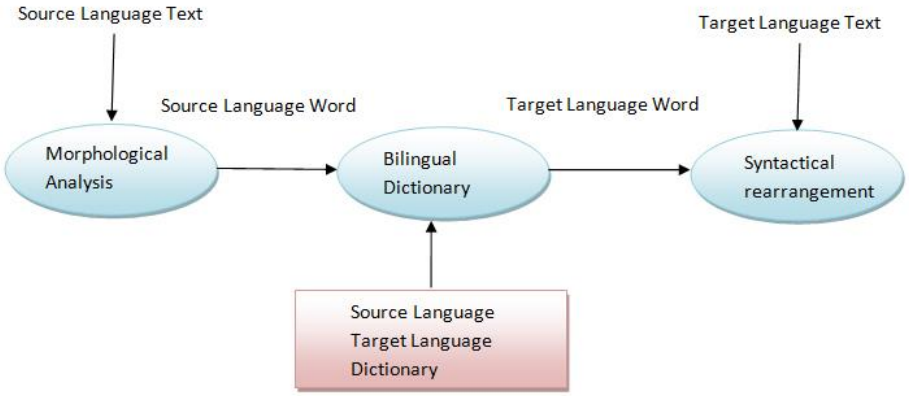

Figure 2: Direct Translation Method

This kind of MT system first analyses the source language grammatically and syntactically (or semantically) to create an intermediary representation. IIT Karnpur's Anusarka is generally the most famous direct machine translation system.

Josan et al.(2008)The approach the author has presented for "Punjabi to Hindi" direct machine translation goes through several stages, including text normalization, tokenization, the translation engine, and target language creation. This method has a 90.67 percent accuracy rate.

Goyal et al.(2010) The method the author has proposed for "Hindi to Punjabi" straight machine translation goes through various steps such as text normalization in hindi,collocations to be found and replaced, locating and swapping out identified items,using lexicons to translate words one for one,eliminating word ambiguity,word transliteration,Processing,increasing the system's precision by using machine learning for each translation project,employing a different test corpus to evaluate the system. This system has the accuracy upto 95%.

2.1.2 Transfer Based

The similar concept underlies Transfer Based Machine Translation, which converts the source text into an intermediary text from which the target text is created. Figure 3 shows block diagram of Transfer based machine translation.

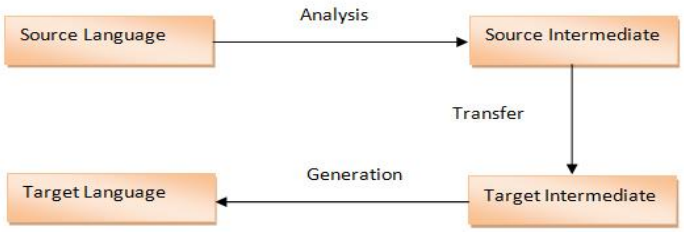

Figure 3: Transfer based Machine Translation

Lavie et al.(2004) According to the strategy the author has described here, a preliminary Hebrew-to-English machine translation system was quickly developed within a transfer-based framework that was created especially for quick MT prototyping for languages with low linguistic resources. This strategy includes pre-processing of the Hebrew input, Analysis of Morphology,Word translation Lexicon,Grammar decoding with the Transfer Engine. This method gives the BLEU score of 0.0606 with no grammar, 0.0775 for lexical grammar and 0.1013 for manual grammar respectively.

2.1.3 Interlingua Translation

This method transforms the original language into a meta-language, or an abstract, language-neutral representation, which then expresses the sentence's semantic meaning. In comparison to the transfer strategy, the target language is then produced from this representation with less effort. This method converts the source language into Interlingua, a middle level abstract representation that is independent of any particular language. Alansary et al.(2014). From this Interlingua, the target language is then produced. The long-held notion that all languages share a common "deep structure," even though their "surface structures" vary widely, served as the inspiration for creating an interlingua. The concept of developing a universal representation that can express this complex structure while gaining the regularity and predictability that natural languages lack was thus born. The block diagram of Interlingua based machine translation is shown in Figure 4.

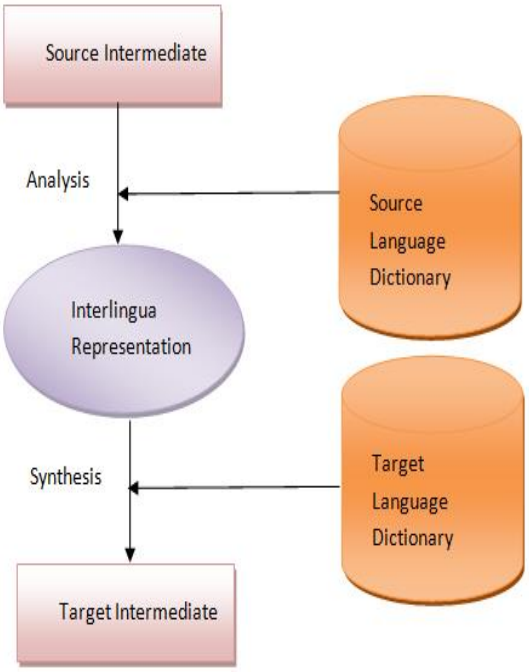

Figure 4: Interlingua Machine Translation

Sreedeepa et al.(2017) In this research, the author suggests a Paninian framework-based machine translation system from Sanskrit to English. Enter the sentence to be translated from Sanskrit, sentence to be shortened, Extract tokens with POS tags, Map and produce interlingua tokens in the target language, make f-structures for the tokens in the target language, after applying the rules to the f-structure of the TL tokens, generate the target language text from the input text. This approach gives the BLEU score of 1.

2.2 Corpus Based Machine Translation

2.2.1 Statistical Machine Translation

Every sentence in a language has a potential translation in the target language, according to the statistical machine translation (SMT) systems. Based on the examination of bilingual corpora, statistical machine translation (SMT) creates translations using a statistical model.

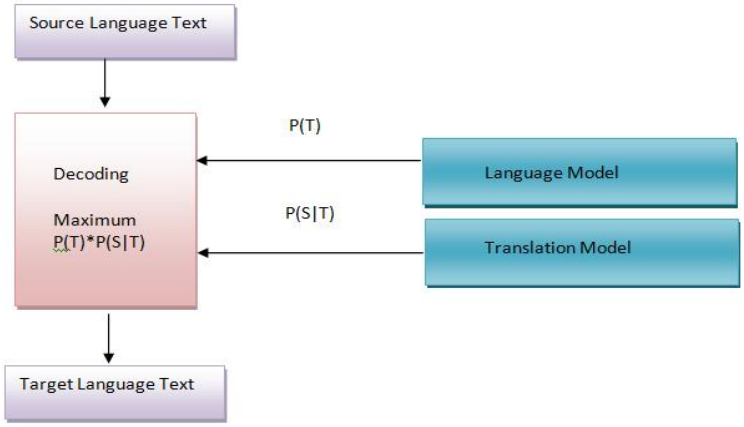

Figure 5: Statistical based Machine Translation

Pandey et al.(2018) Based on bilingual corpora that include both source and destination languages, statistical machine translation (SMT) systems translate text into other languages. The SMT process is divided into three stages: decoding, translation modelling, and language modelling. Target language probability is calculated and indicated by P in the first phase (T). In the second phase, the conditional probability of the target language is calculated given the source language (T|S), and in the final phase, the product of the language model and translation mode is computed. This results in the target sentence that is the most appropriate, P (S, T), which is equal to P (T)(S|T). The block diagram of statistical machine translation is shown in Figure 5.

Pandey et al.(2021)The author used Moses is an open source program that is used to create the Hindi Chhattisgarhi statistical machine translation system. The parallel corpus, a statistical machine translation method, is used to automatically train the translation model for the Hindi/Chhattisgarhi language pair. This machine translation method uses a parallel corpus of 40,000 bilingual utterances in Hindi and Chhattisgarhi. It was discovered that this approach achieves an accuracy of 75% when used to verify the grammatical correctness of 1000 phrases.

Nakov et al.(2008) The author propose English to Spanish statistical machine translation UCB system To build the system, we trained three separate phrase-based SMT systems (max phrase lengths 10): on

the original News Commentary corpus (news), on the paraphrased version of News Commentary (par), and on the Europarl dataset (euro). The system achieved 35.78 and 35.17 Bleu score with the improved and the default recaser and 0.3 in improved recaser.

2.2.2 Example Based

Saini et al.(2015) Examples of translations between source and destination languages are maintained in a corpus by an example-based machine translation (EBMT) system.The bivocal or multivocal corpus, which contains a wealth of data, is translated intelligently by EBMT. For subsequent translation, samples of sentences from the source language and the target language are kept in a corpus. When a piece of material has to be translated, the method checks the corpus to see whether it's already there or looks for any related texts that could help. The administrator updates the corpus for upcoming translations if the administrator discovers a text that has not yet been translated or a better translation. The block diagram is shown in figure 6.

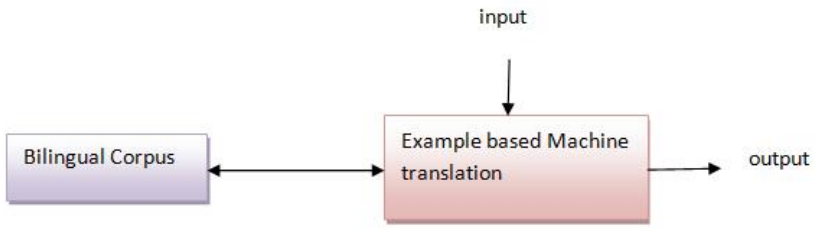

Figure 6: Example based Machine Translation

Pathak et al.(2019) The author used 1.4 million parallel corpora to train the OpenNMT model. For testing the model, we randomly selected 10k sentences from the corpus and computed the BLEU score for each sentence for 6 epoch is as follows 0.0860,0.1403,. The validation source and target were taken as the 20% of 280k sentences of the training corpus.

2.2.3 Neural Based Machine Translation

An artificial neural network is used in neural machine translation (NMT), a method of machine translation, to forecast the likelihood of a word sequence, generally modelling full sentences in a single integrated model. The basic architecture is shown in figure 7.

Figure 7: The neural machine translation system

Laskar et al.(2020) Data preprocessing, system training, and system testing are crucial system architecture phases, and they are all covered in the subsections that follow. To train and evaluate the NMT system, they used the OpenNMT and Marian NMT tools. They have achieved BLEU score 24.6 on primary configuration and 53.7 in constructive configuration.

Madaan et al.(2020) The author suggested High augmentation, Multilingual, and three augmentations (Forward, Backward, and Self); High augmentation includes parallel data from high resource language pairs, such as Hindi and English. This aids in enhancing low resource pair translation models, they have achieved increases BLEU score by 20 points if a rich resource language pair is added and by 15 points if no new data is added.

Singh et al.(2017)Deep neural networks are neural networks with several hidden layers. The author has 20,000 words with their feature values, and they may assign a vector value to a word depending on its feature by retrieving its Hindi meaning. In other words, following word alignment, the vectors of the English word and its matching Hindi word will be the same. After that for word alignment and reordering binary tree is created with the help of greedy strategy and used RNN and RAE for prediction of suitable sequence of word. Performance was really good as GPU is handling the complex computation.

Mujadia et al.(2020) The author in this study focuses on the bidirectional translation of the languages of Hindi and Marathi by recurrent neural network attention based technique. For the Hindi-Marathi and Marathi-Hindi systems, they received scores of 20.62 and 25.55 development and 5.94 and 18.14 test BLEU, respectively.

Pal et al.(2020) In this study, the author shows the WIPRO-RIT systems that were submitted to WMT 2020's shared task for similar language translation. They describe a single, multilingual NMT system that can translate between different languages and is based on the transformer architecture result for Hindi to Marathi average BLEU score is 15.09 and for Marathi to Hindi is 15.20.
Narayan et al.(2014) In this research the author has presented Hindi to English machine translation system which learns the semantically accurate corpus using machine learning. The quantum neural based pattern recognizer uses the part of speech information of each individual word in the corpus to recognise and learn the pattern of the corpus, just like a human. By entering a pair of sentences in Devnagri-Hindi and English, the system translates them into one another using the knowledge it has learned during its learning process. 2600 phrases were tested during simulation and evaluation in order to assess the efficacy of the suggested strategy. In compared to Google Translation, BLEU's accuracy is substantially greater at 0.7502, NIST's accuracy is 6.5773, ROUGE-accuracy L's is 0.9233, and METEOR's accuracy is 0.5456.

2.3 Hybrid Machine Translation

Hybrid machine translation is the combination of two or more translation systems. By utilizing

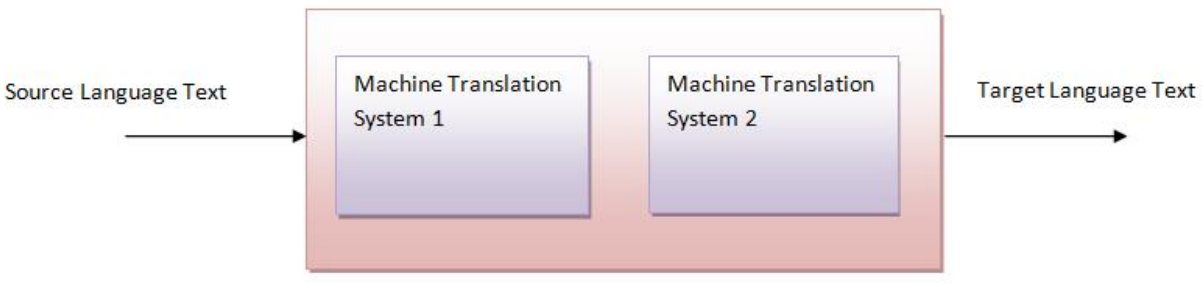

Figure 8 Hybrid Machine translation system

resources that are readily available, this strategy aims to reap the benefits of both systems. The block diagram is shown in figure 8.

Santhanavijayan et al.(2020) This work offers a machine translation system from Hindi to Malayalam that employs hybridized tactics such as phrase-based translation, word alignment, and a language model, with an emphasis on transition probability calculation. This document provides a percentage accuracy of 90.725.

Sitender et al.(2019) The author in this study employs a hybridized kind of rule-based and direct machine translation to offer an MTS from Sanskrit to English. Two bilingual Sanskrit-English dictionaries, a tagged Sanskrit corpus, a Sanskrit analysis rule basis, and an ELGR base were all utilised by the proposed system. The suggested system received a BLEU score of 0.7606 after being tested using Python's Natural Language Toolkit API.

Singh M et al.(2019) The author uses deep learning capabilities to overcome the drawbacks of the RBMT and SMT approaches. This system has discovered that it can operate at a greater speed and with less feedback delay. It achieved 24% higher BLEU score than the rule based machine translation system.

Singh M et al.(2019) The author has suggests a more advanced hybrid machine translation system that translates Sanskrit to Hindi using neural networks and rules. They have therefore achieved 99.99 percent model accuracy and a BLEU score of 61%, which is greater than the RBMT score of 41%.

3 RESULT

Each method of machine translation used to convert texts from the source language to the target language is examined separately. The review compares the various machine translation programmes, and the distinctions between them are illustrated below in table 1.

Table 1 Advantages and disadvantages of Different machine translation system

S.no	Machine translation technique	Advantages	Disadvantages
1.	Direct technique	• Application of it is simple. • The translation works well for languages with comparable grammatical structures.	• It could be pricey in situations involving many languages. • solely involves lexical analysis.
2.	Interlingua technique	• Suitable for a domain-based approach.	• Less time-efficient than Direct technique • a significant issue in defining Interlingua.

3.	Transfer based technique	• The modular construction is described. • It can deal with ambiguity in several languages with ease.	• At the bottom of the translation, a portion of the original text's material can be missing.
4.	Statistical technique	• SMT systems aren't made for any specific language pairings. • It costs less than RBMT, in comparison. • Translations were formerly natural since they were being taught by real-time texts.	• The cost of corpus creation is high. • Finding and fixing errors is challenging. • significant hardware setup is necessary.
5.	Example based technique	• This strategy does not using manually operated rules. • It is linguistically flexible. • The system just needs a little amount of prior information to be attractive.	• huge database is necessary. • Because of its loud corpus, the system is inefficient.
6.	Neural based technique	• The results of NMT are clear. • Both inflection and reordering work better with it. • less memory-intensive than SMT.	• Long phrases are a problem with NMT. • There are issues with source coverage and the restricted vocabulary.
7.	Hybrid Technique	• Results in accurate outcomes since it combines two or more strategies.	• Expensive to build.

4 CONCLUSION

This paper provides a comprehensive summary of machine translation methodologies and the related research. Each machine translation method has advantages and disadvantages, but the optimal one relies entirely on the source language and the target language. For similar language we can go for rule based approach, but the corpus based approach is more convenient for complex languages. But as the advancement of the technologies hybrid approach is giving the best result. We have a great scope of research in the area of machine translation.

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PLEXUS SEARCH – A SEARCH ENUMERATION

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Data Structures and Algorithms, in the field of computer studies is one of the most interesting topics in this domain, and when this subject is fed with some harmonics of mathematics, it gives rise to something new. Sometimes, those ideas may be some modifications from the pre – existing algorithms. Other-wise, those are some completely new ideas. In this study, we have focused in putting forward a new algorithm which could be helpful in searching of data in the data clusters involving the first and the second dimension. The Algorithm developed by us in this paper have been named as Plexus Search. Our main motivation behind this title was the searching cluster – that's the intricate 2 – D or 1 – D data structures.

Keywords: Searching, Matrix, Binary Searching, 2 – Dimensional Searching, Time Complexity

1. INTRODUCTION

In computer world, an algorithm is basically an instance of logic written in software, by software developers to be effective for the intended "target" computer(s) for the target machines to produce output from given input. Searching is one of the most preliminary yet important needs in the world of Data Structures and Algorithms (Thareja R., 2011; Lipschutz S. and Pai V, 2001). It involves the searching of elements (by their index or their address) in a given cluster of data. Now, data can be arranged in numerous ways and more specifically in numerous dimensions. Traditionally there have been a lot of algorithms, like linear search (Bird R. and Gibbons J), binary search(Subero A 2020; Rolfe T. 1997), which was later improvised by Louis F. Williams(Williams L, 1976), interpolation search(Gonnet G., Rogers L. and George J. 1980; Reingold E. and Perl Y. 1977), jump search(Shneiderman B. 1978) to cater to this purpose. In this paper, we have tried to put up an algorithm that is capable of searching in both dimensions. Though, our algorithm can be applied to both the one – dimensional and two – dimensional data structures, the best shine of our algorithm can be seen for 2 – D data structures.

2. PROPOSED ALGORITHM

Let we have a set of n numbers $\mathcal{S} = \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \dots, \alpha_n$
such that $\alpha_i \leq \alpha_j \ni (j > i) \forall \{(i,j) \in [1,n] \,\&\, (\alpha_i, \alpha_j) \in \mathcal{S}\}$
Now, we can imagine of these data elements in the form of a 2 – D square array of order $\lceil \sqrt[2]{n} \rceil$.
As, $n \leq \lceil \sqrt[2]{n} \rceil \times \lceil \sqrt[2]{n} \rceil \forall n \in \mathbb{Z}$

If $\boxed{n = \lceil \sqrt[2]{n} \rceil \times \lceil \sqrt[2]{n} \rceil}$

then the square array $\sigma^{\lceil \sqrt[2]{n} \rceil \times \lceil \sqrt[2]{n} \rceil}$ can be thought of

$$\sigma^{\lceil\sqrt[2]{n}\rceil\times\lceil\sqrt[2]{n}\rceil} = \begin{bmatrix} \alpha_{0\times\lceil\sqrt[2]{n}\rceil+1} & \alpha_{0\times\lceil\sqrt[2]{n}\rceil+2} & \alpha_{0\times\lceil\sqrt[2]{n}\rceil+3} & \alpha_{0\times\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{0\times\lceil\sqrt[2]{n}\rceil+k} \cdots & \alpha_{0\times\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \\ \alpha_{1\times\lceil\sqrt[2]{n}\rceil+1} & \alpha_{1\times\lceil\sqrt[2]{n}\rceil+2} & \alpha_{1\times\lceil\sqrt[2]{n}\rceil+3} & \alpha_{1\times\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{1\times\lceil\sqrt[2]{n}\rceil+k} \cdots & \alpha_{1\times\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \\ \alpha_{2\times\lceil\sqrt[2]{n}\rceil+1} & \alpha_{2\times\lceil\sqrt[2]{n}\rceil+2} & \alpha_{2\times\lceil\sqrt[2]{n}\rceil+3} & \alpha_{2\times\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{2\times\lceil\sqrt[2]{n}\rceil+k} \cdots & \alpha_{2\times\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \\ \alpha_{3\times\lceil\sqrt[2]{n}\rceil+1} & \alpha_{3\times\lceil\sqrt[2]{n}\rceil+2} & \alpha_{3\times\lceil\sqrt[2]{n}\rceil+3} & \alpha_{3\times\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{3\times\lceil\sqrt[2]{n}\rceil+k} \cdots & \alpha_{3\times\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \alpha_{(k-1)\times\lceil\sqrt[2]{n}\rceil+1} & \alpha_{(k-1)\times\lceil\sqrt[2]{n}\rceil+2} & \alpha_{(k-1)\times\lceil\sqrt[2]{n}\rceil+3} & \alpha_{(k-1)\times\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{(k-1)\times\lceil\sqrt[2]{n}\rceil+k} & \cdots \alpha_{3\times\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \alpha_{n-\lceil\sqrt[2]{n}\rceil+1} & \alpha_{n-\lceil\sqrt[2]{n}\rceil+2} & \alpha_{n-\lceil\sqrt[2]{n}\rceil+3} & \alpha_{n-\lceil\sqrt[2]{n}\rceil+4} & \cdots \alpha_{n-\lceil\sqrt[2]{n}\rceil+k} \cdots & \alpha_{n-\lceil\sqrt[2]{n}\rceil+\lceil\sqrt[2]{n}\rceil} \end{bmatrix}$$

More formally, the square array can be represented as:

$$\sigma^{\lceil\sqrt[2]{n}\rceil\times\lceil\sqrt[2]{n}\rceil} = \begin{bmatrix} \alpha_{(0,0)} & \alpha_{(0,1)} & \alpha_{(0,2)} & \alpha_{(0,3)} & \cdots \alpha_{(0,(k-1))} \cdots & \alpha_{\left(0,(\lceil\sqrt[2]{n}\rceil-1)\right)} \\ \alpha_{(1,0)} & \alpha_{(1,1)} & \alpha_{(1,2)} & \alpha_{(1,3)} & \cdots \alpha_{(1,(k-1))} \cdots & \alpha_{\left(1,(\lceil\sqrt[2]{n}\rceil-1)\right)} \\ \alpha_{(2,0)} & \alpha_{(2,1)} & \alpha_{(2,2)} & \alpha_{(2,3)} & \cdots \alpha_{(2,(k-1))} \cdots & \alpha_{\left(2,(\lceil\sqrt[2]{n}\rceil-1)\right)} \\ \alpha_{(3,0)} & \alpha_{(3,1)} & \alpha_{(3,2)} & \alpha_{(3,3)} & \cdots \alpha_{(3,(k-1))} \cdots & \alpha_{\left(3,(\lceil\sqrt[2]{n}\rceil-1)\right)} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \alpha_{((k-1),0)} & \alpha_{((k-1),1)} & \alpha_{((k-1),2)} & \alpha_{((k-1),3)} & \cdots \alpha_{((k-1),(k-1))} \cdots & \alpha_{\left((k-1),(\lceil\sqrt[2]{n}\rceil-1)\right)} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),0\right)} & \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),1\right)} & \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),2\right)} & \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),3\right)} & \cdots \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),(k-1)\right)} \cdots & \alpha_{\left((\lceil\sqrt[2]{n}\rceil-1),(\lceil\sqrt[2]{n}\rceil-1)\right)} \end{bmatrix}$$

If $\boxed{n < \lceil\sqrt[2]{n}\rceil \times \lceil\sqrt[2]{n}\rceil}$

Fill the rest using

$\alpha_n + 1, \alpha_n + 2, \alpha_n + 3, \ldots, \alpha_n + \left(\left(\lceil\sqrt[2]{n}\rceil \times \lceil\sqrt[2]{n}\rceil\right) - n\right)$

Suppose the element we are looking for is $\mathcal{K}$,

Firstly, we will search along the diagonals.

The probability of finding that element, $\mathcal{K}$ in the principal and auxiliary diagonal is

$$\mathcal{P}(finding\ \mathcal{K}) = \begin{cases} \dfrac{2}{\lceil\sqrt[2]{n}\rceil} - \dfrac{1}{\lceil\sqrt[2]{n}\rceil \times \lceil\sqrt[2]{n}\rceil}, \lceil\sqrt[2]{n}\rceil = 2k \pm 1 \forall k \in \mathbb{Z} \\ \dfrac{2}{\lceil\sqrt[2]{n}\rceil} - \dfrac{0}{\lceil\sqrt[2]{n}\rceil \times \lceil\sqrt[2]{n}\rceil}, \lceil\sqrt[2]{n}\rceil = 2k \pm 0 \forall k \in \mathbb{Z} \end{cases}$$

If we manage to find the element $\mathcal{K}$, we will terminate the algorithm.

Else, we will divide the matrix in 4 clockwise triangular sectors if $\left(\lceil\sqrt[2]{n}\rceil = 2k \pm 1 \forall k \in \mathbb{Z}\right)$ with

- base $\left(\lceil\sqrt[2]{n}\rceil - 2\right)$ matrix units

- height $\left(\frac{\lceil\sqrt[2]{n}\rceil}{2}\right)$ matrix units

or 4 clockwise trapezoid sectors if $\left(\lceil\sqrt[2]{n}\rceil = 2k \forall k \in \mathbb{Z}\right)$ with

- base $\left(\lceil\sqrt[2]{n}\rceil - 2\right)$ matrix units
- height $\left(\frac{\lceil\sqrt[2]{n}\rceil}{2} - 1\right)$ matrix units

The maximum and minimum in the 4 sectors will be

Table 1. Tabular Representation of the Maximum and the Minimum

$\lceil\sqrt[2]{n}\rceil = 2k \pm 1 \forall k \in \mathbb{Z}$		$\lceil\sqrt[2]{n}\rceil = 2k \pm 0 \forall k \in \mathbb{Z}$	
Maximum	Minimum	Maximum	Minimum
Sector 1		Sector 1	
$\alpha_{\left(\frac{\lceil\sqrt[2]{n}\rceil}{2}-1,\frac{\lceil\sqrt[2]{n}\rceil}{2}\right)}$	$\alpha_{(0,1)}$	$\alpha_{\left(\frac{\lceil\sqrt[2]{n}\rceil}{2}-2,\frac{\lceil\sqrt[2]{n}\rceil}{2}\right)}$	$\alpha_{(0,1)}$
Sector 2		Sector 2	
$\alpha_{(\lceil\sqrt[2]{n}\rceil-2,\lceil\sqrt[2]{n}\rceil-1)}$	$\alpha_{(1,\lceil\sqrt[2]{n}\rceil-1)}$	$\alpha_{(\lceil\sqrt[2]{n}\rceil-2,\lceil\sqrt[2]{n}\rceil-1)}$	$\alpha_{(1,\lceil\sqrt[2]{n}\rceil-1)}$
Sector 3		Sector 3	
$\alpha_{(\lceil\sqrt[2]{n}\rceil-1,\lceil\sqrt[2]{n}\rceil-2)}$	$\alpha_{\left(\frac{\lceil\sqrt[2]{n}\rceil}{2}+1,\frac{\lceil\sqrt[2]{n}\rceil}{2}\right)}$	$\alpha_{(\lceil\sqrt[2]{n}\rceil-1,\lceil\sqrt[2]{n}\rceil-2)}$	$\alpha_{\left(\frac{\lceil\sqrt[2]{n}\rceil}{2}+1,\frac{\lceil\sqrt[2]{n}\rceil}{2}-1\right)}$
Sector 4		Sector 4	
$\alpha_{(\lceil\sqrt[2]{n}\rceil-2,0)}$	$\alpha_{(1,0)}$	$\alpha_{(\lceil\sqrt[2]{n}\rceil-2,0)}$	$\alpha_{(1,0)}$

3. PSEUDOCODE

function plexus_search(number_of_elements, list_of_elements, key)

```
n ← number_of_elements
rawinput[n] ← list_of_elements in 1 - D
sort(rawinput)
set order = ceil(sqrt(n))
input[order][order] ← list_of_elements in 2 - D
while size(rawinput) not equals order^2

    rawinput.push_back(rawinput[size(rawinput) - 1] + 1)
```

```
    end while
    if order is even

        set M1 = input[((order) / 2) - 2][(order) / 2]
        set m1 = input[0][1]
        set M2 = input[order - 2][order - 1]
        set m2 = input[1][order - 1]
        set M3 = input[order - 1][order - 2]
        set m3 = input[((order) / 2) + 1][((order) / 2) - 1]
        set M4 = input[order - 2][0]
        set m4 = input[1][0]

    else

        set M1 = input[((order) / 2) - 1][(order) / 2]
        set m1 = input[0][1]
        set M2 = input[order - 2][order - 1]
        set m2 = input[1][order - 1]
        set M3 = input[order - 1][order - 2]
        set m3 = input[((order) / 2) + 1][(order) / 2]
        set M4 = input[order - 2][0]
        set m4 = input[1][0]

    end if
    key ← element_to_be_searched
    if key >= m1 and key <= M1

        row_wise_binary_search(Sector1)

    if key >= m2 and key <= M2

        column_wise_binary_search(Sector2)

    if key >= m3 and key <= M3

        row_wise_binary_search(Sector3)

    if key >= m4 and key <= M4

        column_wise_binary_search(Sector2)

    else
        print("Not Present")
    end if
end
```

The Time Complexity of our code is

$$T(n) = \begin{cases} \Omega(1) & \text{, Best Case} \\ \theta(n \log_2 n) & \text{, Average Case} \\ O(n \log_2 n) & \text{, Worst Case} \end{cases}$$

4. COMPARISON WITH OTHER SEARCHING TECHNIQUES

In this section, we have tried to draw a linear comparison in amortized aspect between the normal or naïve searching techniques, better say the brute force algorithms with that of the Plexus Search, which is an improvisation from the basic searching technique. We have mentioned it down in tabular aspect below

Table 2. Comparison Table in the dimension of time.

Time Complexity	Linear Search	Plexus Search
Best Case	$T(n) = \Omega(1)$	$T(n) = \Omega(1)$
Average Case	$T(n) = \theta(n^2)$	$T(n) = \theta(n\,log_2\,n)$
Worst Case	$T(n) = O(n^2)$	$T(n) = O(n\,log_2\,n)$

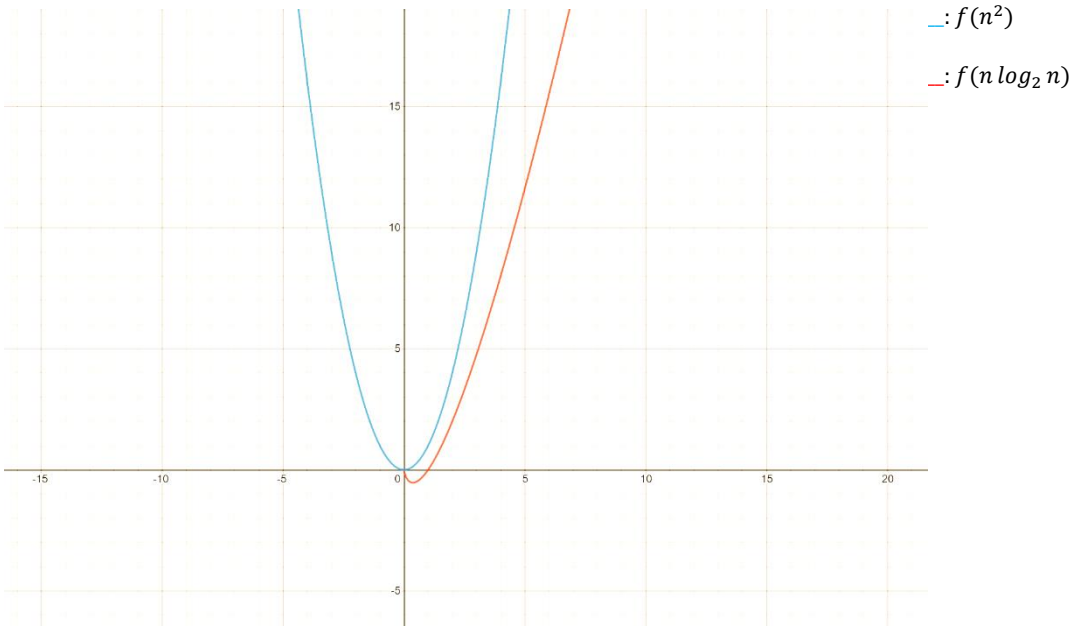

Fig. 1. Comparison Plot of Time Complexity between Linear 2 – D search and Plexus Search

5. CONCLUSION

Plexus is a non – heuristic search technique which can work well for data structures in the dimension of 2 as well as it can be applied in the dimension of one. It is quite fast in comparison to the trivial 2 – D linear search, which operates at a complexity of n^2. The complexity of our searching technique will be $n\,log_2\,n$, which is obviously quite low in comparison with n^2.

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A SURVEY OF BIG DATA ANALYTICS

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In the modern era of computer science, enormous amounts of data have become available on hand to decision makers. Big data refers to datasets that have high volume, variety and velocity, which makes them difficult to handle using traditional tools and techniques. Due to the speedy growth of such data, solutions need to be studied and provided in order to handle and extract important value and knowledge from these data sets. Also, decision makers need to be able to gain some valuable vision from such varied and continuous changing data, ranging from daily transactions to customer interactions and social network data. Such value can be provided using big data analytics, which is the application of advanced analytics techniques on big data. This paper aims to study and analyze some of the different analytics methods and tools which can be applied to big data, as well as the opportunities provided by the application of big data analytics in different decision domains.

Keywords: big data, data mining, analytics, decision making.

1 INTRODUCTION

Imagine a world without data storage; a area where every detail about a person or organization, every transaction performed, or every aspect which can be documented is lost directly after use. Organizations would thus lose the ability to extract valuable information and knowledge, perform detailed analyses and provide new opportunities. Anything ranging from customer names and addresses, to products available, to purchases made, to employees hired, etc. has become essential for day-to-day continuity. Data is the building block upon which any organization thrives.

Now think of the extent of details and the surge of data and information provided nowadays through the advancements in technologies and the internet. With the increase in storage capabilities and methods of data collection, large amounts of data have become easily available. Every second, more and more data is being created and needs to be stored and analyzed in order to extract value. Furthermore, data has become cheaper to store, so organizations need to get as much value as possible from the large amounts of stored data.

The size, variety, and rapid change of such data require a new type of big data analytics, as well as different storage and analysis methods. Such sheer amounts of big data need to be properly analyzed, and pertaining information should be extracted.

The contribution of this paper is to provide an analysis of the available literature on big data analytics. Accordingly, some of the various big data tools, methods, and technologies which can be applied are discussed, and their applications and opportunities provided in several decision domains are portrayed.

The literature was selected research from a number of the highest journals, conferences, and white papers by leading corporations within the industry. Because of long review process of journals, most of the papers discussing big data analytics, its tools and methods, and its applications were found to be conference papers, and white papers. While big data analytics is being researched

in academia, several of the economic advancements and new technologies provided were mostly discussed in industry papers.

2 BIG DATA ANALYTICS

The term "Big Data" has recently been applied to datasets that grow so large that they become awkward to work with using traditional database management systems. They are data sets whose size is beyond the ability of commonly used software tools and storage systems to capture, store, manage, as well as process the data within a tolerable elapsed time **(Kubick, 2012)**.

Big data sizes are constantly increasing, currently ranging from a few dozen terabytes (TB) to many petabytes (PB) of data in a single data set. Consequently, some of the difficulties related to big data include capture, storage, search, sharing, analytics, and visualizing. Today, enterprises are exploring large volumes of highly detailed data to discover facts they didn't know before **(Russom, 2011)**.

Hence, big data analytics is where advanced analytic techniques are applied on big data sets. Analytics based on large data samples reveals and leverages business change. However, the larger the set of data, the more difficult it becomes to manage **(Russom, 2011)**.

In this section, we will start by discussing the characteristics of big data, as well as its importance. Naturally, business benefit can commonly be derived from analyzing larger and more complex data sets that require real time or near-real time capabilities; however, this leads to a need for new data architectures, analytical methods, and tools. Therefore the successive section will elaborate the big data analytics tools and methods, in particular, starting with the big data storage and management, then moving on to the big data analytic processing. It then concludes with some of the various big data analyses which have grown in usage with big data.

Characteristics of Big Data

Big data is data whose scale, distribution, diversity, and/or timeliness require the use of new technical architectures, analytics, and tools in order to enable insights that unlock new sources of business value. Three main features characterize big data: volume, variety, and velocity, or the three V's. The volume of the data is its size, and how enormous it is. Velocity refers to the rate with which data is changing, or how often it is created. Finally, variety includes the different formats and types of data, as well as the different kinds of uses and ways of analyzing the data **(EMC, 2012)**.

Data volume is the primary attribute of big data. Big data can be quantified by size in TBs or PBs, as well as even the number of records, transactions, tables, or files. Additionally, one of the things that make big data really big is that it's coming from a greater variety of sources than ever before, including logs, click streams, and social media. Using these sources for analytics means that common structured data is now joined by unstructured data, such as text and human language, and semi-structured data, such as eXtensible Markup Language (XML) or Rich Site Summary (RSS) feeds. There's also data, which is hard to categorize since it comes from audio, video, and other devices. Furthermore, multi-dimensional data can be drawn from a data warehouse to add historic context to big data. Thus, with big data, variety is just as big as volume.

Moreover, big data can be described by its velocity or speed. This is basically the frequency of data generation or the frequency of data delivery. The leading edge of big data is streaming data, which is collected in real-time from the websites **(Russom, 2011)**. Some researchers and organizations have discussed the addition of a fourth V, or veracity. Veracity focuses on the quality of the data. This characterizes big data quality as good, bad, or undefined due to data inconsistency, incompleteness, ambiguity, latency, deception, and approximations **(TechAmerica, 2012)**.

Big Data Analytics Tools and Methods

With the evolution of technology and the increased multitudes of data flowing in and out of organizations daily, there has become a need for faster and more efficient ways of analyzing such data. Having piles of data on hand is no longer enough to make efficient decisions at the right time.

Such data sets can no longer be easily analyzed with traditional data management and analysis techniques and infrastructures. Therefore, there arises a need for new tools and methods specialized for big data analytics, as well as the required architec- tures for storing and managing such data. Accordingly, the emergence of big data has an effect on everything from the data itself and its collection, to the processing, to the final extracted decisions.

Consequently, **Elgendy, (2013)** proposed the Big-Data, Analytics, and Decisions (B-DAD) framework which incorporates the big data analytics tools and methods into the decision making process **(Elgendy, 2013)**. The framework maps the different big data storage, management, and processing tools, analytics tools and methods, and visualization and evaluation tools to the different phases of the decision making process. Hence, the changes associated with big data analytics are reflected in three main areas: big data storage and architecture, data and analytics processing, and, finally, the big data analyses which can be applied for knowledge discovery and informed decision making. Each area will be further discussed in this section. However, since big data is still evolving as an important field of research, and new findings and tools are constantly developing, this section is not exhaustive of all the possibilities, and focuses on pro- viding a general idea, rather than a list of all potential opportunities and technologies.

Big Data Storage and Management

One of the first things organizations have to manage when dealing with big data is where and how this data will be stored once it is acquired. The traditional methods of structured data storage and retrieval include relational databases, data marts, and data warehouses. The data is uploaded to the storage from operational data stores using Extract, Transform, Load (ETL), or Extract, Load, Transform (ELT), tools which extract the data from outside sources, transform the data to fit operational needs, and finally load the data into the database or data warehouse. Thus, the data is cleaned, transformed, and catalogued before being made available for data mining and online analytical functions (**Bakshi, 2012)**.

However, the big data environment calls for Magnetic, Agile, Deep (MAD) analysis skills, which differ from the aspects of a traditional Enterprise Data Warehouse (EDW) environment. First of all, traditional EDW approaches discourage the incorporation of new data sources until they are cleansed and integrated. Due to the ubiquity of data now days, big data environments need to be magnetic, thus attracting all the data sources, regardless of the data quality **(Cohen et al., 2009)**. Furthermore, given the growing numbers of data sources, as well as the sophistication of the data analyses, big data storage should allow analysts to easily produce and adapt data rapidly. This requires an agile database, whose logical and physical contents can adapt in sync with rapid data evolution **(Herodotou et al., 2011)**. Finally, since current data analyses use complex statistical methods, and analysts need to be able to study enormous datasets by drilling up and down, a big data repository also needs to be deep, and serve as a sophisticated algorithmic runtime engine **(Cohen et al., 2009)**.

Accordingly, several solutions, ranging from distributed systems and Massive Parallel Processing (MPP) databases for providing high query performance and platform scalability, to non-relational or in-memory databases, have been used for big data.

Non-relational databases, such as Not Only SQL (NoSQL), were developed for storing and managing unstructured or non-relational, data. NoSQL databases aim for massive scaling, data model flexibility, and simplified application development and deployment. Contrary to relational databases, NoSQL databases separate data management and data storage. Such databases rather

focus on the high-performance scalable data storage, and allow data management tasks to be written in the application layer instead of having it written in databases specific languages **(Bakshi, 2012)**.

On the other hand, in-memory databases manage the data in server memory, thus eliminating disk input/output (I/O) and enabling real-time responses from the database. Instead of using mechanical disk drives, it is possible to store the primary database in silicon-based main memory. These results in orders of magnitude of improvement in the performance, and allow entirely new applications to be developed **(Plattner et al., 2011)**. Furthermore, in-memory databases are now being used for advanced analytics on big data, especially to speed the access to and scoring of analytic models for analysis. This provides scalability for big data, and speed for discovery analytics **(Russom, 2011)**.

Alternatively, Hadoop is a framework for performing big data analytics which provides reliability, scalability, and manageability by providing an implementation for the MapReduce paradigm, which is discussed in the following section, as well as gluing the storage and analytics together. Hadoop consists of two main components: the HDFS for the big data storage, and MapReduce for big data analytics **(EMC, 2012)**. The HDFS storage function provides a redundant and reliable distributed file system, which is optimized for large files, where a single file is split into blocks and distributed across cluster nodes. Additionally, the data is protected among the nodes by a replication mechanism, which ensures availability and reliability despite any node failures **(Bakshi, 2012)**. There are two types of HDFS nodes: the Data Nodes and the Name Nodes. Data is stored in replicated file blocks across the multiple Data Nodes, and the Name Node acts as a regulator between the client and the Data Node, directing the client to the particular Data Node which contains the requested data **(Bakshi, 2012)**.

Big Data Analytic Processing

After the big data storage, comes the analytic processing. According to **(He et al., 2011)**, there are four critical requirements for big data processing. The first requirement is fast data loading. Since the disk and network traffic interferes with the query executions during data loading, it is necessary to reduce the data loading time. The second requirement is fast query processing. In order to satisfy the requirements of heavy workloads and real-time requests, many queries are response-time critical. Thus, the data placement structure must be capable of retaining high query processing speeds as the amounts of queries rapidly increase. Additionally, the third requirement for big data processing is the highly efficient utilization of storage space. Since the rapid growth in user activities can demand scalable storage capacity and computing power, limited disk space necessitates that data storage be well managed during processing, and issues on how to store the data so that space utilization is maximized be addressed. Finally, the fourth requirement is the strong adaptivity to highly dynamic workload patterns. As big data sets are analyzed by different applications and users, for different purposes, and in various ways, the underlying system should be highly adaptive to unexpected dynamics in data processing, and not specific to certain workload patterns **(He et al., 2011)**.

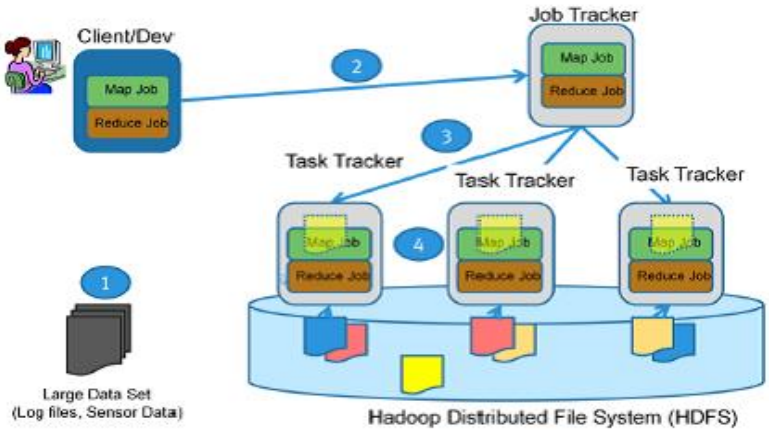
Map Reduce is a parallel programming model, inspired by the "Map" and "Reduce" of functional languages, which is suitable for big data processing. It is the core of Hadoop, and performs the data processing and analytics functions **(Cuzzocrea et al., 2011)**. According to EMC, the MapReduce paradigm is based on adding more computers or resources, rather than increasing the power or storage capacity of a single computer; in other words, scaling out rather than scaling up **(EMC, 2012)**. The fundamental idea of MapReduce is breaking a task down into stages and executing the stages in parallel in order to re- duce the time needed to complete the task **(Cuzzocrea et al., 2011)**.

The first phase of the MapReduce job is to map input values to a set of key/value pairs as output. The "Map" function accordingly partitions large computational tasks into smaller tasks, and assigns them to the appropriate key/value pairs **(Cuzzocrea et al., 2011)**. Thus, unstructured data, such as text, can be mapped to a structured key/value pair, where, for example, the key could be the word in the text and the value is the number of occurrences of the word. This output is then the input to the "Reduce" function **(EMC, 2012)**. Reduce then performs the collection and combination of this output, by

combining all values which share the same key value, to provide the final result of the computational task **(Cuzzocrea et al., 2011)**.

The MapReduce function within Hadoop depends on two different nodes: the Job Tracker and the Task Tracker nodes. The Job Tracker nodes are the ones which are responsible for distributing the mapper and reducer functions to the available Task Trackers, as well as monitoring the results **(EMC, 2012)**. The MapReduce job starts by the Job Tracker assigning a portion of an input file on the HDFS to a map task, running on a node **(Lee et al., 2011)**. On the other hand, the Task Tracker nodes actually run the jobs and communicate results back to the Job Tracker. That communication between nodes is often through files and directories in HDFS, so inter-node communication is minimized **(EMC, 2012)**.

Figure 1 shows how the MapReduce nodes and the HDFS work together. At step 1, there is a very large dataset including log files, sensor data, or anything of the sorts. The HDFS stores replicas of the data represented by the blue, yellow, beige, and pink icons, across the Data Nodes. In step 2, the client defines and executes a map job and a reduce job on a particular data set, and sends them both to the Job Tracker. The Job Tracker then distributes the jobs across the Task Trackers in step 3. The



Task Tracker runs the mapper, and the mapper produces output that is then stored in the HDFS file system. Finally, in step 4, the reduce job runs across the mapped data in order to produce the result.

Figure 1: MapReduce and HDFS

Hadoop is a MAD system, thus making it popular for big data analytics by loading data as files into the distributed file system, and running parallel MapReduce computations on the data. Hadoop gets its magnetism and agility from the fact that data is loaded into Hadoop simply by copying files into the distributed file system, and MapReduce interprets the data at processing time rather than loading time **(Herodotou et al., 2011)**. Thus, it is capable of attracting all data sources, as well as adapting its engines to any evolutions that may occur in such big data sources **(Cuzzocrea et al., 2011)**.

After big data is stored, managed, and processed, decision makers need to extract useful insights by performing big data analyses. In the subsections below, various big data analyses will be discussed, starting with selected traditional advanced data analytics methods, and followed by examples of some of the additional, applicable big data analyses.

Big Data Analytics

Nowadays, people don't just want to collect data, they want to understand the meaning and importance of the data, and use it to aid them in making decisions. Data analytics is the process of applying algorithms in order to analyze sets of data and extract useful and unknown patterns, relationships, and information **(Adams, 2010)**. Furthermore, data analytics are used to extract

previously unknown, useful, valid, and hidden patterns and information from large data sets, as well as to detect important relationships among the stored variables. Therefore, analytics have had a significant impact on research and technologies, since decision makers have become more and more interested in learning from previous data, thus gaining competitive advantage **(Song et al., 2009)**.

Along with some of the most common advanced data analytics methods, such as association rules, clustering, classification and decision trees, and regression some additional analyses have become common with big data.

For example, social media has recently become important for social networking and content sharing. Yet, the content that is generated from social media websites is enormous and remains largely unexploited. However, social media analytics can be used to analyze such data and extract useful information and predictions **(Asur et al., 2010)**. Social media analytics is based on developing and evaluating informatics frameworks and tools in order to collect, monitor, summarize, analyze, as well as visualize social me- dia data. Furthermore, social media analytics facilitates understanding the reactions and conversations between people in online communities, as well as extracting useful patterns and intelligence from their interactions, in addition to what they share on social media websites **(Zeng et al., 2010)**.

On the other hand, Social Network Analysis (SNA) focuses on the relationships among social entities, as well as the patterns and implications of such relationships **(Van der Valk et al., 2010)**. An SNA maps and measures both formal and informal relationships in order to comprehend what facilitates the flow of knowledge between interacting parties, such as who knows who, and who shares what knowledge or information with who and using what **(Serrat, 2008)**.

However, SNA differs from social media analysis, in that SNA tries to capture the social relationships and patterns between networks of people. On the other hand, social media analysis aims to analyze what social media users are saying in order to uncover useful patterns, information about the users, and sentiments. This is traditionally done using text mining or sentiment analysis, which is discussed below.

On the other hand, text mining is used to analyze a document or set of documents in order to understand the content within and the meaning of the information contained. Text mining has become very important nowadays since most of the in- formation stored, not including audio, video, and images, consists of text. While data mining deals with structured data, text presents special characteristics which basically follow a non-relational form **(Sanchez et al., 2008)**.

Moreover, sentiment analysis, or opinion mining, is becoming more and more important as online opinion data, such as blogs, product reviews, forums, and social data from social media sites like Twitter and Facebook, grow tremendously. Sentiment analysis focuses on analyzing and understanding emotions from subjective text patterns, and is enabled through text mining. It identifies opinions and attitudes of individuals towards certain topics, and is useful in classifying viewpoints as positive or negative. Sentiment analysis uses natural language processing and text analytics in order to identify and extract information by finding words that are indicative of a sentiment, as well as relationships between words, so that sentiments can be accurately identified **(Mouthami et al., 2013)**.

Finally, from the strongest potential growths among big data analytics options is Advanced Data Visualization (ADV) and visual discovery **(Russom, 2011)**. Presenting information so that people can consume it effectively is a key challenge that needs to be met, in order for decision makers to be able to properly analyze data in a way to lead to concrete actions **(Manyika et al., 2011)**.

ADV has emerged as a powerful technique to discover knowledge from data. ADV combines data analysis methods with interactive visualization to enable comprehensive data exploration. It is a data driven exploratory approach that fits well in situations where analysts have little knowledge about the data **(Shen et al., 2012)**. With the generation of more and more data of high volume and

complexity, an increasing demand has arisen for ADV solutions from many application domains **(Zhang et al., 2012)**. Additionally, such visualization analyses take advantage of human perceptual and reasoning abilities, which enables them to thoroughly analyze data at both the overview and the detailed levels. Along with the size and complexity of big data, intuitive visual representation and interaction is needed to facilitate the analyst's perception and reasoning **(Shen et al., 2012)**.

ADV can enable faster analysis, better decision making, and more effective presentation and comprehension of results by providing interactive statistical graphics and a point-and-click interface **(Cebr, 2012)**. Furthermore, ADV is a natural fit for big data since it can scale its visualizations to represent thousands or millions of data points, unlike standard pie, bar, and line charts. Moreover, it can handle diverse data types, as well as present analytic data structures that aren't easily flattened onto a computer screen, such as hierarchies and neural nets. Additionally, most ADV tools and functions can support interfaces to all the leading data sources, thus enabling business analysts to explore data widely across a variety of sources in search of the right analytics dataset, usually in real-time **(Russom, 2011)**.

3 BIG DATA ANALYTICS AND DECISION MAKING

From the decision maker's perspective, the significance of big data lies in its ability to provide information and knowledge of value, upon which to base decisions. The managerial decision making process has been an important and thoroughly covered topic in research throughout the years.

Big data is becoming an increasingly important asset for decision makers. Large volumes of highly detailed data from various sources such as scanners, mobile phones, loyalty cards, the web, and social media platforms provide the opportunity to deliver significant benefits to organizations. This is possible only if the data is properly analyzed to reveal valuable insights, allowing for decision makers to capitalize upon the resulting opportunities from the wealth of historic and real-time data generated through supply chains, production processes, customer behaviors, etc. **(Cebr, 2012)**.Moreover, organizations are currently accustomed to analyzing internal data, such as sales, shipments, and inventory. However, the need for analyzing external data, such as customer markets and supply chains, has arisen, and the use of big data can provide cumulative value and knowledge. With the increasing sizes and types of un- structured data on hand, it becomes necessary to make more informed decisions based on drawing meaningful inferences from the data **(Economist Intelligence Unit, 2012)**.

Accordingly, **Elgendy, (2013)** developed the B-DAD framework which maps big data tools and techniques, into the decision making process **(Elgendy, 2013)**. Such a framework is intended to enhance the quality of the decision making process in regards to dealing with big data. The first phase of the decision making process is the intelligence phase, where data which can be used to identify problems and opportunities is collected from internal and external data sources. In this phase, the sources of big data need to be identified, and the data needs to be gathered from different sources, processed, stored, and migrated to the end user. Such big data needs to be treated accordingly, so after the data sources and types of data required for the analysis are defined, the chosen data is acquired and stored in any of the big data storage and management tools previously discussed After the big data is acquired and stored, it is then organized, prepared, and processed, This is achieved across a high-speed network using ETL/ELT or big data processing tools, which have been covered in the previous sections.

The next phase in the decision making process is the design phase, where possible courses of action are developed and analyzed through a conceptualization, or a representative model of the problem. The framework divides this phase into three steps, model planning, data analytics, and analyzing. Here, a model for data analytics, such as those previously discussed, is selected and planned, and then applied, and finally analyzed.

Consequently, the following phase in the decision making process is the choice phase, where methods are used to evaluate the impacts of the proposed solutions, or courses of action, from the design phase. Finally, the last phase in the decision making process is the implementation phase, where the proposed solution from the previous phase is implemented **(Elgendy, 2013)**.

As the amount of big data continues to exponentially grow, organizations throughout the different sectors are becoming more interested in how to manage and analyze such data. Thus, they are rushing to seize the opportunities offered by big data, and gain the most benefit and insight possible, consequently adopting big data analytics in order to unlock economic value and make better and faster decisions. Therefore, organizations are turning towards big data analytics in order to analyze huge amounts of data faster, and reveal previously unseen patterns, sentiments, and customer intelligence. This section focuses on some of the different applications, both proposed and implemented, of big data analytics, and how these applications can aid organizations across different sectors to gain valuable insights and enhance decision making.

According to **Manyika et al. (2011)** research, big data can enable companies to create new products and services, enhance existing ones, as well as invent entirely new business models. Such benefits can be gained by applying big data analytics in different areas, such as customer intelligence, supply chain intelligence, performance, quality and risk management and fraud detection. Furthermore, **Cebr (2012)** study highlighted the main industries that can benefit from big data analytics, such as the manufacturing, retail, central government, healthcare, telecom, and banking industries.

Customer Intelligence

Big data analytics holds much potential for customer intelligence, and can highly benefit industries such as retail, banking, and telecommunications. Big data can create transparency, and make relevant data more easily accessible to stakeholders in a timely manner **(Manyika et al., 2011)**. Big data analytics can provide organizations with the ability to profile and segment customers based on different socioeconomic characteristics, as well as increase levels of customer satisfaction and retention (**Cebr, 2012)**. This can allow them to make more informed marketing decisions, and market to different segments based on their preferences along with the recognition of sales and marketing opportunities **(Russom, 2011)**. Moreover, social media can be used to inform companies what their customers like, as well as what they don't like. By performing sentiment analysis on this data, firms can be alerted beforehand when customers are turning against them or shifting to different products, and accordingly take action **(Economist Intelligence Unit, 2012)**.

Additionally, using SNAs to monitor customer sentiments towards brands, and identify influential individuals, can help organizations react to trends and perform direct marketing. Big data analytics can also enable the construction of predictive models for customer behavior and purchase patterns, therefore raising overall profitability (**Cebr, 2012)**. Even organizations which have used segmentation for many years are beginning to deploy more sophisticated big data techniques, such as real-time micro segmentation of customers, in order to target promotions and advertising **(Manyika et al., 2011)**. Consequently, big data analytics can benefit organizations by enabling better targeted social influencer marketing, defining and predicting trends from market sentiments, as well as analyzing and understanding churn and other customer behaviors **(Russom, 2011)**.

Supply Chain and Performance Management

As for supply chain management, big data analytics can be used to forecast demand changes, and accordingly match their supply. This can increasingly benefit the manufacturing, retail, as well as transport and logistics industries. By analyzing stock utilization and geospatial data on deliveries, organizations can automate replenishment decisions, which will reduce lead times and minimize costs and delays, as well as process interruptions. Additionally, decisions on changing suppliers, based on quality or price competitiveness, can be taken by analyzing supplier data to monitor

performance. Furthermore, alternate pricing scenarios can be run instantly, which can enable a reduction in inventories and an increase in profit margins (**Cebr, 2012)**. Accordingly, big data can lead to the identification of the root causes of cost, and provide for better planning and forecasting **(Russom, 2011)**.

Another area where big data analytics can be of value is performance management, where the governmental and healthcare industries can easily benefit. With the increasing need to improve productivity, staff performance information can be monitored and forecasted by using predictive analytics tools. This can allow departments to link their strategic objectives with the service or user outcomes, thus leading to increased efficiencies. Additionally, with the availability of big data and performance information, as well as its accessibility to operations managers, the use of predictive KPIs, balanced scorecards, and dashboards within the organization can introduce operational benefits by enabling the monitoring of performance, as well as improving transparency, objectives setting, and planning and management functions (**Cebr, 2012)**.

Quality Management and Improvement

Especially for the manufacturing, energy and utilities, and telecommunications industries, big data can be used for quality management, in order to increase profitability and reduce costs by improving the quality of goods and services provided. For example, in the manufacturing process, predictive analytics on big data can be used to minimize the performance variability, as well as prevent quality issues by providing early warning alerts. This can reduce scrap rates, and decrease the time to market, since identifying any disruptions to the production process before they occur can save significant expenditures (**Cebr, 2012)**. Additionally, big data analytics can result in manufacturing lead improvements **(Russom, 2011)**. Furthermore, real-time data analyses and monitoring of machine logs can enable managers to make swifter decisions for quality management. Also, big data analytics can allow for the real-time monitoring of network demand, in addition to the forecasting of bandwidth in response to customer behavior.

Moreover, healthcare IT systems can improve the efficiency and quality of care, by communicating and integrating patient data across different departments and institutions, while retaining privacy controls (**Cebr, 2012)**. Analyzing electronic health records can improve the continuity of care for individuals, as well as creating a massive dataset through which treatments and outcomes can be predicted and compared. Therefore, with the increasing use of electronic health records, along with the advancements in analytics tools, there arises an opportunity to mine the available not identified patient information for assessing the quality of healthcare, as well as managing diseases and health services **(TechAmerica, 2012)**.Additionally, the quality of citizens' lives can be improved through the utilization of big data. For healthcare, sensors can be used in hospitals and homes to provide the continuous monitoring of patients, and perform real-time analyses on the patient data streaming in. This can be used to alert individuals and their health care providers if any health anomalies are detected in the analysis, requiring the patient to seek medical help **(TechAmerica, 2012)**. Patients can also be monitored remotely to analyze their adherence to their prescriptions, and improve drug and treatment options **(Manyika et al., 2011)**.

Moreover, by analyzing information from distributed sensors on handheld devices, roads, and vehicles, which provide real-time traffic information, transportation can be transformed and improved. Traffic jams can be predicted and prevented, and drivers can operate more safely and with less disruption to the traffic flow. Such a new type of traffic ecosystem, with "intelligent" connected cars, can potentially renovate transportation and how roadways are used **(TechAmerica, 2012)**. Accordingly, big data applications can provide smart routing, according to real-time traffic information based on personal location data. Furthermore, such applications can automatically call for help when trouble is detected by the sensors, and inform users about accidents, scheduled road-work, and congested areas in real-time **(Manyika et al., 2011)**.

Furthermore, big data can be used for better understanding changes in the location, frequency, and intensity of weather and climate. This can benefit citizens and businesses that rely upon weather, such as farmers, as well as tourism and transportation companies. Also, with new sensors and analysis techniques for developing long term climate models and nearer weather forecasts, weather related natural disasters can be predicted, and preventive or adaptive measures can be taken beforehand **(TechAmerica, 2012)**.

Risk Management and Fraud Detection

Industries such as investment or retail banking, as well as insurance, can benefit from big data analytics in the area of risk management. Since the evaluation and bearing of risk is a critical aspect for the financial services sector, big data analytics can help in selecting investments by analyzing the likelihood of gains against the likelihood of losses. Additionally, internal and external big data can be analyzed for the full and dynamic appraisal of risk exposures (**Cebr, 2012)**. Accordingly, big data can benefit organizations by enabling the quantification of risks **(Russom, 2011)**. High-performance analytics can also be used to integrate the risk profiles managed in isolation across separate departments, into enterprise wide risk profiles. This can aid in risk mitigation, since a comprehensive view of the different risk types and their interrelations is provided to decision makers (**Cebr, 2012)**. Furthermore, new big data tools and technologies can provide for managing the exponential growth in network produced data, as well reduce database performance problems by increasing the ability to scale and capture the required data. Along with the enhancement in cyber analytics and data intensive computing solutions, organizations can incorporate multiple streams of data and automated analyses to protect themselves against cyber and network attacks **(TechAmerica, 2012)**.

As for fraud detection, especially in the government, banking, and insurance industries, big data analytics can be used to detect and prevent fraud **(Russom, 2011)**. Analytics are already commonly used in automated fraud detection, but organizations and sectors are looking towards harnessing the potentials of big data in order to improve their systems. Big data can allow them to match electronic data across several sources, between both public and private sectors, and perform faster analytics (**Cebr, 2012)**.

In addition, customer intelligence can be used to model normal customer behavior, and detect suspicious or divergent activities through the accurate flagging of outlier occurrences. Furthermore, providing systems with big data about prevailing fraud patterns can allow these systems to learn the new types of frauds and act accordingly, as the fraudsters adapt to the old systems designed to detect them. Also, SNAs can be used to identify the networks of collaborating fraudsters, as well as discover evidence of fraudulent insurance or benefits claims, which will lead to less fraudulent activity going undiscovered (**Cebr, 2012)**. Thus, big data tools, techniques, and governance processes can increase the prevention and recovery of fraudulent transactions by dramatically increasing the speed of identification and detection of compliance patterns within all available data sets **(TechAmerica, 2012)**.

4 CONCLUSION

In this research, we have examined the innovative topic of big data, which has recently gained much interest due to its perceived unprecedented opportunities and benefits. In the modern era of computer science we are currently living in, voluminous varieties of high velocity data are being produced daily, and within them lay intrinsic details and patterns of hidden knowledge which should be extracted and utilized. Hence, big data analytics can be applied to leverage business change and enhance decision making, by applying advanced analytic techniques on big data, and revealing hidden insights and valuable knowledge.

Accordingly, the literatures were reviewed and produce an analysis of the big data analytics concepts which are being researched, as well as their importance to decision making. Consequently, big data was discussed, as well as its characteristics and importance. Moreover, some of the big data

analytics tools and methods specifically were examined. Thus, big data storage and management, as well as big data analytics processing were detailed. In addition, some of the different advanced data analytics techniques were further discussed.

Accordingly, this research has provided the people and the organizations with examples of the different big data tools, methods, and technologies which can be applied. This gives users an idea of the necessary technologies required, as well as developers an idea of what they can do to provide more enhanced solutions for big data analytics in support of decision making. Thus, the support of big data analytics to decision making was depicted.

We believe that big data analytics is of great significance in this era of data overflow, and can provide unforeseen insights and benefits to decision makers in various areas. If properly exploited and applied, big data analytics has the potential to provide a basis for advancements, on the scientific, technological, and humanitarian levels.

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ALKALINE PROTEASE PRODUCTION FROM DAIRY EFFLUENT USING *BACILLUS* SP.

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Alkaline proteases are widely utilized in detergents, leather, food, and feed industrial sectors. The major challenge in alkaline proteases is to minimize production cost and maximize protease efficacy. The potent protease-producing *Bacillus* sp. was isolated from dairy waste. *Bacillus* sp. was further used to synthesize alkaline protease from dairy effluent. The crucial parameters viz., pH, temperature, rate of agitation rate, incubation period, metal ion, activators, and some media supplements were optimized for maximum alkaline protease production by dairy effluent. The V_{max} and K_m of alkaline protease were recorded at 58.24 U mg^{-1} protein and 1.48 mg casein mL^{-1} correspondingly under optimized conditions. Dairy effluent appeared to be cost-effective for alkaline protease production by *Bacillus* sp.

Keywords: Alkaline Protease, Protease kinetics, *Bacillus* sp., Dairy effluent

1. INTRODUCTION

Proteolytic microbial strains are serving a larger cap of the industrial sector viz., food processing, pharmacological, detergent, tannery, and agri-product. Thereby the screening, isolation, assessment, and manipulation of protease-producing microbes are being popular among scientific communities to make it more efficient and cost-effective along with more opportunities to expand its applications (Saeki et al., 2007; Najafi et al., 2005). Proteases are categorized viz., serine, cysteine, aspartate, threonine, and metalloprotease as per the proteolytic activity. Mostly microbes produce alkaline (more than pH 7.0) neutral (closer to pH 7.0) and acid (less than pH 7.0) proteases. Among them, the serine alkaline proteases are widely used due to the wide range of bond cleave of protein moiety. The *Bacillus* spp. are extensively used to produce serine alkaline protease having pH ranges from 9.0 to 11 (Varela et al., 1997; Singhal et al., 2012; Jacobs, 1995; Ito et al., 1998; Yang J. K. et al., 2000; Beg et al., 2003). The microbes producing alkaline protease are widely distributed in the soil system and certain foods i.e., milk. Phenyl Methane Sulfonyl Fluoride (PMSF) inactivates alkaline serine proteases (Page and Di Cera, 2008).

Bacillus sp. offers a higher rate of enzyme secretion (Jacobs, 1995; Ito et al., 1998; Yang J. K. et al., 2000; Beg et al., 2003). *Bacillus* sp. i.e., *B. alcalophilus*, *B. amyloliquefaciens*, *B. cereus*, *B. firmus*, *B. licheniformis*, *B. megaterium*, *B. proteolyticus*, *B. subtilis*, *B. thuringiensis* have been reported for alkaline and acid proteases production (Beg et al., 2003, Banik et al., 2004, Gerze et al., 2005, Soares et al., 2005). *Bacillus*-derived alkaline proteases are either subtilisin Carlsberg or subtilisin novo and are

applicable in zein hydrolysates production (Miyaji et al., 2006). The greater consumption of milk and milk-derived products needs processing for storage and distribution which generates a huge amount of liquid effluent (or dairy effluent). The present research work was focused on the evaluation of *Bacillus subtilis* for protease production using dairy effluent for lucrative protease production and simultaneously dairy effluent management could be done.

2.MATERIALS AND METHODS

The local dairy effluent was collected in sterile tubes from Bilaspur city and stored at 4^{o}C in the refrigerator until used. Each sample was serially diluted and the 10^{-4} dilution was spread over the nutrient agar media plates aseptically. The agar plates were then incubated at 37^{o}C for 48 h. The pure culture of each colony was prepared and made agar slant for storage till the experiment ends. Each pure culture was subjected to a qualitative protease assay as mentioned by Patil and Jadhav (2017). The Skim Milk Agar Media was used as a substrate for the assay. The significant protease-producing bacterial strains were selected as per the diameter of the clear zone around colonies.

Protease-producing culture of agar slant was identified as per Bergey's Manual of Determinative Bacteriology. The Gram's staining, Motility test, Endospore test, Indole production test, Methyl Red test, Voges-Proskauer test, Citrate utilization test, Catalase production test, Oxidase test, and Triple Sugar Iron (TSI) test were carried out for partial identification of bacterial strains.

The *Bacillus* sp. were screened and subject to the assessment of protease activity. The crude extracts were prepared by submerged fermentation. The crude extract was then subjected to a quantitative protease assay to screen potent protease-producing bacterial strains. The tyrosine was used as standard. The crude extract derived from potent protease-producing bacterial strains was then partially purified by the ammonium sulfate precipitation method. The total protein content was estimated by the Lowry method using Folin–Ciocalteu reagent. The Bovine Serum Albumin was used as a standard solution. Statistical calculation and graphical representation were made using MS Office Excel 2021.

3. RESULTS AND DISCUSSION

A total of 12 types of bacterial colonies were observed based on the colony characteristics. The pure cultures were evaluated for qualitative protease assay and results revealed that among them seven bacterial strains exhibited positive protease activity. Seven bacterial strains were identified *Bacillus* sp. 1, *Bacillus* sp. 2, *Pseudomonas* sp. 1, *Pseudomonas* sp. 2, *Streptococcus* sp., *Enterobacter* sp., and *Lactobacillus* sp. General Characteristics of Protease Producing Bacterial Isolates are shown in Table 1. Alalam et al. (2021) have also reported *Pseudomonas* sp. and *Streptococcus* sp. in dairy effluent. Madigan et al. (2000) have reported the presence of *Bacillus sp.*, *Enterobacter sp.*, *Escherichia coli*, *Pseudomonas sp., and Streptococcus sp.* in dairy effluent. Sharma et al. (2018) isolated *Lactobacillus* sp. as probiotics from dairy effluent. As per the objective, the *Bacillus* sp. 1, *Bacillus* sp. 2 were further subjected to protease qualitatively. Most often *Bacillus* sp. and *Pseudomonas* sp. have been documented for significant protease activity (Alalam et al., 2021; Quigley et al., 2013; Krishnaveni et al., 2012; Das and Prasad, 2010; Kuberan et al., 2010; Kebabcý Özgür and Cihangir Nilüfer, 2010; McGarvey et al., 2004).

Bacillus sp. 1 (PDB-30), *Bacillus* sp. 2 (PDB-16), *Pseudomonas* sp. 1, *Pseudomonas* sp. 2, *Streptococcus* sp., *Enterobacter* sp., and *Lactobacillus* sp. were qualitatively examined and results

exhibited 8.2 ±0.12, 7.4 ±0.09, 7.6 ±0.11, 7.1 ±0.09, 6.3 ±0.08, 5.4 ±0.08 and 3.7 ±0.07 diameter of a clear zone in mm ±SD (Table 1 and Fig. 1.).

Further, these strains were subjected to a quantitative protease assay, and the results revealed that *Bacillus* sp. 1 (PDB-30) showed maximum protease production during the spectrophotometric quantitative assay. The protease activity was calculated by the following formula:

$$\text{Protease activity (U/ml)} = \frac{\mu \text{ moles tyrosine equivalents released} \times \text{Total volume of assay} \times \text{Total volume of enzyme}}{\text{Time of Assay} \times \text{Volume used in Calorimetric determination}}$$

Table 1:

General Characteristics of Protease Producing Bacterial Isolates

Characteristics Features	**Bacterial Isolates**						
	Bacillus* sp. 1 *(PDB-30)	***Bacillus* sp. 2 *(PDB-16)***	***Pseudomonas* sp. 1**	***Pseudomonas* sp. 2**	***Streptococcus* sp.**	***Enterobacter* sp.**	***Lactobacillus* sp.**
Protease activity (Diameter of clear zone in mm)	8.2 ±0.12	7.4 ±0.09	7.6 ±0.11	7.1 ±0.09	6.3 ±0.08	5.4 ±0.08	3.7 ±0.07
Color	Cream	Cream	Light blue-green	Yellow -cream	Grey-white	White	Yellow -white
Gram	+	+	-	-	+	-	+
Strain Shape	Rod	Rod	Rod	Rod	Coccus	Rod	Rod
Motility	+	+	+	+	-	+	-
Spore	+	+	-	-	-	-	-

Protease Producing *Bacillus* species were selected for further kinetic analysis. The data of Biochemical analysis were not shown in the article.

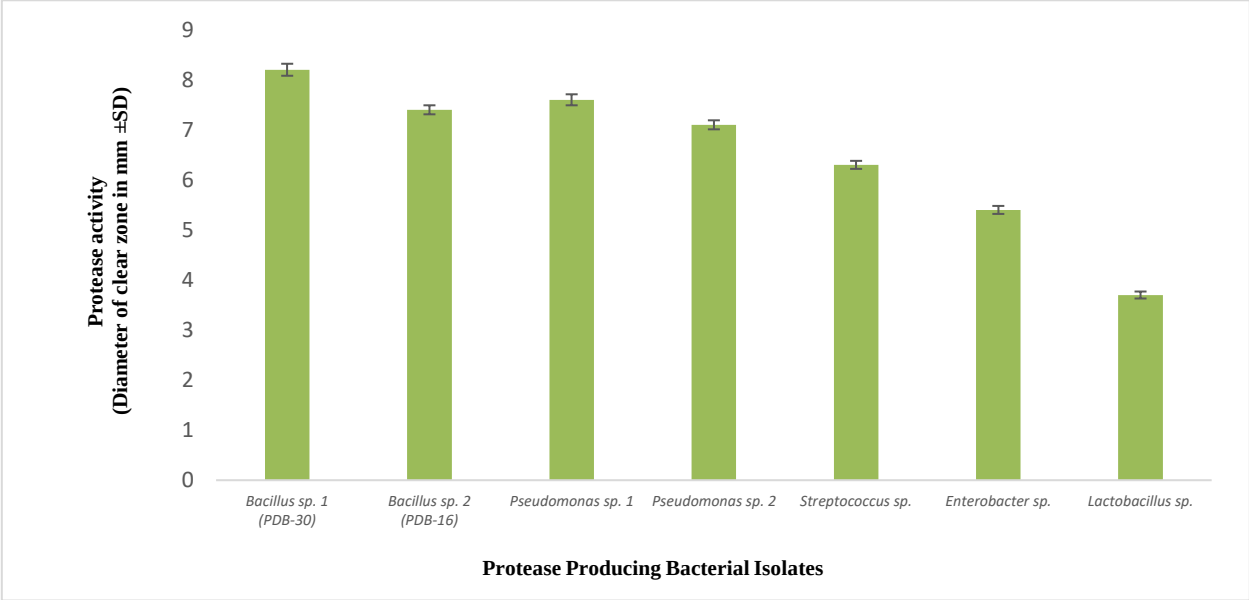

Figure 2: Qualitative Protease Activity of protease producing bacterial isolates

The *Bacillus* sp. 2 was optimized in fortified dairy effluent. The optimized condition was 40^0C, pH - 8.5, 125 rpm, $ZnSO_4$, $MgSO_4$ and $CuSO_4$ at 5.0 mM concentration. The crude protease was prepared by submerged fermentation. The metal ion viz., $ZnSO_4$, $MgSO_4$, and $CuSO_4$ at 5.0 mM concentration were observed to increase protease activity. Sari et al. (2015) reported that the activity of *Bacillus circulans* M34-derived alkaline protease has been increased by 31% with zinc, copper, and cobalt. Patil et al. (2016) revealed that *Bacillus circulans* MTCC 7942 derived alkaline protease has been showing augmented activity with calcium, magnesium, and manganese.

Table 2: Protease activity and Protease kinetics with FDE (Fortified Dairy Effluent) under optimized condition

Protease activity and Protease kinetics	***Bacillus* sp. 1 (PDB-30)**	***Bacillus* sp. 2 (PDB-16)**
Protease Activity (U ml^{-1} ±SD)	55.52 ±2.74	41.63 ±2.17
Total Protein Content (mg ml^{-1}) of Crude Protease	8.67	7.24
Total Protein Content (mg ml^{-1}) of Partially Purified Protease	1.63	1.49
Specific activity (U mg^{-1})	6.45	5.78
Protease kinetics	V_{max} - 58.24	V_{max} – 42.84
Vmax (U mg^{-1} protein) K_m (mg casein mL^{-1})	K_m - 1.48	K_m - 1.36

Optimized condition: 40^{0}C, pH - 8.5, 125 rpm, $ZnSO_4$, $MgSO_4$, and $CuSO_4$ at 5mM concentration.

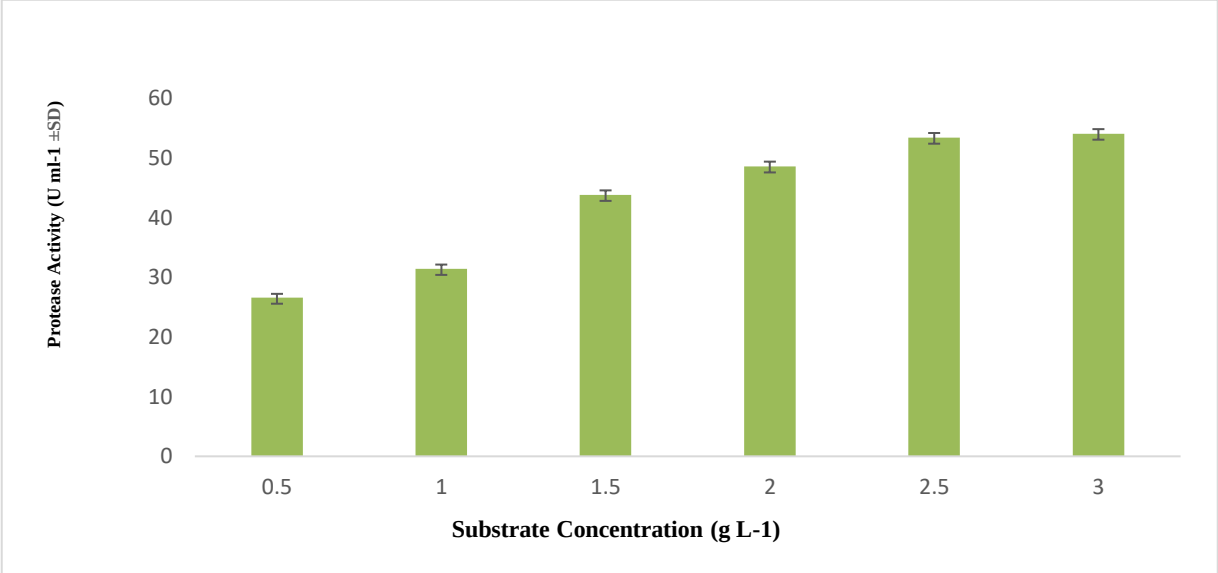

Figure 3: Quantitative Protease Activity of *Bacillus* sp.1 (PDB-30)

Protease activity and Protease kinetics with FDE (Fortified Dairy Effluent) under optimized conditions are tabulated in Table 2. Protease activity and Protease kinetics viz., Protease Activity (U ml^{-1} ±SD) Total Protein Content (mg ml^{-1}) of Crude Protease, Total Protein Content (mg ml^{-1}) of Partially Purified Protease, Specific activity (U mg^{-1}), V_{max} (U mg^{-1} protein) and K_m (mg casein mL^{-1}) of *Bacillus* sp. 1 (PDB-30) was recorded 55.52 ±2.74, 8.67, 1.63, 6.45, 58.24 and 1.48 (Fig. 2) while *Bacillus* sp. 2 (PDB-16) exhibited 41.63 ±2.17, 7.24, 1.49, 5.78, 42.84 and 1.36 respectively.

The V_{max} and K_m of alkaline protease were recorded at 58.24 U mg^{-1} protein and 1.48 mg casein mL^{-1} correspondingly under optimized conditions. Ahmed et al. (2011) claimed 148 U ml-1 V_{max} and 58 µM K_m with casein. The *Bacillus* sp. 1 (PDB-30) was found as a potent protease-producing bacterial isolate on fortified dairy effluent. Therefore, the research outcome revealed that fortified dairy effluent could be used as suitable media for protease production so the dairy waste management and production of value-added products could be done in the same line.

4. CONCLUSION

Bacillus species viz., PDB-30 and PDB-16 were found to be significant extracellular protease production by submerged fermentation using fortified dairy effluent. The protease was alkaline in nature and found to be compatible with detergent. The *Bacillus* species strain could further be analyzed for optimization of bacterial growth and enzyme kinetics along with various biotechnological applications.

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IMPACT OF MICROFINANCE ON WOMEN ENTREPRENEURSHIP IN NORTHEAST INDIA

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Microfinance is emerging as a powerful instrument for economic development and the promotion of gender equality in the new economy. As per the 2020 report, 60% population of India lives below the poverty line, estimated at 812 million, but due to the corona pandemic, it has increased to 68%, which is about 915 million. Microfinance programs like the SHG Bank Linkage Program (SBLP) in India have been increasingly promoted for their positive economic impact and the belief that it acts as a positive catalyst to empower women. The study is being conducted on secondary data from existing literature. The study is focused on two objectives: To study the status of women entrepreneurs in the North East Region and to Study the role of the SHG bank linkage program in the promotion of woman entrepreneurship. Based on the data collected from existing literature and government sources, it has been interpreted that Assam and the Northeast region are lagging far behind the rest of India as far as entrepreneurship is concerned. Various reasons have been addressed, and a few suggestions have been forwarded for the development and enhancement of woman entrepreneur.

Keywords: Microfinance, SHG-bank Linkage Program, Woman Entrepreneur, woman empowerment, North East India.

1. Introduction:

Microfinance is a powerful instrument for economic development, and the promotion of gender equality in the new economy is crucial. As per the 2020 report, 60% population in India is below the poverty line, estimated at 812 million, but due to the pandemic, it has increased to 68%, about 915 million. Microfinance programs are considered the core strategy in addressing the development issues across nations in the last few decades; it has also gained prominence worldwide in economic development. The vision of micro financial systems worldwide is to serve the impoverished majority, lift them out of poverty, and make them participate in their country's social and economic development.

Microfinance provides a broad range of financial services such as deposits, loans, payments, money transfers, and insurance for low-income households and their micro-enterprises to break out of their impoverishment (Lazer, 2008). In India, microfinance has become an essential tool for economic development. (Tiwari and Thakur 2007). Women's empowerment became a critical prerequisite for the socio-economic development of any community. Fostering female participation in nation-building became integral across the world.

Microfinance programs like the SHG Bank Linkage Program (SBLP) in India have been increasingly promoted for their positive economic impact and the belief that it acts as a positive catalyst to empower women.

Women Entrepreneurship empowers women by enhancing family, economic, financial, and social status. Women entrepreneurs commence, organize and manage an enterprise; mainly, a business. Women entrepreneurs have been defined by the Government of India based on women's participation in equity and employment of a business enterprise. In a nutshell, women entrepreneurs come up with an

idea for a business enterprise, work on it, channel the factors of production and carry out the business activities with considerable initiative and risk. Micro enterprises constitute an indispensable part of the planned strategy for striking balanced development of the economy of the deprived women. In agro-based activities, the participation rate of rural women is much more than what statistics reveal. The reason behind this is that most of the farming and household activities conducted by the women are treated as daily chores and not as chargeable labour. Entrepreneurship seems to be an adequate solution for addressing unemployment among rural youth with the growing unemployment problem. This is particularly more beneficial for rural women as it helps them simultaneously carry out their household and livestock activities. Hence, rural women can effectively undertake both production and processing-based enterprises.

Entrepreneurship development plays a significant role in aiding rural women to enhance their capabilities and increase their decision-making status in the family and society, making them a pivotal part of the system. Micro-enterprises help enhance national productivity and employment generation and develop economic independence and personal and social capabilities among rural women, such as socio-economic opportunity, property rights, political representation, social equality, family development, community development, and finally, the development of the nation. Rural women have basic indigenous knowledge, skills, potential, and resources to set up and run the enterprises. However, the problem is that rural women lack knowledge regarding the loan procedure, certification procedures, various funding agencies, and government welfare programs lack motivation, technical skills, and support from family, government, and other organizations.

Women Entrepreneurs in India, despite comprising almost half of the Indian population, the participation of women folk in the nation's economic development is lower than their male counterparts. This is because outdated cultural barriers restrain women in this country. However, women's participation in the country's economic development has been increasing. Women are also enticed into entrepreneurship through government incentives. Most self-employed women are engaged in unorganized sectors like agriculture, handicraft, handlooms, and cottage-based industries. Considering the importance of women's role in the nation's development, the Government of India incorporated in its sixth Plan a scheme called 'Development of Women and Children in Rural Areas (DWCRA)' in 1982. As per the 1988-89 census, the growth of women entrepreneurs was recorded at 1,53,260, claiming 9.01 percent of the 1.7 million entrepreneurs in India. Again, the industrial policy resolution of 1991 stressed the need for a unique training program for developing women entrepreneurs.

Technological up-gradation has facilitated women's role at home and outside. Most women participate in the unorganized sector like agriculture and some in non-agricultural sections, like construction, mining, quarrying, livestock, forestry, fishing, plantation, transport, storage, communication, manufacturing industry, etc. However, their participation in the organized sector is meager but growing steadily. The proportion of the total employment has remained practically constant at 11 percent, which is less compared to other developed countries. In India, women engage in retail trade, selling agricultural and non-agricultural products. Indian women also remain self-employed by producing food items such as pickles, papads, etc. In India, women shoulder significant responsibilities as working women. According to the 1981 census report, there were 45 million women workers in the country who worked for a more significant part of the year and 18.5 million women workers who worked less than 183 days in a year out of 321 million total female population in the country. The role of women in modern society is complex. Banks have been offering many opportunities to establish small business enterprises, which women have hardly utilized. The census of 1991 highlights that only 1,85,900 women account for a meager 4.5 percent of the total self-employed persons in the country. According to International Labour Organization, the value of unpaid household work constitutes 25.39 percent of the Gross National Product in developing countries. Though, on the face of it, there seems to be no disparity between men and women entrepreneurs. However, the challenges women entrepreneurs face

is manifold than their male counterparts regarding needs for achievement, independence, economic gain, and leadership qualities. Women continue to be bound both by traditional and changing values, so their needs and capabilities would differ. Their role would be very challenging in adjusting their personality, needs, family life, social life, and economic independence. In India, participation of women in the industrial entrepreneurial sector has commenced from the 70s onwards. Since 1981 and up to this day, women entrepreneurs have doubled.

Historical Background of Women Entrepreneurs in North-East India

The North-Eastern Region is industrially backward. About 80 percent of the people live in villages with agricultural land. (Kamal Dikshit and Jutta Dikshit ,2014) Even Assam, the most industrially advanced state in NER, is yet to see the light of modern technology in rural areas. The Northeastern region of India consists of eight states of India including Sikkim. These states roughly occupy some 7.7 percent of the total geographical land area of the country. Eighty percent of this region is covered with mountainous ranges, while 12 percent is in the Meghalaya-Karbi plateau. The remaining areas are occupied by Brahmaputra, Barak, Imphal valley, and Tripura plains. The region has international boundaries with Bhutan in the north, Myanmar in the east, and Bangladesh in the south.

India has a multi-regional economy, but there is a disparity in the economic growth because some regions, e.g., the western belt, have developed more rapidly than others. The Northeastern region is the least economically developed area of the country. The Central Government declared the entire North-East region industrially backward and offered various incentives for its industrial growth and development. The region's fundamental problems are unprecedented population rise hampering its economic development, lack of education, inadequate health care policy, unemployment, etc. However, the entire region is blessed with abundant natural resources, which have not yet been fully exploited. The region's industrial development is to be visualized from two broad aspects: potentiality of growth and exploitation. Surprisingly, the latter is more significant and relevant in the study of industrial development of a region than the former. The geographical location also plays a crucial role in developing entrepreneurship.

In ancient times, most trade and commerce were confined to the country's coastal areas because the main transportation link during those days was the sea route. The people residing in the coastal area were privileged to venture into entrepreneurship. Most of the well-developed trading centres in India are located in the western coastal belt of the country; the co-incidentally maximum number of entrepreneurs who are pioneers in many fields belong to these places. The geographical location of the North-East region is a disadvantageous factor in developing entrepreneurship due to the lack of good communication lines with the neighbouring countries and mainland India. The whole region is land-locked. Since the economy of the Northeastern region is predominantly agricultural, substantial agricultural development can cope with the problem of rural poverty to a large extent. Any move towards industrial development should also be supported by progressive and extensive agricultural development. This sector's development is very slow in the region compared to the rest of the country 95 percent of agricultural activities are conducted by marginal farmers with the support of family members, and five percent through hired labour. About 80 percent of the region's population live in villages that engage in agriculture. Thus, agro entrepreneurs' growth will not only help in developing the agricultural sectors but will also help in its industrial growth. Agricultural progress can provide food for industrial workers, raw materials to industries, revenue to the government, and foreign exchange to the country.

Except for Assam, all the states of North-Eastern India suffer from low agricultural productivity. Cultivation does not produce any surplus above its requirements. At the same time, there is little chance of establishing an industry because of the lack of a market for manufactured goods. Even if the pace of industrial and entrepreneurship development in the Northeastern region is slow, industrial culture in the region is gradually developing where Assam is taking the lead. However, the state is still weak

technically compared to other states in India. While India has reckoned to be the tenth industrialized nation in the world, the Northeastern region is still hankering for a berth to share this applaudable success. As a multidisciplinary approach to the region's development, the Central Government, in consultation with the country's leading financial institutions and banks, established North-Eastern Industrial and Technical Consultancy Organization (NEITCO) in 1973 in Guwahati to impart training and guidance to potential entrepreneurs in the region. Again, the Small Industrial Extension Training Institute (SIET), one of the oldest central organizations associated with small-scale industrial development, was established in 1962; it started to function in 1979; and was later developed into The National Institute of Small Industry Extension Training (NISTET) of the North-East region in 1984, which further became Centre for Indian Institute of Entrepreneurs for the region in 1994.

As a continuous process of developing the entrepreneurs in the region, the North-East Consultancy Organization (NECON) was started in 1987 in Imphal as its headquarters, with its organizational operation extended to Manipur, Nagaland, Mizoram, and Tripura as a consultancy organization to meet the training and other relevant requirements for the establishment of small industrial entrepreneurs in the region. The techno-economic survey in 1987, commissioned by the standing committee and development of industries in the region, identified 467 units in Manipur, 172 units for Nagaland, and 129 units for Tripura as feasible for industrial development in the region. Again, the seventh Plan (seventh Five t targeted the growth in employment opportunities to be faster than that of the labour force. The employment potential in the non-agricultural sector is expected to increase by 4.5 percent annually, which may, in turn, lead to a shift in the labour force from agriculture to non-agricultural activities. As per the report of the second census of SSI units of Small Industries Development Organization (SIDO) 1988, there are 9,333 SSI working units and 3,065 close units in the seven states without Sikkim. By the end of December 1996, there were altogether 41,309 units; out of this account, Manipur occupied (15.6 percent), i.e., 5,188 units, Nagaland occupied (1.8 percent), i.e., 749 units, and Tripura (18.2 percent), i.e., 7,500 units. Moreover, the Compound Annual Growth Rate (CAGR) of SSI units between December 1990 and 1996 in the North-East region was 8.4 percent compared to 5.4 percent for the rest of the country.

Among institutions helping in the region's entrepreneurial development, mention can be made of National Small Industry Corporation (NSIC) and North-East Council (NEC), which was established in 1972. These institutions contributed innovative entrepreneurial development awareness programs to fulfil the region's unique needs. The NEC mainly concerns state-level projects and those relevant to the concerned state and the region. Entrepreneurship Motivation Training Centre (EMTC) has also contributed to promoting entrepreneurship development in the region by introducing a comprehensive and wide-ranging mechanism in every state of the North-East region. NEC sponsored 1976 a study on entrepreneurial and managerial needs of the North-East region through SSET, Hyderabad, for human resource development in the North-East region and completed the work in 1978. The study analyses potential entrepreneurs and suggested action strategies for their regional development. Besides NEC, other agencies are working on the promotion of entrepreneurs. They launched specific programs for specific target groups, e.g., the Council for Advancement of People's Action and Rural Technology (CAPART) under the Union Ministry of Rural Areas took the lead in providing such training programs.

The Union Department of Science and Technology, in association with National Bank for Agricultural and Rural Development (NABARD), focuses on promoting entrepreneurship among women, especially in rural and semi urban areas of the region. Thus, under the rural development programs, individual candidates or groups of prospective entrepreneurs facilitate such training programs and take a crucial role in large-scale entrepreneurship development. According to an all-Indian report on the census of Small-Scale Industries in North-Eastern India, the total working units of small-scale industries was 2,653, whereas the all India figure in the same year was 1,39,577, which was only 1.9 percent of the all India figure. Moreover, as per the report of the NISIET (National Institute of Small Industry), this trend of development of small-scale industries in different states of the Northeastern region is 20,377 units as

against the all India figure of 11,58,765 in the year 1988. Women Entrepreneurs in North-East Region in the MSE sector have three different roles- owners, managers, and employees of enterprises. According to the third census of MSEs (2001-2002), the number of women entrepreneurs was 1,37,534, and the number of enterprises managed by women was 1,14,361, accounting for 10.11 percent and 9.46 percent of the total units, respectively. About 13 percent of the women enterprises in the region belong to the registered MSE sector, and the remaining 87 percent are in the unregistered MSE sector.

Regarding the enterprises managed by women, 11.5 percent are in the registered MSE sector, and 88.5 percent are in the unregistered MSE sector. The share of units managed by women in terms of employment is 7.14 percent. Entrepreneurship among women of the North-East states has gradually gained popularity in recent years. In 2001-2002, the total number of women entrepreneurs in the region was 31,072, and enterprises managed by women were 28,090, accounting for 9.8 percent and 8.9 percent of total MSEs of the region.

2. Objectives of the study:

The main objective of this paper is to study the existing literature on women's entrepreneurship through Micro Finance, focusing on the SHG program in North Eastern Region (henceforth NER) in particular. The specific objectives of this paper include-

i. To develop an understanding of the current status of woman entrepreneurship in North East India.
ii. To study the role of microfinance through the SHGs-Bank Linkage program in promoting and developing women's entrepreneurship.

3. Literature Review:

From the existing literature, various global authors have pointed out the significance of microfinance and its impact on women and their entrepreneurial abilities for economic development. Also, in the Indian case, several studies have been undertaken to determine the importance of microfinance, women entrepreneurs, and their implications for the national economy.

Women have been identified as critical agents of sustainable development, and women's equality is central to a more holistic approach toward destabilizing new patterns and processes of development that are sustainable (Jha, 2009). Women as entrepreneurs have become an integral part of national development planning and strategies (Tuladhar, 1996). The contribution of women and their role in the family as well as in the economic development and social transformation are pivotal. This fact is ignored to some extent in a developing economy like India, which results in gender discrimination. According to UNDP-HDR, 1997 gender disparity can be seen through the lens of the Gender-Related Development Index and Gender Empowerment Measure. India's position is too low in the world; consequently, under the 9th Plan, the GOI adopted women empowerment as one of the objectives of economic planning (GOI, 2001). A study reported that women constitute 90 percent of total marginalized workers in the country. Rural women engaged in agriculture form 78 percent of all women in regular work (Sathiabama, 2010).

Consequently, to achieve women's empowerment, the government widely accepted the SHG Bank Linkage Micro Finance Programme in 2001. Ultimately, Govt. established Rashtriya Mahila Kosh, Indira Mahila Yojana, etc., to focus on promoting women's SHGs. Evaluation studies have been conducted to identify the impact of microfinance and SHGs on women's empowerment in the country. Some critical evaluation studies are incorporated here in this paper to assess the role of SHGs in women's empowerment. Microfinance has evolved across India over the past quarter century into various operating forms and found varying degrees of success (Reddy, 2005). One such form of Micro

Finance has been the development of the self-help movement. Based on the concept of 'Self Help, ' small groups of women have formed into groups and operate a 'savings first business model' whereby the members' savings are used to fund loans. The results of these SHGs are promising and have become a focus of intense examinations as it is proving to be an effective method of poverty reduction. SHGs can make women contribute to the economy. There is a long way to go before reorienting power relationships at the household and societal levels. Therefore, empowerment of poor rural women will be possible only if they are trained and imparted skills for particular employment (Sundari & Geetha, 2000). National Commission for Women, 2004 reveals that 30% of the household reported an increase in assets after joining SHG, mainly in Rajasthan and Tamil Nadu. Wadiniale, 2004 reported that the saving credit program in India empowers women living in slums. The study also reported that the SHG program had increased monthly household income; 66% of women converted their houses into permanent structures, positively impacting health and social and cultural values. Further, a few studies (Wadiniale, 2004 and Singh, 2011) reveal a drastic change in the social status of women after joining the SBLP and articulated SHG as a change agent for social and economic empowerment of rural women.

Bokil (2005) reported that SHGs were the best place to address domestic violence issues, forwarded arbitration in domestic quarrels and disputes, provide counselling, facilitate legal action, and provide moral and motivational support to the victim. Mukerjee (2006) reported that SHGs positively impact the members' economic, political, household decision-making, and awareness level concerning social and health issues. Meher (2003) and Ravi & Venkataramana (2002) reported that SHGs are an instrument for women's empowerment through economic intervention. Siwa (2008) reported that the Kudumbashree initiative of the Govt. of Kerala positively impacts economic empowerment and micro-enterprise development among rural women. It is also reported that the members of SHGs are prepared to undertake entrepreneurial activities at a trim scale level with minimum capital requirements (Kamaraj, 2005) and can promote self-employment opportunities for rural women (Manimekalai & Rajeswari, 2000). They reported that women SHG members who took up their enterprise contributed more than 50% of their earnings to the households in Andhra Pradesh.

Further, the National Institute of Rural Development (NIRD) on SHG in 2004 (Das, 2010) reported that about 25% of members of SHGs have taken micro-enterprises and generated an income of more than Rupees 1000/1500 p.m. The study further reveals that about 85% of the members have awareness about various programs and activities on health, education, water and sanitation, and legal rights. Moreover, more than 82% of the members reported that they are sending their kids to school.

Pati and Lyngdoh (2011) reported that microfinance through SHGs has positively impacted the income, expenditure, and savings of women clients in Meghalaya. The same observation is also revealed by Aruna & Jyothirmayi (2011) in the case of Hyderabad, which also reported considerable improvement in self-worthiness and decision-making level of women members. Meetei (2011) reported that microfinance through SHGs, promoted during the last ten years in Manipur, increased average monthly income earning capacity and, in turn, saving capacity and effective productivity of SHG members and have ensured better economic life of rural women in Manipur. Rajendra and Raya (2010) reported that microfinance through SHG has brought higher psychological and social empowerment than economic empowerment. The study reveals a definite improvement in managerial skills, psychological well-being, and social empowerment among rural women participating in the SHG linkage program in Tamil Nadu. Finally, APMAS 2009 reported that the SHG program in the state of Assam resulted in significant social and economic benefits, and the study categorically mentioned that 75% of the group members had experienced an increase in saving habits and income, an increase in access to formal credit and decline in family debts, etc. A large number of evaluation studies reported that after the onset of SHGs, women had better access to assets & resources, developed better leadership skills, awareness regarding health and education, communication skills, and improved financial literacy (Reddy, 2002 & Ramesh, 2004). Another significant contribution of microfinance through SHGs is the

promotion of women's entrepreneurship (Titus, 2002 & Purushotham, 2004Some researchers observed that micro-credit intervention benefited many women entrepreneurs by shifting from wage to self-employment, increased income, repayment of old debts, purchasing assets, sending kids to schooling, etc. Microcredit intervention through SHGs also reduces the gender disparity in access to institutional credit (Sundari & Geetha, 2000).

Idris and Tan (2017), in their paper, 'Review of literature on women entrepreneurs,' highlight that women want to own businesses because of the aspiration of greater freedom and flexibility in managing family matters besides having some income. Rathee and Yadav (2007), in the paper, 'Role of women entrepreneurs in economic empowerment of rural areas,' stressed the importance of women's entrepreneurship because of their contribution to employment generation and revenue creation. Jeyanthi.K. (1999), in the study 'Women Entrepreneurs and Micro Credit,' emphasize that women improve their economic status and reduce their dependency. Micro-credit programmers should be given more priority to women's empowerment. Yadav and Unni (2016), in their paper 'Women entrepreneurship: research review and future directions,' emphasize women's entrepreneurship areas that are still restricted within national boundaries, and there is a need to build research as well as practice networks across transnational borders. Bala and Monga (2007) argued that women's employment supplements the family income enhances their economic status, and places them in a higher income group.

4. Research Methodology:

The study is based on secondary data collected from different sources like existing literature, Research Journals and articles, Annual reports of NEDFI, NABARD, some other concern organizations and the Internet. For evaluating "the role of Microfinance in Women Empowerment," we have focused on as much recent material as possible. In order to get access to the latest developments in this area, several articles published in academic journals and trade magazines have been referred. Collected data were analysed using simple percentage analysis and mathematical tools.

Data Collection and Interpretation:

The collected data from different sources are presented in tabular form to see the percentage share of female entrepreneur of North East Region in comparison to Nation:

Table1.1: State-wise distribution of Female entrepreneurs in North East:

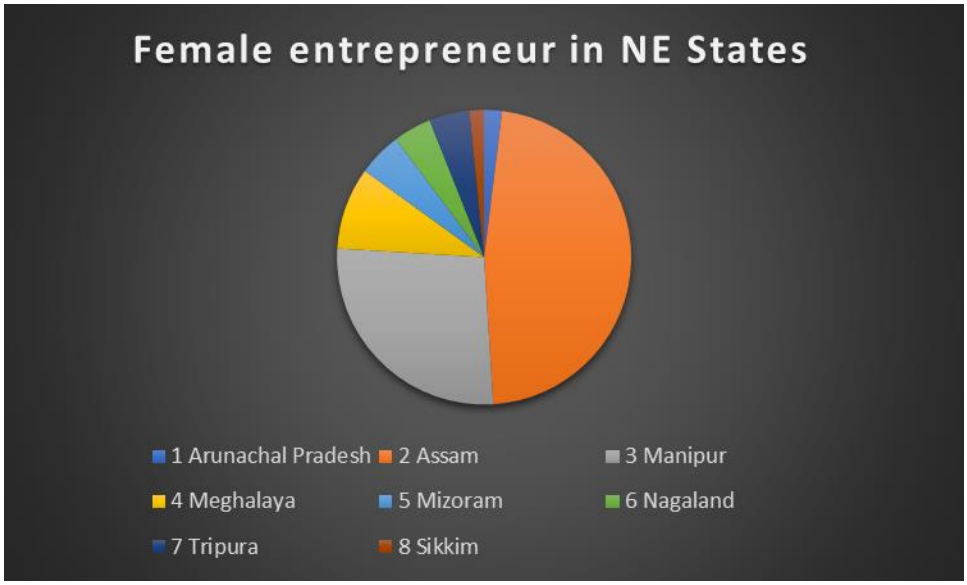
(Total Female Entrepreneur in India as per Sixth Economic Census (2013-2014) - 80,50,819)

Sr No	Name of the States	No of Female entrepreneur	Percentage wise
1	Arunachal Pradesh	6413	0.08%
2	Assam	154158	1.91%
3	Manipur	88286	1.09%
4	Meghalaya	29530	0.36%
5	Mizoram	15828	0.19%
6	Nagaland	13657	0.16%
7	Tripura	14506	0.18%
8	Sikkim	5304	0.065%

	Total of North East	327682	4.07%

Source: -Sixth Economic Census (2013-14), Ministry of Statistics and Programme Implementation.

Graphical representation of the above table:



As per the data from Table 1.1, In North East, the number of entrepreneurs is highest in Assam and the least in Sikkim, which results in a 1.91% share for Assam and 0.065% for Sikkim. For the rest of the Northeastern states, the share for Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, and Tripura is 0.08%,1.09%,0.36%,0.19%,0.16%, and 0.18% respectively. The table shows North East contributes only 4.07% nationally towards female entrepreneurship.

Table 1.2: State-wise distribution of female entrepreneurs in small scale industries sector in North East.

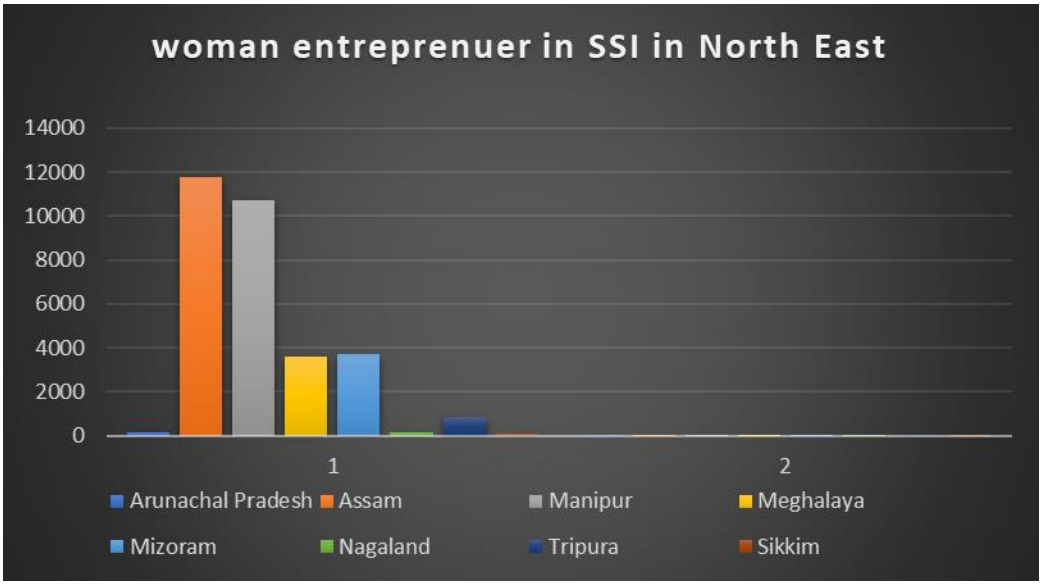
(Total number of female enterprises in India in SSI is – 1063721)

Serial No	Name of States	Number of Woman Enterprises in SSI financed by SHG	Percentage wise
1	Arunachal Pradesh	150	0.01%
2	Assam	11757	1.10%
3	Manipur	10745	1.01%
4	Meghalaya	3580	0.33%
5	Mizoram	3700	0.34%
6	Nagaland	179	0.02%
7	Tripura	863	0.08%
8	Sikkim	98	0.01%
	Total of North	31072	2.92%

	East		

Source: Development Commissioner (MSME) Ministry of Micro, Small & Medium Enterprises, 2017

Graphical representation of table 1.2:



It is observed that all north eastern states contribute only 2.92% (Female entrepreneurs financed by SHG) which is way too less than the rest of India. It comprises only 1.10% in Assam which is the highest among all the Northeastern States, following Assam, its Manipur with 1.01%, Mizoram with 0.34%, Meghalaya with 0.33%, Tripura 0.08%, Nagaland 0.02%, Sikkim & Arunachal Pradesh with 0.01% respectively.

5. Findings:

From the existing literature review, it has been observed that there are several challenges related to women's entrepreneurship in North East India. According to Limbu and Bordoloi (2015), in rural areas of Assam and other North Eastern states, women suffer a lot in running their businesses, and some even do not come forward to do business due to the high failure rate. There are other individual problems related to the participation of women in economic activities, such as lack of motivation, overburden of household work, lack of education and technical knowledge, inferiority complex compared to males, etc. On the other hand, social norms, male-dominant cultural practices, lack of family support, etc., are some factors that create hurdles in the path to bringing women to workplaces. The situation is more or less similar in all other Northeastern States. There are some other challenges related to women's entrepreneurship in the Northeast region of India, which are- a lack of dynamism, inadequate finance, lack of self-confidence, optimistic attitude, lack of infrastructural support system, absence of marketing and managerial skills, etc. (Saha, 2014) The present study reveals that the proportion of women entrepreneurs in Northeastern States to a total number of women entrepreneurs in the country is quite discouraging. There exists a gender gap in participating in entrepreneurial activities in Northeast India. In the northeast States, many women entrepreneurs still depend on money lenders, and most establishments by women are self-financed. Therefore, there is a need for the active role of the government and financial sector to bring more women to these activities. Again, self-help groups

should be strengthened to encourage women to work individually or jointly. It will help in women's empowerment and economic development in the North Eastern region of India.

Suggestions

In order to facilitate women empowerment and entrepreneurship, we may forward the following suggestions.

1. Encourage Promoting entrepreneurship among women by providing different educational and government schemes.

2. Establish good training institutes to enhance their level of work knowledge, skills, risk-taking abilities, and capabilities. Training Centers should provide training to prospective women entrepreneurs free of.

3. The SHG linked-Banking system has not been able to deal with barriers that hinder women from using or gaining access to credit. Adequate arrangements must be made for the supply of credit facilities at a concession rate for the women entrepreneurs, given their growing needs.

4. Provision of introduction micro-credit system with a low rate of interest to the women entrepreneurs at the local level

5. Guidance cells should be set up to deal with issues or queries related to women entrepreneurs.

To increase women's access to credit, the MFIs should:

i. Increase the availability of working capital;
ii. Experiment with lending programs that do not require conventional forms of collateral;
iii. Replicate and expand existing successful methodologies for delivering small working-capital loans;
iv. Introduce savings mobilization components in the context of credit or other enterprise assistance programs.
v. Promote credit policies open to small-scale enterprise activities and enterprises operating in trade, commerce, and other small enterprise sectors where women have higher participation rates.

6. Conclusion:

In the present study, it has been observed that women could be a source of employment in the northeast region with the help of both economic and social assistance. Many women's talents are unexplored not only in Assam or northeast but all over India. Women occupy a vital role in society and the economy, which should be enhanced by increasing women's participation in entrepreneurial activities. As women entrepreneurs face several challenges within or outside their households, the need of the hour is to spread awareness on entrepreneurship among them to minimize such challenges. The government should focus more on providing women training programs and education, which will help realize their potential skills and entrepreneurial abilities for the rapid socio-economic development of the Northeast region. Women today are more willing to take up challenges. Women entrepreneurship must be molded properly with entrepreneurial traits and skills to meet the changes and challenges in the global markets and also be competent enough to sustain and strive for excellence in the entrepreneurial arena. Government should extend better educational facilities, suitable financial schemes, training on technical and management skills, and professional competence to the women folk. On the part of society, ongoing support and recognition are equally essential.

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A STUDY ON DICKSON POLYNOMIALS AND ITS APPLICATIONS IN CRYPTOGRAPHY

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ABSTRACT

Dickson polynomials are one of the most important topics of study for many years and have wide applications in cryptography. Dickson polynomials are of fundamental importance in the theory of permutation polynomials and related topics. The permutation and involution properties are mostly used in the context of cryptographic applications. In this paper we study some properties and applications of Dickson polynomials in public key cryptography.

Keywords: Dickson polynomials; Dickson cryptosystem; Permutation polynomial; involution; fixed point; Public key cryptography.

1. INTRODUCTION

In the recent years we are now very much dependent upon internet and its applications in various technological developments. We are frequently using emails, online transactions and many more, which are very confidential information. That is why we need security to protect our valuable data. Cryptography is a method of protecting information and communication by some mathematical schemes and technological applications. Cryptography plays a major role in the science of secrete writing. Modern cryptography concerns itself with the four objectives such as confidentiality, integrity, non-repudiation and authentication. The procedures and protocols through which encryption and decryption processes are followed that known as a cryptosystem.

There are mainly two types of cryptography, (a) Symmetric-key cryptography or single-key cryptography or private-key cryptography and (b) Asymmetric-key cryptography or Public-key cryptography. Some of the symmetric-key cryptosystems are DES, AES, RC5, RC6 etc. and public-key cryptosystems are RSA cryptosystem, ElGamal cryptosystem, Elliptic curve cryptosystem (ECC) and others. To make a cryptosystem more powerful and more secure the development are proceeds over the years.

A permutation polynomial (Hou X.-d. , 2015) over a finite ring R is a bijection function from R to R. It has several applications in cryptography. The Dickson polynomial is a type of permutation polynomial. The name 'Dickson polynomial' was given by Schur (Schur, 1973)which was firstly introduced by L. E. Dickson(Dickson, 1896). The scope of the Dickson polynomials has been increased in recent years (Cipu & Cohen, 2008), (Hou, Mullen, Sellers, & Yucas, 2009), (Wang & Yucas, 2012), (Qu & Ding, 2014). The application of Dickson polynomial in cryptography is first introduced by Muller and Nöbauer (Muller, 1981) in the year 1981. They proposed a modification of the RSA scheme

by using Dickson functions $x \to D_k(x,a)$ with the parameter $a = 1$ or $a = -1$ instead of the power functions for encryption and decryption. It is examined that the Dickson cryptosystem with the parameter $a = -1$ along with a suitably chosen strong prime p, has better cryptanalytic properties than RSA scheme(Müller & Nöbauer, 1983), (Müller & Nöbauer, 1985), (Nöbauer, 1985). The security of the Dickson cryptosystem is based on the factorization problem. In 1988(Postl, 1988), Postl proposed a fast evaluation algorithm for Dickson polynomials. For given k and $x \in \mathbb{Z}_n$, their algorithm requires $O(\log k)$ time to compute $D_k(x) \bmod n$, which makes Dickson public-key cryptosystem practicable. Müller and Nöbauer (Müller & Nöbauer, 1985) in their paper perform a cryptanalysis of the Dickson cryptosystem and discussed several possible cryptanalytic attacks on the system. A simple modification of Dickson cryptosystem can be found in (Müller S. &., 1998).Wei et al. (Wei, Liao, & Wong, 2011) explains a key-exchange protocol based on Dickson polynomials over finite field with 2^m. In 2013(Brandner, 2013), Brander showed that the degrees of decryption function of Dickson cryptosystem for the parameter $a = -1$ can be reduce. Also, Onishi et al (Onishi, Uchida, & Uchiyama, 2015) discussed a small secret exponent attack on Dickson cryptosystems. In 2016 (Charpin, Mesnager, & Sarkar, 2016), Charpin et al. describe a different aspect of Dickson polynomials. They discussed the involution properties of Dickson polynomials of the first kind in $\boldsymbol{F_2}[x]$. They also gave results related to the cardinality and the number of fixed points in the context of cryptographic applications.

It is observed that even though the application of Dickson polynomial in cryptography is noticed in 1981, but after that a very few research works are found. In this paper, we will study the properties and behaviors of Dickson polynomials in the context of cryptography to motivate researchers.

2. PRELIMINARIES

2.1: Dickson Polynomial over $\boldsymbol{F_q}$:

Definition (Mullen & Panario, 2013): Let k be a positive integer. For $a \in \mathbf{F}_q$,we define the *n*-th Dickson polynomial of the first kind $D_k(x,a)$over $\mathbf{F}_q$ by

$$D_k(x,a) = \sum_{i=0}^{\left\lfloor \frac{k}{2} \right\rfloor} \frac{k}{k-i} \binom{k-i}{i} (-a)^i x^{k-2i}.$$

Here, $\left\lfloor \frac{k}{2} \right\rfloor$is the largest integer not greater than $\frac{k}{2}$. Each term $\frac{k}{k-i}\binom{k-i}{i}$ is an integer.

Theorem 2.1(Mullen & Panario, 2013): Dickson polynomials of the first kind are the unique and monic polynomials satisfying the functional equation

$$D_k\left(y + \frac{a}{y}; a\right) = y^k + \frac{k}{y^k},$$

Where $a \in \mathbf{F}_q, y \in \mathbf{F}_{q^2}$. Moreover, they satisfy the recurrence relation

$$D_k(x,a) = xD_{k-1}(x,a) - aD_{k-2}(x,a),$$

for $k \geq 2$ with initial values $D_0(x,a) = 2$ and $D_1(x,a) = x$.

Remark: The Dickson polynomial $D_k(x,a)$ of the first kind satisfies the following relation:

$$D_{tk}(x,a) = D_t(D_k(x,a), a^k).$$

Hence the set of all Dickson polynomials $D_k(x,a)$of even degree over $\mathbf{F}_q$ are closed under function composition if and only if $a = 0$ or $a = 1$(Mullen & Panario, 2013). In particular, for $a = 0$ or 1 Dickson polynomial satisfies commutative property i.e. $D_t(x,a) \circ D_k(x,a) = D_k(x,a) \circ D_t(x,a)$. Also, the set of all Dickson polynomials $D_k(x,a)$ of odd degree over $\mathbf{F}_q$ is closed under function composition if and only if $a = 0$, $a = 1$ or $a = -1$(Mullen & Panario, 2013).

2.2 Dickson Polynomials over F_{2^n}:

The Dickson polynomials over $\boldsymbol{F_{2^n}}$ have played an important role in cryptography. In this section, we have mentioned some of its properties. Note that, the Dickson polynomial of the first kind of degree k in indeterminate x and with parameter $a \in \boldsymbol{F}_{2^n}^*$ is defined by

$$D_k(x,a) = \sum_{i=0}^{\left\lfloor \frac{k}{2} \right\rfloor} \frac{k}{k-i} \binom{k-i}{i} a^i x^{k-2i}, k \geq 2$$

Where $\left\lfloor \frac{k}{2} \right\rfloor$ denotes the largest integer less than or equal to $\frac{k}{2}$. For $a = 1$, we denote the Dickson polynomial $D_k(x,1)$ as $D_k(x)$. Dickson polynomials $D_k \in \boldsymbol{F}_2[x]$ are recursively defined as follows:

$$D_0(x) = 0 \text{ and } D_1(x) = x; D_{i+2}(x) = xD_{i+1}(x) + D_i(x).$$

Using this definition, it is easy to prove the following properties:

- $\deg(D_i) = i$,
- $D_{2i}(x) = (D_i(x))^2$,
- $D_{ij(x)} = D_i\big(D_j(x)\big)$,
- $D_i(x + x^{-1}) = x^i + x^{-i}$ for all x and for all integer $i, j > 0$.

Again, the Dickson polynomial $D_k \in \boldsymbol{F}_2[x]$ is a permutation on $\boldsymbol{F}_{2^n}$ if and only if $\gcd(k, 2^{2n} - 1) = 1$ (Theorem 3.2 of (Lidl, Mullen, & Turnwald, 1993)). Wei et al. (Wei, Liao, & Wong, 2011)in their paper prove that the Dickson polynomial $D_k(x)$ is a permutation polynomial over the field $\boldsymbol{F}_{2^n}$with $n \geq 2$ if and only if k is odd.

3. SOME PROPERTIES OF DICKSON POLYNOMIAL IN CONTEXT OF CRYPTOGRAPHY

3.1: Computational complexity:

Müller and Nöbauer(Müller & Nöbauer, 1985) in their paper proposed a fast evaluation algorithm for Dickson polynomial $D_k(b) \bmod n, b \in \mathbb{Z}_n$. The algorithm is as follows:

Algorithm:

(i) Choose random numbers n, k.
(ii) Choose a random number $b \in \mathbb{Z}_n$.
(iii) Compute $a_0, a_1 \in \mathbb{Z}_n$ with $u^k \equiv a_1 u + a_0 (\mathrm{mod}\, u^2 - bu + 1)$ by using square and multiply techniques.
(iv) Compute $D_k(b) \equiv a_1 b + 2a_0 (\mathrm{mod}\, n)$.

To verify the algorithm firstly one must solve the relation $u + \frac{1}{u} = b$ i.e.,$u^2 - bu + 1 = 0$ in some extension ring of $\mathbb{Z}_n$. The factor ring $R_b = \frac{\mathbb{Z}_n[u]}{<u^2 - bu + 1>}$ is an extension ring of $\mathbb{Z}_n$ and every element $s \in R_b$ can be uniquely expressed as $s = a_1 u + a_0, a_0, a_1 \in \mathbb{Z}_n$. In R_b by using the formula $(a_1 u + a_0)(b_1 u + b_0) = (a_1 b_0 + a_0 b_1 + a_1 b_1 b)u + a_0 b_0 - a_1 b_1$ the multiplication can be applied. Clearly the element $u \in R_b$ is a solution of $u^2 - bu + 1 = 0$. Also $u(b - u) = 1$ therefore u is always invertible.

By using the "square and multiply technique" in the ring R_b, one can calculate the power u^k for finding the value of $D_k(b)$ and finding the elements $a_0, a_1 \in \mathbb{Z}_n$ with $u^k = a_1 u + a_0$. Since u is invertible so u^{-1} also satisfies the equation $u^2 - bu + 1 = 0$ and the equation $\frac{1}{u^k} = a_1 \frac{1}{u} + a_0$ holds. Therefore, we have

$$D_k(b) = D_k\left(u + \frac{1}{u}\right) = u^k + \frac{1}{u^k} = a_1\left(u + \frac{1}{u}\right) + 2a_0 = a_1 b + 2a_0.$$

Note that, the algorithm requires $O(\log k)$ time to compute a Dickson polynomial.

3.2: Discrete Dickson problem (DDP):

Note that, for any cyclic group G and a generator $g \in G$, the Discrete Logarithm Problem (DLP) asked to compute a for given g, n and y, where $y = g^a (\mathrm{mod}\, n)$. Wei et al.(Wei, Liao, & Wong, 2011) defined Discrete Dickson Problem (DDP) over a commutative ring R, which is similar to the DLP. In the same paper, they prove that the difficulty of solving DDP is equivalent to solving DLP over $\boldsymbol{F}_q$. The DDP is defined as follows:

Definition(Wei, Liao, & Wong, 2011): Let R be a commutative ring with identity. For any $k \in \mathbb{Z}^+$, the problem of calculating the value of k for given y, x such that $y = D_k(x, 1)$ is called discrete Dickson problem (DDP).

3.3: Involution Property:

A permutation f is called an involution if $f \circ f$ is the identity. It has been frequently used in cryptography such as in AES. Involution property is important in cryptographic applications as it has the advantage of having the same implementation of encryption and decryption algorithm, which reduce the implementation cost. Charpin et al. (Charpin, Mesnager, & Sarkar, 2016) studied the involution property of Dickson polynomial of first kind over the finite field of characteristic 2 and

proved that there exists a Dickson polynomial which is involution. They proved that a Dickson polynomial D_k, where $1 \leq k \leq 2^n - 1, n = 2m$ with $m \geq 2$ is an involution on $\boldsymbol{F}_{2^m}$ if and only if

(i) $k \in S_n$, when m is odd;
(ii) $k \in S_n \cup 2^{m/2} S_n$ if m is even.
where $S_n = \{u | 1 \leq u \leq 2^n - 2, u^2 \equiv 1 (\mathrm{mod} 2^n - 1)\}$.

A systematic study on Dickson involution over the field of Characteristic 2 is also found in (Charpin, Mesnager, & Sarkar, 2016).

3.4: Fixed point:

An element x is said to be a fixed point of a polynomial $f(x)$ if $f(x) = x$. The number of fixed points of involution has importance in the cryptography. It is observed that the cryptographic properties and number of fixed points are strongly correlated with each other. Youssef et al. (Youssef, Tavares, & Heys, 1996) observed that the number of fixed points is correlated to the cryptographic properties like nonlinearity and maximum XOR entry table. They showed that lower number of fixed points leads to better value of nonlinearity and maximum XOR entry table. The study of number of fixed points in Dickson involutions are found in (Charpin, Mesnager, & Sarkar, 2016) and (Charpin, Mesnager, & Sarkar, 2016). It is observed that in Dickson involutions the number of fixed points is generally high (Charpin, Mesnager, & Sarkar, 2016). There exist several methods to reduce the number of fixed points without affecting the involution property of Dickson polynomial (Charpin, Mesnager, & Sarkar, 2016), (Charpin, Mesnager, & Sarkar, 2016)

4. APPLICATIONS TO CRYPTOGRAPHY

4.1: Dickson Cryptosystem:

In 1981, Muller and Nöbauer(Muller, 1981) proposed the Dickson cryptosystem, which is a modification of RSA cryptosystem. The security of Dickson cryptosystem is also based on Integer factorization problem. The cryptosystem is defined as follows:

Key Generation:

1. First choose a random integer $r \in \mathbb{Z}^+$.
2. Choose $p_1, p_2, \ldots, p_r$ are odd primes.
3. Compute n as $= \prod_{i=1}^{r} {p_i}^{e_i}$.
4. Compute $v(n) = [{p_1}^{e_1 - 1}({p_1}^2 - 1), {p_2}^{e_2 - 1}({p_2}^2 - 1), \cdots, {p_r}^{e_r - 1}({p_r}^2 - 1)]$.
5. Choose $e \in \mathbb{Z}_n$, such that$\gcd(e, v(n)) = 1$.
6. Compute d is such that $ed \equiv 1 \pmod{v(n)}$.
   Here public keys are (n, e) and private keys are $(d, p_1, p_2, \cdots, p_r)$.

Encryption: Let the secret massage be$m \in \mathbb{Z}_n$. Then ciphertext is

$$c \equiv D_e(m) (\mathrm{mod}\, n).$$

Decryption: Now we have the ciphertext *c*. Therefore, the original massage can be found by,

$$m \equiv D_d(c) (\mathrm{mod}\, n)$$

Verification: As, $D_d(c) = D_d\big(D_e(m)\big)$

$$= D_{ed}(m)$$

$$= D_1(m)$$

$$= m$$

Attacks on Dickson cryptosystem:

1. Müller and Nöbauer(Müller & Nöbauer, 1985)discussed some attacks on Dickson cryptosystem. They proved that the Dickson cryptosystem is secure in certain conditions: (a) $p_i - 1$ and $p_i + 1, (i = 1, 2, \cdots, r)$ contains a large prime factor p_i' and p_i^* respectively and (b) if $\text{ord}_{p_i'}(k)$and $\text{ord}_{p_i^*}(k)$ is large. Moreover, authors stated that the above conditions will be satisfied if:
   (i) $p_i - 1 = a_i p_i', a_i < 10^5, p_i' > 10^{80} and\ p_i + 1 = b_i p_i^*, b_i < 10^5, p_i^* > 10^{80}$
   (ii) $\text{ord}_{p_i'}(k) > 10^{11} \text{and} \text{ord}_{p_i^*}(k) > 10^{11}$.

   When an attacker is unknown to the factorization of n, he cannot compute the decryption key d. In that case the attacker may approach to other methods of decryption. Partial decryption is one kind of that method in which the attacker can decrypt certain ciphertexts without knowing the decryption key. Some other methods are also there. If the condition (i) is satisfied then the attacks given by the methods of partial decryption(Müller & Nöbauer, 1985), factoring of n(Müller & Nöbauer, 1985), factoring by the means of fixed points(Müller & Nöbauer, 1985)on Dickson-scheme does not affect on the security of the scheme. Also, the Dickson-scheme is secure if both the conditions (i) and (ii) are hold for the attack of superenciphering(Müller & Nöbauer, 1985)method.

2. Small secrete exponent attack: The author Boneh and Durfee (Boneh & Durfee, 2000), showed that in RSA cryptosystem, an adversary can efficiently recover d from (n, e), without knowing the factors of n if $d < n^{0.292}$. So, in RSA cryptosystem d must be greater than $n^{0.292}$. A similar approach on Dickson cryptosystem can be noticed in (Onishi, Uchida, & Uchiyama, 2015). They proved that the private exponent key $d$in Dickson cryptosystem can be calculated easily if the value of $d < (1/3\sqrt{2})n^{1/2}$ (Theorem 5 of (Onishi, Uchida, & Uchiyama, 2015)). Also, they improved the bound of d in Dickson cryptosystem to $n^{0.585}$ by using of Boneh-Durfee's algorithm (Theorem 9 of (Onishi, Uchida, & Uchiyama, 2015)).

Remark: In (Lidl, Mullen, & Turnwald, 1993), Lidl et al. showed that $D_k(x, a) = V_k(x, a)$, where $V_k(x, a)$ is the Lucus function. Hence, the LUC cryptosystem (Smith, 1993) becomes a modification of the Dickson cryptosystem with parameter $a = 1$. But LUC cryptosystem reduces the degrees of decryption function by using ciphertext-dependent decryption parameter (Smith, 1993). Later in 2013(Brandner, 2013), Brander showed that the degrees of decryption function of Dickson cryptosystem can be reduced for $a = -1$.

4.2: Key Exchange protocol:

In symmetric key cryptography, we need a secure key exchange protocol to share the secrete key among the parties for better performance of the cryptosystem. Diffie and Hellman (Diffie & Hellman,

1976) proposed the first key exchanged protocol based on Diffie-Hellman problem. In 2011, Wei et al.(Wei, Liao, & Wong, 2011) proposed a new key exchange protocol based on Dickson polynomials over the finite field $\boldsymbol{F}_{2^m}$.They construct the protocol in the similar way of Diffie-Hellman protocol by considering the Dickson polynomial $D_k(x) \bmod 2^m$ of degree k modulo 2^m, where $m \geq 2$ and k is odd. The security of this protocol is based DDP problem. Suppose Alice (A) and Bob (B) wanted to share a secret key over an insecure channel and let α, β be their respective password. For sharing the secret key, a hash value $h = H(ID_A \parallel ID_B \parallel \beta \parallel \alpha)$ can be shared where ID_A and ID_B are random identity chosen by A and B respectively and$H$ is a hash function, which is public for all. The algorithm of the key-exchange protocol is as follows:

1. A compute $AU_1 = H(h \parallel r_A \parallel n_A \parallel ID_A)$, where r_A and n_A are respectively random integer and random nonce chosen by A. After the computation A sends the values AU_1, r_A, n_A and ID_A to the server B.
2. Then B compute $AU_1' = H(h \parallel r_A \parallel n_A \parallel ID_A)$ and check whether it is equal to AU_1 or not. If $AU_1 \neq AU_1'$, then B stop to proceed. Otherwise, B goes to the next step as authentication of A is proved.
3. Now, B choose a random integer r_B and a random nonce n_B to compute $AU_2 = H(h \parallel r_B \parallel n_B \parallel ID_B)$. The computed value AU_2 and r_B, n_B, ID_B are sent to A.
4. In a similar way A compute $AU_2' = H(h \parallel r_B \parallel n_B \parallel ID_B)$ to check whether $AU_2 = AU_2'$ or not. If the equality holds, B is authenticated and then A proceed to the next step. Otherwise, A stops to go further step.
5. Let m be the product of the random integers r_A and r_B, i.e., $m = r_A r_B$. A & B both compute $x_0 = (r_A + r_B)(mod\ 2^m)$. Then A & B choose two odd integers p_A&p_B respectively to compute $X_1 = D_{p_A}(x_0) \bmod 2^m$, $AU_3 = H(h \parallel n_B)$ and $X_2 = D_{p_B}(x_0) \bmod 2^m$, $AU_4 = H(h \parallel n_A)$ respectively. A sends the computed values X_1& AU_3 to B and B sends the values X_2& AU_4 to A.
6. Then A & B compute respectively $AU_4' = H(h \parallel n_A)$ and $AU_3' = H(h \parallel n_B)$ and check whether the two relations $AU_4 = AU_4'$& $AU_3 = AU_3'$ hold or not. If these hold then A & B can compute secrete keys as $D_{p_A}\left(D_{p_B}(x_0) \bmod 2^m\right) \bmod 2^m$ and $D_{p_B}\left(D_{p_A}(x_0) \bmod 2^m\right) \bmod 2^m$ respectively.

Note that, the permutation property of the Dickson polynomial $D_k(x) \bmod 2^m$ for odd k has guarantee that A & B agreed with a same key.

5. CONCLUSION

In this paper, we have discussed some important properties of Dickson polynomials in the contexts of cryptography. We have mentioned some of the cryptographic applications of Dickson polynomials such as Dickson cryptosystem and Key exchange protocol. We discussed some attacks on Dickson cryptosystem. An algorithm for computing Dickson polynomial is also mentioned.

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INTEND AND INTEND OF MEDICINE DELIEVERANCE ROBOTS FOR HOSPITALS

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This paper presents a designing and manufacture of medication conveyance robots for hospitals. Computerization is a field which is skewering its branches practically in all assistance arranged fields which is presently reached out in the field ofmedication. This paper targets planning a robot for conveying the heap to substitute the nursing administration. The correspondence between the client and nursing robot is given by sending remotely the information from a RF transmitter module to a RF beneficiary on the versatile stage. It utilizes a sound and video correspondence to address patients about themedication. It can likewise screen the pulse and temperature levels of the patient and send information to client. This shows that it give steady and reliable framework and keeps the assembling cost low. This robot was executed in an Arduino Mega 2560 and the product utilized is Arduino IDE.

Keywords: Automation, Nursing, Line follower Robot, RFID, Voice play back circuit.

1. INTRODUCTION

Robotics is an innovation which is wide spreading nowadays practically in all of the fields beginning from the complicated rocket innovation to checking the harvest in the field of horticulture. In this paper we utilize the innovation technology in tracking down the option for the human asset for doing basic administrations in hospitals, for example, robots for implying the patients to take medication of to take their food appropriately in time duration and to convey the pills in view of the specialist's recommendation to the patient. These days medical clinics are packed because of expansion in loads of new illness. Deficiency the asset is an outstanding jug neck.

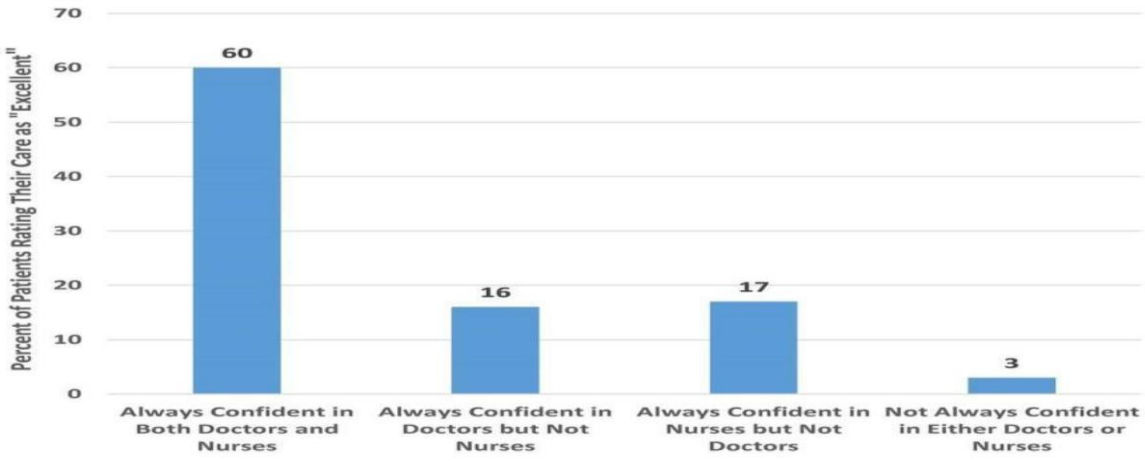

Fig 1 : Comparison of patients rating their care as excellence.

This graph shows that the confidence and trust in the medical attender is much related significance given to a specialist. Import assignment of an attendant is to deal with patient apportioned to them by giving them prescriptions in appropriate time duration and recording the patient's body parameters.
Conveying pills to the patient of one ward in a consistent schedule would take around half to 60 minutes. Yet, conveying a pill is anything but a main job which can be computerized. This was the inspiration driving for evolving this paper. However, hospital is a composite surroundings which is made out of different exercises, for example, laboratories, scan center, emergency ward, short term ward and general ward. Thus designing a robot is an intense undertaking to work in that complicated surroundings. Here the development and observing the way to the patients area is done through wifi camera and RF transmitter and beneficiary , correspondingly to distinguish the snags a module in view of ultrasonic sensor is utilized. Here we us a wireless sound communication framework module which will give a voice aionnd video communication.

2. LITERATURE REVIEW

I. Huang et al proposed the intelligent pill box—Design and implementation (2014),
The implementation of pill box has proposed by keeping the problems of old age people in mind to provide full medication safety. The pill box will remind the patient about timing by doing this drug abusing can be controlled.

II. Al-Majeed et al proposed Home telehealth by Internet of Things (IoT) (2015),
The real time monitoring can be possible through IOT which helps in development of low cost medical sensing, communication and analytic devices which make quality of life, in case of density of messages there is fear of information degradation but by using proper algorithm we can resolve the problem and can make the low cost imaging, sensing and human computer interaction technology.

III. Uday kumar Naik et al Proposed Experimental Framework for automated bed localization an drug identification using Zigbee signal strength and mobile robot(2019).
The aim of this work is to deliver correct drugs to patients on a timely basis.The technique uses a wall follower robot which moves along the ward detecting the beds with the use of infrared sensors and distributes the exact medicine assigned to the patients with the aid of ZigBee network signal variations.The use of motion robots considerably improves the quality of patient care and reduces human errors in medicine administration.

3. METHOD

3.1 Existing Method

There are many new technology advancements in the new days for hospital management. In any case, patient consideration is a significant angle in the hospital surroudings. The existing technique accessible for robotize the hospital administrations in a level 3 hospitals is an attendant carry medicines to the patient's room and records the patient's body parameters in the patient graph. In level two hospitals an attendant will be accessible in the patients ward and all of the subtleties of the patients accessible in the ward will be recorded in a different system and during the ward visit specialist will gather the data from the system. In level 1 hospitals robots are engaged with performing complex activities, for example, davinci robot which gives more exact control with most extreme accuracy and

Xenex Germ-Zapping Robot which utilizes UV rays for eliminating the unsafe microscopic organisms in the hospitals.

3.2 Proposed Pill Delivery Robot

Robotics is a field which is a blend of hardware and Mechanical Engineering. This field was created to substitute the human and to imitate their activities. Here we propose a proficient and savvy technique for including advanced mechanics as a substitute of medical attender in hospital surroundings which is the fundamental needs for a decent hospital. The proposed medicine conveyance robot is of the accompanying modules.

1.Wireless Robotic Chassis with medication plate.
2.Ultrasonic Sensor for recognition the barriers.
3.Temperature sensor module for checking the internal heat level.
4.Pulse sensor for checking the body pulse.
5.A Wifi IP camera module for alarming the patient with regards to the pills.

3.2.1 . nRF24L01 Module

The nFR24L01 is a transceiver module which means that it can both send and receive the data. These modules are very cheap, smaller in size and has a lot of specifications.

3.2.2 Ultrasonic Sensor

It consists of two circular eyes out of which one is used to transmit the US signal and the other to receive the US rays. The time taken by the rays to get transmitted and received back is calculated by the microcontroller Ultrasonic Sensor HC-SR04 is a sensor that can measure distance. It emits an ultrasound at 40 000 Hz (40kHz) which travels through the air and if there is an object or obstacle on its path It will bounce back to the module. Considering the travel time and the speed of the sound you can calculate the distance.

3.2.3. MLX90614 Temperature Sensor Module

Here I'll use a MLX90614 (GY906) Infrared non contact temperature sensor and I'll measure temperature in °C and °F. So, each object emits infrared waves depending on its heat, and these waves are detected using a thermopile which get hotter and hotter, in the same time converting the excess heat to electricity

3.2.4. Measure your heartbeat with Arduino (Sensor XD 58C)

In this article we will go to realize a project with Arduino using the XD-58C sensor. This sensor does nothing but measure heart rate of the heart, it can be found in any medical equipment that is used in measuring heart rate. It can be worn on the finger or on the earlobe. Suitable for all projects that require heart rate data. Measure heart rate with the XD-58C sensor.

3.2.5. WiFi Wireless CCTV HD IP Camera Module

WiFi Wireless CCTV HD IP camera with 128GB SD Card Supported for Indoor Outdoor. Use WiFi Live Video Stream in Mobile or Laptop 2 Way Chat**.**

4. CONCLUSION

At mega 2560 is liked over different sheets since it is the most famously fabricating a robot. The Nursing Robot will assist the patient with taking the pills at the right time. In light of timing, the robot will move starting with one spot then onto the next place. It tracks the way by utilizing camera. Since DC motor is utilized for movement of the robot, so it can move in four headings with no requirements. Assuming any barrier is there it can perceive effectively by the Obstacle sensors. It moves to the following room by wireless idea. Our proposed framework is interacted with sensors which improve the patient caring level in the emergency clinic with the assistance of IoT innovation. We can developing this concerning robot in the emergency clinic for staying the patients about their drugs without human mediations.

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AN IOT FRAMEWORK FOR INTELLIGENT CROP MANAGEMENT

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The unwanted as well as excessive use of pesticides and fertilizers creates health hazards and is making the soil unproductive also. Only a tiny portion of the crop catches the disease, but the farmers spray the pesticides evenly over the entire field, resulting in the wastage of pesticides. They are not aware of the exact composition of the soil. Certain nutrients, pH levels, moisture, and fertility support a certain kind of crop. All of these problems have been observed in the nearby villages of Sonepat, such as in the town of Bhigan and Murthal. We will use a robot with sensors to match the levels of pH, temperature, humidity, and soil moisture to the levels required for growing crops. This will identify the best crop to grow in that soil. The sensors are connected with raspberry pi, which will send the data to Thinkspeak, which will compare the sensed data with the standard data and gives us all the information required. A drone is hovering over the field, which will click the pictures of the area and tell us about the diseases caught by the crops. The productivity can be increased without adversely affecting the soil. This will reduce the use of chemical fertilizers by 30% to 75%. This will help to improve economic and environmentally sustainable crop production. The equipment manufacturing companies are potential buyers for the patent of the proposed technology. Marketing of this technology may be done in partnership with fertilizer suppliers.

Keywords: Farming, Productivity, temperature, Pesticides, Disease, Robot, Drone

1. INTRODUCTION

We all know how vital crop production is for our country. But the quality and quantity of production are degrading year by year. Farmers are not utilizing their resources to the fullest, and they are not aware of the exact composition of the soil. The nutrients, pH level, moisture, and fertility are the factors that affect production. A particular composition of all these factors supports a specific kind of crop. Hence, it becomes very crucial to understand how we can increase the level of productivity. Another problem that arises with lack of knowledge is that a part of the crop sometimes catches the disease, and farmers unknowingly spray an irrelevant quantity of insecticides and pesticides, which in turn spoil the whole produce. This gives us another matter to address, that is, how to keep a check on the crop and how to know the exact quantity of sprays required to cure the diseased crops. As a solution to these problems, the authors introduce a solution based upon a robot and a drone to increase the

productivity of farmers. A revolutionary concept that would change the whole ideology of the conventional approach towards farming. A robot connected with four different types of sensors will be monitoring our soil continuously. It will match the levels of pH, temperature, humidity and nutrients with the standard levels required to grow crops. By doing this, we will be able to identify the best suitable crop for our soil, and we also are able to locate the diseased crops with a drone that will be hovering above our crops day in and day out. It will be taking pictures of our products which will serve as input for our robot, and it will assess the crops based on some measures. Identifying diseased crops and tackling productivity problems at the same time will bring exactly the kind of revolution we are looking for.

2. LITERATURE SURVEY

Agriculture robots face a special set of technology and engineering obstacles that are not typically present for indoor robotic systems because they operate outdoors as well as on rough terrain. These research activities concentrated on problems unique to agriculture. Navigation in rugged terrain, handling wheel slip, natural lighting, its effects on the performance of image processing, impacts of vegetation on localization, consistency of tractor-trailer movement, mechanical design, as well as other issues were all addressed by researchers. No industrial-scale or large-scale agricultural operations using agriculture robots have been reported(*THE ROBOTREPORT- Exploring the Business and Applications of Robotics*, 2022).

Durmus and others (2015) presented the Agrobot, a multifunctional agricultural robot, was created by this team. Designing the robot as well as creating a cloud-based facility to link it to the farmers' mobile were the two primary foci from the beginning. They used readily available tools and equipment to build their robot internally for less than $2,000, and they were able to manage it wirelessly (Durmus et al., 2015) . A four-wheeled mobile trolley with tracker sensors was introduced, and it can move around the greenhouse on its own using a guidance line and tracker sensors. For managing the harvesting and insect control operations, the carts also have a control range with a joystick, control panel, and an RFID tag reader (K. Kashiwazaki, 2010).

Amer et al. (2015): The group created a working prototype of the Agribot agricultural robot, which can carry out various agricultural tasks. The robot could quickly move in any direction thanks to its hex pad physical design as well as the walking mechanism(Amer et al., 2015). They suggested that in order for an agro-based robot to succeed, complexity, as well as functionality, must be balanced (Emmi et al., 2014).

(Naik et al., 2016) presented Robotics in the agricultural industry, with its execution based on the idea of precision farming, is the most recent emerging technology in recent years. (Sajjad Yaghoubi, 2013) (Auat Cheein & Carelli, 2013), the efficiency of developed agriculture needs to be raised in novel ways. Oil testing, according to Shah Alamgir and Israt Jahan(Sajjad Yaghoubi, 2013), is crucial for modern agriculture in order to maximize output, safeguard the environment from excessive fertilizer use, and conserve resources while producing food.

(Pavan.C, 2012) illustrated in their paper continues the review of agro-based robots and looks into the potential causes of this phenomenon, this time concentrating on viability and practicability. An effective structure for HRI (Human-Robot Interaction) among both robots and agricultural members, a

platform for software communication and reuse, and all other services and technologies required by agro-based machines while in operation make up the infrastructure.

2.1 PROBLEM PEOPLE ARE FACING

The assessment of soil conditions before choosing a particular crop is a necessity of modern-day farming. The unwanted and excessive use of pesticides and fertilizers is a potential health hazard and is making the land infertile too. Only a tiny part of the crop catches the disease, but farmers spray the pesticides all over the field resulting in the excessive wastage of pesticides and money and often leading to death because the one spraying the pesticides is also inhaling them indirectly. Farmers take a loan for pesticides and fertilizers to save their crops, and after some time, they are not able to pay the loan and commit suicide because they get to sink into debt. Agricultural automation problems:
Different Approaches:
Three options are typically available when performing an agricultural task.

1. Manual work
2. "Blind machine" (i.e. A machine devoid of sensors)
3. Automated devices

The table below provides a summary of these three options' qualities.

Basic Characteristics

	PRODUCTION EFFICIENCY	RUNNING INITIALLY	INVESTMENT COST
MANUAL WORK	less	less	more
BLIND MACHINE	more	more	less
ROBOT	less	more	less

Researchers need to examine the economic and socioeconomic, technical aspects as well as the unfavourable factors like financial aspects, technical hurdles, industrial safety aspects and environmental issues.

3. MATERIALS USED:

This section presents the materials used in designing a lab-scale prototype of the proposed robot. Authors devised a lab-scale device and are engaged in continuous work for a farm-scale prototype. Following are the materials used for the lab scale prototype (shown in fig. 7):

3.1 Raspberry pi: The small single-board computer called the Raspberry Pi was invented in the UK by the Raspberry Pi Foundation to promote computer science education in classrooms and in developing countries. Outside of its intended market, the original model has become much more common than anticipated for applications like robots (as shown in fig. 2).

Features include a 700 MHz to 1.2 GHz CPU speed range.

• The size of the onboard memory (RAM) can vary from 256 MB to 1 GB.

• USB slots are distinct from 1 slot. 3.5mm phone jack, composite video output, and HDMI.

• GPIO pins that support popular protocols example, I2C (inter-integrated circuit), provide low-level output. 8 Position 8 Contact Ethernet (8P8C).

Fig 2. Raspberry Pi

3.2 Python: Python is a high-level, interpreted programming language used for computer programming. Python provides a variety of options for GUI development (Graphical User Interface). The most popular GUI method is tk inter, which is used the most frequently. The Tk GUI toolkit provided by Python has a typical Python interface. Python and Tk Inter are the quickest and most straightforward tools for developing GUI applications. Utilizing tk inter to create a GUI is simple. Power Supply or Battery, DC Motor Driver (L293D), DC Motor, Relay paired with a driver, Soil Moisture Sensor (shown in fig. 3), Temperature Sensor (shown in fig. 4).

Fig 3. Soil Moisture Sensor.

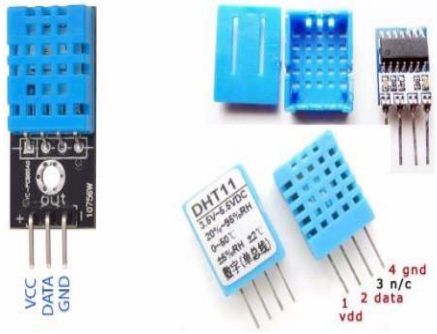

Fig 4. DHT11 Humidity Temperature Sensor

4. SOLUTION AND WORKING:

The IoT is made up of various modules and sensors that enable automation, i.e., the removal of human interaction from the process of operating an object. It is made up of different hardware (shown in fig 6) and software combinations that enable things to operate automatically. A robot connected with different types of sensors will be monitoring our soil continuously. It will match the levels of ph, temperature, humidity and soil moisture with the standard levels required to grow crops. By doing this, we will be able to identify the crop best suited for that soil. The sensors are connected with raspberry pi, which will send the data to Thinkspeak**,** which will compare the sensed data with the standard data and gives us all the information required (shown in fig. 5). A drone is hovering over the field, which will click the pictures of the field and tell us about the diseases caught by the crops or by this drone we will also get to know about the trees or plants in the field and so that a right amount of fertilizers and pesticides can be sprayed over the field.

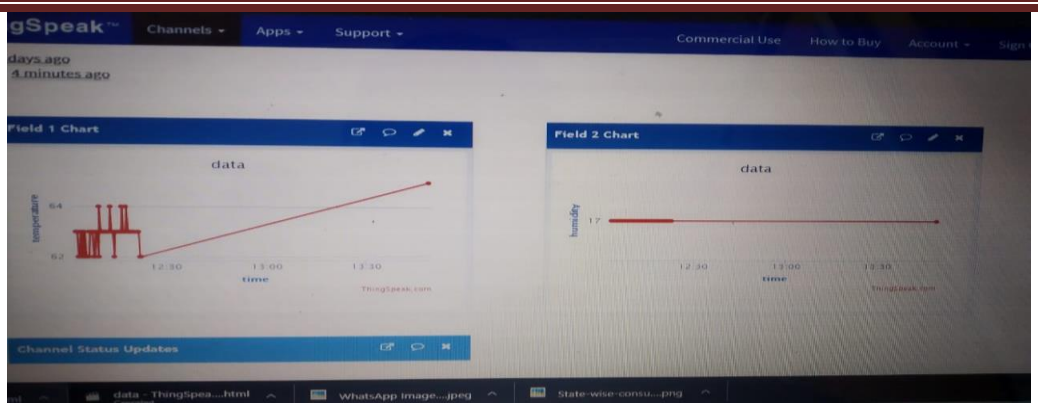

Fig. 5 Data Received

Fig. 6 Material used

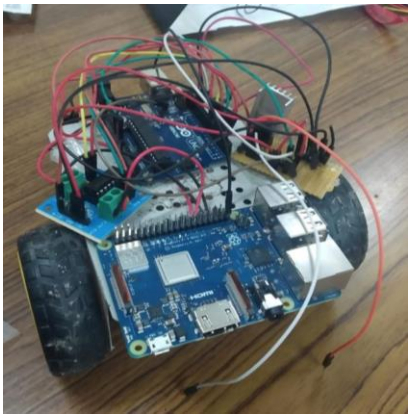

Fig. 7 Prototype.

4.1 SALIENT FEATURES:

• Acquiring knowledge about soil components beforehand.

• Early detection and prevention of any disease.

• Use of renewable solar power.

• Exponential increase in produce.

5. CONCLUSION:

Agriculture development greatly depends on the development of field networking technology, which is also a key indicator of how far along agriculture is in that development. It will be part of the long-term strategy for agricultural development. Utilizing available resources effectively and ensuring the efficiency, accuracy, and stability of crop production are two major benefits of implementing the IoT to crop production. In the present research and development project, the authors proposed an intelligent system based upon the sensing of soil parameters through an IoT-enabled robot, continuous visual monitoring of crops by a drone and giving the indication for the appropriate crop for the soil in the farm, also indicating the emergence of any diseases thereby suggesting the appropriate use of pesticides and fertilizers.

5.1. FUTURE SCOPE:

- As more features are added to the Internet of Things (IoT), these systems will become more accurate, fast, stable, and cost-effective as technology advances daily.
- Farmers who work in agriculture in the future should and can adopt this system.

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MACHINE LEARNING APPROACH IN PREDICTION OF EDUCATION SYSTEM

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Education is the right of every human being living around the world, and it should be provided to all people with full quality. It is very important to search for reforms in the field of education so that education can be conducted in an effective and efficient manner. Over the past few decades, new portable devices have emerged along with computers that have greatly improved the education world, and have made it possible to access a large collection of electronically available materials that are employed in all phases of daily life. These developments have created new ways for teachers to communicate with learners. In this regard, technology has been more involved in contemporary education. There are various machine learning techniques which have already been applied by various researchers in the field of prediction of fundamental thinking in the education system and there is still a lot of potential. . In this research we have reviewed some research articles where machine learning techniques are applied to enhance the result of previous predictions.

Keywords: Education System, Digital Education, Machine Learning

1. INTRODUCTION

The assessment of teaching performance looks at academic credentials, relevant experience, instructional effectiveness and professional achievements. The student, or the teacher himself, can evaluate each of these factors. In this research we have reviewed some research articles where machine learning techniques are applied to enhance the outcome of previous predictions. According to Alemoni, students are the primary source of information about the learning environment, including the ability of teachers to motivate them to continue studying, and the level of communication. The University of Wisconsin-Statistics has a database where the findings of many evaluations are kept. In order to build a model that can use some past evaluations to determine future predictions, in this research we have reviewed some research articles where machine learning techniques are applied to enhance the outcome of past predictions.

The format of this letter is as follows. There is various literature reviews related to the education system which have been summarized in the first part. The methods used to solve this problem are then introduced. The results are presented in the next section, followed by the final analysis and conclusions. In order to build a model that can use some past evaluations to determine future evaluations, this research focuses on applying various machine learning methods to this data.

Machine learning Machine learning is a type of application of artificial intelligence (AI) which gives systems the ability to learn automatically and improve themselves if needed.

To do this, they use their own experience and not explicitly programmed. Machine learning always focuses on the development of computer programs so that it can access the data and later use it for its own learning.

In this learning starts from observations of data, for example direct experience, or instruction, to find patterns in the data and make it easier to take better decisions in future.

The main goal of Machine Learning is how computers automatically learn without any human intervention or assistance so that they can adjust their actions accordingly.

2. LITRATURE REVIEW

We have reviewed more than 40 number of research papers which are downloaded from Elsevier, IEEE, science direct websites, SCI journal websites and others. Reviews of these are as follow:-

Jagadhesan B. et al. (2021) conducts a research on "An impact of block chain technology on digital education in machine learning" In the context of device learning, many aspects of the use of the Block chain era framework are examined. The areas of machine learning where the use of block chain is advantageous are also investigated.

Jaiswal A. et al. (2021) conducts a research on" Potential of Artificial Intelligence for transformation of the education system in India" Using a qualitative method of data inquiry Four subject matter experts working on AI-related technologies and four senior managers from top Indian educational technology companies that have created AI-based apps for schools participated in our in-depth interviews. Using grounded theory, we discovered that adaptive assessments, recommendation systems, and individualized learning are beneficial to both students and instructors.

Shafiee et al. (2020) conducts a research on "Prediction of Mental Health Problems among Higher Education Student Using Machine Learning" The goals of this study are to (1) discuss the issues related to mental health that higher education students face, (2) identify the causes, and (3) review the machine learning tools that are now available to assess and forecast these issues. The study's findings will be used to other research to further the conversation on mental health issues for use in computer modeling.

Mduma et al. (2019) conducts a research on "A Survey of Machine Learning approaches and techniques for students Dropout Prediction" This paper provides an overview of machine learning in education with a particular emphasis on methods for predicting student dropout. The report also identifies outstanding problems for potential future research topics.

Sekeroglu et al. (2019) conduct a research on "Student Performance Prediction and Classification Using Machine Learning Algorithms" In this study, two datasets were taken into account while employing five machine learning algorithms to predict and categories student performance. 18 studies have been conducted, and preliminary findings indicate that student performance may be predicted and that these performances can be increased by applying pre-processing to the raw data before implementing machine learning algorithms.

Kaur P. et al. (2015) conducts a research on "Classification and prediction based data mining algorithms to predict slow learners in education sector" EDM's goal is to examine these data and provide solutions to problems in educational research. EDM focuses on creating fresh approaches to investigating educational data and employing data mining techniques to comprehend the learning environment of students.

Padmapriya S. et al. (2015) conducts a research on "Mining educational data using data mining techniques and algorithms –a review" The ability to accurately forecast student exam success depends on a variety of difficult-to-assess characteristics, but student personal, social, and psychological distinctions are crucial to this ability. Therefore, it is imperative that a precise performance monitoring, warning, and evaluation system be developed.

Mohammad Thakaa Z. et al. (2014) conducts a research on "An Intelligent Educational Data Mining Classification Model for Teaching English for Slow Learner Students" The goal of this project was to develop an intelligent educational data mining classification model specifically for teaching English to

students who are slow learners in order to identify the most efficient learning style and enhance their performance.

Richard A. et al. (2014) conducts a research on" A survey of educational data mining research" This paper's goal is to present an overview of the research on educational data mining. Uses for personal recommender systems, student retention and attrition, and other data mining management systems are included as specific applications of educational data mining. In the paper's conclusion, suggestions for more research are made.

Ranbaduge T. (2013) conduct a research on "Use of data mining techniques in evaluating educational data" The necessity to develop such advances, to raise people's levels of knowledge, has become critical in the contemporary society. At the moment, online learning has greatly increased awareness within the higher education setting. E-learning is highly valued in today's culture since it links students to an unlimited number of learning materials.
Sean et al. (2012) conducts a research on "playing the ta lottery: a study of how teaching assistants impact grades in engineering courses" In this essay, we assess how Teaching Assistants (TAs) affect students' grades. We examine the performance of students in six different basic computer engineering courses with a total of 12 different teaching assistants (TAs) and about 800 students.

Mard˙ikyan S. et al. (2011) conduct a research on "Analyzing Teaching Performance of Instructors Using Data Mining Techniques"This study examines the variables influencing the evaluation of instructors' instructional performance using stepwise regression and decision trees, two separate data mining methodologies.

Georgiana Dragomir E. (2010) conducts a research on "Teaching Performance Evaluation Using Supervised Machine Learning Techniques" In order to automatically categorise new instances, the models are constructed utilising certain historical evaluations that are recorded in a database. From this experiment, we can infer that the KNN approach classifies a new teaching performance assessment instance more accurately than a model based on the SVM technique under the parameters stated in this study.

S. N.	Paper Title	Technology Used	Outcome		
			Dataset	Techniques	Recognition Rate (%)
1	Potential of Artificial Intelligence for transformation of the education system in India	AI-technologies such as facial recognition, emotion recognition, natural language processing, and image processing,	K-12 education	supervised machine learning Techniques	90%
2	Prediction of Mental Health Problems among Higher Education Student Using Machine Learning	Linear regression and logistic regression. Linear regression is statistical tool for modeling, decision tree and neural network.	Ministry of Higher Education (MOHE)	supervised machine learning Techniques	70% To 90%
3	A Survey of Machine Learning approaches and	Survey Paper	-	-	-

	techniques for students Dropout Prediction				
4	Student Performance Prediction and Classification Using Machine Learning Algorithms	Regression (SVR) and Long-Short Term Memory (LSTM), Gradient Boosting Classifier (GBC)	educational data especially the effect of social environment and family on the students'	Backpropagation (BP), Support Vector	87.78%
5	Classification and prediction based data mining algorithms to predict slow learners in education sector	Multilayer Perception Naive Bayes, SMO, J48, REP Tree	Real world high school	Multilayer Perception	75%
6	Mining educational data using data mining techniques and algorithms – a review	Association rule, Multi-level association rule, Genetic Algorithm, Fuzzy FP Tree Algorithm, cloud computing	Primery data	Bayes classification techniques	70%
7	An Intelligent Educational Data Mining Classification Model for Teaching English for Slow Learner Students	ASP.NET and C# with SQL database language	Student Navigation Behaviors Dataset	Classification model	79.5%
8	Use of data mining techniques in evaluating educational data	Review paper	-	-	-
9	Analyzing Teaching Performance of Instructors Using Data Mining Techniques	Decision trees, neural CHAID and CART	Bogazici University.	KDD	90%
10	Teaching Performance Evaluation Using Supervised" Machine Learning Techniques		Statistics Department of the University of Wisconsin-Madison.	KNN,SVM	67.3 To 96.6

3. METHOD OF STUDY

This essay reviews the case studies, academic publications, and books in the field. The goal is to compile, arrange, and synthesise current knowledge about machine learning methods for predicting student and teacher performance. The papers that were surveyed concentrated on a number of studies

on machine learning in education such as the prediction of student and teacher performance, academic achievement, and final outcome forecasting, etc. These research' conclusions are very helpful for understanding the issue and enhancing steps to address the issue. Several databases, including ResearchGate, Elsevier, and the Association for Other computer science periodicals include Computing Machinery (ACM), Science Direct, Springer Link, IEEE Xplore, and others.We utilised the terms " teacher and student performance " and " teacher and student performance " in our phrases and keyword searches using machine learning methods, and applying in machine learning algorithms for prediction. In order to find any possibly pertinent study or journal titles, we looked through each article's reference list. The publishing periods considered are from 2011 to 2021. We search PDF files, documents, and full-length papers with an abstract and keywords. Additionally, when searching for things, we looked for journal articles, conference papers, workshop papers, and subjects that were blogs, expert seminars, and other topic-related groups, such as the community for instructional machine learning, are all examples. A sizable portion of the publications that were selected helped to support their inclusion in this study.

4. METHODOLOGY USES BY RESEARCHERS

When we looked at the goals of this study, the aforementioned research questions were taken out. We conducted a literature review in order to respond to these research questions. We chose to employ the SLR technique to compile the pertinent primary studies and adhered to recommendations.

We chose to do an electronic search for the SLR. The databases used were Science Direct, Web of Science, Scopus, IEEE Explore Digital Library, and others (Google Scholar and similar). (Machine Learning" AND "Education" OR (Machine Learning" AND "Educational") was the search keyword. Between fifty and one hundred related studies were the number we were looking for, since this would provide us with enough data to classify the studies and identify research patterns.

The papers were divided into four categories at the next stage. The majority of the published articles were very different in terms of the study purpose, technique, and application, which formed the basis for this classification. We divided the studies into four categories to keep things as simple as possible while still taking into account the different topics.

In this manner, we looked at the research publications that were similar. 67 papers were ultimately collected. Several categories were used to group certain research.

Following are the research categories and overall number of chosen studies:

- Students Dropout (10 studies)
- Teaching performance (8 studies)
- Online learning (5 studies)
- Improving student retention (10 studies)
- Predicting student performance (12 studies)
- Testing students (6 studies)

There are simply used as tags and a mark for additional referencing in the remaining portions of this study.

5. CONCLUSION

This study's objective was to assess the state of the art for using machine learning in the field of education System. Only a few of the research, which we considered to be excellent representations, were highlighted in the study's findings due to the sheer number of studies (papers and articles) that were available. This study demonstrates that there are several, varied ways that machine learning applications in the field of education system might be advantageous.

A review of machine learning methods & classification technique for tackling the issue of teaching performance is provided. The report offers numerous findings, the first of which is that while machine learning has been used successfully in affluent nations to address the issue of teaching performance, less research has been done in underdeveloped nations. Second, many academics have chosen to disregard the problem of data imbalance despite significant attempts to use machine learning in education. This makes it easier to evaluate algorithm performance using inaccurate measurements. Third, rather of using ranking and forecasting systems to address the issue of teaching performance, many studies concentrate on early prediction.

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STUDY OF GRAVITATIONAL SEDIMENTATION OF FLEXIBLE PLANKTONIC SHAPED PARTICLE USING IMMERSED BOUNDARY METHOD

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We deliberated the sedimentation of flexible planktonic shaped particle saturated in a Newtonian, incompressible and viscous 2D fluid domain. Numerical formulation of the concentrated problem was solved by Immersed boundary method (IBM). Parametric investigations were conducted to examine the effect of changing flexibilities and distortion of the particle on the settling velocity (terminal velocity) of the immersed planktonic structure. We further observed that for fixed flexibility, settling velocity decreases by increasing the viscosity of the particle. We also concluded that for fixed viscosity, terminal velocity of the particle escalates as flexibility of the particle increases.

Keywords: Immersed boundary method; sedimentation; viscosity; flexible; settling velocity.

1. INTRODUCTION

The major study of this work is the settling due to gravitational effect on flexible planktonic shaped particle in a restricted medium which is filled by Newtonian, incompressible, and viscous fluid in two dimensions. Fluid structure interaction of concerned problem were solved by Immersed boundary method (IBM). Sedimentation of flexible bodies are experienced in various fields like sedimenting of drifting particles with various flexibilities in assembling clean rooms Li et al. (2013), dissemination of carbon nanotubes Jiang et al. (2003) and pecking order in the streams Kamali et al. (2015) and Gooday et al. (1990).

In literature, there has been no broad review done for sedimenting flexible planktonic particle. In literature analysts have done nitty gritty investigation of rigid impermeable planktonic particle Ghosh (2020) and Feng et al. (1994), yet the flexibility condition was not considered in this research. On the other hand, there are many real-life sedimentation examples involving flexible planktonic particles. For example, after the detachment of the microbes from the matured biofilms can take any arbitrary shape. One of the most common detached microbial shapes is of plank tonic type, which can be flexible in nature too. Since in near future authors plan to model biofilms,

so this work will help to solve one of the components of the whole research. In this study, we analysis the effect of the flexibility and distortion due to flexible nature of the particle on the terminal velocity of the structure.

To analyze the current problem, Immersed boundary method (IBM) has been used as a tool to model the problem. At the very beginning IBM was utilized for simulation of the movement of heart valves by Charles Peskin in 1972. This method has been carried out to tackle different genuine issues, for example, conduit blood stream and move of mass Arthurs et al. (1998), bunching together of platelets in blood Fogelson (1984), hydrodynamics of swimming miniature life forms in Fauci et al. (1988), motion of single adaptable cell proteus Bottino et al. (1998) and analysis of ciliary beat design Dillon et al. (2000). To analysis of sedimentation related problem, large numbers of the investigator adapted IBM (Wang et al. 2014) etc.,

The novelty of the work is thinking about the particle flexible rather than inflexible which till now has not been referred to in the literature so explicitly by any fluid-structure interaction solving mathematical procedures including IBM.

In the next section, we will have brief depiction about the mathematical procedure executed in this work.

2. IMMERSED BOUNDARY METHOD (IBM)

IBM is a mathematical methodology considered here for solving the current problem. It is both a fluid structure interaction working out numerical scheme and furthermore a mathematical formulation with the supposition that fluid is viscous, Newtonian, and incompressible. The IBM definition uses a Eule- rian depiction for the fluid and a Lagrangian set up for the structure. In this review, brief depiction of numerical formulation is examined. The point-by-point clarification of the formulation can be fetched in Ghosh (2020) and Ghosh et al. (2015). The parameters and variables used in the formulation are listed below:

Table 1: List of Parameters

S. No.	Parameters	
1	Ω	Domain of fluid
2	Γ	Structure
3	$\Delta\rho$	Difference between the fluid and structure density
4	μ	viscosity of the fluid
5	v	velocity of fluid
6	F_{IB}	Force density
7	$\mathbf{x}$= (x, y)	Eulerian co-ordinates
8	s	parametrization of the immersed structure Γ
9	ρ_f	fluid density

2.1 Mathematical Formulation

In this section, we will report the delta function detailing of IBM for the sedimentation of flexible planktonic particle.

The incompressible Navier- Stokes equation are implemented to calculate fluid's motion.

$$\rho_f \frac{\partial v}{\partial t} + \rho_f v \cdot \nabla v = \mu \nabla^2 v - \nabla p + \mathbf{f}_{IB} + \mathbf{f}_G \qquad (1)$$

$$\nabla \cdot v = 0 \qquad (2)$$

Particle's effect on the fluid is designated by $\mathbf{f}_{IB}(x,t)$ and is shown in the following way Ghosh et al. (2015):

$$\mathbf{f}_{IB} = \int_\Gamma \mathbf{F}_{IB} \delta(x - X) ds \qquad (3)$$

In this study, we consider $M(s)$ to be the added Lagrangian mass and is considered constant. The fluid structure compound material density is expressed as $\rho(x,t) = \rho_f + \Delta\rho(x,t)$, whereas $\Delta\rho$ is expressed in the way shown in Ghosh et al. (2015).

$$\Delta\rho(x,t) = \int_\Gamma M(s) \delta(x - X(s,t)) ds \qquad (4)$$

In the model we assume that the density difference $\Delta\rho$ is much smaller than ρ_f.

The settling term due to gravity ($\mathbf{f}_G(x,t)$) is demonstrated by Equation 5:

$$\mathbf{f}_G = -g\hat{k}\Delta\rho = -g\hat{k}\int_\Gamma M(s) \delta(x - X) ds \qquad (5)$$

where $g = 980 cm/s^2$ is the gravitational acceleration and $\hat{k}$ define the unit vector along vertical direction. The particle movement is showed by Equation 6.

$$\frac{\partial X}{\partial t} = \int_\Omega v(x,t) \delta(x - X(s,t)) dx \qquad (6)$$

2.2 Problem setup for planktonic shaped particle

The Figure 1 portrays the problem description of the current work. The dimension of a fluid domain considered is picked as $L_x \times L_y$ alongside two vertical walls put on the fluid at a gap $W < L_x$. The planktonic formed particles are set along the centreline of the channel walls. The planktonic shaped particle generated by Distmesh is shown in Figure 2.

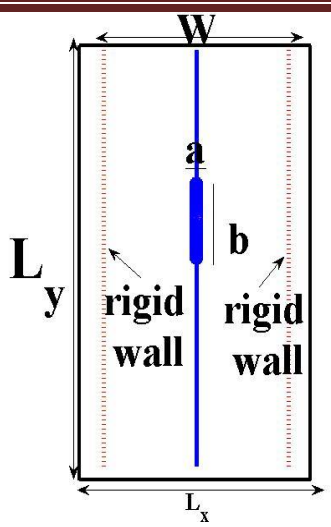

Figure 1: Initial geometry for gravitational sedimentation of a planktonic particle.

2.3 Modeling of planktonic shaped particle

The particle is comprised with Lagrangian points (N_f) which are situated on its boundary and inside. The unstructured mesh is made with the assistance of triangular mesh code generator called Distmesh (Persson et al. (2004)). The immersed structure points X_a (where “a" ranges from 1 to N_f) are the nodes of the triangulation which are associated by edges. These represents the network of springs alongside bearing structure spring forces, the framework is also used to circulate the extra particle mass. The spring forces acting on the system are characterized as designed in Alpkvist et al. (2007).The planktonic shaped particle generated by Distmesh is shown in Figure2.

Figure 2: Mesh generated by distmesh2d for planktonic particle.

Consider two IB points r, s with distance interconnecting r, s is constituted as

and $d_{r,s}(t) = |\mathbf{d}_{\mathbf{r},\mathbf{s}}(\mathbf{t})|$ respectively.

The springs in the network have initial length $d_{r,s}(0)$. Let $\mathrm{I} = (\mathrm{I}_{r,s})$ be the matrix having entries 1 or 0 depending on whether points r and s are connected or not, respectively. The force density acting on the r^{th} IB point of the circular particle is expressed as shown below in equation 7.

$$F_r^c = \sigma_c \sum_{\substack{s=1 \\ \mathrm{I}_{r,s} \neq 0}}^{N_f} \mathrm{I}_{r,s} \frac{d_{r,s}}{d_{r,s}} (d_{r,s}(0) - d_{r,s}) \qquad (7)$$

The sum is taken only over those s for which X_s is associated with X_r. The spring rigidity σ_c $[g/cms^2]$ is considered to be constant for all edges. **In this work, flexibility of the particle has been varied by varying the value of σ_c.**

2.4 Distortion Analysis

Distortion is seen in flexible particles which is not the case when we deal with rigid particle.

There have been number of approaches to estimate the deformity of a flexible particle. According to best of authors knowledge, there are papers where the deformation has been measured for 1D structure like fibers Alhassan et al. (2018) but not for two-dimensional structure.

In this work, we have adapted the following approach to calculate the distortion.

Deformation measurement

Following are the steps adapted for measuring deformation of flexible planktonic shaped particle:

(1) We have identified the boundary nodes along with their coordinates.
(2) After the system has reached steady state the deformed shape of the structure is superimposed onto the original particle shape, and we have also tackle into account the coordinates of the final shapes boundary nodes
(3) Then the difference between the initial and final coordinates of the boundary nodes are calculated and is named as D_1.
(4) Then the final deformation is calculated by root mean square method.

3. NUMERICAL RESULTS

In this section, we will be discussing the simulations done by using IBM for the problem geometry discussed in Section 2.2. The following numerical set up has been implemented for flexible planktonic shaped particle.

Table 2: The parameters h_x and h_y represents horizontal and vertical direction grid resolutions respectively and Δt is the time step chosen for simulations.

S. No.	Parameter	Value	Unit
1	L_x	1	[cm]
2	L_y	16	[cm]
3	W	0.98	[cm]
4	$h_x = h_y$	0.008	[cm]
5	μ	[0.01, 1]	$[g/cms]$
6	$\Delta\rho$	0.16	$[g/cm^3]$
7	σ_c	[1.6, 160000]	$[g/cms^2]$
8	Δt	10^{-5}	[s]

In the approaching subsection, we will report the simulations performed for flexible planktonic shaped particle where we have done sensitivity study with various flexibilities for varying viscosity.

3.1 Sensitivity study of flexible planktonic shaped particle for different viscosity

In this section, the aim is to examine the sensitivity study of planktonic flexible particle for different flexibilities [1.6, 160000] and by varying the value of viscosity in the range [0.01,1].

Table 3: Settling velocities of the planktonic particles with different flexibilities for $\mu = [0.01,1]$

σ_c $[g/cms^2]$	μ $[g/cms]$			
	0.01	0.25	0.5	1
160000	1.2215	0.8575	0.7080	0.5012
160	1.4310	0.9467	0.7526	0.5432
1.6	1.6205	0.9825	0.7835	0.5921

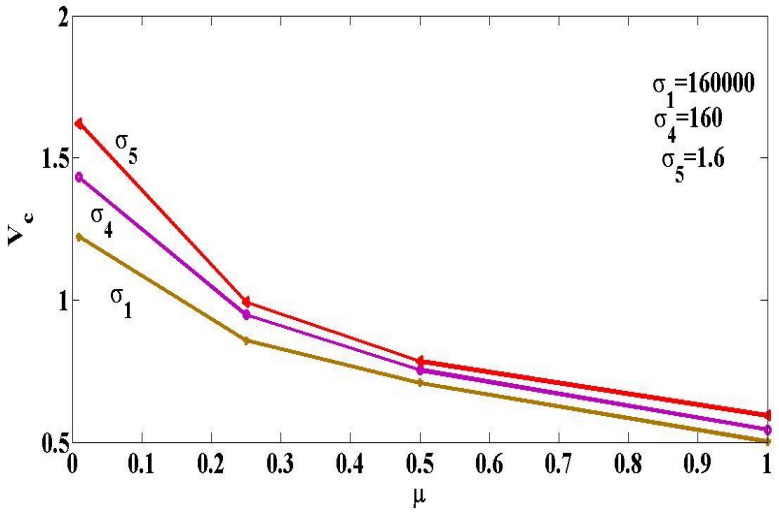

Figure 3: Dependence of settling velocity (V_c) $[cm/s]$ of the planktonic particle on μ $[g/cms]$ for different flexibilities of the particle.

The results interpret that for a fixed dynamic viscosity the particle terminal velocity directly proportional to its flexibility, whereas for a fixed flexibility the terminal velocity of the particle is inversely proportional to fluid viscosity. The same fact holds good for rigid particle also Ghosh et al. (2015).

In the coming section, we will compute the distortion experienced by the particle with the help of the approach discussed in Section 2.4.

4. DISTORTION COMPUTATION

In this section, we have calculated the distortion experienced by the planktonic shaped particle (in percentage) for $\Delta\rho = 0.16$ and variable viscosities $\mu = 0.01, 0.25, 0.5, 1$ of fluid by Section 2.4. The results are summed up in table 4 and distortion also shown pictorially in figures $4-5$. The distortion experienced by the most flexible particle irrespective of fluid viscosity in the range of $6-8$ percent of the original shape whereas the particle with least flexibility has undergone deformation in the range of $0.7-1.6$ percent irrespective of any fluid viscosity.

Table 5: Distortion table for different viscosities by varying flexibilities

σ_c $[g/cms^2]$	μ $[g/cms]$			
	0.01	0.25	0.5	1
160000	1.5124	1.1024	0.9821	0.7811
160	3.5324	3.2324	3.0012	2.9871
1.6	8.6197	7.2512	6.8140	6.2312

For better visualization we have also shown the deformation experienced in Figures 4-5.

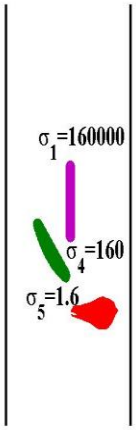

Figure 4: Distortion in the particle shape for different flexibilities with viscosity $\mu = 0.01$.

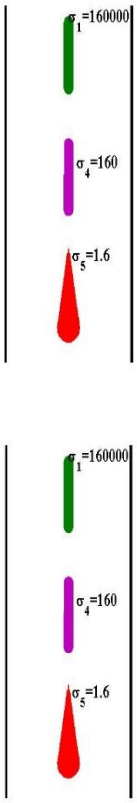

Figure 5: Distortion in the particle shape for different flexibilities with viscosity $\mu = 0.05$.

5. CONCLUSION

The results obtained in this study are physically justified which further ascertains that IBM is well suited for investigating sedimentation problem related to flexible particle. The author further will like to extend single particle system to multiple particle system.

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IDENTIFICATION OF MEDICINAL WEEDS USING DEEP LEARNING MODEL

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Assam, a state in the North-Eastern part of India, is rich in flora and fauna and offers a home to various medicinal weeds resources. Climate of the state favours the growth of ample species of the valuable weeds. Most of the weeds available in the state are indigenous and have medicinal values. The medicinal weeds play a vital role in the diet of the people of the state mainly, because of the medicinal values, easy accessibility, low cost and no side effects. These weeds have specific role in the rural health care. Common diseases are often treated by these effective herbal weeds. Most of these weeds are unknown or less known. In fact, many youths of the state cannot identify these weeds and have limited knowledge of their medicinal values. It is therefore necessary to make people realize the importance of these indigenous medicinal weeds before their extinction. In this paper we propose a Convolutional Neural Network (CNN) based model to identify the weeds which are quite nutritious and have promising medicinal values that are available in the Kamrup district of Assam, India and are used by the different communities in curing diseases. Machine learning and deep learning techniques have recently attracted a lot of researchers in plant identification. Proper identification of these weed species has major benefits for a wide range of stakeholders ranging from physicians, pharmaceutical laboratories, botanists, organizations fighting for endangered species and mostly the public.
Keywords: Deep learning, Convolutional Neural Network (CNN), EfficientNet, Ayurveda, medicinal weeds

1. INTRODUCTION

All unwanted plants are called weeds but all weeds are not unwanted plants. Weeds are harmful to the crops as they affect the growth of the planted plants. They are thus removed or destroyed from the crop fields. They grow along with the crop plants and are regarded as nuisance for the crops. Those plant we call weeds, can have many useful functions. Many are edible, medicinal, attract wildlife, increase biodiversity and also provide valuable information about the condition of our land. Some of the weeds are a boon to the pharmaceutical industries as these weeds yield chemicals used in formulation of various important drugs. Many weeds are the source of several potential life saving drugs. A number of weeds have medicinal properties and are available in cropped and non-cropped areas. These weeds may be fruitfully utilized to serve the medicinal purposes against various diseases. These weeds can become an additional source of income for the people, if they are made aware of the medicinal importance of these crop weeds.

Assam, situated in the northeast of India is a state rich in flora and fauna. Also, the state is rich in medicinal weeds resources. The climate of the state favours the growth of ample species of the valuable weeds. Most of the weeds available in the state of Assam are indigenous and have medicinal values. These weeds have specific role in the rural health care. The common diseases are often treated by these effective herbal weeds. Most of these weeds are unknown or less known. In fact, many youths of the state cannot identify these weeds and have limited knowledge of their medicinal values. It is therefore necessary to make people realize the importance of these indigenous medicinal weeds before their extinction.

The Corona virus pandemic has turned the world's attention to the immune system, the body's defence system against disease-causing bacteria, viruses and other organisms that we touch, ingest and inhale every day. Ayurveda puts larger emphasis on building strength of mind and body to cope with various diseases. The term Ayurveda is derived from the Sanskrit words ayur (life) and veda (science or knowledge). Recently, an article highlighted the possible role of Ayurveda in treatment of COVID-19 through psychoneuroimmune pathways (Rajkumar, 2020). In India, several initiatives have been taken to utilize the vast potential of Ayurveda in this pandemic. The Ministry of Ayush, a nodal Ministry of Complementary and Alternative Medicine, has released a set of guidelines for boosting immunity and measures for self-care by using Ayurvedic principles. Ayurveda works hand in hand with medicinal weeds and there is a big problem that most people cannot reognize these medicinal weeds and are thus not able to take advantage of the herbal power to cure diseases.

The valuable medicinal weeds available in the Kamrup district area are Manimuni (Centella asiatica L. Urban), Durun phool (Leucas plukenetii), Jarmoni bon (Chromolaenaodorata L.), Masandari (Houttuynia cordata), Khutura (Amaranthus viridis), Dubori bon (Cynodon dactylon L. Pers.), Bon tulokhi (Ocimum basilicum L.), Doron bon (Leucas aspera), Jilmil xaak (Chenopodium album), Tengesi tenga (Oxalis corniculata), Brahmi saak (Bacopa Monnieri), Mati Kanduri (Alternanthera sessilis) etc. (Borah et al., 2006). Almost all parts of the weeds available, like leaves, stem, roots are useful for various purposes. People are now moving to Ayurvedic medicine system, which has no side effect and easily provided with nominal rate by the medical practitioner.

2. LITERATURE REVIEW

Artificial intelligence with the implementation of machine learning and deep learning techniques has been used in research studies related to weed detection Leaves are classified on the basis of their shape and texture (Shah et al., 2017), some depends on leaf shape and vein geometry within the leaf (ignoring their colour and texture) (Park et al., 2008). The issue of vein detection depends on edge detection. Most of the techniques used utilized support vector machines (SVM) as the primary classifier. Probabilistic neural networks have been used to identify leaf showing a recognition accuracy of 90% on Flavia dataset by using leaf information. Neural network architecture has been used as an effective solution to extract high-level features from data. Machine learning algorithms have been used to classify plants using different handcrafted features. However, to classify plants and leaves using non-handcrafted features has been focused in this study using a deep learning approach.

Convolutional Neural Network is an effective identification method, developed in recent years that caused widespread attention. Now, CNN has become one of the most efficient methods in the field of pattern classification and recently, has been used more widely in the field of image processing. CNN can learn basic filters automatically and combine them hierarchically to describe underlying concepts to identify patterns.

In a research (Oide et al., 2000) researchers have used neural networks to classify soybean leaves using a Hopfield network and a simple perceptron to discriminate 364 soybean leaves shapes. They considered 38 varieties of soybean leaves. Krizhevsky et al., 2012 have used Deep Convolutional Neural Networks for ImageNet classification to classify 1.3 million high-resolution images in the LSVRC-2010 and LSVRC-2012 ImageNet training set and had achieved the best results till then on those datasets. Their research results had created a new rush for deep learning. Several publications have suggested the use of CNN in leaf classification in recent years.

Venkataraman et al., 2016 in their study Computer Vision Based Feature Extraction of Leaves for Identification of Medicinal Values of Plants, collected plant leaves used in Ayurveda and created a system for the plant identification with SVM and Probabilistic neural network techniques. The technique in (Begue et al., 2017) utilizes Random forest classifier, K-nearest neighbors and SVM for the recognition of medical plants showing an accuracy of 90.1% in their paper, Automatic recognition

of medicinal plants using machine learning techniques. The study performed on Identification and Classification of Medicinal plants (Rajani et al., 2018) shows the importance of medicinal plants and their different image processing techniques. Deep learning model, CNN has been used to recognize the Bangladeshi ordinary medical plants (Bhuiyan et al., 2021) achieving an accuracy of 84.58% in the study, MediNET: A deep learning approach to recognize Bangladeshi ordinary medicinal plants using CNN. Ghazi et al. in their paper, Plant identification using deep neural networks via optimization of transfer learning parameters, used the deep learning architectures like GoogLeNet, AlexNet, and VGGNet with LifeCLEF 2015 dataset and got an overall accuracy of 80% on the validation set. Researchers in the conference paper, Identification of Philippine herbal medicine plant leaf using artificial neural network (DE Luna et al., 2017) tried to resolve the problem of identification and familiarization of the herbal medicine plant leaves of Philippine. Matlab's neural network toolbox was used on 600 samples extracting the primary and secondary features of the plants. The classification rate of the system was found to be increased from 72.16% to 98.16% by varying the different parameters of the ANN model.

This paper proposes to build an intelligent computer model based on image classification to identify some of the medicinal weeds found in the Kamrup district of Assam, India. The model would help to preserve the traditional medicinal knowledge carried by our ancestors in a digital form and provides an easy way to identify and classify the medicinal plants.

3. RESEARCH METHODOLOGY

3.1 Sample collection and Image acquisition

The type of this research is a Quantitative research. Medicinal weed images are selected for the purpose of this research. The weeds having medicinal values in the Kamrup district are collected with the help of a high resolution smartphone. The weeds selected for the study are Bor manimuni, Durun phool and Jarmoni bon. All the images are saved in JPEG format. The figure 1 below shows some of the self collected images of these weeds.

(a)

(b)

(c)

(d)

(e)

(f)

(g) (h) (i)

Figure 1: (a–c) Bor manimuni; (d-f) Durun phool; (g-i) Jarmoni bon

For the experiment, the different types of weed plants are selected from the areas during the daytime and from different angles. A total of 1500 samples are collected from different areas; 500 samples from each of the category. The images are captured using an OnePlus Nord CE 5G smartphone having 64 MP camera. The images were captured during different times of the day in a natural environment setting. Some of them were also collected from Google images. The details of the selected plants are given in the table below.

Table 1: Names of medicinal weeds and their medicinal uses

Plant name/Scientific name	Local name	Uses
Centella asiatica	Bor manimuni	Cures stomach ailments such as diarrhoea and dysentery.
Leucas plukenetii	Durun phool	Leaf juice is taken to cure sinusitis, pharyngitis and throat trouble.
Chromolaena odorata	Jarmani bon	The leaf paste or juice is applied locally immediately after cut to stop bleeding or to prevent infection.

3.2 Image preprocessing

The images acquired using the smartphone camera required preprocessing due to the presence of noises. Preprocessing of the images also helps in decreasing the model training time and increases the speed of model inference. Preprocessing enhances the features of the images and helps to extract the relevant information. The conventional method of cropping the captured images has been carried out so as to remove the irrelevant information. The original images were larger in dimensions, so the images have been resized to 224 x 224 x 3 dimensions for faster computation but without compromising the quality of the data. The images used are in RGB format. The images have been converted to array form.

3.2 Data Augmentation

The deep learning networks like CNN have been successfully applied to image classification, object detection and image segmentation. Convolutional neural networks (CNNs) have proven to be very effective in plant leaf identification. Despite the accuracy achieved by CNNs, the issue of limited training data remains. In such cases, CNN methods tend to have the overfitting problem. Overfitting

means the model has low error in the training set and a higher error in the testing set. In smaller dataset overfitting is a common problem. One of the solutions to the problem of a smaller dataset is expansion of the dataset. Data augmentation methods are effective in solving this problem by generating newer images with more variation from the original dataset.

In this study, to increase the dataset, image augmentation technique has been used using Keras. Data augmentation means creating new images from the original ones. It increases the number of images without adding new images to the dataset. Different transformations have been applied to the original images which resulted in different copies of the same image. However, each of the copy is different from the others in certain aspects. The deep learning model becomes more robust when it is being trained on slightly altered images. Increasing the dataset is similar to human imagining different scenarios of the problem based on his experience. Imaginations help to get a better understanding of the situation. These affine transformation methods have proven to be good methods of increasing the training dataset. The transformations used in this study are

i. Rotate 90 degree left.

ii. Height shift range.

iii. Shear by certain amount.

iv. Flip horizontally

Bigger datasets results in a robust deep learning model. Apart from size of the dataset, this research has also considered the problem of class imbalance. Solutions to class imbalance has been given in the survey paper (Joffrey et al., 2018). Class imbalance could skew the performance of the classifiers, especially with big data. In their study, they tried to cover two techniques of dealing with such problems – data level and algorithm level methods. The dataset size for the purpose of this study has been increased to 2406 by augmentation.

3.4 Convolutional Neural Network

In classical machine learning methods, the manual feature extraction should be flawless to achieve successful results. Thus, there arises a need for a model that does not need much pre-processing and can perform a successful classification. In the recent years, a tremendous interest in deep learning has developed among the researchers (LeCun et al., 2015). CNN or ConvNet is one of the deep learning methods that have gained a lot of attention in image processing. CNN is the most widely used for image detection and classification. The benefit of using CNN model is that it automatically takes the high level useful features from the image data without having to manually extract the features of the plant images from the dataset. It allows multilevel representations from a pixel to high-level semantic features to be learned automatically (Zhao et al., 2019; Litjens et al., 2016).

The main building block of CNN is convolution layer. Apart from this there are the pooling layers and the fully connected layers. The CNN model is designed to automatically learn the features of the data through a backpropagation algorithm. A typical CNN architecture consists of a stack of convolution and pooling layers followed by one or more fully connected layers (FC). The convolution and the pooling layers perform feature extraction. The fully connected layer performs mapping of the extracted features into the final output. The CNN architecture is shown in figure 2.

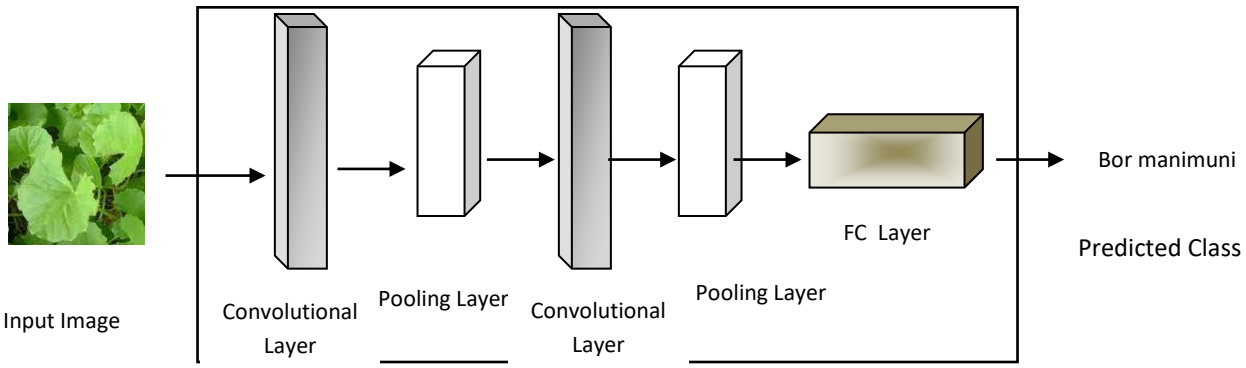

Figure 2: CNN architecture

3.4.1 EfficientNet

In this research work, we have used a deep learning architecture based on a recent convolutional neural network called EfficientNet to classify the medicinal weed plants. EfficientNet is a recent classification model released by Google Brain. It has been designed by neural architecture search (NAS). It is a convolutional neural network that achieves more efficient outcomes than the state-of-the-art models. It uses a scaling method that uniformly scales the depth, width and the resolution dimensions with a set of fixed scaling coefficients instead of scaling a single dimension (Tan et al., 2019) while scaling down the model. It can efficiently scale the size of the Convolutional Neural Network.

Resolution is the image resolution passed to the CNN model. Resolution scaling is increasing the number of pixels so as to acquire more information from the images. The model when trained on a high resolution image would result in more accuracy as more features could be extracted. To process high resolution image a deeper neural network, a network with deep layers, would work better.

The depth dimension indicates the number of layers in the network. Depth scaling is simply increasing the number of layers in the network so as to achieve more accuracy. Increase in the number of layers results in more accuracy however after a particular point there may arise the problem of vanishing gradient. One of the measures of width is the number of channels or feature maps in a Conv layer. CNN basically works on depth scaling and EfficientNet scales depth, width and resolution for better accuracy.

The EfficientNet model **uses a compound coefficient ϕ to uniformly scale network width, depth, and resolution. The coefficient regulates the** number of additional resources used for model scaling. The baseline model "EfficientNet B0" is used to scale the depth, width and resolution. The compound scaling method balances the dimensions of the network. EfficientNet is a series of networks comprising of 8 models ranging from B0 to B7 and the baseline network, EfficientNet-B0 is scaled up by fixing the coefficients a, b and c. From EfficientNet B0 to B7 the number of calculated parameters does not increase much. However, the accuracy is noticeably increased. EfficientNet uses a new activation function called Swish instead of the Rectifier Linear Unit (ReLU) activation function.

The network is scaled by the following equation [Chowdhury et al., 2021)

$$\text{Depth, } D = a^{\phi}$$
$$\text{Width, } W = b^{\phi}$$
$$\text{Resolution, } R = c^{\phi}$$

$$a \geq b \geq c$$

where a, b, and c are constants that can be identified through a quick grid scan.

3.5 Experiments and Performance evaluation

Google Colaboratory is used to perform the experiments in this research. Python can be written and executed in Colab. It also gives free access to resources such as GPU and easy sharing.

The study is performed to show the importance of identifying the medicinal herbs and plants these days. The model has been developed using deep learning model in Python using TensorFlow. Three different classes of images has been taken and considered in this study. The images have been captured from the natural environment in the daylight. To implement B0 model, the images had been resized to 224 x 224 x 3.The model has been tested to let us know which class of the dataset the image belongs to. The dataset has been divided into training set and testing set with the help of the data science library *scikit-learn*. This splitting is done so as to minimize the potential for biasness in the model evaluation and the validation process. In this study, the dataset has been split in the ratio 70 to 30. Adam optimizer has been used to prepare our model with a smaller learning rate of 0.001. For 30 epochs with batch size of 16 we did compiled our model and the using *fit()* method trained it. The problem being a multiclass classification, categorical cross entropy is used for calculating the loss function.

The model summary along with last few epochs is listed below. The training accuracy of the model is found to be 98.96% meaning that our model can predict the medicinal weeds 98% correctly. Accuracy is a percentage of the correct predictions.

MatPlotlib is used for data visualization for the study. The performance of the model can be found out from the accuracy. It is the proportion of accurately anticipated perception to the complete perceptions.

$$\text{Accuracy} = (TP + TN) \div TP + FP + FN + TN$$

Prediction = Reality = YES, then True Positive (TP).
Prediction = Reality = NO, then True Negative (TN).

Prediction = YES and Reality = NO, then False Positive (FP).
Prediction = NO and Reality = YES, then False Negative (FN).

```
_________________________________________________________________
 Layer (type)                 Output Shape              Param #
=================================================================
 input_1 (InputLayer)         [(None, 224, 224, 3)]     0

 efficientnetb0 (Functional)  (None, 3)                 4053414
=================================================================
Total params: 4,053,414
Trainable params: 4,011,391
Non-trainable params: 42,023
_________________________________________________________________
```

```
Epoch 20/30
43/43 [==============================] - 13s 308ms/step - loss: 0.2457 - accuracy: 0.9243 - val_loss: 1.5656 - val_accuracy: 0.8398
Epoch 21/30
43/43 [==============================] - 13s 308ms/step - loss: 0.1259 - accuracy: 0.9510 - val_loss: 0.3916 - val_accuracy: 0.9021
Epoch 22/30
43/43 [==============================] - 13s 308ms/step - loss: 0.1467 - accuracy: 0.9525 - val_loss: 0.2503 - val_accuracy: 0.9169
Epoch 23/30
43/43 [==============================] - 13s 309ms/step - loss: 0.1095 - accuracy: 0.9659 - val_loss: 0.2783 - val_accuracy: 0.9199
Epoch 24/30
43/43 [==============================] - 14s 315ms/step - loss: 0.1328 - accuracy: 0.9592 - val_loss: 0.3033 - val_accuracy: 0.9050
Epoch 25/30
43/43 [==============================] - 14s 334ms/step - loss: 0.0540 - accuracy: 0.9852 - val_loss: 0.3494 - val_accuracy: 0.9050
Epoch 26/30
43/43 [==============================] - 13s 309ms/step - loss: 0.1615 - accuracy: 0.9480 - val_loss: 0.5360 - val_accuracy: 0.8160
Epoch 27/30
43/43 [==============================] - 13s 309ms/step - loss: 0.1535 - accuracy: 0.9517 - val_loss: 0.3481 - val_accuracy: 0.8902
Epoch 28/30
43/43 [==============================] - 13s 309ms/step - loss: 0.1325 - accuracy: 0.9614 - val_loss: 0.3665 - val_accuracy: 0.8961
Epoch 29/30
43/43 [==============================] - 13s 308ms/step - loss: 0.0469 - accuracy: 0.9807 - val_loss: 0.2781 - val_accuracy: 0.9050
Epoch 30/30
43/43 [==============================] - 13s 309ms/step - loss: 0.0461 - accuracy: 0.9896 - val_loss: 0.2471 - val_accuracy: 0.9347
```

The training accuracy and the model loss graphs generated by the model against the number of epochs (30) are shown in the figure 3 below. From the figures, it is clear that the training accuracy increased with the number of epochs. The model accuracy graph is shown in figure 4.

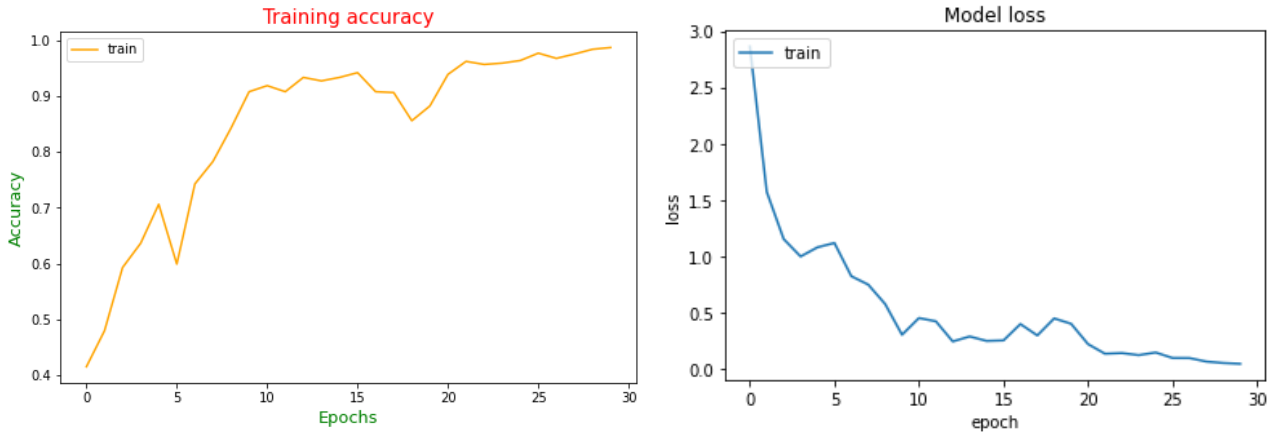

Figure 3: Training accuracy and loss graph

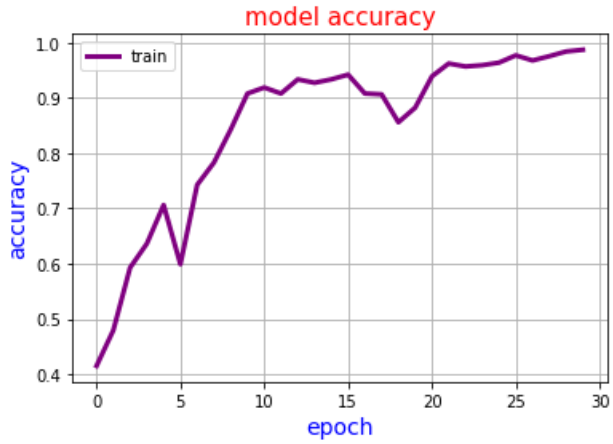

Figure 4: Model accuracy graph

To have a visual representation of the model layers, the architecture using Keras is shown in the figure 5 below.

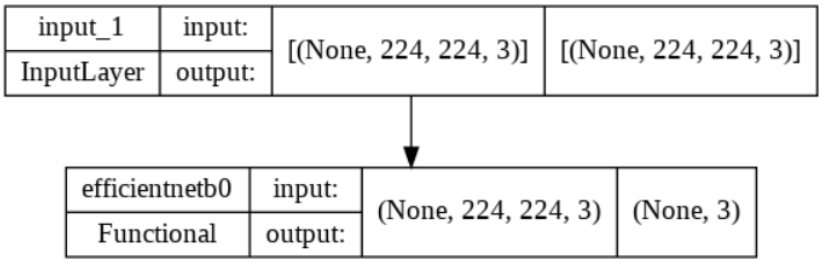

Figure 5: Model architecture

The class labels for the 3 classes namely Jarmoni bon, Bor manimuni and Durun phool are 0, 1 and 2 respectively. Confusion matrix is used to provide insight into the model's predictions. It is a comparison between predictions and reality. It reports the counts of the True Positives (TP), False Positives (FP), True Negatives (TN) and False Negatives (FN). The TP values for the multi-class obtained are 205, 214 and 252 respectively. Accuracy, precision and recall are the metrics used to measure the performance of a model. The metrics in the report are predicted by the True Positives, False Positives, True negatives and False Negatives. The 3x3 confusion matrix obtained thus is shown in the figure 6. The diagonal elements represent the number of points for TP for each of the 3 different classes. The off-diagonal elements are the ones not correctly predicted.

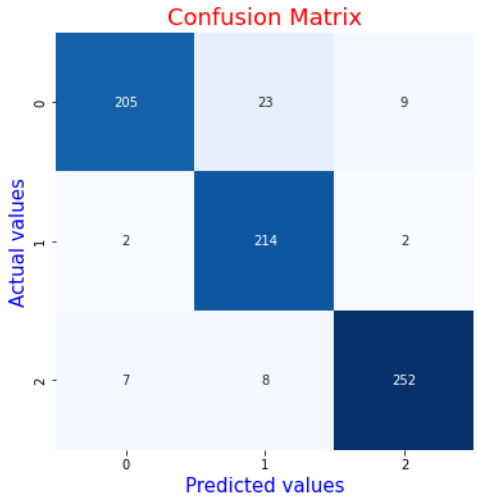

Figure 6: Confusion matrix

	precision	recall	f1-score	support
0	0.96	0.86	0.91	237
1	0.87	0.98	0.92	218
2	0.96	0.94	0.95	267
accuracy			0.93	722
macro avg	0.93	0.93	0.93	722
weighted avg	0.93	0.93	0.93	722

Figure 7: Classification report

Precision

High precision means there are more number of True Positive cases, that is, the model giving lesser False predictions. It is the ratio of True Positive to the sum of True and False positives.

Precision = TP/(TP + FP)

Recall

Recall is the fraction of the positive cases that are correctly identified. It is the ability to find all positive instances. It is the ratio of True Positive to the sum of True positives and False negatives.

Recall = TP/(TP + FN)

F1 score

F1 score is a measure of the balance between precision and recall. The best score is 1.0 and the worst is 0.0

F1 Score = 2*(Recall * Precision) / (Recall + Precision)

To know the performance of the model both precision and recall are important and as such the F1 score, which takes both into account, is calculated. Performance evaluation of the model is important and after evaluation, the test accuracy of our model has been found to be 93%. The performance metrics for the classification technique is shown in figure 7. The classification report displays the classification parameters - precision, recall and f1-score on a per-class basis. The model was tested with 722 data images. From the report that has been calculated from our model, it can be stated that a satisfactory result has been achieved.

4. CONCLUSION AND FUTURE WORK

It has been realized that medicinal weed flora would play an important role in future in Ayurvedic medicinal system. From time immemorial the traditional method of curing diseases using the medicinal plants available in the region had been practiced. Urbanization has caused a considerable number of these plants to be on the verge of being endangered. Moreover, in the recent years we learnt that how immunity is of utmost importance to the health factors. The medicinal herbs and plants could help the people to boost immunity and many of the common illness could be cured using such herbs. Many of the medicinal herbs and plants are being considered as weed due to the ignorance of their utility. The youths of today should be able to identify those medicinal weed plants and their usages.

Deep learning requires a large amount of data for better and efficient classification. Limitation of this study is the constraints for collecting more different types of data images of various medicinal weeds available in the region. This study has taken into consideration only three classes of such plants, Bor manimuni, Durun phool and Jarmoni bon. The other medicinal weeds would be considered for further research.

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A SURVEY ON DETECTING FAKE NEWS IN SOCIAL MEDIA WITH AI: CHALLENGES AND POSSIBLE DIRECTIONS

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Fake news spreads much faster than real news according to the recent study of India. People's attitudes about news have shifted as social media has grown in popularity. Some false news is so close to actual news that it's impossible to distinguish between the two. People's thoughts and attitudes are shaped in large part by the news. Fake news has been a concern for a long time. Fake news identification on social media has unique characteristics and obstacles that render classic news media detection algorithms inefficient or inapplicable. Fake news is purposefully created to encourage readers to believe misleading facts, such as using social media interactions on social media, in order to aid in decision-making. Its usage of this auxiliary data is also difficult in and of itself since consumers' social interactions with false news generate data that is large, fragmentary, unstructured, and huge. Complexity is not only on text and images, it includes different languages, In this paper the classification and detection of fake news using AI techniques are proposed and it is found that the publishing of false information for any purpose is not a new phenomenon, but contextual conditions, speed of distribution, and potential message range have changed immensely over time
.

Keywords: Fake News Detection, AI, Deep Learning, Machine learning, Soft computing, Social media.

1. INTRODUCTION

The use of social media for news consumption has two sides. People seek out and consume news via social media because of its low cost, quick access, and rapid delivery of information. On the other side, it facilitates the widespread dissemination of fake news, which is low-quality news that contains purposefully misleading material.

The most significant reason for the proliferation of false news is the ease with which it can be manufactured and distributed online. As an ideal platform for accelerating fake news dissemination, social media breaks down the physical distance barrier between individuals, provides rich platforms for sharing, forwarding, voting, and reviewing, and encourages users to participate and discuss online news. This surge in activity around online news can have serious ramifications, but it also has significant potential and financial benefits. Researchers have done a lot of work on Classifiers using segmentation bases and Classification using NLP to try to solve these problems. Semantic analysis on different leagues using CNN but the accuracy was low (Dong-H L), other hand 2 types of data sets are used in deep learning models which gave 99.94% and 96.4% accuracy (Tao J), Some of them also used CNN to find fake news, which turned out to be quite successful and good. Even though these methods have been very successful, they need a lot of labels to train the model. Deep learning models are also facing difficulties on semantic analysis and multimodal data, so some researchers use unsupervised methods to find fake news.

Figure 1 and Figure 2 are result of a survey on google scholar for last 10 years data at 8/7/2022 11.49PM and found 2020 highest fake news records are present while for same 10 years data at same time fake news detection keywork 2021 has highest record. It shows significant increase year by year, which indicates scholars are working to solve fake new detection problem.

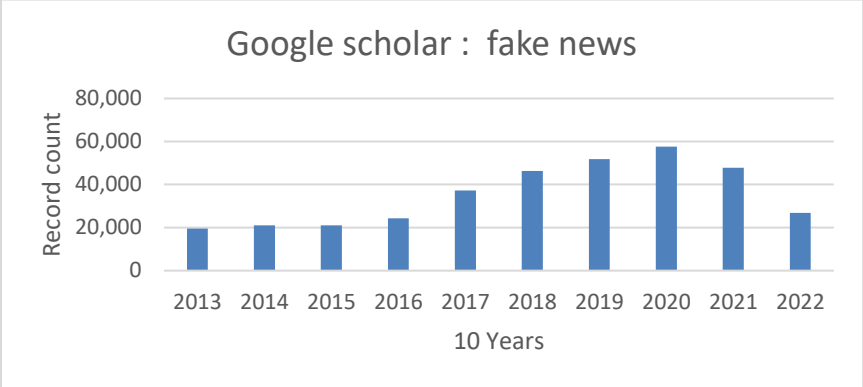

Figure 1: Google scholar 10 years data on fake news

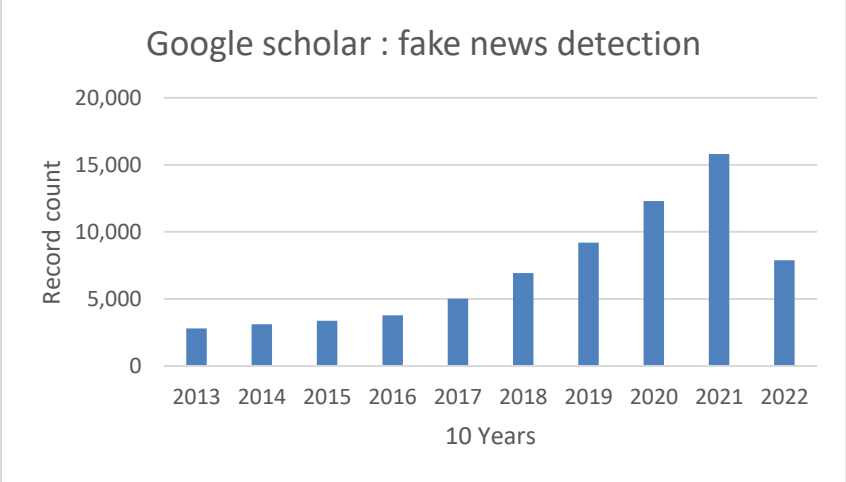

Figure 2: Google scholar 10 years data on fake news detection

1.1 Fake News

Fake news on social media has been occurring for several years. However there has been no universal definition for fake news, even in journalism, a clear and accurate definition helps lay a solid foundation for fake news analysis and evaluating related studies. Fake news starts with two things authenticity and goal of it, this include disinformation which is verified as such and creation of its with dishonest goal. (Dun Li) Fake news is a news that is intentionally and verifiably false.

1.1.1 Characterization

The two components that make up the concept of fake news are its authenticity and its goal. False information has been written with a deliberate intention to deceive readers.

1.1.2 Feature extraction

To extract every fake new, we need to analyses features of it, which will be used to extract few of them are (origin, subject line, body text, image, video), beside this to give weight to news some of the them are written in specific language and images which can be considered syntactical features.

Origin: The source of fake news where it is generated. who, where, when is included, Subject line: The headline or subject line written in text, Body text: text written in body and style of writing?

Mathematically Problem statement to identify mathematically representation of problem as social medium suppose a set of social media f(a), if we consider f as a function and a is the news. Then value of f will be 0,1.

$$F(a) = \{0: \text{if a is a fake new}, 1: 0 \text{ therwise}\}$$

6. LITERATURE REVIEW

Manually identifying fake news is a huge effort required evaluation at soft computing machine has changed the gate. Leveraging deep learning technique gives immense privilege to detect features of fake news, Fake news problem is a sequence classification problem and classification be a binary classification, in general deep learning-based method yield good accuracy. However, this approach ignores the correlation among news articles which have been shown to be effective for analyzing online news and events. Table 1 Shows some contributions which have worked with deep learning and NLP.

Table1: Summary of published fake newspapers with respect to different model and methods

Ref	Authors	Contributors	Models
[1]	Fake news Detection using Deep Learning	Dong-Ho Lee, Yu-Ri Kim	RNN, Bi-LSTM, BCNN
[2]	A Novel Stacking Approach for Accurate Detection of Fake News	Tao Jian,Jian Ping li , Amin UL Haq	LSTM,CNN,GRU,SVM,LR,DT,RF,KNN
[3]	Fake News Detection Using Machine Learning Ensemble Method	Iftikhar ahmad, Muhammad Youseaf,Suhail Yousaf	LR,SVM,,KNN,RF,CNN,BI-LSTM
[6]	Unsupervised Fake News Detection Based On Autoecoder	Dun Li, Haimei Guo, Zhenfei Wang, Zhiyun Zheng	AUTOENCODER
[7]	MVAE:Multimodal Variational Autoecoder for Fake News Detection	Dhruv Khattar,Jaipal Singh Manisha Gupta,Vasudeva Varma	MAVE
[9]	Fake News Detection using Bi-directional LSTM-Recurrent Neural Network	Pritika Bahad ,Preeti Saxena, Raj Kamal	CNN, NN,UNIDIRECTIONAL LSTM-RNN,BI-DIRECTIONAL LSTM-RNN
[10]	Advance Machine Learning techniaues for fake news (online disinformation)) detection: A systematci mapping study	Michal Choras,Agata Gielczyk, konstantinos Demestichas	NLP,SYNTAX,REPUTATION,IMAGES
[12]	Deep learning for misinformation detection on online social networks: a survey and new perspectives	Rafiqul Islam, Saowu Liu	HYBRID MODEL. CNN,RNN

[16]	Supervised learning for Fake News Detection	Julio C.S. Reis, Andre Correia,Fabricio Murai,Adriano Veloso	KNN,NB,RF,SVM,XFB
[17]	Detecting Fake News with capsule neural networks	Mohammad Hadi Goldani,Saeedeh Momtazi , Reza Safabakhsh	SVM,LSVM,KNN,DT,SGD,LR
[18]	Benchmarking study of machine learning models for online fake news detection	Junaed Younus Khan, Md. Tawakat Islam,Sadia afroz,	CNN,LSTM,Bi-LSTM,C-LSTM,HAN,Conv-HAN
[21]	Detection of fake news using deep Learning CNN-RNN based methods	Kadek Sastrawan,I.P.A Bayupati,Deva Made Sri Arsa	CNN,LSTM,Bi-LSTM
[22]	Fake news detection on Handi news dataset	Sudhanshu kumar, Thoudam dorenshing	Naïve Bayes, Logistic Regression,LSTM
[25]	A Comprehensive revieww on Fake News Detection with Deep Learning	M.F.Mridha, Ashfia Jannat keya	Non-NLP, NLP

3. CHALLENGES AND POSSIBLE DIRECTIONS

3.1.1 Challenges

There are challenges which are reported in automatically identifying fake news process.

- Correlation between features is ignored while performing automation on fake news detection
- Difficulty on operating multimodal data for identifying fake news.
- Highly dependent on target group of domain content datasets.
- Cross-Domain (-topic, website, languages), generic model is not work in all languages (Dong-Ho)
- Due to the similarity between authentic and fake videos, detecting fake videos is difficult.
- Over filling of deep learning models, there are models which provides 98.4% accuracy (Tao-Jira)

3.1.2 Possible directions.

- Solution to deal with multimodal data.
- Redefining models and data collection to prevent overfitting of deep learning models.
- Avoiding social media echo chamber (Saowu Liu)
- Normal and irregular user identification
- Metadata can be a viable solution for this problem of greater dataset features.
- Larger datasets with an industry-specific focus.

4. APPROACHES AND METHODS

In line with the scoring system of the challenge, section, we describe virous methods. algorithms, datasets evaluation metrics. These can be divided into two parts (Non-Neural Network and Neural Network).

4.1 NON-NEURAL NETWORK

4.1.1 Word Embedding

Word embedding is a method of mapping words or phrases to vectors of real numbers. The traditional method discrete representation has a one-hot vector representation that consists of 0 second in all dimensions with the exception of a single 1 in only one dimension that is used to represent the word.

However, discrete representation does not reflect the context and has problems handling synonyms and antonyms. Recently, distributed representation has emerged as a way to represent words in a continues vector space where all dimension is required to represent the work.

4.1.2 Word2vec

Word2vec represents word embedding using a neural network. It has model architectures for learning destruction representations of works: continues bag-of-words (CBOW) and skip-gram. The skip-gram architecture is widely used because it works better on sematic tasks than the CONOW model. Fasttext is a method of adding the concept of Sub-word to Word2Vec. Each word is represented as the sum of n-gram vectors and the word vector itself.

4.1.3 Term Frequency (TF)

TF is a common tokenization technique that calculate the similarity between documents by using the counts of words in the documents, by utilizing TF technique, each document will be represented by a vector that contains the word counts. Then each vector will be normalized and the sum of its elements will be one which makes the word counts convert into probabilities.

4.1.4 Term frequency inverted document frequency (TF-IDF)

This is a weighting metric commonly used in text classification problem, it is used to assign score with shows the importance of the term to every term in the document. in this method a term's significance increase with the frequency of the term in the dataset.

4.1.5 Decision Tree (DT

Decision tree has a top-down structure and shapes like a tree in which a node can only be a leaf node which is binding with a label classes a decision node which a responsible for making decisions. Decision tree is easily understandable about the process of making the decision and predications.

4.1.6 K-Nearest neighbor (KNN)

K-NN is a well-known algorithm in machine learning. The K-NN procedure are very simple. Given a test sample, it first finds out k nearest neighbors to this sample based on a distance measure, then it predicts class label of the test instance with major vote strategy. Sometimes classification performance of K-NN is not high mostly because of curse of dimensionality. K-NN also is a lazy learning algorithm and it can spend a lot time on classification.

4.1.7 Random Forest (RF)

Random Forest is an ensemble consisting of a bagging of unpruned decisions tress with a randomized selection of features at each split. Each individual tree in the random forest produces a prediction and the prediction with the most votes are the final prediction. According to NO Free Lunch theorem: There is no algorithm that is always the most accurate, thus RF is more accurate and robust than the individual classifiers.

4.1.8 Support Vector Machine (SVM)

For binary and multi-classification related problems, SVM is one of the most popular its supervised machine learning classifier and many researchers adopted it for binary and multi-classification related problems. The instances are separated with a hyper plan in binary classification problem in such a way $w^t x+b =0$,determining the values of w and b is the main task in SVM.

4.2 NEURAL NETWORK MODELS

In the study, for classifying fake news and real news, three deep learning models. have been used, these models have been discussed in details.

4.2.1 Neural Network

A neuron is a cell within the nervous system, called neurons, communicate with each other with a different way, it's a basic working unit of the brain, a specialized cell designed to pass information to other never cells. In AI a neuron is an information-processing unit that is fundamental to the operation of a neural network.

Mathematical representation of neuron

$$u_k = \sum_{j=1}^{m} w_{kj} - x_j$$

$$y_k = \emptyset \ (u_k - b_k)$$

4.2.2 CNN (Convolution Neural Network)

The typical model of ANN has single input and output layer along with multiple hidden layers. A particular neuron takes input vector (x) and produces output (y)by performing some function F on it, represented by the question

$$f(x, w) = y$$

where, (w) denotes the weight vector which represents the strength of interconnection between neurons of two adjacent layers.

4.2.3 RNN (Recurrent Neural and Layers)

Its type of NN (Neural Network) where the output from previous step are fed as input to the current steps.

4.2.4 Autoencoder

Autoencoders are a type of unsupervised neural network i.e., no class labels or labeled data that seek to:

- Accept an input set of data i.e., the input.
- Internally compress the input data into a latent-space representation i.e., a single vector that compresses and quantifies the input.
- Reconstruct the input data from this latent representation i.e. the output.

In other way an autoencoder is composed of an encoder and a decoder sub-model. The encoder compresses the input and the decoder attempts to recreate the input from the compressed version provided by the encoder.

5. CONCLUSION

By analyzing the existing literature it is found that the publishing of false information for any purpose is not a new phenomenon, but contextual conditions, speed of distribution, and have changed immensely with respect to the time. There are a few issues that have been brought to light, such as the fact that neglecting correlation between features and sematic analysis is lot more complex for fake news identification, solving multimodal problem with deep learning can improve performance. Deep learning relies on datasets that have problems with (quality, interpretability, explain ability, and privacy), and moving on from those datasets to get domain-specific data is difficult. Moreover the deep learning models provide nearly 94.4% of accuracy. Feature direction can be taken on solving multimodal, semantic and over fitting of model to identify fake news. Overall, the need for developing and applying methods to efficiently detect intentionally published Fake News stories increased with the

use of Social Media and potentially unlimited and fast-running possibilities to produce and spread information. Further research is needed to improve practical used mechanisms to overcome existing difficulties like users' reactance, unclear definitions of truth, and ethical considerations around restricting or limiting the extent of user expressions with the help of some new methods and technology.

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CASCADING BEHAVIOR OF INFORMATION DIFFUSION AND ITS MORPHOLOGICAL HANDLINGS IN ONLINE SOCIALNETWORKS; A COMPARATIVE STUDY

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Online social networks govern the flow of huge amounts of data in the form of relationships, interactions and broadcasting advertisements. This flow of information in online social networks is creating a new dimension for studying the online social networks called as information diffusion in online social networks. This information diffusion is creating a phenomenon of information dissemination across various paths known as information cascades. For studying the information diffusion in online social networks we must study how to handle the information cascades in online social networks. These information cascades that are a result of information diffusion have various features in spatio temporal framework. In this paper we are going to study these information cascading behaviors of information diffusion in online social networks. In this paper we are going to make a comparative study of different types of information cascades, in view of morphology of information cascades in online social networks . This study also takes into account the morphological features of different information cascades and paper finally makes a comparative study of different types of structural cascades of information diffusion in online social networks.

Keywords: Information Cascades, Information Diffusion, Online Social Networks, Trees, Stars, Directed Networks, Undirected Networks.

1. Introduction:

People are becoming more social when they find ease in connecting with their known and unknown ones. Using some of the dedicated websites for social interactions are termed out to be online social networks (Marrom et al.,2021). These online social networks are always flooded with the different types of data and thus results into the new phenomenon of information diffusion in online social networks(Kanavos et al.,2022)

These online social networks can be modeled as a graph G(V,E) ,where V is the nonempty set of nodes representing people in the online social network and E is the set of edges representing the interactions among the people in the given online social network(Su et al.,2022). When some form of interactive data gets diffused in these online social networks, it creates varied paths of information diffusion in online social networks and the phenomenon of information cascades is said to have

occurred (Shafiq et al.,2012). To study this information diffusion in online social networks,researchers mainly make use of morphology of information cascades ,such as cascade size, cascade shapes and etc(Shafiq et al.,2012).

These information cascades can be modeled mathematically as:

Given users $V=\{V_1,V_2,\ldots,V_N\}$ and Cascade set $C=\{C_1,C_2,\ldots,C_M)$

Where N and M are the number of users and number of cascades respectively(Chen et al.,2022).

A cascade $Ci =(v_1,t_1),(v_2,t_2),\ldots,(v_{|ci|},t_{|ci|}),t_1\leq t_2\leq t_2\leq\ldots\leq t_{|ci|}\}$ is a sequence of infected user and timestamp in the diffusion process, where $|c_i|$ is the number of infected users,t_i is the timestamp of v_i(Chen et al.,2022).

To characterize the different kinds of information diffusions in online social networks, we should have a clear understanding of properties of information cascades that are resulted from the information diffusion in online social networks, so in this paper we going to adopt a unique way to compare different types of cascades based on some of their morphological properties.

2. Types of cascades in online social networks Based on Morphology of information Diffusion:

When the information gets diffused in online social networks, it creates different paths as a sequence of links called information cascades(Tokita et al.,2021)(Leskovec et al.,2008).Information diffusion have always two aspects in online social networks: one is space ,which is captured by the structural property of online social networks and the other one is time, which captures the temporality property of information diffusion in online social networks. These cascades have different morphological properties based on their structural and temporal aspects(Alrajebah et al.,2017). A comparative study of these different types of cascades based of morphology of information diffusion in online social networks:

2.1 Structural cascade:

considers the structural properties of cascades in online social networks (Alrajebah etal.,2017) (Alrajebah ,2018). Some of the properties that are used to categorize structural cascades are:

Height of cascade: It is the maximum height of an information cascade that is resulted by the information diffusion in online social networks. It is calculated by considering the root level as zero height and next sequential levels are incremented by the value of one. The height of an information cascade provides the maximum distance covered by the information diffusion in the given online social network.

Width of a cascade: It is maximum number of nodes that are occurring a given level of a cascade. It is the that property that can be considered when some form of boundaries will be labeled based on the levels of the structural cascades.

Frequency of cascades: The maximum number of different cascades in online social networks. This property provides us with the universe of cascades that can be found in the detected cascading structures of information diffusion in online social networks (Alrajebah et al.,2017) (Alrajebah ,2018).

2.2 Temporal morphology:

Considers the time based properties of information cascades in online social networks (Alrajebah et al.,2017) (Alrajebah ,2018). These properties are used to make a differentiation of different types of cascades .some of these properties are:

Speed of the cascade: It is the time based diffusion of information in a given cascade in online social networks. It is the temporal length of information diffusion that is captured in the form of an information cascade.

Cascading density: It is the number of cascades that are created by the information diffusion per day.It is the amount of information cascades that are being created by the information diffusion in the twenty four hour format.

Cascade popularity: It is the time based growth of a cascade that has been created by information diffusion in online social networks. It basically captures the evolutionary growth of cascades of information diffusion in online social networks (Alrajebah et al.,2017) (Alrajebah ,2018).

These two aspects of information cascades and their related properties in online social networks can be best understood by the given table1.

Table1: Morphological comparative study of types of cascades

Type of Cascade	Property Type	Description of Property
Structural cascade (Alrajebah et al.,2017) (Alrajebah ,2018).	Height of cascade	The maximum height of an information cascade in online social networks.
	Width of a cascade	The maximum number of nodes that are occurring at a given level of an information cascade.
	Frequency of cascades	The maximum number of different cascades that are occurring as a result of information diffusion in online social networks.
Temporal cascade (Alrajebah et al.,2017) (Alrajebah ,2018).	Speed of the cascade	It is the time based diffusion of information in a given cascade in online social networks.
	cascading density	It is the number of cascades that are created by the information diffusion per day.
	cascade popularity	It is the time based growth of a cascade that has been created by information diffusion in online social networks.

Based on the structural and temporal morphology of information cascade in online social networks, we have made a comparative study of different types of cascades in online social networks with the purpose of understanding the cascades in depth.

3.Structure Based information cascades: Based on the structural dimension of information diffusion in online social networks, we have information cascades of different shapes, The main two types of information cascades based on structural dimension are tree and star shaped information cascades. Both these types of cascades have a varied geometry. The main geometrical features that are main to our study are: circuit shaped structures , path shaped structures ,edge direction and edge magnitude.

3.1 Tree information cascades: These types of information cascades have no cycles at all. These types of cascades have only the paths through which information gets diffused.

3.2 Star information cascades: These types of information cascades have cycles. In these cascades the information on diffusion loops in the given online social network. Mostly the information cascades in online social networks are star shaped cascades.

The comparative study of these two types of information cascades is given below in the table

Table2: Comparative study of types of structural cascades of information diffusion in online social networks.

Type of cascade based on shallowness and depth of cascade	Type of cascade based on direction of edges	Type of cascade based on magnitude of edges	Description of cascade type
Tree shaped cascades (Goel et al.,2012)(Anh et al.,2018)	Directed cascade	Weighted cascade	Information diffusion is modeled as trees which are directed and weighted
	Directed cascade	Unweighted cascade	Information diffusion is modeled as trees which are directed and unweighted
	Undirected cascade	Weighted cascade	Information diffusion is modeled as trees which are undirected and weighted
	Undirected cascade	Unweighted cascade	Information diffusion is modeled as trees which are undirected and unweighted
Star shaped cascades (Taxido et al.,2014)	Directed cascade	Weighted cascade	Information diffusion is modeled as nontrees or stars which are directed and weighted
	Directed cascade	Unweighted cascade	Information diffusion is modeled as nontrees or stars which are directed and unweighted
	Undirected cascade	Weighted cascade	Information diffusion is modeled as nontrees or stars

			which are undirected and weighted
	Undirected cascade	Unweighted cascade	Information diffusion is modeled as nontrees or stars which are undirected and unweighted

The tree and the star types of cascades are occurring during the information diffusion in online social network, so these two types of structural cascades are the main two ways in which information cascades can be categorized in online social networks.

4.Conclusion:

In this paper we have made a comparative study of information cascades to provide researchers aflexibility in understanding how information diffusion creates cascades and results into different cascades with varied morphology. Keeping this study in hand , we are going to further uncover these information cascades of information diffusion in online social networks using new methodology. In future we will be focusing on the structural morphology of information cascades in online social networks.

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