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ICCRET 2025

Proceedings of the
4th International Conference on

Current Research in ENGINEERING & TECHNOLOGY

Theme: Innovation in Engineering and Technology for Sustainable Development

Editors

Dr. Alex Khang | Dr. Debabrata Samanta | Dr. Arindam Biswas
Dr. Sandipan Biswas | Dr. Biswarup Mukherjee

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ABOUT THE CONFERENCE

4th International Conference on Current Research in Engineering and Technology ICCRET-2025 an international forum dedicated to fostering collaboration and innovation at the intersection of computer science and various applied domains. As computational technologies continue to transform industries and research fields worldwide ICCRET-2025 aimed to bring together leading experts, researchers, and practitioners from diverse backgrounds to share their cutting-edge findings and explore the future of computational advancements with special focus on sustainability.

The conference received submissions of original research papers that demonstrated innovative computational methods, theoretical advances, and practical applications across all areas of computer science and its applied interfaces.

Participants had the opportunity to present their latest research, engage in thought-provoking discussions, and network with peers from around the globe.

The conference was held in a hybrid mode, blending the benefits of physical presence with the convenience and accessibility of virtual participation.

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CHANCELLOR'S MESSAGE

Mr. Phalguni Mookhopadhayay
Chancellor
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I extend my heartfelt appreciation to the Department of Computer Science and Engineering – Artificial Intelligence and Department of Computer Science and Engineering at Brainware University, Kolkata, for successfully organizing the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025)* from February 21-22, 2025.

This conference highlighted cutting-edge research and innovations in engineering and technology. The event featured impactful keynote addresses and insightful technical sessions, meaningful discussions and knowledge sharing. It served as an excellent platform for collaboration, bringing together experts to drive technological progress.

I sincerely commend the unwavering efforts of the faculty and students for their dedication and meticulous planning, ensuring the conference's remarkable success.

Mr. Phalguni Mookhopadhayay
Chancellor, Brainware University

VICE–CHANCELLOR'S MESSAGE

Prof. (Dr.) Sankar Gangopadhyay
Vice Chancellor
Brainware University

I am delighted to witness the successful completion of the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025),* hosted by the Department of Computer Science and Engineering – Artificial Intelligence and Department of Computer Science and Engineering at Brainware University, Kolkata.

In an era of evolving digital landscapes, addressing technological challenges through collaboration and innovation is crucial. This conference served as an outstanding platform for researchers, scientists, and academicians to exchange insights on key areas of engineering and technology and computing advancements.

I extend my sincere appreciation to the organizers for convening such an impactful event. The thought-provoking discussions and pioneering ideas presented will undoubtedly drive future innovations and inspire young researchers.

My best wishes to everyone involved in making ICCRET-2025 a remarkable success!

Prof. (Dr.) Sankar Gangopadhyay
Vice Chancellor, Brainware University

REGISTRAR'S MESSAGE

Ms. Mahua Pal
Registrar
Brainware University

I am pleased to see the successful completion of the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025),* organised by the Department of Computer Science and Engineering – Artificial Intelligence and Department of Computer Science and Engineering at Brainware University, Kolkata.

In today's rapidly evolving digital landscape, technological advancements continue to bring new challenges, particularly in automation and modern computing through sustainability. Addressing these demands is crucial, especially in developing nations where innovation in computing technologies plays a vital role. The discussions at ICCRET-2025 have been highly relevant, highlighting their importance of Sustainability through innovations in engineering and technology.

I commend the organizers for successfully bringing together experts from diverse interdisciplinary fields to exchange ground-breaking ideas. The conference has undoubtedly fostered stimulating discussions, inspired young minds, and contributed to technological advancements.

Congratulations to the organizers, speakers, and participants for making ICCRET-2025 a truly impactful event.

Ms. Mahua Pal
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MESSAGE FROM THE GENERAL CHAIRS

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The successful completion of the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025),* organized by the Department of Computer Science and Engineering – Artificial Intelligence and Department of Computer Science and Engineering at Brainware University, Kolkata, is truly commendable.

In today's rapidly advancing digital landscape, technological innovations continue to introduce new challenges. These increasing complexities put immense pressure on IT infrastructures, especially in developing regions, where advancements in computing technologies are crucial for overcoming such hurdles. The conference has undoubtedly fostered insightful discussions, inspired young researchers, and contributed to technological progress. Supporting aspiring scholars and innovators remains a significant commitment.

It was a pleasure being the part of a truly enriching and influential event.

Dr. Shivnath Ghosh
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ORGANISING SECRETARY'S MESSAGE

Dr. Saumya Das
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It is truly commendable to witness the successful execution of the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025),* organized by the Department of Computer Science and Engineering – Artificial Intelligence and Department of Computer Science and Engineering at Brainware University, Kolkata.

In an era of rapid technological transformation, the need to address emerging challenges through engineering and technology is increasing. The growing complexity of technological infrastructures, particularly in developing regions, underscores the significance of advancing computing solutions. ICCRET-2025 has served as a crucial forum for exploring key areas of innovation-driven progress.

I extend my heartfelt appreciation to the entire team for their unwavering support in curating an event that fostered collaboration across diverse disciplines. The insightful deliberations and pioneering research shared during the conference will undoubtedly inspire new breakthroughs and technological excellence.

Dr. Saumya Das
Organizing Secretary,
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MESSAGE FROM THE CONVENER & CO-CONVENERS

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Dear Participants,

It is our great pleasure to present the proceedings of the *4th International Conference on Current Research in Engineering and Technology (ICCRET-2025).* We express our sincere gratitude to all contributors for making this event a remarkable success. Held on February 21-22, 2025, at Brainware University, Kolkata, ICCRET-2025 revolved around the theme *"Innovation in Engineering and Technology for Sustainable Development,"* enabled collaboration and innovation among researchers worldwide.

We extend our heartfelt gratitude to our esteemed patrons for their unwavering support and guidance, which have been instrumental in the success of ICCRET-2025.

We extend our heartfelt thanks to all External advisory members, Internal committee members, authors, reviewers, keynote speakers, session chairs, sponsors, and attendees for their invaluable support. Special appreciation goes to the organizing committee members and volunteers for their dedication and hard work.

This year, ICCRET-2025 received around 131 paper submissions, of which 78 were accepted after rigorous review, achieving an acceptance rate of approximately **59%**. These proceedings reflect the high standards and diverse research contributions aimed at advancing sustainable practices in engineering and technology.

On behalf of the organizing team, we hope the knowledge shared during this conference inspires future research and innovation. We look forward to welcoming you to future editions of ICCRET.

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CONTENTS

High-Performance Real-Time Data Store

Bhuvan Chandra Sarakam
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***Abstract*—This paper presents Druid, an open-source, dis tributed data store designed specifically for real-time analytical processing of massive datasets. Druid combines the efficiency of a column-oriented storage model with the flexibility and scalability of a shared-nothing architecture, enabling high-performance ingestion, exploration, and aggregation of time-series data. The system is optimized for sub-second query latency, even when dealing with large-scale data, by utilizing advanced indexing techniques such as inverted indices, bloom filters, and bitmap indexes. The multi-tiered node architecture of Druid plays a crucial role in enabling low-latency query processing and ensuring high availability across distributed environments. Real time data ingestion is coupled with the ability to execute complex analytical queries over both real-time and historical data, making Druid particularly well-suited for applications requiring quick insights into time-sensitive data.**

Introduction

The rise of internet technology has led to a surge in machine- generated events, which are often low-value individ ually but hold potential in aggregate. While infrastructure like IBM's Netezza [1], HP's Vertica [2], and EMC's Greenplum [3] exists to process such data, these solutions are costly and cater primarily to large organizations.

Architecture

A Druid cluster comprises various node types, each serving distinct roles, enabling separation of concerns and minimizing intra-cluster communication failures. This design ensures data availability while facilitating collaboration among nodes for complex data analysis.

Storage Format

Druid stores timestamped events in data tables called data sources, partitioned into segments, each spanning a time inter val (e.g., an hour or a day) and containing 5–10 million rows.

QueryAPI

Druid accepts queries via HTTP POST requests, using a JSON object to specify parameters such as data source, time range, granularity, query type, and aggregations. Query results are returned as JSON objects containing aggregated metrics over the specified time range.

Experimental Results

Query Performance

Query Performance: A test cluster was set up with 6TB of uncompressed data (tens of billions of rows) containing over a dozen dimensions with cardinalities ranging from tens to millions. Each row included metrics for counts, sums, and averages. The data was sharded on timestamps and dimensions, with shards of approximately 8 million rows each.

Data Ingestion Performance

Ingestion latency was tested on a real-time node (2.3GHz CPU, 2GB JVM heap). A basic setup (timestamp-only data) achieved 800k events/sec/node. Ingesting realistic data sets showed performance decreases with increasing dimension

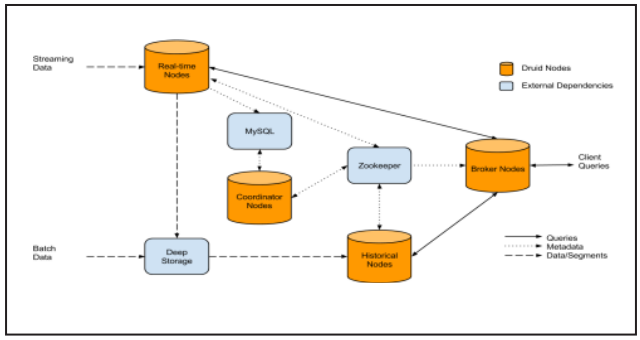

Fig. 1: Overview of Druid Cluster Architecture and Data Flow.

Table 1: Sample D Ruid Data for Wikipedia Edits

Timestamp	Page	Username	City	Characters Added	Characters Removed
2011-01-01T01:00:00Z	Justin Bieber	Boxer	San Francisco	1800	25
2011-01-01T01:00:00Z	Justin Bieber	Reach	Waterloo	2912	42
2011-01-01T02:00:00Z	Kesha	Helz	Calgary	1953	17
2011-01-01T02:00:00Z	Kesha	Xeno	Taiyuan	3194	170

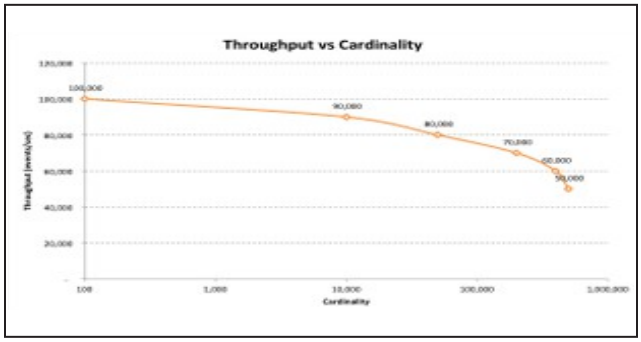

Fig. 2: Throughput Decreases with Higher Dimension Cardinality.

Conclusion

In this paper, I introduced Druid, a distributed, column oriented, real- time analytical data store, specifically designed to support high-performance, large-scale applications that re quire low-latency query responses. Druid is optimized to handle both real-time streaming data ingestion and fast, efficient querying, making it suitable for use cases that demand quick insights from massive datasets. Druid's ability to ingest and query streaming data sets it apart from many traditional databases, offering fault tolerance and seamless scaling to handle growing data volumes. By leveraging a columnar storage model and advanced indexing techniques, Druid can process large datasets in real-time, delivering fast results for analytical queries.

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Keywords Driven Question Bank Generation for Educational System using NLP

Deepayan Das[1*], Atanu Kumar Paul[2], Srinjoy Chanda[3], Ryan Saptarshi Ray[4], Sandipan Biswas[5]

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***Abstract*—Creating an efficient question bank is essential for conducting coherent and balanced examinations. Using NLP, syllabus keywords are converted into a systematic framework to generate diverse, relevant questions. NLP enables the automated classification of questions into easy, medium, and hard categories based on complexity and cognitive requirements. Marks are allocated to each question following specific examination patterns, ensuring adherence to scoring rules. This approach combines keyword extraction, automatic question generation, difficulty assessment, and marks allocation to create a dynamic, intelligent question bank. It helps students by providing diverse questions for effective preparation and assists educators in designing effective question papers.**

Introduction

Examinations are becoming more digital, with Natural Language Processing (NLP) serving as a significant facilitator [1]. NLP, which is a subset of artificial intelligence, enables machines to comprehend and handle human language through computational linguistics and machine learning techniques. It drives applications such as chatbots and speech recognition, transforming the way humans interact with machines. In a similar vein, Knowledge Graphs organize information into related components, facilitating advanced reasoning and decision-making processes [2]. In the field of education, producing question banks is essential for assessing students' knowledge and application abilities. A keyword-driven method automates this by extracting relevant keywords from syllabi to form a variety of questions. NLP methods evaluate these keywords to generate multiple-choice, descriptive, and problem-solving questions, which are categorized into easy, medium, and hard levels. This approach ensures compliance with curricula while maintaining a balance in complexity. The system also allocates marks based on difficulty and relevance, enhancing efficiency, and guaranteeing that examination standards are upheld. This pioneering method streamlines the process of question bank generation and elevates its overall quality.

Results

In the syllabus for Operating System Engineering, the section focused on Process Synchronization and Deadlock was examined. Keywords such as "Peterson's Solution" and "Semaphores" were identified using a partially connected graph, resulting in the creation of 143 distinct questions. Phrases like "explain" and "compare" were used to formulate questions that encourage critical thinking, for example, "Compare semaphore and Peterson's solution." With the help of a spacy model, the difficulty of each question was evaluated and classified into Easy, Medium, and Hard categories to ensure a well-rounded assessment. An analysis of mark distribution associated complexity with scoring, aiding students in managing their time effectively and improving clarity during exams. This method contributes to the enhancement of exam quality.

Conclusion

A keyword-driven question bank guarantees well-rounded examinations by including a variety of difficulty levels, equitable mark allocation, and clear wording, which supports precise evaluation and boosts student's confidence and time management skills.

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A Survey on Domain Generalization for Face Anti-Spoofing on Unseen Target Domains

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***Abstract*—Face anti-spoofing (FAS) plays an integral role in biometric systems to protect them from presentation attacks (PAs) which might include printed photos, video replays, or 3D masks. However, many FAS models face a downhill slide in performance when domain shifts are presented at unseen target domains. The scope of methods transferred to its domain generalization bias is well reviewed. This is followed by an analysis of learning aligned along the lines of feature learning, meta-learning, and adversarial learning. Competitive methods are compared for their pluses and minuses. Open problems such as explainability and real-world applicability are pinpointed, along with actual directions for future work that may improve generalization in FAS.**

Introduction

For possibilities, one can mention device authorization, monetary transactions, access control, to name a few. However, they are trivialized to several attacks on pictures ,replayed videos, or 3D masks. These are termed face Anti-Spoofing or FAS systems and are intended to counter these attacks. While many of the FAS techniques have shown some good results in controlled environments, they mostly fail with unseen conditions of illumination, spoofing materials, and devices. That definitely hampers their use in real-world applications. The real challenge for such systems lies in ensuring robust performance when one is placed in new, unpredictable environments, which is the generalization challenges focused on in this survey.

Results

This survey has centered upon domain generalization in face anti-spoofing, with other approaches targeting enhancement of the robustness of face recognition systems against spoofing attacks in unseen domains. Techniques for dealing with domain shifts include: feature alignment, adversarial training, and domain-invariant representation learning. The paper discusses existing datasets, evaluation metrics, and performances of those methods in improving generalization. A final set of recommendations for future research directions is given, where further improvement of the cross-domain adaptation would provide more accuracy and reliability for current anti-spoofing systems.

Conclusion

Face anti-spoofing protects biometric systems from attacks but suffers from the problems of domain shifts during testing. Some methods may work but have shown some limitations in terms of scalability, data quality, and noise robustness in this regard.

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eFBNet 1.0: An Automated Deep Network Model for Early Detection of Lung Cancer Utilizing Histopathological Image Classification

Tejaswini Das[1], Debasish Swapnesh Kumar Nayak[2*], Roseleen Anjum[3], Sabyasachi Mohanty[4], Sanghamitra Panda[5], Avijit Kumar Chaudhuri[6], Suprava Ranjan Laha[7]

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***Abstract*—Lung cancer is one of the leading causes of cancer-related death worldwide, emphasizing the importance of early and accurate detection to improve patient outcomes. This study studies the application of EfficientNetB7, an advanced convolutional neural network, for automated lung cancer detection using medical imaging. EfficientNetB7, with its scalable architecture and enhanced parameter efficiency, has robust feature extraction capabilities, making it ideal for analyzing complex medical images (histopathological images). The proposed eFBNet 1.0 pipeline involves pre-processing the lung imaging dataset, using data augmentation techniques to improve model generalization, and fine- tuning the EfficientNetB7 model, which was pre-trained on ImageNet for lung cancer classification. Custom top layers are added to the model to adjust it to the specific dataset, allowing for the accurate diagnosis of malignant and benign cases. The initial findings show that the eFBNet 1.0 achieves 99.96% accuracy, significantly higher than classical machine learning and other deep learning models in terms of sensitivity and specificity.**

Introduction

This coronary artery disease (CAD)-based technique for early identification and prediction includes several essential patterns. Lung cancer typically results from uncontrolled cell proliferation in one or both lungs. If it spreads to the brain, it can cause consequences like vision issues and weakness on one side of the body. Primary lung cancer symptoms include chronic coughing, coughing up blood, chest pain, and shortness of breath. Although diagnostic procedures such as chest X-rays, CT scans, MRIs, and sputum cytology are extensively employed, they are frequently costly and time-consuming, making them unaffordable to many [1]. Emerging approaches, such as image processing, have intriguing prospects to increase diagnostic accuracy and efficiency in early lung cancer diagnosis. While artificial intelligence-driven medical imaging has made great advances in lung cancer detection, there are still obstacles in attaining accurate early diagnosis. Compared to conventional CNN models, our method allows EfficientNetB7 to attain state-of-the-art accuracy with fewer parameters and reduced computing needs.

Lung cancer is a serious global health issue, with incidence and mortality rates varied greatly by region. Smoking and pollution contribute to high rates in China and Eastern Europe, whereas prevention and early detection initiatives in the United States have resulted in decreases. In India, bidi smoking and indoor air pollution contribute to cases, emphasizing the importance of region-specific interventions. Figure 1 shows the number of patients (annually) affected by lung cancer of different counts.

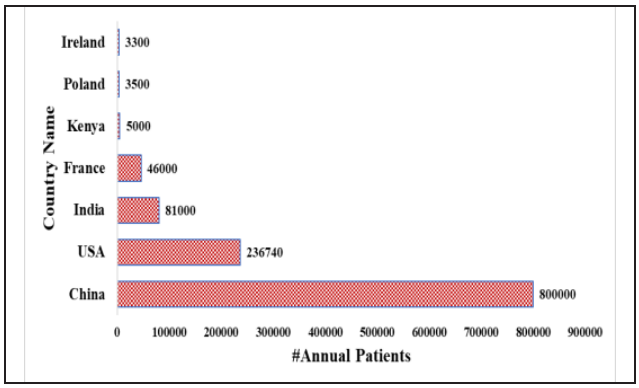

Fig. 1: Numbers of Lung Cancer Patients of different Counts.

Dataset Description

Only lung-related images were utilized to diagnose lung cancer, with a focus on three main categories: lung adenocarcinoma, lung benign tissue, and lung squamous cell carcinoma. Each class provided 5,000 images, yielding a balanced collection of 15,000 images. The Table-I describes how the dataset was used to test and train the EfficientNetB7 model for detecting lung cancer [8].

Table 1: Dataset Description

Category	Total Images	Images per Class	Lung Adenocarcinoma	Lung Benign Tissue	Lung Squamous Cell Carcinoma	Training Set (80%)	Validation Set (10%)	Test Set (10%)
Lung and Colon Cancer Histopathological Image Dataset (LC25000)	25,000	5,000 per class	5,000	5,000	5,000	12,000	15,000	1,000
Images Used for Lung Cancer Classification	15,000	5,000 per class	5,000	5,000	5,000	12,000	1,000	15,000
Augmented Data (DCGAN)	24,000	8,000	8,000	8,000	8,000	19,200	2,400	2,400

Result and Discussion

This section presents and analyses the results obtained from the EfficientNetB7 model and other models. The model was trained and validated over 20 epochs, with accuracy and loss monitored throughout to assess performance.

System Specification

The Python platform is used for training and testing the model. The experiment runs on a workstation includes a 500 GB SSD secondary storage drive, 32 GB of RAM, and Ubuntu 20.4 OS loaded. Our experiment shows that using a workstation significantly reduces computation times compared to using the other system.

Discussion

This study evaluates, model performance using accuracy and loss plots, confusion matrixes, and ROC curves to provide useful insights into its effectiveness. Accuracy and loss plots aid in detecting potential problems such as overfitting or underfitting, guaranteeing adequate model optimization. The confusion matrix provides a detailed breakdown of right and incorrect predictions, which helps to examine the model's strengths and flaws.

Conclusion and Future Scope

This study shows how different deep learning models CNN, EfficientNet-B3, and EfficientNet- B7 classify lung cancer using raw and pre-processed data. The results demonstrate EfficientNet-B7's outstanding performance, with the highest accuracy (99.96%) and excellence across all performance parameters, including precision, sensitivity, specificity, F1- score, and MCC. These findings show EfficientNet-B7's promise in medical diagnostics, specifically its capacity to distinguish between healthy and malignant tissues with high accuracy and reliability. Furthermore, preprocessing strategies like as imagine scaling, data augmentation, and dataset segmentation improved model generalization and computing efficiency, emphasizing the necessity of correct data preparation in attaining the best results.

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Machine Learning based Real-Time Traffic Sign Detection and Recognition

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***Abstract*—This study presents a voice-assisted real-time traffic sign identification system aiming to make the roads safer. The classification of the different traffic signs will be done by the system through image processing and machine learning with audible alert for the drivers. The setup will have a Raspberry Pi as a controller which will work with image processing for detection and machine learning to generate appropriate audio alerts. The algorithm segments the images into 120 parts and uses color segmentation for better recognition. The images captured were converted into a grayscale image for better segmentation. The model presented achieves an accuracy of 98% with a timely alert for distracting the driver away from an accident.**

Introduction

Road safety is a serious issue in developing countries such as India as the rate of vehicle ownership rises. It is recorded that every year 1.25 million people die in road accidents, with many more disabled or injured. The toll on humanity, humans, and society is high, evidencing the urgency for better road safety measures. The automatic traffic signs and hazardous road condition detection systems have excellent potential in times of lowered accidents. With different colors, shapes, signs depict warning signals, prohibitions, suggestions, and stops, with great importance on accurate sign identification contributing to road safety.

Results

This study demonstrates a machine-learning, real-time traffic sign detection and recognition system that utilizes image processing and AI algorithms to identify signs and alert the driver, thereby increasing safety on the road.

Fig 1: Sample Sign for Detection

Conclusion

In the improved outdoor image processing, an augmented reality application is being developed for traffic-signal detection and voice alerting, to counter the issues presented by motion blur on rough terrain.

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Price Optimization in Q-Commerce Platforms using Swarm Intelligence

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***Abstract*—Price in the Q-commerce (Quick Commerce) platforms is the critical factors in a business for enhancing competitive market, customer satisfaction and become profitable in the ecosystem, which encourages rapid delivery and higher customer satisfaction. This research explores the application of Ant Colony Optimization (ACO) to optimize the pricing strategy in the Q Commerce Platform. The proposed optimization algorithm dynamically adjusts product prices based on market sentiments, competitor pricing and multi-level of inventory facility, with customer satisfaction feedback and rapid delivery.**

Introduction

Commerce in India has been around since ancient times and it is the important segment for the country's growth. In the year 2013 a revolution came to the Indian market named as Q-commerce, which focusing on rapid delivery of products to the customer within 10 minutes or less. After the Covid-19 pandemic the Q-commerce market get boost and in the year 2024 generate revenue USD 3,349.00 m and is expected to generate USD 9,771.00 m by 2029 with a CAGR (Compounded Annual Growth Rate) of 23.88%. w India is Price sensitive market, high price product fails the business soon. We can learn from the example of google glass, which is positioned the product by google with the help of influencers in the market in such a way which depicts the future of technology.Ant Colony Optimization is a swarm intelligence technique inspired from the ant's behaviour and offers a promising solution through decentralized decision making.

Results Summary

- **Revenue Comparison:** ACObased pricing optimization surpassed both Fixed Pricing and Dynamic Pricing methods regarding revenue maximization
- **Profit Margin:** ACO regularly attained the highest profit margins because of its capability to adjust prices according to variations in supply and demand.
- **Customer Satisfaction:** ACO maintained a balance between competitive pricing and customer contentment, guaranteeing optimal pricing for various customer segments.

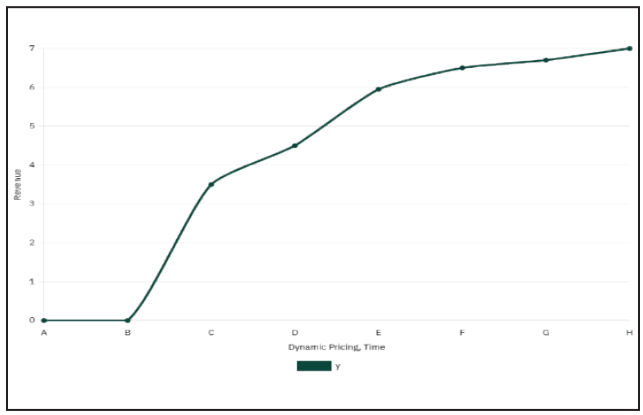

Fig 2: Graphical Representation of Result.

Conclusion

Price optimization within Q-commerce platforms utilizing Ant Colony Optimization (ACO) signifies a promising and effective method for addressing the fluid nature of online retail and consumer behaviour. By utilizing ACO's capability to simulate intricate decisionmaking processes and adapt to evolving environments, Q-commerce platforms are able to identify optimal pricing strategies that enhance profitability while preserving competitiveness

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Review of Agribot Systems: Integrating AI, IoT, and Robotics for Precision Farming

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***Abstract*—Agricultural robots or Agribots are heralding the future of precision farming. The large stride taken in the very recent past in areas involving artificial intelligence, IoT, and robotics would surely make these Agribots extremely efficient, effective, and sustainable. The paper documents the applications, design perspectives, and impacts of Agribots in modern agriculture. Key components relay data online through connections and share information as sensors measuring soil moisture, temperature, and pH contribute further in the implementation of AI technologies in irrigation, pest monitoring, and pest control. Some case studies even indicate the benefits of Agribots in increasing quality yield, efficiency, and lowering costs. Although sensor calibration and economic viability-related challenges exist, Agribots are promising in the bright future and should involve technological advances that work towards unlocking opportunities for sustainable agriculture.**

Introduction

Agriculture has always been the backbone of civilization; modern agriculture grapples with climate change, population growth, soil degradation, and water scarcity. Sustainable farming, however, is necessary to meet food demands without environmentally taxing the land. Behind this new age effort in sustainable farming, lies the need for newer technological varieties like precision farming. By employing both numerical and informatics methods, precision farming is geared towards optimal resource use with yield maximization and consequently is geared towards lessening environmental impact. Robotics, AI, and IoT are automating agriculture by enabling automated tasks through Agribots, data collection and analysis on soil, weather, and crops, predicting diseases, and ensuring sustainability. This integrated system results in more efficient, cost-effective, and precise farming practices that define the future of agriculture.

Results

The review explores the Agribot systems that integrate AI, IoT, and robotics to revolutionize precision farming. It highlights their impact on resource optimization, crop monitoring, automation, and sustainable agricultural practices.

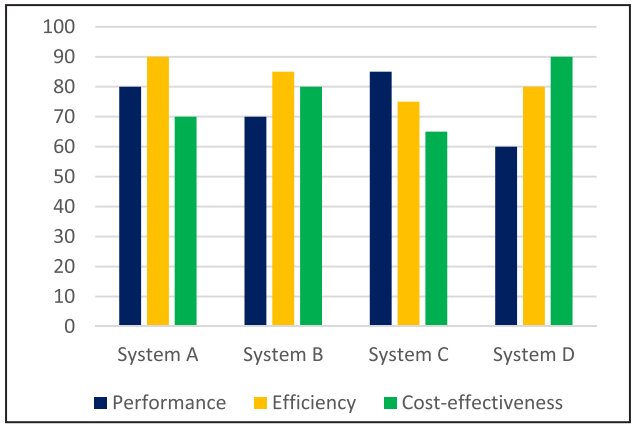

Fig. 1: The Performance, Efficiency, and Cost-effectiveness of different Agribot Systems in Various Agricultural Applications.

Conclusion

This review details the use of Agribots in precision farming using IoT, AI, and robotics for real-time cultivation management. Increasing resource efficiency, productivity, and sustainability, it is predicted that future advancements and policies will spur global adoption.

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AI-Enabled Cybersecurity: A Framework for Next-Generation Threat Defense

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***Abstract*—With the escalating sophistication of cyber-attacks and data breaches, organizations face unprecedented challenges in maintaining robust security postures. This paper examines the strategic integration of AI/ML technologies in cybersecurity frameworks to enable proactive threat defense. We analyze how AI-driven solutions enhance threat detection capabilities, automate response mechanisms, and improve overall security operations efficiency. The research investigates practical applications of AI in threat detection and response, examines the effectiveness of ML techniques in anomaly detection, and evaluates how AI/ML integration optimizes cybersecurity operations. Through this analysis, we provide insights into the practical implementation of AI and ML technologies in building resilient cybersecurity systems.**

***Keywords*—Cryptography, AES, Rivest-Shamir-Adleman (RSA), Elliptic Curve Cryptography (ECC)**

Introduction

The digital transformation era has profoundly impacted various sectors, embedding technology into every facet of daily operations and personal activities. This widespread digitization, while significantly enhancing efficiency and connectivity, has also exponentially increased the vulnerability to cyber threats. Traditional cybersecurity measures, despite their effectiveness, are increasingly challenged by the sophisticated nature and frequency of cyber- attacks. AI and ML-based systems can significantly enhance threat detection capabilities by learning from past incidents and fitting to new threat landscapes in real-time[1]. Recent research has demonstrated that AI- driven cybersecurity frameworks provide proactive defense mechanisms, marking a shift from reactive to preventive security approaches [2]. The integration of AI/ML into cybersecurity practices is revolutionizing threat identification and mitigation. AI systems' continuous learning capabilities enable dynamic security solutions that adapt to emerging threats in real-time, with studies showing ML algorithms effectively detecting anomalies that traditional systems might miss [3].

Results

This paper is going to discuss the transformational role of AI/ML in cybersecurity. Enhancement of threat detection and a better ability for real-time monitoring are accompanied by the refining of response to incidents with proactive defense mechanisms. AI/ML also enhance the efficiency of operations, support anomaly detection, and reduce false positives. However, challenges still exist in the form of data privacy and scarcity of highly skilled professionals.

Conclusion

This section studies how AI and ML can drastically make cybersecurity better through real-time data analysis, thus enhancing detection and response to threats. They enhance the efficiency of operation and reduce the risks of breach. Challenges like AI biases and data privacy issues are still prevalent. Stronger cybersecurity can only be achieved if AI is well-integrated with human teams. More research will be required in order to better optimize AI potential while working around these challenges.

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Creative Canvas: A Visionary Art Project

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***Abstract*—Creative Canvas revolutionizes digital art creation for children by offering an intuitive platform that bridges the gap between physical gestures and digital interfaces. Leveraging computer vision and machine learning technologies, Creative Canvas allows users, particularly children, to translate hand gestures into strokes on a digital canvas using only a webcam. It empowers artists of varying technological proficiencies to explore their creativity in a digital space. Through sophisticated image processing algorithms, the platform tracks hand movements captured by the webcam in real time and seamlessly translates them into lines drawn within a graphics scene.**

Introduction

The traditional process of digital art creation often presents significant barriers to entry, particularly for individuals with limited technological proficiency or access to specialized equipment. Existing interfaces can be complex and intimidating, hindering the creative expression of users, especially children, and novices.

By developing a platform that prioritizes simplicity, intuitiveness, and inclusivity, we aim to break down barriers and empower anyone with a desire to create. Through this project, we aspire to ignite a passion for art and innovation, unlocking new avenues of expression and discovery for generations to come. The major objectives of this project are:

1. **Intuitive Interaction:** Gesture Recognition: Develop robust computer vision algorithms to accurately identify and track a wide range of hand gestures.
2. **Mapping:** Establish a clear mapping between specific hand gestures and their corresponding actions within the digital canvas.
3. **Responsiveness:** Minimize latency between a user's gesture and the visual feedback on the screen.
4. **Intuitive Interface:** Create a user interface that is clear, uncluttered, and easy to navigate, even for those with limited digital art experience.

Results

This project aimed to develop a computer vision-based drawing application that offered intuitive and artist-centric functionalities for users of all ages. The implementation of a robust file management system allowed users to save and export their drawings in various formats, including PNG, JPEG, and PDF.

Fig. 2: User Snapshot

Conclusion

Creative Canvas stands out as a beacon of creativity in the digital art landscape, offering a user-friendly platform that resonates deeply with children. Whether it's through collaborative projects or individual masterpieces, Creative Canvas provides a nurturing environment where young artists can thrive, learn, and grow.

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Implementation of Drag & Drop Application using Cloud Storage Platform

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***Abstract*—With the increasing dependence on digital files, the need for secure and efficient file management solutions has grown significantly. Our drag-and-drop application is designed to simplify file management while safeguarding user data, leveraging modern technology and cloud storage. It streamlines file organization, allowing users to stay focused on their tasks without technical distractions.This work offers an application with drag-and-drop functionality that integrates AWS S3 for cloud storage, Tkinter for its graphical interface, and SQLite for database management. Tkinter interfaces, together with SQLite, are employed to create a user authentication system that requires registration with a username, email, and a securely hashed password (using SHA-256), ensuring secure, user-specific file handling. The boto3 library manages AWS S3 interactions, enabling seamless cloud transfers. The system focuses on efficient, secure, and user-friendly file management, allowing uploads of both files and folders**

Introduction

Current drag-and-drop file management systems often create a fragmented user experience, as they may lack seamless integration between local and cloud storage. Many of these systems overlook security during file transfers or storage, leaving user data vulnerable to potential breaches. Additionally, they may not provide a smooth, intuitive interface, which can make file management cumbersome and inefficient. What's needed is a comprehensive program that offers secure local and cloud storage integration, real-time file management, and an intuitive interface, enabling users to handle files effortlessly while ensuring data security and integrity.

Literature Survey

Survey of Existing System

Many drag-and-drop file management programs on the market do not deliver a fully secure, integrated experience. Popular platforms like Dropbox and Google Drive.

1. **Absence of Integrated Storage Options:** Many platforms don't provide a cohesive solution for managing both cloud and local storage. Without this integration, users must manually sync files, risking data loss and inconsistent results across devices.
2. **Security Concerns:** While some programs include basic security features, they may not ensure secure file transfers or comprehensive end-to-end encryption. This can leave user data exposed to breaches or unauthorized access during uploads.

Results and discussion

The application will feature a graphical user interface (GUI) developed in Python using Tkin- ter, which provides a straightforward and accessible user experience. It will utilize AWS S3 (Amazon Simple Storage Service) for cloud storage, ensuring secure file uploads and efficient file management. For local data handling, SQLite will be implemented to manage user authentication and data storage, ensuring that login credentials and other sensitive information are stored securely. This local database solution offers a light weight and efficient way to handle user data. To facilitate communication with AWS S3, the application will leverage the Boto3 library, which allows for seamless integration and interaction with cloud storage services directly from the application. This combination

of Tkinter for the GUI, AWS S3 for cloud storage, SQLite for local data management, and Boto3 for AWS integration creates a robust framework for building a secure and user-friendly application, enabling users to easily upload, manage, and access their files in the cloud.

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Carbon-Neutral Blockchain: Transforming Rural Education in India

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***Abstract*—With decentralized ledger technology, blockchain makes it possible to generate verified educational records for students in rural areas, thereby providing a level playing field for career advancement, skill development, and higher education. The research further espouses sustainability by investigating carbon-neutral designs of blockchain systems ready for resource-constrained rural areas. Such a proposed solution will ensure reduced environmental footprints, and promote inclusiveness along with transparency using energy-efficient consensus mechanisms. The research lists a few barriers associated with rural learners, the role of blockchain in these barriers, and how it creates a more equitable, sustainable, and technologically advanced education system.**

Introduction

Blockchain technology is a novel way of dealing with the difficult problems in education, especially those in rural areas. Blockchain has come up with a solution that makes the security of academic records possible, virtually temper-proof, and capable of being verified. The system ensures equal opportunities for the growth of knowledge and that it will be used for the betterment of others.

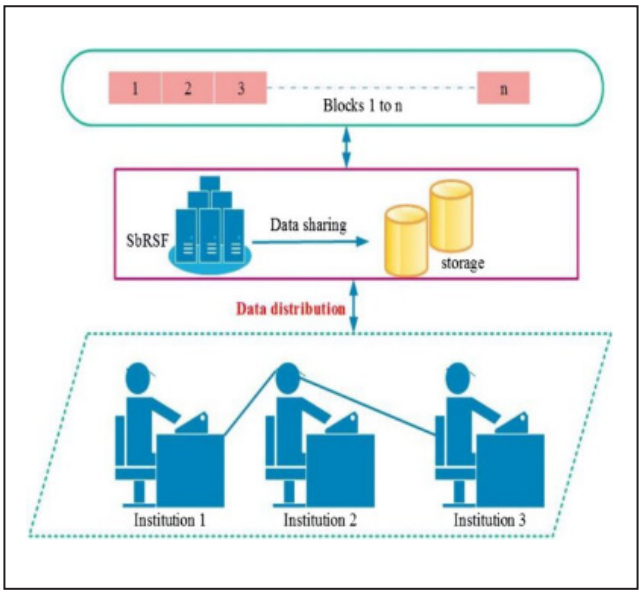

Fig. 1: Blockchain System in Education[1]

The benefits of the technology include modern workplace opportunities, skill development as well as getting higher education. Additionally, this work will explore eco-friendly, carbon-zero blockchain networks dedicated to areas short in resources using energy-efficient consensus mechanisms. For instance, Proof-of-Stake (PoS) is such incept for these problems as it reduces the environmental impact and supports transparent and inclusive activity. This research studies the impact of blockchain technology on the matter of making education more inclusive. Rural education can be revolutionized by blockchain, which has enabled secure and verified records, thus ensuring the equal opportunity access of the students.

Results

The result of the study can be outlined as the design of a blockchain-based automated framework for the verification of academic credentials for rural education that will use a decentralized ledger and smart contracts for secure automated verification of academic credentials. This framework deals with credential falsification, digital inequitability, and scalability concerning rural educational environments. Carbon-neutral blockchain models exploiting energy-efficient consensus mechanisms such as Proof-of-Stake (PoS) and Proof-of-Authority (PoA) could be proposed for tackling rural resource constraints, representing a significant

energy saving when compared to Proof-of-Work (PoW) systems. The distributed nature of the blockchain improves data security while eliminating single points of failure, ensuring a robust resilient foundation[2].

Conclusion

This paper contributes to the discourse that blockchain technology holds the ability to impact rural knowledge through secure, scalable, and secure means of credential verification. Strengthening accessibility, data security, and resiliency in underdeveloped areas. Unmet challenges include interoperability in large expanses, digital literacy, energy efficiency, data security, collaborative synergies, and financing.Solutions regarded as probable include lightweight nodes, targeted training, API integration, renewable energy usage, cryptography, collaboration among stakeholders, and phased funding to reinforce both adoption and impact.

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Detecting Spam SMS using Voting Classification Approaches

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***Abstract*—Spam SMS has significantly increased as a result of digital communication's exponential expansion, endangering security and privacy. This study examines how well different machine learning models identify spam SMS and contrasts their results with ensemble methods such as hard and soft voting. Several machine learning models along with a publicly accessible SMS spam dataset is used in the work. According to experimental data, both the hard voting and the soft voting outperform individual models, with the hard voting achieving an accuracy of 92.87% and 94.36%, respectively. These results demonstrate how ensemble techniques may increase the precision and dependability of spam identification.**

Introduction

Short Message Service (SMS) is one of the most used routes for information interchange since there was an improvement in communication through mobile technology. But the popularity of SMS has also led to a growing problem: of unwanted and often, obnoxious spam text messages. However, these spam messages are a big security and privacy concern since in addition to wasting the users' time, have embedded the major gateways to fraud, virus spreading and phishing.

Although to some extent effective, initial approaches based on hard rules and standard algorithms can hardly adapt to new strategies employed by spammers. One plausible strategy of bearing variable success rates when determining the authenticity of new arriving messages as spam or actual SMS or not may be Machine Learning (ML) approaches. It can also easily find patterns in labeled datasets in order to generalize and easily identify any spam in possibly unknown communications.

Soft voting and hard voting are a result of integrating the predictions of various classifiers since using one model offers the benefits of the others and eliminates its flaws

Results

The outcome of each individual classifier as well as the ensemble approaches were measured using precision, recall, F1-score and accuracy. The accuracy of individual classifiers and voting approaches is visualized in Fig 1.

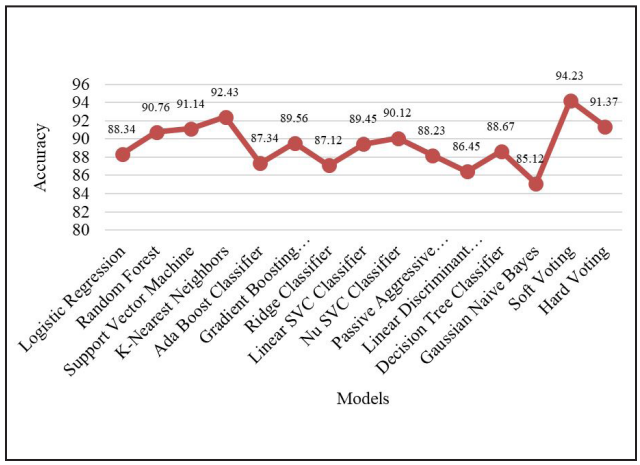

Fig 1: Accuracy Analysis of different Models.

With the greatest accuracy of 92.43%, K-KNN was followed by Random Forest (90.76%) and SVM (91.14%). KNN had the highest F1-score of 92.48% out of all the approaches. It was discovered that the fundamental kinds of ensembles performed noticeably better than the previously mentioned methods. With the greatest accuracy of 94.23% and F1 score of 94.36%, the Soft Voting classifier outperformed all other classifiers. Accuracy of the Hard Voting classifier, 91.37% and F1-score of 92.87 were higher compared to the performance of many separate models.

Conclusion

We examined and evaluated a number of machine learning strategies for spam SMS detection, with a focus on ensemble learning methods. It has been seen that soft voting produces far better results than any one model.

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Sustainable Smart Cities: Integrating Quantum Imaging and AI Digital Twins

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***Abstract*—This paper is a study of how quantum imaging and AI-based digital twins could make smart cities more sustainable and efficient ecosystems. Quantum Imaging relies on properties like entanglement and superposition which when combined with the qualities of AI-based digital twins, offer real-time monitoring, predictive analytics, and decision-making through virtual urban models. This paper further focuses on sustainable energy and environmental monitoring applications in which the synergetic properties can be explored to lower the use of resources and minimize the negative ecological impact, resulting in greener cities and smarter approaches.**

Introduction

Traditional urban management systems face scalability and efficiency issues. Resource allocation heavily depends on static models that don't take real-time changes into account, and this is an area of heavy waste. Tools for environmental monitoring don't have the resolution to determine critical issues before they occur. Disaster response mechanisms are reactive and not proactive. Moreover, there is a huge difficulty in integrating diverse data sources, which will limit the holistic solution for urban challenges. Existing smart city solutions are fragmented with suboptimal integration between data acquisition systems and analytical tools[1]. This gap points to the need for a harmonized framework that leverages advanced technologies. Quantum Imaging offers high precision in sensing using quantum properties such as entanglement and superposition, while AI Digital twins facilitate real-time simulation and predictive analytics. These technologies form a synergistic system to enhance resource management, improve capacities for disaster responses, and decrease ecological impacts thereby paving the way for environmentally sustainable and technologically advanced urban solutions.

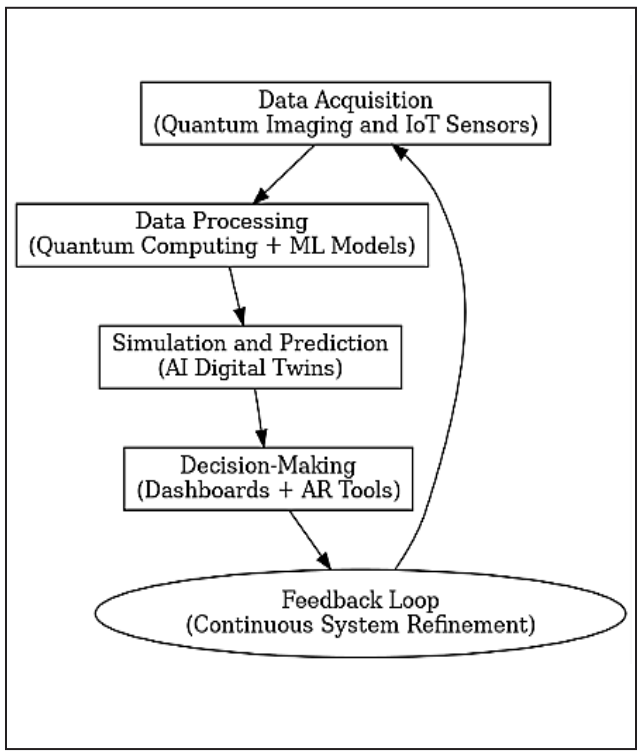

Fig. 1: Suggested Framework for the Integration of AI Digital Twins and Quantum Imaging[2]

Results

Category	Details	Key Improvement
Energy Usage	Tracking of energy by utilizing quantum imaging to develop computing systems that learn the behavior of sectors for which it is difficult to calculate emissions using quantum entanglement	Reduction in energy waste by optimizing sector-specific energy allocation and identifying inefficiencies.
Disaster Management	Quantum Imaging utilizes quantum superposition properties and AI systems to improve coordination and efficiency in disaster response efforts.	The disaster response time is reduced by improvising situational awareness and proper resource allocation..

Conclusion

The study can be useful in terms of minimizing energy wastage reduction, improved preparedness for and mitigation of disasters, and proactive monitoring of infrastructure hence it is suitable for cities with different sizes and complexities. However, there are issues that need to be overcome for this system to gain widespread acceptance: high implementation costs and data governance issues . These can be solved by cost-effective hardware implementation and various funding policies.

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Online Path Planning of a Mobile Robot with an Ultrasonic Range Sensor based on an Improved Point Bug Algorithm

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***Abstract*—The goal of the present work is to develop accurate path algorithm and develop software for navigation of mobile robot to reach target point from the starting point avoiding obstacles on the workspace using ultrasonic sensory feedback. After location of obstacles on the workspace is determined by ultrasonic sensor, the Activity Bot will move towards the destination from the starting position. The analyses, techniques and algorithms described in the work are related to any mobile robot, and the program development and experiments described in the work and run by Simple IDE software.**

Introduction

A mobile robot is a particular kind of robot that is managed by software that uses sensors and other technologies to detect obstacles in its surroundings and move around. Mobile robots are able to move around on their own, that is, without the assistance of human operators. Mobility allows mobile robots to execute a wide range of applications with considerably more freedom. Even tasks that are not intended for surroundings can be easily completed by mobile robots. Locomotive mechanisms are used in mobile robots to facilitate movement around their surroundings. The mobile robots are composed of several hardware and software components, such as sensors, actuators, controllers, and control software. To determine the position of objects (obstacles), several types of sensors, such as laser and ultrasonic sensors, are also necessary. Actuators that transform electrical energy into mechanical energy are most frequently found in mobile robots.

Results

The developed C program has been run for moving the Activity-Bot robot from its starting point to the goal point by detecting any obstacle using Ping sensor. The angular position of the sudden point is obtained from servo motor rotation on which the sensor is mounted. Initially, the robot orientation is parallel to the x-axis and it rotates towards goal by turning through required angle, and calculating the numbers of ticks and using drive_goto command for rotating clockwise or counter clockwise direction accordingly.

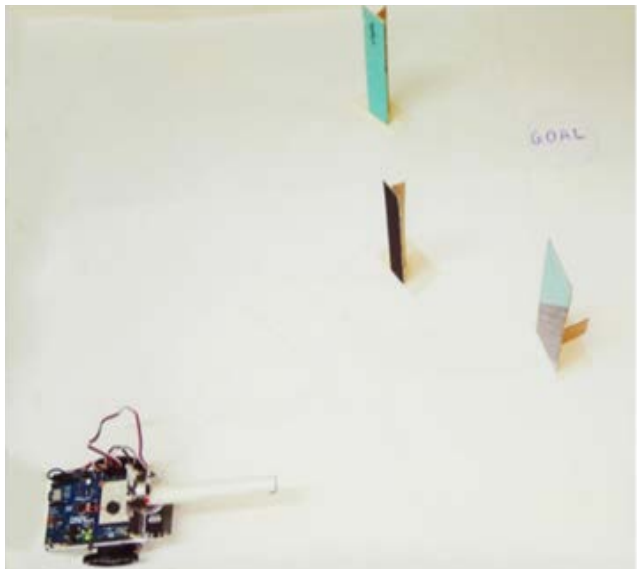

Fig. 1: Transmittance Spectra of $TiO_2/Cu/TiO_2$ Coating on Glass Substrates. (At Least 1 Figure)

Conclusion

Based on the foregoing analysis, program development, experimentations and results for the present project, the following conclusions may be drawn

I. Various algorithms of different path planning techniques have been studied thoroughly including Bug group of algorithms, where Point Bug and some other modified Bug algorithms have been found suitable in most cases.

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A Comprehensive Survey of LSTM-Based Approaches in Text Classification

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***Abstract*—A basic task in natural language processing (NLP) is text classification, which entails grouping text according to its content into predetermined classes. Because they can capture long-term dependencies in sequential data, Long Short-Term Memory (LSTM) networks have become very successful models for this task. Along with architectural differences, the survey looks at ways to make LSTM-based models operate better. Discussions are held regarding optimization tactics, hyperparameter tuning, and the impact of preprocessing approaches like tokenization, stemming, and embedding. It is also examined how various dataset attributes, including as text variety, dataset size, and the existence of noisy data, affect LSTM performance. The success of LSTM-based text categorization models in a number of real-world applications is discussed. Sentiment analysis, spam detection, subject classification, and more intricate tasks like document classification in social media, legal, and medical contexts are some examples. LSTM networks are a popular option for many NLP applications due to their versatility across domains and data sources, as well as their resilience when dealing with loud and unstructured text. This survey provides a thorough analysis of LSTM-based text classification techniques, emphasizing their development, uses, and significant breakthroughs.**

***Keywords*—LSTM, Text Classification, Natural Language Processing, Bidirectional LSTM, Attention Mechanism, Hybrid Models, Hyperparameter Tuning, Deep Learning, NLP Applications, Transformer Models.**

Introduction

In natural language processing (NLP), text classification—the process of giving text predetermined labels—is an essential undertaking. This procedure facilitates the efficient arrangement and understanding of textual data by supporting important applications including sentiment analysis, spam detection, and document categorization. When it comes to deep learning methods, Long Short-Term Memory (LSTM) networks—a variant of Recurrent Neural Networks (RNNs)—have proven crucial in solving problems involving sequential data. By using a special gating mechanism, LSTMs are able to get beyond restrictions like the vanishing gradient problem and capture long-term dependencies. They are very successful at tasks requiring contextual comprehension because of this skill.

Results

The performance and conclusions of numerous studies on LSTM-based methods for text classification are examined in this section.

Table 1: Performance Comparison of LSTM-based Models

Model	Accuracy	Precision	Recall	F1-Score	Dataset
Standard LSTM	85.2%	83.5%	84.0%	83.8%	IMDB Sentiment Analysis
BiLSTM	88.1%	86.7%	87.3%	87.0%	AG News Classification
CNN-LSTM Hybrid	91.4%	89.0%	90.2%	89.6%	Yelp Reviews Classification
Transformer (BERT)	94.5%	93.0%	93.5%	93.3%	SST-2 Sentiment Analysis

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Leveraging AI for Fraud Detection and Prevention in Decentralized Finance with a New Innovative Ensemble Model

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***Abstract*—The current paper presents a new form of AI model for detecting fraud within DeFi networks using anomaly detection, pattern recognition, and behavior analysis. When used on a large data set of DeFi transactions, the model increases detection fidelity while at the same time decreasing false positive rates. Thus, the results suggest that AI can be useful in strengthening and stabilising decentralised finance environments as scam threats increase.**

Introduction

With the appearance of decentralized finance, financial services such as lending, borrowing or trading are performed without the intercession of middlemen and are based on blockchain for openness. However, as decentralized applications grow, decentralization, and anonymity inherent to DeFi raises its susceptibility to fraud, which trouble conventional centralized identification systems [1][2]. This work utilizes ML they advance an ensemble model based on AI to serve the goal of improving accuracy in fraud detection in DeFi platforms despite the problems inherent in them.

Results

Previous findings show the feasibility of applying modern ML models such as decision trees, SVM, and the deep learning of older fraud detection models. Even though there are some techniques which have already been adopted to DeFi, for example anomaly detection or network analysis, DeFi is relatively decentralised and anonymous. This work presents the development of a new hybrid ensemble model comprising of more than a single ML model to amplify the fraud detection particularly in decentralized finance.

Table 1: Model Performance Metrics

Model	Accuracy (%)	Precision (%)	Recall (%)	F1-Score (%)	AUC-ROC (%)
Random Forest	92.3	91.8	90.5	91.1	93.2
LSTM	89.5	88.7	87.3	88.0	90.8
KNN	85.7	84.5	83.2	83.8	86.1
Ensemble	95.2	94.5	93.6	94.0	96.4

Conclusion

This paper proposes the use of an ensemble deep learning AI model of Random Forest, LSTM, and KNN for efficient fraud detection in DeFi. Based on this model, one could consider future development of reinforcement learning, GANs or other AI based methods to improve the model.

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Parkinson Disease Detection, Prediction, and Nanomedicine-Based Recovery using Artificial Intelligence and Internet of Things: A Technical Review

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***Abstract*—Parkinson's disease is a neurodegenerative disorder that slowly impedes motor and non-motor functions. The traditional methods that are followed for the diagnosis and therapy of the disease have bad accuracy and are late for arriving at the treatment. This paper aims to shed light on the transformations happening with the integration of AI, IoT, and nanomedicine to overcome the mentioned challenges. AI allows early diagnosis and predictive modeling through complex data analysis. IoT allows real-time monitoring, as smart devices can continuously transmit data. Nanomedicine will enhance the treatment by targeted drug delivery and molecular diagnostics. The analysis discusses the recent advancements, challenges, and future directions with the potential for this multidisciplinary approach in revolutionizing the management of Parkinson's Disease and improving the results of the patients.**

Introduction

Parkinson's disease is a chronic and a progressive disorder affecting the entire population worldwide. It is said that there are more and more people diagnosed each year due to an increase in the elderly population. The condition has degenerative processes that include the destruction of dopaminergic neurons located in the brain, which eventually hinders an individual's mobility.

Year	Milestone	Description
2016	AI-Based Gait and Voice Analysis	Early application of AI to analyze gait and speech patterns for PD diagnosis.
2018	Wearable IoT Sensors for Continuous Monitoring	Integration of IoT-enabled wearables for real-time monitoring of tremors and motor symptoms.
2019	Deep Learning for PD Detection	Use of deep learning (CNNs, RNNs) on sensor data for highly accurate PD classification.
2020	Smart Home IoT Systems for PD Patients	Deployment of smart environments (IoT-based) to track activity, medication adherence, and safety.
2022	Federated Learning in PD Data Analysis	Use of privacy-preserving AI models to train on distributed wearable data without centralizing it.
2024	AI-IoT Integration with Edge Computing for PD	Real-time PD monitoring and decision-making using edge AI devices to reduce latency and improve autonomy.

Tremors, rigidity, bradykinesia, and, eventually cognitive decline become common manifestations. This condition creates many risks to the society as it cripples one's ability to carry out daily activities which basically impact their quality of life. It is also challenging to care for such patients as they require constant assisted support and supervision that adds much pressure to their caregivers.

Life expectancy rates are going up hence it is anticipated that the number of cases will rise correspondingly causing great concern. Currently, diagnosis and management of PD's symptoms rely on health care providers conducting physical examinations besides the patients' descriptions of their state of health. The integration of the two sources of information becomes inefficient in diagnosing patients bringing a negative effect on PD management due to it being complex, costly, and lengthy risking the development of targeted therapies. Such a disconnection between the diagnosis and treatment showcases the gaps present in systems at the moment and calls for new advancements to solve this issue. With the rapid advancement of technology, the presence of AI, IoT as well as nanomedicine will create a more favorable environment for such individuals. Through AI, the patient's condition can be more closely monitored over time.

Conclusion

Parkinson's disease's rising prevalence demands innovative AI, IoT, and nanomedicine solutions for improved diagnosis, management, and patient care.

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AI-Powered Innovations in Oral Cancer Diagnosis

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***Abstract*—Oral cancer is a major global health challenge because of its high mortality rate and late detection. However, the traditional diagnostic procedure is largely dependent on subject assessments that often lead to delayed accurate diagnosis and treatment. This study investigates the transformative power of Artificial Intelligence in oral cancer diagnosis, focusing on Machine Learning and Deep Learning innovations. We propose a novel AI-powered diagnostic framework that utilizes multi-modal data from histopathological, clinical photography, and radiomic datasets. Experimental results show enhanced diagnostic accuracy and efficiency, outperforming current methods. Our results highlight the value of real-time, interpretable models for improving patient outcomes.**

Introduction

Oral cancer, primarily oral squamous cell carcinoma (OSCC), represents an important public health concern for global morbidity and mortality. However, OSCC is often diagnosed when it has become visible for clinical examination, as yet adequate early detection methods and minimal public awareness combine to provide relatively late diagnoses [1]. Each year in the U.S., there are about 54,540 new cases and over 11,580 deaths from oral cancer, and survival rates are much lower later in the disease. The limitations of traditional diagnostic methods based on visual and histopathological inspection underline the necessity for development of innovative diagnostic tools. Machine learning and deep learning are starting to make AI a real game changer in the healthcare industry, where they are being applied to improve disease detection and classification [2]. A variety of different data types can be analyzed by AI diagnostic tools, making diagnostic accuracy and efficiency better, as well as helping with better patient outcomes in the fight against oral cancer.

Proposed Framework

In order to tackle the intricacies of the oral cancer diagnosis, we present an effective AI-powered framework assembled from multi-modal data sources consisting of clinical photographs, histopathological and radiomic data. Thus, we intended to design this framework to improve the accuracy of diagnosis, decrease analysis time and offer useful insights to the clinicians.

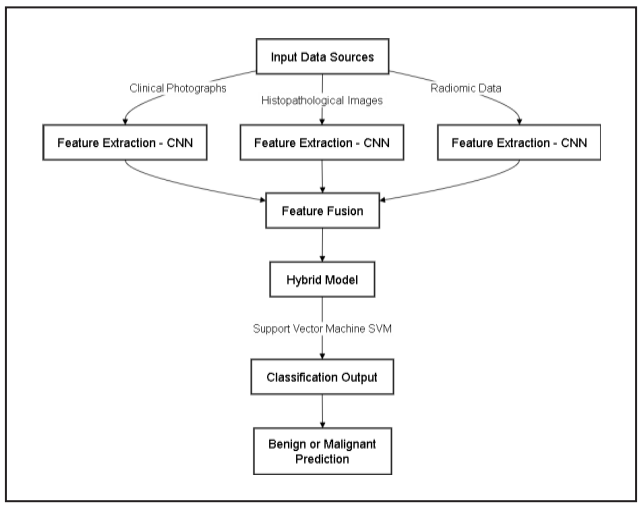

Fig. 1: Overall Proposed Framework

Conclusion

The role of AI into oral cancer diagnosis is highlighted in this study. Using multi modal data and hybrid algorithms, we propose a framework that outperforms existing approaches on the diagnostic task. Future work should aim at developing real time, explainable models that will facilitate clinical adoption and improve patient outcomes.

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Social Media's Role in Political Campaigns

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***Abstract*—Social media's role as a key tool of political campaigns and impacts of electoral dynamics, voter engagement and public discourse cannot be overlooked because they also show the transformative effect on contemporary political campaigns. Modern platforms such as Facebook, Twitter, Instagram and TikTok now give political stakeholders the tools to directly communicate, mobilize, and create narratives. This work thoroughly examines the multipronged effects of social media in tightening information to the campaigns, solidifying support base, and steering the candidate's voter behavior. Using theoretical insights, empirical findings and illustrative case studies this review critically examines the merits, impediments and ethical issues in the process of social media integration for politics.**

Introduction

With the advent of social media, political communication has undergone a new paradigm: There is no longer the traditional one way communication channel from politicians to the public; rather, political figures and the electorate are able to communicate nearly instantaneously in ways that were unthought of before. The democratization of political content dissemination through social media is enabled by undermining the traditional media gatekeepers, but simultaneously puts forward additional challenges and new opportunities. This section provides the historical evolution of social media's ability to rise as a central part of political campaigns, and the research objective of the study.

Case Study

Table 1: Strategies to Overcome Ethical and Regulatory Challenges in Social Media Campaigns

Proposed Strategy	Key Actions	Predicted Success Rate
Strengthen Data Governance Policies	Develop and implement stronger data protection frameworks	80%
	Enforce compliance with data protection laws	
	Increase transparency around data collection, use, and storage	
	Ensure regular audits and assessments of data security practices	
Develop Fact-Checking Partnerships	Establish formal collaborations with independent fact-checking organizations	75%
	Provide real-time fact-checking tools within platforms	
	Encourage users to report false information	
	Support fact-checking initiatives financially and operationally	
Mandate Transparent Moderation Practices	Require social media platforms to publicly disclose moderation policies and enforcement actions	85%
	Create public-facing dashboards to show content removal data	
	Ensure clear communication of moderation rules to users	
	Implement external audits of moderation practices	
Integrate Digital Literacy into Education Curricula	Launch nationwide media literacy education programs	70%
	Include digital literacy in K-12 education systems	
	Organize workshops and awareness campaigns for different age groups	
	Collaborate with educators and experts to develop curricula	

Conclusions

Social media's potential to transform political debates and media demands is significant, but ethical, legal, and regulatory hurdles require significant investment. Policymakers, platforms, and society must work together to balance the long-term implications of incorporating social media into political systems.

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Enhancing Supply Chain Sustainability through Blockchain Technology: A Scholarly Analysis

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***Abstract*—Environmental and social changes that are rapidly emerging worldwide make the concept of sustainable supply chain management (SSCM) relevant. Therefore, this research explores how blockchain can improve supply chain sustainability in terms of traceability, transparency, efficiency, and security. The document offers a series of case and quantitative analyses to describe a range of applications of the technology with respect to waste minimization, ethical procurement, engagement of stakeholders, and compliance with sustainability standards. Implementations including data standardization, high costs and low levels of adoption are also discussed, and corresponding strategies are provided.**

Introduction

Dedicated buying and selling arrangements have become precursors of sustainable supply chain management (on occasion, referred to as green supply chain management) in modern business considerations, due to accreditation of environmental and social issues intertwined with the economy's stability and growth plans. Sourcing has become complex and globalized thus requiring solutions that cannot be solved using conventional methods.

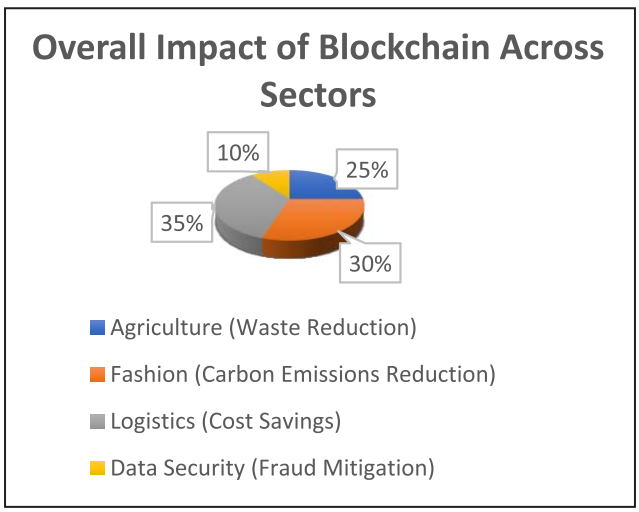

Fig. 1

The demands of sharing data in this manner can be met using a particularly strong platform that is offered by the field of blockchain. Blockchain has various functions in SSCM, let's critically analyse its use in increasing the traceability, visibility, operations and data security in SSCM. In this dissertation, I examine the theoretical implications and practical applications of blockchain technology to better characterize the transformative value of the technology in industrial processes and contribute to the achievement of sustainable development goals.

Results

Blockchain continues to transform industries and increase traceability and transparency mechanisms. This has led to accurate tracking in real-time of food through proper conveyor belts systems that have helped to cut down wastage in food production by up to 25% taking other standard requirements of safety into consideration. It has indeed decreased the carbon footprint of fashion brands through sustainable sourcing by 30% with the help of blockchain to build consumer confidence and encourage more sustainable choices.

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Recent Advances in the Deep Learning-Based End-to-End Glaucoma Detection Techniques

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***Abstract*—Glaucoma is the leading cause of permanent blindness globally. The primary challenge in detecting glaucoma is the difficult diagnosis process and case- dependent evaluation. However, new advances in deep learning-based AI technology have provided a light of hope for automating the glaucoma diagnostic procedure. This paper provides a detailed description of recently applied deep learning-based AI techniques for glaucoma detection processes using fundus, optical coherence tomography, and visual field images. ScienceDirect, Google Scholar, and IEEE Xplore have been searched to find recently published relevant articles applying specific selection criteria and keywords. Year of publication is mainly restricted from 2020 to 2024. It is found that Convolutional neural networks-based glaucoma diagnosis, Autoencoder based network for glaucoma diagnosis, Attention- based networks for glaucoma diagnosis, Generative adversarial networks for glaucoma diagnosis, Geometric deep learning networks for glaucoma diagnosis and Hybrid networks for glaucoma diagnosis are the most common categories of deep learning-based glaucoma detection techniques. Also, it is found that the main challenges that lie in this domain are on dataset dimension and diversity, combining data from different sources and formats, and medical comprehension.**

Introduction

Glaucoma is one of the leading causes of blindness worldwide. At present, globally about 80 million people are suffering from glaucoma [1-2] at present. If not treated in time, glaucoma can lead to permanent vision loss because of the damage of optic nerve head and retinal nerve fibre layer. Despite the advent of advanced treatments, many people lose vision because of late diagnosis. Fig. 1 illustrates a gradual loss of vision due to glaucoma [3]. Conventional glaucoma diagnosis is complex, time- consuming and expensive. Therefore, the time has come to develop a simple, less time consuming, inexpensive glaucoma detection method that can save the vision of many people.

Table 1: Anatomical Terminologies Related to Retina

Anatomical Terminology	Abbreviation	Details
Retinal Ganglion Cells	RGCs	The deepest layer of the retina contains neurons that receive and relay visual information to the brain.
Inferior Superior Nasal Temporal	ISNT	The ISNT rule represents a structure of rimwidth in the optic disc. The letters indicate inferior (I), superior (S), nasal (N), and temporal (T).
Ganglion Cell Layer	GCL	The Ganglion Cell Layer in the retina contains ganglion cells that transmit visual information from the eye to the br:oin via the optic nerve.
Inner Plexiform Layer	IPL	The Inner Plexiform Layer of the retina is where bipolar, amacrine, and ganglion cells connect, facilitating the transmission of visual signals.
Ganglion Cell Complex	GCC	The Ganglion Cell Complex includes the retinal nerve fiber layer, ganglion cell layer, and inner plexiform layer, crucial for transmitting visual signals to the brain.
Ganglion Cellwith the Inner pbxiform layer	GCIPL	The ganglion cells, located in the inner layer of the retina, receive visual information and send it to the brain through the optic nerve.
Optic Nerve Head	ONH	The optic nerve head i> the point where the optic nerve connects to the retina, transmitting visual information from the retina to the brain.
Rim	NRR	The rim isthe tissue surrounding the optic disc, consisting of retinal ganglion cell axons. It helps transmit visual signals from the retina to the brain.
Optic Disc	OD	A round section where the retina and optic nerve meet
Optic Cap	OC	Central part of Optic nerve head
Cup-to-Disc Ratio	CDR	Ratio of optic cup to optic disc
Intraocdar Pressure	IOP	Pressure of fluids inside the eye
Retinal :-lerve Fiber Laver	RNFL	RGCs produce the layer of nerve fibers (axons) that make up the optic nerve and retina.
Retinal blood vessels	RBVs	It supplies the oxygen and nutrients to retina while removing waste.
Cornea	Cornea	The cornea focuses light and protects the eye.

Available Datasets and Performance Metrics

The performance of the deep learning model is mainly evaluated through metrics like accuracy, specificity, sensitivity, precision and F1 score. Formal definitions of the above-mentioned metrics are displayed in Eq. (1-5) commonly used to record morphological changes associated with glaucoma, they cannot detect functional changes induced by glaucoma.

Fig. 1: Gradual Loss of Vision Due to Glaucoma [3]

$$F1\,Score = \frac{2 \times Sensitivity \times Precision}{Sensitivity + Precision} \quad (5)$$

Hybrid Networks for Glaucoma Diagnosis

A "hybrid network" is a neural network model that combines different types of neural network architectures, such as convolutional neural networks (CNNs) and recurrent neural network (RNNs), to capitalize on the strengths of each individual architecture and achieve better performance on complex tasks, particularly when dealing with diverse data types. The model includes feature extractor and a volume-based predictor. The feature extractor uses residual and attention based convolutional neural network to get the significant information from the data.

Table 8: Use of Hybrid Networks for Glaucoma Diagnosis

Ref	Model	Data type	Dataset Information	Performance Metrics for Classification (%)					
				Accuracy	Sensitivity	Specificity	Precision	F l Score	AUC
[66]	Multi-Rater Consensus Model	Fundus	REFUGE, DRISHTI-GSI	98.00 86.14	82.50 91.43	99.72 74.19	-	-	96.83 89.63
[67]	CNN and LSTM	SD-OCT	Private (G:93, H:156)	81.25	75.86	85.71	-	78.57	80.79
[68]	CNNs (ResNet50, VGG-16) and Random Forest	Fundus RGB images	ACRIMA, GI020, ORIGA and REFUGE	95.41	88.37	-	99.37	93.52	

Conclusion

This paper provides an overview of current research using deep learning and computer vision approaches to diagnose glaucoma. The existing research have been compiled on many architectural categories, including Convolutional neural networks-based glaucoma diagnosis, Autoencoder based network for glaucoma diagnosis, Attention-based networks for glaucoma diagnosis, Generative adversarial networks for glaucoma diagnosis.

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AI-Assisted Coronary Artery Disease Diagnosis: An Extensive Analysis

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***Abstract*—Coronary artery disease (CAD) remains a critical global health issue requiring improved diagnostic methods to reduce morbidity and mortality. Traditional approaches, such as stress tests and coronary angiography, face challenges related to invasiveness and accessibility. Artificial intelligence (AI), leveraging machine learning (ML) and deep learning (DL), offers promising alternatives by analyzing complex datasets, including imaging studies and electronic health records. This study highlights AI applications in CAD diagnosis, focusing on imaging techniques like echocardiography and coronary computed tomography angiography (CCTA). Despite progress, challenges remain, including model interpret-ability, data standardization, ethical concerns, and clinical integration, necessitating collaborative efforts for trans-formative advancements.**

Introduction

One of the most common cardiovascular diseases in the world, coronary artery disease (CAD) causes a large number of fatalities as well as disabilities. Heart failure, myocardial infarction (heart attack), or sudden cardiac death can result from atherosclerosis, or the accumulation of plaque in the coronary arteries, which causes CAD. In order to manage CAD and avoid disastrous results, early diagnosis and prompt intervention are essential.

Results

The comparative evaluation demonstrates the variety of AI methods used in healthcare, each with its own advantages and disadvantages. Due to their capacity to efficiently capture spatial relationships in CT scans, models such as Capsule Networks (Brown *et al.*, 2020) scored the highest accuracy (97%) and are hence especially well-suited for image analysis.

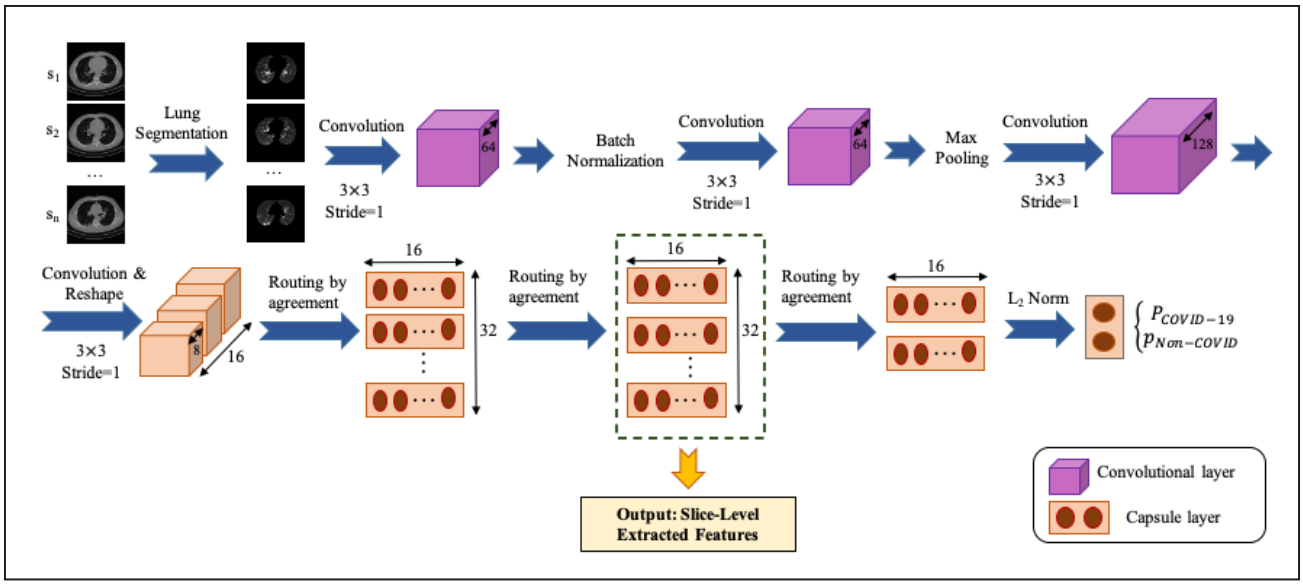

Fig 1: The Capsule Network Model Used to Extract Slice-level Features.

Conclusion

AI-assisted CAD diagnosis has shown great promise to transform healthcare delivery by facilitating precise and timely detection. Notwithstanding the notable advancements, resolving issues with data accessibility, model interpretability, and clinical integration is crucial to maximizing AI's promise in this field. To enhance patient outcomes, future research should concentrate on developing reliable, comprehensible, and clinically verified AI systems.

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Harnessing Artificial Intelligence for Sustainable Green Technology: Innovations, Challenges, and Applications in Waste Management and Resource Efficiency

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***Abstract*—This paper seeks to understand how AI can be applied in impactful development of sustainable green technology particularly with reference to waste management and resource utilization. AI applications for improving efficiency in waste sorting, predicting equipment failures, and optimizing consumption of resources are discussed. Data shows that the use of AI increases productivity leads to decreased environmental harm. Data privacy issues, exhibits algorithm bias that is also accompanied by issues of scalability. Reasoning discusses how AI can improve sustainable activities in the future and stress the importance to introduce ethical reflections and efficient principles for applying innovations.**

Introduction

The growing concerns with the optimum solutions to the waste management problems and optimization of the use of resources have paved way to development of AI technologies. AI therefore brings a huge potential in promoting efficiency, minimizing inefficiency and improving recycling capacity.

Results

Multilayer coating structure comprising a copper (Cu) layer sandwiched between titanium dioxide (TiO_2) were demonstrated as a heat reflecting coating on glass for energy-saving window application. Fig. 1 shows the heat reflecting property of the coating. The performance of the THR can be tuned through thermal treatment.

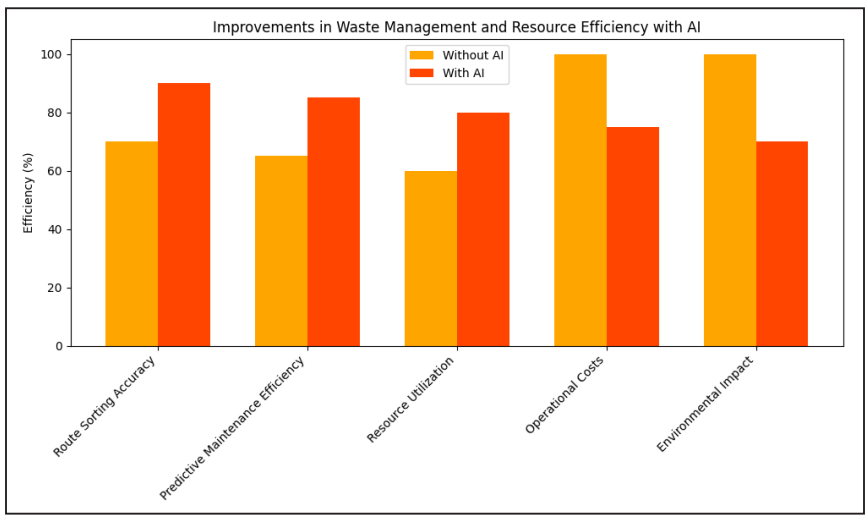

Fig 1: A Bar Graph Showing the Percentage Improvements across these Metrics

Accuracy of waste sorting – Presenting the state of affairs where accuracy has been improved before and after applying the AI-based models.

The share of the actual efficiency rates of predictive maintenance using AI and not using it.

- **Resource Use:** Demonstrating an enhancement on resource use productivity.
- **Grouped Expenses:** showing controlled operating costs before and after the integration of Artificial Intelligence.
- **Environmental Impact:** Explaining how the environmental impact has gone down because of AI.

We have also demonstrated bar graph percentage improvements across matrices.

Conclusion

AI is a powerful enabler that helps bring sustainable green technology. However, it is obvious that ethical factors as well as the perfection of the frameworks urgently need solutions for such problems as data protection and adaptability.

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Survey on E-Learning Recommendation System

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***Abstract*—The exponential growth of e-learning platforms has created a need for personalized learning experiences to cater to diverse learner preferences and requirements. This survey provides a comprehensive overview of e-learning recommendation systems, focusing on their methodologies, algorithms, and applications. It explores various approaches, including content-based filtering, collaborative filtering, hybrid models, and deep learning techniques, highlighting their advantages and limitations. Furthermore, this survey reviews current trends, such as adaptive learning, context-aware recommendations, and the integration of artificial intelligence, to envision the future of personalized e-learning. By consolidating the existing research and identifying key gaps, this work aims to provide valuable insights for researchers and practitioners in developing more effective and adaptive e-learning recommendation systems.**

Introduction

Learning is now more accessible and individualized than ever because to the quick development of digital technology and the broad use of online learning platforms, which have completely transformed the educational landscape. Recommendation systems, originally popularized in domains such as e-commerce and entertainment, have proven to be equally transformative in the context of e-learning. By leveraging techniques from fields such as machine learning, data mining, and artificial intelligence, these systems analyze user preferences, behavior patterns, and learning objectives to provide customized recommendations. The adoption of ERS in e-learning platforms has the potential to enhance learner engagement, improve knowledge retention, and foster a more effective and enjoyable learning experience.

The underlying techniques, applications, and difficulties of e-learning recommendation systems are the main topics of this paper's thorough examination. It examines the many strategies used, such as content-based filtering, collaborative filtering, hybrid models, and cutting-edge methods like context-aware suggestions and deep learning.

The study also addresses the crucial role that data plays in e-learning recommendation systems, emphasizing concerns about data security, privacy, and sparsity. In order to foster trust and guarantee moral application in educational settings, it also discusses the significance of examinability and transparency in recommendation algorithms.

Result

In this paper we have go through many research papers and in the result section we have jot down the main research contribution of those papers along with the existing research gap with future research scope.

Ref [1]: Details description (Finding, observation):

1. Proposed a model, design, and implementation details of an interactive video-based m-learning approach incorporating smart learning paradigm.
2. The adaptability model is one of the key features in the design.
3. A prototype model is being implemented with a group of students to assess their acceptance and validity.
4. Proposed a model, design, and implementation details of an interactive video-based m-learning approach incorporating smart learning paradigm.
5. The adaptability model is one of the key features in the design.

Research Gap

1. The client end application needs more additional features like note taking and managing it.
2. Needed to include transcripts facility.
3. Beside text based one-way interaction, the application must incorporate annotation, file upload, form-based interaction, blog-based interaction.
4. A proper log of what had been studied and what is left for studying is required.

Ref [2]: Details description (Finding, observation):

1. A metadata model, comprising a set of essential educational and pedagogical features LOs, is proposed. This model is a substantial extension of the IEEE LOM.
2. To extract each of the proposed educational metadata suitable extraction methods are suggested.

Conclusion

In order to overcome the difficulty of navigating the deluge of online educational resources, e-learning recommendation algorithms have emerged as a crucial part of contemporary educational platforms. These systems offer individualized learning experiences catered to each user's requirements and preferences by utilizing cutting-edge techniques including collaborative filtering, content-based filtering, and hybrid methods.

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Deep Learning-Powered AI Models for Early Glaucoma Detection and Predictive Analytics

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***Abstract*—Glaucoma represents the major reason for permanent blindness throughout the world even though the condition usually advances slow progress until causing major vision impairments. Early diagnosis stands vital for effective treatments which protect visual function. The creation of artificial intelligence specifically using deep learning methodologies has enabled unprecedented ways to detect glaucoma early and predict its management course. This paper examines recent AI system developments powered by deep learning techniques which focus on clinical practice implementation for glaucoma diagnosis and disease forecasting. This review examines hybrid approaches using genomic and imaging biomarkers as well as ongoing data heterogeneity and clinical application challenges to demonstrate these technologies' potential for transforming ophthalmic medicine.**

Keywords—artificial Intelligence, Deep Learning, Glaucoma, predictive analysis

Introduction

The dataset used in this work was specifically curated for the challenges of glaucoma detection. Merging two publicly available datasets from RoboFlow resulted in a rich dataset of 3175 labeled images in total. These were divided into three subsets to effectively train and evaluate the models: 2222 images for training, 635 for validation, and 318 for testing. Each image was tagged as either 'glaucoma' or 'normal' and preprocessed into YOLO- compatible format for easier integration into the detection framework [1,2].

Result

The results derived from the four evaluated YOLO versions present with different performance characteristics, differences in precision, recall, and computation efficiency. YOLOv8 had a good performance by yielding a precision of 0.885, recall of 0.945, and mAP50 of 0.955 but had a little lower mAP50- 95 of 0.836 compared to its newer versions. Later, YOLOv9 outperformed YOLOv8 for precision and mAP50-95 at 0.918 and 0.857, respectively. Although very accurate, YOLOv9 is the slowest of the models, having an inference speed of 30.3 ms per image.

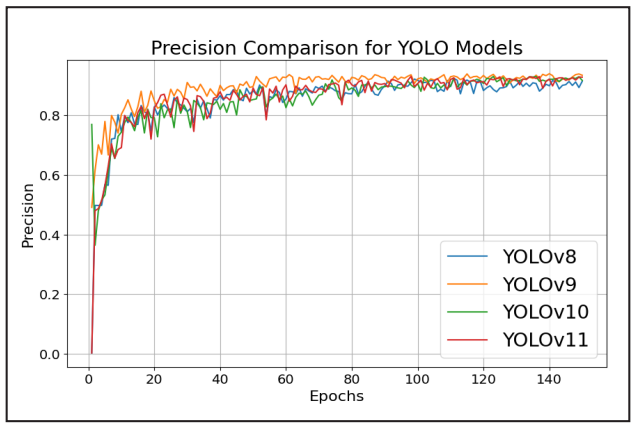

Fig. 1

Conclusion

The results of the study have clearly shown the trade-off between different variants of YOLO in accuracy and speed. YOLOv8 proved to be the fastest model, with an inference speed of 4.5 milliseconds per image, hence workable for real-time applications. This is slightly slower than the exact mAP50-95 value, which is indicative that there is a sacrifice for speed. In contrast, YOLOv9 achieved the highest mAP50-95 score of 0.857, making it ideal for scenarios that prioritize precision,

although at the cost of computational efficiency due to its slower inference time.

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Neural Network Approach for Predicting Domestic Electricity Consumption

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***Abstract*—Innovative approaches to energy optimization are essential in tackling global energy challenges. By leveraging predictive analytics and material engineering, significant advancements can be made in energy efficiency and sustainability. Neural networks, applied to forecasting domestic electricity consumption, have demonstrated marked improvements in accuracy over traditional statistical methods. Using historical data and auxiliary variables such as weather and household occupancy, these models enable precise energy distribution optimization. Concurrently, advancements in multilayer coatings employing low-cost materials like Cu and TiO2 showcase their potential for energy-saving applications, including transparent heat-reflecting windows and solar energy harvesting. This integrated approach combines artificial intelligence and material science to foster sustainable energy solutions.**

Introduction

The exponential rise in energy demand has necessitated innovative solutions to enhance energy efficiency and sustainability. Domestic electricity consumption, a major contributor to overall energy usage, demands accurate forecasting to minimize waste and optimize distribution. Traditional forecasting methods, while effective to an extent, often struggle to capture the non-linear dynamics of energy consumption patterns. Neural networks, with their advanced capabilities in pattern recognition, provide a promising solution, integrating diverse datasets such as weather conditions, household occupancy, and time-of-day data to predict consumption trends accurately.

Results

We analyzed neural network models, revealing that feedforward networks achieved 85% accuracy in predicting daily electricity consumption trends, while recurrent networks (LSTM, GRU) outperformed them with a 92% accuracy rate. Neural networks showed a 20% improvement in forecasting precision compared to traditional methods like ARIMA and regression-based models. A dataset of 10,000 households from a smart grid initiative showed that the LSTM model accurately predicted hourly consumption, enabling utility providers to shift 15% of peak load to off-peak hours, saving $1.2 million annually and reducing greenhouse gas emissions by 8%.

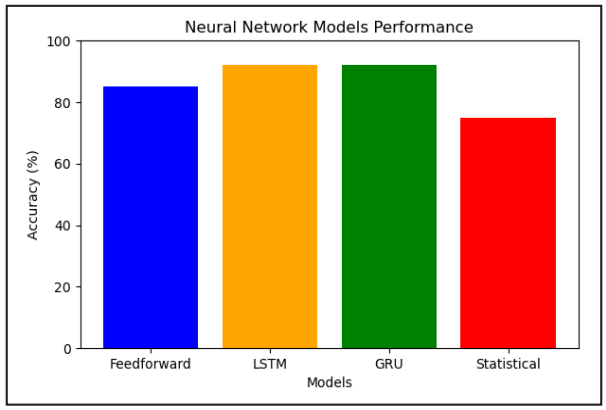

Fig 1: Neural Network Models Performance.

Conclusion

The study highlights the potential of integrating neural networks with material innovations in energy optimization, enabling precise electricity demand forecasts and efficient resource allocation. Advancements in TiO2 and Cu materials offer cost-effective energy savings and harvesting, contributing to a sustainable energy future.

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A Review of the Use of Drones and IoT Technology to Protect Crops from Insects and Enhance Crop Health and Productivity

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***Abstract*—Precision farming is made possible by the combination of drone technology and the Internet of Things (IoT), revolutionizing agricultural management. Multispectral cameras and drones with IoT sensors detect crop stress and insect activity and also provide real-time surveillance. IoT-driven analytics combined with aerial surveys allow targeted interventions, reducing environmental impacts and reliance on broad-spectrum insecticides. Predictive analytics powered by IoT and AI foresees pest outbreaks, optimizing resource use and fostering sustainable practices. This study explores their synergy through case studies, enhancing crop health and productivity.**

Introduction

Modern agriculture has been completely transformed by the introduction of creative solutions to persistent problems brought about by the development of drone technology and the Internet of Things (IoT). Advanced sensor and camera-equipped drones offer accurate, real-time airborne agricultural surveillance, facilitating the early identification of insect activity and crop stress indicators [1]. When combined with Internet of Things devices like weather stations and soil sensors, these technologies give farmers useful information that enables them to make focused fertilization, irrigation, and pest management adjustments. This integration improves resource efficiency, lessens the need for broad-spectrum pesticides, and lowers environmental effects by utilizing predictive analytics and data-driven tactics. This analysis examines how drones and the Internet of Things might work together to protect crops, enhance plant health, and advance sustainable agricultural productivity.

Discussion

Drones and IoT revolutionize agriculture through precise pest monitoring, real-time crop health assessment, and predictive analytics. IoT sensors and drones enable targeted interventions, reducing chemical usage and improving resource efficiency. Despite challenges like high costs and data management, studies highlight significant improvements in crop productivity and sustainability worldwide.

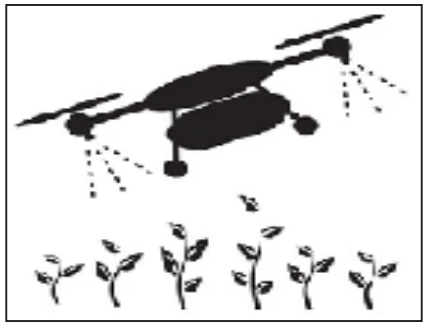

Fig. 1: Utilization of Drones to Protect Crops.

Conclusion

The integration of drone technology and IoT has emerged as a transformative approach in modern agriculture, addressing critical challenges in pest control and crop health management.

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A Survey on the Classification of Node Detection using a Machine Learning Approach

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***Abstract*—Node detection plays a crucial role in various fields such as network analysis of mobile ad-hoc networks and many others. Correct identification of patterns plays a vital role in detecting network anomalies. Machine learning techniques are promising alternatives to reduce the complexity of the node detection and scale of data. The paper provides a detailed overview regarding the comprehensive survey of node detection using a machine learning approach. Various machine learning methods are used such as SVM-based Misbehaviour detection and Trust Management framework for Mobile Ad-Hoc network and many others.**

Introduction

Network topologies used in Mobile ad-hoc networks are considered as dynamic. As a result, MANET faces a wide range of attacks that reduce performance. Nodes are termed as entities such as users, devices, or many others. With the rapid adoption of the latest applications, there is an increase in demand for more effective and adaptive algorithms to identify complicated networks [1-2]. Machine Learning plays a key role in detecting nodes and makes it more scalable and flexible compared to the latest techniques. These approaches can be used to learn patterns from data and adopt network structures. These algorithms are used to tackle a large dataset. Machine learning algorithms such as SVM, Bayesian networks, and many others. These algorithms are used to solve the issues associated with node classification. Recent advancements of ML algorithms make it easier to detect the nodes successfully [3-4]. Machine Learning strategies are used as a powerful tool to improve the performance of node detection. It can easily be used to identify the patterns from data and improve decision making process at a larger rate. Use of advanced algorithms (such as SVM, decision tree and many more) are used to improve the level accuracy of the survey.

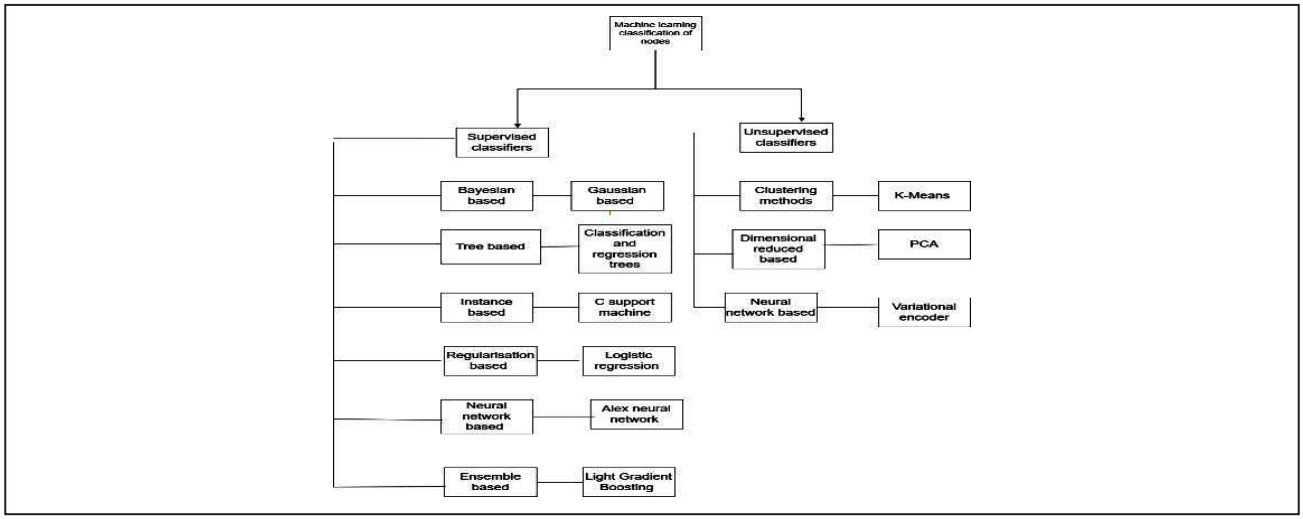

Fig. 1: Classification of Machine Learning based Schemes

Conclusion

The survey on the classification of nodes in machine learning shows significant advancements to the application of the machine learning. Node detection includes identification as well as classification of nodes within a network based on some features. Several machine learning algorithms are implemented for node classification, including supervised and deep learning models. SVM based misbehaviour detection process is used to identify malicious nodes. Fuzzy proximity with Bayesian Classifier increases the complexity of computation because of increase in size of the network.

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Optimizing Platelet Detection: Comparative Analysis of YOLO Algorithms in Automated Medical Diagnostics

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***Abstract*—The necessity for sophisticated diagnostic technology to increase efficiency and accuracy is highlighted by the rise of health automation, particularly in the post-COVID-19 age. Timely medical treatments are delayed by the inconsistency and slowness of traditional platelet detection techniques in blood smear pictures. This study assesses the use of versions 3, 5, 7, and 8 of the YOLO (You Only Look Once) algorithm to improve platelet detection speed and accuracy. These models were trained and refined using a carefully selected dataset, and their accuracy, precision, recall, and computational efficiency were subsequently thoroughly compared. Although it moves a little more slowly than the other versions under study, YOLOv5 showed the highest mean Average Precision (mAP), as well as higher precision and recall, making it the most dependable version for clinical use. slower than YOLOv8's inference times. However, owing of its powerful detection capabilities and fast inference times, YOLOv8 showed exceptional performance in real-time applications. The findings highlight the benefits and drawbacks of the different YOLO versions, indicating that YOLOv5 and YOLOv8 are appropriate instruments for clinical diagnostic platelet detection automation.**

Introduction

Platelets, the smallest and most common blood cells, are crucial for maintaining hemostasis and stopping excessive bleeding. Making clots that seal wounds and prevent blood loss address these challenges by improving platelet recognition in microvascular blood smear images using the YOLO deep learning algorithm, specifically versions 3, 5, 7, and 8. This approach aims to decrease human contact and speed up the diagnosis process in healthcare settings, producing more accurate and timely findings. requires platelets, which are produced in the bone marrow as fragments of megakaryocyte cytoplasm [1,2]. Despite the need of accurate platelet counting, the current methods have numerous shortcomings.

Results

The effectiveness of the YOLOv3, YOLOv5, YOLOv7, and YOLOv8 models in identifying platelets from blood smear images was assessed in this study. Key performance parameters, including as Mean Average Precision (mAP), Precision (P), Recall (R), F1-Score (F1), and inference speed, were used to evaluate the models.

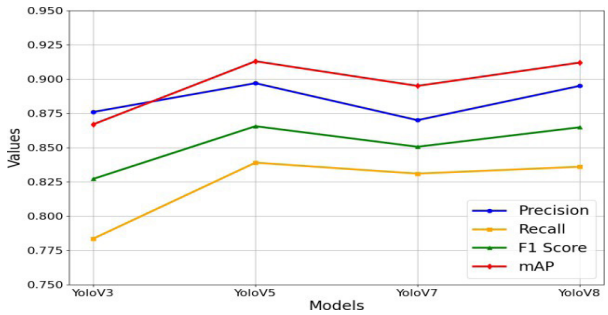

Fig. 1

Conclusion

YOLOv8 provided the fastest inference and was almost as accurate as YOLOv5 (mAP of 0.912), which made it perfect for real-time applications. YOLOv5 and YOLOv8 have a great deal of promise for improving automated platelet detection in clinical diagnostics.

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Geotechnology Applications in Civil Engineering: Innovations in Sustainable Development and Infrastructure Management

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***Abstract*—Geotechnology, an interdisciplinary field bridging geology and technology, plays a pivotal role in advancing civil engineering practices. This study explores the integration of geotechnology in civil engineering, emphasizing its applications in soil stabilization, geospatial mapping, and sustainable construction. The research highlights the use of advanced geotechnical software, remote sensing, and geographic information systems (GIS) to optimize infrastructure development. Key focus areas include earthquake-resistant design, landslide risk assessment, and foundation engineering. By leveraging innovative technologies, geotechnology not only improves the safety and efficiency of construction projects but also supports eco-friendly practices, aligning with the global push towards sustainable urbanization. This work provides insights into the transformative potential of geotechnology in addressing modern civil engineering challenges.**

Introduction

An *interactive indoor mapping* climate is a carefully remade model of an actual indoor space that permits clients to explore and connect with virtual items arranged at similar spatial areas as their true partners. Such conditions act as cutting-edge *user intimacies,* furnishing a natural and consistent connection with a virtual reproduction of this present reality.

Specifically, conditions populated with sensor-empowered objects, framing the supposed *Internet of Things* (lot), track down a viable connection point in intelligent indoor planning frameworks. These frameworks can uphold indoor route by directing clients through courses and permitting connection with objects experienced end route. Also, with headways in client indoor confinement advancements, like GNSS (World- wide Route Satellite Framework), Wi-Fi, Bluetooth, and LTE (Long haul Development), intuitive planning empowers cease- less indoor-open air route by coordinating numerous situating strategies.

The formation of such an intuitive stage requires a nitty gritty and organized portrayal of the indoor climate. This falls under the area of indoor map making, which has developed from fundamental floor intends to cutting edge advanced designs. Organizations like Google have incorporated indoor guides of striking public areas into stages, for example, Google Guides [1].

Related Work

The investigation of cartographic techniques for addressing indoor conditions is different and utilizes a large number of methodologies. These techniques depend on different information sources, and the accuracy of the subsequent models is impacted by the methodology embraced. A few methodologies use mechanized or semi-computerized strategies to handle documents like BIM (Building Data Modeling) [2] and IFC (Industry Establishment Classes) [3], which detail compositional fmmats. Picture handling procedures are likewise utilized to get topological information from floor plan imagery [4]. Then again, some examination rethinks building information and distinct boundaries completely from scratch [5]. Nonetheless, these methodologies face difficulties because of the insufficiencies of their organizations: pictures give restricted data, and computer aided design documents are not advanced for such applications.

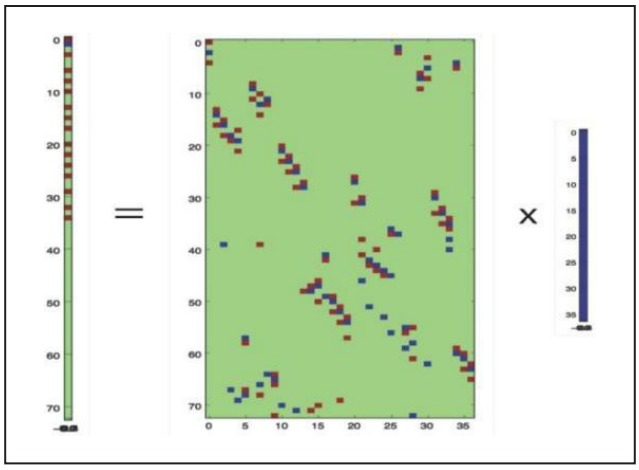

Fig. 1: A Toy Illustration of the LAR Plot: (a) the Absolute Minimum of Information with *Complete* Data about Geography; (b) the Extricated Limit; (c) the Extraction Technique [e] = [8l[f] Gives the Direction Portrayal (in the Discrete Premise of the I- Cells) of the Limit Edges [e] by the Result of the Scanty Limit Administrator Network [8] and the Direction Portrayal [f] of the 2-cells (Faces), in the Discrete Premise of the 2-cells.

The GeoJSON Format

GeoJSON is a JSON-based open norm for encoding geospa- tial information structures, offering adaptability for addressing geographic substances. Dissimilar to exclusive GIS designs, GeoJSON is openly accessible, and its infonnation is ordinar- ily encoded in geological directions (frequently WGS84).

Hierarchical Structure

The HUSON design empowers a various leveled p01trayal of indoor spaces. This design lays out parent-kid connections among substances in the model, reflecting holder contained affiliations.

Case Study

As a contextual investigation for the methodology examined, The upkeep administration work process necessities of Sogei S.p.A. have been considered. This is especially significant as their server farm, one of the biggest in Europe, is represented by tough access control approaches.

The general status of the server farm can be observed by means of the *Supervisor* client.

Conclusions

This paper presents another archive design, HUSON, in- tended for indoor ca1tographical portrayals. By utilizing a neighborhood metric direction framework as opposed to worldwide geological directions, which are much of the time bulky when applied to indoor conditions, the organization fundamentally works on the displaying and delivering of the record content. HIJSON's configuration is focused on a various leveled portrayal of indoor spaces, empowering a total catch of their geography. In view of this portrayal, a virtual web climate can be made, working as a bound together stage for different applications.

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Revolutionizing Geotechnical Simulations: A Novel Framework for Complex Soil Dynamics

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***Abstract*—In soil mechanics, the interaction between the soil and the structures in the saturated state might be quite challenging, due to its poor permeability, a high bulk modulus of permeability, and soft and variable-stiffness properties which govern its plastic flow behavior. Classics time integration techniques often are marred by pressure oscillations and instability processes during rapid loading. Hence, in order to handle these limitations, the work proposes a two-phase contact approach embedded in the Material Point Method (MPM). Utilizing Chorin's projection method, followed by interpreting the soil as a saturated porous medium, minimizes numerical oscillations and permits larger stable time increments. The technique represents a breakthrough in hydro-mechanical soil-structure interaction simulations, increasing speed and accuracy.**

Introduction

Soil-structure interaction (SSI) comprehends deformation and stability, particularly during dynamic events such as earthquakes or moving traffic. The problem of SSI models is large deformation, typically pipe embedment or footing penetration. A powerful remedy is offered by the Material Point Method (MPM), which allows huge displacements to be modeled without mesh distortion, whereas traditional techniques such as finite element analysis (FEM) suffer from mesh distortion under high deflections. This paper presents a semi-implicit MPM scheme intended for enhancing accuracy and stability in SSI simulations.

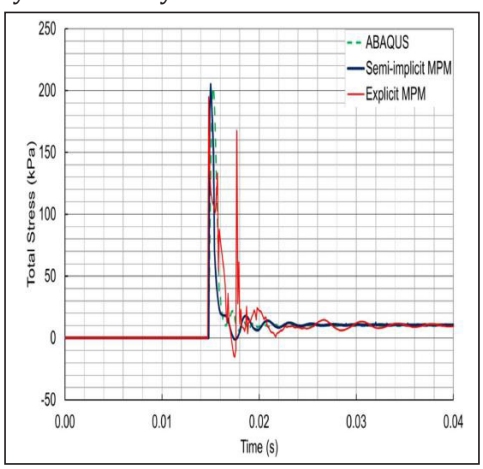

Fig. 1: Comaprison of Total Stresses at the Interface

Results

By strengthening soil dynamics models and tackling issues with stability, accuracy, and massive deformation, a novel framework improves geotechnical simulations.

Conclusion

For soil-structure interaction, we created a semi-implicit two-phase contact algorithm that outperforms explicit techniques in terms of stability, accuracy, and time steps.

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Advanced Geotechnical Simulations using MOOSE Framework: Techniques and Application

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***Abstract*—With an emphasis on transient process modeling, strain and stress estimates, and boundary conditions, this paper provides insight into the application of the MOOSE framework in geotechnical simulations. Mesh interface, geometries management, and building stage simulation have all seen improvements.For efficiency, the project uses methods like using other libraries, especially NEML2, and managing partial input files. The project's main goal is to influence geotechnical design approaches while empowering engineering experts to work on creative projects using parallel computing in MOOSE.**

Introduction

In geotechnical engineering, the finite element modeling (FEM) forms the basis for accurate deformation predictions, failure analyses, and complex construction simulations. Numerical simulations are thus imperative in slope stability, soil-structure interaction, and ground improvement questions. The MOOSE (Multiphysics Object Oriented Simulation Environment) framework is long known for massively parallel computation, and solving connected multiphysics issues. This study looks into such recent developments in MOOSE as subdomain-based management and external library integration to better capture material behaviors and building stages in geotechnical modeling.

Results

Through the resolution of related multiphysics problems, enhanced modeling of material behavior, construction stage simulation, and improved computational efficiency, the MOOSE framework enables complex geotechnical simulations.

Conclusion

The MOOSE framework enables significant improvements in geotechnical simulations, promotes infrastructure development, enhances material behavior modeling accuracy, and provides practical solutions for difficult problems.

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Rain Prediction System in Andaman and Nicobar Islands to North-East India using SARIMA Model

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***Abstract*—With implications for agriculture, hydrology, water management, and disaster preparedness and response, rainfall prediction is an essential part of modern weather forecasting. Rainfall forecasting has always relied on historical data and meteorological measurements. Predicting the amount of daily rainfall improves agricultural productivity and secures food and water supply to keep citizens healthy. To predict the ensemble data, predict the location range of data prediction of various datasets, which enables the production of the result consisting of various parameters. Because north western monsoon comes from Andaman and Nicobar Islands, it results in different directions. Then, different obligatory data sources can be in different times and conditions. Basically, the sources can be manifested from different longitude and latitude of different fringes of different states of India.**

Introduction

Almost all influences, whether or not they can be identified independently, are taken into consideration in the empirical models. The primary advantage of these models is this. Nevertheless, these models' correctness is dependent on the precision of the measurements, the statistical approach taken to create the empirical model, and the resemblance between the conditions under which the rain attenuation is measured and those under which the measurements are conducted [1]. Since the deterministic models are grounded in physics, their correctness remains unaffected by variations in application. However, to execute them, a large database of radio meteorological features including atmospheric temperature, pressure, etc; which are all practically hard to measure. The application of deterministic models is therefore typically limited to the specific region, where radio meteorological data may be accessible [2]. At present, Rainfall decline prediction are mainly divided into long-term statistical model and short-term dynamic prediction model. Long-term statistical model is difficult to accurately predict short-term (one minute below) rainfall decline, and its practicability and guidance are not very strong. Various models for short-term dynamic forecasting contain different constant parameters, some of which can only provide statistical characteristics of rain decay time series [3]. As a result, applying the statistical features acquired by employing constant parameters and particular rain attenuation series samples to the dynamic adaptive rain attenuation technology is challenging [4]. Rainfall is a natural phenomenon defined as the outcome of interaction between several complex atmospheric processes.

Methodology

Loading and Subset Selection

(a) First, we need an accurate Data source - The data file of rainfall in India from 1901-2015.csv holds the accurate rainfall data from different subdivisions of India, which are averaged yearly as well as seasonally.

(b) Second is Subset selection – The data collected from the data file of India were filtered to narrow it down to one subdivision, specifically focusing on ANDAMAN & NICOBAR ISLANDS to be deeply- analyzed according to our project.

Cleaning and Pre-processing

(a) First the irrelevant columns are deleted like Annual, Jan-Feb, Mar-May, Jun-Sep, Oct-Dec as the problem statement is based mainly on a monthly prediction.

(b) Second, we made the year a date/time object for our convenience (easier time series).

Results

Using auto-regressive models we capture the relationship between an observation and several logged observations. The core idea is that the current value of a time series can be expressed as a linear combination of its past values,with some random noise. Mathematically, an auto-regressive model of order p, denoted

$$Xt = c+\phi 1Xt-1+\phi 2Xt-2+...+\phi pXt-p+\varepsilon t$$

Thus, the result comes of the following parametres.

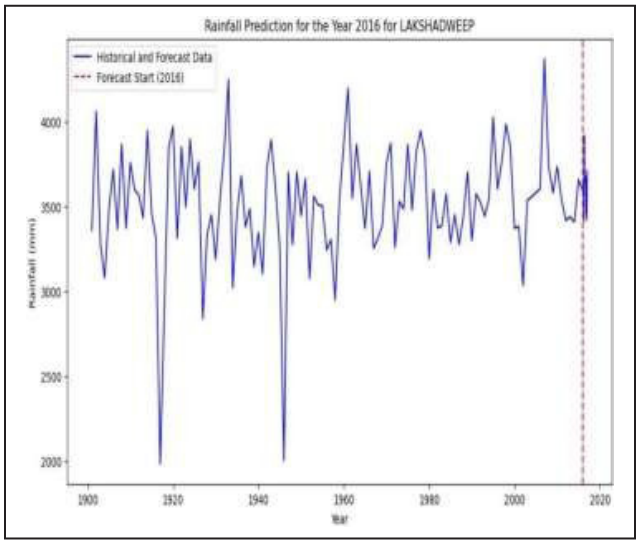

Fig. 1: Area Near Lakshadweep

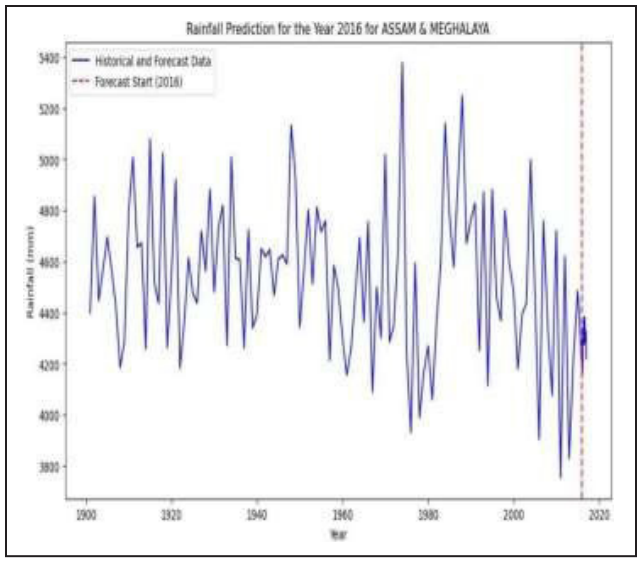

Fig. 2: Area of Assam and Meghalaya

Conclusion

The study delves into the intricate dynamics of rainfall prediction through meticulous examination of machine learning models, including the SARIMA model, the resulting nature, feasible towards the results of feasible nature crossing the correlation of historic and forecast data, forecast data using resultant of phased of different parameters.

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Mitigating Social Engineering Threats: A Behavioural-Centric Framework for Enhanced Organizational Security

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***Abstract*—Social engineering attacks circumvent technology protections by exploiting human psychology, which is trusting, time-sensitive, and prejudiced toward authority. In order to assess network influence and individual sensitivity, this research suggests a behaviorally-driven approach that integrates SNA and psychological testing. Fundamentally, the BRP algorithm uses behavioral and network characteristics to identify high-risk individuals. By offering specialized training, updating policies, and more sophisticated monitoring systems, this framework offers a collection of action measures that can help decrease an organization's risks. This architecture, which addresses human behavior as a crucial security component, enables a proactive and flexible defense against the always changing social engineering threat field.**

Introduction

Social engineering uses tactics like phishing, luring, and pretexting to get past users' technology barriers by taking advantage of human weaknesses including trust, urgency, and authority biases [1]. Despite the advancements in technology security measures, human conduct continues to be a critical vulnerability [2]. This study proposes a behaviorally-driven methodology for analyzing an individual's network influence and vulnerability that combines SNA with psychological evaluation. The BRP algorithm calculates a risk rating that permits targeted actions, such as policy revisions, training, and monitoring.

Results

The suggested Behavioral-Driven Framework (Fig. 1) that combines behavioral insights with Social Network Analysis (SNA). By combining behavioral characteristics (trust, urgency, and authority bias) with centrality metrics (degree, betweenness, and closeness), it employs the Behavioral Risk Prediction (BRP) method to determine an individual's Risk Index (RI). Comprehensive risk profiles will be produced using information gathered from organizational surveys and simulated phishing attacks. This strategy will provide monitoring-based interventions, policy changes, and targeted training to the high-risk users that have been identified. According to preliminary modeling, phishing success rates can be decreased by 40%, organizational security can be improved, and a culture that is resistant to social engineering risks can be developed.

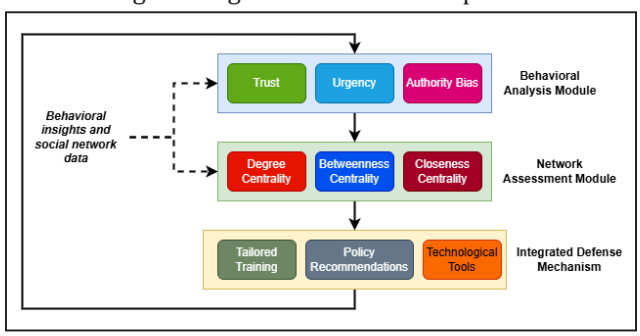

Fig. 1: Proposed Framework

Conclusion

The Framework integrates behavioral insights with SNA and BRP algorithm to prioritize high-risk individuals for targeted interventions, enhancing organizational resilience against social engineering.

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AI and 6G Security: Opportunities and Challenges

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***Abstract*—Future needed an automated independent network which has manage network intelligently and proactive threat detection. Intelligently manage the network components of the 6G network is a crucial work. Therefore, machine learning and artificial intelligence play big role in the 6G paradigm. However, the alliance between 6G and AI may also be a double-edged sword in many cases as AI's applicability for protecting or infringing security and privacy. As a result, this paper has detailed focus on the ongoing projects based on 6G and factors that make 6G technology necessary. The role of ZT architecture is discussed in detail, use of AIML in 6G, Various application areas and challenges associated in 6G has been mentioned in this paper**

Introduction

The 6G communication era imagines how people would engage with the digital virtual worlds beyond, as the digital transformation anticipated with 5G networks has already started and is still developing this decade. To solve the communication and networking issues beyond 2030, future networks must have cutting-edge technologies that allow digital virtual worlds with connected intelligence. Literature predicts new application fields for 6G systems, including wireless Brain-Computer Interactions (BCI), Connected Robotics and Autonomous Systems (CRAS), and multimodal extended reality (XR) applications, even though traditional uses like multimedia streaming would continue. The development of 6G application domains necessitates a novel network architecture that goes beyond existing network designs. Four main interworking components make up Nokia Bell Labs' open and distributed reference architecture for 6G architectural building blocks. A heterogeneous cloud environment known as the "het-cloud" makes it simpler to develop, deploy, and scale dynamic cloud applications. "RAN-core convergence" refers to the extension of the 5G core network service-based architecture to the Radio Access Network (RAN).

Even smaller "sub-networks" such as in-body networks will emerge, which generally operate in a standalone fashion while benefiting from the wide area network. 6G will transform wireless networks from "connected things" to "connected intelligence," transforming network softwarization. Pervasive AI services are necessary for distributed heterogeneous networks to meet 6G objectives. Big data analytics for 6G, closed-loop network optimization, and intelligent wireless communications all highlight the application of AI in various 6G network domains.

Security Threat Landscape of 6G

The security concerns with 6G networks are discussed in this section. The security flaws carried over from 5G to 6G are explained by pre-6G security. Also covered in this section are security concerns that from 6G's innovative technologies and architectural modifications.

Pre-6G Security

6G systems can still use network softwarization technologies from 5G, such as Software-Defined Networking (SDN), Network Function Virtualization (NFV), Multi-access Edge Computing (MEC), and network slicing. 6G will transform wireless networks from "connected things" to "connected intelligence," transforming network softwarization. Pervasive AI services are necessary for distributed heterogeneous networks to meet 6G objectives.

AI For Security and Privacy in 6G

AI plays a place in 6G systems by providing intelligent security and privacy. The applications of AI in pre-6G

security, 6G architecture security, 6G technology security, and 6G privacy are covered in this section. AI's function as a 6G application defender is depicted in Figure 3.

Use of AI to Identify/Mitigate Pre-6G Security Issues

In networks supported by SDN/NFV, multilayered intrusion detection and prevention utilizing deep reinforcement learning and Deep Neural Networks (DNN) is feasible [18]. Compared to a number of traditional techniques, they successfully protect against IP spoofing, flow table overloading, DDoS, control plane saturation, and host location hijacking attacks.

Issues and Counter-Measures

AI presents ethical, privacy, and security concerns despite its significance in 6G systems. Furthermore, AI may be used as a tool to initiate clever attacks. The ethical, security, and privacy concerns with AI are discussed in this section along with possible solutions.

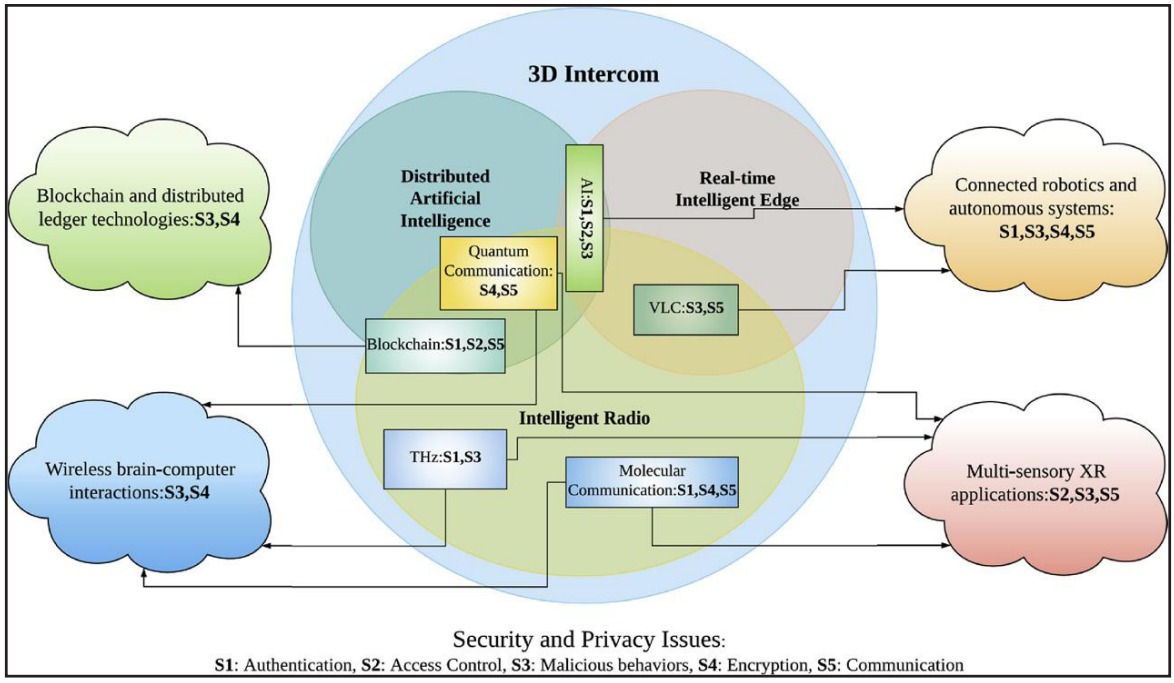

Fig. 3

AI's function as a 6G application defender is further demonstrated in Figure 3.

Security Issues in AI

Issues: Through AI-enabled features, particularly with ML systems that are vulnerable to security risks, 6G achieves linked intelligence. Poisoning attacks affect an ML system's learning phase, causing the model to learn incorrectly. Poisoning attacks include, for instance, data modification, data injection, and logic corruption.

Conclusions

The next generation 6G mobile networks are largely made possible by AI, and achieving the 6G vision requires careful consideration of security. 6G security with AI capabilities offers strong, intelligent security solutions. An overview of the many benefits and difficulties of having intelligent security and privacy features as part of AI's function in 6G systems is given in this study.

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Detection of Malicious Intention using Gaussian Naïve Bayes Classifier about Drones in Flying Ad-Hoc Network

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***Abstract*—Flying Ad-Hoc Network (FANET) is a technology-based network used in different networks and mostly with the wireless area network. Ad-Hoc networks are mostly used in the wireless LANs. Communication between one node to another is also termed as not secured. There is no such authorised protocol for secured communication. Therefore, an algorithm is used to identify malicious node within a network. This paper produces an effective approach named as Gaussian Naive Bayes Classifiers for detecting malicious nodes in FANET. It highlights the real time intrusion detection for calculating accuracy.**

Introduction

Rapid Technological Evolution has led to the development of several innovative devices such as UAV or known as drones. FANET is different from the existing networks to maintain quality of services, data delivery and many others. There are three main types of Ad-Hoc network such as Multi-Group Ad-Hoc Network, Multi-Group UAV Ad-Hoc network and many others. One of the most important concern regarding FANET is the detection of malicious nodes. UAV is insecure regarding variety of attacks for the detection of malicious nodes. Malicious nodes can easily disrupt the functions of the network by delivering fraudulent information [1]. The main objective of this research work is to identify the models of supervised learning model to identify fraudulent behaviour. This paper focuses on the use of the supervised learning algorithms on Mobile Ad-Hoc network to detect the fraudulent nodes in MANET. It is highly possible to create robust as well as scalable solution to identify threats in real time basis.

Proposed work

The fig. 1 shows the flow of Gaussian Naïve Bayes algorithm for detecting the malicious nodes in FANET. The start symbol indicates that the process is initiated. Packet Delivery Ratio is the first step to calculate the success of the data within a specified network. A low ratio might highlight regarding the malicious activities inside the network.

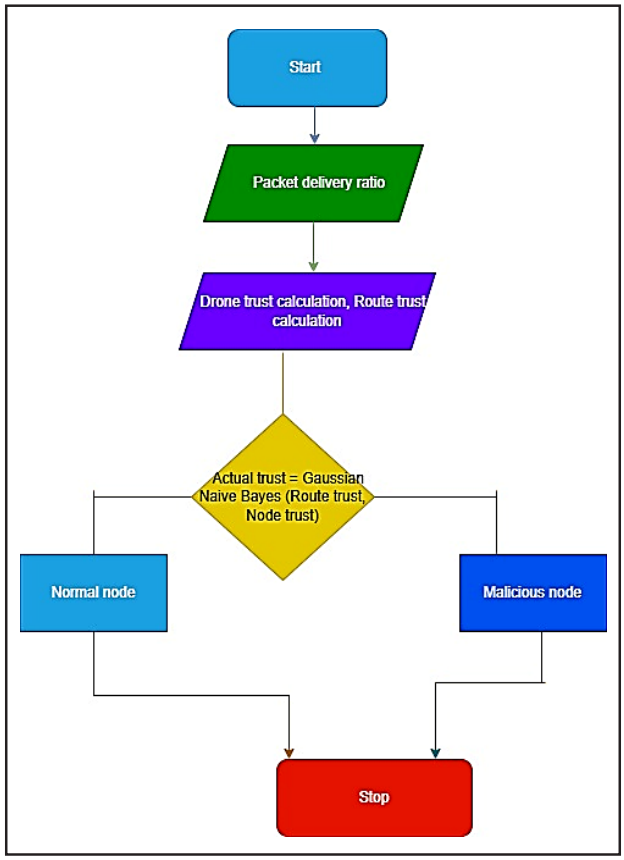

Fig. 1: Flow of Gaussian Naïve Bayes Algorithm

Conclusion

FANET is considered as one of the fastest growing technologies and there is no standard protocol to maintain the security feature. The research work compares regarding the accuracy and trust score of the drones.

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Detection of Malicious Intention Using a Light Gradient Boosting in Flying Ad-hoc Network

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***Abstract*—This paper highlights the node detection algorithm by implementing the Light Gradient Boosting algorithm. Identifying fraudulent networks can be crucial for different types of applications. The LightGBM model is trained effectively on the features extracted from the networks. It includes the degree of the nodes, centrality structures, and several clustering coefficients. The model's performance is calculated using several datasets highlighting diverse data types. The result highlights the competitive performance to detect the accuracy as well as improving computational effectiveness. The paper highlights the effectiveness and accuracy of the LightGBM algorithm to detect malicious nodes for a wide range of applications.**

Introduction

Innovative devices have been developed using latest technology solutions to improve the quality of data transmission as well as services in Ad-Hoc networks. FANET can be categorised based on several topologies and identify malevolent nodes. It provides reliable as well as scalable solution to identify real time threat. This research provides to evaluate the supervised learning to identify fraudulent activities in MANET.

Results

The comparison of accuracy of drones and trust scores is in the below mentioned image.

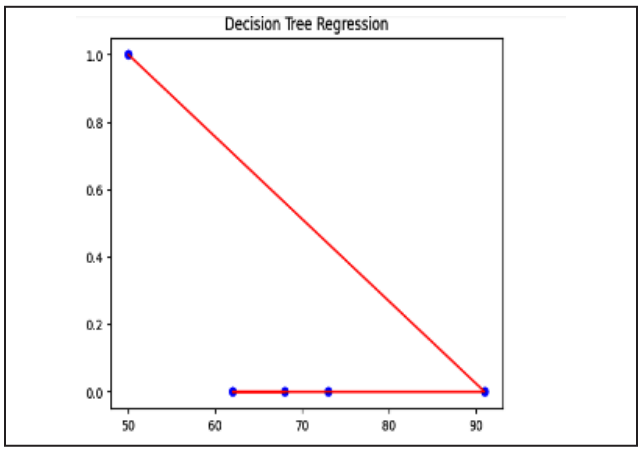

Fig. 1: Decision Tree Regression

The decision tree regression is used to calculate the accuracy and trust scores. The X-axis of the graph represents the input feature or the independent variables. The value range is approximately between 50 to 90. The value of Y-axis is ranging from 0 to 1.0. The blue dots of the image represent the actual data points or observations. Several clusters are available between 62 and 92 in this decision tree regression. This analysis is used to classify the drones having low trust scores. It is also termed as fake nodes in FANET. The nodes are situated in the high accuracy zone in the MANET. It shows the accuracy level of the nodes in the FANET. In this analysis, malicious drones get high accuracy score which in turn improves the classification rate. The above graph depicts the performance of classifier and distinguishes between the trust ratings. It shows the high level of effectiveness in the trust score.

Light Gradient Boosting is a method used in FANET to differentiate between real as well as non-co-operative nodes. The data can easily be normalised by implementing various input parameters such as transmitted, received and routed packets. It helps to extract the accurate features from the model. The model is used to perform the classification of nodes based on the predictions. The model is perfect for real world applications of FANET because of its high precision and accuracy.

The study is focused on the identification of the fraudulent nodes in FANET networks using Light Gradient Boosting algorithm. The classifier is used to evaluate the total amount of packets transmitted,

received nodes and potential routes. The study proposes the accuracy level of drones and trust ratings. It can also be used to increase the resilience power of the drone networks.

References

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Industrial AI: Transforming Modern Industries through Innovation and Intelligence

Arnab Maity[1], Sayan Samanta[2], Subir Sardar[3], Sayon Dey[4], Nityanando Mahato[5], Gourab Chakraborty[6]

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***Abstract*—The emergence of Industrial Artificial Intelligence has revolutionized the industrial scenario by bringing forth advanced technologies that blend with the traditional processes. This paper covers the foundational elements of Industrial AI, such as its key components, ecosystem, and challenges. A case study in detail reflects its transformative effect on certain industries, which underscores real-world applications. This massive potential for Industrial AI goes along with tough challenges, from security of the data to systems' integration as well as moral implications. From here, an effort is put together in a roadmap for a feasible and sustainable approach to industrial AI.**

Introduction

Industrial AI represents the confluence of artificial intelligence with industrial processes, increasing efficiency, accuracy, and innovation [1]. Unlike the more general applications of generic AI, Industrial AI is targeted for industry-specific problems that exploit massive datasets through connected systems. This idea brings IoT, machine learning, and data analytics to make things possible in terms of predictive maintenance, smart manufacturing, and real-time decision-making. The proliferation of IoT devices has expanded Industrial AI's scope, enabling seamless communication between machines and systems. Industry 4.0 focuses on developing more digital systems and integrating networks through smart systems. Smart systems would make it possible to replace humans in some duties and improve the working environment through Industry 4.0. Humanity was freed from animal power by earlier industrial revolutions, which also enabled mass production and gave billions of people access to digital capabilities [4].

Result

Analytics technology, big data, cloud, and cyber technologies are the drivers of industrial AI. These help in optimizing operations, improving efficiency, and reducing downtime. The core elements are domain know-how and evidence, which shape the transformation in Industry 4.0. Challenges arise in terms of data quality, scalability, real-time processing, and cybersecurity, but AI-human collaboration accelerates innovation in smart manufacturing.

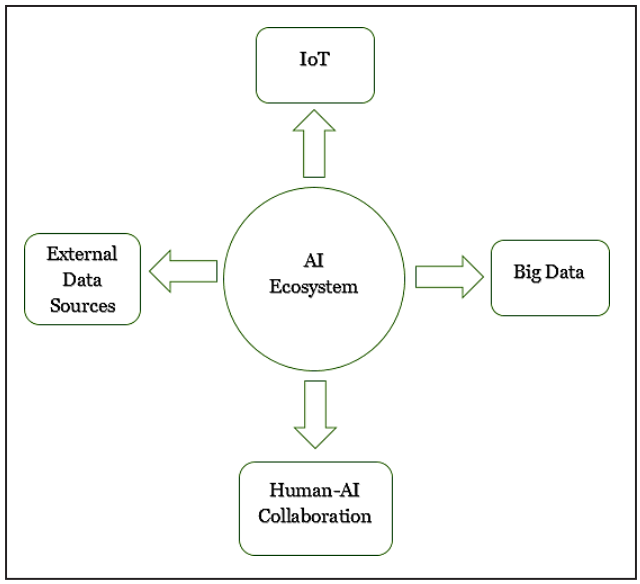

Fig. 1: Industrial Key Elements

Conclusion

The future of Industrial AI lies in collaborative innovation: businesses, researchers, and policymakers working together to address these challenges while ensuring that the solutions are ethical and sustainable. AI can be fully unleashed to not only optimize industrial operation but also help industries make resource efficiency and environmental sustainability goals. Industrial AI is actually the foundation of Industry 4.0, which will make way for intelligent manufacturing, dynamic decision-making, and resilient industrial ecosystems in an unprecedented manner.

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Artificial Intelligence for Smart Waste Management Algorithm in Cities: A Comprehensive Review

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***Abstract*—There is a need for innovative solutions toward achieving sustainable waste management with rising global waste production due to the growth in cities, increase in population, and economic development. AI technologies streamline integration with machine learning, robotics, and sensor-based systems to sort waste with the help of technology, predictive modelling, routing optimization, and conversion into energy produced from waste. All of these developments are said to help reduce operational costs, enhance environmental sustainability, and improve public health outcomes. It helps optimize chemical analysis processes involving pyrolysis and biogas production for circular economy purposes. More importantly, AI solutions help deal with illegal dumping, inefficient logistics, and the problem of hazardous waste management.**

Introduction

In recent years municipal solid waste management will generate 2.6 billion tonnes annually by 2030 for rapid urbanization, population growth, and economic development globally. According to the World Bank global annual waste generation is expected to jump to 3.4 billion tonnes over the next 30 years which is a 70 % growth in waste generation. Artificial Intelligence (AI) plays a crucial role in waste management for enhancing efficiency, reducing costs, and promoting sustainability.

This study is divided into five sections. The first section presents the difference between traditional waste management processes and artificial intelligence (AI) approaches. The second section outlines Key Technologies in AI-driven Waste Management. The third section discusses a comparative analysis of the aforementioned technologies. The fourth section presents and analyzes the practical implementations.

Results

- AI-powered waste sorting improves recycling efficiency by identifying materials accurately.
- IoT-enabled smart bins optimize collection schedules, reducing emissions and operational costs.
- Sensor-based tracking systems monitor waste levels and environmental conditions for better decision-making.

Fig. 1: Use of Artificial Intelligence for Smart Waste Management

Conclusion

AI revolutionizes waste management by improving efficiency, reducing environmental impact, and optimizing logistics. Future research should refine AI algorithms, address biases, and integrate AI-driven waste management systems for a sustainable, zero-waste future.

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Reversible Gate Matrix Representation

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***Abstract*—The literature in the fast-growing topic of quantum computing is quite extensive. The area of study comprises creating circuits using reversible gates and calculating outer products for calculating matrix with quantum computing concepts. The main concern of this research is the matrices over quantum reversible gates. These matrices are then compatible with K-Map to create quantum circuits. Additionally, this paper presents the essential concepts of quantum technology as well as the previous development of quantum algorithms. Also use mitigation to reduce clamour from the produce. In essence, it blends practical methodologies with theoretical insights to cv advance the field of quantum computing.**

Introduction

Metal in the 20th century, quantum theory arisen as one of the greatest scientific achievements, providing a framework for modern physical theories. Over 50 years later, it combined with computer science to create quantum computation. Unlike classical computers, quantum computers may occur in numerous states at once and can produce interference effects. Quantum algorithms aim to get solution of problems significantly and efficiently than classical ones, leading to substantial interest in quantum computation and the development of many quantum algorithms for various computational problems.

Basic Concepts in Quantum Computation

A classical bit, which is fundamental to traditional computing and information, can be either 0 or 1. In contrast, quantum computing relies on quantum bits (Qubits). Instead of just 0 or 1, a Qubit can also exist in superpositions of these states, represented as $|0\rangle$, $|1\rangle$, or any linear combination of both. Classical computers use electrical circuits with wires and logic gates, Basic quantum circuits with imperative quantum gates and wires are utilized in quantum computers.

Quantum Gates in Matrix Form

The matrix form presentation of Quantum reversible gate

$\Sigma_i |input_i> <output_i|$

Quantum NOT Gate in the Matrix Form

It changes the sign of |1 > to - |1 > while preserving |0 > unaffected. The consequence is |0 > for |0 > input and -|1 > for |1 > input. Matrix Form: - = |0 >< 1| + |1 >< 0|

$= [^{1}] [0\ 1] + [^{0}] [1\ 0]$

$0 \qquad 1$

$= [0\ 1] + [0\ 0]$

$0\ 0 \qquad 1\ 0$

$= [0\ 1]$

$1\ 0$

CNOT in the Matrix Form

$C_{not} = \Sigma\ |input><output|$

$= |00 >< 00| + |01 >< 01| + |10 >< 11| + |11 >< 10|$

$1 \qquad 0 \qquad 0$

SWAP Gate

Two qubits' states are toggled by the SWAP gate. A trio CNOT gates can be used to implement it, and it is essential for several quantum algorithms. Here's a quick breakdown:

Conclusion

The paper delves into the early development and challenges in the field of quantum computation. It covers the fundamentals of quantum computation and provides detailed analysis of various quantum gates, represented in matrix form. These matrices aid in constructing quantum circuits. It aims to be a valuable resource for beginners researching quantum computation models.

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Parametric Fault Diagnosis in Analog Circuits: A Combined Approach of Machine Learning and Functional Testing

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***Abstract*—Fault diagnosis in analog circuits is a challenging task in mixed signal integrated circuits design. This paper proposes a combined approach of machine learning and functional testing for addressing parametric fault diagnosis in analog circuits. A two stage OPAMP is considered as the test circuit for the validation of the proposed technique.**

Introduction

Analog circuit fault diagnosis is a complex task and of prime importance in today's IC industry [1]. Two types of faults are observed in analog circuits, catastrophic (hard) faults and parametric (soft) faults.

Catastrophic faults are relatively easier to be detected since a circuit with catastrophic faults trends to malfunction. On the other hand, parametric fault (defined as the deviation of performance/functional parameters caused by deviation of process parameters) are much harder to be detected. The circuit is identified as faulty when the performance parameters are found (by functional testing) out of bound of the tolerance window specified for particular application. Since parametric faults in analog circuits are quantified according to the application of the circuit, functional testing is always preferred. However, estimation of performance/functional parameters of analog circuits require costly equipment and long time. In search of alternative test techniques to reduce the test cost and time, a number of researchers showed the use of machine learning for fault diagnosis in analog circuits [2]. However, very few attempts are made in the field of machine learning based analog circuit fault diagnosis considering functional parameter as test metric.

Results

This work proposes a technique of fault diagnosis in analog circuits based on the combination of functional testing and machine learning. Training data sets are constructed by Monte Carlo analysis (i.e. variation of outputs of the circuits as a function of process parameters). The dimensionality of the data set is reduced by Principal component analysis (PCA) and finally parametric faults are classified by SVM. The proposed method is validated with a two stage OPAMP consisting 8 MOSFET (4 NMOS and 4 PMOS). The diagnosis accuracy is found 98.81%.

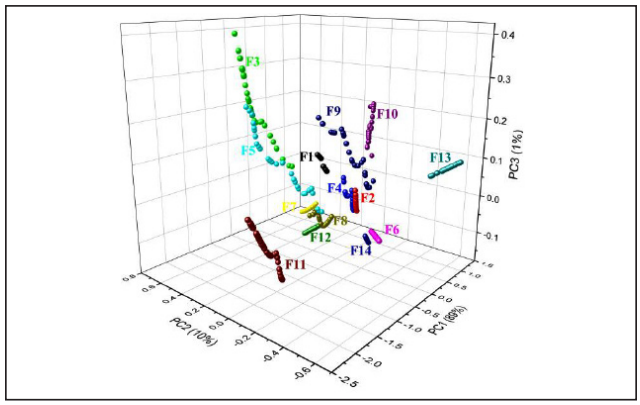

Fig. 2: Projection of Faulty Circuit Instances of OPAMP on the Three Principal Components

Conclusion

The diagnosis accuracy and time is comparable to the recently proposed works as well as meet the industry standards. The fault clusters are clearly separable in principal component space. The proposed method not only follows a generalized approach but also is insensitive to measurement noise or equipment drift.

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Exploring the Requirements of Data for Bengali Speakers Recognition: A Comparative Analysis with English

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***Abstract*—This study explores data requirements for training speaker recognition models in under-resourced Indo-Aryan languages like Bengali. Due to the scarcity of large-scale datasets, a d-vector speaker verification model, initially pre-trained in English, is fine-tuned with Bengali data. Performance is evaluated using Equal Error Rate (EER) and Detection Cost Function (DCF), comparing models trained from scratch with fine-tuned ones. Fine-tuning with Bengali data, equivalent to 39% of the English dataset, achieved an EER of 3.76%, closely matching the English-trained model. Results highlight the effectiveness of transfer learning in speaker recognition for low- resource languages.**

Introduction

Speaker Recognition (SR) is a vital research area in speech technology, widely applied in forensics, AI assistants, and biometric security. It also enables speaker embeddings used in Speaker Diarization, Voice Conversion, and Text-To-Speech systems. SR consists of two main tasks: Speaker Identification, which matches a voice to known speakers, and Speaker Verification, which confirms a claimed identity.

Most SR models are trained on English datasets, requiring extensive speech corpora with thousands of speakers. This poses challenges for under-resourced languages. Transfer Learning [1] can help adapt pre-trained models to new languages, but the required data quantity remains an open question. This study explores adapting d-vector models for Bengali, a major Indo-Aryan language spoken by over a billion people.

Key research questions include whether a model can function in an unseen language, whether training from scratch is preferable, and how data size affects adaptation. Through experiments, this paper assesses Transfer Learning's effectiveness in achieving an Equal Error Rate (EER) comparable to English- trained models. The following sections discuss SR [2] models, training methodologies, experimental details, and results.

Results

The model was trained by varying the number of speakers and the total training duration and was evaluated on a test set of 44 speakers (22 male, 22 female). This dataset was created using audio extracted from YouTube. Performance was measured using the Equal Error Rate (EER) and the Detection Cost Function (DCF) at target probabilities of 0.01 and 0.001.

The model was also trained on the full dataset (370 hours, 850 speakers), achieving an EER of 4.35% when trained from scratch and 4.10% when fine- tuned from an English-trained model. Results show that increasing both speakers and training hours improves performance, though the impact of speaker count is less significant with limited data (e.g., 5h or 25h). Contrary to expectations, adapting an English model to Bengali required less data than assumed, possibly due to differences in speech rate and syllable structures rather than phoneme count.

Conclusion

This study explored d-vector model adaptation for Hindi speaker verification. Fine-tuning an English-trained model with 125 hours of Bengali data (800 speakers) achieved an EER of 4.35%, closely matching English model performance. Increasing data improved

results more than increasing speakers, highlighting transfer learning's effectiveness for under-resourced languages.

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Machine Learning in Electrochemical Micromachining for Precision Machining with Multi-Frequency Modulation

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***Abstract*—Electrochemical micromachining (ECMM) is essential in fabricating and structuring miniaturized components for applications like MEMS production, surgical instruments, and cooling channels. Challenges such as oxide layers, gas bubbles, and sludge hinder anodic dissolution. A novel step pulse waveform with multi-frequency modulation addresses these by limiting bubble formation and sludge in stagnant electrolytes. Machine learning (ML) aids in predicting machining outcomes, optimizing parameters. Experiments identified an optimal 100 Hz and 12 kHz combination, achieving precision micro-cooling channels with a 9.653 µm overcut, 78.25 µm depth, 90.364° corner angle, 12.509° taper angle, and 0.0713 µm surface roughness. This technique simplifies ECMM processes effectively.**

Introduction

Electrochemical micromachining (ECMM), based on ionic-level material removal using voltage and electrolyte, offers advantages such as reduced stress, tool wear, and thermal effects, leading to enhanced machining accuracy and surface finish. Studies on pulse waveforms—sinusoidal, parabolic, and triangular—reveal their influence on machining precision [1]. Ultra-short voltage pulses increase anodic dissolution rates, enabling the fabrication of microtools and precise microholes [2]. A pulse power supply for generating these pulses, coupled with a positive feedback control loop in the electrical circuit, improves the time constant, enhancing accuracy [3].

A novel step pulse waveform (SPWMF) multi-frequency modulation technique simplifies anodic dissolution, replacing complex setups. This research investigates frequency effects and voltage influences for precise microchannel fabrication.

Additionally, this study integrates ML into ECMM to model parameter-performance relationships before conducting experiments.

Results

The dataset was split 80-20 into training and testing sets, and a Decision Tree Regressor with a maximum depth of 4 was trained to balance complexity and interpretability. This process helps identify the optimal parametric combination for experiments. L-shaped micro-coolingchannels fabricated at 7V achieved improved machining accuracy, with a uniform edge, 9.653 µm overcut, 12.509° taper angle, 90.364° corner angle, and 0.0713 µm surface roughness. SEM and 3D analyses confirmed smooth, precise, high-quality features.

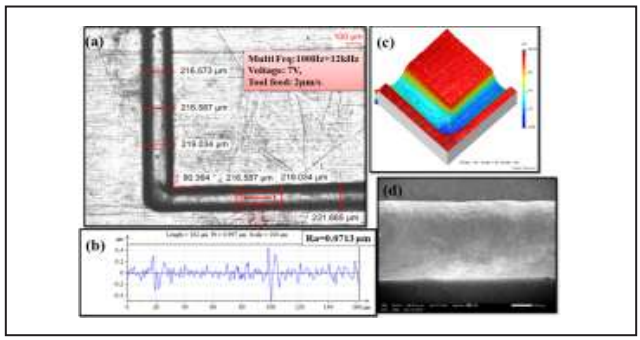

Fig 1: Machined L-shape Microchannel at 7V (a), Surface Roughness Profile (b), 3D Image of Microchannel (c), SEM Image of Micrograph (d)

Conclusion

The SPWMF technique effectively eliminates large gas bubbles in narrow machining gaps, enabling precision micro-component fabrication. It offers a cost-effective alternative to complex flushing systems and high-frequency power supplies in ECMM.

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Sustainable LLM Deployment: Local Inference of Generative Chatbots on WebGPU

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***Abstract*—For generative chatbots, many companies utilize either large-scale LLM API services or deploy resource-hogging LLMs on backend servers, incurring high operational costs and energy consumption and raising sustainability concerns. In this paper, we propose a cutting-edge architecture using the WebGPU API for local AI model inference on user devices. The computation is thus moved from centralized servers to the local GPUs in devices. This promotes chatbots' efficiency while cutting down on the carbon footprint of the server-based processing and encourages environmentally friendly practices. Thereby, our work will lead to innovative avenues in the sustainable realm of AI applications while still being able to push generative capabilities.**

Introduction

Traditionally, companies have deployed decision tree-based or simple NLP chatbots for personalized customer support, guiding users along predefined paths or very simple queries. Yet, such systems are often unable to go on with complexity in serving client needs. Recent advances in large language models (LLMs) improve customer interactions by enabling context-aware responses and supporting multiple languages. By using technologies like Retrieval-Augmented Generation (RAG), LLMs access relevant documents in runtime through document retrieval, thus leading to improved quality of answers. While there are considerable advantages to employing LLMs, they do consume great resources and thus can be costly and energy-consuming. This paper proposes yet another architecture that uses WebGPU and runs the optimized models entirely on user devices as a step toward sustainability and reduced ecological footprint.

Results

Our analysis indicates that running large language models on user devices uses less power than on centralized servers. This is due to the thermal design power (TDP) differences, with mobile devices using between 25 watts and 150 watts, while server hardware often exceeds 200 watts, resulting in significantly higher energy consumption to operate remotely.

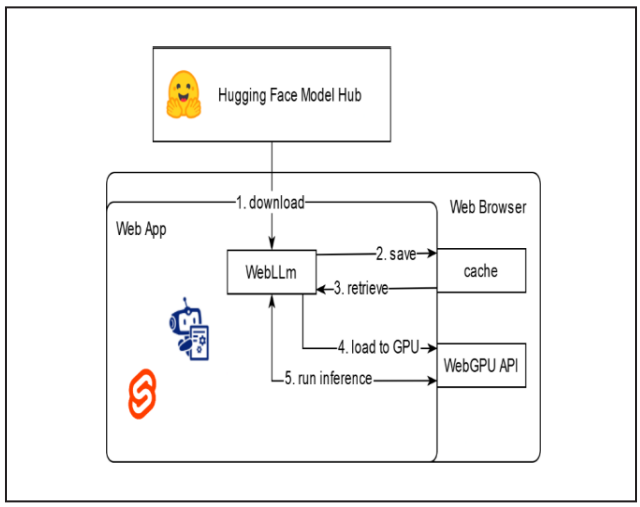

Fig. 1

Conclusion

In conclusion, our research highlights the importance of balancing performance, efficiency, and sustainability in the deployment of conversational AI, paving the way for more responsible and effective implementations in the future.

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Lifespan Prediction using Large Population of Spiking Neurons

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***Abstract*—Recent research in lifespan prediction using spiking neural model shows that it performs Bayesian inference closer to human prediction. However, it does not go in consonance with several claims that the Bayesian framework adequately captures human behavior. Second human prediction is subjective and varies with the demographical data. Therefore, in this paper, we investigate a large scale neural population model of neurally plausible Bayesian computation to predict the lifespan inference and its feasibility to ideal Bayesian computations by using Neural Engineering Framework (NEF). Through this approach, we also investigate the optimality of Bayesian computations in the brain by analyzing the posterior probability. We conducted experiments by increasing the number of neurons in the existing spiking neuron model as well as at various levels of Bayesian network. Our findings from the experimental results suggest that as we increase the number of neurons, the neural predictions match the ideal Bayesian computations. This also provide us a key to further explore how these computations are performed in the human brain with other complex probability distributions to investigate the biological plausibility of the probability distributions.**

Introduction

The central nervous system comprises billions of interconnected neurons and neuronal ensembles, with connections occurring both within specific regions and across different areas. These connections enable the integration and processing of vast amount of information, allowing for complex functions such as sensory perception, motor coordination, and cognitive processes [1]. t the cognitive level, the brain must rely on models that can adapt to the incomplete and imperfect information available about its environment. In most of the cognitive tasks, where sensory data is integrated with prior experiences, Bayesian framework can describe the performance of such tasks. Nearly all behaviors are shaped by the interaction between prior experience and current sensory input. When sensory evidence is weak, past experience tends to guide the behavior; in contrast, when sensory evidence is strong, it takes precedence over prior experience.

Result

With larger numbers of neurons, experimental predictions are found more closely to perfectly Bayesian computations. The large neuronal population model contained 26 000 LIF neurons, far outperforming previous models through a considerable accuracy in predictions from the perspective of Bayesian inference-its deviation significantly lower and therefore its Kolmogorov-Smirnov value is minimal.

Conclusion

We increased the number of neurons in the spiking neural model. Hence we improved accuracy in lifespan prediction when compared to Bayesian computations. Future directions include incorporating more behavioral data pertinent to India, which would further improve the model and make it closer to real-life scenarios.

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The Role of Generative AI in Shaping Academic Outcomes: A Feature-Based Machine Learning Approach

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***Abstract*—Generative AI productivity tools like ChatGPT, DALL-E, and GitHub Co-pilot help students recycle their work, while helping students with everything from essay writing and problem solving to creativity. But on the other hand, such tools could lead to reliance on AI, depriving students of valuable intellectual property and causing problems in academic honesty.**

In this study, the researchers collected data from 239 students regarding their background, usage of AI, and their personal feelings about how these tools affect their academic performance. Further, we applied four feature-selection methods, namely InfoGain, GainRatio, ReliefF, and OneR, which emphasized seven most influential factors that determine the performance of students. The influences of the use of AI in improving academic results are measured in this paper by eight different machine learning models: Simple Logistic, Naïve Bayes, and Random Forest. Notably, focusing on key features boosted accuracy for every model, with perfect scores achieved even by Random Forest.

Introduction

The integration of artificial intelligence solution or technology in ones learning process is one of the most impactful innovations in this century. Products like ChatGPT, DALL-E and GitHub Co-pilot are disrupting academic activities by writing, solving problems, and creating new things. It is witnessed that these AI front runners employ state of the art machine learning techniques teaching them to think like human beings, to provide optimum and flexible solutions [1]. The increase in their population is enabling students get immense support in their study besides various fields of discipline [2]. One is the use of over reliance, with regards to effects on growth in intellect, dishonesty in learning, and in the long run the institution itself warrants further attention [3].

This study uses machine learning to analyse data collected from students to better understand the dual effect of generative AI on academic performance. The responses of 239 students are contained in the dataset, with many of which have diverse attributes that include demographic factors, patterns of AI usage, and self-reported academic outcomes [31].

Data Mining Tools

Classification Algorithms

Predictive modelling is founded on classification algorithms: algorithms which assign instances to predefined categories, chosen on specific attributes. A total of eight classification algorithms are applied to evaluate the relation between generative AI usage and academic performance in this study.The assumption of feature independence lent itself to a probabilistic approach to classification with Naïve Bayes. While this simplifying assumption made the algorithm more subject to failure, the algorithm even performed well on attributes like “AI tool type” and “self-reported engagement levels.”

Results

Table 1: Comparison of Accuracy

Train - Test Split	Number of Features	NB	SGD	SL	VP	MLP	J48	RT	RF
50 - 50	All Features	0.87	0.91	0.86	0.84	0.9	0.88	0.69	0.9
	Reduced Feature	0.82	0.96	0.84	0.95	1	1	0.95	1
66 - 34	All Features	0.87	0.92	0.93	0.85	0.95	0.85	0.82	0.87
	Reduced Feature	0.81	0.97	0.97	0.86	1	1	0.88	1
80 - 20	All Features	0.95	0.89	0.93	0.87	0.89	0.93	0.79	0.89
	Reduced Feature	0.91	1	1	0.95	1	1	1	1
10-fold Cross Validation	All Features	0.87	0.90	0.88	0.85	0.89	0.91	0.78	0.86
	Reduced Feature	0.86	0.95	0.94	0.89	1	1	0.98	1

Table 2: Comparison of Precision

Train - Test Split	Number of Features	NB	SGD	SL	VP	MLP	J48	RT	RF
50 - 50	All Features	0.91	0.9	0.9	0.88	0.9	0.88	0.73	0.99
	Reduced Feature	0.93	0.95	0.91	0.95	1	1	1	1
66 - 34	All Features	0.97	0.94	0.95	0.97	0.95	0.89	0.89	0.98
	Reduced Feature	0.91	0.96	0.96	0.96	1	1	0.96	1
80 - 20	All Features	1	0.95	0.95	0.93	0.9	0.93	0.86	0.97
	Reduced Feature	0.94	1	1	1	1	1	1	1
10-fold Cross Validation	All Features	0.96	0.94	0.97	0.97	0.91	0.95	0.86	0.97
	Reduced Feature	0.87	0.93	0.92	0.90	1	1	0.99	1

Conclusion

Generative artificial intelligence (AI) in a short period has brought changes to education, which provides interactions such as ChatGPT, DALL-E, and GitHub Co-pilot for students as they practice in academic tasks. The mixed effects of generative AI on students' learning outcomes were investigated in this study based on a sample of 239 cases using feature selection and classification techniques. The findings suggested that the usage of generative AI tools has the potential to increase productivity, level of engagement, and accessibility in learning when deployed as a supplementary model to existing practices. However, they also focussed on the negative aspects of these technologies like overdependence on the investment made in AI as well as impacts on cerebral development.

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LINT: An LLM-Based Interaction Network for Clinical Trial Outcome Prediction of Biologic Interventions

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***Abstract*—We propose LINT (LLM-based Interaction Network), a novel approach using large language models (LLMs) to predict clinical trial outcomes for biologic drugs based solely on free-text descriptions. Biologics present unique challenges due to the lack of traditional molecular property data, limiting methods like graph neural networks. LINT addresses this by leveraging text data to predict trial success. Extensive validation across phases I, II, and III of biologic trials demonstrates its effectiveness, with ROC-AUC scores of 0.770, 0.740, and 0.748, respectively. This work highlights the potential of LLM-driven methods in advancing biologic drug development.**

Introduction

Accurate estimation of clinical trial's success probability is essential for stakeholders such as researchers, biopharma investors, and others, informing their scientific and investment decisions. Inaccurate risk evaluation can lead to grave mistakes in drug development choices [52]. Moreover, given the high costs and generally low success rates of trials, it is crucial to prioritize correctly. For example, approval rates for oncology drugs that enter clinical development are estimated to be as low as 3.4-19.4%, 8.7-25.5% for Cardiovascular, 8.2-15% for Central Nervous System, etc [4, 10, 52, 53]. The goal of drug discovery is to design diverse and novel drug molecular structures with desirable pharmaceutical properties, while the goal of drug development is to evaluate the effectiveness and safety of the drug on human bodies via clinical trials A drug needs to pass three phases of clinical trials to be approved and enter the medical market. Additionally, there also exists literature that describes the pharmaceutical properties of drug molecules (Absorption, Toxicity, etc). LLM-based Interaction Network (LINT). Our model builds on pretrained language models (PLM) to predict trial outcomes by jointly considering the text descriptions of the trial, its associated drugs, and the corresponding medical codes.

Experimental Results

We present and analyze the experimental results. Table 4 reveals that LINT excels at Phase 3 prediction, garnering Test AUC scores of 0.770, 0.740, and 0.745 for biologic, drugs, and combined predictions, respectively. While the model delivers a solid performance in Phase 1 prediction, its overall performance dips in Phase 2. This downturn is expected, given that Phase 2 has the highest trial volume and is generally the most challenging task. Table 3 comparison reveals LINT surpasses all baseline models in all metrics. The simple Logistic Regression with our BERT embedding input, the second-best model, achieves Phase 3 Test F1 scores of 0.865, 0.800, and 0.806, which still lags considerably behind LINT. Note that HINT is solely applicable in Drugs mode, as it doesn't cater to Biologics.

***Model Calibration**:* from Figure 2, we can visualize the probability of actual success vs. model-predicted success for phase 3, and from Figure 6 we see the number of predictions by probability. Most of the predictions have higher scores (which makes sense as there are more positive true labels).

Table 1: Data Partitions According to Modality and Phase. The Final Two Columns Provide the Total Quantity of Training Data for Training and Testing, and the Percentage of Successful Trials (in Parentheses).

Mode	Phase	# Train (Pos. %)	# Test (Pos. %)
Bio.	1	505 (71.29%)	441 (71.88%)
	2	973 (59.61%)	571 (55.52%)
	3	692 (78.03%)	366 (74.32%)
Drugs	1	2032 (59.45%)	1681 (59.79%)
	2	6401 (48.68%)	3873 (54.40%)
	3	4745 (65.99%)	2388 (67.63%)
Both	1	2418 (62.57%)	2019 (62.95%)
	2	6999 (50.49%)	4215 (55.26%)
	3	5249 (67.96%)	2619 (69.19%)

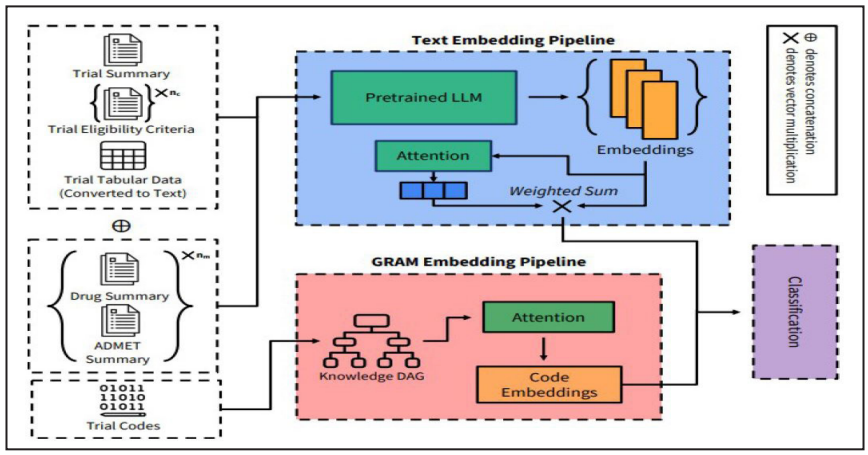

Fig. 1: The Proposed LINT Model Processes a Series of Free Texts Corresponding to Clinical Trials along with their Associated Drug/Biologics Interventions. All Text is Encoded using a Pretrained Large Language Model (LLM), with the Resulting Embeddings Further Processed by a Transformer Encoder. Let nc Represent the Number of Eligibility Criteria, nm the Number of Molecules, and nd the Number of ICD Codes for the Respective Input Trial.

Table 2: Toptest Set Performance Comparison. Drugs* Denotes Small-Molecule Drugs.

Mode	Phase	PR-AUC	ROC-AUC	Fl	Ace
Bio.	1	0.860 ± 0.026	0.723 ± 0.029	0.778 ± 0.015	0.694 ± 0.018
	2	0.758 ± 0.022	0.702 ± 0.01I	0.687 ± 0.016	0.651 ± 0.011
	3	0.882 ± 0.016	0.770 ± 0.028	0.879 ± 0.010	0.817 ± 0.016
Drugs*	1	0.728 ± 0.014	0.643 ± 0.014	0.698 ± 0.008	0.6I 5 ± 0.009
	2	0.696 ± 0.010	0.654 ± 0.007	0.678 ± 0.008	0.606 ± 0.008
	3	0.854 ± 0.010	0.740 ± 0.011	0.820 ± 0.008	0.726 ± 0.011
Both	1	0.770 ± 0.015	0.667 ± 0.013	0.716 ± 0.010	0.637 ± 0.010
	2	0.699 ± 0.010	0.650 ± 0.006	0.706 ± 0.006	0.585 ± 0.007
	3	0.860 ± 0.009	0.748 ± 0.009	0.826 ± 0.005	0.737 ± 0.007

Conclusion

Clinical trial outcome prediction is vital for predicting the safety of new drug sand biologics. In this paper, we focus on developing a machine learning model to predict the outcome of clinical trials that can account for biologics, a quickly growing intervention type. Specifically, we propose an open source, flexible framework built on top of pretrained language models–LINT–a method that supports the accurate prediction of success in clinical trials[1],[2].

Thorough empirical studies are carried out to validate the effectiveness of the proposed method, which achieves state-of-the-art ROC-AUCs approval.

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Bridging Distributional and Risk-Sensitive Reinforcement Learning with Computational Efficiency

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***Abstract*—We introduced RODI-Rep, an efficient distributional reinforcement learning (DRL) algorithm designed for risk-sensitive reinforcement learning (RSRL). Traditional RL methods focus on maximizing expected returns, but RSRL is essential in high-stakes fields like finance and healthcare to account for outcome variability. While recent DRL advances excel in risk-neutral settings, existing RSRL methods are computationally inefficient. RODI-Rep addresses these challenges by combining distribution representation, projection techniques, and exploration strategies, achieving near-optimal regret bounds. Both theoretical and empirical results show RODI-Rep significantly improves sample and computational efficiency, bridging the gap between DRL and RSRL in practical applications.**

Introduction

Standard reinforcement learning (RL) primarily focuses on developing optimal policies to maximize expected returns. This approach, often referred to as risk-neutral RL, emphasizes the average outcomes of return distributions without directly addressing the variability or uncertainty in the returns [1]. While this framework is effective in many domains, it becomes insufficient in high-stakes environments such as finance [2]– [4], medical treatment [5], [6], and operations research [7]. In these contexts, decision-makers often prioritize risk-sensitive measures, which explicitly account for the variability and tail risks in the return distributions, rather than relying solely on expected outcomes. The concept of risk-sensitive reinforcement learning (RSRL) has its roots in the seminal work of Howard and Matheson [8], which introduced risk-sensitive decision-making frameworks. One of the most widely adopted approaches in RSRL is the use of the exponential risk measure (ERM). This measure balances the expected return and the variability in returns, with adjustable risk sensitivity controlled by a risk parameter.

In this work, we provide an affirmative answer by developing computationally efficient DRL algorithms with strong regret guarantees. We propose two variants of RODI tailored for tabular ERM-MDPs, incorporating principled exploration strategies and leveraging the optimism in the face of uncertainty (OFU) principle at a distributional level. These algorithms effectively manage the exploration-exploitation tradeoff while addressing the computational and sample complexity gaps that have historically hindered DRL in RSRL settings.

Related Work

The field of Deep Reinforcement Learning (DRL) has witnessed remarkable advancements, particularly since the foundational contributions of Bellemare *et al*. [20], which established key frameworks for value-based methods. Subsequent research has predominantly concentrated on enhancing performance in risk-neutral environments.

Contributions

This paper makes the following primary contributions: We introduce a novel method for distribution representation and projection specifically designed to mitigate the computational inefficiencies encountered in the existing DRL algorithm, RODI.

Experimental Results

To validate the empirical performance of our algorithms, we conducted numerical experiments comparing the proposed RODI-Rep with the risk-neutral algorithm UCBVI (Azar *et al*., 2017), RSVI in (Fei *et al*., 2020), RSVI2 in (Fei *et al*., 2021), and RODI in (Liang & Luo, 2022). The experimental setup involved

an MDP with S = 5 states, A = 5 actions, and a horizon H = 5, mirroring the setup in (Du *et al*., 2022). The MDP consists of a fixed initial state denoted as state 0, and S additional states. The agent started in state 0 and could take actions from the set [A], transitioning to one of the states in [S] in the next step. This MDP was designed to be highly risky, with the risk-neutral optimal policy leading to a mean reward of 0.5 but with a chance of receiving no reward. A risk-aware policy might prefer the last action A, which offers slightly less mean reward but a more consistent return, indicating lower risk.

We set $\delta = 0.005$ and $\beta = -1.1$. The results, as illustrated in Figure 1, demonstrate the regret ranking of These algorithms are ranked as:

RODI < RODI-OTP < RODI-PTO | RODI-Rep $\preceq$ RSVI2 < RSVI. Figure 1 includes the following key observations:

1 Advantage of distributional over non-distributional algorithms: DRL algorithms (RODI and RODI-Rep) outperform non-distributional algorithms, demonstrating the effectiveness of distributional optimism over bonusbased optimism.

2 Performance of RODI vs. RODI-Rep: While RODI shows better performance than RODI-Rep, the latter offers a balance between statistical and computational efficiency.

Conclusion

We introduce significant advancements in the integration of DRL and RSRL through the development of the RODI algorithm. Our innovations address critical challenges in computational efficiency and provide robust regret guarantees. The proposed RODI-Rep variant, in particular, demonstrates improved regret performance compared to traditional nondistributional methods while maintaining high computational efficiency. Promising future directions include extending the DRL algorithm with distribution representation to accommodate large state-action space.

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Sequential Attribute Designator (SAD): An Innovative Method for Feature Selection in Any Dataset

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***Abstract*—In this research, authors employ one random recursive feature elimination technique (SAD), which iteratively removes the least significant features and trains a model on subsets. Feature ranking is based on multiple linear regression, leading to the final selection of key features. The paper introduces a novel feature selection method, differing from existing approaches, designed to identify features that enhance the performance of advanced or ensemble machine learning models. Using a lung cancer dataset from Kaggle with 15 independent and one dependent variable, selecting 5 features using SAD achieved 94.11% accuracy with logistic regression, while using all 15 features resulted in only 78.8% accuracy.**

Introduction

Feature selection is an important procedure of eliminating the input variables whose elimination will contribute to enhancing the efficiency of a model, reducing the computational cost, and, in some instances, the general performance of a model. This is an important decision in preparation for both the classification and regression models, and the contingency of such a decision lies in the kind of data, data characteristics, form of machine learning model, and the type of correlation between features and target variable.

The traditional ways of feature selection include methodology like forward feature selection (FFS), where one adds features based on the enhancement of the model. However, these deterministic approaches can be less robust and may be trapped into local optima and, therefore, obtain suboptimal feature sets which generalize less on other data sets. To overcome this limitation, the proposed Sequential Attribute Designator (SAD) integrate random probability to ensure that the model will not triumph in selecting a larger feature subset, which has a greater risk to the model.

Rather than considering a single feature with the best enhancement, at each step, a random set of features in the set of available features is chosen. The best feature from this subset is then selected and included in the feature set. It continues endlessly until no further performance enhancement can be noted or until the fixed terminating criterion, such as the maximum number of features, is attained.

Relevant Literature

Lung cancer is one of the deadliest diseases, and it's a global problem. Likewise, its global prevalence has risen gradually over decades (Thandra *et al*., 2021; Li *et al*., 2023). While most cases are directly linked to smoking and have contributed to 80% of the incidents of the disease, the effect can be observed in non–smokers caused by passive smoking or General exposure to toxicants such as fine dust (Walser *et al*., 2008).

Lung cancer is categorized into SCLC and NSCLC (Pechprasarn *et al*., 2024; Ketkomol *et al*., 2024). Non-small cell lung cancer is much more common and is subclassified into squamous, adenocarcinomas, and Large Cell Carcinoma (Slatore *et al*., 2022).

Diagnostic modalities among patients with lung cancer include imaging studies such as computed tomography (CT), magnetic resonance imaging (MRI) and

positron emission tomography (PET scans). White light bronchoscopy (WLB) is a common diagnostic technique that permits observation of true and false cavity pathology in the trachea and bronchi. Flexible fiberoptic bronchoscopy is a first-line diagnostic technique for lung cancer as it allows the evaluation of subsegmental lobular structures of the tracheobronchial tree (Nooreldeen & Bach, 2021). AI technology, such as machine learning, expert systems, and neural networks, has advanced, allowing systems to learn from data to diagnose more accurately (Pechprasarn *et al*., 2023a; Sarker, 2021). SVMs are specifically suitable for working within structured, multidimensional data, making them ideal for the diagnosis of Lung cancer as well as the prognosis part (Sowmya *et al*., 2021).

Results and Discussion

Table 2 shows the comparison of the accuracy, sensitivity and specificity trained models using 80/20 % train-test ratio and 10-fold cross-validation.

Table 2: Predictions Details from the Downloaded Dataset

	With all Features			With Selected 5 Features		
Partition	**Accuracy**	**Sensitivity**	**Specificity**	**Accuracy**	**Sensitivity**	**Specificity**
80-20	78.8	86.6	25	96.92	98.11	91.67
10- fold cross validation	92.38	93.85	83.57	94.12	95.45	91.67

The feature set is reduced down to the 80-20 partition, there is an accuracy rise from 78.8% to 96.92%, a sensitivity increases from 86.6% to 98.11%, and a significant improvement in the specificity from 25% to as high as 91.67%. This evaluation proves that by applying our selection feature model, our model will perform better if we only consider the five selected features rather than all existing features.

Conclusion

This study conveys how feature selection is crucial in machine learning through the demonstration of a novel feature selection technique SAD. The proposed model of feature selection is effective in systematically and selectively eliminating non-relevant features and enhancing and maintaining high accuracy by concentrating on the most relevant features. When applying this to a lung cancer dataset, it was shown that the method produced a very high accuracy of 94.11% using only a total of five features and only 78.8% when all fifteen features were used.

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Survey Paper on Machine Learning and Deep Learning for Cyber-crime Detection

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***Abstract*—Criminal behaviour involving the purposed utilization or intending of a computer network, computer, or networked device is referred to as cybercrime. Hackers and other cybercriminals who aim to gain from their crimes carry out the greatest number of cybercrimes. Nevertheless, there are times when cybercrime will be on the lookout to abuse networks or systems for motives other than financial gain. They could have personal or political ramifications. Individuals as well as Cybercrime are committed by organizations. Some cybercriminals are highly organized, have sophisticated technological abilities, and make use of state-of-the-art cutting-edge methods. There are some people who are not very good hackers. This paper's primary goal is to investigate machine learning techniques for identifying several kinds of cybercrimes.**

Introduction

One kind of network security technology called an intrusion detection system (IDS) was first evolved to spot inherent threats to a specified computer or application. Furthermore, the IDS is a listen-only device. An administrator takes outputs from the IDS's traffic supervision. An intrusion detection system (IDS) is a type of monitoring tool that examines unfamiliar action and alerts users when it does. An incident responder or security operations center (SOC) analyst can look into the matter and take the imperative steps to remove the threat in response to these alerts. A form of DOS assault called distributed denial of service (DDoS) happen when a lot of trojan-infected systems target a single system, resulting in a DoS attack.

A DDoS attack floods the targeted site with traffic from numerous servers and Internet connections. One of the most potent tools on the cyber platform is a DDoS attack. When you learn that a website has been taken down, it generally specifies that a DDoS assault has taken place.

Results

The field research various machine learning and deep see techniques for cybercrime detection. Intrusion Detection Systems (IDS) use ensemble acquisition to ameliorate threat detection, while mannikin like SVM and Random Forest efficaciously place DDoS flak. Proficiency such as Decision Trees and CNNs help find malware and SQL injection attacks. However, many mannikin rely on predefined patterns, confine their ability to detect evolving scourge. While deep eruditeness amend truth, it requires declamatory datasets and wide training.

Conclusion

Various methods of machine learning for detecting intrusions were compared. SDN using NCA and Decision tree gave 100% success in classification, but were restricted to pre-defined traits. kNN, SVM proved effective to detect sophisticated malware. However, unsupervised and deep learning algorithms to be used to identify unknown malware. The algorithms applied in research showed some limitations in terms of accuracy. For future, accuracy in detection of intrusions needs to be improved.

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Survey Paper on Machine Learning for SQL Injection Detection

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***Abstract*—An online protection flaw called SQL injection (SQLi) entitles an attacker to tamper with the database queries which is put forward by an application. An attacker can look into the data that they would not normally can access. This could incorporate any data which the application can access, incorporating data that is held by other users. An attacker can habitually modify or detach this data, which changes the application's content or behaviour in an indefinite manner. The principal server or other back-end framework may periodically be undermined by an attacker making use of SQL injection attack. They can also throw denial-of-service assaults thanks to it. The main goal of this paper is to explore various machine learning approaches to detect SQL injection attack.**

Introduction

SQL injection is a type of web attack that falls under the injection family. It involves an attacker inserting inputs into a system in order to run harmful statements. The loser system is usually not equipped to control this input, that usually results in data revealing and/or giving the attacker prohibited access. In this scenario, the attacker can access and/or alter the data, which impacts all security aspects, incorporating data availability, confidentiality, and integrity. An SQL injection occurs when a hacker inserts a SQL statement into a communication between a database server and a client. Database management system (DBMS) inquiries are represented using SQL (structured query language). The purpose of the malevolently inserted SQL statement is to alter or retrieve data from the database server. If an injection is successful, authentication and bypass may occur. Additionally, the hosted operating system could be overrun and commands could be executed by such an assault, which usually results in more severe outcomes. Therefore, SQL injection attacks constitute a notable threat to businesses. In order to combat this issue, numerous studies have been conducted, offering a range of artificial intelligence (AI) methods for detecting SQL injection assaults through the use of machine learning and deep learning models. Artificial intelligence (AI) methods to help detect threats are often applied by learning from past attack and/or normal data. Learning from historical data can help identify attack patterns, comprehend traffic that has been identified, and even anticipate future assaults before they happen.

One of the biggest security threats still affecting vital data, including financial and health information, is SQL injection attacks. The difficulty of identifying attacks of SQL injection has grown in significance as our reliance upon the internet increases rapidly. Investigating the efficacy of the suggested probabilistic neural network PNN for SQL injection detection was the primary goal of the study conducted by Nayeem Ahmad Khan and Fawaz Khaled Alarfaj [1]. The study by Bahman *et al*. [2] offers an efficient method for identifying SQL injection attacks. Two binary categories of the Gray-Wolf algorithm were established for the sake of choosing the dataset's most beneficial characteristics. One of the main benefits of recommended approaches is the small number of well-chosen effective features. The method's second purpose is that it yields greater values for correctness, preciseness, and reactiveness. Providing comparable outcomes across several executions is the study's additional benefit. In order to overcome the difficulties of different attack patterns and the extraction of useful information, the study by Hao *et al*. [3] suggests a procedure on the basis of deep learning for detecting attack on SQL injection. The suggested technique vectorizes SQL samples while maintaining the most information possible by combining TF-IDF and Word2Vec.

Important local information is automatically extracted from the vectorized SQL samples using an improved TextCNN. Additionally, the sequential information in the specimen is secured utilizing a Bi-

LSTM network. This paper's primary goal is to identify and assess conventional first-order SQL injection attacks.

Attaining automated detection or high detection accuracy is currently difficult in view of the intricacy and unique features of attacks of SQL injection of second-order. As a result, our research's next phase will focus on creating efficient detection methods for unique second-order SQL injection assaults in challenging scenarios.

Crespo-Martínez *et al*. [4] use two datasets based on data from multiple SQL injection attacks to show that it is feasible to identify SQL injection attacks incoming data through protocol information. The authors then tested a number of machine learning methods to identify SQLi scenarios, and for the network traffic data they had gathered, Logistic Regression produced the best results. It is evident from these current solutions that none of them aim to create a solution for detecting SQLi while taking scalability and response time concerns into account.

Conclusion

Various categories of Machine Learning and Deep Learning were applied to detect SQL injection. BAT algorithm was able to given great correctness. For identifying SQLI assaults, SVM algorithms demonstrated highest level of correctness in one of the research projects works and proved reliability to recognize attacks on SQL injection. In some approaches, future work has to be done to improve precision and correctness.

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Spiking Neural Network Model for Predicting Stability in Decentralized Smart Grid Control Systems

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***Abstract*—In this research paper, we developed a spiking neural network (SNN), the third-generation neural network for the local stability of a four-node star electrical grid system which consists of a central grid producer and implements it in a Decentralized Smart Grid Control concept. The SNN is applied for Electrical Grid Stability Simulated Data collected from the UCI Machine Learning repository. After analyzing the data, our model gives an accuracy of 90.80%, precision of 99.43%, recall of 86.12%, specificity of 99.12%, F1 score of 92.29%, and a Cohen's Kappa of 0.81.**

Introduction

The complexity of the electrical grids is increasing continuously due to the integration of renewable energy sources, fluctuating demands, and decentralization. It is now a requirement for innovative approaches to maintain stability in the grid.

Results

The spiking neural network (SNN) was developed to analyse the Electricity Grid Stability Simulated Data. Performance matrices like accuracy, precision, recall, specificity, F1 score, and Cohen's Kappa help us to determine. The results are given in Table 1.

Metric	Value
Accuracy (%)	90.80
Precision (%)	99.43
Recall (%)	86.12
Specificity (%)	99.12
F1 Score (%)	92.29
Cohen's Kappa	0.81

Conclusion

In this paper we proposed a Spiking Neural Network (SNN) model to detect the stability of a four-node star electrical grid system operating under a Decentralized Smart Grid Control (DSGC) framework. The SNN is a biologically inspired third-generation neural network that we utilised to analyse the Electricity Grid Stability Simulated Data from the UCI Machine Learning Repository. The model gave good results of performance matrices like 90.80% accuracy, 99.43% precision, 86.12% recall, 99.12% specificity, an F1 score of 92.29%, and a Cohen's Kappa of 0.81.

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Leveraging Blockchain Technology for Optimized Food Safety and Quality Assurance

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***Abstract*—Blockchain technology provides a decentralized, immutable ledger that improves traceability, prevents fraud, and increases supply chain transparency. Traditional supply chain systems rely on centralized databases that are susceptible to errors, compromising food safety and trust. In the present work, we have proposed a blockchain-based system that integrates IoT sensors, computer vision, and UV-C light sterilization to enable real-time tracking of goods while reducing microbial contamination. This approach improves trust, traceability, and food safety, making it a viable model for worldwide adoption.**

Introduction

The global food supply chain is a complex network that faces inefficiencies, fraud, and lack of transparency, costing the industry $10-15 billion annually by affecting public health and destroying business and industry reputations [1]. Traditional supply chain systems typically cannot solve such issues because they rely on centralized, error – prone approaches. Blockchain technology is a decentralized digital ledger that records transactions in a secure and transparent manner. It can also integrate with IoT devices for real-time monitoring of critical factors such as temperature and humidity to ensure food quality and safety [2]. Additionally, the integration of advanced technologies like computer vision optimizes operations, and ensures quality, while UV-C light technology ensures food safety by reducing microbial contamination. The food quality and delivery are the key factors in the food industry today which is due to the customer's desire for safe, nutritious, and fresh products efficiently delivered. On-time and undamaged delivery besides food quality also helps to satisfy the need for convenience which continues to be the driver of the growing market.

Results

Figure 1 shows the ratings of different customers who ordered from various restaurants listed on Zomato in Bangalore, India. Blockchain's traceability and transparency features can address issues impacting lower-rated restaurants, such as food safety, quality assurance, and trustworthiness.

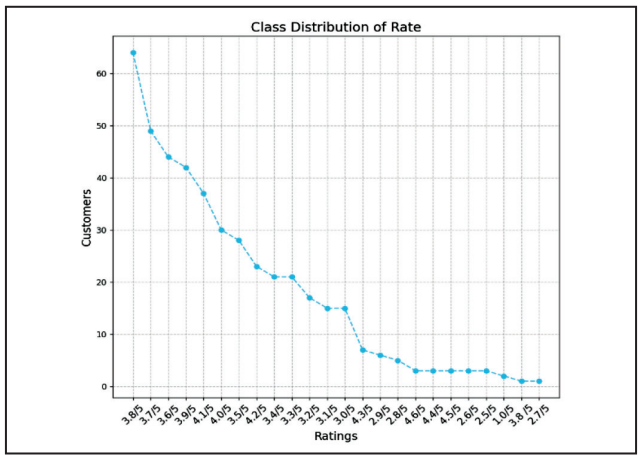

Fig. 1: Class Distribution of Rating Categories

Conclusion

The proposed approach will alter the face of global supply chains to make them more transparent and traceable and improve their operational efficiencies. It not only tackles significant issues in the food supply chain but also offers a scalable approach to enhance food safety and minimize waste.

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TUMMY TIME: An AI based Food Ordering Website

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***Abstract*—TUMMY TIME is an interactive web application designed to simplify online food ordering. It offers a user-friendly interface where users can sign up and log in to explore a categorized menu, add items to their cart, and dynamically calculate total costs. Developed using React.js, Node.js, and MongoDB, it ensures scalability, security, and responsiveness. The project demonstrates the effective implementation of modern technologies for e-commerce in food services, addressing user convenience and enhancing the ordering experience.**

Introduction

The advent of digital technology has revolutionized food delivery services, integrating them into modern lifestyles. E-commerce platforms like Swiggy, Zomato, and Uber Eats have demonstrated the need for user-friendly interfaces, real-time order tracking, and diverse food options, yet challenges such as limited personalization and accessibility persist. TUMMY TIME bridges these gaps through a user-centric design, emphasizing simplicity, security, and responsiveness. Inspired by studies on responsive design and user behavior, TUMMY TIME offers streamlined navigation, personalized food options, and device adaptability. Its innovative approach ensures a seamless food-ordering experience while addressing unmet needs in existing platforms.

Results, Analysis & Discussions

The project achieved its objectives by providing a responsive design for seamless access across devices, real-time cart functionality, and secure user authentication. These features contribute to a smooth user experience and lay the foundation for future enhancements such as payment integration and multilingual support.

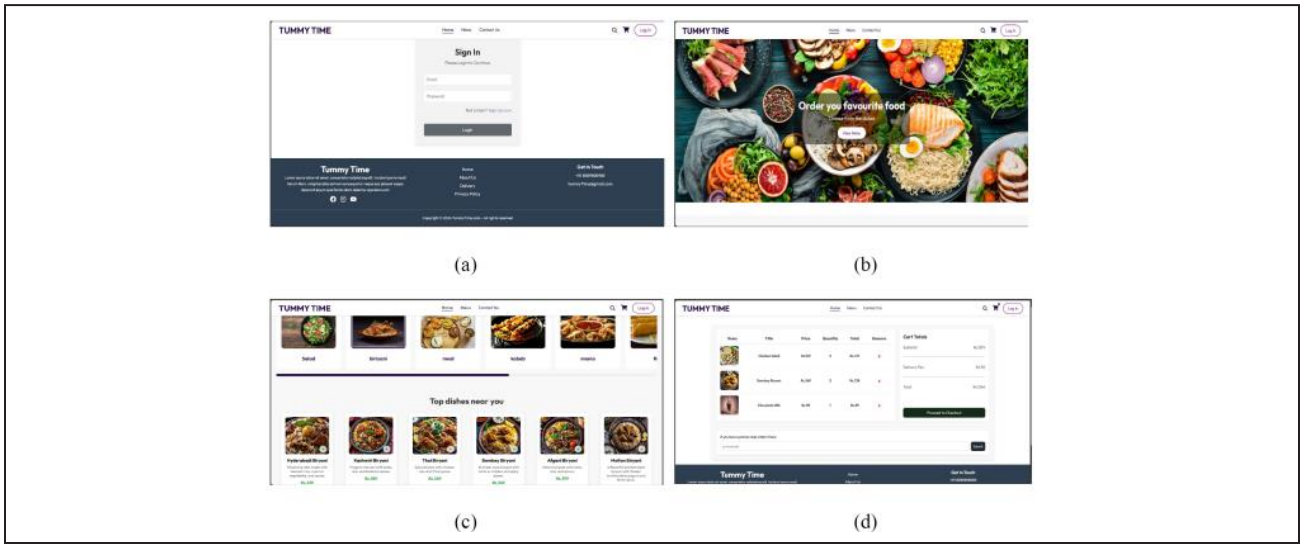

Fig. 1: Snapshots of TUMMY TIME: (a) Log in page, (b) Home page, (c) Item page, (d) Cart Page

Conclusion

TUMMY TIME demonstrates the potential of modern web technologies in building scalable, responsive e-commerce platforms. By addressing gaps in existing food delivery services, it creates a comprehensive and enjoyable user experience. Future developments will include payment integration, advanced security measures, and multilingual support.

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Quantum Cryptographic Encryption based on QPP and its Implementation in IBMQ

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***Abstract*—A quantum (plural: quanta) is the smallest discrete unit of a phenomenon. Quantum computing uses specialized technology—including computer hardware and algorithms that take advantage of quantum mechanics—to solve complex problems that classical computers or supercomputers can't solve, or can't solve quickly enough. It shows a working implementation of the Quantum Permutation Pad (QPP) originally suggested by Kuang et al. on the International Business Machines (IBM) quantum computer systems that are now on the market. This is done by utilizing the Qiskit development kit. In this paper, it employs a pad with 56 2-qubit permutation gates, which yields 128 bits of entropy, for this implementation. It splits the plaintext into chunks of two bits each in this implementation. One such chunk at a time is encrypted. A quantum circuit is constructed for each given plaintext block, initializing the qubits in accordance with the provided plaintext 2-bit block. Next, 2-qubit permutation operators selected from a 56-permutation QPP pad are applied to the plaintext qubits. The ciphertext qubits are measured and sent to the decrypting side because qubits cannot be sent directly. It is possible to decrypt using a quantum or classical computer. Using the Hermitian conjugates of the respective permutation gates used for the encryption, an inverse quantum permutation pad is employed for the decryption process. It is presently trying to advance QPP implementation by adding more security and efficiency- enhancing procedures.**

Introduction

Stephen Wiesner provided the first ideas for quantum cryptography [3] in his paper "Conjugate Coding," which sadly took more than ten years to publish. Meanwhile, the topic was taken up and developed by Charles H. Bennett and Gilles Brassard in a sequence of studies that concluded with the presentation of an experimental prototype proving the concept's viability from a technological standpoint. Quantum cryptography [3] methods capitalize on Heisenberg's uncertainty principle [6], which states that any measurement done on a quantum system generally perturbs it and provides only partial knowledge about its state before to the measurement. A greater interest in quantum encryption and quantum key distribution emerged with the recent developments in quantum computing.

The Quantum Permutation Pad [4] is a unified symmetric encryption system that Kuang and Bettenburg proposed in 2020.That is, a secure connection between two quantum computers, two classical computers, and a classical and a quantum computer is made possible by a symmetric encryption system that can be used on both types of machines. In this research, It will demonstrate a functional implementation of the QPP that yields 128 bits of entropy while utilizing a notably lesser number of quantum gates when compared to AES.

Result

Upon defining the Permutation Pad [2], the encryption process starts by transforming the picture file into a bitstring. The plaintext that has to be encrypted is his bitstring. The plaintext is divided into blocks of two bits each to take into consideration the limits of the quantum computers that are currently in use. In other words, the first 2-bit block is split into two qubits and encrypted using the first permutation from the Permutation Pad, followed by the second and so on. When it reaches the end of the pad of permutations, they start over at the first option.

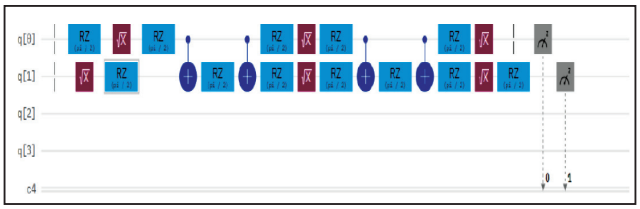

Fig. 1

Conclusion

This paper demonstrates a working implementation of the Quantum Permutation Pad proposed by Kuang et al. using the IBM quantum computers that are now available to the public and the Qiskit programming tool. It utilities IBM's quantum computer to encrypt a PNG picture using the symmetric encryption algorithm QPP.

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Study of the Evolutionary Algorithm-driven Optimization in Photonic Crystal Designs

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***Abstract*—This article explores the use of evolutionary algorithms to optimize photonic crystal designs for advanced optical applications. We investigate the methodologies employed in evolutionary computation, including genetic algorithms and differential evolution, to enhance photonic crystal structures. By optimizing photonic bandgaps and other critical parameters, we demonstrate the efficacy of this approach in achieving high-performance designs. Numerical simulations validate the optimized structures, showcasing significant improvements in efficiency and functionality for various photonic applications.**

Introduction

Metal oxides are promising candidates for solar energy harvesting and energy saving application.

Low cost photovoltaic technology is essential to meet the large scale electrical supply with low carbon emission.

Photonic crystals (PCs) are periodic dielectric structures that manipulate electromagnetic waves, leading to unique optical properties such as photonic bandgaps (PBGs). These characteristics make PCs critical for applications in waveguides, filters, sensors, and light-emitting devices.. Evolutionary algorithms (EAs), inspired by natural selection and biological evolution, offer a robust alternative for optimizing PC structures. These algorithms excel in exploring large solution spaces, enabling efficient identification of high-performing designs. This paper presents a detailed analysis of EA methodologies applied to PC optimization, emphasizing genetic algorithms (GAs) and differential evolution (DE).

GAs simulate natural selection by encoding potential solutions as chromosomes. In PC design, GAs optimize structural parameters by iteratively evaluating the fitness of designs based on their PBG width or other performance metrics. DE is a population-based optimization algorithm that focuses on the differential vectors between solutions. DE is particularly effective for continuous parameter optimization, making it ideal for refining PC structures. Numerical simulations of PC structures are performed using finite-difference time-domain (FDTD) methods. These simulations calculate the band structure and validate the photonic bandgap properties. The optimization process iterates until convergence criteria, such as maximum PBG width or minimum defect loss, are met.

Results

The application of GAs and DE led to significant improvements in PC designs. Table 1 compares the performance of GAs and DE for a representative 2D PC design task.

Table 1

Metric	Genetic Algorithm	Differential Evolution
Convergence Speed	Moderate	Fast
PBG Width Improvement	20%	25%
Robustness to Noise	High	Moderate

Conclusion

This study highlights the potential of evolutionary algorithms in photonic crystal design. By leveraging the strengths of GAs and DE, significant enhancements in PC performance were achieved. Future work will focus on hybrid optimization techniques and real-time applications in adaptive optics.

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A Graph-Based Model for Identifying Privacy-Sensitive Data in Transitions

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***Abstract*—In the modern era, the proliferation of personal data collection raises concerns about privacy risks during data publication. This study introduces a graph-based theoretical model to identify privacy- sensitive data in transitions between states. By leveraging directed graphs, the model identifies critical transitions and risky states, highlighting areas with heightened privacy vulnerability. The proposed algorithm efficiently detects sensitive data items using similarity-based techniques and provides a basis for secure data sharing. Experimental results using real-world datasets validate the model's applicability and efficiency in mitigating privacy risks.**

Introduction

Data publication involves sharing personal information with third-party entities for accessing services, participating in research, or fulfilling legal requirements. However, sharing such data often poses privacy risks, especially when sensitive information is inadvertently exposed.

Traditional approaches like k-anonymity and data perturbation focus on privacy preservation through sanitization techniques, but these methods often assume sensitive data items without empirical validation. This study aims to address this gap by proposing a directed graph-based model that empirically identifies sensitive data items during transitions between states, such as interactions with hospitals, banks, or companies.

The model introduces concepts such as critical transitions, representing highly sensitive paths, and risky states, denoting nodes with significant privacy risks.

Methodology

The proposed algorithm for detection of sensitive data items:

1. **Graph Construction**: Build a directed graph with states as vertices and transitions as edges, assigning random weights to edges and data items.
2. **Similarity Calculation**: Use Euclidean distance to calculate transition weights.
3. **Sensitivity Score**: Compute sensitivity scores for data items on transitions:
4. Value(di,Sj→Sk)=w(Sj→Sk)×w(di)\text{Value}(d_i, S_j \to S_k) = w(S_j \to S_k) \times w(d_i) Value(di,Sj→Sk)=w(Sj→Sk)×w(di)
5. **Threshold Determination**: Select the top 20% of scores to establish a sensitivity threshold.

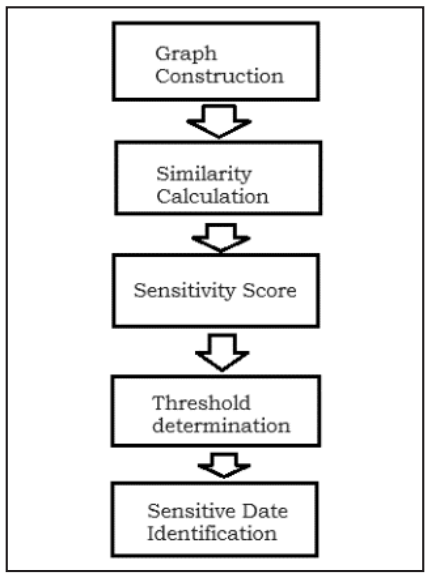

Fig 1: Algorithm Flowchart

Conclusion

This paper presents a directed graph-based model for detecting privacy-sensitive data items during

state transitions. By identifying critical transitions and risky states, the model provides actionable insights for secure data sharing. Experimental validation confirms its efficacy and highlights the trade-off between sensitivity detection and algorithmic efficiency. Future work will explore the integration of advanced privacy definitions and real- time adaptability for dynamic environments.

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Stress Detection through Facial Expression using Deep Learning with Image Processing

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***Abstract*—Stress detection is crucial for advancing mental health care by enabling timely interventions and promoting well-being. Traditional stress detection methods often rely on intrusive wearable devices, which are challenging in terms of scalability and user comfort. This paper proposes a non-invasive stress detection method using image processing and machine learning algorithms to classify and predict stress levels based on facial expressions. Techniques like Support Vector Machines (SVMs) and Convolutional Neural Networks (CNNs) were employed on annotated datasets. Results reveal that CNNs significantly outperform traditional methods, achieving high classification accuracy. This study highlights the potential of fusing advanced machine learning with image processing to create scalable and accessible mental health monitoring technologies.**

Introduction

Stress, a natural response to challenging conditions, significantly impacts physical and mental health, with prolonged exposure linked to issues such as cardiovascular disease and anxiety. Traditional stress detection methods, like heart rate and electrodermal activity monitoring, often rely on wearable devices that may not be practical for continuous use.

However, detecting stress through live video feeds poses challenges, including variations in facial expressions, environmental lighting, and individual physiological differences, which can impact the accuracy of detection. This project aims to develop a robust, real-time stress detection system using image processing and machine learning techniques. By employing models such as Support Vector Machines (SVM), Decision Trees, and Convolutional Neural Networks (CNNs), the system will analyze stress markers while adapting to lighting changes and expression variability. With a focus on high accuracy and scalability, the project seeks to enable non-invasive stress detection suitable for diverse environments and practical applications.

Results

Performance of Models

The performance of each model—Convolutional Neural Networks (CNN), Support Vector Machines (SVM), and Decision Trees—is evaluated using several key metrics: accuracy, precision, recall, and F1- score.

Decision Trees exhibit the lowest metrics, suggesting that they struggle with complex patterns in image data, likely due to overfitting or limited feature representation.

Table 2: Comparative Performance of Models

Metric	CNN	SVM	Decision Tree
Accuracy (%)	92.5	87.0	81.5
Precision (%)	90.0	85.5	80.0
Recall (%)	94.0	89.5	82.0
Fl -Score (%)	92.0	87.5	81.0

Conclusion

The potential applications of this research are vast, especially in the fields of healthcare and personal well-being. Reliable stress detection systems could serve as valuable tools for mental health professionals, enabling timely interventions and personalized care strategies.

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Stationary Analysis of the Characteristics of the M/ M/ 2 Queue with Constant Repeated Attempts and State Dependent Service Rate

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Abstract—M/M/2 retrial queuing system with state dependent service rate. In this model, the customer arrives in a Poisson distribution with rate λ > 0. The customer immediately undergone service, when anyone of the service is free. If all the servers are busy, then the customers join in the orbit, and the customers becomes a source of repeated calls to retry after a random amount of time. The retrial intensity is μ ≥ 0 as depicted in the State – Transition diagrams. When there is one customer in the orbit, the retrial intensity is μ and when there is a j customer, the retrial intensity is jμ. and μ=0, if there is no customer in the orbit (empty). Any primary arrival or retrial can serve immediately; if it finds anyone of the free servers. The successive service times are mutually independent and the service rate is v_1 if one server is busy and v_2 if both the servers are busy. The service rate is 'State Dependent'.

Keywords RQ – Retrial Queues, QT – Queuing Theory

Introduction

Assume that the primary arrivals, intervals between repeated attempts and service times are all mutually independent. At any time t, the state of the system can by described by the bivariate process {C, N}.

$$X(t) = \{(C(t), N(t)) \mid t \geq 0\}$$

where,

C(t) – This denotes the number of busy servers at time 't 'and

N(t) – This denotes the number of customers (sources) in the orbit at time 't '.

The process is defined or termed as Markovian.

Here,

C (t) can take values 0, 1, 2.

N (t) can take values 0,1,2,3…

(i.e.) This is defined as the state space is the cross product of finite set {0,1,2} and half-line,

We define the limit distribution as the following equation

$$P_{ij} = \lim_{t\to\infty} P\{C(t=i, N(t)=j); i=0,1,2$$
$$j=0,1,2\ldots$$

The steady state equations are

$$\left(\lambda + \mu\left(1-\delta_{j0}\right)\right)Pa_{0j} = v_1 p_1;\ j \geq 0 \qquad (1)$$

$$\left(\lambda = v_1 = \mu\left(1-\delta_{j0}\right)\right)P_{1j} = \lambda P_{0j} + v_2 P_{2j} + \mu P_{0,j+1};\ j \geq 0 \quad (2)$$

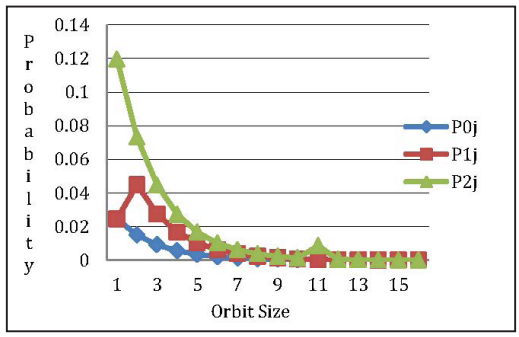
$$\left(\lambda = v_2\right)P_{2j} = \lambda P_{1j} + \mu P_{1,j+1} + lP_{2,j-1}\left(1-\delta_{j0}\right);\ j \geq 0 \quad (3)$$

Results

The results have shown some promising features and processing or retrial queues. The waiting time and the cooling period might depend on the queue and will be fully dependent on the queue size. These retrial queues would be a type of queuing model. There would be retrial queues which are used in queuing models which are implied in particular tasks. These are the tasks which are the requests that would be taking time, or there would be a delay, caching issues, or delay in fetching the appropriate data, or informations, congestions happening, due to various reasons or a request that would fail to access the servers. These fail to access the servers immediately or inappropriate in serving the requests in time or would rather fail to access the servers very immediately which would be requesting us to retry or abort or ignore. That would ask us to retry the requests after there is some delay. This can be applied to GPUs (Graphical Processing Units) which would be implied in the process of computing, Deep Learning and Machine Learning. These Retrial queues applications would be focused on the aim of managing efficiently manage workloads, especially in the view of approach which would be shared with the GPU resources, task failures, or contention of the resources

Conclusion

These are applied in the implications of Telecommunications, Computer Networks and Customer Support Systems. The Performance Metrics would rely on the following issues under these metrics



X axis – Probabilities

Y axis – Orbit Size

Fig. 1: Orbit Size Vs Probabilities

1. Performance Metrics
   - Service Availability
   - Queue Length
   - Retrial Rate.
2. Model Variants
   - M/M/1 Retrial Queue.
   - M/M/c Retrial Queue
   - Generalized Retrial Queues

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IoT Enabled Healthcare System for Remote & Near Patient Monitoring

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***Abstract*—A vast amount of data may be gathered, saved, and examined for data-analytics procedures thanks to the Internet of Things devices' simple ability to collect and send data with other devices via the cloud. By detecting physiological indicators like systolic and diastolic blood pressure, heart rate, and body temperature, this paper aims to improve the quality of life for patients by providing real-time visibility into their status. The main concept is to provide care to patients by continuously monitoring their vital signs, such as blood pressure, pulse rate, and body temperature, without requiring them to transfer between facilities for ongoing health monitoring. Data collected by the temperature and blood pressure sensors is processed and saved in the cloud, where the patient's careers can view it from anywhere and react appropriately to any alerts.**

Introduction

The populace of the planet is rising colossally. The towns that have more inhabitants confront an uncommon urban life burden [1]. Farther wellbeing care is portion of our life with the rising numbers of individuals with therapeutic challenges [3]. We have seen an increment of intrigued of wearable sensors in later a long time and these gadgets are accessible on the showcase at a lower fetched in individual healthcare and mindfulness of operation [4].

System Architecture

There are four layers of the protocol, as example (i) physical layer (ii) networking layer (iii) middleware layer (iv) application layer. The network layer gives sensor for flag transmission for clouds when work handling of center layer information accessibility of cloud to create concern especially [12]. The figure 1 appears the framework design, which concentrates on close as well as patients who are in inaccessible area [13]. Typically, IoT conceivable as it were due to everything for web.

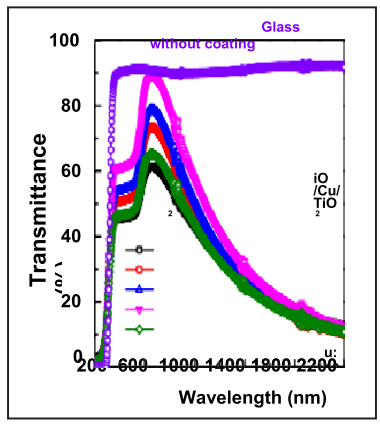

Fig. 1

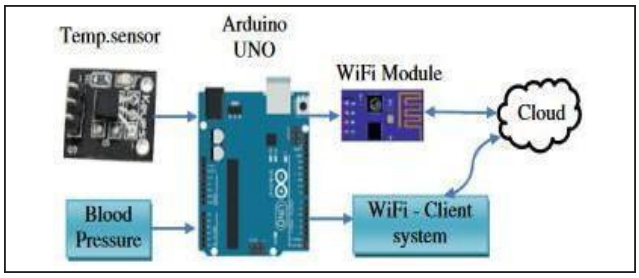

Fig 2: Monitoring and Alert System

Figure 2, shows the block diagram for an IoT-based smart real-time health care.

Implementation of Hardware

The pulse and temperature sensors are used independently to assess the health parameters, such as blood pressure, heart rate, and temperature level. Through interfaces, the collected medical data is saved in the Ardunio UNO. The ESP8266 is then notified of this information. The mobile application might be used to get the data that was saved in the Thing Speak cloud administration. By providing the channel ID, it enables users to easily see their Thing Speak commands.

Conclusion

In the area of health surveillance, the Internet of Things is starting to look like a viable answer. employing remote patient monitoring to monitor a person's health and assist a physician in spotting illness symptoms. An Internet of Things-based patient monitoring system has been suggested in this paper. The mobile application might be used to get the data that was saved in the Thing Speak cloud administration. By providing the channel ID, it enables users to easily see their Thing Speak commands.

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Recent Advances in Image Classifications using CNN-based Deep Learning Technique

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***Abstract*—Deep learning has significantly advanced image classification, with Convolutional Neural Networks (CNNs) becoming the dominant approach since 2012. CNN architectures, originally developed for image classification, have been widely applied to other visual recognition tasks, including object detection and semantic segmentation. Their success has also extended to remote sensing image classification, achieving state-of-the-art accuracy. This review explores the evolution of CNNs, covering fundamental artificial neural network structures, classic models, recent advancements, and a comparative analysis of various classification methods. Finally, we summarize key insights and discuss emerging trends in CNN-based image classification.**

Introduction

Image classification is a fundamental task in computer vision, enabling applications [1] like object detection [2], segmentation [3], and pose estimation [4]. Early methods relied on manual feature extraction with limited generalization, leading to the adoption of Artificial Neural Networks (ANNs) and later Convolutional Neural Networks (CNNs). Breakthroughs like LeNet-5 [5]and AlexNet [6] revolutionized large-scale image classification, driving further advancements. Since 2015, CNNs have been widely applied to remote sensing, with various training strategies emerging. This article provides a comprehensive review of CNN-based image classification, exploring architectures, training methods, and datasets to guide future research.

Overview of CNNs

This section introduces the basic concepts of CNNs, providing a foundational understanding of their data flow and components to help readers better grasp the upcoming sections.

Neural Network

Neuron

In artificial neural networks, neurons are the basic processing units, similar to those in the biological nervous system. They take multiple input values, apply a mathematical transformation, and produce an output value.

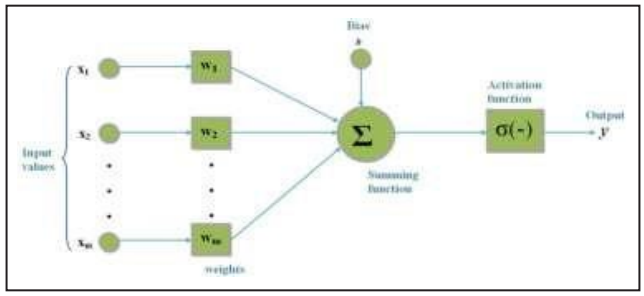

Fig. 1: General Structure of an Artificial Neuron [7]

CNN Architecture

CNN architecture consists of convolutional, pooling, nonlinear activation, and fully connected layers. The image is pre-processed, input through the network, and processed by alternating convolutional and pooling layers before classification by the fully connected layer. Unlike MLP, CNN [9] incorporates convolutional and pooling layers [10], which improve efficiency for larger datasets. The convolutional layer identifies correlations between image features using a local receptive field and parameter sharing, reducing the model's size.

Convolutional Layer

Convolutional Neural Networks (CNNs) use multiple convolution layers to extract hierarchical features from input data. Lower layers capture basic patterns like textures, edges, and lines, while higher layers identify more abstract features.

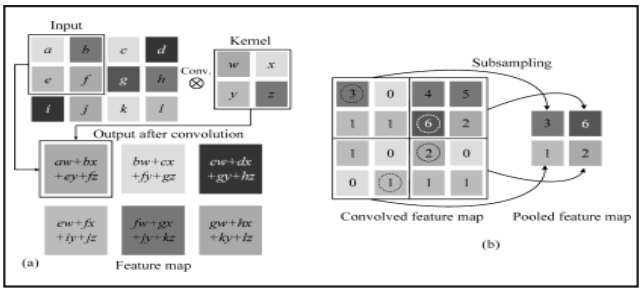

Fig. 3: (a) Schematic Diagram of 2D Convolution: a 2 × 2 Kernel Convolves with a 3 × 4 Input Image to Produce a 2 × 3 Feature Map [32]; (b) Max Pooling: a 4 × 4 Convolved Feature Map is Divided into Four Disjoint 2 × 2 Regions, and Take the Maximum of Each Region to Generate a 2 × 2 Pooled Feature Map. [12]

Conclusions

This survey reviews mainstream CNN models, hybrid methods, and training strategies in image classification. Key insights include:

Classic models (2012–2017) shaped CNN architecture.

- Attention mechanisms (e.g., SE blocks) enhance performance.
- Mobile-optimized networks balance efficiency and resource constraints.
- Hyperparameter choices significantly impact performance.

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Efficiency of Theta A* for Optimal Pathfinding in Static Environments

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***Abstract*—Pathfinding is a critical problem in robotics, autonomous vehicles, and AI, where efficient algorithms are needed to navigate agents while avoiding obstacles.This paper provides a comprehensive comparison of four popular A* variants—A*, Multi-Heuristic A*, Bidirectional A*, and Theta*—for pathfinding in grid-based static environments with fixed obstacles on different grid cell sizes over the same grid area.To evaluate the performance of each algorithm, four key metrics were chosen: path length, traversal time, smoothness, and the number of nodes expanded during the search process. Experimental results reveal that Theta A* consistently outperforms the other algorithms across tested metrics. Specifically, Theta* generates the shortest path, significantly reducing the path length compared to A*, Multi-Heuristic A*, and Bidirectional A*. In addition to offering a more optimal path, Theta* achieves the fastest traversal time, completing pathfinding tasks in far less time. Notably, it also expands the fewest nodes, demonstrating its efficiency in search space exploration. Although Theta A* has a slightly lower smoothness score compared to other algorithms, the difference is minimal and does not significantly impact overall performance. These results confirm the superior efficiency of Theta A* for pathfinding in static environments, making it an excellent choice for real-time applications in fields such as robotics and autonomous navigation, where both optimality and computational efficiency are paramount.**

Introduction

Pathfinding is a fundamental problem in several fields, including robotics, autonomous vehicles, artificial intelligence (AI), and game development. It involves finding the most efficient route between two points in a given environment while avoiding obstacles. Whether navigating a robot through a factory, directing an autonomous vehicle through traffic, or moving characters in a game, pathfinding algorithms play a crucial role in ensuring safe and efficient movement. The challenge lies in designing algorithms that balance computational efficiency with the optimality of the paths they generate, especially in dynamic or complex environments.

The A* algorithm, in its simplest form, computes the shortest path by considering both the current cost to reach a node and the estimated cost from that node to the goal. However, it suffers from high computational demands as the size of the search space grows, requiring the expansion of many nodes, particularly in large or complex environments.

Theta*, a more recent development, extends the A* algorithm by allowing direct connections between non-adjacent nodes, reducing the number of waypoints and providing smoother paths. This variant has gained popularity due to its ability to generate more natural and efficient paths, particularly in static environments where obstacles are fixed and known ahead of time. Unlike traditional A*, which only allows connections between adjacent nodes, Theta* takes into account line-of-sight between nodes, allowing the path to cut across obstacles where possible, resulting in a path that is not only shorter but also more intuitive and direct.

Methodology

In this study, we conducted a series of experiments to evaluate and compare the performance of several variants of the A* algorithm in a controlled static environment. The environment was deliberately designed with randomly placed static obstacles to simulate realistic navigation conditions, where pathfinding algorithms must navigate through obstacles while ensuring the shortest and most efficient path to

the goal.Simulations were conducted on grids with varying cell sizes while maintaining a constant grid area.

*A Algorithm**

The A* algorithm is one of the most well-known and widely used pathfinding algorithms, valued for its ability to compute the shortest path between two points in a grid-based environment. The fundamental principle of A* is the use of a heuristic function combined with a cost function to select the most promising node for exploration. It calculates the total cost, denoted as f(n), for each node n based on the formula:

$$f(n) = g(n) + h(n)$$

where:

- g(n) represents the actual cost from the start node to the current node, and
- h(n) is the heuristic estimate of the cost to the goal node.

*Multi-Heuristic A Algorithm**

The Multi-Heuristic A* variant is designed to address the limitations of relying on a single heuristic by utilizing multiple heuristics during the search process. In this study, we use three distinct heuristics: Euclidean Distance, Hybrid ManhattanEuclidean Distance, and Octile Distance.

Result and Discussion

The results of the experiment provide a detailed comparison of the four A* variants—A*, Multi-Heuristic A*, Bidirectional A*, and Theta A*—across various performance metrics on multiple grid cell sizes for the same environment. These metrics include path length, smoothness, traversal time, and the number of nodes expanded.

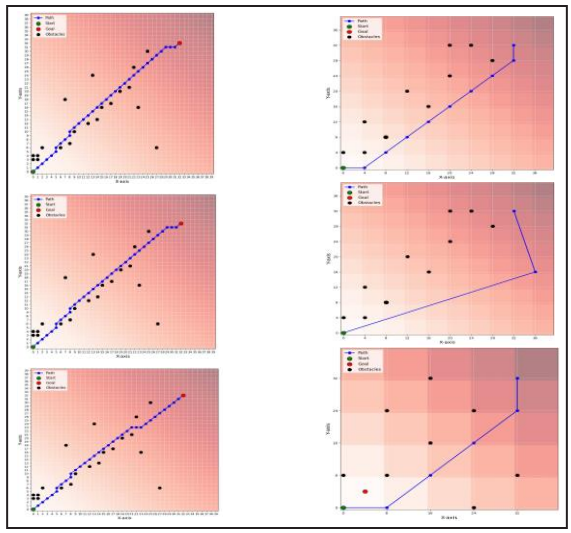

Fig. 1

Conclusion

This study has shown that among the different variants of the A* algorithm, Theta A* is the most efficient for pathfinding in static environments with fixed obstacles. It offers significant advantages in terms of path length, traversal time, and node expansion, making it an excellent choice for real-world applications that require reliable and efficient navigation.

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Advanced Deep Learning and Sensor-based Techniques for Enhanced Corn Disease Detection and Smart Agriculture Applications: A Review

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***Abstract*—The prediction and classification of corn diseases are vital for effective crop management. Recent advancements in deep learning (DL) have led to the use of convolutional neural networks (CNNs), such as VGG-19, for disease detection in corn using UAV imagery. Models like U-Net have also been employed to analyze plant density and emergence uniformity. While these approaches how promising results, challenges such as small datasets and controlled conditions persist. This literature review explores the integration of UAV technology and DL models for disease detection and crop monitoring, highlighting their potential and future directions in precision agriculture.**

Introduction

The prediction and classification of corn diseases are critical for safe guarding crop health and sustainable agricultural practices. Corn (Zea mays L.) diseases significantly impact global food security and farm productivity, necessitating early and accurate diagnostic methods. Advances in deep learning (DL)and computer Vision have enabled innovative solutions for addressing these challenges. Helong et al. [1] developed a CNN model optimized from the VGG-19 architecture for diagnosing corn diseases, utilizing convolutional layers, pooling operations, and preprocessing techniques to extract significant features from input images. Such approaches demonstrate the potential of DL models in identifying diseases under controlled experi mental conditions. U-Net, a convolutional neural network ,has shown promise in segmenting plants from complex backgrounds, offering a robust tool for analyzing plant spacing and density in agricultural applications[2]. Similarly,UAV imagery integrated with DL models has emerged as a powerful tool for field-scale monitoring, providing valuable insights into crop emergence patterns and spatial variability[3]focuses on integrating UAV imagery and advanced deep learning tech niques for predicting and classifying corn diseases.

Literature Review

The authors in [4] present a deep learning model for classifying healthy and unhealthy corn plant leaves using two pre-trained CNNs, EfficientNetB0 and DenseNet121. The deep features extracted from both networks are fused, and data augmentation techniques are applied to enhance the dataset.

Methodology

The block diagram (as shown in Fig 1) illustrates a deep learning and sensor-based system for corn disease detection in smart agriculture. It begins with Data Acquisition, where images from RGB/multi spectral cameras and environmental data from IoT sensors are collected. The next stage is Preprocessing, where the data is normalized and features are extracted to enhance model performance. The Deep Learning Model, typically a Convolutional Neural Network (CNN), processes these inputs to identify disease patterns.

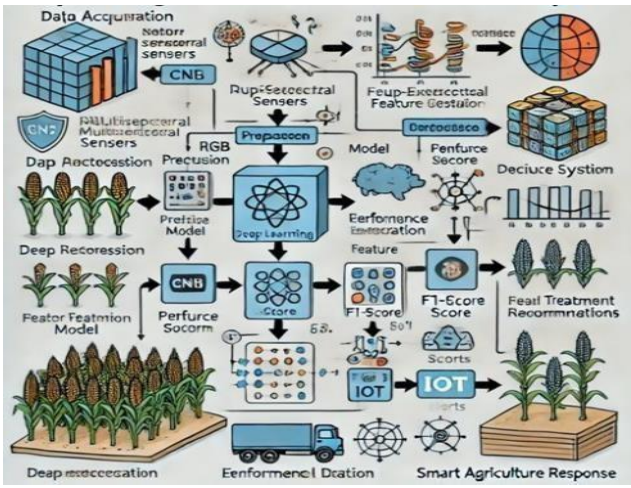

Fig. 1: Deep Learning and Sensor-Based Disease Detection

Algorithm1 Deep Learning & Sensor-Based Corn Disease Detection

Require: I (Sensor images: RGB, multispectral), S (Environmental sensor data), M (Pretrained deeplearning model),T (Classification threshold),E(Training epochs)

Ensure: D(Disease class),P(Performance metrics)

Data Processing:

Normalize images I, extract sensor features S.

Model Training:

for e=1to$E$ **do**

    Forward Pass: Extract features, integrate S, classify disease.

    Loss Calculation: Compute cross-entropy loss.

    Backward Pass: Update weights using Adam optimizer.

end for

Disease Detection:

Input new I', S', classify disease D.

if confidence $>T$ **then**

    Assign disease class.

else

    Mark as healthy.

end if

Performance Evaluation:

Compute Precision,Recall,F1-score,Accuracy.

Smart Farming Decision:

if disease detected **then**

    Suggest treatment & send IoT alerts.

end if

return D(Disease class),P(Model performance),Recommended actions for smart farming

Conclusion and Future Scope

Machine and deep learning over precision agriculture have advanced significantly in the comparison. Using multi- contextual characteristics, MMFNet detects maize leaf diseases with 99.23% accuracy, whereas attention-based FCN monitors Southern maize Rust with 82.1% accuracy. Fast and efficient real-time corn kernel detection using YOLOv5 beats other models. 99.06% EfficientNetB5. Future research shows the need for better agricultural monitoring along with disease detection. For monitoring accuracy and to overcome obstruction and pathogenicity, researchers focus on multi view imaging spectral measurements (MISM) fusion approaches. For IoT applications, MMF-Net and attention-based FCNs show potential but need tuning. Heterogeneous data, feature fusion, and environmental complexity requires improvements. Enhancing crop management data, kernel recognition in obstructed situations, and sensor-based smart farming systems might enhance efficiency, minimize resource consumption, as well as promote sustainable agriculture.

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LibraryXAuto: Transforming Library Operations with Automated Fine Tracking, Real-Time Updates, and User-Centric Features

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***Abstract*—In today's digital world, automation is essential for libraries to meet the evolving needs of users. Traditional systems struggle with inefficiencies like outdated data, slow processing, and extensive human input, leading to inaccuracies and delays. An automated library management system provides real-time updates, accurate data, and reduced human error, enhancing the user experience. Automation streamlines book borrowing, returning, and tracking, improving efficiency, accessibility, and accuracy for both users and librarians, while saving time and and ensuring modernized operation.**

Introduction

This system offers a comprehensive, modern approach to managing library resources by automating cataloging, circulation, and resource tracking. It improves efficiency, streamlines user interactions, and provides real-time data insights, resulting in a more accurate, user-friendly experience for both library patrons and staff. The solution integrates support for digital and physical media, simplifies query management, and offers a scalable platform that adapts to the needs of libraries of all sizes.

Our Automated Library Management System (ALMS) transforms traditional library functions with a streamlined, user-friendly approach that automates cataloguing, circulation, and resource tracking. Designed to support both physical and digital resources, ALMS enables real-time analytics, providing insights into usage patterns for data-driven improvements. The system's intuitive interface and query management simplify interactions, allowing libraries to serve patrons with greater accuracy and efficiency.

From Manual to Automated: The Evolution of Library Management

Problem Statement

The primary challenge in traditional library systems is the extensive manual effort required for book tracking, catalog updates, and data management. Additionally, lack of real-time data prevents users from accessing up-to-date information on resource availability. These issues are compounded by outdated interfaces, leading to a less accessible and user-friendly experience. This paper investigates whether an automated system can address these inefficiencies effectively [15].

Comparing Traditional Library Management Systems with the Proposed Automated System

While existing systems like Koha, Evergreen, Alma, and LibAnswers offer valuable features, they each have limitations that the Automated Library Management System (ALMS) seeks to overcome. For example, Koha and Evergreen have complex interfaces and lack real-time notifications, making them less accessible for users. ALMS, in contrast, provides a user-friendly interface with real-time alerts for due dates, fines, and book availability. Additionally, these systems often lack efficient reservation features, limiting users' ability to request unavailable books. ALMS addresses To support academic schedules, ALMS includes flexible return policies, allowing users to request extensions around exam dates. Lastly, ALMS fosters a community-oriented experience by including a notes section for users to share reviews and insights, enhancing engagement and knowledge sharing within the library[3][18].

Table 1: Table of Comparison

Features	Koha	Evergreen	Alma	Proposed Solution LibraryXAuto
Cataloging & Circulation [18]	✓	✓	✓	✓
Real-Time Notifications [21]	✗	✗	✓	✓
Digital & Physical Resources [14]	✗	✗	✓	✓
Reporting & Analytics [19]	✓	✗	✓	✓
Flexible Return Policies [6]	✗	✗	✗	✓
Fine Tracking by Department [17]	✗	✗	✗	✓
Bulk Data Upload [10]	✓	✓	✓	✓

Methodology and Planning

The development of libraryxauto can be shown in the figure 1 given below:

The flowchart in figure 1 outlines the structure of a Library Management System (LMS) with two main user roles: User and Admin, beginning with a login or signup step that directs users based on their roles. User and Admin, beginning with a login or signup step that directs users based on their roles. Regular users have a User Dashboard providing access to various functionalities, including checking history, receiving notifications on due dates and reservations, and receiving fine alerts via email, SMS, or Twilio. Additionally, users have a Profile section for account overview, transaction history, customization, and analytics related to reading and borrowing patterns, as well as reservation and wishlist management.

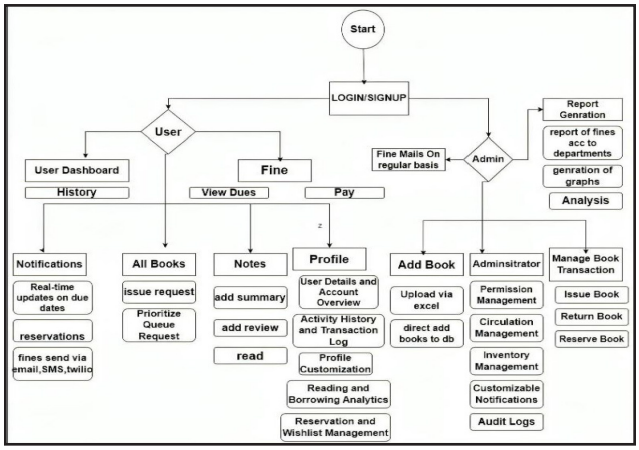

Fig. 1

Implementation and System Design

The Automated Library Management System (ALMS) is developed using the MERN stack (MongoDB, Express.js, React, and Node.js), which provides a scalable and robust platform for web applications. A centralized MongoDB database is used to handle real-time data processing and storage, ensuring that updates to book inventories, user information, and transactions are instantly reflected across the system.

Notifications System

The notification functionality is integrated with Nodemailer for email notifications and Twilio's Communication API for SMS and voice alerts.

Database and Bulk Uploads

CSV files of Excel spreadsheets can be directly uploaded to the MongoDB database, enabling librarians to easily add or update large volumes of book and user data.

Acknowledgment

We would like to express our sincere gratitude to everyone who contributed to the development of this project. Special thanks to our faculty mentors and advisors for their invaluable guidance and support, which helped shape our research and implementation. We also thank our peers and library staff members, whose feedback and insights were instrumental in identifying key functionalities and improving user experience within the Automated Library Management System.

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Feature Selection using Neighborhood Component Analysis for Improving Accuracy

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***Abstract*—This research explores how feature selection methods are becoming more and more important in a variety of scientific domains, specifically to improve software project accuracy. Our main objective is to utilize feature selection techniques, particularly the Neighborhood Component Analysis (NCA) algorithm to improve accuracy. Using a well-known dataset, we assess the effectiveness of NCA for feature selection. We test different values of fitmethod, solver, and lambda to see how they affect the results of feature selection. By systematically varying the parameters, we investigate a range of possible outcomes. With respect to the original dataset, our results demonstrate a significant improvement and highlight the crucial role that feature selection plays in accuracy improvement. Experimenting with different parameter settings reveals the hidden nature of feature selection outcomes, as varying parameters results in different values. It's important to note that we can use these parameters to estimate effort after determining their best values. This demonstrates how adaptable the NCA algorithm is for optimizing different software project analysis compon.**

Introduction

One of the most crucial issues in project management and a continuing challenge for project managers is accurate software project effort estimation. Effort estimates are one of the most critical inputs for project planning activities such as developing a schedule and estimating the required budget. Therefore, the accuracy of the estimates has a direct impact on the project's success. The inaccurate estimation of project effort can result in uachievable schedules and budgets. One study on software development projects reported that 13 to 15 percentage of software projects failed because of inadequate planning. Another study reported that only 17% of the projects were completed on schedule and within budget, and that effort overruns result in unsatisfied customers, poor quality of product, and frustrated employees.

Accurate estimation of a software project effort is a difficult task considering that multiple parameters are used in software project effort estimation. The data sets used are mostly multi- dimensional, which despite creating certain opportunities, also create many computational challenges. One of the existing problems in this regard is that not all features are critical for finding the hidden knowledge amongst the important data, and in many cases, some of the candidate features are unrelated and redundant. In addition, the gathering of these data is time consuming and highly costly.

Methodology

As previously mentioned, this research was performed with the purpose of increasing effort estimation accuracy using feature selection. In order to make a prediction for software project cost and effort estimation, this research employs an experiment in conjunction with a machine learning technique. The experimental protocol is depicted in Figure 1.

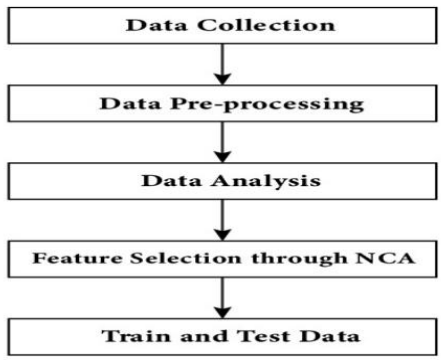

Fig. 1: Methodology

Result Analysis

In this section, the outcomes of performing this research according to the method proposed in previous sections will be examined. The proposed method is executed and evaluated on MATLAB software using the datasets COC81. With our data still not normalized, the greatest loss value was seen when the lambda value was set to 0.015, the solver to lbfgs by default, and the fitmethod to exact. Notably, 11 characteristics were chosen as a result of this setup. This result emphasizes how important parameter settings are in shaping the NCA based feature selectionperformance and results, which highlights the need for careful parameter tweaking to maximize the model's effectiveness in effort estimation for software development projects.

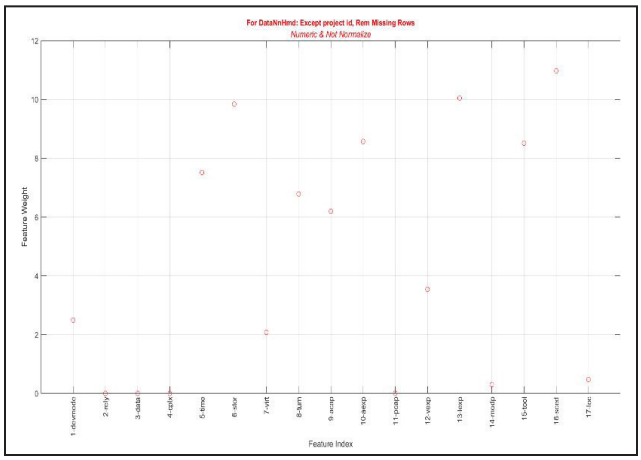

Fig. 2

Acknowledgment

The satisfaction of completing a task would be incomplete if I mentioned people whose cooperation made it possible, the constant guidance and encouragement that crowns all efforts with success is worth it. We are thankful to our project guide Prof. Sushma Khatri for her guidance, inspiration, and constructive suggestions, which were very useful for us in the preparation of this project.

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Smart Kitchen Safety and Automation using IoT

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***Abstract*—To Reduce the risk of accidents related to gas leakages, a proposed Digital kitchen safety system is presented. The system applies a mixed approach in hardware (including Arduino Uno, Node MCU, gas detectors, fire detectors, and load cells) and software (such as mobile applications and Node MCU) in the monitoring of the gas levels. The system can identify a gas leak, send text alerts, sound an alarm as well as shut down the power supply to avoid the probability of the gas catching fire. This is a "smart" solution accepting and acknowledging even inaccuracies within up to 97%.**

Introduction

A gas leak in the kitchen usually happens due to a leakage of the liquified petroleum gas (LPG) due to a damaged or perforated pipe. An unfortunate incident waiting to happen given the presence of such combustibles. With IoT-oriented gas sensors. Smart kitchens include gas sensors, actuated by IoT gateways connecting to the cloud servers as to enable the kitchens efficient management of operations. Enhancing personal, operational and energy safety and various explosion and fire hazards can be minimized. The purpose of this study is to develop and deploy a kitchen safety system with an IoT alert system and control system that activates automatically once any fault occurs on the IoT smart kitchen. Seamless integration of sensor based monitoring techniques with smart control approaches ensures the immediate ability to address any form of dangers. Such an intervention provides unprecedented possibilities with regard to kitchen safety and can be considered a cutting edge technology for eliminating domestic kitchen accidents.

Result

The information retrieves Gas Value, provides the Date and Time with a graph. If gas flow goes above one minute, an alarm is conveyed through a wireless app.

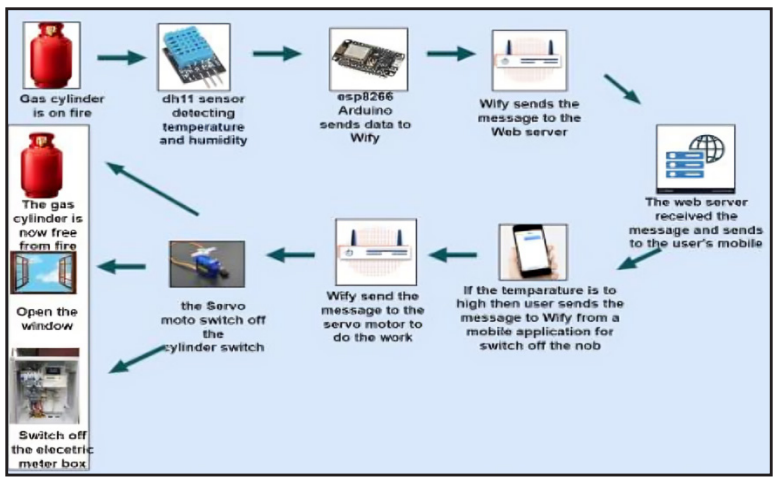

Fig. 1

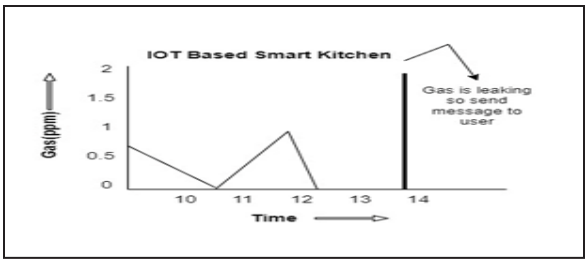

Fig. 2: The Variation of Gas Leakage with Respect to the Response Time

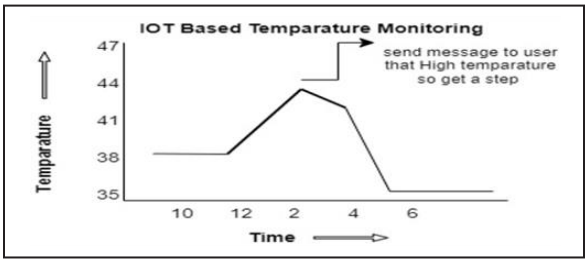

Fig. 3: Temperature Detection IoT Cloud Data

Conclusion

The IoT-focused smart kitchen concept employs a system that inhibits LPG Gas leaks by transmitting information on the cloud data meant for real-time evaluation.

There are plans in the pipeline to introduce website development so that the system can be automated; incorporate AI and machine learning for enhanced performance, and safety management through sending SMS notifications.

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Diabetes Prediction using Machine Learning Algorithms: A Comparative Analysis

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***Abstract*—Diabetes mellitus is a dangerous condition brought on by a number of variables, including genetics, age, obesity, poor food, and elevated blood pressure. It increases the risk of heart disease, stroke, loss of vision, kidney failure, and nerve damage. Using a variety of tests, diabetes is identified but it is time consuming. Big data analytics, which examines vast databases and forecast outcomes quickly. In this article different machine learning methods for diagnosis include XGBoost, Random Forest, Decision Tree, and others are discussed where using 80% training and 20% testing data, Decision Tree, Random Forest, and XGBoost attain 90% accuracy, according to the results.**

Introduction

Diabetes is a major health concern globally, affecting both developed and developing nations [1]. The 2020 National Diabetes Statistics Report estimates that 7.3 million Americans don't have knowledge that they are effected in diabetes, whereas 34.2 million Americans (10.5% of the population) have the disease. In India, 77 million people were diagnosed in 2019, making it the second-highest globally. The inability of the body to create or react to insulin causes diabetes, which raises blood sugar levels [2]. There are three types of gestational diabetes: type 1, type 2, and type 2. Type 2 diabetes is the most prevalent, accounting for 90% of cases. Various factors contribute to diabetes, including genetics, obesity, high cholesterol, poor diet, stress, and lack of exercise. Common diagnostic tests include the A1C, OGTT, and FPG, but these methods can be costly and time- consuming. More than 50% of diabetic individuals remain undiagnosed, highlighting the need for early detection. Machine learning and artificial intelligence offer efficient, low-cost prediction models for diabetes, enabling early diagnosis without medical intervention. These computational techniques analyze large datasets to predict diabetes accurately, aiding in early prevention and treatment. The scientific community is increasingly focusing on AI-based approaches for reliable and timely diabetes prediction, ensuring improved healthcare outcomes worldwide.

Results

In this article different types of machine learning algorithms like Support vector machine, Gradient Boosting, Adaboost, Decision Tree, Naïve Bayes , Random Forest and XgBoost are analysed here. The figure 1 gives an accuracy comparison between these algorithms.

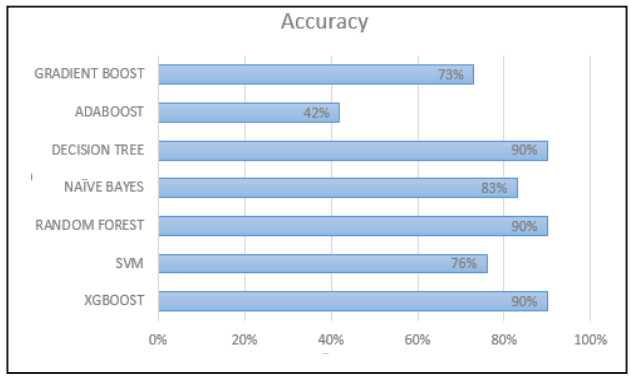

Fig. 1: Accuracy Comparison between the Machine Learning Algorithms.

We have also demonstrated the comparison of precision, recall and F1-Score.

Conclusion

This study evaluates seven machine learning techniques for diabetes prediction, comparing their accuracy, recall, precision, and F1-score. The results indicate that 90% accuracy attained using Random Forest, Decision Tree, and XGBoost, with room for improvement.

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Investigating the Impact of Social Networking on Students with Predictive Analysis of Depression Levels

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***Abstract*—Social networks, a technological boon, serve as platforms for sharing views and ideas. However, their overuse, especially among students, often leads to addiction, loneliness, depression, and even suicidal tendencies. This unsocial behavior fosters self-isolation, increasing the risk of crimes and illegal activities. The correlation between extensive utilisation of social media and psychological problems is being studied using techniques like sentiment measurement and psychological state tracking. This study explores the relation between students' mental states and social media addiction, predicting the potential aggravation of such tendencies. A comparative analysis of male and female students' scores uses machine learning for deeper insights.**

Introduction

Social networks offer a platform for sharing thoughts and ideas but also lead to student addiction, loneliness, and depression, potentially fostering harmful behaviours [1]. The correlation between digital media usage and psychological condition, and forecasting the likelihood of addiction through sentiment analysis and machine learning. A comparative study analyses score-wise frequency among male and female students, aiming to identify and address psychological challenges.

Results

This study assessed the specificity, sensitivity, and accuracy of four machine learning algorithms. Findings revealed significant online platform usage among students, with 23.6% spending over five hours daily and others averaging 1-4 hours. Excessive use reduced participation in activities like reading and sports, highlighting its impact on students' daily lives [Fig 1].

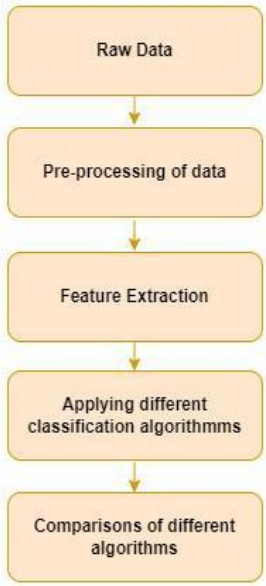

Fig 1: Overall Methodology Used

Conclusion

Our study explored the link between depression and online platform usage among 474 undergraduate students from a Kolkata university. Using KNN, Random Forest, Naïve Bayes, and SVM algorithms, Random Forest proved most effective, confirming increased depression among frequent digital platform users.

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Differential Evolution Algorithms: A Review

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***Abstract*—A popular population-based optimization technique that is well-known for its effectiveness in resolving challenging optimization problems is Differential Evolution (DE). Its straightforward yet potent process, based on mutation, crossover, and selection procedures, makes it successful in continuous optimization. DE has excellent performance in managing nonlinear, multimodal, and constrained optimization problems and has been successfully applied to various domains, including engineering, machine learning, and control systems. This article thoroughly examines DE, reviewing its core ideas, significant variations, and improvements to increase convergence rate and solution precision.**

Introduction

Differential evolution (DE) is a powerful and efficient evolutionary method for global optimization, particularly in continuous and multimodal search spaces. Since its introduction by Storn and Price in 1995, DE has garnered much attention due to its ease of use, simplicity, and robustness in resolving complex, nonlinear, and constrained optimization problems [1,2,3,4].

DE uses mutation, crossover, and selection techniques to enhance a population of possible solutions iteratively. Because DE doesn't require gradient information like traditional optimization methods, it can solve issues involving dynamic, noisy, or non-differentiable objective functions.

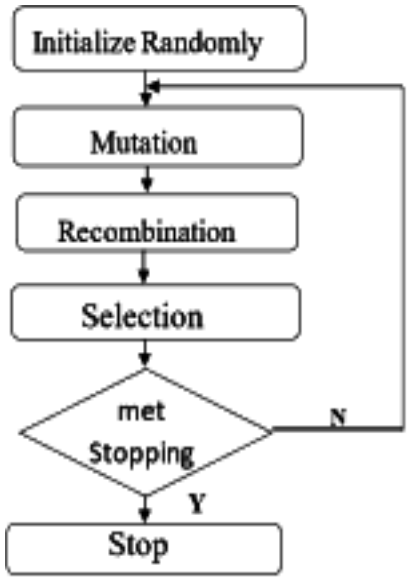
In-depth analysis of DE's fundamental concepts, notable modifications, performance improvements, and practical applications is the goal of this paper. By contrasting several evolutionary algorithms, such as Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) [2,4,5,6,7,8], the benefits and drawbacks of DE are illustrated.

Algorithm for Differential Evolution

The crossover, mutation, and selection operators used by the genetic algorithm are also used by the population-based method differential evolution (DE). The main distinction that permits the creation of better solutions is that differential evolution depends on mutation operators, while genetic algorithms depend on crossover. The variances of population-wide pairings of randomly chosen solutions serve as the foundation for this crucial procedure.

The Differential Evolution algorithm is explained in detail in Fig. 1 and is briefly given below [3,4,13].

1. Create all vector populations at random inside the specified higher and lower bounds.
2. Each vector in the population should have its fitness evaluated.
3. Create a new population in which every potential member is produced simultaneously.
4. Unless the termination requirement is satisfied, loop to step 3.



Conclusion

Complex scientific and technical problems require optimization, and evolutionary methods like Differential Evolution (DE), Genetic methods (GA), and Particle Swarm Optimization (PSO) have shown promise in addressing these issues. Each algorithm operates on distinct principles: GA is inspired by natural selection, PSO mimics swarm intelligence, and DE utilizes vector differentials for mutation-based optimization.

On the other hand, DE provides a balanced approach by efficiently handling both exploration and exploitation, making it a robust choice for high-dimensional and multimodal optimization problems.

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Enhanced Gene Expression Analysis using Variational Autoencoder and Self-Organizing Maps for Precise Clustering

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***Abstract*—One of the primary methods for observing biological processes in cells, proteins, and tissues is through DNA microarrays, as indicated by gene expression data. Gene expression demands some extents of controlling at the multiple levels namely transcriptional level, post-transcriptional level and translational level. The transcription maps the DNA strands to the corresponding RNA form and the RNA is mapped to the protein finally in translation phase. Each of such levels consists of some well-defined number of operations. The amount of gene expression data is growing rapidly along with the development of human observation and recording equipment. Any structural gene consists of different components which work integrally and synchronously to perform the entire cellular activity. The accuracy in analysis of gene expression has been heavily impacted by the high dimensionality and the inherent complexity of enormous amounts of data used in the analysis and processing phases of such expression. The additional expressions appearing in the analysis phase gets manifested in terms of the RNA expressions or protein expression. The machine learning approach can be effectively used but the use of the image data has scored high in comparison to the raw data in achieving the accuracy. The deep learning-based approach has been instrumental and which has further been upgraded with the use of Autoencoder. The dimension reduction aspect has been achieved by incorporating the variational autoencoder (VAE).**

Introduction

All living things' growth, development, adaptation, and reproduction are controlled by gene expression. The lethal diseases like heterogeneous cancers can be treated and the protein production for biotechnology application could be managed if the regulatory codes concerned could be understood well. This is completely beyond our knowledge periphery that much the DNA code influences mRNA abundance or how this information is encoded in the DNA, despite transcriptional regulation being a focus of research for decades and allowing accurate measurements of mRNA levels ranging from a few copies to several thousand per cell. The ability to precisely control mRNA and protein levels by merely modifying the sequence of the four DNA nucleotides is hindered by the lack of such quantitative insight.

The most crucial aspect of SOM, omitting the buried layer, differs from DL in that it is a separate feature. Kohonen made the initial suggestion for the SOM in 1990. This clustering algorithm's goal is to map points in high-to-low dimensional space while preserving as much topological structure [1] as possible between each point. This can provide effective grouping and visualization of the data as well as the ability to map the data to a two-dimensional grid. Given the benefits of VAE described above, the technique of merging VAE and SOM was first used to improve the accuracy of clustering in order to generate a more accurate representation of the gene expression pattern.

The current paper offers the following contributions:

- A technique to analyze enormous amounts of gene expression data gleaned from DNA micro-arrays is becoming increasingly necessary. The presented technique comprises the methodologies for categorizing and analyzing the gene expression data that combines a self-organizing map (SOM) with a k-means clustering.

- The combined framework for SOM and VAE includes techniques for learning unsupervised neural networks that map high-dimensional data to a two-dimensional environment.

Methodology

DL model is the solution to high-dimensional problems in many domains which transforms the raw data at the input layer into increasingly abstract feature representations by sequentially combining outputs from the preceding layer and encapsulating extremely complex functions. This research presents a novel clustering framework that extends the conventional shallow clustering algorithm into the deep clustering algorithm in order to improve clustering accuracy and decrease the time cost when used with a particular DL.

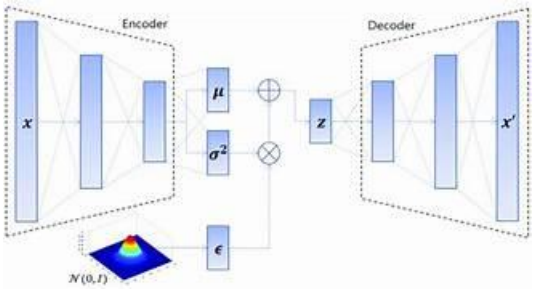

Fig. 1: Architecture of Autoencoder

One (or more) such variable settings could result in something P′ (m-dimension, m n) that is comparable to P for each data point Q (n-dimension) in a dataset from Fig. 2. Data points P in high-dimension space serve as the basis for the original data distribution Q(p) for the generation model (Eq. 1).

$$\mathbb{E}_{p_D(x)}[\log p_\theta(x)] = \mathbb{E}_{p_D(x)}[\log \int_{\_} p_\theta(x|$$

Conclusion

Clustering helps in gene expression data; numerous biological and novel molecular functions of the organism are made visible. The raw data concerning gene expression data are grouped without labels in this study using the VAE-SOM model. To enhance the precision and effectiveness of SOM, the VAE model is introduced. In actual use, the approach suggested in this study can be used to define gene relationships and track gene expression in a cell. The clustering framework of gene expression data, integrating deep learning and self-organizing map (SOM) techniques, offers a powerful approach for analyzing and understanding gene expression patterns. By leveraging advanced algorithms and equations, this framework provides improved biological insights and facilitates discoveries in genomics and bioinformatics research.

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A Multistage Energy efficient and Secure Node Localization Policy for Wireless Sensor Networks

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***Abstract*—This paper proposes a Secure Node Localization (SABWP-NL) approach for Wireless Sensor Networks (WSNs), enhancing localization accuracy, scalability, and energy efficiency. It integrates Self-Adaptive Binary Waterwheel Plant Optimization (SABWP) with Bayesian optimization and uses Dempster-Shafer Evidence Theory to assess node trust against rogue nodes. A mobile anchor updates node locations, followed by SABWP-based localization. The approach outperforms BWP, ROA, and AO in localized nodes and localization accuracy, demonstrating superior performance in dynamic environments with node failures and random shifts.**

Introduction

Wireless Sensor Networks (WSNs) have gained significant attention in recent years due to their wide range of applications, including environmental monitoring, healthcare, industrial automation, and military surveillance. One of the critical challenges in WSNs is the accurate localization of sensor nodes, as the functionality and effectiveness of these networks heavily depend on knowing the precise positions of nodes. These challenges become more pronounced in large-scale and dynamic environments where sensor nodes may fail, shift randomly, or be subject to security threats like rogue nodes. Localization accuracy is often compromised by the trade-off between energy efficiency and precision, which is especially problematic in resource- constrained WSNs [1-5]. Applications such as target tracking and data source location are made possible by the location information in WSNs, which also allows for effective routing and power savings [6]. For a large-scale network with movable nodes, manual location setup is not possible. Since global positioning systems (GPS) are expensive in terms of both cost and energy consumption, it is not a practical option to equip every node with GPS hardware for localization[7]. However, conventional localization solutions sometimes encounter difficulties due to things like challenging deployment conditions, scarce resources, and possible security risks. Incorrect node localization can cause data integrity issues, and ineffective routing, and eventually make it more difficult for the network to achieve its monitoring targets. Existing routing techniques may not always emphasize energy efficiency, which could result in early node resource depletion and shorter network lifetime [15-18].

Problem Statement

In WSNs, sensor node localization is still a difficult task in spite of great progress made in the area. The energy consumption, accuracy, scalability, and adaptability of current geolocation algorithms are frequently limited. Furthermore, the suggested approaches' evaluations are frequently not thorough enough, with insufficient analyses of their scalability, robustness, and flexibility to different deployment environments.

Performance Evaluation of Node Localization

This section presents the analysis of Localized Node (LN) and LE of the SA-BWP based NL methodology with other existing techniques such as BWP, ROA, and AO.

The forementioned LE analysis demonstrates that the proposed approach produced the lowest LE of 0.27 under 10 anchors, but ROA, BWP, and AO algorithms produced higher LEs of 0.4, 0.35, and 0.57, respectively.

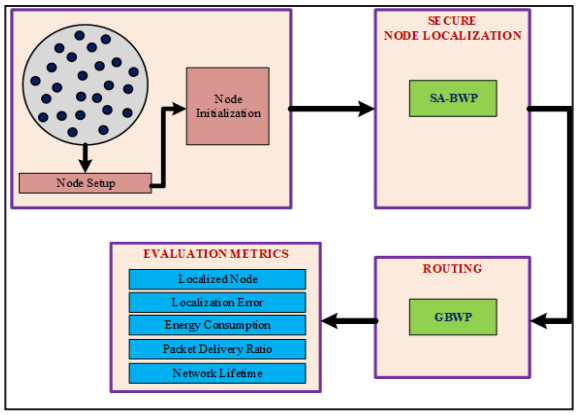

Fig. 1

Table 1: Evaluation of LN using AN

Methods	No. of Anchor Nodes				
	10	**20**	**30**	**40**	**50**
Proposed SA-BWP	149	153	179	192	203
BWP	129	137	151	168	183
ROA	103	136	147	151	163
AO	114	111	121	134	143

Conclusion

This study focused on secure node localization presenting a novel strategy to improve WSN performance. The position of sensor nodes is efficiently and accurately determined by SA-BWP algorithm. The purpose of this stage is to reduce security risks from the initial deployment phase by including trust evaluation. The position of sensor nodes is efficiently and accurately determined by SA-BWP algorithm. The performance of proposed method is evaluated and compared with various existing algorithms such as BWP, GOA, ROA, and AO. The proposed method performs better in NL than other existing models and energy efficent. This study addresses significant issues of security, efficiency, and performance optimization while contributing innovative methods to WSN.

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Lifetime Maximization using Clustered Energy Optimization Protocol with GSO in Wireless Sensor Networks

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***Abstract*—This paper deals with lifetime maximization, coverage and energy optimization of the wireless sensor network. In large deployed network the transmission range is vital for data transmission. In our proposed model, this area coverage of the cluster can be done using Glow worm Swarm Optimization (GSO) based clustering (GSO-C), network lifetime constraint can be optimized using the novel routing algorithm Clustered Energy Optimization (CEO). Clustering has been proven to be one of the most efficient techniques for saving energy of wireless sensor networks. However, in a hierarchical cluster based WSN, cluster-heads (CHs) consume more energy due to extra overload for receiving and aggregating the data from their member sensor nodes and transmitting the aggregated data to the Base Station (BS). Therefore, proper selection of CHs plays a vital role to conserve the energy of sensor nodes for prolonging the lifetime of WSNs. In this work, a novel hierarchical cluster-based approach called Clustered Energy Optimization [CEO] with GSO is proposed for wireless sensor networks [WSNs]. The proposed algorithm shows better results when compared with the existing protocols such as HCPSO, GSO and GSA with respect to throughput, energy consumption and routing performance.**

Introduction

Wireless Sensor Network is a network, which can selforganize them with a large number of small sensors. These sensor nodes can perform the packet transmission among themselves within their radio range and also, they are organized in a way to sense, observe, and recognize the physical entity of the real-world environment.

Prolonged network lifetime, reliable data transfer, energy conservation in sensor nodes, and scalability are the main requirements for WSN applications [14, 16]. Because of the several constraints in the sensor nodes, WSN is having various issues such as coverage area, network lifetime, scheduling, and data aggregation. It comprises wireless sensor nodes in huge number which has been arranged and installed based on the applications and a sink or base station (BT) that is located very near to or within the radio range [8,9,10].

The figure 1 above shows the basic architecture of the wireless sensor networks. The sensor nodes are deployed in the sensor field where it senses and transmit the data, either in single hop or in multi-hop, as shown in the figure.

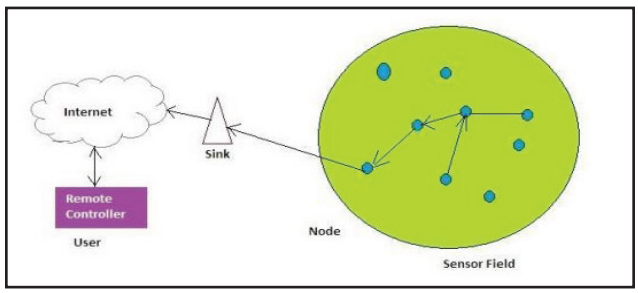

Fig. 1

Literature review

This section describes the literature review in the direction of network coverage and energy optimization.

Amita Yadav, Suresh Kumar suggests an algorithm based on Particle Swarm Optimization (PSO) technique for improving network life time. It helps in forming the clusters as well as the Cluster Head (CH) selection. The proposed algorithm is extensively experimented and then the results of this algorithm are compared with the

previously proposed algorithms such as LEACH, etc. It is concluded that the PSO based clustering algorithm gives better results [21].

Network Energy Model

In this section, we discuss mostly the network and energy model considered for this work along with the node deployment aspects.

Node Deployment

Topological deployment of sensor nodes is an important consideration for wireless sensor networks. The type or mode of deployment depends on the application and affects the performance. In deterministic situations, the sensors are placed manually and data is routed through pre-determined paths.

Performance Analysis

Throughput

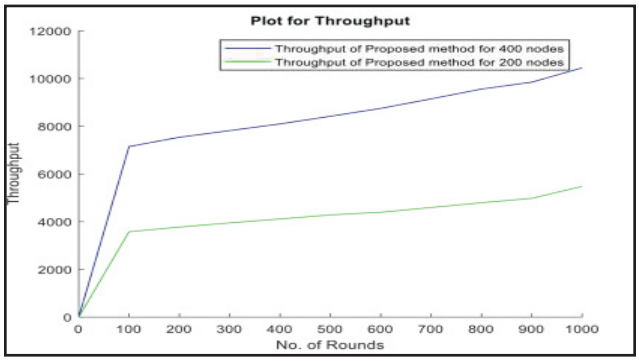

Fig. 2: Throughput of proposed CEO-GSO protocol

Conclusion

Energy and lifetime are the two major constraints in designing any routing protocol for wireless sensor networks. A lot of research has been done to achieve enhancement in this direction. In this paper, we have proposed a cluster-based energy optimization model to enhance the lifetime of the sensor network. In large area networks, the nodes are often distantly deployed.

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Versevo LLM: Shaping Speech Processing Excellence through Data-Driven Innovation

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***Abstract*—"Versevo" is a pioneering project at the forefront of revolutionizing the landscape of speech processing and language-related services. This report provides a comprehensive overview of the project's objectives, methodologies and future planning. Focused on unparalleled accuracy, versatility, and user satisfaction, "Versevo" employs a robust data-driven approach that leverages cutting-edge technology and advanced machine learning models.**

The project's key objectives include surpassing industry benchmarks in accuracy, offering a versatile platform with extensive language support, prioritizing user-centric experiences, fostering continuous innovation, and maintaining the highest standards of data security and reliability.

"Versevo" stands out in the speech processing domain by achieving a 40% improvement in transcription accuracy compared to competitors, providing 30% more language support than industry leaders, and ensuring a 20% higher user satisfaction rate.

Introduction

The VERSEVO project stands at the forefront of innovation in multilingual speech processing and language-related services. It aims to revolutionize the way we understand and utilize language technologies by combining cutting-edge machine learning models with extensive, diverse datasets. VERSEVO's primary objective is to surpass industry benchmarks in accuracy, versatility, and user satisfaction, focusing on both high-resource and low-resource languages. Leveraging state-of-the-art technologies like the No Language Left Behind (NLLB) model and Seamless Align, the project addresses complex challenges in multilingual translation, speech recognition, and data security. Through rigorous research, comprehensive methodologies, and a commitment to continuous innovation, VERSEVO aspires to set new standards in the field of language processing, making advanced linguistic services accessible to a global audience.

Research & Development Procedure

The scope of "Versevo" extends beyond its immediate service offerings to encompass a robust Research and Development (R&D) framework. The project distinguishes itself as an R&D-focused organization committed to continuous innovation within the speech processing field. This commitment is not a mere aspiration but a structured procedure that involves ongoing analysis of advancements in artificial intelligence and multimodal speech models.

Upcoming Indigenous Multimodal Speech Model - Verso

An integral part of the scope of "Versevo" is the anticipation and introduction of the upcoming Indigenous Multimodal Speech Model - Verso. This proprietary model signifies a leap forward in technological capabilities, representing a fusion of cutting-edge technology and indigenous innovation. "Verso" is not just a model; it is a testament to the project's commitment to setting new standards in the industry.

Literature Survey

- **Overview of Speech Processing:** The landscape of speech processing unfurls a captivating narrative, mirroring the relentless pursuit of transforming audible language into a comprehensible digital form. At its inception, the exploration of voice recognition embarked on a quest for decoding the intricacies of human speech.

- **Current Landscape of Speech Processing Services:** Speech processing is a broad and interdisciplinary field that encompasses various tasks such as speech recognition, speech synthesis, speech enhancement, speech translation, speech emotion recognition, and speech analytics.
- **Innovation in Speech Processing Model:** Speech processing is a broad and interdisciplinary field that encompasses various tasks such as speech recognition, speech synthesis, speech enhancement, speech translation, speech emotion recognition, and speech analytics. Speech processing models are applications that perform these tasks using artificial intelligence and machine learning techniques.

Results

Phase 2: Mining Bitexts for Low-Resource Languages

Low-resource languages are gradually introduced into the training process, leveraging the knowledge gained from high-resource languages to improve translation quality for less represented languages.

Phase 3: Balanced Multilingual Training

The model undergoes balanced training across all languages, ensuring that no language is disproportionately favored. This phase employs a dynamic sampling strategy to maintain an equilibrium between high-resource and low-resource languages.

Flores-200 Dataset

A significant aspect of the NLLB project is the creation of the FLORES-200 dataset, a comprehensive multilingual benchmark that includes professionally translated sentences in 204 languages.

Evaluation and Results

The NLLB-200 model's performance was evaluated using both automatic metrics and human assessments. The model achieved a 44% improvement in BLEU scores compared to previous state-of-the-art models, demonstrating its effectiveness in handling diverse languages.

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Analysis of Skin Diseases using Deep Learning Techniques

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***Abstract*—The analysis of human skin diseases is crucial to gain valuable insights into their classification and diagnosis. This study utilizes a Skin Problem Dataset comprising ten distinct skin disease categories, collected from reliable sources. To ensure an effective and accurate analysis, the data set is possessed to extract meaningful and informative features. Various deep learning techniques are then applied to determine the most suitable model for disease classification. The research follows a structured workflow that encompasses data pre-processing, analysis, and model evaluation. The findings demonstrate that deep learning approaches significantly improve skin disease classification accuracy, highlighting their potential to improve diagnostic processes.**

Introduction

Throughout the world, millions of people suffer from skin diseases across all ages. These conditions range from minor infections to chronic and life-threatening diseases, including eczema, psoriasis, melanoma, and dermatitis [1]. Skin diseases must be diagnosed and classified accurately in order to be treated and managed effectively. There are, however, numerous limitations to traditional diagnostic methods, including the requirement for dermatological expertise, which can be subjective and time-consuming [2].

A study conducted in Western Ethiopia found that between 47% and 53% of individuals self-reported having a skin disease, but upon clinical examination, 67% of those who denied having a condition were actually diagnosed with treatable infections [17].

Methodology

Deep Neural Network

Deep neural networks (DNNs) extend artificial neural networks (ANNs) by incorporating additional hidden layers between input and output layers, thus increasing the depth of the model [20]. Deep learning, a specialized branch of machine learning (ML), emphasizes algorithms that refine performance through the learning process rather than explicit programming.

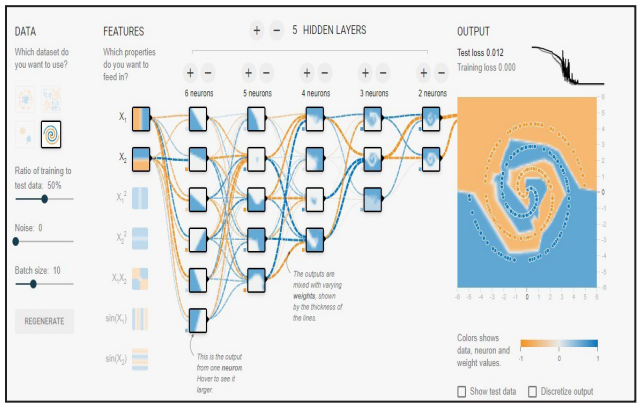

Fig. 1: A Deep Learning Model

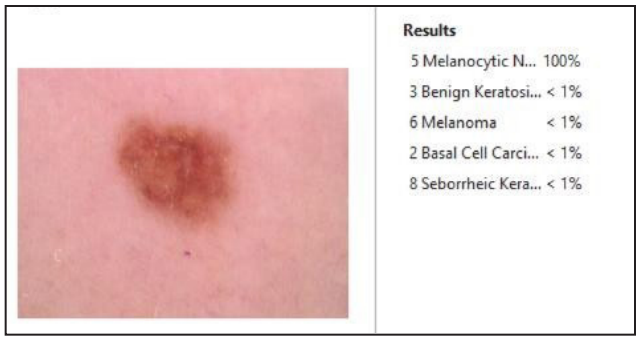

Fig. 2: Shows a Skin Lesion with a Classification Result on the Right Side.

Understanding ResNet50 Architecture

The ResNet50 model comprises 48 convolutional layers with one MaxPooling and one AveragePooling layer. It performs 3.8×10^9 floating-point operations and is widely used in deep learning applications. It outlines the configuration of layers, specifying convolutional layers, filter sizes, and feature map dimensions, along with the computational complexity measured in Floating Point Operations (FLOPs) for each model.

Result

The proposed model achieved an accuracy of 0.9205, demonstrating its effectiveness in classifying skin disease images. Additionally, the training time was recorded as 21,259 seconds, indicating the computational complexity of the model.

Conclusion

The analysis of the Skin Problem Dataset is highly complex yet crucial for accurate skin disease prediction. By leveraging DNN + ResNet50, we can effectively classify newly provided skin disease images. The DNN + ResNet50 methodology has proven to be a highly efficient deep learning technique for this task. The outcomes align with our expectations, reinforcing the reliability and effectiveness of this approach.

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Colour Image Enhancement using Undecimated Wavelet Transformation with Histogram Equalization

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***Abstract*—Over the last few years, there has been a growing need in developing efficient algorithms for image improvement since images are widely used in various areas like medicine, satellites, and photography. Basic image enhancement methods often struggle to retain finer details, facing challenges in balancing both fine-grained information and clarity. This can lead to issues with maintaining contrast and brightness consistently across the image. Therefore, this study seeks to provide a new enhancement technique called Undecimated Wavelet Transform with Histogram.**

Equalization (UWT-HE) to eradicate these limitations. The fundamental reason behind this approach is to take advantage of UWT's ability to perform multi-scale representations to capture and analyse details at different sub-bands of frequencies. Due to the sub-banding of an image, the UWT provides multi-level enhancement of an image as decomposed into sub-bands. Next, HE is processed to increase the contrast of the image so as to maximize the image quality while preserving the original details. Finally, the performance of the proposed method is evaluated in terms of Peak-Signal-toNoise Ratio (PSNR) and Structural Similarity Index Measure (SSIM) to determine the efficiency of the method. The obtained values show that the proposed UWT-HE approaches has PSNR level of 57.70136 and SSIM level of 0.984918. The findings affirm that the method is able to maintain image quality and fine features thereby improving the image contrast. This makes it an ideal tool for high quality image processing applications where fine details of the images coupled with the enhancement of image contrast is critical.

Introduction

Enhancement of colour image is a very necessary task in today's world of technology in scientific fields like electronic postal and media, health and medical sciences computer science and technology, space and telecommunication, surveillance technology etc [1]. The main goal is enhancement of the image quality for better view and interpretation by naked eyes or machines in appropriate manner. Whereas in the enhancement of the grayscale images, the techniques mainly involve the brightness and contrast of the images, colour image enhancement involves complexities such as representation of colours such as RGB, HSI and their interactions [2]. This complexity arises because; coloured images are created from three channels; RED, GREEN and BLUE with each of them holding different aspects of colour of the image [3]. Amending a colour image entails more than just equalizing these channels; it concerns keeping their relations intact in order to obtain a natural-looking image. One of the main challenges that have to be solved is to define how to maintain the colours' integrity while enhancing them. Most of the standard image enhancement methods like histogram stretching, histogram equalization is not suitable directly on colour images as they distort the colours [6]. This is because the said methods could not capture the dependency between the several colour channels and in the process produces wrong values that lead to saturation, unnatural colour cast, and affects the overall visual quality of the result.

Related Works

Majead and Hadi [20] addressed various issues related to image contrast improvement and resolution

enhancement of infra-red (IR) images. According to the presented investigations, LWT is implemented to enhance the quality of IR images. In fact, using the gained high sub-band components (LH, HH, and HL) with the initial IR image, the application of LWT-HE allowed obtaining an image with considerably enhanced recognition ability while being observed by thermal cameras.

Pullagura, Valasani, and Kesari [21] addressed the difficulties and developments in capturing and processing images and videos in long range and aerials which are mostly Viewed from digital cameras used in spacecrafts, drones and UAVs.

Comparison of Image Enhancement Using UWT with and without HE

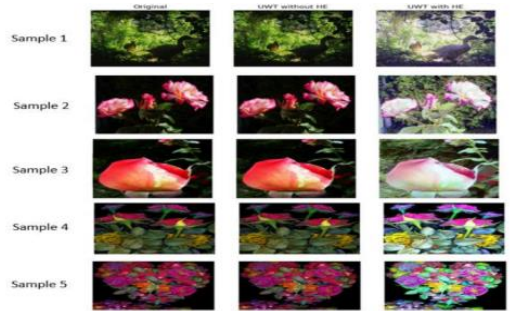

Fig. 1: Comparison of Flower Image Enhancements: Original, UWT without HE, UWT with HE

Fig 1 shows the comparison between the result obtained applying HE on different flower images. The first pictures by applying UWT alone and that of applying UWT after are shown in the "Original" column, and they are used for platform.

Result and Discussion

Findings of these given metrics prove that the processed images not only seem to have a higher aesthetic quality but also possess a preserved structural form or information bearing capacity hence confirming the efficiency of the enhancement method.

Conclusion and Future Works

This research analyses the results obtained through histogram equalization and also the results of undecimated wavelet transform when applied together. The analytical results show that the presence of HE considerably enhances the contrast of the image and enhances the information capacity but at the same time distorts the signal to noise ratio and the existence of artifacts shows that PSNR and UQI have been reduced.

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Data-Driven Predictions: Analyzing Stock Market Trends with Analytics

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***Abstract*—Stock price prediction is a crucial yet challenging task due to financial markets' unpredictable and multifaceted nature. Outmoded anticipating methods, like statistical and econometric models, often fail to capture nonlinear dependencies and long-term temporal patterns. This study integrates deep learning techniques, combining Long Short-Term Memory (LSTM) networks and Convolutional Neural Networks (CNN) to enhance predictive accuracy. The LSTM component effectively learns sequential dependencies, while the CNN extracts key features from historical stock data. Moreover, stirring average indicators (50-day, 100-day, 200-day) are scrutinized to identify price trends and potential market signals. Using real-time stock data from Yahoo Finance, our model's performance is evaluated through visualization techniques, highlighting actual vs. predicted price trends. The results demonstrate that the proposed approach improves forecasting accuracy, providing valuable insights for traders and investors in making data-driven decisions.**

Introduction

The financial markets are complex and ever-changing, influenced by various factors such as economic conditions and investor comportment. Because of their volatile nature, accurately predicting stock prices has always been a key objective for traders, investors, and financial analysts.[1] A reliable prediction model can lead to better investment decisions, improved risk management, and potential economic gains. Traditional methods, such as statistical models and econometric techniques, have been widely used, but they often struggle to capture the intricate patterns and time-based dependencies in financial data.

Stock markets are highly dynamic, partial by various factors such as economic trends, investor sentiment, geopolitical events, and company performance. Accurate stock price prediction is critical for traders, investors, and financial analysts to make informed decisions and manage risks effectively.

This study aims to develop a hybrid deep learning model integrating LSTM, CNN, and an attention mechanism to enhance stock price prediction. Additionally, we incorporate moving average indicators (MA 50, MA 100, MA 200) to analyze market trends and validate our predictions. Using instantaneous stock data from Yahoo Finance, we envisage price inclinations and evaluate the model's predictive performance using key metrics such as Mean Squared Error (MSE) and Root Mean Squared Error (RMSE).

Methodology

This study employs a hybrid deep learning approach to predict stock prices using historical data. The methodology consists of several key stages: data collection, pre-processing, feature engineering, model development, training, evaluation, and visualization. Below is a step-by- step breakdown of the process:

Hybrid Deep Learning Approach for Stock Price Prediction

This study employs a hybrid deep learning approach to predict stock prices using historical data. The first step involves collecting real-time and historical stock price data from the Yahoo Finance API using the yfinance Python library. The dataset includes daily closing prices of selected stocks (e.g., AAPL, MSFT) determined from September 1, 2021, to May 1, 2024, ensuring coverage of various market conditions.

Analysis

In analyzing the Golden Cross, where the 50-day moving average crosses above the 200-day moving

average, indicated bullish market trends, while the Death Cross, where the 50-day moving average falls below the 200-day moving average, signaled bearish trends. Moving average convergence-divergence patterns aligned well with historical market corrections, making them valuable tools for traders.

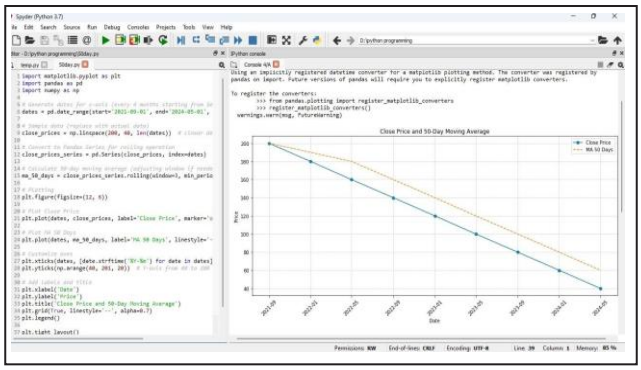

Fig. 1: Comparison of 50-Day Moving Average with Closing Price.

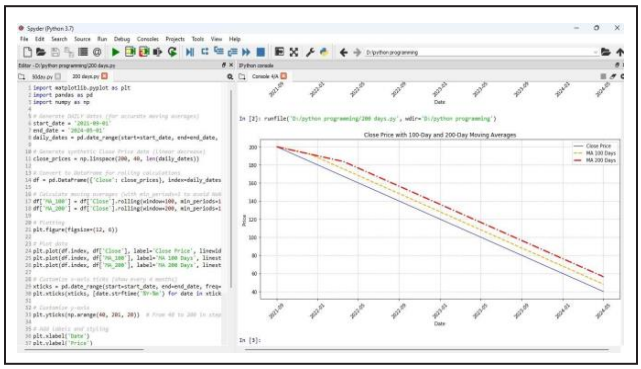

Fig. 2: Comparison of 100-Day and 200-Day Moving Averages with Closing Price.

- **50-Day Moving Average:** The 50-day moving average is a widely-used indicator in technical analysis that helps smooth out short-term fluctuations in stock prices, allowing for a clearer view of longer-term trends.
- **100-Day Moving Average:** Similar to the 50-day moving average, the 100-day moving averages serve as a crucial tool for identifying longer-term trends in stock prices. It averages the closing prices over the most recent 100 trading days, providing a broader perspective on the stock& performance.

Conclusion

The stock price prediction model combining LSTM, CNN, and an Attention Mechanism demonstrated strong potential in forecasting stock movements, particularly in stable market conditions. The LSTM component effectively captured long-term trends, while CNN improved feature extraction, and the Attention Mechanism helped the model focus on key time steps, refining prediction accuracy. Moving averages provided useful insights into market trends, helping identify potential buy and sell signals.

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A Novel Predictive Model for Identification of Heart Disease using Machine Learning

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***Abstract*—We here consider early CVD detection via machine learning (ML) from lifestyle and lab test attributes in the Framingham Heart Study data set (15.2% CVD incidence). We compare Logistic Regression, Naïve Bayes, SVM, Decision Tree, Random Forest, and a Stacking Classifier. Individual best performances come from Random Forest and SVM. Yet, the Stacking Classifier greatly improves performance, with more than 86% accuracy, sensitivity, and specificity, ROC-AUC greater than 71%, and F1-score and precision greater than 83% with Multi-Layer Perceptron as the meta-classifier with RF and Gradient Boosting. This demonstrates the capability of ensemble techniques to enhance early CVD diagnosis.**

Introduction

CVD is a major health issue worldwide; WHO estimates that around 17·9 million deaths occur due to CVD each year, and this figure includes the year 2016. This situation is especially evident in LMICs, for more than three-quarters of CVD-related mortality rates were recorded in these regions. This association with behavioural risk factors for CVD and competing conditions like hypertension and diabetes further compounds the CVD burden.

The diagnostic test for CVD is based on the results of tests on one's blood pressure, cholesterol level, and other biomarkers, among others. Nevertheless, behavioral risk factors might be taken into consideration, while the diagnosis remains complex and ambiguous in many situations, even when there are no other conventional risk factors.

Machine learning applications for CVD prediction are still in a catch-22 situation with respect to reaching stability and maximum effectivity consistently. Other works have also investigated several approaches, such as rule-based algorithms, Decision Trees (DT), Naive Bayes (NB), Artificial Neural Networks (ANN), and Support Vector Machines (SVM). For instance, Srinivas et al. (2010) established that There are several works on how to improve the predictive model, such as Ensemble learning and Feature selection methods, but these approaches always connect with the inevitable loss of information. This research addresses these challenges by developing a stacked classifier for CVD prediction based on the Framingham Heart Study. The records of 4240 patients with 15 features of CVD, including patients with and without the disease, are also available on the Kaggle website.

Methodology

Dataset

The Framingham Heart Study dataset is available at Kaggle, which has information on the health of 4,240 patients.

Sl. No	Attributes	Description	Range of Values	% of categories	Mean	Std. Dev
1	Age	Age at exam time in years	Continuous		49.58	8.57
2	male	Male orFemale	0 = Female 1 = Male	43% Male, 57% Female		
3	education	Education of the patient	1 = Some High School 2 = High School or GED 3 = Some College 4 = college	11% Some High School 32% High School or GED 16% Some College 41% college		

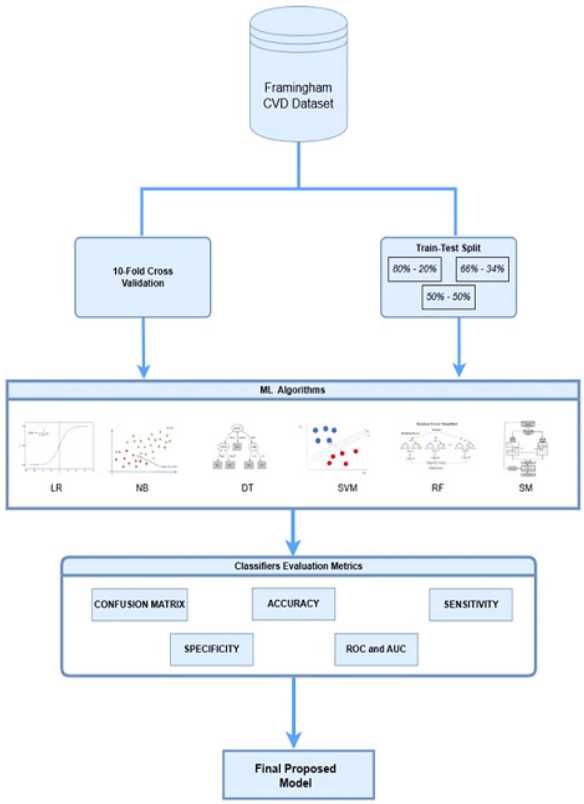

Fig. 1: ML Pipeline

Results and Discussion

The accuracy analysis of the actual data set concerning all the classifiers (LR, NB, DT, SVM, RF, and SM) shows that most of the classifiers' accuracy varies minimally across the sets. . Logistic Regression (LR), Support Vector Machine (SVM), Random Forest (RF), and SM achieve an accuracy of approximately 84-85%.

	LR	NB	DT	SVM	RF	SM
10 Fold	85%	82%	74%	84%	84%	84%
50 - 50	85%	83%	74%	84%	84%	85%
66 - 34	85%	82%	76%	84%	84%	85%
80 - 20	85%	82%	75%	84%	84%	86%

Table 1: Accuracy score of different ML models

Conclusions

Specifically, the Area Under the Receiver Operating Characteristic Curve (AUC-ROC) is recommended for evaluating classifiers' performance in the case of imbalanced datasets because it is a more reasonable measure if compared to accuracy. Suppose the majority class instances are significantly larger than those of the minority class. In that case, accuracy can be quite deceiving since a classifier can be highly accurate by merely classifying samples from the majority class a majority of the time. AUC, on the other hand, tells the measure of a model that is focused in terms of its ability to classify between the two classes, disregarding the distribution of the classes; it also gives importance to the true positive rate of a model and avoids the false positive rates of the model.

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Short Term Solar Power Forecasting using CTRNN

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***Abstract*—To successfully integrate the large scale photovoltaic (PV) generation to conventional power systems, there is need to accurately predict solar power such that sustainable operations of microgrids and smart grids can be ensured. In this paper, as short-term solar power forecasting method, Recurrent Neural Network (RNN) is used (LSTM, GRU). Mean absolute error (MAE) and root mean square error (RMSE) are used to measure the performance of the LSTM, GRU algorithm and this was compared with some existing model of the statistical models and traditional machine learning. The results show that LSTM, GRU and CTRNN algorithm has higher accuracy in short term prediction and thus suitable for completing real time solar power forecasting so as to ensure accuracy and reliability.**

Keywords—solar power forecasting, machine learning, deep learning

Introduction

In the recent decades, coal and oil as non-renewable energy sources have been abundantly used. So, it has started from various problems like global warming, the depreciating of the ozone layer, and air pollution and the concerned countries from different continents [1, 2, 3]. To be under the 2 degrees C limit of temperature rise required under the Paris Agreement, 2 thirds of world energy is to be based on renewable energies by next 2050. Renewable energy includes sun, ocean, biogas, wind and so on. On the other hand, these sources of energy have more advantages than other non-renewable sources of energy like high reserve, low emission, and sustainable.

Generally speaking, there exist physical, statistical, hybrid and deep learning models for solar power forecasting models. The comparing of all models is good as they have different limitations; however, we get the better result of them into deep learning models. Following from the literature, it can be concluded that Deep Learning Model generally recurrent neural network such as LSTM, GRU, which has different set of applications with better results in forecasting. They have their own limitations such as they can't learn complex time series in whole, nor their long-term dependence can be kept if they lose their long-term dependence due to vanishing gradient. Therefore, the purpose of this work is to predict wind power by using CTRNN model and comparing its result (CTRNN) with other recurrent models (LSTM, GRU) according to evaluation criteria such as RMSE, MAE, and R2.

Results

A solar power forecasting model based on the deep learning is currently being implemented. Preprocessing 'Berkeley_Solar' data was carried out for initial experiments to ensure data quality and consistency. To tackle the problem of data dependencies in the data, we use this model that encompasses CTRNNs to capture temporal and spatial dependencies in the data. An improvement in the forecast accuracy relative to the traditional statistical methods is the expected outcome

Conclusion

The aim of this project is the development of solar power forecasting deep learning model to handle variability challenges. Results are yet to be shown, but it is forecast to improve forecasting accuracy thus improving solutions to grid management and renewable energy integration.

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