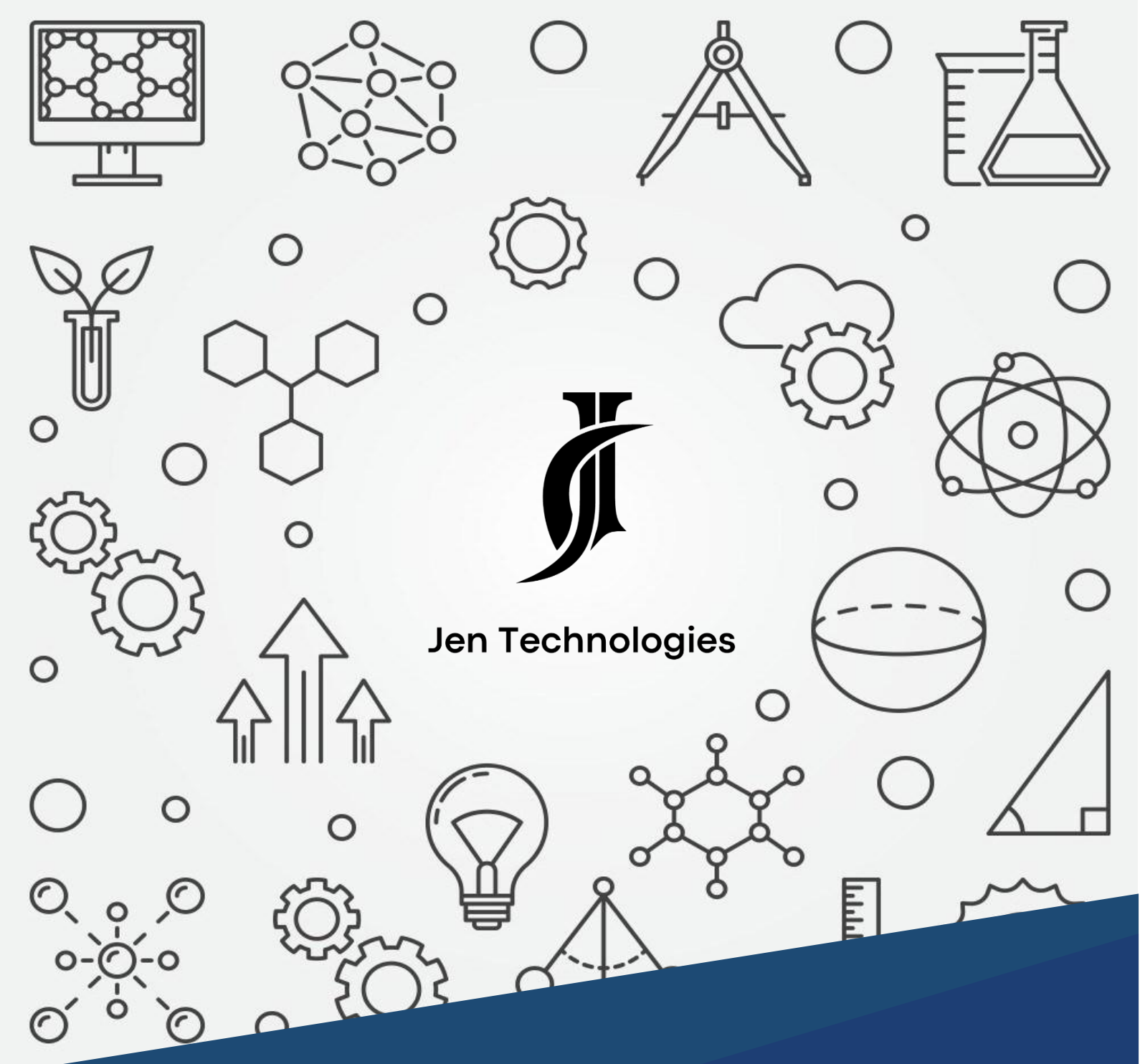




Jen Technologies

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Contemporary Research Trends in Multidisciplinary
Science and Technology Conference
12&13 November 2025**

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Message from the Editor-in-Chief

It is my great pleasure to present the proceedings of the **“International conference on Contemporary Research Trends in Multidisciplinary Science and Technology” (ICCRTMST)**, on the theme, **“Novel Scientific Inventions for a better future”** held on **Nov 12 & 13, 2025** in hybrid mode. This volume brings together a collection of peer-reviewed papers that reflect the latest research trends, innovative methodologies, and practical applications in different disciplines which comes under the categories of Arts, Science, Engineering, Management and Interdisciplinary approaches. The contributions included in these proceedings were carefully selected after a rigorous review process conducted by experts in the respective domains. The diversity and quality of the papers demonstrate the strong academic engagement and research excellence of the participants. I sincerely appreciate the efforts of the authors for their valuable contributions, the reviewers for their critical evaluations, and the organizing committee for their dedicated efforts in making this conference a success. I am confident that this volume will serve as a useful reference for researchers, academicians, and industry professionals.

Yours sincerely,

Ms.R.Jeny,
CEO,
Jen Technologies.



A Special Message

Greetings! It is a true honour to be here for this concluding session. Now, most people think a concluding session is an end. It's the final item on the agenda. The "wrap-up". I see it differently. I believe a concluding session is not a full stop. It's a starting gun. For the last two days, you've been gathering insights. Now, the real work begins. The question is no longer "what are you learning?" but "what are you going to do with it?" Your theme for this conference is "Multidisciplinary Science and Technology." I want to be very clear: this isn't just a popular buzzword. It is the single biggest shift in how we solve problems. The era of the lone genius-the single scientist in a lab having a "Eureka!" moment is over. It's a myth.

The world's grand challenges don't care about our university departments. Climate change is not just a meteorology problem. A global health crisis is not just a biology problem. They are messy, complex, and interconnected. They are systems problems. And that means the future doesn't belong to the specialist. It belongs to the collaborator. It belongs to the person who can stand at the intersection of different fields and act as a translator.

So, what does this new world of innovation actually look like?

Let me give you two quick stories.

For 50 years, biology had a "grand challenge." It was called the "protein folding problem". Understanding the 3D shape of a protein is the key to creating new medicines for almost every disease. And for 50 years, the smartest biologists in the world were stuck.

Who solved it?

Not biologists.

It was solved by a team at DeepMind called AlphaFold. And this team was a deliberate "mash-up" of machine learning experts, computer scientists, chemists, and biophysicists. They brought their different perspectives together and taught an AI to solve a problem that was impossible for a single discipline. Today, AlphaFold is used by two million researchers and is accelerating drug discovery at a pace we've never seen. That is the new model. Here's another one. Ask yourselves: what if your phone's case was its battery? What if the body of an electric car was the battery?

-a mash-up of.....

That's not just a chemistry question. It's not just an electrical engineering question. It's a new field called "structural battery composites" materials science, chemistry, and engineering. That's what innovation looks like. It's not a new idea. It's two old ideas colliding to make something brand new. This is why you are here. In preparing for today, I looked at the proceedings from previous multidisciplinary conferences. I saw early, niche papers on things like "wastewater renovation" and the "integration of AI in laboratory diagnostics".

At the time, those were just interesting academic ideas. Today? They are foundational, multi-billion-dollar industries. The ideas being shared in your sessions right now are the solutions of tomorrow.

My own world of space exploration lives this every day. You can't build a Mars rover with just one skill set. You need aerospace engineers to build the body, material scientists to invent alloys that survive extreme temperatures, and AI specialists to write the code for autonomous driving and data analysis.

But here is the real challenge. And it's not the technology.

It's us.

The biggest hurdle in multidisciplinary research is the human element.

First, there's the language barrier. I'm not talking about English or Hindi. I'm talking about the fact that an engineer, a biologist, and a sociologist are trained to speak completely different professional languages. They have different "conflicting paradigms". An engineer's goal is to find a solution. A sociologist's goal is to understand the complexity. To innovate, you must first learn to translate. Second, there's your ethical compass. When you start merging fields like AI, neurotechnology, and synthetic biology, you will be the first person in history to face questions no one has easy answers for. Just because you can build it, should you? Your generation doesn't just get to be the engineers; you must also be the ethicists.

So, as you leave this hall, I have one final charge for....

You are the "Convergence Generation."

you.

Your future career is not your major. Your major is just your starting point. The most in-demand, highest-impact jobs of the next decade will be hybrid roles: "bioinformaticians," "renewable energy engineers," "computational linguists," "AI ethicists". Your university is, by design, separated into silos. You have a biology building, an Engineering Hall, a Computer Science lab.

Your mission is to break those walls!

Go have coffee with a physics major. Crash a lecture in the economics department. Argue with a philosophy student. Build a project with a biologist. The most innovative ideas are waiting

for you, not in the centre of your discipline, but at the messy, chaotic, and brilliant edges. This conference wasn't the destination. It was the starting gun.

Now... go find your team. Go start the collaboration.

Thank you!

Yours sincerely,

Dr. Harikrishnan,
Scientist-G,
Group Director,
Technology Transfer and Documentation Group,
Vikram Sarabhai Space Centre,
Thiruvananthapuram.

Table of Contents

Abstract title & Authors	Page No.
IoT based Self Charging System for Electric Scooters using Alternator <i>Shijinde P, Jesni J, Adlin Femil S J</i>	1
Smart Waste Management System Using IoT and Machine Learning <i>Santhiya S, Vincy A, Aiswarya K</i>	2
Convolutional Neural Network-Driven Intrusion Detection System Architecture for Cybersecurity in Smart Internet of Things Networks <i>Aiswarya S*</i>	3
Smart Public Transport Tracking Using Portable Ticket Machines and Mobile Access Efficient Real-Time Tracking for Tamil Nadu and Kerala Public Transport Systems <i>V.Shaniya, M.Sriharshini, V.Ajisha</i>	4
The Transformative Role of MBA Education in Enhancing Strategic Project Management Amid Technological and Sustainable Advancements <i>Raja S R*, Ramya M, Divya Sri M</i>	5
A study on the role of HR policies in reducing workplace stress <i>Anukragah Sundar*, Anaciya Lincy S</i>	6
Saliva based Glucose Monitoring System <i>Parvathy M, Santhana Arumuga Sankari M, Herlinzia C P</i>	7
A study on financial performances and growth of non-banking financial companies <i>Kewyin C Ebee P*</i>	8
Efficient Attendance Tracking using Smart AI-Based Technology <i>Dr.F.R.Shiny Malar, S.Sabinesh, M.Aswin</i>	9
A novel approach for detecting blood cancer through an enhanced machine learning algorithm <i>A Bindhu, W Bivi Evangelin, D Davija</i>	10
IOT based smart night patrolling robot <i>Selvi H, Sobiya R S, Bindhiya T*</i>	11
AURA – AI Guardian For Women’s Safety Intelligent Prediction and Real-Time Response for Women’s Protection <i>Binusha Sornil*, Dharshana, Sree Devi</i>	12
Investigation of Cd content impact on morphological and optical characteristics of Cd _x Pb _{1-x} S thin films. <i>Dibya Jyoti Borah*, L. Gogoi, P.K. Saikia</i>	13
Applying Intelligent Speed Adaptation to a Road Safety Mobile Application – DriverSafeMode <i>Jerlin Sharon J, Bibin B. S. Nair, Femina Jalin A</i>	14

Green Celebrations, Golden Traditions: Innovative Techniques in Indian Cultural Events <i>Pallavi Deshpande*</i>	15
Evaluating the Combined Effects of Plant Protein and Vitamin B Complex in Bombyx mori <i>Joseph. D. Livingston*, C. Albert</i>	16
AI-Powered Campus Surveillance System for Real-Time Fight Detection and Abnormal Crowd Monitoring <i>T.Karthija, S.J.Stevin Ramesh, S. Sali Mary Mol</i>	17
Beauty Bot: AI-Powered Skincare Store <i>R Anuja, V Gopika, M Karthika*</i>	18
Disease prediction and medication advice using machine learning algorithms <i>Kirubha J. Wilson, Abina T, Bindhu A</i>	19
Verbal lie deception and detection system <i>Lekha P, Monica T*, Sathya V</i>	20
A Study on Smart Infrastructure: Designing Energy-Efficient and Resilient Urban Systems <i>D. Luke Jebasundar*</i>	21
Structural and Electronic Characterization of 2-Amino-4,6-dichloropyridine via DFT, Molecular Docking, and Nonlinear Optical Analysis. <i>Md. Uvesh*, Dr. Saleem Javed</i>	22
Integrated spectroscopic, computational, and biological evaluation of an imidazole–tartaric acid charge transfer complex synthesized in polar solvents. <i>Mohd. Anas*, Ishaat M. Khan</i>	23
Exploring Socio-Affective Experiences of Adults Living in Single-Parent Families: A Qualitative Inquiry <i>Omisha Sangeet, Ashi Kumar</i>	24
Advances and Perspectives in the Evolution of Micropolar Elasticity Theory <i>Rafiya Nazir*</i>	25
Impact of braiding parameters on physical properties of braided structure <i>Rudra Narayan Saha*, Manas Datta Roy, Subrata Ghosh</i>	26
Secure Signature-Based Authenticated Key Establishment Method for Upcoming IoT Applications <i>Sabin C, Dheeraj John J, Akhash S</i>	27
Agro Homoeopathy-The present need <i>Sabrin Sumaila Samiudeen*</i>	28
New class of anisotropic charged strange quark star in Durgapal IV metric and its maximum mass <i>Samir Sarkar*</i>	29

Image Forgery Detection Using Deep Neural Network <i>Ajisha A, Alan Sabu, Shari R. G</i>	30
Smart Social Media Event Detection with Real-Time Alerts Using Big Data Analytics <i>Juswin J V, Abishek J S, Shervin V</i>	31
Smart Lifestyle Interventions for Obesity and Metabolic Health: Integrating Technology with Personalized Wellness Strategies <i>Shiv Kumar*</i>	32
Bioinformatics-Based Analysis of Panchakarma Detoxification: Exploring Molecular and Genetic Correlates of Ayurvedic Rejuvenation <i>Dr. Simi*</i>	33
Smart IoT-Enabled Aromatherapy System with Integrated Air Quality Monitoring and Adaptive Wellness Control <i>Srinivasan M*, Dr.G.Aravind Swaminathan</i>	34
Comparative analysis of deep learning and machine learning models for blood group classification using retinal features <i>Jerlin T*, Priskilla Angel Rani J</i>	35
Long-term degenerative neurological disorder <i>J Akshaya*, Mukesh Krishnan M</i>	36
5G Network Security: Challenges and Emerging Defense Strategies <i>Dr. J.Jelba*</i>	37
Efficient and Light Deep Learning Framework for Micro-Expression Analysis <i>T. Balaprabha*, Dr.T.Beula Bell</i>	38
Synthesis and spectrophotometric study of charge transfer complex and explaining its application. <i>Zara Siddiqui*, Dr. Ishaat M. Khan</i>	39
Labelling Outliers using Different Types of Boxplot Rules <i>Dr. Mintu Kr. Das*</i>	40
Adaptive Hybrid Fruit Bee Optimization-based Deep Convolution Neural Network for brain tumour classification using MRI image <i>Dharshini T, Nivetha R, Aynun Jarria S P*</i>	41
Thumbnail preservation encryption for secure and efficient image <i>C. Jeniba*, Dr. Beula Bell T</i>	42
AI- enabled adaptive therapeutic assistance architecture and postural instability detection with intelligent protective mechanisms <i>B. Aishwarya Devi*, M. Sakthipriya, A. Piriyaadharshini, S. Darwin</i>	43
Vehicle with Obstacle reporting and GPS integration using ESP32-Cam <i>Dr. A. Beno, J. Gifty Ensalata Miraclin, I. Regina, C. Ulageswari</i>	44

Ethical Challenges of AI in Legal Decision-Making: A Cross-Disciplinary Analysis <i>T.Hubertson, Dr.S.Anitha</i>	45
Federated Forensic Image Retrieval System for Criminal Investigation <i>C. R. Dhivya, Dr. D. Latha</i>	46
Khel Scout: An AI-Powered Platform for Inclusive Sports Talent Identification in India <i>J Aldam Jeffron*, Geoffrey Jabez, Abishek Joel E, I. Domilin Shyni</i>	47
RNN-Driven Liquid Biopsy Biomarker Classification for Early Detection and Recurrence Monitoring of Hepatocellular Carcinoma <i>J. M. John Britto*, Dr. Beula Bell T</i>	48
Recent Advances in Nanoengineered Surface Modifications of Titanium-Based Implants for Enhanced Osseointegration, Corrosion Resistance, and Bioactivity <i>Aslin Sharmi. T*</i>	49
Stroke recognition using Image processing <i>Oviya S R, Athira S P, Sowmiya R*</i>	50
ViT Backbone Optimization with Multi-Scale Patch Embedding in Dendritic Learning Framework <i>Rajan G, Euodial</i>	51
Temporal cross-camera face tracking for law enforcement intelligence <i>Shrija T*, Doulas J</i>	52
Automated Player Detection and Performance Tracking in Football Videos Using Deep Learning: A YOLO-Based Approach on the Soccer Player Dataset <i>Dr. E. Jesudin Rajesh*, P. Jabalin Reebea</i>	53
Smart Agriculture through AI and IoT: A Lightweight Approach to Plant Disease Detection <i>Mathavi R*, Dr.T. Beula Bell</i>	54
CanteenFlow — A Camera-Free, Privacy-First Queue & Wait-Time Prediction System for Multi-Counter Cafeterias <i>Samuel Frederick Nirmal E*, Tryphena R, Dr. A. Tamizhselvi</i>	55
Adaptive Waste Management Assistant: AI and IoT-Based Smart Waste Handling System <i>Dr. G. Venkat Narayanan*, Dev. G. Shayne, E. Evan Stains E, D. Ephraim Melwins, I. Domilin Shyni.</i>	56
Revolutionizing Sea Transmission for Secure and Lossless Maritime Connectivity <i>Ishwaya J*, Prabha A, Seeniammal Snega S, Dr.Beno A</i>	57
Deep CNN-Based Multi-Class Skin Disease Classification Using Image Processing Techniques <i>Dr. M. Anline Rejula*, J. Benitta</i>	58

Quantum Computing and Artificial Intelligence: A Synergistic Approach to Revolutionizing Legal Research and Practice <i>Damaraju Pradeep Kumar*, Dr. Rajbir Kumar</i>	59
A stacking ensemble model for diabetes prediction integrating symptom and blood test analysis <i>Muthu Lakshmi*, Sivakumar</i>	60
Confidential asset/data protection with tamper avoidance in Cargo transit system. <i>Divina.M, Sumathi.M, Shobhika.V, Dr.A.Beno</i>	61
Smart high voltage detection helmet with emergency alert system for electrical linemen <i>Ajitha M*, Pavithra M, Rathna Varshini A, V Monisha</i>	62
IoT Based Real-Time Street Light Fault Detection and Maintenance System with Machine Learning Driven Solution Prediction <i>Geethu K, Janakhi M, Sharlin Lins L*</i>	63
Mood based Music Recommendation System <i>Jernisha J. M, Abish M. A, Jenisha R. J*</i>	64
Influence of Low-Density Polyethylene on the Mechanical and Thermal Properties of High-Density Polyethylene <i>Gobind, Tejeet Singh</i>	65

IoT based Self Charging System for Electric Scooters using Alternator

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Technology, Kuttakuzhi, Tamil Nadu, India*

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Abstract:

Electric scooters are an eco-friendly alternative to fuel-powered vehicles but depend heavily on external charging. This project proposes a self-charging electric scooter system aimed at minimizing the need for external charging infrastructure. The system integrates an in-wheel alternator that generates electricity as the scooter moves, converting mechanical energy into electrical energy. The generated power is stored in a battery and managed by a Battery Management System (BMS) to ensure safe and efficient energy usage. To enhance safety, an IoT-based temperature monitoring system is incorporated. A temperature sensor continuously tracks the battery temperature, and if overheating is detected, the system automatically cuts off the current to prevent damage. The real-time temperature is also displayed on a digital screen for user awareness. This solution improves energy efficiency, extends battery life, and contributes to the development of sustainable electric mobility.

Key words: Wheel Alternator, Electromagnetic Induction, Battery Management System (BMS), Energy Efficiency, Sustainable Mobility.

Smart Waste Management System Using IoT and Machine Learning

Santhiya S, Vincy A, Aiswarya K

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Abstract:

The rapid growth of urbanization and population has raised significant concerns about environmental security, particularly in waste management. Improper disposal and segregation of waste pose serious health and environmental risks, especially in densely populated regions like India. Current waste management systems rely heavily on manual segregation, which is inefficient, time-consuming, and hazardous to waste workers. This paper proposes an automated waste management system that leverages Internet of Things (IoT) and deep learning algorithms to classify and segregate waste into wet and dry categories without human intervention. The system utilizes ultrasonic sensors to monitor waste levels and transmits data to an IoT cloud for real-time analysis. By automating waste segregation, the proposed system aims to improve recycling rates, reduce environmental pollution, and promote sustainable waste management practices. The integration of IoT and machine learning not only enhances efficiency but also ensures a cleaner and healthier ecosystem for future generations.

Key Words: Waste management, IoT, Machine Learning, Deep Learning, Recycling, Smart Bins.

**Convolutional Neural Network-Driven Intrusion Detection System Architecture for
Cybersecurity in Smart Internet of Things Networks**

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Abstract:

With the rapid expansion of smart IoT networks, ensuring cybersecurity has become increasingly critical. Traditional intrusion detection systems (IDS) often face challenges in resource-constrained IoT environments due to high computational overhead. This paper presents a CNN-driven Intrusion Detection System (IDS) architecture designed for lightweight, real-time threat detection in smart IoT networks. The proposed system leverages the feature extraction capabilities of Convolutional Neural Networks (CNNs) combined with adaptive optimization techniques to improve detection accuracy while minimizing computational complexity. Extensive simulations on benchmark IoT datasets demonstrate that the architecture achieves high detection rates, low false positives, and efficient real-time performance, making it suitable for deployment in diverse smart environments. The proposed approach provides a scalable and effective solution for enhancing the security of IoT infrastructures.

Key Words: Traditional intrusion detection systems, Convolutional Neural Networks, IoT infrastructures, diverse smart environments, Extensive simulations.

**Smart Public Transport Tracking Using Portable Ticket Machines and Mobile Access
Efficient Real-Time Tracking for Tamil Nadu and Kerala Public Transport Systems**

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Nagercoil, India.*

Abstract:

Real-time tracking of public transportation is essential for improving passenger experience and operational efficiency. This paper introduces a smart tracking system that integrates portable ticket-generating machines used by conductors in Tamil Nadu and Kerala with a cloud-based monitoring platform. The system captures vehicle location, route data, and ticket events using embedded GPS and mobile connectivity, transmitting this information in real time to a central server. Commuters can access accurate live bus locations and estimated arrival times through a mobile application or web portal. The system leverages Internet of Things (IoT) communication, secure data synchronization, and light weight machine learning algorithms for predictive arrival estimation. By digitizing ticketing data and enabling real-time visibility, the proposed solution reduces passenger wait times, enhances transparency, and optimizes fleet management for transport authorities. The implementation demonstrates a scalable and low-cost approach that modernizes traditional transport infrastructure.

Keywords: Public transport, real-time tracking, IoT, GPS, portable ticketing machine, mobile application, cloud computing, predictive analytics, smart mobility.

**The Transformative Role of MBA Education in Enhancing Strategic Project
Management Amid Technological and Sustainable Advancements**

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Abstract:

Project management is currently characterized by one of the most turbulent and rapidly changing environments. Technologies, sustainability, and innovation are constantly changing the role of the manager (governance). As artificial intelligence (AI), green energy and circular economy are emerging trends, project managers must not just have technical expertise, but a level of strategic thinking and leadership adaptability. An MBA can help to make project managers significantly more effective by giving them higher order analytical, decision making and problem-solving skills required for the management of complicated technology driven projects. MBA programs develop strategic thinking, financial planning, organizational behavior, and leadership capabilities that enable managers to align project goals with corporate objectives. As businesses begin to shift toward sustainability, an MBA trained project manager can formulate projects within environmental social governance (ESG) frameworks to comply with green economies and promote circular economy practices. The MBA curriculum's exposure to various management disciplines also provides opportunities for the development of cross-functional collaboration, negotiation, and stakeholder management skills. In a globalized and technology-enabled environment, these capabilities become important for innovation and competitive advantage to successfully deliver projects in an increasingly interconnected world focused around sustainability.

Key Words: Management, MBA Program, Project Management.

A study on the role of HR policies in reducing workplace stress

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Abstract:

All organisations aim to keep their employees in a good state of health and wellbeing. Workplace stress is a crucial issue where the employees face physical and mental pressure. The purpose of the survey process is to provide a more accurate assessment on the stress level of the employee due to high work pressure, issues with the colleagues, unclear policies, personal problems, excessive workloads, work life balance, lack of training etc., Workplace stress affects the performance of the brain, functions of work performance, memory, concentration, learning, change in their ability to cope, periodical activities, utilization of professional time and affects their behaviour in the organization. If the fit employees are stressed the management can provide them flexible working hours, frequent breaks, motivations, rewards and recognition, transparent communications, improve the effectiveness of existing programs, recognize wellbeing policies and introduce strategies to overcome work stress by providing proper counselling and grievance handling to burn out the stress. Key recommendations for the study are all these influential factors fall under the control of HR policy makers. Well designed and effectively implemented HR policies not only reduces workplace stress but also enhances employee engagement and overall performance of the organisation.

Keywords: Workplace stress, HR Policies, Human Resource Management

Saliva based Glucose Monitoring System

Parvathy M, Santhana Arumuga Sankari M, Herlinzia C P

Department of Information Technology, Velammal Engineering College, Chennai.

Abstract:

This paper presents a literature survey and proposal for a non-invasive device that monitors glucose levels using saliva, aiming to replace traditional blood-based glucose monitoring methods. The proposed system employs a micro fluidic sensor-based approach to collect, process, and analyze saliva for glucose concentration, enabling real-time data visualization and alerts. By leveraging this technology, the device promises improved comfort, better patient compliance, and cost-effective continuous monitoring. The paper explores current invasive methods, highlights their drawbacks, and outlines the potential of saliva-based diagnostics in transforming diabetes care.

Keywords: Diabetes, Glucose Monitoring, Saliva-Based Diagnostics, Non-Invasive Devices, Electrochemical Sensors, Microfluidics.

A study on financial performances and growth of non-banking financial companies

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Abstract:

An integrated overview highlights that Indian NBFCs play a pivotal role in complementing the traditional banking system and advancing financial inclusion. This study investigates the growth feasibility of NBFCs from 2020 - 2025 using quantitative tools such as the Current Ratio, Debt-Equity Ratio, Net Profit Ratio, Return on Capital Employed (ROCE) and Return on Net Worth (RONW). In addition, the study utilizes the Analysis of Variance (ANOVA) method to statistically examine whether significant differences exist in the financial performance of selected NBFCs over the study period. This approach involves the analysis of secondary data to assess profitability, liquidity, leverage, and overall financial stability across prominent NBFCs, including Bajaj Finance, Muthoot Finance, and Shriram Finance. The findings indicate that several leading NBFCs displayed strong financial resilience, consistent profitability, and steady growth despite disruptions caused by the COVID-19 pandemic, evolving RBI regulations, and tightening liquidity conditions. These NBFCs also showed steady revenue growth and healthy profit margins, reflecting operational efficiency. The study concludes that the long-term sustainability of NBFC growth will depend on their ability to balance market innovation with stronger governance, diversify funding sources to reduce reliance on short-term borrowings, strengthen capital buffers, and continue innovating while maintaining prudent risk controls.

Keywords: NBFC, Current Ratio, D-E Ratio, Net Profit Ratio, ROCE, RONW, ANOVA, financial resilience, profitability.

Efficient Attendance Tracking using Smart AI-Based Technology

Dr.F.R.Shiny Malar, S.Sabinesh, M.Aswin

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Nagercoil, India.*

Abstract:

Maintaining accurate attendance in classrooms is a vital task for educational institutions. Traditional manual methods such as roll calls or register marking are time-consuming and prone to human error. This paper presents an AI-based automated attendance tracking system using smart technology to address these challenges. The system leverages real-time face detection and recognition to automatically identify students through live camera feeds and record attendance without manual intervention. It integrates modern deep learning models for efficient face recognition, a web-based interface for accessibility, and secure database storage for attendance records. Additionally, the system ensures data privacy through encryption and secure communication protocols. By automating attendance processes, the proposed system significantly reduces staff workload, saves time, and improves accuracy in attendance management, making it a practical and scalable solution for educational institutions.

Keywords: Attendance system, artificial intelligence, face recognition, deep learning, computer vision, automation, real-time detection, web application, privacy preservation.

**A novel approach for detecting blood cancer through an enhanced machine learning
algorithm**

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*¹Department of Computer Science and Engineering, Marthandam College of Engineering
and Technology, India*

*²Department of Artificial Intelligence and Technology, Marthandam College of Engineering
and Technology, India*

Abstract:

The incidence of blood cancer has increased over the past ten years, highlighting the importance of early treatment following an accurate diagnosis. The diagnostic process involves various tests and specialists, which can be both time-consuming and costly. To improve the accuracy of predictions regarding patient outcomes, there's a need for an automated diagnostic system. This paper presents a novel approach for detecting blood cancer through an Enhanced Machine Learning Algorithm that combines the Ensemble Method with Effective Fuzzy C Means (EFCM) and Iterative Morphological Process (IMP). By employing EFCM and IMP, we can effectively segment and analyze blood image data to identify distinguishing features linked to blood cancers. This segmentation allows the algorithm to concentrate on critical regions of interest, ultimately enhancing the precision and focus of cancerous cell detection. Additionally, we have implemented preprocessing and enhancement techniques for the blood images. Through the application of Machine Learning in analyzing blood cancer images, we achieve precise diagnoses, reduce evaluation time, and offer faster, more affordable, and safer diagnostic testing.

Keywords: Convolutional Neural Networks CNN, Blood smear images, Hematopoietic stem cells (HSCs).

IoT based smart night patrolling robot

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Abstract:

The implementation of an IoT-based smart night patrolling robot is presented in this paper, utilizing an Arduino Uno, camera module, sound sensor, ultrasonic sensor, motor driver, motors, Nodemcu, and buzzer. The proposed robot is designed to autonomously patrol a designated area and capture images and videos of the area using the camera module. The ultrasonic sensor is used to detect obstacles and prevent collisions, while the sound sensor is used to detect unusual sounds and alert the user. The buzzer is included to provide an audible alarm in case of any significant disturbance in the patrolling area. The robot is designed to move around and change directions using the motor driver and motors, which are operated by an Arduino Uno. The Nodemcu provides internet connectivity, enabling remote monitoring and control. The proposed system can be used for a variety of applications, such as surveillance and security, and has the potential to improve the efficiency and effectiveness of night patrolling operations. The proposed system is developed at a low cost, making it accessible to a wider range of users. The implementation of the proposed system has been tested, and the results indicate that the system is efficient and effective in detecting and responding to environmental stimuli. The system is controlled using a web-based interface, and the users can monitor and control the system remotely.

Keywords: Arduino Uno, camera module, sound sensor, ultrasonic sensor, motor driver, motors, Nodemcu, and buzzer.

AURA – AI Guardian For Women's Safety

Intelligent Prediction and Real-Time Response for Women's Protection

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Abstract:

Women's safety remains a global concern, demanding innovative solutions that combine technology, intelligence, and accessibility. This paper introduces AURA – An AI Guardian for Women's Safety, an intelligent system designed to predict, prevent, and respond to potential threats in real time. The system leverages artificial intelligence, IoT-enabled wearable devices, and mobile connectivity to continuously monitor environmental and behavioural cues. AURA detects distress signals through voice stress analysis, motion patterns, and location anomalies. In emergencies, it automatically alerts trusted contacts and nearby responders, sharing live location and audio-visual data. The system also integrates predictive analytics to suggest safer routes and prevent high-risk situations before they occur. Through machine learning, community data sharing, and privacy-focused design, AURA aims to empower women with proactive protection, ensuring safety, confidence, and autonomy in both public and private spaces. The project demonstrates a scalable, low-cost, and AI-driven approach toward building a safer society for women.

Keywords: Women safety, artificial intelligence, IoT, wearable devices, predictive analytics, voice recognition, GPS tracking, real-time alert system, smart mobility, machine learning.

**Investigation of Cd content impact on morphological and optical characteristics of
 $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ thin films.**

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Abstract:

$\text{Cd}_x\text{Pb}_{1-x}\text{S}$ has dealt with immense interest of research. Because, it offers the advantage of tuning the optical and optoelectronic properties of both cadmium sulphide (CdS) and lead sulphide (PbS), viz. band gap, electrical conductivity and thermoelectric power in a controlled manner. Tuneable composition of $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ provides a wide range of variations in optical band gap, and it is possible to widen the spectral window. In the present research work, nanocrystalline $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ thin films were prepared by chemical bath deposition method with different Pb and Cd solute ratios. The chemical bonding present in the films was studied by FTIR and micro-Raman spectral analysis. Micro-Raman spectra reveals the presence of cubic and hexagonal phases in the films. SEM images show uniformly distributed grains of different sizes over the substrates. Optical studies show the prominent blue shift in band gap energy (E_g) with the increase in Cd content in PbS. The increment of Cd addition to $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ has led to enhance the transmittance as well as band gap energy. The values of E_g found to be increase from 2.8 to 3.42 eV. The variation in the optical band gap as a function of Pb: Cd ratios is shown in figure 1. The large modification in E_g confirms the formation of ternary $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ thin films. So, it is concluded that by changing the Cd content in $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ films, the band gap as well as transmittance of the films can be enhanced. Due to this property, the nanocrystalline $\text{Cd}_x\text{Pb}_{1-x}\text{S}$ films are suitable for photovoltaic cells as a window layer.

Keywords: $\text{Cd}_x\text{Pb}_{1-x}\text{S}$, Chemical Bath Deposition, micro-Raman, Band gap energy.

**Applying Intelligent Speed Adaptation to a Road Safety Mobile Application –
DriverSafeMode**

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Abstract:

Road safety is an utmost important concern regarding motorized transportation. The increasing motorized transportation has placed a significant burden on people's health in the form of uncontrollable growth rate of road traffic accidents and fatalities which has caused detrimental social and economic consequences in Sri Lanka. Despite number of interventions and action plans the government of Sri Lanka has enforced in order to ensure road safety, the statistics under road safety remain dangerously negative. In this paper, we present an intelligent mobile application solution "DriverSafeMode", which applies Intelligent Speed Adaptation (ISA) to aid drivers to avoid excessive speed, which is the most common and dangerous road and traffic offence committed by the drivers in Sri Lanka. In addition, the proposed system provides an effective aid to avoid mobile phone distraction while driving. The test results and user evaluation has proved that the proposed solution provides a reachable and a contrasting approach, compared to the existing road safety systems.

Keywords: Intelligent Speed Adaptation (ISA), Road safety, excessive speed, mobile phone distraction.

**Green Celebrations, Golden Traditions: Innovative Techniques in Indian Cultural
Events**

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Abstract:

India shines as a global inspiration of cultural renewal, where every event tells a story of unity, empathy, and forward-looking pride. Festivals are now redefining their essence through nutritious traditional dishes, organic decorations and zerowaste gatherings. These creative celebrations reflect India's evolving identity preserving heritage while promoting social harmony. Through innovative techniques like digital awareness campaigns, biodegradable materials, and inclusive cultural programs, event managers are reshaping community consciousness. Each event becomes a green celebration of values, inspiring youth to become more responsible. By merging Event management transforms celebrations into sustainable progress of India. Thus, India's golden traditions shine brighter when illuminated by the spirit of innovation and cultural pride.

Keywords: Event Management, Cultural Sustainability, Green Events, Sustainable Development

**Evaluating the Combined Effects of Plant Protein and Vitamin B Complex in *Bombyx
mori***

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Abstract:

This study evaluates the combined effects of plant-based protein (soy protein) and Vitamin B complex supplementation on the growth, health, and silk production of the silkworm *Bombyx mori*. Experimental diets were supplemented with soy protein and Vitamin B complex individually and in combination at concentrations of 0.25%, 0.5%, and 1%. Growth parameters including larval weight, pupal weight, cocoon weight, and food conversion efficiency were recorded to assess nutritional impact. Results indicated that soy protein supplementation significantly improved growth performance and silk gland development, while Vitamin B complex contributed to enhanced metabolic health. Notably, the combined supplementation, particularly at the lowest concentration (0.25% + 0.25%), produced the most pronounced improvements in larval growth, cocoon yield, and overall efficiency, suggesting a synergistic interaction between plant protein and Vitamin B complex. Higher concentrations showed comparatively reduced benefits. The findings demonstrate that balanced, low-level dietary supplementation can effectively enhance silkworm productivity and support sustainable sericulture practices.

Keywords: *Bombyx mori*, soy protein, Vitamin B complex, silkworm productivity, sustainable sericulture practices.

**AI-Powered Campus Surveillance System for Real-Time Fight Detection and Abnormal
Crowd Monitoring**

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Abstract:

Campus safety remains a critical concern in educational institutions, where traditional CCTV surveillance relies on manual monitoring that is often inefficient and prone to human error. This paper presents an AI-powered campus surveillance system designed to enhance security through real-time video analysis. The proposed system focuses on two main objectives: detecting physical altercations using deep learning-based spatial-temporal features and pose estimation, and identifying abnormal crowd gatherings or potential panic situations through density estimation and motion trajectory analysis. The integrated framework combines a Fight Detection Module and a Crowd Anomaly Detection Module to deliver a comprehensive safety solution. Upon identifying suspicious or violent activities, the system automatically generates alerts to a centralized dashboard, enabling timely response by security personnel. The approach emphasizes privacy preservation by focusing solely on behavioral analysis and excluding facial recognition, ultimately creating a safer and more intelligent campus environment.

Keywords: Campus safety, AI-powered surveillance, fight detection, crowd anomaly detection, deep learning, pose estimation, 3D-CNN, CNN-LSTM, density estimation, computer vision, real-time monitoring, privacy preservation.

Beauty Bot: AI-Powered Skincare Store

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Abstract:

The Beauty Bot: AI-Powered Skincare Store represents an innovative integration of Artificial Intelligence (AI), Machine Learning (ML), and modern web technologies aimed at transforming the online skincare and cosmetic shopping experience. In today's fast-growing digital beauty industry, consumers often face challenges in selecting suitable products due to diverse skin tones, types, and preferences. This project addresses this gap by providing a smart, personalized, and interactive AI-driven recommendation system that enhances user satisfaction and confidence in product selection. The proposed system uses K-Means Clustering for efficient skin tone detection and classification, enabling accurate cosmetic shade matching and product suggestions. It also utilizes image processing techniques to extract and analyze skin regions, ensuring precision in tone categorization. The frontend of the system is developed using Angular and Bootstrap, offering a responsive and visually appealing user interface that allows seamless navigation, image uploads, and chatbot interactions. The backend, built with Node.js and MongoDB, manages data flow, ensures secure authentication, and maintains efficient communication between the user interface and machine learning models. An integrated AI-powered chatbot enhances real-time user engagement by answering skincare-related queries, guiding users through product selections, and refining recommendations through conversational feedback. Furthermore, the system incorporates continuous learning, adapting to user preferences and improving recommendation accuracy over time. This project showcases the use of AI and ML in e-commerce through data analytics, computer vision, and automation. The Beauty Bot enhances customer experience and shows how AI can transform the beauty industry. Future work includes adding AR try-ons, deep learning-based skin analysis, and a larger global dataset for better accuracy and inclusivity.

Key Words: Beauty Bot, Artificial Intelligence (AI), Machine Learning (ML), modern web technologies, Chatbot

Disease prediction and medication advice using machine learning algorithms

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Abstract:

People today deal with a variety of diseases as a due to their lifestyle choices and the surroundings Disease prediction is an essential component of treatment. So, it becomes crucial to make disease predictions early on. The hardest task is making an accurate diagnosis of a disease. So, Machine learning is crucial in predicting the disease in order to solve this issue. The system proposed in this project uses the patient's symptoms as input to predict the disease and then recommends the right medication. This system takes the symptoms of the user from which he or she suffers as an Input. We use Classification Algorithms for disease prediction and drug recommendation, such as Naive Bayes (NB) and Random Forest, with a variety of accuracy levels. Once the disease has been predicted by the system, then it is followed by recommending the appropriate medicine. In order to improve the capabilities of the current systems, this paper discusses about the creation of a system that serves the dual purpose of disease prediction and medication suggestion. To make it easier for users to engage with the symptoms, an interactive interface is designed as the front-end and the front-end is deployed by using Flask.

Keywords: Naive Bayes (NB), Random Forest, Disease Prediction, Drug Recommendation, Flask, Healthcare.

Verbal lie deception and detection system

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Abstract:

Verbal deception detection has become an important area in computational linguistics and forensic analytics. It aims to automatically tell truthful statements apart from deceptive ones using natural language understanding. This paper introduces a transformer-based architecture that uses DistilBERT, a lightweight and efficient version of BERT, to detect deceptive political and general statements. The system processes data from start to finish, including preprocessing, tokenization, and fine-tuning on labeled text datasets while keeping class representation balanced. Experimental results show high accuracy and F1 performance in binary deception classification, confirming the model's reliability. Besides standard training, the framework includes an interactive visualization suite. This suite offers tools like word cloud analytics, confusion matrices, probability histograms, and prediction dashboards for better understanding. Additionally, a voice-enabled interface that uses Google Text-to-Speech (gTTS) improves accessibility. Interactive widgets and Plotly-based dashboards support real-time, user-driven deception analysis. The approach strikes a strong balance between accuracy, interpretability, and computational efficiency, making it a scalable solution for future uses in media verification, interview analysis, and behavioural forensics.

Key Words: BERT, Google Text-to-Speech, Verbal deception detection, computational efficiency.

**A Study on Smart Infrastructure: Designing Energy-Efficient and Resilient Urban
Systems**

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Autonomous Institution), Tirunelveli, Vannarpettai-627003*

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Abstract:

This study explores how smart infrastructure contributes to building energy-efficient, safe, and sustainable cities. It emphasizes the use of advanced technologies such as sensors, smart grids, artificial intelligence, and renewable energy systems to improve the quality of urban life. By integrating these technologies, cities can effectively manage resources, reduce pollution, and enhance transportation, communication, and energy distribution systems. The research also examines the benefits and challenges of implementing smart systems, including cost, maintenance, and data security issues. Furthermore, it highlights the positive impacts of smart infrastructure on economic growth, environmental protection, and overall social wellbeing. The findings show that adopting smart infrastructure not only promotes technological innovation but also ensures long-term sustainability and resilience. Overall, the study concludes that smart infrastructure plays a vital role in shaping cleaner, greener, and smarter cities for future generations.

Key Words: sustainable cities, sensors, artificial intelligence, smart infrastructure, technological innovation.

**Structural and Electronic Characterization of 2-Amino-4,6-dichloropyridine via DFT,
Molecular Docking, and Nonlinear Optical Analysis.**

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Abstract:

The computational evaluation of 2-amino-4,6-dichloropyridine, whose indications point to potential medicinal uses, is presented here. Using auxiliary methods of Density Functional Theory (DFT), namely the B3LYP functional and the 6-311++G (d, p) basis set, we thoroughly examined the characteristics of this molecule. Molecular Electrostatic Potential (MEP) and Electron Localization Function (ELF) mapping have been used to investigate the electrical structure, and vibrational analysis provides important details about the compound's stability. Vibrational modes and electronic transitions are examples of computational results that are validated by comparing them with experimental data from methods like as FTIR and UV-vis spectroscopy. To investigate the interaction with a biological target, we also carried out molecular docking of the 4E1Y receptor complex. To gain more understanding of the behaviour of this unique molecule, we also examined its Nonlinear Optical (NLO) features using the techniques of Natural Bond Orbital analysis and Frontier Molecular Orbital (FMO) analysis. When taken as a whole, the aforementioned results provide insightful information about the structural and electronic origin of reactivities in 2-amino-4,6-dichloropyridines, which can be useful for conducting a novel lead identification.

Keywords: DFT; Molecular Docking; FT-IR; ELF

**Integrated spectroscopic, computational, and biological evaluation of an imidazole–
tartaric acid charge transfer complex synthesized in polar solvents**

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Abstract:

A new charge-transfer (CT) complex has been developed from imidazole (IM) as an electron donor and tartaric acid (TA) as an electron acceptor, synthesized in methanolic medium. The complex was characterized using UV–Visible, FT-IR, and single-crystal X-ray diffraction (SC-XRD) techniques. Spectral analyses confirmed a 1:1 stoichiometric ratio and revealed distinct band shifts—particularly the O–H vibration near 3345 cm^{-1} and the C=O stretch around 1723 cm^{-1} —consistent with $\text{N}^+-\text{H}\cdots\text{O}^-$ hydrogen bonding. Crystallographic data indicated a monoclinic structure (space group $\text{P2}_1/\text{n}$) with lattice constants $a = 7.586\text{ \AA}$, $b = 6.659\text{ \AA}$, and $c = 17.799\text{ \AA}$, verifying strong donor–acceptor interaction within the lattice. Density Functional Theory (DFT) and Time-Dependent DFT (TD-DFT) calculations at the B3LYP/6-311++G(d,p) level demonstrated a narrowed HOMO–LUMO energy gap (3.87 eV) relative to the individual components, implying enhanced electronic delocalization and reactivity. Molecular docking studies showed effective binding to Bovine Serum Albumin (BSA) with a binding energy of $-9.8\text{ kcal mol}^{-1}$, stabilized through hydrogen bonding with Arg144, His145, and Ser192 residues. Biological screening revealed notable antioxidant activity (71.1 % DPPH radical inhibition at $500\text{ }\mu\text{g mL}^{-1}$) and significant antibacterial efficacy against *Escherichia coli* (30.1 mm inhibition zone) along with antifungal potential toward *Fusarium oxysporum* (22.1 mm zone). The combined structural stability, electronic tunability, and bioactivity highlight the IM–TA CT complex as a promising scaffold for pharmaceutical and advanced material applications.

Keywords: FTIR, SC-XRD, Charge transfer, protein binding, DFT

**Exploring Socio-Affective Experiences of Adults Living in Single-Parent Families: A
Qualitative Inquiry**

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Abstract:

The present qualitative study explored the socio-affective experiences of young adults raised in single-parent households, focusing on the interplay of family dynamics and wider socio-cultural contexts in shaping the complex psychitechture of their adaptive mechanisms. Seven participants from the Delhi-NCR region were interviewed, and thematic analysis generated five core themes: Accelerated Maturity, Protective Buffering, Fragile Rational-Emotional Balance, Selective Support Networks, and Cognitive Reframing of Parental Absence. Findings indicated that participants often adopted responsibilities beyond their age, suppressing personal emotions to avoid burdening the parent, which fostered emotional fragility and a preference for rational control. To manage this imbalance, they developed selective networks for support, often relying on siblings or certain extended family members, while navigating conditional kinship dynamics. Cognitive reframing of parental absence served as a key adaptive strategy, facilitating meaning-making and stability. Overall, the findings highlight how young adults from single-parent families develop adaptive psychosocial strategies that cultivate salubrity.

Keywords: single-parent adults, accelerated maturity, protective buffering

Advances and Perspectives in the Evolution of Micropolar Elasticity Theory

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Abstract:

The mathematical theory of elasticity is a sublime and attention-grabbing subject that studies the stresses and distortions created in elastic media due to some external force or due to temperature change. However, the analysis of the materials with microstructure was entirely beyond the scope of the classical theory of elasticity. Therefore, a micropolar theory of elasticity was developed in order to analyse these kinds of materials. Thus, a review of the evolution of the micropolar theory of elasticity is the focus of the current study. Furthermore, in this study, we have also showcased a few of its applications.

Key Words: theory of elasticity, micropolar theory, stresses, distortions, evolution.

Impact of braiding parameters on physical properties of braided structure

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Abstract:

The configuration and properties of the braided structure are crucial factors to consider when selecting it for diverse technical applications. The braiding process settings have a significant impact on the mechanical properties of braided structures, ultimately affecting their functional performance. In this study, the effects of braided samples composed of polyester filament yarns are examined simultaneously for variables like braid structure (1/1 and 2/2) and take-up rate on braiding angle, braid diameter, braid fineness, pick count, pitch length, total mass, tensile strength, elongation and bending stiffness. This study indicated how changes in braid pattern and take-up rate, affect the mechanical properties of polyester tubular braided structures. The braiding machine's take-up speed has a direct impact on the braid's formation speed and it is possible to modify this speed without affecting the carriers' sequential motion. To determine the significance of the difference in results, statistical analysis is performed at each state of observation.

Key Words: braided structure, configuration, properties, effects, polyester tubular braids

Secure Signature-Based Authenticated Key Establishment Method for Upcoming IoT Applications

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Abstract:

The Internet of Things (IoT) represents a vast network of devices connected to the Internet, enabling remote access and control through existing network frameworks. This integration of computing systems with the physical world not only minimizes human effort but also enhances accuracy and efficiency, leading to significant economic advantages. IoT devices play a crucial role in simplifying everyday activities for users. Nevertheless, the IoT landscape poses considerable security and privacy risks due to its diverse and ever-evolving nature. One of the most pressing challenges within this environment is authentication. For external users to directly access device information, mutual authentication between the user and the devices is essential. In this paper, we introduce a novel signature-based authenticated key establishment scheme tailored for the IoT environment. Our proposed solution undergoes rigorous security testing through established methodologies, including the Burrows-Abadi-Needham logic and both informal and formal security analyses, using the widely recognized automated validation of Internet security protocols and applications tool. Moreover, we implement our proposed scheme utilizing the popular NS2 simulator, with simulation results showcasing its effectiveness. Ultimately, our scheme not only offers enhanced functionality but also maintains computational and communication costs comparable to existing solutions.

Key Words: Internet of Things, Burrows-Abadi-Needham logic, NS2 simulator, computational and communication costs.

Agro Homoeopathy-The present need (A Sustainable Approach to Agriculture).

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Abstract:

This study explores Agro-Homeopathy, an innovative approach to sustainable agriculture utilizing homeopathic remedies to promote soil health, crop resilience, and environmental conservation. The primary objectives are to promote sustainable agriculture, improve crop health, enhance soil fertility, and increase crop yields. Homeopathic remedies are prepared through potentization and applied through seed treatment, soil application, foliar spray, and irrigation. Results show improved plant growth, pest and disease management, soil health, and climate change resilience. Strengths include sustainability, environmental benefits, cost-effectiveness, and improved crop yields. Weaknesses include limited scientific evidence, unclear regulatory framework, and public perception. Opportunities lie in growing demand for sustainable agriculture and research development. Threats include conventional agriculture practices and regulatory challenges. Agro-Homeopathy offers a valuable tool for sustainable agriculture, enhancing crop yields, reducing chemical usage, and promoting environmental sustainability.

Key Words: Agro-Homeopathy, sustainable agriculture, homeopathic remedies, soil health, crop resilience.

**New class of anisotropic charged strange quark star in Durgapal IV metric and its
maximum mass**

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Abstract:

In this paper, we have explored the relativistic stellar model considering pressure anisotropy. An anisotropic solution of the Einstein Field Equations (henceforth EFE) has been presented for charged strange quark stars considering the interior space-time geometry described by the Durgapal IVth metric. In the case of a strange quark star, if the equation of state $p_r = 13(\rho - 4Bg)$ as prescribed in the MIT bag model is applicable, then at the surface, one may consider that the surface energy density $\rho_s = 4Bg$. Imposing the constraint value of Bg within the range of 57.55-95.11 MeV/fm³ required for stable quark matter with respect to a neutron when the external pressure is zero, we have determined the maximum mass and radius of the strange quark star and other relevant properties. It is noted that the maximum mass and radius for $Bg = 57.55$ MeV/fm³ are $M_{\text{max}} = 2.92M_{\odot}$ and $b_{\text{max}} = 13.749$ km, respectively, whereas those for $Bg = 95.11$ MeV/fm³, are $M_{\text{max}} = 2.27M_{\odot}$ and $b_{\text{max}} = 10.695$ km for an isotropic uncharged star. In the presence of pressure anisotropy and charge, the value of maximum mass increases. We have predicted the radii of a few recently observed pulsars from our model and found that the radii agree with the predictions from observations. Furthermore, stability and energy conditions are also satisfied in the present model.

Key Words: relativistic stellar model, pressure anisotropy, Einstein Field Equations, charge, mass

Image Forgery Detection Using Deep Neural Network

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Technology, Kuttakuzhi, Tamil Nadu, India*

Abstract:

The detection of fake images is crucial to maintain the credibility of digital content, especially in the current era of digital media and social networks. Image forgery has become increasingly common and sophisticated, posing a serious threat to the authenticity and validity of digital content. This paper presents a deep learning-based approach to image forgery detection, specifically using Error Level Analysis (ELA) with Convolutional Neural Networks (CNNs) and a pre-trained VGG-16 model. The study compares the performance of the two models and provides an in-depth analysis of the results. The experiments show that the ELA-CNN model achieves a remarkable accuracy rate of 99.87% and correctly identifies 99% of invisible images, while the VGG-16 model achieves a lower accuracy rate of 97.93% and a 75.87% validation rate. The research highlights the significance of using deep learning techniques in image forgery detection and explores the implications of the findings. The paper also discusses the limitations of the study and future enhancements that could be made to improve the precision and generalization skills of image forgery detection algorithms. This research contributes to the field of image forgery detection by providing a comprehensive comparison of deep learning-based algorithms and their effectiveness in identifying fake images. The findings of this study can be utilized to develop precise and effective image forgery detection tools to maintain the integrity of digital content and mitigate the negative consequences of picture alteration.

Key Words: Image Forgery, Machine Learning, CNN, Deep Learning, Neural Network, Error-level Analysis.

Smart Social Media Event Detection with Real-Time Alerts Using Big Data Analytics

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Abstract:

Social media has evolved into a dominant medium for real-time communication and information sharing, especially during emergencies such as floods, earth quakes, and public disturbances. Rapid identification of these events is vital for public safety and disaster management. This paper presents a multimodal event detection framework that utilizes big data analytics, machine learning and Natural Language Processing (NLP) to analyze social media posts and generate real-time alerts. Unlike conventional text-based approaches, this system integrates image analysis, geolocation, multilingual processing, and automated fact-checking to enhance accuracy and liability. Using the Chennai flood scenario as a case study, the proposed system demonstrates effective event detection, filtering of misinformation, and timely alert dissemination. Results show significant improvements in detection accuracy and alert timeliness, positioning this framework as a robust solution for public safety, disaster response and media verification.

Key Words: Social media, Big Data Analytics, Event detection, Real-time alerts, Multimodal Analysis, Artificial Intelligence.

**Smart Lifestyle Interventions for Obesity and Metabolic Health: Integrating
Technology with Personalized Wellness Strategies**

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Abstract:

Obesity and metabolic disorders such as type 2 diabetes and dyslipidemia have emerged as major public health challenges globally, driven by sedentary behaviors, poor dietary habits, and psychosocial stress. This study explores the effectiveness of smart lifestyle interventions—leveraging wearable technologies, mobile health (mHealth) apps, AI-based dietary coaching, and digital behavior modification tools—in promoting sustainable weight loss and metabolic improvements. A randomized controlled trial was conducted involving 200 overweight adults aged 25–50 years, divided into intervention and control groups over a 16-week period. The intervention group received customized activity goals, dietary monitoring through AI-integrated nutrition apps, and real-time feedback via smart wearables. Key outcome measures included changes in BMI, waist circumference, fasting glucose, lipid profile, and quality of life scores. Results indicated statistically significant reductions in body weight (mean $\Delta = -5.2$ kg), improved glycemic control (HbA1c reduced by 1.1%), and enhanced HDL levels in the intervention group compared to the control. Participants also reported improved sleep and stress management. These findings underscore the potential of smart, technology-enabled lifestyle interventions in addressing obesity and metabolic dysfunction. The integration of digital health tools with personalized coaching presents a scalable, cost-effective strategy to combat lifestyle-related diseases in both urban and rural populations.

Keywords: Smart lifestyle, obesity, metabolism, wearable technology, digital health, mHealth, AI coaching, metabolic syndrome

**Bioinformatics-Based Analysis of Panchakarma Detoxification: Exploring Molecular
and Genetic Correlates of Ayurvedic Rejuvenation**

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Abstract:

Panchakarma (PK) is the main detox and rejuvenation therapy in Ayurveda. It is gaining attention worldwide for its overall health benefits. This area of research aims to create a scientific foundation for these traditional practices using Bioinformatics and '-omics' technologies. A key finding from experiments involved metabolomic profiling of healthy individuals undergoing a 6-day Panchakarma intervention. This study, called the Self-Directed Biological Transformation Initiative (SBTI), found changes in metabolomic profiles after the intervention. Among these changes was a significant drop in certain plasma phosphatidylcholines and sphingomyelins. Further Pathway Analysis indicated that PK leads to measurable changes in phospholipid biosynthesis, choline metabolism, and lipoprotein metabolism. These findings provide molecular signs of health and support its broad effects. These detox processes relate closely to the idea of Prakriti, or individual constitution, which Ayurgenomics aims to connect with modern genetics. Prakriti is defined by the unique balance of Vata, Pitta, and Kapha. It serves as a framework that combines genetic traits and environmental factors. Stories that link this idea with modern epigenetic science suggest that lifestyle changes like Panchakarma might achieve their strong rejuvenating effects by affecting gene expression and changing the epigenetic landscape. In conclusion, combining PK with molecular and genetic studies offers a promising path for modern healthcare. More research is needed to thoroughly investigate these processes, define the role of PK in treating modern lifestyle diseases, such as metabolic syndromes, and ultimately develop personalized Panchakarma plans suited to an individual's Prakriti.

Keywords: Panchakarma, Bioinformatics, Metabolomics, Ayurgenomics, Prakriti, Detoxification, Personalized Medicine, Epigenetics.

**Smart IoT-Enabled Aromatherapy System with Integrated Air Quality Monitoring and
Adaptive Wellness Control**

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Abstract:

This paper presents a novel Internet of Things (IoT)-enabled aromatherapy diffusion system that integrates real-time environmental monitoring, biological parameter feedback, and artificial intelligence for personalized wellness applications. The proposed system employs ultrasonic atomization technology operating at 2.4MHz frequency to preserve essential oil molecular integrity while delivering precision dosing of more than one medicated oil. Key innovations include multi-sensor integration (PM1, PM2.5, CO₂, humidity, temperature), heart rate variability (HRV) synchronization via wearable devices, and machine learning algorithms for adaptive scent optimization. The system architecture supports both local processing and cloud connectivity, enabling remote monitoring and data analytics as an optional feature if required. Preliminary testing demonstrates 99.2% atomization efficiency with 2-5µm particle size distribution and < 3 seconds response time for environmental parameter adjustments. Applications span healthcare facilities, corporate wellness programs, and smart home environments with target publication period of 10 weeks for rapid research dissemination.

Key Words: Internet of Things, aromatherapy diffusion system, multi-sensor integration, smart environments

**Comparative analysis of deep learning and machine learning models for blood group
classification using retinal features**

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Abstract:

Blood Group Detection through sclera and fundus it detects a person's blood group using the eye images with the help of the deep learning- based feature extraction. The problem solving is traditional blood group tests require invasive blood sampling, which can be time-consuming and uncomfortable. So, it approaches the extract biometric and vascular features from eye images and use a trained deep convolutional neural network to classify the blood group accurately. So, in this we are using the Alex Net to classify the accuracy and for the backend we are using the SQLite Database. For the personalization it is very user-friendly web platform where patients or medical staff can upload images and get instant results. This blood group detection using the eye images that is useful in emergency cases because if any accident occurs that time this is very useful because if any patient is unconscious on that time, they cannot tell their blood group so on that time we can use this blood group detection using their eyes.

Key Words: Blood Group Detection, Convolutional neural network, SQLite Database, Alex Net, biometric data.

Long-term degenerative neurological disorder

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Abstract:

Voice-based biomarkers can offer help analyze signs of dementia such as Parkinson's disease, PD may be a progressed neurodegenerative sickness impacting roughly 7 million people around the world (more regularly than not grown-ups), approximately 150 thousand present day consistent logical consistent analyze performed each year. By and large, PD has been troublesome to discover and records tend to center on numerous side impacts and in fact neglect some, depending on the scores of free centers. Due to the diminish in motor control which can be a sign of affliction, the term can be utilized as a suggests of recognizing and diagnosing PD. Common sense has suggested that specialists habitually center on the side impacts of PD while neglecting the other. By utilizing free estimation scales, the term can be utilized to analyze and analyze the sickness. This paper presents demonstrate to back the concept of coordinated classification, which can be utilized to analyze individuals with diseases such as diabetes and aspiratory fibrosis. Through Coordinate Backslide, Calculated Backslide, Choice Trees, Reinforce Vector Machine, Self-assertive Forest, XG Boost, Neural Orchestra and Ada boost we were able to achieve a beat exactness of 100% for diagnosing fanatical conditions. The expand as well livelihoods distinctive Evaluation Techniques and Estimations such as Confuse Organize, Classification Report, F1-Score, Precision, Precision, Audit.

Key Words: Random Forest, XG Boost, logistic regression, Linear regression, Ada boost.

5G Network Security: Challenges and Emerging Defense Strategies

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Abstract:

The rapid deployment of Fifth Generation (5G) networks marks a transformative shift in wireless communication, enabling ultra-low latency, massive device connectivity, and high data throughput for applications such as autonomous vehicles, smart cities, remote healthcare, and industrial automation. However, this technological advancement also introduces unprecedented security challenges due to its highly virtualized architecture, software-defined networking (SDN), network slicing, and reliance on cloud-native infrastructure. Unlike previous generations, 5G expands the attack surface through increased entry points, decentralized control mechanisms, and integration with heterogeneous Internet of Things (IoT) devices. Key security threats include signalling storms, Denial-of-Service (DoS) attacks, man-in-the-middle interception, rogue base stations, and vulnerabilities in edge computing. Traditional security frameworks designed for 4G networks are insufficient to counter these sophisticated cyber risks. This paper presents a comprehensive review of 5G security challenges across the core network, radio access network (RAN), and user equipment layers. Furthermore, it explores emerging defence strategies such as AI-driven intrusion detection, block chain-based authentication, quantum-safe cryptography, and secure network slicing. The objective is to provide insights into building a resilient and adaptive security framework capable of safeguarding next-generation communication infrastructure.

Keywords: 5G, Network Security, SDN, IoT, Cyber Threats, Authentication, Block chain, Intrusion Detection.

Efficient and Light Deep Learning Framework for Micro-Expression Analysis

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Abstract:

A crucial field in emotional computing is micro-expression analysis, which makes it possible to identify small, involuntary face movements that convey true human emotions. However, reliable detection and classification are severely hampered by the short duration, low intensity, and restricted availability of micro-expression data. An effective and lightweight deep learning framework for automatic micro-expression analysis is proposed in this work. The system uses compact convolutional and attention-based modules for spatial-temporal feature extraction, sophisticated preprocessing for noise reduction, and optimal classification layers for computational cost reduction. Methods including model compression, transfer learning, and fine-tuning are used to improve efficiency and generalization. The suggested framework delivers good recognition accuracy with fewer parameters and quicker inference time, according to experimental assessment on benchmark micro-expression datasets. The outcomes demonstrate its applicability for real- time emotion analysis in settings with limited resources. This work advances the creation of reliable and scalable emotion recognition systems that can be used in security monitoring, psychological testing, and human–computer interaction.

Key Words: Micro-expression analysis, Deep learning, Lightweight model, Attention mechanism, Emotion recognition.

**Synthesis and spectrophotometric study of charge transfer complex and explaining its
application.**

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Abstract:

This study involved the synthesis of a charge transfer (CT) complex between the π -acceptor tartaric acid (TA) and the donor 2,6-diaminopyridine (DAP) in room temperature methanol. The transfer of lone pair electrons from DAP to TA results in the complex's creation, which has important uses in environmental research, especially in the areas of pollution detection, cleanup, and air and water purification. FTIR, NMR, UV-Vis, PXRD, and SEM were among the spectroscopic methods used to characterize the produced compound. Hydrogen bonding ($N^+ \cdots H \cdots O^-$) occurs after proton migration from the acceptor to the donor in the CT contact. The formation constant (KCT), molar extinction coefficient (ϵ_{CT}), interaction energy (ECT), ionization potential (ID), resonance energy (RN), free energy (ΔG°), and oscillator strength (f) were all determined by spectrophotometric analysis. Using the straight-line approach between donor and acceptor, the complex's stoichiometric ratio was determined to be 1:1. The physical characteristics of the complex were ascertained using the Benesi–Hildebrand equation, and single crystal X-ray diffraction investigation provided additional support for the findings. Furthermore, the produced proton transfer complex demonstrated encouraging outcomes when tested for antibacterial activity. Its photocatalytic activity was also explored, demonstrating its potential applications in environmental remediation. The study's overall findings support the 2,6-DAP–TA charge transfer complex's stability, multifunctionality, and effective creation.

Key Words: Charge transfer; SC-XRD; Photocatalytic activity; Antimicrobial activities.

Labelling Outliers using Different Types of Boxplot Rules

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Abstract:

A crucial assumption in hypothesis testing is that the parent population from which a sample is drawn follows a normal distribution. The violation of this assumption restricts the usage of some parametric tests to draw inferences. The presence of outlier often violates such assumptions and the test results obtained by analyzing contaminated sample data often leads to incorrect inferences. To avoid such situations, boxplots can be used to identify or label outliers before analysing the data. Different types of boxplots have been proposed in the literature. In this paper, an attempt has been made to compare the performance of a few modified boxplot rules in outlier labelling.

Key Words: Outlier, Normal distribution, Boxplot, Skewness.

**Adaptive Hybrid Fruit Bee Optimization-based Deep Convolution Neural Network for
brain tumour classification using MRI image**

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Abstract:

Brain tumor classification is an important area in the field of medical imaging. In this research, a brain tumor classification approach using Adaptive Hybrid Fruit Bee Optimization-enabled Deep Convolutional Neural Network (AHFBO-based Deep CNN) is developed. Here, Segnet is employed for the segmentation of pre-processed images and then several features are extracted. A new Adaptive Hybrid Fruit Bee Optimization (AHFBO) method is developed for updating the weights of the neuron in the training of the neural network, thereby reducing the feature selection space. The proposed AHFBO is a combination of adaptive techniques, the Chaotic Fruit Fly Optimization Algorithm (CFOA), and the Artificial Bee Colony algorithm (ABC). Brain tumor classification is performed using the Deep CNN, which is trained using the introduced AHFBO method, over the BRATS 2018 dataset. The introduced method is evaluated for its performance based on various parameters, such as accuracy, sensitivity, and specificity. The experimental outcomes illustrate that the proposed AHFBO method enhances the performance of DCNN and provides efficient brain tumor classification with maximal values of accuracy at 0.936, sensitivity at 0.928, and specificity at 0.941.

Key Words: Brain tumor, Brain tumor classification, MRI images, Deep learning, CNN, Segnet.

Thumbnail preservation encryption for secure and efficient image

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Abstract:

The swift expansion of multimedia applications and cloud-based image sharing has made it essential to address the challenges of secure and efficient image transmission. Conventional encryption methods offer robust protection; however, they frequently hinder rapid visual assessment and elevate computational demands, leading to inefficiencies in extensive image repositories and time-sensitive applications. This paper introduces a novel approach aimed at ensuring secure and efficient image transmission through a thumbnail preservation encryption scheme. The suggested approach ensures that a low-resolution thumbnail of the original image remains visually accessible, while the full-resolution image content is securely encrypted. This allows for quick image navigation, cataloguing, and oversight while maintaining the privacy of sensitive visual data. The approach combines targeted encryption, efficient cryptographic processes, and image modification methods to achieve a harmonious balance of security, transmission efficiency, and user-friendliness. The findings from the experiments indicate that the suggested method effectively minimizes transmission duration and storage requirements, all while ensuring strong safeguards against unauthorized access. This approach is especially effective for cloud storage, medical imaging systems, surveillance applications, and extensive multimedia databases, where the importance of both security and efficiency cannot be overstated.

Key Words: Thumbnail preservation encryption, secure image transmission, Selective image encryption, Multimedia security, Lightweight cryptography, Cloud image storage, Privacy-preserving image sharing, efficient image transmission.

**AI- enabled adaptive therapeutic assistance architecture and postural instability
detection with intelligent protective mechanisms**

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Abstract:

Access to efficient healthcare monitoring remains a challenge in rural and resource-limited areas, where medical support and supervision are often delayed. To address this, the proposed project introduces an AI-powered healthcare monitoring system integrated with automated oxygen regulation and fall detection for real-time, patient-specific care. The system employs a Raspberry Pi as the central processing unit, interfaced with multiple biomedical sensors for continuous health tracking. The MAX30100 sensor monitors the patient's SpO₂ and heart rate, while the DHT11 sensor measures body temperature. A motion sensor (MPU6050) continuously analyses body orientation and acceleration to detect falls or abnormal posture changes. In case of a fall, the AI-based fall detection algorithm classifies the motion pattern and, upon confirmation, activates protective mechanisms such as airbag inflation using a micro air pump and simultaneously sends an SMS alert to the caregiver through a GSM module. This ensures immediate protection and response, minimizing the risk of injury. For oxygen regulation, the system automatically controls oxygen flow from the cylinder based on the patient's real-time SpO₂ levels. A solenoid valve, attached to the oxygen regulator and controlled via a relay module, manages oxygen flow. When the SpO₂ drops below 90%, the Raspberry Pi triggers the relay to open the solenoid valve, allowing oxygen to flow through the flowmeter and mask. Once the SpO₂ returns to normal range, the valve is closed automatically. This conserves oxygen and ensures delivery only when required. To make oxygen control adaptive and predictive, an AI model is integrated into the Raspberry Pi.

Key Words: AI-powered healthcare monitoring, Raspberry Pi, SpO₂ monitoring, MAX30100 sensor, DHT11 sensor.

Vehicle with Obstacle reporting and GPS integration using ESP32-Cam

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Abstract:

Road accidents due to blind spots and inadequate situational awareness continue to pose significant threats to driver and pedestrian safety. This project proposes a cost-effective embedded system that enhances vehicle safety by detecting obstacles both in front and behind the vehicle, measuring and displaying their distances to the driver, and concurrently reporting the vehicle's real-time location using GPS technology. The heart of this system is the ESP32-CAM microcontroller, a powerful and compact board that combines processing capability with wireless communication and camera functionality. The project integrates ultrasonic sensors to detect the proximity of nearby objects, a GPS module (Neo-6M) to fetch accurate geographic coordinates, and a user interface to present the distance data and location to the driver through an OLED display. The modular and scalable architecture of the system also opens opportunities for future expansion, such as side obstacle detection, cloud-based data logging, and smartphone integration. Overall, this project provides a practical and accessible approach to intelligent vehicle monitoring for improved road safety.

Key Words: ESP32-CAM, Obstacle detection, GPS, Embedded systems, Vehicle safety, Ultrasonic sensor, User interface.

Ethical Challenges of AI in Legal Decision-Making: A Cross-Disciplinary Analysis

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Abstract:

This paper explores the intersection of law, ethics, and technology in the context of AI-driven legal decision-making, with particular emphasis on issues of algorithmic bias, opacity, accountability, and the digital divide. To examine these issues from a societal perspective, an empirical study was conducted involving 200 respondents drawn from legal, academic, and general backgrounds. The survey revealed that 84% believe AI legal systems lack accountability in rectifying errors or biases, while 88% perceive a lack of transparency in how AI decisions are made. Furthermore, 82% agree that stakeholders including legal professionals and the public—do not adequately understand how AI systems function. A striking 91% of respondents believe AI algorithms have a profound impact on individuals and society, and 86% support the need for ongoing ethical evaluation of such systems. These results validate all five hypotheses (H1a–H1e) and underscore the urgency of addressing ethical and legal gaps in AI governance. The findings are situated within broader global developments, including the European Union’s AI Act, OECD AI principles, and India’s emerging regulatory framework. By synthesizing insights from empirical evidence, legal scholarship, ethical theory, and policy analysis, this paper proposes a set of actionable recommendations. These include establishing institutional AI ethics boards, implementing human-in-the-loop decision models, mandating algorithmic audits, and introducing targeted training for legal professionals on AI literacy and ethical compliance. Ultimately, this paper argues for a balanced and rights-based approach to AI in legal systems—one that leverages technological advancement while safeguarding fundamental principles of justice, fairness, and human dignity.

Key Words: Artificial Intelligence in Law, Algorithmic Bias, Legal Ethics and Technology, Judicial Decision-Making, AI Governance and Accountability.

Federated Forensic Image Retrieval System for Criminal Investigation

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Abstract:

In modern criminal investigations, large volumes of digital images are distributed across multiple law-enforcement agencies, surveillance networks, and forensic databases. Traditional centralized image retrieval methods face significant challenges related to data privacy, security, bandwidth limitations, and inter-agency data-sharing restrictions. To address these issues, this paper proposes a Federated Forensic Image Retrieval System (FFIRS) that enables efficient, privacy-preserving retrieval of forensic images without requiring raw data to be shared or centralized. The system employs federated learning to collaboratively train deep visual feature extractors across distributed nodes while keeping sensitive image data stored locally. A secure feature aggregation and matching mechanism is designed using homomorphic encryption and differential privacy to ensure confidentiality during model updates and query processing. FFIRS supports criminal investigations by enabling rapid suspect identification, cross-agency evidence correlation, and enhanced retrieval accuracy. Experimental evaluations demonstrate that the proposed system achieves high retrieval performance while significantly reducing privacy risks and communication overhead. This federated approach strengthens cooperative intelligence across agencies and provides a scalable, secure framework for forensic image retrieval in real-world investigative environments.

Key Words: Federated learning, forensic image retrieval, criminal investigation, privacy-preserving learning, deep feature extraction.

Khel Scout: An AI-Powered Platform for Inclusive Sports Talent Identification in India

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Abstract:

India has a large pool of talented young athletes, but many of them—especially those from rural areas—do not get noticed because they lack access to proper training facilities and fair evaluation systems. To solve this problem, we have developed Khel Scout, a mobile-based platform that uses Artificial Intelligence (AI) to identify and assess sports talent. With just a smartphone, athletes can record themselves performing basic fitness tests such as push-ups or endurance runs. The app then uses AI to analyze the videos in real time, checking for correct posture, timing, and distance covered. This ensures that the results are accurate, consistent, and free from human bias. Once verified, the data are securely shared with sports authorities and talent scouts who can then guide promising athletes for further training and opportunities. Because it runs on a mobile device, Khel Scout is easy to use even in remote or low-resource areas. The goal of this initiative is to make sports talent identification fair, transparent, and accessible to everyone. By combining technology with sports assessment, Khel Scout helps create a more inclusive and data-driven sports ecosystem across India, where every athlete—regardless of background—has a chance to be discovered and supported.

Key Words: Artificial intelligence, computer vision, sports technology, talent identification, fitness assessment, mobile application, inclusivity.

**RNN-Driven Liquid Biopsy Biomarker Classification for Early Detection and
Recurrence Monitoring of Hepatocellular Carcinoma**

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Abstract:

Hepatocellular carcinoma (HCC) is difficult to detect early because of the low sensitivity of AFP assays and imaging, particularly in disease with AFP-negative disease and those in the early stage. This paper assesses the non-invasive liquid biopsy biomarkers, such as circulating miRNAs, extracellular vesicles (EVs), fucosylated EV profiles, and circulating tumor DNA (ctDNA), to better HCC diagnostics. To analyze multi-omics biomarker profiles with greater accuracy in the diagnosis of hepatitis B-induced hepatocellular carcinoma, a recurrent neural network (RNN)-based classification model is trained that can be used to predict through the learning of temporal patterns. Factors of metabolic dysregulation, such as the bile acid imbalance, gut dysbiosis, and transcriptional regulators, such as ZHX2, are also studied in order to understand the mechanisms of biomarker expression. Variation of subpopulations in terms of HBV, NAFLD, and Indigenous-patients is evaluated to facilitate precision surveillance. Moreover, minimal residual disease (MRD) biomarkers on liquid samples are being researched to identify recurrence in the post-treatment or post-transplantation stage. The suggested model combines the use of biomarker panels and imaging, and AFP tests to enhance clinical decision-making, and it also deals with shortcomings such as standardization of assays and clinical translation. The potential of AI-powered liquid biopsy plans for early diagnosis and individualized follow-up of HCC.

Key Words: AFP-negative HCC, Biomarker signature, Deep learning in oncology, Temporal biomarker analysis, multi-analyte diagnostic model, Precision oncology, Survival prediction.

**Recent Advances in Nanoengineered Surface Modifications of Titanium-Based Implants
for Enhanced Osseointegration, Corrosion Resistance, and Bioactivity**

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Abstract:

Titanium and its alloys are extensively used in orthopaedic and dental implants owing to their superior mechanical strength, corrosion resistance, and biocompatibility. However, their bioinert nature often limits effective osseointegration and long-term implant stability. Recent developments in nanoengineered surface modifications have significantly improved the biological performance and functional lifespan of titanium implants. This paper reviews the latest advancements in nanoscale coating technologies, including anodization, electrophoretic deposition (EPD), laser texturing, and pulsed laser deposition (PLD), focusing on coatings composed of hydroxyapatite (HAp), bioactive glass, zinc oxide, and iron oxide composites. These approaches enhance surface topography, wettability, and bioactivity, thereby promoting osteoblast adhesion and reducing bacterial colonization. Notably, PLD-derived bioglass coatings exhibit superior homogeneity, corrosion resistance, and hemocompatibility, offering a promising route toward multifunctional implant surfaces. The synergistic integration of nanostructured coatings and bioactive materials provides a pathway to next-generation titanium implants with improved osseointegration, mechanical durability, and long-term biological performance.

Key Words: Titanium Implants; Nanoengineering; Surface Modification; Osseointegration; Bioactivity; Corrosion Resistance; Bioglass; Pulsed Laser Deposition (PLD).

Stroke recognition using Image processing

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Abstract:

To increase recovery and survival chances, stroke must be detected early. By merging Media Pipe's facial landmark identification with cutting-edge machine learning models Random Forest (RF), Extreme Gradient Boosting (XGB), and Categorical Boosting (CB), this work offers a novel method for diagnosing strokes through the examination of facial landmarks. With Media Pipe, 228 facial landmarks are extracted from significant areas impacted by stroke-related asymmetry in an extensive collection of facial photographs of stroke and non-stroke patients. By improving model interpretability, explainable AI (XAI) approaches enable a more thorough comprehension of the key face regions involved in stroke prediction. Hyperparameter tweaking is used to optimize each machine learning model separately, and we also suggest a Multimodal Voting Classifier (MVC). The technique lessens the possibility of inaccurate classifications that could result from the shortcomings of a single model by combining the predictions using weighted average or majority voting. As seen by its 94.75% accuracy, this produces a more reliable and generalized model with better diagnostic accuracy than any one model could have on its own. The model's diagnostic accuracy was greatly increased when feature importance analysis, made possible by XAI, identified important face regions, including the eyes, cheeks, and lips, as crucial markers of stroke. The robustness of the model is further reinforced by the use of t-SNE visualization, which offers insight into the classification of stroke and non-stroke instances. Real-time data demonstrate the model's effectiveness and versatility on a range of hardware, allowing for useful clinical integration. The suggested approach provides a real-time, affordable, non-invasive diagnostic tool that could increase access to stroke diagnosis in isolated and resource-constrained locations.

Key Words: Explainable AI, facial landmarks analysis, feature importance, machine learning, Media Pipe, stroke recognition.

**ViT Backbone Optimization with Multi-Scale Patch Embedding in Dendritic Learning
Framework**

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Abstract:

Vision Transformers (ViTs) operate under the concept of dividing pictures into tiny patches and training on the relationships between them. They are good; however, they require a significant amount of computing power and may occasionally fail to capture finer details to the local area. In the present paper, we propose an alternative method of enhancing ViTs: Multi-Scale Patch Embedding (MSPE): Multi-Scale Patch Embedding (MSPE): Uses patches of different sizes instead of just one, helping the model capture both fine details and overall patterns. Dendritic Learning Framework (DLF based on the principles of brain neurons processing the signals by using synapses, dendrites and the soma so that the model could more effectively assemble the features. The experiments of the Tiny-ImageNet model demonstrate that MSPE-DVT is more accurate and more efficient than conventional ViTs, remaining computationally light.

Key Words: Vision Transformer (ViT), Multi-Scale Patch Embedding (MSPE), Dendritic Learning, Deep Learning, Image Classification, Transformer Models, Bio-Inspired Neural Networks, Scale-Aware Feature Extraction.

Temporal cross-camera face tracking for law enforcement intelligence

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Abstract:

A smart facial recognition system is proposed to assist law enforcement agencies in tracking individuals across multiple surveillance cameras. The system converts raw video footage into structured, time-stamped intelligence, addressing the challenge of analyzing large volumes of unorganized video data. A hybrid machine learning pipeline is employed, combining Face Net for deep feature extraction with DBSCAN clustering to group similar faces without labeled data. Following clustering, a Local Binary Pattern Histogram (LBPH) classifier is trained to achieve fast and accurate recognition. The system operates through a Tkinter-based graphical interface and stores recognition logs using MySQL and CSV formats, ensuring usability and efficient data management. It supports both live and recorded video streams, automatically identifying individuals and logging their appearances with timestamps. Experimental results demonstrate a recognition accuracy of 98.2% with an average processing speed of 50 milliseconds per frame, confirming the system's suitability for real-time surveillance. This solution enhances crime detection, improves surveillance efficiency, and accelerates investigative processes for law enforcement agencies.

Key Words: Face Recognition, Deep Learning, DBSCAN Clustering, Criminal Identification, Surveillance Video Analytics.

**Automated Player Detection and Performance Tracking in Football Videos Using Deep
Learning: A YOLO-Based Approach on the Soccer Player Dataset**

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Abstract:

The application of deep learning in sports analytics has gained significant attention for enhancing performance evaluation and tactical decision-making. In football, analyzing player movement and positioning is essential for understanding match dynamics, yet manual annotation remains labor-intensive and error-prone. This paper presents an automated approach for football player detection and performance tracking using a YOLO-based deep learning framework. The model is trained on the Soccer Player Detection Dataset from Kaggle, which contains annotated football images under varying environmental conditions. YOLOv8 is employed for player localization, and the DeepSORT algorithm is used for maintaining identity consistency across frames. The system further estimates positional metrics such as player displacement and movement patterns to support tactical analysis. Experimental results demonstrate that the proposed method achieves high detection accuracy and robust tracking performance, offering a reliable offline tool for football video analytics. This work contributes toward advancing automated sports performance assessment using modern computer vision techniques.

Key Words: Football analytics, object detection, YOLOv8, DeepSORT, player tracking.

**Smart Agriculture through AI and IoT: A Lightweight Approach to Plant Disease
Detection**

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Abstract:

The combination of Artificial Intelligence (AI) and the Internet of Things (IoT) has transformed contemporary agriculture through the facilitation of real-time monitoring, accurate control, and prompt disease identification. This study presents a streamlined AI-IoT framework for smart agriculture, emphasising effective plant disease detection through the utilisation of low-power edge devices. IoT sensors consistently gather environmental parameters including temperature, humidity, and soil moisture, while an integrated camera node acquires images of leaves. A streamlined convolutional neural network (CNN) model, refined via model pruning and quantisation techniques, is implemented for disease classification, guaranteeing real-time inference with reduced latency. The system sends processed data to a cloud dashboard, equipping farmers with notifications and suggestions for proactive measures. The experimental evaluation conducted with the PlantVillage dataset resulted in an impressive accuracy of 97.6%, precision of 96.8%, recall of 97.2%, and an F1-score of 97.0%. The model was efficiently sized at 18 MB, with an average inference time of just 0.42 seconds on Raspberry Pi 4 hardware. The reduction in power consumption by 31% compared to standard deep CNN models illustrates the potential for implementing AI at the edge in the pursuit of sustainable agriculture. The suggested method adeptly harmonises precision, velocity, and resource utilisation, facilitating scalable smart agriculture solutions for environments with limited resources.

Key Words: Smart Agriculture, Internet of Things (IoT), Artificial Intelligence (AI), Plant Disease Detection, Lightweight CNN, Edge Computing, Deep Learning, Precision Farming, Model Optimization, Real-Time Monitoring.

**CanteenFlow — A Camera-Free, Privacy-First Queue & Wait-Time Prediction System
for Multi-Counter Cafeterias**

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Abstract:

In most college campuses and large corporate cafeterias, peak dining hours often lead to long, unpredictable queues that cause significant time wastage, user frustration, and uneven counter utilization. Existing cafeteria management systems primarily focus on digital menus, payment integration, or pre-ordering mechanisms, but lack the capability to deliver real-time queue analytics or accurate waiting time predictions. Furthermore, surveillance-based solutions relying on cameras or computer vision introduce privacy risks and demand high infrastructure costs. CanteenFlow presents a camera-free, privacy-preserving framework designed to predict queue lengths and waiting times in multi-counter cafeterias. The system utilizes passive sensing through low-cost IoT devices that capture anonymous Wi-Fi and Bluetooth Low Energy (BLE) signals from users' smartphones to estimate crowd density near each counter. These aggregated data are combined with Point of Sale (POS) transaction rates to derive service rates, enabling the application of queueing theory models such as M/M/1 and M/M/c for accurate waiting time computation. A mobile or web interface then provides real-time recommendations to users on the optimal counter choice. Privacy is ensured through local hashing of MAC addresses and the implementation of differential privacy to anonymize transmitted data. The proposed system reduces waiting times, balances customer distribution, and enhances operational efficiency without compromising user privacy. Beyond cafeterias, the framework is adaptable to other high-traffic environments such as airports, hospitals, and retail outlets, offering a scalable, cost-effective, and ethical solution for intelligent queue management.

Key Words: Queue prediction, IoT, privacy preservation, BLE sensing, queueing theory, smart cafeteria.

**Adaptive Waste Management Assistant: AI and IoT-Based Smart Waste Handling
System**

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Abstract:

The Adaptive Waste Management Assistant (AWMA) is an intelligent urban waste management system that integrates Artificial Intelligence (AI) and the Internet of Things (IoT) to improve the efficiency, accuracy, and sustainability of waste collection. The project addresses key challenges faced by municipalities, such as missed garbage pickups, improper waste segregation, and inefficient routing of collection vehicles. The proposed solution features AI-enabled smart bins equipped with sensors and cameras capable of identifying fill levels, detecting contamination, and classifying waste into categories such as plastic, paper, and organic matter. Once the bin reaches a predefined capacity, an automated pickup request is transmitted to a central server, where optimized routing algorithms assign the most efficient collection path to nearby vehicles. This integration of real-time monitoring and data analytics reduces manual labor, minimizes overflow incidents, and promotes effective recycling. The system also provides data-driven insights for municipal authorities, supporting predictive planning and sustainable urban development. In the prototype phase, Figma-based designs and no-code applications were used to simulate functionality, while future versions aim to employ machine learning for enhanced waste classification accuracy.

Key Words: Smart Waste Management, Artificial Intelligence, Internet of Things, Smart Cities, Waste Segregation, Route Optimization, Sustainable Urban Systems.

Revolutionizing Sea Transmission for Secure and Lossless Maritime Connectivity

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Abstract:

Maritime communication is the backbone of global navigation, safety, and data exchange at sea. However, traditional RF (Radio Frequency) systems often suffer from signal attenuation, limited bandwidth, and vulnerability to interference, leading to data loss and compromised security in harsh oceanic environments. To overcome these challenges, emerging technologies such as millimeter-wave (mmWave) communication, 6G-enabled broadband, and quantum-encrypted RF links are redefining sea transmission standards. These systems enable lossless data transfer, enhanced signal integrity, and high-level security through advanced modulation, adaptive beamforming, and quantum key distribution techniques. Furthermore, the integration of Reconfigurable Intelligent Surfaces (RIS) extends coverage and minimizes propagation losses across vast maritime regions. This paper explores the convergence of next-generation RF, quantum encryption, and intelligent communication systems, highlighting their potential to establish secure, reliable, and lossless maritime connectivity essential for future autonomous vessels and smart ocean networks.

Key Words: Maritime communication, RF transmission, mmWave, 6G, quantum encryption, QKD, lossless connectivity, Reconfigurable Intelligent Surfaces (RIS), secure communication, beamforming.

**Deep CNN-Based Multi-Class Skin Disease Classification Using Image Processing
Techniques**

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Abstract:

The diagnosis of skin diseases is a critical aspect of dermatology, often requiring expert evaluation and biopsy confirmation. However, such methods can be time-consuming and subject to inter-observer variability. This paper presents a deep learning-based framework for the multi-class classification of skin diseases using Convolutional Neural Networks (CNNs). The system was trained and evaluated on the Skin Disease Classification Dataset containing 900 dermatoscopic images across nine disease categories, including melanoma, actinic keratosis, and atopic dermatitis. Preprocessing steps such as image resizing, normalization, and augmentation were applied to enhance generalization. A comparative analysis was conducted between custom CNN, VGG16, and ResNet50 architectures. The proposed CNN achieved an overall accuracy of 95.4%, outperforming pre-trained transfer learning models. Experimental results show that CNNs can effectively learn discriminative skin texture and color features for accurate diagnosis. This study highlights the potential of AI-driven dermatological image analysis for faster, more consistent skin disease detection and clinical decision support.

Key Words: Skin disease classification, Convolutional Neural Network, Medical image processing, Deep learning, Transfer learning.

**Quantum Computing and Artificial Intelligence: A Synergistic Approach to
Revolutionizing Legal Research and Practice**

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Abstract:

The convergence of Quantum Computing (QC) and Artificial Intelligence (AI) heralds a transformative era for legal research and practice, addressing longstanding inefficiencies in data processing, predictive analytics, and ethical decision-making. This article critically affirms the synergistic potential of these technologies to democratize access to justice, enhance precision in case outcomes, and foster innovative regulatory frameworks, while navigating inherent risks such as algorithmic opacity and equity disparities. Drawing from interdisciplinary advancements, the importance of this synergy lies in QC's exponential computational power, leveraging superposition and entanglement to solve intractable problems, complemented by AI's pattern recognition and natural language processing (NLP) capabilities, enabling unprecedented scalability in handling voluminous legal corpora. Examining how quantum-enhanced AI might transform legal operations, from contract analysis to e-discovery, and suggesting flexible approaches for ethical integration are among the goals. We synthesize recent international sources from 2023 – 2025, using a systematic literature review methodology. These sources include reports from the Hastings Science and Technology Law Journal, policy reports and empirical studies from the European Journal of Risk Regulation, arXiv preprints on quantum NLP, and peer-reviewed journals. This method affirmatively highlights the higher correctness of hybrid models over classical systems while critically evaluating empirical evidence, such as quantum algorithms speeding up legal data analysis by orders of magnitude.

Key Words: Quantum Synergy, Legal Innovation, AI Enhancement, QNLP Revolution, Ethical Integration, Predictive Justice.

**A stacking ensemble model for diabetes prediction integrating symptom and blood test
analysis**

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Abstract:

This project presents a stacking ensemble model for diabetes prediction by integrating symptom-based analysis with blood test parameters. Traditional single-model approaches often struggle with accuracy and generalization, especially when handling heterogeneous health data. The proposed framework combines multiple base learners with a meta-classifier to leverage diverse predictive strengths. Symptom features provide early indicators, while blood test values add clinical reliability, enabling comprehensive assessment. Advanced ensemble techniques enhance precision, recall, and robustness, minimizing false predictions. This approach supports early detection and effective management of diabetes, offering a scalable and reliable decision-support system for healthcare applications.

Key Words: Diabetes Prediction; Stacking Ensemble Model; Symptom-Based Analysis; Blood Test Parameters; Machine Learning; Meta-Classifier; Healthcare Decision Support; Early Detection; Predictive Accuracy

Confidential asset/data protection with tamper avoidance in Cargo transit system.

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Abstract:

In modern logistics, ensuring the reliability, safety, and transparency of cargo transportation is a major challenge. Issues such as unauthorized access, tampering, theft, and inefficient space utilization often affect the security and performance of supply chain operations. To overcome these challenges, this project proposes an Integrated Smart Cargo Security and Management System integrated with a custom-designed antenna that combines intelligent space allocation, digital authentication, GPS tracking, and wireless communication for real-time monitoring and secured cargo transit. The proposed system features a smart container designed to accommodate three standardized cargo sizes — Small (S), Medium (M), and Large (L). An intelligent box-counting and space allocation algorithm ensures optimal container utilization and systematic arrangement of parcels to prevent loss or mismanagement. For enhanced security, the system employs a digital locking mechanism with two-way authentication, incorporating OTP and CAPTCHA verification. The OTP is generated only upon reaching the destination, ensuring that only authorized personnel can access the container contents. A GPS tracking module, integrated with the custom-designed antenna, enables continuous communication between the cargo vehicle and the monitoring system. The antenna ensures reliable data transmission for real-time tracking, route deviation alerts, and status updates, even in low-signal conditions. This enhances operational transparency and enables immediate response to unauthorized stops or tampering attempts. The project delivers a comprehensive solution that optimizes space, protects cargo from theft or damage, and strengthens customer confidence through advanced digital and wireless technologies.

Key Words: OTP, CAPTCHA, GPS, Cargos, Cargo transit System.

Smart high voltage detection helmet with emergency alert system for electrical linemen

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Abstract:

Electrical linemen face life-threatening hazards due to exposure to high-voltage power lines, accidental contact with live conductors, and delayed rescue operations. Despite advancements in safety equipment, the absence of intelligent, real-time monitoring systems continues to result in fatalities and injuries. This paper presents the design and development of a Smart High Voltage Detection Helmet integrated with an Emergency Alert System, aimed at ensuring worker safety through continuous monitoring and rapid response mechanisms. The proposed system employs an ESP8266 Node MCU microcontroller interfaced with an electrostatic field (EMF) detection sensor to identify the presence of nearby live high-voltage lines without physical contact. The collected data and alert signals are transmitted to the Thing Speak IoT cloud platform, enabling supervisors to monitor real-time safety conditions remotely through a web dashboard. The system was tested under various simulated field conditions, demonstrating reliable detection of live electrical fields and consistent data transmission to the cloud with minimal latency. The dual alert mechanism—local and cloud-based—enhances both self-awareness and remote supervision, significantly reducing accident response time. This low-cost, portable, and IoT-enabled smart helmet offers a scalable solution for occupational safety not only in the power sector but also in construction, industrial, and hazardous maintenance environments. The integration of real-time sensing and cloud monitoring transforms traditional protective gear into a proactive, intelligent safety device capable of saving lives and improving workplace safety standards in high-risk electrical operations.

Key Words: Smart high voltage detection helmet, Electrical linemen, low-cost, portable, Cloud based.

**IoT Based Real-Time Street Light Fault Detection and Maintenance System with
Machine Learning Driven Solution Prediction**

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Abstract:

The proposed system provides a complete solution for fault prediction with suggested fixes, accurate position tracking, automated real-time streetlight fault detection, and an effective maintenance strategy. For both general city beauty and public safety, street lighting functionality is essential. Our technology makes use of the Internet of Things (IoT) to continuously monitor streetlights in real-time and quickly identify problems through machine learning. Every streetlight has sensors installed that can detect abnormalities instantly and provide information to a central control system for prompt defect finding. By ensuring a responsive and effective system, this method shortens the period between defect discovery and repair. The system's ability to provide accurate geographic information, offer remedies for errors that are recognized, and help maintenance workers locate and resolve problems more rapidly are some of its important features. By integrating geographic data, maintenance operations are directed and efficient, reducing downtime and improving system reliability overall. This study explores the technical features of the sensor-based system and highlights how effectively it functions as a reliable and straightforward option for regions trying to enhance their maintenance procedures for streetlights.

Key Words: Internet of Things, Machine Learning, Sensors.

Mood based Music Recommendation System

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Abstract:

A user's emotion or mood can be detected by his/her facial expressions. These expressions can be derived from the live feed via the system's camera. A lot of research is being conducted in the field of Computer Vision and Machine Learning (ML), where machines are trained to identify various human emotions or moods. Machine Learning provides various techniques through which human emotions can be detected. One such technique is to use MobileNet model with Keras, which generates a small size trained model and makes Android-ML integration easier. Music is a great connector. It unites us across markets, ages, backgrounds, languages, preferences, political leanings and income levels. Music players and other streaming apps have a high demand as these apps can be used anytime, anywhere and can be combined with daily activities, travelling, sports, etc. With the rapid development of mobile networks and digital multimedia technologies, digital music has become the mainstream consumer content sought by many young people. People often use music as a means of mood regulation, specifically to change a bad mood, increase energy level or reduce tension. Also, listening to the right kind of music at the right time may improve mental health. Thus, human emotions have a strong relationship with music. In our proposed system, a mood-based music player is created which performs real time mood detection and suggests songs as per detected mood. This becomes an additional feature to the traditional music player apps that come pre-installed in our mobile phones. An important benefit of incorporating mood detection is customer satisfaction. The objective of this system is to analyse the user's image, predict the expression of the user and suggest songs suitable to the detected mood.

Key Words: Face Recognition, Image Processing, Computer Vision, Emotion Detection, Music, Mood detection.

**Influence of Low-Density Polyethylene on the Mechanical and Thermal
Properties of High-Density Polyethylene**

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Abstract: Blending high-density polyethylene with low-density polyethylene is a well-known industrial strategy for tuning the properties of polyethylene. In this work, HDPE was melt-blended with LDPE at six different weight fractions— using a twin-screw extruder, and the resulting sheets were characterized across a comprehensive range of mechanical and thermal tests. Thermal behavior was probed through differential scanning calorimetry (DSC), which captured both the melting temperature and the degree of crystallinity, while Fourier transform infrared spectroscopy (FTIR) was used to establish whether any chemical reaction occurred between the two polymer phases. Surface morphology was investigated through scanning electron microscopy (SEM). As LDPE content rose from 0 to 55 wt%, tensile strength and stiffness declined progressively, most sharply beyond the 25 wt% threshold, while elongation at break climbed substantially. Impact resistance improved up to 25 wt% LDPE, where it reached its highest recorded value, then fell at higher concentrations, indicating a compositional sweet spot for toughness. Shore D hardness decreased steadily across all compositions. DSC data showed that adding 25 wt% LDPE lowered the melting peak temperature from 133.26 °C to 129.26 °C and reduced the crystallinity from 33.5% to 27.6%, confirming structural disruption of the HDPE phase. SEM images showed that increasing LDPE content introduces a two-phase morphology, although the blend surface retained better uniformity than pure LDPE alone. The findings point to 25 wt% LDPE as a practically useful composition for improving toughness and flexibility of HDPE without unacceptably sacrificing strength.

Keywords: HDPE/LDPE blends; tensile strength; impact toughness; Shore D hardness; scanning electron microscopy.