1st International Conference on

Sustainable and Futuristic Technologies (ICSFT – 2026)

24th – 25th April 2026

Organised by

Marathwada Mitra Mandal's College of Engineering
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Message

Hon. Shri. Shivajirao D. Ganage
President,
Marathwada Mitra Mandal, Pune

Greetings!

It gives me immense pleasure to extend my greetings on this platform, where technology endorses the wellbeing of the Environment, through intellectual deliberations. A hearty welcome to the **IEEE International Conference on Sustainable and Futuristic Technologies 2026, conducted by Marathwada Mitramandal's College of Engineering (MMCOE), Pune**.

The trust "Marathwada Mitramandal", Pune was established in the year 1967 with the sole objective of uplifting the under-privileged by providing education to one and all. Inspired by socially and educationally charged personalities, the sole objective of the trust is "Welfare of the Masses" which focuses on imparting quality education for Professional Excellence and sustainable development through continual improvement and team work.

In today's dynamic and technology-driven world, Outcome-Based Education (OBE) plays a crucial role in shaping learners who are not only knowledgeable but also capable of applying their skills to real-world challenges. At MMCOE we explore futuristic technologies such as Artificial Intelligence, smart systems, and digital innovations, and align these advancements with sustainable practices and measurable societal outcomes.

International conference on the theme **Sustainability and Futuristic Technology, conducted by Marathwada Mitramandal's College of Engineering (MMCOE), Pune**, reflects the very spirit of bringing together academicians, researchers, industry experts, and students to exchange ideas that are innovative, impactful, and outcome-oriented. It is through such platforms that we nurture responsible technocrats who contribute meaningfully to a sustainable and progressive future.
Since its inception in the year 2006, MMCOE in-sink with the distinctive mission of "**Welfare of the Masses**" ensures to make education accessible to the students from all backgrounds and classes. With these sacred intentions we draw on an unwavering drive toward excellence, a spirit of innovation and above all a culture of collaboration.

I commend the organizers for their vision and dedicated efforts in creating this enriching academic forum. I extend my best wishes to all participants for insightful discussions and fruitful outcomes.

Let us continue to innovate with purpose, guided by outcomes that truly benefit the society at large. and the environment.

Message

Hon. Prin. B. G. Jadhav
Executive President,
Marathwada Mitra Mandal, Pune

In an era marked by rapid technological advancements and pressing global challenges, the need to align innovation with sustainability has never been more critical. As we stand at the crossroads of transformation, it is imperative that technological progress not only accelerates growth but also safeguards the environment, promotes inclusivity, and ensures long-term resilience for future generations.

At the outset I extend my warm greetings to all the delegates, researchers, academicians, industry experts, and students participating in the **IEEE International Conference on Sustainable and Futuristic Technologies 2026 organized by Marathwada Mitramandal's College of Engineering (MMCOE), Pune**.

Since its inception in the year 2006, MMCOE has been recognized as the place **Where Innovation Meets Excellence in Service of Society** with the sole motto of '**Welfare of the Masses'**. True progress lies not merely in innovation, but in purposeful innovation. As we envision the future, it is vital to adopt a holistic approach that balances technological growth with ecological preservation and social -being.

This conference serves as a catalyst for transformative thinking and a dynamic platform to foster dialogue, exchange ideas, and explore cutting-edge research that addresses the evolving needs of our society. I am confident that the deliberations and collaborations during this event will inspire innovative solutions and pave the way for a sustainable and technologically empowered future.

I commend the organizers for their dedicated efforts in bringing together such a diverse and distinguished gathering of minds from across the globe. Your commitment to academic excellence and societal progress is truly commendable.

I extend my best wishes for the success of the conference and hope that it proves to be intellectually enriching and professionally rewarding for all participants.

Let us collectively strive to shape a future where technology and sustainability go hand in hand for the welfare of humanity.

Message

Dr. Sachin Sakhare,
Principal,
Marathwada Mitra Mandal's College of Engineering, Pune

Welcome to Marathwada Mitramandal's College of Engineering, Pune, an autonomous institution with the highest grade 'A++' by NAAC, and a place where potential leads to opportunity and aspirations convert into achievements!

It is a matter of great pride and privilege to welcome all the esteemed delegates, researchers, academicians, industry professionals, and students to the IEEE International Conference on Sustainable and Futuristic Technologies 2026, organized by Marathwada Mitramandal's College of Engineering (MMCOE), Pune.

We, at MMCOE, strongly believe that the actual meaning of excellence is attained only when it uplifts the society, empowers the under-privileged and contributes to sustainable development. Since its inception in the year 2006, MMCOE has been recognized as the place - Where Innovation Meets Excellence in Service of Society with the sole motto of 'Welfare of the Masses'. Thus, through our state-of-the-art facilities, student and faculty led research initiatives and outreach programs we strive to create solutions that are driven technologically but are Socially responsible as well.

In today's rapidly evolving world, technology plays a pivotal role in shaping the future of humanity. However, the true measure of progress lies in our ability to innovate responsibly—ensuring that technological advancements are sustainable, inclusive, and aligned with the needs of society and the environment. This conference is a significant step in that direction, bringing together brilliant minds to deliberate on solutions that are not only futuristic but also sustainable. At MMCOE, with a strong inclination towards OBE (Outcome Based Education), we are committed to fostering a culture of research, innovation, and ethical responsibility among our students and faculty. Marathwada Mitramandal's Research Promotion Scheme, is one such initiative, encouraging faculty to undertake innovative and impactful research by providing financial incentives, seed funding and institutional support.

Platforms such as this conference provide invaluable opportunities for knowledge exchange, interdisciplinary collaboration, and the nurturing of ideas that can address real-world challenges.

My heartfelt gratitude to IEEE for providing this platform to our faculty, to showcase their knowledge, skills and capabilities.

I sincerely appreciate the efforts of the organizing committee for conceptualizing and executing this global event with such dedication and vision. I am confident that the discussions and outcomes of this conference will contribute meaningfully to the advancement of sustainable technologies and inspire participants to think beyond conventional boundaries.

I extend my heartfelt wishes for the grand success of the conference and hope that all participants find this experience enriching, engaging, and impactful.

Let us work together to create a future where innovation serves humanity while preserving the planet.

Message

Dr. Kalpana Thakre
Head, Department of Computer Engineering,
Marathwada Mitra Mandal College of Engineering,
Pune

It is truly a moment of pride and joy for me to welcome you all to the **IEEE International Conference on Sustainable And Futuristic Technologies (ICSFT), 2026 organized by Marathwada Mitra Mandal's College of Engineering, Pune**.

As someone deeply engaged with technology and the aspirations of young engineers, I often find myself reflecting on a simple yet powerful question—what kind of future are we building? Today, innovation cannot be viewed in isolation from sustainability. The technologies we design must not only be cutting-edge but also responsible, resource-efficient, and aligned with the well-being of our planet and society. And so, the seed of the title of this Conference was sown.

This conference provides a meaningful platform for researchers, academicians, industry experts, and students to come together, exchange ideas, and explore solutions that can shape a sustainable and technologically empowered future. I am confident that these discussions will spark collaborations and innovations that create lasting impact.

We, at this cross- road, are witnessing an exciting wave of futuristic technologies—Artificial Intelligence, Machine Learning, Internet of Things, Blockchain, Quantum Computing, and smart autonomous systems—reshaping the way we live and work. These advancements hold immense promise, but they also demand thoughtful integration with sustainable practices. The true challenge before us is to ensure that the future we create is not just advanced, but also balanced and inclusive.

In Computer Engineering, this convergence of sustainability and futuristic innovation is becoming central to our vision. From green computing and energy-efficient data systems to intelligent solutions for smart cities, climate monitoring, and resource optimization, we are moving toward technology that is both forward-looking and responsible.

I am sure this endeavour of ours will translate into actionable insights, innovative solutions, and meaningful collaborations to address real-world challenges and contribute significantly to a sustainable and technologically advanced future.

It is indeed an honour, and I gratefully acknowledge IEEE for their esteemed support and valued association for providing this opportunity to MMCOE, Pune, which has significantly enhanced the academic rigor, Global outreach, and overall excellence of this conference.

I sincerely appreciate the dedicated efforts of the organizing team in bringing this important initiative to life. I extend my best wishes to all participants for insightful deliberations and a rewarding experience.

Let us move ahead with a shared commitment—to innovate not just for the future, but for a future that sustains.

Message

Prof. Dr. Carl James Debono
Dean ICT, University of Malta

It is both a privilege and a profound honour, in my capacity as Dean of the Faculty of Information and Communication Technology, to welcome you to the IEEE International Conference on Sustainable and Futuristic Technologies 2026 organized by Marathwada Mitramandal's College of Engineering (MMCOE), Pune.

We gather at a pivotal moment in human progress—where the frontiers of innovation intersect with the imperatives of sustainability. The technologies we envision, design, and deploy today will indelibly shape the environmental, economic, and social fabric of tomorrow. This conference stands as a testament to our shared commitment to advancing knowledge while safeguarding the future of our planet.

International conferences of this nature and stature are important platforms for Researchers, Academicians, Industry Professionals, Collaborators and above all the student fraternity to come together and exchange ideas on emerging technologies, that will shape the future of society. This conference will play a significant role in providing innovative pathways to tap the ground-breaking mindsets of the budding engineers, working in collaboration with their mentors for providing a plethora of interdisciplinary research options aiming at addressing global, technological and sustainable solutions. I am confident that the exchange of insights and the spirit of inquiry cultivated here will catalyze impactful research and enduring partnerships.

I commend the organizers for curating a program of exceptional depth and relevance, and I extend my sincere gratitude to all the participants, whose contributions elevate the discourse to global significance.
May this conference not only broaden perspectives but also ignite innovations that guide technological advancement with sustainable development.

With my best wishes for a truly enlightening and successful conference.

Keynote Speaker

Prof. Dr. Carl James Debono
Dean ICT, University of Malta

Bio: Prof. Carl James Debono, obtained his B.Eng.(Hons.) degree in Electrical Engineering from the University of Malta, Malta in 1997 and Ph.D. degree in Electronics and Computer Engineering from the University of Pavia, Italy in 2001.

In 1997 he was employed as a Research Engineer with the Department of Microelectronics at the University of Malta. In 2001 he was appointed Lecturer in Communications and Computer Engineering at the University of Malta and was promoted to Senior Lecturer in 2006, to Associate Professor in 2011 and to Professor in 2017. Prof. Debono has served as Deputy Dean of the Faculty of ICT between November 2009 and September 2015. He also served as Head of the Department of Communications and Computer Engineering between October 2015 and September 2019. He is currently the Dean of the Faculty of ICT.

Prof. Debono has participated in a number of local and European research projects in the area of communication systems and image/video processing. His research interests are in Resilient Multimedia Transmission, Multi-view Video Coding, and Computer Vision.

Keynote Speaker

Yohannes Kurniawan
Information Systems Department, School of Information Systems,
Bina Nusantara University, Jakarta, Indonesia, 11480

Title: Human-Centered AI Integration for Sustainable Development: Bridging Innovation, Ethics, and Societal Impact

Abstract: The blistering development of the Artificial Intelligence (AI) has offered unprecedented possibilities to speed up the accomplishment of sustainable development objectives in economic, social, and environmental aspects. Nonetheless, the implementation of AI into the systems of society needs not only the technological preparedness but also a human-centered, ethical, and context-conscious solution. This keynote discusses the potential of AI to be strategically involved in the support of sustainable development, especially in developing economies. It underscores the importance of AI in improving decision-making, resource optimization, access to improved services, and data-guided governance. Meanwhile, it critically analyzes the main obstacles like data bias, model transparency, digital inequality, and ethical risks that can impede inclusive development. Based on interdisciplinary approaches to information systems, data intelligence and digital transformation, this talk suggests a framework of Human-Centered AI Integration with three pillars: (1) responsible AI governance, (2) local ecosystems adaptation, and (3) human capabilities being empowered by technology. The session wraps up by providing strategic recommendations to academia, industry, and policymakers to unite around AI as not a means of innovation, but a driver of sustainable and just change to society.

Bio: Yohannes Kurniawan is a full professor and researcher in the field of Management Information Systems and Human Computer Interaction at BINUS University, Indonesia. His expertise lies in Artificial Intelligence applications, digital transformation, and the strategic use of analytics for organizational and societal impact. He has been actively involved in interdisciplinary research projects focusing on AI adoption, user experience research, and data-driven decision-making for business, particularly within the context of developing countries. His work also explores the intersection of technology, ethics, and human-centered design, aiming to ensure that digital innovation contributes meaningfully to sustainable development. In addition to his academic role, Yohannes contributes to curriculum development, international collaborations, and conference engagements, with a focus on bridging theory and practice. His recent initiatives include research on AI integration in healthcare systems, student engagement through technology-driven innovation, and policy-oriented discussions on responsible AI use in higher education and society.

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ICSFT2026 Programme Schedule

Track No: 1	Track Name: Computational Technologies			
Day 1	24th April 2026 | Session 1 | 12.30pm-1:30pm			
Venue	IMERT Hall			
Session Chair:	Mr. Sankalp Taralekar (Offline)			
Session Co-Chair:	Dr. Anita Shinde			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	185	Collision Avoidance in Low Earth Orbit: Review	Krishnat N Molawade	Offline
2	477	AI-Resistant Image Based CAPTCHA Generation using Diffusion Models	Tanmay Deshpande	Offline
3	742	Vakya: An Intelligent Framework for Automated Research Synthesis and Conference Recommendation	Varad Kulkarni	Offline
4	1081	A Systematic Review of Explainable AI Methods in Financial Decision-Making and Compliance-Driven Applications	Ms. Manisha Vishnu Kakde	Offline
Lunch Break(1:30 pm- 2:30 pm)				
Day 1	24th April 2026 | Session 2| 2.30pm-4:30pm			
Session Chair:	Mr. Sankalp Taralekar (Offline), Dr. Shiva Kumar Madishetty (Online)			
Session Co-Chair:	Dr. Geetha Chillarge, Dr. Neha Jain			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	458	Machine Learning Analysis of Alignment Entropy in Handwriting for Cognitive Flexibility Assessment	Rituja Jagannath Malode	Offline
2	587	Forecasting Tidal Dynamics and Energy Potential in Data-Scarce Coastal Regions Using Deep Learning and ERA5 Reanalysis	Chandan Bhirud	Offline
3	206	Water optimization technique for precision irrigation system using IoT and machine learning	Anand Digambarrao Kadam	Offline
4	1099	Transforming Drug Discovery and Development: The Synergistic Role of AI, Machine Learning, and Deep Learning	Tejas Mankeshwar	Offline
5	897	A Basic Implemetation of Deep Learning-Based Object Detection for Museum Artifacts	Simantinee Kulkarni	Offline
6	1160	Multiclass Vehicle Detection On Indian Road Traffic Using YOLOv8	Adarsh Kasliwal	Offline
7	1092	A Distributed Framework for Cross-Device OS Automation using Multi-Agent Systems	Lavesh Akhadkar	Offline

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8	530	AI-Driven Career Pathway Identification Using Multidimensional Skill and Interest Analysis	Arnav Sirse	Online
9	797	Automated Grading System Using LLMs	Aparna Nimishakavi	Online

Track No: 1	**Track Name: Computional Technologies**
Day 2	**25th April 2026 | Session 1 | 9.30am-1:30pm**
Venue	**IMERT Hall**
Session Chair:	**Dr. Sandhya Arora (Offline), Dr. Deepak Kumar Jain (Online)**
Session Co-Chair:	**Dr. Anita Shinde**

Sr No.	Paper_ID	Title	Author	Mode of Conduction
1	651	Deep-Radiomics Fusion Framework for Automated Multiple Sclerosis Classification using MRI Images	Gandhamueni Sathvik	Online
2	802	BrailleCraft – Crafting Braille Transcripts from Gestures in Real Time	Daksh Jadhav	Online
3	561	AI-Powered Public Safety Monitoring System Using Street Surveillance Cameras	Muthaiah Gokul M	Online
4	399	Hybrid Resnet-BiGRU Architecture For Intelligent Survillance Systems' Real-Time Robbery Detection	Gandhamuneni Sathvik	Online
5	610	Mapping AI-Driven Advances in Colon Cancer Identification A Deep Learning Study Using Histopathological Images	Mamidala Sruthi	Online
6	555	News Under the Lens of Time: Causal Signals and Concept Drift on a Language Manifold	Riya Kansal	Online
7	259	Artificial Intelligence Based Mock Interview Platform on Behavioral, Speech, and Technical Performance Evaluation	Yejarla Nanda Kumar	Online
8	803	IntelliGraph: A Knowledge Graph and Sentiment Retrieval System for Unstructured Document Intelligence	Mohit Garg	Online
9	686	ResNet for Cataract Detection and Classification: A Deep Learning approach	Mahavir Shantnath Kasar	Online
Lunch Break(1:30 pm- 2:30 pm)				

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Day 2	25th April 2026 | Session 2 | 2.30pm-4:30pm
Session Chair:	Dr. Poonam Railkar (Offline), Mr. Selvaraj Durairaj(Online)
Session Co-Chair:	Dr. Yogesh Deshpande, Dr. Shailaja Jadhav

Sr No	Paper_ID	Title	Author	Mode of Conduction
1	624	Meta-Learning Paradigms for Data-Efficient Classification: A Unified Framework with Adaptive Prototype Refinement	Ganesh Vitthal Kadam	Online
2	254	Advances in One-Shot and Few-Shot Learning: Bridging Theory and Practice Through Meta-Learning	Ganesh Vitthal Kadam	Online
3	283	AI-Based Hybrid Model Integrating Cnn And Dense Networks For Leaf Disease Diagnosis And Preventive Recommendations	Logeshwaran S	Online
4	600	An Integrated Deep Learning Framework for Medical Image Analysis: Synergizing Multi-Task Learning, Feature Transfer, and Deep Supervision	Palash Hemade	Online
5	544	IoBot-AI Powered Interview Preparation Platform for SSB Aspirant	Bhushan Mane, Vedant Mukhekar, Divyansh Mohta, Anuradha Yenkikar, Pranjal Pandit	Online
6	980	Adaptive Cloud Defense through Honey-Vault: A Multi-Layer AI Framework for Intrusion Detection, Deception, and Self-Healing	Jayasree.P	Online
7	226	Smart medical appointment system with no show prediction	Miruthula D	Online
8	299	Epidemiological Trends in Nutrition, Physical Activity, and Obesity: A Behavioral Risk Factor Surveillance System Analysis	Muvva Sai Bharath	Online

Track No: 1	Track Name: Computional Technologies
Day 1	24th April 2026 | Session 1 | 12.30pm-1:30pm
Venue	MB 405
Session Chair:	Dr. Vahida Attar
Session Co-Chair:	Dr. Bharati P. Vasgi

Sr No.	Paper_ID	Title	Author	Mode of Conduction
1	461	A Web based Crowdsourcing System for Polarity Analysis in Marathi Sports News	Pallavi Vitthalrao Kulkarni	Offline

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2	343	Deep Learning Architectures for Ophthalmic Diagnosis: Evaluating CNN, VGG16, ResNet50, and Inception V3 in Myopia Detection	Yogita D. Patil	Offline
3	732	Extending Six Sigma for AI Automation Across Global Industries	Rajvardhan Umesh Tekawade	Offline
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Day 1	**24th April 2026 | Session 2 | 2.30pm-4:30pm**			
Session Chair:	**Dr. Vahida Attar**			
Session Co-Chair:	**Dr. Bharati P. Vasgi**			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	754	Autoencoder-Based Transfer Learning for Multi-Stage Keratoconus Classification Using Corneal Biomechanical Parameters	Shalini Rajendra Bakal	Offline
2	590	IoT and Machine Learning - Based Smart Controller for Non-Smart Air Conditioners	Shubhangi Mathe	Offline
3	540	Assessing the Reliability of DIY Tutorial Videos: A Multimodal Approach Combining Procedural Structure and Audience Feedback	Aditya Sahu	Offline
4	133	Centralized Monitoring System Using Computer Vision Smart Infrastructure	Dr. Pragati M Fatinge	Online
5	125	On-Site Safety Feature Detection System Using Monitored Computer Vision	Aditya Baisware	Online
6	522	Neuro-Symbolic ProofOps: An LLM Copilot That Explains and Repairs Formal Models in the Loop	Tushar Shrivastava	Online
7	419	A Review on Recent Advances and Emerging Trends in Human Camouflaged Detection	Atharva Velhankar	Online
8	813	Video Forgery Detection: Enhancing Deep Learning with Slantlet Transformation	Krittika	Online

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Track No: 1	**Track Name:Computional Technologies**
Day 2	**25th April 2026 | Session 1 | 9.30am-1:30pm**
Venue	**MB 405**
Session Chair:	**Dr. Preeti Patil**
Session Co-Chair:	**Dr. Vikas Kadam**

Sr No.	Paper_ID	Title	Author	Mode of Conduction
1	157	SmartMed: A Secure and Personalized Healthcare Assistant Using LLMs and Decentralized Storage	Dr. Gauri Kalnoor	Online
2	459	Cross Dataset Generalization of a Hybrid Transformer Evaluator for Human Aligned Chess Move Prediction	Shreyas Kiran Durge	Online
3	357	A Machine Learning Based Model for Forecasting Hepatic Disorders	Manbir Kaur	Online
4	294	AI-Driven Placement Preparation Platform Using Peer-Shared Experiences and Personalized Roadmaps	Meet Oza	Online
5	843	Deep Learning-Based Currency Recognition for Smart Wallet Applications	Mr.Vilas D Ghonge	Offline
6	261	Feature-Centric Telemedicine NLP: A Survey of Datasets, Representations, and Selection Methods for Virtual Care	Madhuri Rajendra Zawar	Online
7	766	A Survey of Modern Transport Protocols for a Low-Latency, Bandwidth-Adaptive Virtual Classroom Architecture	Pranav Bhosale, Anvay Kulkarni, Vikas Kolekar, Gaurav Kaushalye, Jay Rajankar	Online
8	306	Comparative Evaluation of Machine Learning, Ensemble, and Deep Learning Models for Depression Detection Using Socio-Demographic and Behavioral Data	Chinnabathuni Mary Pavithra	Online
9	79	Trusted and Explainable Federated Reinforcement Learning with Human Fedarated Feedback for Privacy-Preserving Edge enabled Cyber Physical Systems	Sanjana MS	Online
10	789	Multilingual Phishing Analysis Feature Based Scoring and Level Classification	Dhvani Shah	Online

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Lunch Break(1:30 pm- 2:30 pm)				
Day 2	**25th April 2026 | Session 2| 2.30pm-4:30pm**			
Session Chair:	**Dr. Sangita Jaybhaye**			
Session Co-Chair:	**Dr.Prakash Gadekar**			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
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2	682	Spiral Drawing Analysis for Early Parkinson's Detection Using Image Processing and SVM Classification	Chakali Teja nagendra Prasad	Online
3	304	Deep Learning Techniques for Pancreatic Cancer Analysis: A Comprehensive Review of Imaging-Based Approaches	Shubham Nagare, Rohit Arwat, Omkar Kadam, Atharav Aher	Online
4	987	Post-Quantum Cryptography Models for Securing Multi-Cloud Environments	A. Shiny	Online
5	534	Heart, Liver, Lungs, Diabetes and Kidney Disease Prediction using Machine Learning and Voting Ensemble Technique	Ramdas Pandurang Bagawade	Online

Track No: 1	**Track Name: Computational Technologies**			
Day 1	**24th April 2026 | Session 1 | 12.30pm-1:30pm**			
Venue	**MB 509**			
Session Chair:	**Dr. Jaya Dewan**			
Session Co-Chair:	**Dr. Dhanraj Dhotre**			
Sr no	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	388	Real Time Driver Drowsiness Detection and Alert System Based on Time of Travel	Ashirwad Pathak	Offline
2	327	Lamarr-Turing Graphs: Integrating Spread-Spectrum Principles and Intelligent Adaptivity for Next-Generation Secure Networks	Atharva Khambete	Offline
3	525	A Systematic Review of Multimodal AI and Explainable Deep Learning Techniques for Autism Spectrum Disorder Detection	Siddhi Vanshiv	Offline

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Lunch Break(1:30 pm- 2:30 pm)				
Day 1	**24th April 2026 | Session 2| 2.30pm-4:30pm**			
Session Chair:	**Dr. Jaya Dewan**			
Session Co-Chair:	**Dr. Sinu Nambiar**			
Sr no	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	625	Quantum-Enhanced MFO Optimization for Load Frequency Control	Hussain Shaik	Online
2	462	AI + IoT-Based Portable Intruder Detection System with GPS Tracking and Real-Time Telegram Alerts	B Sharmilaa	Online
3	857	Enhanced Glioma Brain Tumor Detection Using a Fusion of LSTM and Bi-LSTM Neural Networks	Ignatius Savari raj A	Online
4	879	Graph - Enhanced Multimodal Deep Learning for Sentiment Recognition - A transformer GNN Hybrid Architecture for Mental Health Analysis	Jagriti Bhatia	Online
5	535	An EfficientNet-B2 Powered Deep Learning Model for Potato Leaf Disease Identification	Ashutosh Kumar	Online
6	769	Hybrid Wavelet-CNN Residual Learning Model for Robust Image Denoising in Complex Environments	Satrughan Kumar	Online
7	232	VedaBind-Drug–Protein Binding Affinity Prediction using Deep Learning	Harshal Santosh Gavali	Online
8	491	Evaluating Machine Learning Models for Sentiment Analysis in Marathi–English Code-Mixed and Script-Mixed Text	Madhuri Kumbhar	Online

Track No: 1	**Track Name: Computational Technologies**			
Day 2	**25th April 2026 | Session 1 | 9.30am-1:30pm**			
Venue	**MB 509**			
Session Chair:	**Dr. Manjusha Tatiya**			
Session Co-Chair:	**Mrs. Swati Jakkan**			
Sr no	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**

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1	749	Statistical Quality Analysis using Regression and ANOVA (SQA-RA Framework) for Data-Driven Process Optimization	Aditya Sonone	Online
2	782	Next Generation AI for Geo-science Remote Sensing: Applications, Challenges and Future Directions	Babita Verma	Online
3	790	HS Code and Description Analyzer with RAG	Shreyas Shripad Mulavekar	Online
4	521	Graph-Aware Planning: A Data-Centric Benchmark for Efficient Decision Search	Tushar Shrivastava	Online
5	143	FaceMaskify: A Deep Learning Approach to Face Mask Classification	Battineni Arun	Online
6	429	Secure Health Care System Using Block Chain Technology	Cherukuri Sandhya Rani	Online
7	619	A Comprehensive Analysis of Medical Data Revealing New Insights into Cardiovascular Disease	Mrs. Aparna Lahane	Online
8	1128	Hybrid Deep Learning with Metaheuristic Siberian Tiger Carpet Weaver Optimization for Cotton Leaf Disease Severity Level Prediction	Vasanth Kumar Reddy G	Online
9	1122	Reconfigurable Intelligent Surfaces for Next-Gen Wireless Communication	Saiprasanna sadula	Online
Lunch Break(1:30 pm- 2:30 pm)				
Day 2	**25th April 2026 | Session 2 | 2.30pm-4:30pm**			
Session Chair:	**Dr. Vina Lomte**			
Session Co-Chair:	**Mr. Kalpna Saharan**			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	952	Multilingual Speech to Text Recognition System	Akshara Rakhe	Online
2	1069	SmartEyeX: OCT and Fundus-Based Deep Learning System for Multi-Level Eye Disease Diagnosis and Analysis	Senthil Pandi S	Online
3	1005	Servify: An Innovative Multi-Domain Service Platform	Bolnidi Manikanta	Online
4	992	Enhanced Network Attack Detection Using a TCN–BiLSTM–Transformer Framework	Anji Reddy Duggempudi	Online
5	523	Scheduling Out Heisenbugs: Azure-Native Systematic Testing for Storage and Fabric Services	Tushar Shrivastava	Online

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Track No : 2	Track Name: Electrical & Electronics Technologies
Day 1	24th April 2026 | Session 1 | 12.30pm-1:30pm
Venue	MB309
Session Chair:	Dr. Sheetal Bhandari
Session Co-Chair:	Dr.Anjali Bhatlawande

Sr No.	Paper_ID	Title	Author	Mode of Conduction
1	659	AI/ML based Health Detection of a Transformer	Abhishek Pawar	Offline
2	94	Joint Image Compression and Encryption using BinDCT	R. Amutha	Offline
3	745	SMARTSTEP: IoT-Enabled Piezoelectric Footpath Tile for Sustainable Micro-Energy Harvesting and Real-Time Analytics	Shrivardhan Gajanan Patil	Offline
4	669	Smart Renewable Energy System with Over-The-Air (OTA) Update	Rushikesh Pandurang Kharat	Offline
Lunch Break(1:30 pm- 2:30 pm)				
Day 1		24th April 2026 | Session 2 | 2.30pm-4:30pm		
Session Chair:		Dr. Sheetal Bhandari		
Session Co-Chair:		Dr.Anjali Bhatlawande, Dr.Archana Kanwad		
Sr No.	Paper_ID	Title	Author	Mode of Conduction
1	348	FPGA implementation of Image Processing operations using verilog HDL	Sanika Dhobale	Offline
2	1100	A Review of Multi-Functional Wire Health Sensor for Insulation Resistance, Leakage Current and Temperature Monitoring Real-Time Wireless Connectivity.	Rushikesh Ashok Kamble	Offline
3	1196	PLC Controlled Emergency Evacuation and Dynamic Exit System	Harshada Kale	Offline
4	586	Optimization of Fan Speed Using Smart Temperature Technique	Mahammadakaif Idris Khan	Offline
5	660	RideSafeX: A Smart Helmet System with Embedded IoT and Mobile Connectivity	Anagha Kokate	Offline
6	1297	Design and Development of a Regenerative Suspension System for Passenger Vehicles	Rahul Anil Sonwalkar	Offline

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7	1045	Smart Pothole: Detection and Location Reporting System Using STM32	Krishna Dugad	Offline
8	1226	Climate-Aware Crop Recommendation System Using Hybrid Machine Learning Models	C B Selva Lakshmi	Online
9	403	A Comprehensive Review of Deep Learning–Driven Vision Techniques for Advanced Driver Assistance Systems	Suvarna Phule, Shaikh Uzma, Shaikh Mudassar, Aman Ibushe	online
10	276	LoRa Based Affordable Wireless Weather Station	Dr. Aravinda K.	Online
11	502	Alera-Smart Fall Detection System	Parin Vanjari	Online

Track No : 2	**Track Name: Electrical & Electronics Technologies**
Day 2	**25th April 2026 | Session 1 | 9.30am-1:30pm**
Venue	**MB309**
Session Chair:	**Dr. Mangesh S. Thakare**
Session Co-Chair:	**Dr. Mrunal A. Deshpande**

Sr. No.	Paper_ID	Title	Author	Mode of Conduction
1	1249	Communication Control for Battery and Charger Using CAN Bus	Shreyash Bandawar, Mrinmayi Mirajkar, Madhura More, Dr. J.M.Bakliwal	Offline
2	805	Green-Ink: Vehicle Emission Into Usable Ink conversion	Pushkar Thakare	Offline
3	718	FPGA Accelerated AI system for Multi Organ Medical Image Segmentation	Mr. Rushikesh Vijay Chaukate	Offline
4	428	Hysteresis Controlled Modified Interleaved SEPIC Converter for Electric Vehicles	N R ANAND	Online
5	842	Battery Management System	Dhruvi Indani	Online
6	390	Smart Helmet for mining industry	Gaurav Ganesh Kulkarni	Online
7	379	A Sensor Fusion Approach to Attendance Validation: The IRFID Infrared–RFID Framework	Sanket Pande	Online
8	195	Boundary value-controlled fuel cell based QBC fed EZSI for an induction motordrive	Krishnan Selvaraj	Online

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9	288	Closed Loop Controlled PV fed Cock Croft Walton Converter System	Krishnan Selvaraj	Online
10	335	Closed Loop Controlled Piezo Electric Energy Harvesting System	Krishnan Selvaraj	Online
11	198	Design And implementation of Primitive battery management system for electric Vehicles	Sireesha Pendem	Online
Lunch Break(1:30 pm- 2:30 pm)				
Day 2	**25th April 2026 | Session 2 | 2.30pm-4:30pm**			
Session Chair:	**Dr. Shankar D. Chavan**			
Session Co-Chair:	**Dr. Mrunal A. Deshpande**			
Sr. No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	538	Smart Trolley Using Gesture-Controlled Robotic System	Rohan Raju	Online
2	1204	Design of an Integrated Model for Validation Driven Control and Certification of Hybrid AC-DC Microgrids	Atul S. Dahane	Online
3	844	AI–IoT Based Adaptive Smart Street Light System	Ankur Shrikrishna Chopde	online
4	753	Weapon Detection Method Using Convolutional Neural Network with Human Pose Estimation	Avdhut Suhas Dani	Online
5	1290	Idle Virtual Machine Management in Cloud Computing: A Bibliometric Survey	Ashlesha Sawant	Online
6	1012	Smart Voting Machine Using Biometric Authentication to Enhance Security in the Voting System	Prathmesh Krishna Devkar	Online
7	551	Hysteresis Controlled LLC Resonant Converter Based Battery Charger	Mohanakrishnan C	Online
8	315	SafeRoute: a crowdsourced Machine Learning framework for safe Urban navigation Survey Report	Nishant Pradip Kumbhar	Online
9	520	PV-Fed Synchronously Rectified Soft-Switching Bidirectional Modified SEPIC for Battery Charging	Vijayram S	Online

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Track No. : 3	**TrackName: Next Generation Technology in Mechanical Engineering**			
Day 1	**24th April 2026 | Session 1 | 12.30pm-1:30pm**			
Venue	**MB213**			
Session Chair:	**Dr. Swapnil Vyavhare**			
Session Co-Chair:	**Dr. Rajendra Todkar**			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	850	Aqua-Ammonia Vapour Absorption Refrigeration System: Simulation and Optimisation using DWSIM Software	Hemant Chandrahar Pisal	Offline
2	801	Smart Inspection and Force Analysis of Car Air Conditioning Vent Louvers Using A Linear Actuator, Sensors and Vision-Based Systems	Arpit Mitesh Baviskar	Offline
3	1296	Arduino-based Automatic Pet Feeder for Efficient and Sustainable Feeding.	Shatakshi Shiravale	Offline
Lunch Break(1:30 pm- 2:30 pm)				
Day 1	**24th April 2026 | Session 2 | 2.30pm-4:30pm**			
Session Chair:	**Dr. Swapnil Vyavhare**			
Session Co-Chair:	**Dr. Pradip Tamkhade**			
Sr. No	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	532	Experimental Evaluation of Mechanical Properties of Jute–Epoxy Composites Enhanced through Intra-Ply Glass Fiber Hybridization	Rahul Uttamrao Patil	Offline
2	648	Zero Trust Security: A Novel Cybersecurity Paradigm for Enterprises and Manufacturing	Raj Shyam Mahajan	Offline
3	613	Prediction of Wear Characteristics of Nano- Oil using Neural Network Approach	Abhijeet Shivaji Suryawanshi	Offline
4	970	CNC Turning: Machine Learning implementation in CNC turning parameters: A bibliometric and Thematic review	Mr. Dhanesh Manohar Pawar	Offline
5	1021	AI-Powered Multi-Agent System for Smart Manufacturing Automation : A Comprehensive Review	Siddhi Suresh Pawar	Offline

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Track No. : 3		Track Name: Next Generation Technology in Mechanical Engineering		
Day 2		25th April 2026 | Session 1 | 09.30am-1:30pm		
Venue		MB213		
Session Chair:		Dr. Mrs. P. H. Selmokar		
Session Co-Chair:		Dr. Vijay Bhatkar		
Sr no	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	995	Design and Development of Modified Field Soldier Modular Operational (FSMO) for Defence purposes	Dr. Dilip S.Choudhari	Online
2	1027	A Comprehensive Review of Failure Analysis in Multidirectional Composite Laminates	Dr Pramod Ram Wadate	Online
3	1294	Field Data Based Mathematical Modelling in the Era of Artificial Intelligence: A Review with Emphasis on Sheet Metal Manufacturing	Mr. Sudarshan Dattatraya Martande	Online
4	1230	Sustainable Concrete Mix Design Using Bio-Waste materials and Metaheuristic Algorithms Optimization	Letcham K	Online
5	1272	AI-assisted Optimization of Shear-Dominant Aerospace Frame Structures using Surrogate Modeling	Stephen Paul J	Online
Lunch Break(1:30 pm- 2:30 pm)				
Track No : 2		**Track Name: Electrical & Electronics Technologies**		
Day 2		**25th April 2026 | Session 2 | 2.30pm-4:30pm**		
Session Chair:		**Dr.Vijaya Pawar**		
Session Co-Chair:		**Dr.Anjali Bhatlawande**		
Sr no	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	1227	Tomato Leaf Disease Detection using Hybrid Feature Extraction and CNN	Dr. G. Sandhya	Online
2	1016	Performance Analysis of Classical and Modern Cryptographic Algorithms: From Caesar to AES	Ajinkya Ghule	Online
3	891	Design of a 16-bit vedic risc processor integrated with high-speed prefix adder and mac unit	M.V Sruthi	Online

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4	1223	Smart Decision Support System for Crop Improvement Using Multi-Omics Data Analytics	Diwahar Pari	Online
5	337	Smart and Intelligent Materials for Sustainable and Adaptive Technologies	D. Sushma Kumari	Online
6	1096	FPGA Implementation and Performance Analysis of a Scalable Pipelined Vedic Multiplier	Pranavi Nikam, Apurva Rahate, Mayuresh Abhang, Prathamesh Tarale, Kaiwalya Wankhade	Online
7	1232	Smart Irrigation and Soil Management using AI and IoT-Integrated Sensor Networks	M. Kalpana	Online
8	1231	3D IC Design with Machine Learning-Based Thermal Optimization	S. Alagumuthukrishnan	Online
9	895	Implementation of Compact Approximate Multiplier	Suman Turpati	Online
10	1292	An Embedded Sensor-Based Head Motion Controlled Wheelchair with Real-Time Obstacle Detection	Nakul Santosh Thote	Online

Track No : 4	**Track Name: Management and Computer Applications**
Day 1	**24th April 2026 | Session 1 | 12.30pm-1:30pm**
Venue	**MB 511**
Session Chair:	**Dr. Chhaya Gosavi**
Session Co-Chair:	**Dr. Sarita Sapkal**

Sr no	Paper_ID	Title	Author	Mode of Conduction
1	300	Innovating HR Tech: A Comprehensive Evaluation of Chatbot-Assisted Diversity and Inclusion Initiatives in IT Recruitment	Aaradhana Rukadikar	Offline
2	537	StayEase : Digital Solution for Rent and Tenant Tracking	Yashwardhan Rajshekhar Manikshetty	Offline
3	569	ChatGPT in Classrooms: Tool or Threat? A Comprehensive Study of Student Perceptions	Dr.Vidya Gavekar	Offline
Lunch Break(1:30 pm- 2:30 pm)				

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Day 1	24th April 2026 | Session 2 | 2.30pm-4:30pm			
Session Chair:	Dr. Chhaya Gosavi			
Session Co-Chair:	Dr. Shailaja Jadhav			
Sr no	Paper_ID	Title	Author	Mode of Conduction
1	533	An AI-Powered Platform for Interview Simulation and Comprehensive Placement Preparation	Sandip Kalappa Awale	Offline
2	705	Krishimitra: A Vision for Predicting Agricultural Commodity Prices in India.	Aatish More	Offline
3	1161	Deepfake Video Detection Using CNN with GRU	Prasad Ganesh More	Offline
4	329	Emotion Aware Smart Learning system for Personlized Education using AI and Multimodal Emotion Detection	Saaraah Bharat	Online
5	938	An Explainable Machine Learning and Ensemble Stacking Approach Based Multiclass Intellectual Property (IP) Rights Violation Prediction Scheme	AL Shahriar Hossain	Online
6	924	Smart Telehealth and Remote Wellness System Using Machine Learning	Madhuruba R, Mahalakshmi G P, Mahalakshmi K	Online
7	1135	An Anger, Jealousy, Envy, and Hatred Emotion Prediction Scheme Using EAI and Hybrid Machine Learning Approach	Fatema Binte Hassan	Online
8	1129	Deepfake Detection Using Biometric Consistency and Visual Feature Fusion	Yash Tayade, Nisha Shinde, Rutuja Deshmukh, Samiksha Lade, Vikas Kolekar and Yogesh Sharma	Online

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Track No : 4	**Track Name: Management and Computer Applications**
Day 2	**25th April 2026 | Session 1 | 9.30am-1:30pm**
Venue	**MB 511**
Session Chair:	**Dr. Sharmila Wagh**
Session Co-Chair:	**Dr. Swati Shekapure/ Dr. Smita Chaudhari**

Sr no	Paper_ID	Title	Author	Mode of Conduction
1	443	Analysing Deep Neural Network Models and Methods for Image Synthesis	Mrs. Sonal Sachin Fatangare	Online
2	394	Exploring Wireless Communication Protocols for Embedded Systems: Performance, Challenges, and Future Directions	Jaya sri Mateti	Online
3	325	Student Certificate Validation Using Blockchain Technology	Akanksha Chhaburao Kudale	Online
4	846	Predictive Risk Analytics in Housing Finance: An Empirical Study Across Multiple Banking Sectors	Dr. Venkaiah Babu Prathipati	Online
5	518	A Chat-Based System for Identifying Alexithymia	Dr.Jane Rubel Angelina, E.Sai Pradeep, K.Guru Vardhan Reddy, D.Jithendra Reddy, J.Naveen Kumar Reddy	Online
6	860	AI + IoT-Based Aircraft Cabin Safety Monitoring System with Emergency Response Assistant	B Sharmilaa	Online
7	450	Real-Time Road Pothole Detection System Using YOLOv8 to Detect Road Anomalies	Manavaditya Rathawa	Online
8	531	From Financial Reporting to Strategic Taxation: Investigating Auditing Ethics and Governance for Profit Stability in Emerging Economies	Nilesh P. Sable	Online
Lunch Break(1:30 pm- 2:30 pm)				

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Day 2	25th April 2026 | Session 2 | 2.30pm-4:30pm
Session Chair:	Dr. Sandip Pande
Session Co-Chair:	Dr.Sarita Sapkal

Sr no	Paper_ID	Title	Author	Mode of Conduction
1	260	A Rule-Based NLP Approach for Automated Legal Document Generation: Design, Implementation, and Evaluation	Hanumanagutti Venkata Nikhil	Online
2	1103	Explainable Hybrid Ensemble Model for Multi-Dimensional Employee Outcome Prediction in HR Systems	Harshitha G	Online
3	667	Predictive Hybrid Machine Learning Model for Evaluating Students' EFL Readiness and Academic Success	Dr. D Jayavelu	Online
4	1117	Machine Learning–XGBoost Prediction of Online Shopping Behavior in the Digital Economy	Shaik Ismail	Online
5	1118	Enhanced Heart Disease Classification Using Optimized Feature Selection and Advanced Stacking Ensemble Learning	pallapati Venkatesh	Online
6	934	Honeypot Detection Network for Enhanced Security against Cyber Attacks using AI Machine Learning	Prasad Raghunath Kotkar	Online

Track No : 5	Track Name: Engineering Sciences and Humanities
Day 1	24th April 2026 | Session 1 | 12.30pm-1:30pm
Venue	Syndicate Room
Session Chair:	Dr. Sarita Balshewar
Session Co-Chair:	Dr. Pravin K. Katare

Sr. No.	Paper_ID	Title	Author	Mode of Conduction
1	1217	Academic Assistant using Ai	Manish Rajkumar Mankar	Offline
2	1043	ZenithMind: Mental Health Assistant with CBT Integration	Parth Rajesh Chandurkar	Online
Lunch Break(1:30 pm- 2:30 pm)				

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Day 1	24th April 2026 | Session 2 | 2.30pm-4:30pm			
Session Chair:	Dr. Sarita Balshewar			
Session Co-Chair:	Dr. Tushar Gadekar			
Sr. No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	212	A Survey On Blockchain-Based Duplicate Healthcare Data Management Framework with Color-Coded Identification and Automated Merge Notifications	Rohit Ragade	Online
2	1224	Impact of Employee Engagement on Organizational Productivity in IT Sector	V. Lalitha	Online
3	1053	A Literature Review on Lung Cancer Detection and Classification with Optimal Feature Selection and ML/DL	J S Sowmiya	Online
4	874	Open-Graph Markets for Machine Intelligence: Tokenized Microtasks, Model APIs, and Distributed Training	Priyanka Muppuri	Online
5	381	Computer Vision and Gesture-Based Biofeedback: A Serious Gaming Approach for Hemiparesis Muscle Coordination	Jonnalagadda Nihit	Online
6	475	A Deep Learning and Multilingual Conversational System for Disease Detection in Guava and Dragon Fruit	Venkateswarlu Boppana	Online
7	395	Intelligent Urban Traffic Flow Optimization Using Dueling Double DQN Reinforcement Learning Enhanced by Fuzzy Reward Modulation	sakthiyavathi	Online

Track No : 5	Track Name: Engineering Sciences and Humanities			
Day 2	25th April 2026 | Session 1 | 9.30am-1:30pm			
Venue	Syndicate Room			
Session Chair:	Dr.Archana Kollu			
Session Co-Chair:	Dr. Mayuri Deshmukh			
Sr No.	**Paper_ID**	**Title**	**Author**	**Mode of Conduction**
1	902	Smart Agri-Monitoring system for soil fertility	Charudesna J J	Online
2	631	Precision and Sustainable Agriculture Using IoT-Integrated Framework	Parnika Suryakant Maskar	Online

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3	1077	From Automation to Autonomy: Evaluating the Role of AI-Driven Autonomous Agents in Cross-Functional Coordination and Real-Time Workflow Management	Shruthy Harita A R, Deepthi R, Sreevidya V M, Kavya R, Amit Verma	Online
4	1062	A Ensemble Learning and Explainable AI Based Multi-class Poultry Chicken Disease Classification Approach	Mohammed Mehedi Masum	Online
5	1075	Enhancing Synthetic Speech Detection Generality through Spectral Augmentation and Lightweight Convolutional Architectures	Harsh Varshney	Online
6	1150	A Vision-Driven Sign Gesture Interpretation Engine for Assistive Communication Using Random Forest	Yuvaraj B	Online
7	1148	PneuEffNet: A Powerful Deep Learning Architecture to detect pneumonia.	Shaik Jaynul Irshad	Online
Lunch Break(1:30 pm- 2:30 pm)				
Day 2	**25th April 2026 | Session 2 | 2.30pm-4:30pm**			
Session Chair:	**Dr. Subhash Rathod**			
Session Co-Chair:	**Dr. Alka S. Sawaikar**			

Sr no	Paper_ID	Title	Author	Mode of Conduction
1	1144	Deepfake Video Detection Using Quantum Neural Learning (QNN) and Vision Transformer Features	kanugulla srisailam	Online
2	1211	From Action Recognition to Standard Action Understanding - A modular vision language framework	Akash S A	Online
3	661	AI-Powered Smart Eco Advisor: Bridging Environmental Knowledge and User Decision Support	Karina Vitthal Rathod	Offline
4	1023	Malware classification and Detection using Deep Neural Network	Shree Devamankai B	Online
5	743	Sustainable Incorporation of Marble Waste Enhanced with Additives in Construction Materials: A Comprehensive Review with Machine Learning Insights	Dr. Veena Doss	Offline
6	1145	Block chain enabled self-sovereign identity management for credit card fraud detection using interference-tolerant fast convergence zeroing neural network	S.Dalton Griffin	Online

Abstracts

Paper ID: 79

Trusted and Explainable Federated Reinforcement Learning with Human Feedback for Privacy- Preserving Edge-Enabled Cyber-Physical Systems

Sanjana M S (R.M.K. Engineering College)*, Akshaya Swati R (R.M.K. Engineering College), Yuvashree M (R.M.K. Engineering College), Rekha A (R.M.K. Engineering College), P. Umaeswari (R.M.K. Engineering College)

Abstract: In the contemporary realm of fast-paced cyber-physical systems (CPS), it is necessary that the decision-making is done instantaneously, since one cannot determine when the edge is going to be required. In this case, to train distributed edge platforms better, a new system of integrating federated reinforcement learning (FRL) with explainable AI (XAI) and privacy-preserving functionalities, including the consideration of human input, is proposed. Federated updates and differential privacy are used to update agents uniformly in their policy, and embedded explainability enables actors to monitor and analyze the line of action in real life and position specific inferences and corrections. Learning in the system is aligned with the larger picture of life, and this is achieved through the integration of human participation in the learning process. The actual test of the smart grid control and self-regulating traffic is more uniquely flexible, transparent, and less susceptible to uncertainty. Minimally, the paper will take us into secure, consistent edge systems that we can learn on a continuous basis, but then we have to preserve data decentralization and need explainability.

Paper ID: 94

Joint Image Compression and Encryption using BinDCT

R.Amutha (Sri Sivasubramaniya Nadar College of Engineering, Chennai, India)*

Abstract: A secure image compression and encryption framework is implemented for images, combining efficient data reduction with strong protection. Compression is achieved by applying a Binary Discrete Cosine Transform (Binary DCT) in an 8×8 block-wise manner, preserving only the top-left 2×2 coefficients to retain essential visual information while significantly reducing data size. For encryption, a cosine-based chaotic map which generates a dynamic sequence is used to rearrange pixel positions (confusion) and alter pixel values through chained bitwise operations (diffusion). The visual quality of the reconstructed images is assessed using fidelity measures, while the encryption strength is evaluated by analyzing pixel differences, intensity variations, and the breakdown of pixel correlations. Scatter diagrams further illustrate the disruption of statistical dependencies between adjacent pixels, highlighting the system's capability to ensure both compression efficiency and data security for sensitive image applications

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Paper ID: 125

On-Site Safety Feature Detection System Using Monitored Computer Vision

Dr. Pragati Fatinge (G. H. Raisoni College of Engineering and Management, Nagpur, Maharashtra, India), Ishika Pawar (G. H. Raisoni College of Engineering and Management, Nagpur, Maharashtra, India)*, Aditya Baisware (G. H. Raisoni College of Engineering and Management, Nagpur, Maharashtra, India)*, Aman Zarariya (G. H. Raisoni College of Engineering and Management, Nagpur, Maharashtra, India), Dimple Gupta (G. H. Raisoni College of Engineeringand Management, Nagpur, Maharashtra, India), Gitendrasingh Desai (G. H. Raisoni College of Engineeringand Management, Nagpur, Maharashtra, India)

Abstract: The paper will suggest a real-time model to identify personal protective equipment (PPE) to improve the level of safety monitoring in the construction and industrial sectors. Precisely, we utilized deep learning YOLOv8 model to detect and estimate the presence of important PPE such as safety helmets, face masks, and safety vests, among others, on live video, without human intervention. When using this model, we constructed our own dataset to maximize its comfort in the field, when doing this our model took into consideration a variety of field effects, such as the change in illumination, occlusion, and the depth of the scene or background scene. Our strategy attained a mean average precision (mAP) of 0.81 between post-implementation of a series of optimization processes, which may represent very high accuracy and consistency among PPE categories. Accuracy of helmets, masks and vests were 0.85, 0.90 and 0.88 respectively. Such findings indicate that the model is capable of detecting safety compliance reliably when uninterrupted human observation is not required. It is real-time and hence it can respond in time minimizing incidences of violations that would go un-noticed on the ground. The framework is also more flexible to larger workplaces and can be extended further to track other safety equipment in further uses, which makes it a scalable solution to manageable industrial safety.

Paper ID: 133

Centralized Monitoring System Using Computer Vision Smart Infrastructure

Dr. Pragati Fatinge (G. H. RaiSoni College of Engg. and Mgmt. Nagpur), Kanchan Dhote (G. H. RaiSoni College of Engg. and Mgmt. Nagpur), Karan Churasia (G. H. RaiSoni College of Engg. and Mgmt. Nagpur)*, Aditya Dumbhare (G. H. RaiSoni College of Engg. and Mgmt. Nagpur), Saima Sheikh (G. H. RaiSoni College of Engg. and Mgmt. Nagpur), Komal Wagh (G. H. RaiSoni College of Engg. and Mgmt. Nagpur)"

Abstract: Crowd monitoring systems that are commonly used today are highly expensive to operate and also they don't provide accurate results. This is why we have created something simpler and smarter. In this work, we built a low-cost setup that uses both basic sensors and a camera to track people through sensors and cameras more accurately. The hardware part includes two InfraRed sensors with Arduino Nano that can tell whether someone is entering or leaving. Along with this, we are using a camera that runs a YOLOv8 model that detects and follows people in the video in real time through cameras like CCTV. When we tested our prototype at that time, both hardware and software parts worked smoothly together and gave very accurate results. By combining these two ways, the system becomes reliable, affordable, cost-effective and useful for managing the crowds in busy places like railway stations or bus stands, where public safety and real-time information are more important.

Paper ID: 143

FaceMaskify: A Deep Learning Approach to Face Mask Classification

Mothe Suneetha (Narasaraopeta Engineering College Narasaraopeta), Battineni Arun Kumar (Narasaraopeta Engineering College, Narasaraopeta)*, Kondaveety Venugopala Swamy (Narasaraopeta Engineering College Narasaraopeta), Yaragani Hemanth Raja (Narasaraopeta Engineering College Narasaraopeta) P. Gopala Krishna (GRIET, Hyderabad, Telangana, India), G. Nagababu (G. Narayanamma Institute of Technology Science (Women), Shaikpet, Hyderabad, Telangana, India), R. Sireesha Moturi (Narasaraopeta Engineering College (Autonomous), Narasaraopet, India)

Abstract: The present-day face mask detection is an important technology in the field of the global health, particularly after the recent world respiratory pandemics. This study uses the Face Mask Detection Data of Omkar Gurav, that is composed of thousands of labeled masked and unmasked images of faces in various settings. The model proposed and implemented is a deep learning convolutional neural network (CNN) model which has been trained and tested on this data, to detect mask compliance in real-time. The model is

extremely accurate in terms of identifying masked and unmasked faces and has shown great performance in terms of lighting conditions that are favorable and unfavorable, face orientation as well as background. Preprocessing of data were augmentation strategies that would enhance diversity in dataset and model resilience and transfer learning would be used to take advantage of the representational capacity of state- of-the-art networks. Competitive analysis versus the rest of the architectures shows how our model is competitive compared to the rest in both accuracy and efficiency. Its developed system is compatible with a smooth implementation of smart surveillance apps and edge devices and highlights the effectiveness of the system in promoting better human health and safety in the real environment.

Paper ID: 157

SmartMed: A Secure and Personalized Healthcare Assistant Using LLMs and Decentralized Storage

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Abstract: Handling and processing medical reports is essential to healthcare because analysis of patient details and test results is quite cumbersome and prone to error. Late or missed diagnoses and treatment, resulting from delayed diagnoses, can adversely affect patient outcomes. Medical data is also sensitive and is also a target for cyber-attacks; therefore, strong security is required. However, most current solutions rely on manual processes or basic automation, which is insufficient to accurately deal with complex data from a variety of reports. On top of that, they usually keep data in centralized systems, and as a result are susceptible to breaches. However, even though few platforms allow chatbot-led opinions in patients, they do not provide the integration of report analysis to customize care and treatment according to their needs. In the proposed work, these become automated using Large Language Models (LLM) which generate detailed diagnoses and prescriptions with the help of Low Rank Adaptation (LoRA). The intuitive chat bot interface allows for easy interaction with healthcare professionals and the patient and answering questions and guiding users through the process. All medical data are stored using blockchain and decentralised storage to ensure security. This creates a great way to achieve that and together allow the system to capture and process complex medical data in a way that will be accessible to healthcare professionals. The goal of this project is to save time and effort in preparing medical reports faster while also avoiding misdiagnosis and erroneous prescriptions. Patient engagement also is enhanced through the chatbot, making the whole experience personalized. The overall aim of the system is to ensure improvement in the delivery of health care through automation of routine work, provision of secure data as well as personalized health care.

Paper ID: 185

Collision Avoidance in Low Earth Orbit: A Review

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Abstract: Collision Avoidance (COLA) has long since stopped being a normal business practice and has become a matter of safety necessity because of the high growth in Low Earth Orbit (LEO) satellite constellations and the consequent accumulation of space debris [3], [17], [21]. The latest developments in the COLA methodologies will be discussed in this paper along with the traditional ground-based methods analysis and the learning-enabled frameworks. The five key technical areas that we talk about are probabilistic risk assessment, using robust screening techniques, deterministic and convex optimization techniques, aerodynamic modulation of drag

techniques, artificial potential fields and physics-informed guidance techniques, and methods based on learning, including supervised deep learning, Reinforcement Learning (RL), and Multi-Agent Reinforcement Learning (MARL) [1,2], [4,5], [17]. We assess these strategies by providing a relative survey of 30 recent papers in the period between 2020 and 2025 on 5 major dimensions of operations safety assurance, resource-efficiency, scalability to large constellations, real-time computational feasibility, and integration with existing ground control infrastructure. Combinations of a hybrid framework consisting of a RL-based trajectory optimization solution and formal safety guarantees, namely, Control Barrier Functions (CBF) can be regarded as the most balanced performance trade-off solution in these aspects as we can see [16], [28]. We have concluded with a list of ongoing research questions including how complex a large-scale multi-agent coordination problem is, whether it is possible to implement onboard learning and whether there are standardized verification processes of space-certified artificial intelligence systems. Based on these findings, we suggest that additional research should be conducted in the fields of developing hybrid MARL-CBF systems able to produce adaptive policies to be trained in practice and apply safety bounds that are provable.

Paper ID: 195

Boundary value-controlled fuel cell based QBC fed EZSI for an induction motor drive

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Abstract: This paper proposes a closed loop fuel cell-based Quadratic Boost Converter (QBC) fed Extended Z-Source Inverter with Induction Motor system (FC-QBC-EZSI-IMS) for pump operation that is controlled by Current Mode-BV (CM-BV). This study suggests using QBC in conjunction with an EZSI between the asynchronous motor system and the DC link source. This will lower the PV panel's initial cost as well as its voltage rating. Stator current spikes are lessened by EZSI. The goal of this research project is to control FC-QBC-EZSI-IMS speed. This project addresses the closed loop response of FC-QBC-EZSI-IMS in conjunction with CM-BV and CM-PI controllers. Using CM-PI and CM-BV controllers to control a QBC-EZSI with motor load, the performance investigations are examined, and a thorough comparison is provided. The MATLAB/Simulink outputs with the corresponding torque and speed characteristics in the time domain are shown. Compared to the CM-PI control, the CM-BV control is better. The suggested QBC-converter lowers the PV panel's voltage rating, and EZSI lessens motor current spikes. The article's innovation is the use of BV to improve FC-QBC-EZSI-IMS's dynamic reactivity. Using BV, the torque steady state inaccuracy is lowered to 0.27 N-m.

Paper ID: 198

Design And Implementation Of Primitive Battery Management System For Electric Vehicles

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Abstract: The rapid growth of Electric Vehicles (EVs) has intensified the demand for advanced Battery Management Systems (BMS) to ensure safe operation, high performance, and extended battery lifetime. Among the critical challenges, thermal management plays a pivotal role, as overheating significantly reduces battery lifespan and may trigger hazardous conditions such as thermal runaway. This work presents a microcontroller-based prototype for intelligent thermal management of EV batteries. The system integrates an Arduino Uno with a DS18B20 digital temperature sensor, a relay-controlled cooling fan, an LCD interface, and a GSM communication module for real-time alerts. When the battery temperature exceeds a predefined threshold, the controller autonomously activates the cooling

mechanism and simultaneously transmits an SMS notification to a registered mobile user. Experimental validation demonstrates that the proposed scheme provides reliable monitoring, efficient thermal regulation, and robust remote alerting capabilities. The approach offers a cost-effective and accessible solution to enhance EV battery safety, reliability, and service life, thereby supporting the broader adoption of electric mobility. Electric vehicles (EVs) are having a transformative impact on transportation, playing a critical role in reducing greenhouse gas emissions and dependence on fossil fuels. The performance, range, and lifespan of EVs are heavily dependent on the lithium-ion batteries that power them. Lithium-ion batteries perform optimally in moderate thermal conditions (often cited around 15 °C to 35 °C) and suffer under both high and low extremes. Elevated temperatures accelerate capacity fade, increase internal resistance, and in severe cases can trigger thermal runaway events, which pose serious safety hazards [1]–[3].

Paper ID: 206

Water optimization technique for precision irrigation system using IoT and machine learning

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Abstract: Due to growing water shortage and the necessity in sustainable farming, this study addresses a development of an integrated precision irrigation system based on Internet of Things (IoT) and machine learning (ML) technologies. Information such as temperature, humidity, precipitation, nutrient composition, etc., measured in real-time by several farm locations throughout Maharashtra, trained machine learning algorithms to forecast yield and irrigation requirements. The work carried out K-Nearest Neighbors and Gradient Boosting algorithms, their efficiency was measured by the R 2 score, RMSE, and Spearman correlation. Of the models, the best in terms of accuracy and resilience to manipulation was Gradient Boosting. The comparison of various sites with location variation and soil parameters indicated that there are vital trends that can be applied to optimize the use of water. The findings indicate that the combination of IoT and ML in smart farming systems is very effective in minimizing the wastage of water, maximizing plant yield, and making informed decisions using data in agriculture. The current solution can be used to scale and make efficient use of resources in the water-strained areas, and is ready to become the foundation of the intelligent farming infrastructure of the future.

Paper ID: 212

Cloud-Enabled Blockchain-Based Framework for Duplicate Healthcare Data Management with Color-Coded Identification and Automated Merge Notifications

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Abstract: Blockchain technology is frequently mentioned in healthcare because it securely locks away medical data, meaning nothing can be modified. This presents a significant challenge. The issue is this: If the user can't modify anything, duplicate and useless records can build up very quickly. user are using up storage, the system is slowing down, and doctors are experiencing contradictory data points that confuse their decision-making.Currently, the emphasis in blockchain implementations is on privacy and security—there is hardly any attention given to duplicate records. This study proposes a novel framework for managing duplicate healthcare records in blockchain systems., "the Duplicate Data Management Framework," which identifies both the unused and utilized records and automatically merges the duplicate records without violating core blockchain features. For the sake of simplicity, a simple color code identifies the duplicate records when merging data.Before any merge occurs, users can identify and view any duplicate records. When the merge is complete,

users will be notified, and freed space is available in the storage. The results of the testing give credible support to the honorability of an implementation like this as it reduces storage issues, no major speed reductions, the data remains secure, and data remains immutable. This is a method to manage healthcare data on the blockchain without resembling. blockchain systems are used to identify duplicate records by indicating whether they are Active or Inactive using colour coded ways (active “Green”; inactive are red”)

Paper ID: 226

Automated Stroke Detection from CT Images Using CNN-GA-LSTM with Grad-CAM Visualization

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Abstract: Stroke is one of leading causes of death and disability worldwide, necessitating early and accurate diagnosis. This paper presents a deep learning-based stroke identification system using CT brain images, incorporating Convolutional Neural Network (CNN) for automatic feature extraction, Genetic Algorithm (GA) for feature selection, and Long Short-Term Memory (LSTM) for classification. Gradient-weighted Class Activation Mapping (Grad-CAM) is integrated to provide the visual interpretability by highlighting stroke-affected regions in the brain scans. The model was trained and evaluated on labeled dataset, with CNN only achieving an accuracy of 89.2%. When combined with LSTM, accuracy increased to 93.4%, and the inclusion of GA further improved accuracy to 96.5%. Grad-CAM did not influence performance metrics but offered critical visual explanation to enhance clinical trust. The proposed model demonstrates high accuracy and interpretability, making it a reliable tool for automated stroke diagnosis in the medical applications.

Paper ID: 232

VedaBind-Drug-Protein Binding Affinity Prediction using Deep Learning

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Abstract: In the field of computer-aided drug discovery, Predicting drug–protein binding affinities is one of the core tasks to be completed using two main approaches: structure-based molecular docking and physics-based simulation techniques. However, these methods are limited by the need for high-quality 3-dimensional structures and also require a larger cost in terms of computational time. Recent advances in applying deep learning techniques have made it possible to build models based on the biological and chemical sequences of a drug to learn a meaningful representation of the sequence data used in building the model. In this paper, we describe the development of a deep learning model similar to the Deep-DTA architecture which applies the SMILES representation of the drug and protein FASTA sequence inputs to predict drug–protein binding affinity. We propose to extract features independently from the drug input and from the protein input using a dual branch convolutional neural network (CNN). The extracted features will then be fused together to produce a continuous affinity prediction. The model is evaluated based on common regression metrics, including mean squared error, root mean squared error, and coefficient of determination. The results show that the proposed model achieves high-quality predictive performance while remaining computationally efficient. We will also present a case study in which we will demonstrate how our model can be applied to carry out real-world inference and virtual screening during the early phases of drug discovery.

Paper ID: 254

Advances in One-Shot and Few-Shot Learning: Bridging Theory and Practice Through Meta-Learning

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Abstract: Traditional deep learning models require vast amounts of labeled data to achieve high performance, which limits their applicability in domains where data collection is expensive or impractical. One-shot and few-shot learning addresses this fundamental challenge by enabling models to learn new concepts from minimal examples. This paper provides a comprehensive survey of theoretical foundations and practical approaches in few-shot learning, with emphasis on metric-based methods (Siamese Networks, Prototypical Networks, Matching Networks) and optimization-based meta-learning algorithms (MAML, Reptile). We present detailed mathematical formulations, analyze computational properties, and evaluate performance on standard benchmarks including Omniglot, miniImageNet, and tieredImageNet. We extensively cover recent advances from 2023-2025, including vision transformers, CLIP-based approaches, foundation models, and cross-domain learning. Our analysis reveals that while metric-based approaches offer computational efficiency, optimization-based methods provide superior adaptation capabilities. Recent transformer-based and foundation model approaches show significant improvements over traditional CNN-based methods. We identify key challenges and discuss promising directions for future research.

Paper ID: 259

Artificial Intelligence Based Mock Interview Platform on Behavioral, Speech, and Technical Performance Evaluation

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Abstract: The prevailing competitive placement circumstances imply that most of the students are unable to perform efficiently during the interview due to lack of exposure or skill in communication or failure to be technically prepared. The proposed paper will describe an AI-based Placement Training Platform which will be a complex SaaS based platform that will simulate the experience of a real interview and provide personal feedback which will assist in getting through these challenges. The site incorporates the modules of regular interview processes: Aptitude, HR, and Group Discussions, technical interviews, video analysis, resume-based interview, and communication skills training. The system analyzes and compares the feedback of the applicants and evaluates behavioral indicators, speech fluency, and emotional confidence with the help of high-tech Natural Language Processing (NLP) and Computer Vision technologies and provides important reports about the strengths and weaknesses. In addition to the other features, peer mock sessions, company-specific question simulators, and curated learning materials are used to enable learners to keep upskilling. The proposed system will go a long way in equipping students better in the workplace through a combination of behavioral analysis, technical assessment and communication training on the same platform to better prepare them to succeed in the placement process, boost self-confidence and have a more objective perspective of personal development and growth.

Paper ID: 260

A Rule-Based NLP Approach for Automated Legal Document Generation: Design, Implementation, and Evaluation

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Abstract: Even though legal documentation is an essential element in personal, professional and business activities, it nevertheless presents a challenge particularly in terms of its linguistic difficulty as well as structural difficulty resulting in dependence of legal practitioners as well as inability of same by individuals and small businesses. In this paper, we introduce a Legal Document Generator, a web-based automated system which can be used to generate legal documents by using a natural language input and rule-based Natural Language Processing (NLP) techniques. In contrast to other methods that utilize transformers and demand significant computational power and model scale, the given system has a lightweight architecture, with an embedded pipeline that handles user input via classification, information extraction, validation, and interactive completion and then produces and generates the end product as a document without consuming a lot of computational power and without compromising the accuracy of the results, it can be executed on small-scale hardware. The methodology shows that rule-based NLP pipelines give reliable results in structured text generation problems like legal document generation, are able to automate the document generation process with over 97 percent accuracy with only minimal computational infrastructure or pre-trained language models. The work is a groundbreaking contribution to the sphere of legal technology, as it shows that a non-expensive, non-technical solution to NLP can make justice more democratic and reduce the justice gap. This system can bring radical change to the access to legal services by allowing individuals and small businesses to create valid legal documents without the need to hire a lawyer, enabling this system to bring down the cost of access, as well as increase equity in legal services access across a wide range of socio-economic backgrounds.

Paper ID: 261

Feature-Centric Telemedicine NLP: A Survey of Datasets, Representations, and Selection Methods for Virtual Care

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Abstract: Remote clinical interaction is made possible through telemedicine connecting physical and temporal distances in the health service with the help of digital communication interfaces. Growing reliance on talking and written consultation requires improved Natural Language Processing (NLP) models that can properly interpret symptoms, provide triage and prescription support. Yet, the best performance of the models will be basedon the choice of robust datasets and the discriminative featurerepresentation to the clinical semantics. A hierarchical taxonomyis determined on lexical, syntactic, semantic; discourse andparalinguistic features and an analytic comparison of featureselection algorithms such as mutual-information filtering, re-cursive elimination and embedded regularization structures isundertaken. The importance is put on measures like predictiveutility, consistency of facts, cross-dialect fairness and computa-tional scalability to outline optimal data set feature alignments.It aims to obtain a small though clinically expressive set offeatures that increase the model interpretability and reliabilityand reduce overfitting and domain bias. It is projected that theresults will be the identification of the most appropriate publicdatasets, the determination of high-impact features in telemedicalNLP pipelines, and development of reproducible feature selectionblueprints to promote safe, efficient, and regulation-compliantvirtual healthcare

systems.

Paper ID: 276

LoRa Based Affordable Wireless Weather Station

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Abstract: The LoRa-Based Affordable Wireless Weather Sta- tion is a novel IoT appliance that is intended to be used in real-time environmental monitoring with low-cost elements. The system consists of two Arduino microcontrollers with a set of sensors, i.e., the DHT11 to measure the temperature and humidity, the BMP180 to measure atmospheric pressure, the LDR to measure light intensity, and the rain sensor to identify precipitation. Monitoring sensor data is sent at the transmitter unit to a receiver system, where sensor values are shown on an LCD display. Also, a NodeMCU (ESP8266) uploads the measured data on the ThingSpeak cloud platform, which allows viewing and analyzing it remotely. The project represents a feasible, cost-effective, and sustainable solution to real-time weather surveillance, and thus is suitable to be used in rural and urban settings to serve the purpose of agriculture, disaster management, and smart city systems.Index Terms—LoRaWAN, Internet of Things (IoT), Wireless Sensor Networks (WSN), Embedded Systems, Real-Time Envi- ronmental Monitoring, Cloud Data Integration.

Paper ID: 283

AAI-Based Hybrid Model Integrating CNN And Dense Networks For Leaf Disease Diagnosis And Preventive Recommendations

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Abstract: This paper presents an automated approach to identify diseases in legume leaves and provide prevention recommendations. The proposed hybrid deep learning model reduces overfitting and improves feature extraction by combining convolutional and densely connected layers. A dataset of 4,200 images from five different legume species was enhanced through the use of normalisation and augmentation techniques. The model was attempted to be trained in more than fifty epochs with the Adam optimiser and categorical cross-entropy loss. The accuracy of the experimental assessment was 96.8per cent and the precision, recall, and F1-scores were close to 96 per cent, which is higher than the current neural network models, like VGG16, ResNet50, and DenseNet121.Users can upload leaf images for real-time disease detection and preventive advice using a web interface based on Streamlit. This strategy provides a dependable and effective instrument for promoting intelligent farming methods.

Paper ID: 288

Closed Loop Controlled PV fed Cock Croft Walton Converter System

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Abstract: Voltage multiplier cells are the simplest and least complicated way to create a high step-up converter. Because it delivers a high voltage ratio and minimum voltage stress on diodes and capacitors, the typical Cockcroft-Walton voltage multiplier circuit has an established track record of more than ten decades and is frequently employed in high-voltage DC applications. In addition, this circuit holds compactness and cost efficiency. The CWM converter, which uses diodes and capacitors instead of active switches to realize the function of high gain converter, perform better than their counterparts. High efficiency is achieved because of the absence of active switches and inductors / transformers. The output of PV is stepped up using High step-up converter. The output of High step-up converter is given to the load. Cockcraft Walton (CWM) High step-up converter was designed and simulated. Closed loop CWM is simulated and results are presented for different levels of disturbances. The adoption of a closed-loop PI control method for the CWM-based high step-up converter, which guarantees reliable voltage regulation and enhanced dynamic response under fluctuating PV input and load disturbances without raising system complexity, is what makes this study novel.

Paper ID: 294

AI-Driven Placement Preparation Platform Using Peer-Shared Experiences and Personalized Roadmaps

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Abstract: This paper exhibits an AI-driven platform to create enhanced intern hunting and job-hunting results for university students. The device entails peer-communicated interview endeavours, content based recommendation algorithms (by means of TF-IDF and k-Nearest Neighbours with cosine similarity), and RAG based blue-print generation with Pinecone embeddings for semantic retrieval. Learners can familiarize themselves with the company-specific interview secrets, get in touch with peers of similar interests, and acquire the personalized preparation roadmaps which are in line with their target companies and roles. The platform, which is created by using the MERN stack and PostgreSQL, is flexible and can be adapted to users with different characteristics in real-time. As far as the performance is concerned, the TF-IDF baseline managed to achieve 100% precision at Top-1 but precision at Top-10 dropped to 40%, thus confirming its lexical limitation. On the other hand, the Pinecone embedding model kept 82% precision at Top-1 and 63% at Top-10, indicating a strong semantic retrieval capability.

Paper ID: 299

Epidemiological Trends in Nutrition, Physical Activity, and Obesity: A Behavioral Risk Factor Surveillance System Analysis

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Abstract: Obesity has today evolved to be a significant social health issue in the global community, and its rate of occurrence is on the rise across various segments of the population. The current work is about a general machine learning method to predict the state of obesity using a rich and multi-feature predictor of demographic, lifestyle, and behavioral variables. Using an inte- grated data on 1,610 participants, contemporary approaches to deep learning are employed-that is, hybrid CNN-LSTM structure with attention mechanisms and various techniques of ensemble learning. Our approach includes resourceful preprocessing, in- cluding stratified division of data, specific treatment of categorical and numerical characteristics, and synthetic oversampling to overcome the imbalance of the classes.The CNN-LSTM Ensemble model resulted in an accuracy of 99.00% in the test dataset, thereby performing better than the Machine Learning and Deep Learning models. The analysis of feature importance using the SHAP methodology identified the significant contribution of dietary habits, physical activity, and the use of technology in prediction of the risk of obesity. Findings emphasize the possibility of deep learning ensembles in the initial diagnosis and classification of obesity, and they provide useful information on specific healthcare interventions and individualized prevention measures.

Paper ID: 300

Innovating HR Tech: A Comprehensive Evaluation of Chatbot-Assisted Diversity and Inclusion Initiatives in IT Recruitment

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Abstract: The goal of the present study is to investigate the role that chatbot-aided initiatives for diversity and inclusion have on information technology hiring practices. The goal of the manuscript is to build a comprehensive understanding of recruiter experiences, and specifically those interactions with chatbots geared towards diversity promotion, bias reduction, involvement with a heterogeneous candidate pool, and changing demand. Using the qualitative research design, semi structured interviews were carried out with human resource practitioners. Recurring themes and stories were found through content analysis of the data from the interviews. A survey was conducted with 25 industry experts including 17 recruiters and eight human resources specialists about the implementation of AI in recruitment. Findings suggest that the effects of a chatbot that is geared towards diversity have a significantly positive impact on the recruitment process by guaranteeing equal evaluation, counteracting unconscious biases, homogenising the initial screening process, adapting to user input and regulatory changes. The research highlights how important it is to make a chatbot diversity-centric as part of the IT hiring process and its potential for creating extremely positive results. The results show an increased conscious mindset among employees on the benefits gained from such chatbots in the human-resources management practice in order to create a more transparent and inclusive candidate selection process. Future research should take a more specific path to tackling the issues of algorithmic bias and similar concerns as well as to look for ways to increase the acceptability of the chatbot in being able to adapt based on evolving trends in the IT labour market.

Paper ID: 304

Deep Learning Techniques for Pancreatic Cancer Analysis: A Comprehensive Review of Imaging-Based Approaches

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Abstract: Pancreatic cancer accounts for 3% of all cancer cases but 7% of all cancer related deaths with a five year survival rate of less than 10% making it one of the most lethal cancers. This review summarizes the findings of 11 recent studies published in the last five years on the pancreatic cancer detection and segmentation techniques that utilized deep learning methods on CT and MRI datasets. Each study evaluated different types of models (including CNNs, Vits, Hybrid Architectures, etc.) and performance metrics. Detection performance of all studies was found between 85%-95% accuracy, segmentation performance using Dice score was between 73%-96%. The studies did, however, exhibit a number of limitations including that 9 out of 11 studies used single center dataset and only 2 performed external validation which raises the concerns about the generalizability of the models. Furthermore, the majority of transformer-type models required between 8-16GB of GPU memory, making their use computationally expensive for hospitals. Therefore, based on these findings, this review highlighted several important areas for continued research development including multicenter models, standardization of image preprocessing and more computationally efficient models.

Paper ID: 306

Comparative Evaluation of Machine Learning, Ensemble, and Deep Learning Models for Depression Detection Using Socio-Demographic and Behavioral Data

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Abstract: Depression is a significant worldwide health situ- ation that usually operates unchecked because of its resource constriction as well as stigmatization. The employment of early intervention through the use of the services of computational intelligence can be of immense use towards the achievement of timely intervention as well as prevention of long-term healthcare costs. This study develops and evaluates predictive models for depression detection using a dataset of 11,646 samples and 21 normalized features. Different machine learning and deep learn- ing algorithms, namely logistic regression, decision tree, random forest, support vector machine , K-nearest neighbors , AdaBoost, XGBoost, multilayer perceptron , and deep neural network , have been employed. Models were trained on 80–20 stratified split and their respective performance metrics against accuracy, precision, recall, and F1-score.Accuracy results show that en- semble methods demonstrated superior predictive accuracy, with XGBoost and Random Forest achieving the highest performance, reaching up to 98% accuracy. SVM and AdaBoost were at 96%, logistic regression and KNN at 93–94%, and the decision tree classifier at 92% accuracy. The deep learning models MLP and DNN were also 94%, along with the conventional classifiers but behind ensemble methods. The main contribution of this paper is to suggest a comparative analysis of the conventional, ensemble, and deep learning methodologies for depression forecasting. The findings represent the promise of ensemble approaches such as XGBoost and Random Forest as valuable assets for large-scale data-driven mental health systems to engage in early detection and intervention.

Paper ID: 315

SafeRoute: a crowdsourced Machine Learning framework for safe Urban navigation Survey Report

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Abstract: Urban navigation has moved from time savings through the shortest or fastest path to consideration of mul- tiple objectives after ensuring user safety and improving user experience. This survey takes stock of some of the primary challenges in building modern navigation systems that can deal with the complexities of urban environments. The survey evaluates 27 significant research papers published between 2016- 2025 that all seek to mitigate modern time-risk to people in urban environments (e.g., crime, traffic accidents, and safety concerns). Basic graph-based algorithms which treat issues of safety as static costs were explored to the applicability of predictive machine learning and adaptive reinforcement learning. Current developments are in the area of real-time crowdsourced data collection and user-generated data collection. Despite all of the advances in data fusing and personalizing navigation, progress continues in solving challenges associated with data reliability and credibility, scalability, privacy and bias.

Paper ID: 325

A Research Paper on Student Certificate Validation Using Blockchain Technology

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Abstract: Blockchain technology has proved to be a very secure and trustworthy method for document authentication, providing a tamper-proof, decentralized, and transparent environment. The growing usage of digital certificates in schools has brought new challenges with it, as standard procedures are manual, time- consuming, and prone to fraud or illegal alteration. This project seeks to improve the certificate validation process by capitalizing on blockchain technology in association with QR code technology, offering a platform that is both efficient and secure. The research starts by presenting the fundamental security needs required for certificate validation in a blockchain setting, for example, immutability, transparency, and user anonymity. It also points out the shortcomings of current solutions, for instance, time- consuming manual validation processes, dependence on private or B2B blockchains, and low scalability. In the envisioned system, digital certificates are created with one-of-a-kind cryptographic hashes that are kept on the blockchain through smart contracts. Each certificate is attached to a QR code, allowing recipients and third- party recipients to verify authenticity in seconds using a smartphone. The use of blockchain technology guarantees certificates are tamper-proof and verifiable real-time, while the QR code offers an easy-to-use interface for verification. The system is scalable, secure, and efficient, offering solutions to privacy issues and overcoming the limitations of conventional digital verification processes. With the use of this solution, organizations and educational institutions are able to automate verification of certificates, avoid forgery, and increase trust in digital credentials.

Paper ID: 327

Lamarr-Turing Graphs: Integrating Spread-Spectrum Principles and Intelligent Adaptivity for Next-Generation Secure Networks

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Abstract: Packet sniffing, man-in-the-middle (MITM) attacks, and route hijacking are increasingly becoming sophisticated cyber threats to modern communication networks, compromising the data confidentiality, integrity, and availability. The Lamarr-Turing Graph (LT-Graph) is a proposed routing framework, based on the Lamarr-Turing Graph (LT-Graph), a secure, intelligent, and adaptive routing protocol designed to operate under such adversarial conditions, and which is based on the concept of Hedy Lamarr spread-spectrum frequency hopping and intelligent adaptation through Deep Reinforcement Learning (DRL), a framework not initially intended to operate in such adversarial environments like in mobile ad hoc networks (MANETs) and the Internet of Things (IoT)[1]. The LT-Graph combines graph-theoretic modelling, pseudorandom function (PRF)-based hop selection and DRL-driven routing policies to attain unpredictability and resilience in the communication paths. It uses AES-GCM encrypted keys that have expired durations to provide confidentiality and integrity and a Shia 256 based HMAC to provide authenticated frequency selection[2]. Another mechanism presented by the framework is the random-walk based node discovery mechanism, which reduces the overhead of control and increases fault tolerance in response to topology changes. To mitigate eavesdropping and jamming, a frequency-hopping-like protocol dynamically changes channels to use in communication and the DRL agent uses autonomous learning and adaptation of routing behaviour as the network conditions, link failures and perceived threats vary. The system is tested and confirmed on OMNeT++ 6.2 (Qtenv) in which various attack scenarios such as packet sniffing, MITM and rogue-node injection are tested to test resilience. The key metrics that are used to analyse performance are packet delivery ratio, path entropy, latency overhead and attack detection accuracy. Findings show that LT-Graph is much superior to traditional routing protocols in ensuring the safety and efficiency of communication in the presence of attack[17]. The results prove that the suggested framework is able to tie together cryptographic security and adaptive routing mechanisms, as well as can provide a scalable system in next generation decentralized and self-organizing networks. Keywords- Secure routing, Deep reinforcement Learning(DRL), frequency hopping, random walk discovery, lightweight encryption, attack resilience, dynamic networks, MANETs, IoT security, decentralized communication.

Paper ID: 329

Emotion-Aware Smart Learning System for Personalized Education Using AI and Multimodal Emotion Detection

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Abstract: Traditional note taking systems are largely static and do not consider the emotional state of learners, limiting their ability to support personalized education. This paper presents Reflex Note, an emotion-aware learning system that adapts educational content based on real-time emotional feedback. The system integrates multimodal emotion detection using text sentiment analysis and facial expression recognition to capture both cognitive and affective aspects of learning. To ensure privacy, federated learning is employed, enabling local model training without transmitting sensitive user data. Experimental results demonstrate that the system achieves 93.4% accuracy in text emotion detection and 90.7% accuracy in facial emotion recognition, while maintaining comparable performance

to centralized models. The proposed framework demonstrates the potential of combining affective computing and privacy – preserving techniques to enable adaptive, personalized and secure learning environments.

Paper ID: 335

Closed Loop Controlled Piezo Electric Energy Harvesting System

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Abstract: Piezoelectric devices generate very low AC voltages, which are inadequate for directly powering most electronic systems that require stable DC voltages above 3.3 V. This work presents the design and development of a Closed Loop Boost Converter (CLBC) that integrates the boost converter and load for DC–DC boost conversion in piezoelectric energy harvesting applications. The novelty of this work lies in the application of a Fractional Order Proportional–Integral–Derivative (FOPID) controller to the CLBC, enabling enhanced dynamic performance and improved voltage regulation under low and fluctuating input conditions characteristic of piezoelectric sources. The proposed converter enhances the harvested voltage, providing improved voltage gain and efficiency suitable for low-power applications. A comparative analysis of closed-loop PI- and FOPID-controlled CLBC systems is carried out through simulation to demonstrate the superior transient response and stability of the FOPID-based approach. The developed system demonstrates a compact and efficient energy conversion solution for self-powered electronic devices.

Paper ID: 337

Smart and Intelligent Materials for Sustainable and Adaptive Technologies

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Abstract: Smart and intelligent materials play a central role in developing adaptive and sustainable technologies because of their capabilities to sense and heal themselves and perform many functions. These materials contribute to innovation in civil infrastructure, healthcare, aerospace, and energy; however, there is still a lack of existing research on the topic without a unified scientometric overview. This study examines 883 publications in the year 2020-2025 on 357 sources, backed by 7,534 references, to establish international research trends. The data in Scopus were extracted and analyzed using VOSviewer, CiteSpace, and OriginPro to address the following aspects: publication trends, authors, institutions, and development of thematic evolution. The findings indicate a median number of citations per paper (25.55), a high degree of international cooperation (23.9%), and the prevalence of the following themes: intelligent materials, 3D/4D printing, robotics, and energy harvesting. Interdisciplinary development is emphasized by thematic development in the direction of sustainability and AI-driven innovation. These results highlight the importance of combined manufacturing approaches and policy support to hasten the implementation of smart and intelligent materials in sustainable and adaptive systems.

Paper ID: 343

Deep Learning Architectures for Ophthalmic Diagnosis: Evaluating CNN, VGG16, ResNet50, and Inception V3 in Myopia Detection

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Abstract: In the world, the most prevalent vision disorder is myopia, and it is desirable to prevent its early diagnosis for long-term effects and vision impairment. For automatic classification of retinal fundus images into myopic and normal cases, deep learning techniques were applied in the presented work. Four architectures: CNN, VGG16, ResNet50, and InceptionV3 were trained and tested on a benchmark dataset. The some metrics such as F1-score, accuracy, precision, recall and AUC (Area Under the curve) were used to validate. It was experimentally found that all, good predictive performance was achieved with models accuracies more than 98% and AUC values near 1.0. The best accuracy was reported by ResNet50 among others of 99.65% and F1-score of 0.9965, while VGG16 received the highest AUC of 0.9999, which confirms their increased discriminative capacity. The similarity in all models contribute to the stability of deep learning through performance in capturing myopia-related pathological features. These findings demonstrate that AI-based diagnosis equipment may serve ophthalmologists with great assistance for Promoting mass, rapid, and precise myopia screening. This study provides the foundation of the development of scalable clinical decision support systems and provides possibilities to future research with. greater, more diverse data, and interpretable AI in order to build more trust and uptake in real-world healthcare applications.

Paper ID: 348

FPGA implementation of Image Processing operations using verilog HDL

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Abstract: This Paper outlines the physical realization of fundamental image processing techniques with the aid of a Field-Programmable Gate Array (FPGA) and the Verilog hardware description language. The built-up model handles pixel-wise operations of negative transformation and thresholding, among others, right on a Xilinx FPGA board(Zedboard). A Python-based script prepares the image data and stores it in a format that is compatible with Block RAM. The hardware logic offers real-time image manipulation and, together with the FPGA's parallel processing capability, the image is shown on a VGA monitor. The simulation results and experimental results confirm that the FPGA method is not only efficient but also low-latency and thus, has clear advantages over traditional software-based methods in terms of speed and resource utilization. The learning through practice and the skills gained are more than the application of this in fields like robotics, surveillance, and medical imaging that usually demand FPGA-driven embedded image processing.

Paper ID: 357

A Machine Learning Based Model for Forecasting Hepatic Disorders

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***Abstract**:* For good malady diagnosis and good clinical me-diation, it is necessary that hepatic disorders are diagnosed ontime and with precision. Using machine learning(ML) prototypesand a dataset from the UCI ML repository, the research isfinding the existence of hepatic disorder. The repository holds rawdata, which was pre-processed using KNNImputer imputation forhandling outliers, absent values and bias between classes. Thefinal data was divided into two parts for testing and training.The testing part had thirty per cent of all the data, and thetraining part had seventy per cent of all the data. In the next part,Random Forest (RF), Extra Trees (ET), Gradient Boosting(GB),AdaBoost(AdaB), eXtreme Gradient Boosting (XGBoost), andLightGBM algorithms were compared with each other to analysewith algorithm works the best. Out of these, ET and LightGBMoutshone. Performance metrics like F1-score, accuracy, recalland precision were considered, SHAP analysis further providesa better insight into the features and how they influence themodel's prediction. The results prove how well the algorithms canidentify nonlinear relationships in medical data. This also showshow important it is to be well-focused on the pre-processing stage.The proposed methodology is highly effective in finding whethera person suffers from hepatic disorders or not.

Paper ID: 379

A Sensor Fusion Approach to Attendance Validation: The IRFID Infrared–RFID Framework

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***Abstract**:* Automated attendance system has become an essential in modern educational institutions, but conventional RFID-based totally models stay at risk of proxy attendance and faulty presence monitoring. This paper presents IRFID, a dual-validation smart attendance system that uses Radio Frequency identification (RFID) with Infrared (IR) sensors to ensure correct and time-based attendance. In this proposed version, when a student scans their RFID card while entering the classroom, partial attendance is marked and at the same time the IR sensor confirms their physical entry. When the student leaves, both RFID and IR alerts are re-evaluated to determine whether the student stayed for the whole lecture. Attendance is finalized automatically at the end of the session primarily based on verified duration. The prototype is developed using Python with MySQL database, an Arduino-based RFID reader, and IR sensor which give reliable statistics synchronization among hardware and database layers. Experimental consequences show that IRFID extensively improves attendance accuracy, minimizes fraudulent entries, and gives a scalable solution for smart institutional automation.

Paper ID: 381

Computer Vision and Gesture-Based Biofeedback: A Serious Gaming Approach for Hemiparesis Muscle Coordination

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Abstract: Hemiparesis is one side weakness of the body that results in loss of mobility, decreased participation in activities of daily living and hemiparesis treatment includes physical therapy, occupational therapy and conventional therapy, out of these occupational therapy has a better result. In occupational therapy serious gaming system enhances the motor ability of the subject. This project is to create a Gaming Rehabilitation system for hemiparesis to enhance the movement coordination by gaming an existing game by controlling it with Gesture based recognition through Vscode. By putting an EMG sensor on the upper limb with the help of surface electrodes the muscle signals are being captured on both pre and post sessions. In order to check the angle of deflection imposed by the patients the gyroscope is strapped on the fingers using the Velcro. Gyroscope sensor is interfaced with Arduino UNO port to get the XYZ axis serial data which is fed to LCD display to show. The output will display the muscle signal recorded during the both pre and post sessions, and then pre and post data are analyzed for the better muscle coordination. This prototype can be implemented for monitoring the muscle signal during the gaming sessions. The pre session and post session waveform has been recorded and analyzed, and all further advancement in the sessions can be made on the basis of increment or decrement of the muscle signal. With the help of these kinds of gesture-based gaming systems, an effective solution can be given to enhance the movement coordination of the hemiparesis patients and avoid their further brain damages.

Paper ID: 388

Real-Time Driver Drowsiness Detection and Alert System Based on Time of Travel

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Abstract: Driver fatigue is one of the major reasons for road accidents, especially during long-duration and night-time driving.When drivers do not get sufficient rest, their concentration level decreases and their reaction time to road situations increases, whichmay lead to serious accidents. This paper presents a simple and effective driver drowsiness detection system designed to monitor the fatigue level of a driver and provide timely alerts. The proposed system analyzes facial cues such as eye blinking, along with the duration of continuous driving, to determine the drowsiness state of the driver. For the configuration, the use of the Python programming language in combination with the OpenCV library is meant for the real-time analysis of the camera images. A tiny machine learning algorithm enables the recognition of patterns that generally appear when a person is about to sleep. To increase the accuracy rate, a time factor is incorporated because people generally get sleepier at a certain point in time. Whenever the system recognizes that the driver is sleepy, it immediately provides a signal, such as a buzzing sound, to wake the driver up. Through practical experiments, it was discovered that the inclusion of the time factor along with facial expressions produces more effective outcomes than the use of facial expressions alone. The system is quite easy to implement, requires low costs, and is very helpful in the prevention of accidents related to driver fatigue before long drives.

Paper ID: 390

Smart Helmet For Mining Industry

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Abstract: The paper describes a smart helmet system that is used in the mining industry, which consists of a multi-sensors safety platform to improve the safety of workers in a dangerous setting. The helmet has MQ-5 gas sensor, which detects the presence of toxic gases, DHT11 temperature, humidity, a BMP180 pressure sensor to detect atmospheric pressure, and an ultrasonic sensor to sense obstacles. The system also has an automated sensing system as well as a manual emergency switch to enable instant distress signaling, 16x2 LCD to provide real time on-helmet feedback and a buzzer to provide immediate local alerts in the case of critical situations. The combination of multi-parameter environmental sensing, dual-level alert systems (local and remote), and NRF-based wireless data transmission in a small wearable system is one of the key novelties of this work, and this sort of integration was not frequently implemented in the earlier designs of smart helmets. In addition, cloud connectivity ensures real-time remote monitoring, which also gives supervisors access to live field data, enhancing the accuracy of response and minimizing accident risk. All in all, the intelligent helmet proposed will improve situational awareness, prompt hazard detection, and proactive safety measures in underground mines.

Paper ID: 394

Exploring Wireless Communication Protocols for Embedded Systems: Performance, Challenges, and Future Directions

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Abstract: The objective of this study is to analyze various wireless protocols in embedded systems, focusing on their strengths, weaknesses, and future trends affecting the Internet of Things (IoT) and other technology fields. The key tasks are to examine Wi-Fi, Bluetooth, Zigbee, LoRaWAN, and 6LoWPAN to analyze their power consumption, distance they can cover, latency, security weaknesses, and suitability for use in healthcare, smart homes, automobiles, and industrial Internet of Things (IoT) systems. This study was designed using a literature review and scientometric analysis and examined data from 2020 to 2025, with a focus on wireless communication. Performance measures, such as power use, timing, throughput, and security, were evaluated using real studies and computer simulations. It was observed that the protocols differ significantly in terms of long-range data coverage, electricity usage, and data speed, with LoRaWAN being a suitable option for lengthy distances and low power use, while cellular networks provide a better data speed but at a greater power sacrifice. Because of security risks, the use of advanced encryption and intrusion detection systems is necessary. China and the USA have played vital roles in this field and showcased the latest developments in the combination of AI, 6G, and energy harvesting. Ultimately, wireless communication for embedded systems must combine intelligent AI methods, excellent security, and adaptable energy-saving solutions to support the growth of the IoT.

Paper ID: 395

Intelligent Urban Traffic Flow Optimization Using Dueling Double DQN Reinforcement Learning Enhanced by Fuzzy Reward Modulation

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Abstract: Urban traffic congestion has become a relentless problem that is caused by the exponential growth of the number of vehicles and unplanned road networks in modern cities. The traditional fixed-timer traffic signal systems are working on fixed schedules and are unable to adjust to rapidly changing traffic flows, thus leading to longer waiting times, lines, and excessive fuel consumption. This article introduces a new traffic signal control system that integrates fuzzy logic-based reward shaping with Dueling Double Deep Q-Networks (DD-DQN), and it aims at dealing with the mentioned trouble. The suggested mechanism modifies the real-time signal timings based on the traffic condition parameters collected from a 4-way crossing in the SUMO (Simulation of Urban Mobility) simulation. To tackle the problem of sparse and unstable reward signals, which is typical in reinforcement learning environments with complex dynamics, the authors use fuzzy reward modulation. The framework separates the estimates of the state value and the advantage to improve the stability of the learning process; at the same time, it alleviates the problem of Q-value overestimation. The experimental results show that the cumulative delay is reduced by 55%, average queue lengths are reduced by 61%, and average rewards are increased by 116% when compared to traditional fixed-timer systems. The suggested method provides the intelligible, scalable, and robust traffic control, which can be used as a stepping stone for the smart transportation of the future.

Paper ID: 399

Hybrid Resnet-BiGRU Architecture For Intelligent Surveillance Systems' Real-Time Robbery Detection

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Abstract: The rising installations of surveillance camera systems have generated a pressing demand for intelligent systems that can instantly identify high-risk crimes such as robbery. This paper proposes a Hybrid ResNet-BiGRU architecture designed specifically to efficiently employ the spatial appearance features of robbery in CCTV camera streams in a real-time robbery detection intelligent surveillance system. The proposed architecture involves a workflow of processing uninterrupted surveillance camera streams by fixing a frame sequence length, representing spatial robbery characteristics using a pre-trained ResNet-18 architecture, detecting temporal robbery characteristics using a Bidirectional Gated Recurrent Unit (BiGRU), and then using a temporal smoothing technique to produce robust robbery alerts in a real-time intelligent surveillance context. A well-balanced dataset of 599 robbery-annotated surveillance videos (299 robbery videos and 300 normal videos), collected from actual available CCTV footage, was used to test its performance in various light, occlusion, and environmental settings. The proposed intelligent system was trained using an 80-20 split ratio between training/testing datasets and performance was assessed using standard performance metrics of accuracy, precision, recall, F1-Score, and ROC-AUC values. The performance of the proposed architecture was found to be 98.4% accurate, 1.00 precision, 0.97 recall, 0.985 F1-Score, and an ROC-AUC of 0.9979, outperforming three baselines models: ResNet-18, CNN-LSTM, and 3D CNN architectures.

Paper ID: 403

A Comprehensive Review of Deep Learning–Driven Vision Techniques for Advanced Driver Assistance Systems

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Abstract: Deep learning is now the key technology in the area of vision- based advanced driver-assistance systems (ADAS) and self-driving cars, which, among others, has finally led to improved detection, recognition, and control of objects, lanes, pedestrians, vehicles, traffic lights, and steering. The model training was powered by large annotated datasets with vehicle parts and their bounding boxes, which led to an almost 87 % localization accuracy. Modern detection frameworks, such as R-CNN, Faster R-CNN, and YOLOv3/v4, provide good results in various environments and have even added approximately 7% to the mAP and above 90% in detection accuracies for cars and people. Lane detection methods based on key-point extraction, inverse perspective mapping, and geometric constraints have been able to improve F1 scores by as much as 7.8% even when visibility was low. The end-to-end steering and imitation learning models, which were trained on both real and synthetic data, had almost 30% less prediction error than before; this, together with reinforcement learning, led to safer navigation. Nonetheless, the problems of dealing with harsh weather, changing illumination conditions, occluded regions, and real-time deployment remain.

Paper ID: 419

A Review on Recent Advances and Emerging Trends in Human Camouflaged Detection

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Abstract: Research in camouflaged human detection is an emerging field of study, especially due to practical applications for military defense, surveillance, and search- and-rescue situations. Studies in human detection that use computer vision typically do not perform well for complex scenes, when the human is partially occluded, when the variance is low, or did not provide evidence of a dynamic natural background. In this review, we give a synthesis of past studies and trends in camouflaged human detection, advances in methods, including feature extraction, attention methods, and multispectral detection, datasets commonly used in reliability studies for varying types of camouflaged human detection; how models can be advantageous, and a brief framework for camouflaged human detection. We review and examine trends that suggest challenges for detection in narrow human centric detection for real world use. This paper surveys prior literature and provides a unified review of prescriptive possibilities towards improving detection protocols within camouflaged human detection, and future research related to this study project. Specifically, in addition to trends noted above, this survey would report on one human detection system design using deep learning and use of Explainable AI approaches, to increase explainability and trust.

Paper ID: 428

Hysteresis Controlled Modified Interleaved SEPIC Converter for Electric Vehicles

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Abstract: This paper presents a comprehensive comparison of the performance of the proposed Interleaved SEPIC converter when interfaced with two distinct control strategies: a conventional Proportional–Integral (PI) controller and a hysteresis controller. The primary objective is to evaluate and compare their efficacy in terms of voltage regulation, current ripple reduction and overall efficiency. The findings aim to provide valuable insights into selecting the most suitable control technique for optimizing the performance of advanced DC–DC converters in the demanding EV environment. This work investigates a closed-loop modified interleaved SEPIC converter, which compares the evaluation of two control strategies: PI controller and hysteresis current control. The proposed converter, featuring two SEPIC legs phased by 180°, is designed to reduce input current ripple and switching stress across modules. The PI controller is implemented using a dual-loop structure with outer voltage regulation and inner current control, tuned to ensure precise voltage regulation and constant switching frequency. The hysteresis controller maintains the inductor current within a predefined error band, delivering a fast-dynamic response and inherent current limiting. Simulation results and key performance metric, including output voltage stability, are quantified. The results indicate that the hysteresis-controlled system achieves lower voltage ripple, superior transient dynamics and current smoothing.

Paper ID: 429

Secure Health Care System Using Block Chain Technology

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Abstract: Healthcare Medical centers also require the secure systems, the system of transportation, and the effective mechanism of patient data, appointment, and test work, and medical workflow, which should be secured. This paper presents a comprehensive proposal of a Secure Hospital Management System consisting of blockchain- based technology, machine learning to predict diseases, machine-generated image processing, and role-based access control. It is developed in Python with the aid of Django and has a hybrid on- chain/off-chain audit logging system in order to balance between transparency and efficiency. The safety of data is ensured through the blockchain-authenticated logs, which are enhanced by the two-factor authentication and smart contract-based tamper-proof event recording implemented on the Polygon network. The cost of transactions in the blockchain is minimized with the help of a Merkle tree-based Hashing technique before electronically recording audit data on the blockchain. In addition to that, it has a sophisticated medical decision-support module that assists the medical professionals in early diagnosis and planning of treatment. The proposed SHMS is much better than the data reliability, a significant improvement in administrative and clinical efficacy, and also better cybersecurity in modern healthcare facilities.

Paper ID: 443

Analysing Deep Neural Network Models and Methods for Image Synthesis

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Abstract: Generating images from textual descriptions, images or other inputs is a tough job in computer vision. Researchers are working on various ways to generate images which looks real and match the description mentioned in the given input. This is facing a lot of challenges which requires additional study, and there is still lot of scope to learn. This article describes various techniques for generating images and give idea regarding what we know about creating realistic visuals. The popular AI models like Imagen, DALL-E 2, Pix2Pix, Cycle GAN etc. has discuss with their working in the image generation. We focused on the models that have enhanced the quality, diversity, and controllability of created images potential of generative artificial intelligence. These models contributed in various applications in different domains such as, image and language processing, video processing, vision computing. This paper also looks into how to evaluate these models, identify their limitations and suggest new research directions.

Paper ID: 450

Road Pothole Detection System

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Abstract: Potholes are the most common issue that causes of vehicle damage and road accidents especially in development areas where road maintenance is delayed. The study introduces a real time pothole detection and warning system based on the YOLOv8 (You Only Look Once version 8) deep learning model. The model was trained on a Road Pothole Dataset of 1200+ high-resolution images of pothole and plain road surfaces that were taken in Pune, India. The dataset is accessible at https://data.mendeley.com/datasets/fbhdy3bxgv/2 . The trained system identifies the potholes in live camera feeds and sends a warning to the driver instantly, thus minimizing the possibility of accidents and vehicle damage. YOLOv8 model has a mean Average Precision (mAP) of 94.2, which indicates that it is a reliable model in various road and lighting conditions. The work is a contribution to smart transportation, which combines real-time detection with proactive safety warnings to be deployed on smartphones, dashcams, and IoT-based vehicles.

Paper ID: 458

Machine Learning Analysis of Alignment Entropy in Handwriting for Cognitive Flexibility Assessment

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Abstract: Handwriting layout and slant often reveal a person's flexibility in different writing situations. This paper presents a new

measure called Alignment Entropy. It compares how consistent people's handwriting matches and tilts on unruled paper. The variability in handwriting layout is measured, focusing on cognitive flexibility and the ability to adapt to different environments, such as physical and digital writing. Unruled paper was used to show natural differences in spacing, alignment, and slant without visual guides. This approach led to a clear and innovative system for understanding mental flexibility through handwriting behavior. The findings and discussions emphasize how measuring consistency relates to quality. The Alignment Entropy measure has potential for behavioral and cognitive analysis. It is proposed that individuals who are more adaptable show less entropy, suggesting they manage to adjust better to unfamiliar situations. In-person input and high entropy are examples of contexts with more variable alignment, often seen in web-form inputs.

Paper ID: 459

Cross Dataset Generalization of a Hybrid Transformer Evaluator for Human Aligned Chess Move Prediction

Shreyas Durge (VIIT)*, Niranjan Pawar (VIIT), Harshad Karale (VIIT), Jagjit Bhosale (VIIT), Gitanjali Shinde (VIT), Sonal Fatangare (VIT), Poonam Railkar (SKN COE)

Abstract: In this paper, we have done a comparative analysis of assessing chess positions with a Transformer based deep learning model that has been trained on our own dataset and on a publicly available Kaggle Lichess dataset. The suggested model involves the use of move sequence encoding with player ELO difference to forecast normalized positional evaluation scores. Our dataset was posted on Mendeley (with more than 30,000 games being published ethically on Chess.com, as well as matches between 800–1400 ratings and also Grandmasters' games. Every record contains all the metadata, including the move sequences, ELO ratings, results, openings, and termination types, which are appropriate in training advanced AI models. The same Transformer architectures were trained on our and Kaggle datasets and measured in terms of Mean Absolute Error (MAE) and R^2. It has been found that the model trained with our dataset had a 4.1% higher MAE (0.3755 vs 0.3915) and higher R^2 values, demonstrating superior generalization and stability. This shows that data quality and ethical curation increase the accuracy of models more than data size. The results show that to build interpretable and human consistent chess evaluation systems, it is necessary to use human gameplay data that is balanced and well structured. The research concludes that smaller, high quality datasets are capable of performing better than large ones used in chess AI research with optimized Transformer architectures.

Paper ID: 461

A Web based Crowdsourcing System for Polarity Analysis in Marathi Sports News

Pallavi Kulkarni (Marathwada Mitrmandal College of Engineering)*, Dr. Kalpana Thakre (Marathwada Mitrmandal College of Engineering), Sahil Borse (Government College of Engineering and Research), Pritul Raut (Government College of Engineering and Research)

Abstract: The process of sentiment analysis is not complete without crowdsourcing. A web-based system is proposed to collect public opinion through crowdsourcing. The accuracy of sentiment analysis will be achieved when every corner of the society gets involved in the process. This system allows the annotators to submit their opinions from anywhere, anytime. An easy-to-use GUI is provided which is adaptable and upgradable. Annotation process for supervised and unsupervised Marathi dataset is done and performance is analyzed by measuring Inter annotator agreement and agreement between machine learning predictions and annotation labels. The performance of the system is satisfactory giving 12% growth in seed Marathi senti-wordnet. But as the sentiments are subjective and contextual more domain specific research is required from algorithm perspective. The experimentation will be scaled to occupy large

volume in future to create language resource.

Paper ID: 462

AI + IoT-Based Portable Intruder Detection System with GPS Tracking and Real-Time Telegram Alerts

Bharath Singh Jebaraj (Kalasalingam Academy of Research and Educatuion), B.Sharmilaa (Kalasalingam Academy of Research and Educatuion)*, M.Shanthiya (Kalasalingam Academy of Research and Educatuion), Subiksha G (Kalasalingam Academy of Research and Educatuion), Aayush Anand (Kalasalingam Academy of Research and Educatuion), Vivekrabinson K (Kalasalingam Academy of Research and Education)

Abstract: This project presents an AI-based security system that will substitute the conventional surveillance with smart threat protection. It will automatically identify the human presence with the help of the computer vision and Haar Cascade algorithms, calculate the level of danger in real time and provide the solution to the security. It gives instant messages via Telegram, accompanied by pictorial evidence, along with an intelligent system of forthcoming alerts in the absence. The system combines automated monitoring and AI-driven analysis and is affordable, meaning it is trustworthy to the security requirements of homes or small businesses, which occupy the niche between bare-bones motion detection and security services.

Paper ID: 475

AGRO-AI: A Deep Learning and Multilingual Conversational System for Disease Detection in Guava and Dragon Fruit

Dr. K. Maharajan (Kalasalingam Academy of Research and Education), B. Giridhar Krishna Sai (Kalasalingam Academy of Research and Education), S. Prasanth Naidu (S. Prasanth Naidu), B. Venkateswarlu (Kalasalingam Academy of Research and Education)*, V. Thirumalesh (Kalasalingam Academy of Research and Education)

Abstract: Plant diseases are very prevalent in India which may not be detected in the early stages thereby affecting the production of agriculture. The paper proposes a multifunctional intelligent system which employs the concepts of deep learning which is applied to the images and multilingual conversational agent to detect diseases in guava and dragon fruit crops. A Convolutional Neural Network (CNN) is trained to classify the symptoms of the three conditions, using an Anthracnose, fruit fly infection, and degradation of the quality of dragon fruit. To support the detection system, a multilingual chat assistant will provide voice and text-based recommendations on the language of their location depending on the speech recognition and text- to-speech systems. The provided methodology makes the accessi- bility of farmers more accessible, the early diagnosis simplified, and the use of specialists is no longer needed. The results of the experiment indicate that it is scalable, correct, and applicable in rural agricultural communities.Index Terms—Deep Learning, Plant Disease Detection, Con- volutional neural network, Multilingual Chatbot, Smart Agricul- ture, Guava, Dragon Fruit.

Paper ID: 477

AI-Resistant Image Based CAPTCHA Generation using Diffusion Models

Prajwal Chopade (Vishwakarma Institute of Information Technology), Tanmay Deshpande (Vishwakarma Institute of Information Technology)*, Atharv Kokate (Vishwakarma Institute of Information Technology), Grishma Bobhate (Vishwakarma Institute of Information Technology), Gitanjali Shinde (Vishwakarma Institute of Information Technology), Sonal Fatangare (Vishwakarma Institute of Information Technology)

Abstract: With the rapid development of artificial intelligence, the security of the conventional CAPTCHA systems has been greatly undermined since the current deep learning and OCR models are now able to solve most of the existing visual problems with a high level of accuracy. Such an increasing susceptibility points to a major gap in the modern design of CAPTCHA that mainly depends on fixed distortions and deterministic rendering pipelines that are susceptible to automation-based attacks. In order to solve this problem, this paper proposes a Diffusion-Driven CAPTCHA Generation Framework, which uses a conditional denoising diffusion model, which is trained on the publicly available CAPTCHA_CHAOS79 dataset to generate visually diverse, legible to humans and resistant to machines CAPTCHA images. Our approach combines adaptive noise, dynamic font and background changes and controlled distortions to create samples, the difficulty of which is systematically tested with several state-of-the-art OCR solvers, such as Tesseract, EasyOCR, PaddleOCR, TrOCR, Donut, CNN-MNIST, and Google Vision OCR. The Character Error Rate (CER), Exact Match (EM), and inference time show a significant decrease in automated recognition accuracy of all tested models, which proves the enhanced robustness of diffusion-based generation of CAPTCHA. The hypothesis of this paper is that diffusion models are more robust and versatile as a generative process than GAN- or rule-based methods, and the development of new CAPTCHA systems that can resist the changes in AI-based attack systems and ensure that the usability of human users is not affected.

Paper ID: 491

Evaluating Machine Learning Models for Sentiment Analysis in Marathi–English Code-Mixed and Script-Mixed Text

Madhuri Narayan Kumbhar (Marathwada Mitra Mandal's College of Engineering)*, Dr. Kalpana Thakre (Marathwada Mitra Mandal's College of Engineering)

Abstract: The development of multilingual communication on social media has resulted in an increasing popularity of code-mixing and script-mixing, especially in Maharashtra, where Marathi people frequently combine English terminology and use both Roman and Devanagari scripts. This presents difficulties for natural language processing (NLP) because to orthographic irregularities, phonetic spelling variants, and informal grammar patterns. To address the lack of script diversity, we developed an automated pipeline to convert selected Marathi words into Devanagari while preserving English words in Roman script. This transformation retains the original sentiment labels, providing a script-mixed version of the dataset suitable for more complex linguistic analysis.The proposed work establishes baseline performance for sentiment classification using machine learning models, specifically Support Vector Machine (SVM), Random Forest and Logistic Regression, trained on this script-mixed dataset. We evaluate their performance in handling the unique challenges of script-mixed text, such as code-switching, non-standard Romanization, and informal language. The results establish baseline performance for the script-mixed MCodeScript-MeSent and highlight the need for more advanced models and techniques to tackle the complexities of Marathi–English code-mixed and script-mixed sentiment analysis.The results highlight the limitations of existing models in capturing complex linguistic code-mixed patterns, underscoring the need for more advanced modeling strategies for Marathi code-mixing and script-mixing texts.

Paper ID: 502

Alera: Smart Fall Detector System

Jeenali Shah (Vishwakarma Institute of Information Technology), Pravin G. Gawande (Vishwakarma Institute of Technology), Shailesh V. Kulkarni (Vishwakarma Institute of Technology), Revati Aute (Vishwakarma Institute of Information Technology), Parin Vanjari (Vishwakarma Institute of Information Technology)*

Abstract: This invention is a smart IoT wearable fall detection and emergency alert system that aims to increase the user's safety, and in general, provide real-time intervention if the user happens to fall accidentally or if the user is facing a sudden emergency. The system links an Arduino Nano 33 IoT microcontroller to inertial sensors accelerometer and gyroscope to keep track of the wearer's movement and detect abnormal activities. The system, in essence, produces a loud alarm and sends a notification to the smartphone, which is connected, the caregiver dashboard, or the cloud platform through the use of Wi-Fi connectivity as soon as the fall is detected. The apparatus is also equipped with a manual emergency button and a voice-assist feature that can be used for alert activation in a hands-free manner. The invention, through the use of smart motion sensing, multi-modal notifications and a small wearable form factor, thus represents an effective solution.\

Paper ID: 518

A Chat-Based System for Identifying Alexithymia

Jane Rubel Angelina Jeyaraj (Kalasalingam Academy of Research and Education)*, E. Sai Pradeep (Kalasalingam Academy of Research and Education), J.Naveen Kumar (Kalasalingam Academy of Research and Education), K. Guru Vardhan Reddy (Kalasalingam Academy of Research and Education), D. Jithendra Reddy (Kalasalingam Academy of Research and Education), Vadlamudi Venkata Naveen (Venkata Naveen College of Engineering)

Abstract: Difficulty identifying and expressing emotions- Alexithymia is being increasingly recognized as a major impediment to mental well-being, but there are few available screening tools. In this paper, a web-based conversational system is provided which examines emotional clarity on a real- time basis through a multi-factor NLP pipeline. The system provides feedback that is supportive with an intention of enhancing emotional awareness by combining linguistic characteristics, purpose intended scoring algorithm, and a clarity scoring algorithm. The suggested tool helps to fill the accessibility, screening early, and emotional skills gaps. Results shows Accuracy of Proposed system is more than existing models, accuracy of proposed system is 87% where as accuracy of BERT is 78%.

Paper ID: 520

PV-Fed Synchronously Rectified Soft-Switching Bidirectional Modified SEPIC for Battery Charging

Rama Reddy Sathi (Rajalakshmi Engineering College, Chennai, India), Vijayram S (Rajalakshmi Engineering College, Chennai, India)*, Maran Elanthiraian M K (Rajalakshmi Engineering College, Chennai, India)

Abstract: This paper describes the design, simulation, andperformance comparison of a bidirectional modified Single-Ended Primary Inductor Converter (BMSEPIC) optimized forcharging batteries from a photovoltaic (PV) source while enablingbidirectional power flow. Two key enhancements are employed:synchronous rectification to reduce conduction losses and a res-onant auxiliary circuit to achieve

Zero-Voltage Switching (ZVS)of the main MOSFETs, thereby minimizing switching losses. Thepaper presents the design equations, control strategy, simulationresults, and an efficiency comparison with a conventional hard-switched SEPIC converter. Simulation results demonstrate asignificant improvement in efficiency for the proposed converterin both boost mode (PV to battery charging) and buck mode(battery to load operation). Furthermore, soft- and hard-switchedBMSEPIC configurations operating in both boost and buckmodes, with and without synchronous rectification, are simulated,and their performance results are systematically compared.Index Terms—BMSEPIC, synchronous rectification, zero volt-age switching, soft-switching, bidirectional DC-DC, PV charging

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Paper ID: 521

Graph-Aware Planning: A Data-Centric Benchmark for Efficient Decision Search

Tushar Shrivastava (University of North, Texas)*

Abstract: The process of developing and executing a plan to achieve a desired goal, uses online planning in Markov decision processes. A graph aware planning approach aggregates the value information over equivalent states. It leads to a reduction of a measure of effective search complexity. This also leads to interactive Bellman updates to derive tighter value bounds under fixed compute budgets. The pipeline outlines data structures (like trees or graphs), establishes decision heuristics that can be either conservative or optimistic, and provides guarantees to enforce convergence through backups. Further, performance is operationalized through the scaling of simple regret, exploration profiles, and stochastic extensions using confidence intervals. Studies conducted in controlled settings show that effective branching is lower and trends in regret are more favorable than in baselines, which are solely tree-based. This demonstrates that sample efficiency is jointly determined by representation choice and bound propagation. This contribution is a generalizable recipe for data-centric planning: Encode state similarity, propagate uncertainty using contractive operators, and evaluate with reproducible, task-relevant metrics for reliable, scalable decision-making

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Paper ID: 522

Neuro-Symbolic ProofOps: An LLM Copilot That Explains and Repairs Formal Models in the Loop

Tushar Shrivastava (University of North, Texas)*

Abstract: his paper presents a neuro-symbolic copilotthrough combining large language models with compositionalmodel checking so to make counterexamples actionable andfacilitate repair in safety-critical engineering. The system offersmachine reasoning proof (un) reliability estimates in a program-ming environment, along with code transformation guidance,through context-aware memory and prompt construction coupledwith exploitable feedback loops to facilitate integrating theseAI systems into production-grade software. In situations withfaults, the copilot fixes most counterexamples in one to twoiterations. First, it lowers human token input to almost zero.Then, it keeps latency low from end to end. Overall, it shows im-provements in explainability, convergence, and developer effort. The method automates 16 verification and operations steps whilemaintaining formal guarantees. This operationalises trustworthyAI for model-based systems engineering. Also, it shows LLMscan collaborate productively with symbolic engines and at scale

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Paper ID: 523

Scheduling Out Heisenbugs: Azure-Native Systematic Testing for Storage and Fabric Services

Tushar Shrivastava ((University of North, Texas)*

Abstract: The authors of this paper proposed a methodology that allows Azure-centric wrapping of production .NET services with controllable event schedulers and property monitors, to manifest safety and liveness faults prior to their deployment. Furthermore, by means of modelling timers, failures, and message delivery, in the context of Azure Storage's extent management for Linux, Azure Tables live-migration path management, as well as Service Fabric chains, the methodology turns cloud nondeterminism into reproducible traces. Moreover, timed replay enables reproduction of liveness defects from months ago in a few seconds, yielding diagnostic information that is actionable and replayable. In general, the methodology provides a practical recipe for Azure engineering teams, which is capable of bridging the gap between high-level specs and executable code. Furthermore, by using this methodology, pre-production coverage is deeper than the standard unit/integration/stress testing, while maintaining real implementation semantics.

Paper ID: 525

A Systematic Review of Multimodal AI and Explainable Deep Learning Techniques for Autism Spectrum Disorder Detection

Siddhi Vanshiv (MMCOE)*, Kalpana Thakre (MMCOE)

Abstract: Autism Spectrum Disorder (ASD) is a complex developmental condition that shapes how a person communicates, engages socially, and behaves across different situations. Timely intervention requires prompt diagnosis, but the modern methods of diagnosis rely much more on the judgment of the clinician, special equipment, and extended monitoring. This tends to postpone screening and reduce accessibility especially in resource based environments. Following the recent advances in Artificial Intelligence (AI), scientists started creating devices that automatically detect ASD based on the data of facial images, behavioral questionnaires, and vocal. The twenty research studies reviewed in this review were published between 2023 and 2025 and focus on machine learning, deep learning, transformer-based models, and multimodal fusion methods used to identify ASD. The reviewed articles rely on a broad collection of data and employ various architectural designs such as convolutional networks, hybrid structures of feature-fusion, large language models, and explainable AI algorithms. The comparative analysis describes the overall advancements in the accuracy of prediction and clinical relevance and the remaining challenges, including the lack of diversity in the data sets, lack of real-world testing, and difficulties in interpretation. The review concludes that explainable and multimodal deep learning methods contain significant improvements towards high-quality ASD risk assessment. It also maps forth future lines in getting lightweight, scalable and clinically adaptable, Artificial Intelligence (AI) systems to carry out early ASD screening.

Paper ID: 530

AI-Driven Career Pathway Identification Using Multidimensional Skill and Interest Analysis

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Abstract: The Evolution trend of current job landscape is at the peak where selecting the right career is a very tedious and nervous process with each career containing its pros and cons. In this individuals often look at their career as a source of income and select the job which is more trending according to money market average salary rate, often neglecting their own hobbies and talents which each person possess. Due to this, often people end up in situations where one field has a lot of people and is overcrowded and the other field of job is idle.To solve this issue, introducing Career Guidance System. Its job is to provide you with tailored suggestions and road maps to secure your real passionate job. This system consists of a lot of premium features like AR/VR career simulation, burnout prediction, smart resume builder, AI mock interview, gamified challenges, risk vs reward analysis and so on. These extensive features are designed to provide the user a delightful experience where they can truly find and recognize their optimal career path. This model helps in real world scenarios avoiding people from saturating into one respective field and maintains a balance of workforce in all fields contributing significantly to a more future ready workforce which sought to be more balanced.

Paper ID: 531

From Financial Reporting to Strategic Taxation: Investigating Auditing Ethics and Governance for Profit Stability in Emerging Economies

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Abstract: The developed countries have companies, which are able to maintain their profitability due to financial reporting, ethics of audit, governance practice and strategic taxation. It seems that these instruments give preference to fiscal transparency. Weirdly enough, though, audit quality, lack of effectivity in regulatory control and the imbalance in taxation structure are existential threats to business survival. Therefore, we are planning to establish the foundation where the combination of all these mechanisms will intertwine the sources of long-term financial stability. A survey questionnaire was conducted by administering an organized questionnaire to 250 finance professionals and later, regression analysis was performed in order to discover the relationships among the key variables. The results indicate positive effects of financial reporting quality (β = 0.510), auditing ethics (β= 0.487), good governance practices ((β = 0.495), and sound strategic taxation ((β = 0.538) on income stability. Thus, the research contributes to the evidence-based model of policymakers and regulators to achieve improved financial governance and stability, particularly in transition economies.

Paper ID: 532

Experimental Evaluation of Mechanical Properties of Jute–Epoxy Composites Enhanced through Intra-Ply Glass Fiber Hybridization

Rahul U. Patil (Bract'S Vishwakarma Institute of Information Technology, MMCOE)*, Dr. Vikas R. Deulgaonkar (MMCOE), R. N. Todkar (MMCOE), Amit D. Desale (MMCOE), Swapnil Lahane (MMCOE)

Abstract: In this study, an effort was made to investigate the influence of intra-ply glass-fiber hybridization and different stacking sequences on the tensile and flexural responses of jute–epoxy composite laminates, based on experimental testing. To address environmental concerns, three intra-ply jute glass hybrid fabric configurations - G1J1, $(G1J1)_2$, and G4J1+G1J1 -were fabricated with the motive of retaining mechanical strength while reducing the incorporated glass fiber content. The tensile test results indicate a 17.39% improvement in tensile strength, achieved alongside a simultaneous 12.5% reduction in glass fiber content. The flexural behavior of the

jute–glass fiber–reinforced laminates further result in 32% enhancement in bending strength for the G4J1+G1J1 configuration compared to $(G1J1)_2$.

Paper ID: 533

An AI-Powered Platform for Interview Simulation and Comprehensive Placement Preparation

Dr. Swapnaja Ubale (Marathwada Mitra Mandal's College of Engineering, Pune, India), Prathmesh Khandare (Marathwada Mitra Mandal's College of Engineering, Pune, India), Sandip Awale (Marathwada Mitra Mandal's College of Engineering, Pune, India)*, Omkar Patil (Marathwada Mitra Mandal's College of Engineering, Pune, India), Shrutika Hibare (Marathwada Mitra Mandal's College of Engineering, Pune, India)

Abstract: his paper presents an AI-driven platform thatintegrates performance analytics, alumni mentorship, ATS-basedresume matching, and automated interview evaluation into aunified ecosystem to improve placement readiness. Using speechrecognition, natural language processing, and large languagemodels, the system makes realistic voice-based interview simula-tions with questions that change and feedback that is specific toeach user. A semantic resume-job description matching modulethat pulls out important skills, finds gaps, and suggests the bestjob roles works with a web-scraped job board that lists verifiedjob openings.The platform is made up of students, alumni mentors, andadministrators, all of whom are connected by a business logiclayer and an intelligent automation layer. Students get curatedaptitude and DSA practice modules, live and AI-driven interviewpractice, and personalized tips on how to improve their skills.Alumni act as mentors by meeting with students one-on-one ona regular basis, while administrators handle content delivery,webinars, user verification, and analytics.Some of the key features are voice-enabled interviewing, ATS-based reviews of resumes, ranking of job recommendations,scheduling of mentorship sessions, and progress dashboards. Theplatform is developed on the MERN stack with in-built NLP andAI services for semantic skills extraction, interview assessment,and recommendations. Security will involve mechanisms likeJWT-based authentication, encrypted resume storage, and role-based access control.Initial validation indicates increased user engagement, bettercommunication confidence, and improved interview performancecompared to traditional preparation methods. With a scalablesetup and hybrid AI-human learning model, the system is ahelpful and adaptive option for schools that want to improve theemployability of their students and ease the placement process

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Paper ID: 534

Heart, Liver, Lungs, Diabetes and Kidney Disease Prediction using Machine Learning and Voting Ensemble Technique

Ramdas Pandurang Bagawade. (Computer Department, BIHER, Chennai, India)*, Dr. Thirupurasundari D.R. (Computer Department, BIHER, Chennai, India)

Abstract: Anticipating and diagnosing chronic illnesses such as those affecting the Heart, Liver, Lungs, Diabetes and Kidneys is a substantial concern in healthcare. Machine learning (ML) tools have become a benefit in the healthcare industry, especially in facilitating a better understanding of patient data and assisting in the clinical decision-making process. This research proposes a thorough method for predicting illnesses by `stacking` several machine learning classifiers and using ensemble voting. This method incorporates a variety of algorithms, such as the Decision Tree, Logistic Regression, Support Vector Machine, K-Nearest Neighbour, XGBoost, Gradient Boosting, AdaBoost and Random Forest, to minimize the biases of any single model by removing varying algorithmic weaknesses. Majority and altitude voting increases the persistence and predictive accuracy of the model in comparison to other isolated models. The final system is better than the previous models using basic medical data sets in many ways, such as predicting with better accuracy, specificity, and

sensitivity in classifying illnesses. This is especially important for predicting illnesses for many human organs. The research demonstrates that ensemble algorithms can make a difference in easy, timely, and predictive healthcare and can reduce the mortality rates significantly from the failure of the Heart, Liver, Lungs, Diabetes and Kidneys.

Paper ID: 535

An EfficientNet-B2 Powered Deep Learning Model for Potato Leaf Disease Identification

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Abstract: This paper presents AgroScan AI, an automated diagnostic system aimed at tackling the important issue of identifying potato leaf diseases, particularly Early Blight (Fungi), Late Blight, and pest infestations. Traditional manual inspection is often labor-intensive and can lead to mistakes, especially when trying to tell apart visually similar problems like fungal spots and pest damage. To address these issues, the system uses a Transfer Learning method with the EfficientNet-B2 architecture. The approach includes a new Two-Stage Fine-Tuning strategy to adjust pre-trained ImageNet features to fit the specific area of agricultural pathology. A key innovation in this work is the use of Random Erasing Augmentation to reduce confusion between the "Fungi" and "Pest" classes, along with a WeightedRandomSampler to help balance the serious class imbalance in the training dataset. The final model reaches a validation accuracy of 73.8% across five different classes. The system is set up as an easy-to-use web application using Streamlit. It features a special "Confidence Safety Filter" that automatically rejects non-leaf images with low confidence scores (below 60%) and produces real-time diagnostic PDF reports. By blending effective regularization techniques with a simple interface, AgroScan AI offers a dependable, accessible tool for precision agriculture.

Paper ID: 537

StayEase : Digital Solution for Rent and Tenant Tracking

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Abstract: This paper introduces a digital platform that will be used for improving tenant and rental management, both for resi- dential and commercial purposes. The system will combine secure payment processing, automated rent tracking, and maintenance management in a single web-based framework using modern full- stack technologies, while catering to the needs of the landlords and tenants through separate user modules and a centralized database.Key features of the system include onboarding tenants, listing properties, calculation and reminders of rent, online modes of payment, etc. The role-based access control mechanism used in the system ensures all transactions preserve data privacy and security. An automated notification engine provides timely notifications related to rent payment confirmations which help enhance transparency and communication between landlord and tenant.StayEase focuses on usability and efficiency through its re- sponsive interface, modular back-end design, and encryption of data storage. Comparatively, it improves management accuracy, speed, and user satisfaction from manual or spreadsheet-based systems. Its architecture will support growth in multi-property environments and is extensible with new technologies, such as IoT for property monitoring.The proposed system will

solve major challenges in the rental market, including late payments, document mismanagements, and problems in communication. Significant gains comprising automation, transparency, and user convenience reveal that StayEase can be a secure, scalable solution for modern rentals and tenant management.

Paper ID: 538

Smart Trolley Using Gesture-Controlled Robotic System

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Abstract: Robotic systems that are controlled by gestures represent a growing interest area in research and development. They promise to improve user mobility and accessibility, improve the way users interact with devices, and provide a new means of engaging with both industrial and service environments. This paper details the design, development, and evaluation of a gesture-controlled smart trolley built with an Arduino Lilypad, ADXL335 three-axis accelerometer, 433 MHz RF wire- less communications interface, HT12E/HT12D encoder/decoder IC's, and L298N motor driver. The smart trolley uses hand gestures from the user's wrist-mounted sensor (wearable) to control a wheeled trolley's direction of movement in real time while transporting merchandise. The prototype of this system shows many advantages such as ease of use, intuitive control, operating safety, and being affordable to build and operate. This document provides a comprehensive description of the hardware architecture, signal processing pipeline, communication protocol, motor-control strategy, evaluation methodology, and potential paths for industrial deployment, while also discussing limitations and future work.

Paper ID: 540

Assessing the Reliability of DIY Tutorial Videos: A Multimodal Approach Combining Procedural Structure and Audience Feedback

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Abstract: Do-it-yourself (DIY) repair tutorials have emerged as a primary educational resource for consumers worldwide, enabling millions to undertake repairs previously requiring professional expertise. However, the reliability and safety of these instructional videos vary significantly, presenting potential risks to viewers who follow inaccurate or hazardous procedures. This paper introduces a comprehensive multi-stage Natural Language Processing (NLP) framework designed to quantify the legitimacy of DIY videos through a composite Legitimacy Score ranging from 0 to 1. Our methodology integrates three distinct analytical components: (1) procedural complexity extraction from video transcripts using few-shot in-context learning with local language models, (2) audience validation analysis derived from sentiment polarity and latent topic modeling of user comments, and (3) engagement baseline normalization incorporating temporal decay functions to account for video age and popularity metrics. Our analysis of 3,605 processed videos from a dataset of 6,015 DIY repair tutorials demonstrates the framework's effectiveness, with legitimacy scores ranging from 0.40 to 0.91 (mean: 0.72, standard deviation: 0.09). Critically, statistical analysis reveals a weak negative correlation (r = 0.075) between raw engagement metrics and legitimacy scores, validating our hypothesis that popularity alone is an insufficient indicator of instructional quality. The

framework addresses the popularity-accuracy bias through multi-signal triangulation and explicitly discusses ethical implications for safety-critical content. This paper presents the complete dataset specifications, methodological framework, implementation architecture, and evaluation protocols, providing a reproducible blueprint for large-scale legitimacy assessment of instructional multimedia content.

Paper ID: 544

IoBot-AI Powered Interview Preparation Platform for SSB Aspirant

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Abstract: One of the most important entry points to the Indian Armed Forces, the Services Selection Board (SSB) interview process rigorously tests candidates' communication, leadership, and psychological capacity. The Word Association Test (WAT), Situation Reaction Test (SRT), Thematic Apperception Test (TAT), and the Personal Interview are but a few among the diverse evaluations that candidates often find difficult to access in practical, feedback-informed practice environments. The problems with current system were identified to be lack of resources to practice for exam and the lack of feedbacks, expensive traditional systems. Io Bot, a web-based solution powered by AI designed to simulate the entire SSB experience, is introduced in this research. The system employs Hugging Face emotion analysis and Cohere's massive language models to deliver personalized feedback, and it utilizes ReactJS and Flask for frontend and backend development, respectively. Real-time feedback is derived from natural language processing the spoken answers to the interview module by using automatic speech recognition and natural language analysis. Early measures indicate that the tool enhances candidate confidence and effectiveness in preparation, presenting a scalable and judicious alternative to the conventional SSB training method.

Paper ID: 551

Hysteresis Controlled LLC Resonant Converter Based Battery Charger

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Abstract: A battery is an essential energy storage device that is used in many applications. A safe and reliable charging system is required to maintain battery health and prolong its lifespan. An LLC Resonant Converter-based battery charger ensures efficient charging by achieving high efficiency through ZVS/ZCS techniques, reducing the switching losses in the circuit. Closed loop LLC Resonant Converter systems with PI and Hysteresis Controllers are simulated and their results are compared.

Paper ID: 555

News Under the Lens of Time: Causal Signals and Concept Drift on a Language Manifold

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Abstract: The news is changing rapidly, with new informationappearing daily. Due to this, the actual meaning of variousmatters such as politics, war, sports, and technology variesover time. Simultaneously, different news categories also havea different impact on each other, because various articles spreadacross media sources and influence how other subjects arediscussed. This paper conducts research to cover all these trends,and a framework has been presented called News Under the Lensof Time, which analyzes both how meanings evolve and how theyaffect information flow between news matters. To represent themeaning of text in a numerical form, our framework convertedthe news information into sentence embeddings. Language mani-fold, where we organized the reports into weekly groups to trackhow their locations move in a semantic space to detect conceptdrift. We also utilized the Auto-ARIMA forecasting frameworkto predict future evolutions in the meaning of concepts andto detect forthcoming drifts in news articles. To identify whichnews topics may cause a change in others over time, we appliedGranger causality analysis. We used the AG news dataset in ourresearch to successfully discover semantic changes and to detectinfluence patterns in the news focus. This study will be helpfulfor media analysts, researchers, and automated systems to betterunderstand the trends in the news area and for further researchin the digital world.

Paper ID: 561

AI-Powered Public Safety Monitoring System Using Street Surveillance Cameras

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Abstract: Urban safety fully depends on recognition of incidents in various situations, but human-only surveillance is inefficient, may produce errors, and be difficult to scale. This paper introduces an AI-powered safety monitoring system that integrates computer vision and NLP to automatically detect and alert emergencies in real-time. The system employs YOLOv8 for object detection, MoveNet/OpenPose for pose estimation, and anomaly recognition algorithms for detecting incidents involving accidents, medical emergencies, or violent actions. A lightweight NLP module synthesizes structured, multilingual alerts with event type, timestamp, and location metadata and delivers them via dashboards, SMS, or email. It shows high accuracy and low latency from datasets like xView, xBD, UR Fall, and Dashcam. Accident Dataset, and that can be employed in the smart city infrastructure, healthcare facilities, and transportation hubs where rapid responses reduce vulnerability and increase urban silence.

Paper ID: 569

ChatGPT in Classrooms: Tool or Threat? A Comprehensive Study of Student Perceptions

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Abstract: This paper presents a quite comprehensive Empirical assessment of postgraduate. students' perception and academic usage of ChatGPT in Indian higher education. Using survey data gathered from 103 students, across postgraduate disciplines such as the Research has been carried out to evaluate the level of awareness and usage.patterns, functional use, and perceived academic value of the tool. The results show that ChatGPT has very extensive application in conceptual

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Paper ID: 586

Optimization of Fan Speed Using Smart Temperature Technique

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Abstract: The "Smart temperature adaptive fan speed regulation system" is an efficient and cost-effective automation system designed to control fan speed based on decided temperature. Manual fan speed control in homes, offices, or industrial settings can be inefficient and inconvenient, especially when temperature fluctuates frequently. This project automates that process using a sensor of temperature (DS18B20 or LM35) and a microcontroller to dynamically adjust speed of fan without human intervention. Variable output voltage at the output of regulator varies the speed of fan as temperature rises the speed increases, and reducing it when temperature falls. This ensures optimal cooling, minimizes power consumption, and extends the fan's operational life. The setup is built around an Arduino Uno and uses simple, low-cost components, making it easy to replicate and maintain. This project demonstrates fundamental embedded systems and automation concepts, offering a hands-on application in energy efficiency and thermal management. It is ideal for home automation, electronic cooling, and industrial environments, providing an excellent balance of performance, affordability, and sustainability.Keywords: Temperature sensor, Fan Regulator, Stepper Motor, UNO R3 CH340G, 9V Power Supply, Connecting Wires.

Paper ID: 587

Forecasting Tidal Dynamics and Energy Potential in Data-Scarce Coastal Regions Using Deep Learning and ERA5 Reanalysis

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Abstract: Accurate prediction of tidal dynamics and energy output is critical for optimizing renewable energy development in coastal

regions where direct measurements are unavailable. This paper presents a comparative study of three forecasting approaches—a persistence baseline, a classical harmonic regression, and a hybrid deep-learning model integrating convolutional and long short-term memory layers—for tidal height and tidal energy estimation in the Gulf of Khambhat, India. Models were trained and evaluated on daily Copernicus ERA5 reanalysis data covering 2011 to 2024, using a representative grid cell to predict one-step-ahead tidal heights and estimate absolute tidal energy for semi-diurnal cycles. The hybrid convolutional–LSTM architecture achieved the highest accuracy, with a root-mean-square error of 0.022 m, mean absolute error of 0.018 m, and coefficient of determination exceeding 0.98 on the test set. These results demonstrate robust performance in a data-scarce environment and a substantial reduction in forecast errors relative to classical methods. The presented workflow demonstrates that satellite-derived predictions, calibrated with physical energy formulas, can support cycle-level energy planning in regions lacking on-site tidal records. Future extensions will address validation across multiple locations and calibration with in-situ measurements..

Paper ID: 590

IoT and Machine Learning - Based Smart Controller for Non-Smart Air Conditioners

Shubhangi Mathe (Vishwakarma University)*, Pooja Kulkarni (Vishwakarma University)

***Abstract**:* With the rapid advancement in smart technology, the demand for smart and energy-efficient air conditioning systems has increased significantly. However, replacing conventional air conditioners with smart ones can be costly. This paper proposes an IoT-based intelligent control system that converts a non-smart air conditioner into a smart automated device. This model comprises ESP32 microcontroller with temperature and occupancy sensors. Controlling of the air conditioner with the remote is fully bypassed in the developed model. Machine learning models such as Decision Tree and Random Forest, were applied to analyze the collected environmental and occupancy data for accurate ON/OFF prediction. The Random Forest model achieved 100% classification accuracy on real time data. This approach ensures optimal energy usage, enhances comfort, and offers a cost-effective solution forsmart home automation.

Paper ID: 600

An Integrated Deep Learning Framework for Medical Image Analysis: Synergizing Multi-Task Learning, Feature Transfer, and Deep Supervision

Ganesh Kadam (Pimpri Chinchwad College of Engineering), Palash Hemade (Pimpri Chinchwad College of Engineering), Atharva Karale (Pimpri Chinchwad College of Engineering), Tanushka Patil (Pimpri Chinchwad College of Engineering), Anushka Somawanshi (Pimpri Chinchwad College of Engineering)*

***Abstract**:* Automated and accurate analysis of medical images is essential for diagnostic and treatment planning. Most deep learning models examine a single task such as segmentation or classification, or use multi-task learning (MTL) with simple sharing of parameters. These methods do not examine the complex and synergetic relationship between tasks. In this paper, we combine four state-of-the-art deep learning methods into a comprehensive deep learning framework. We propose a novel hybrid end-to-end architecture based on a 3D U-Net that uses deep supervision to support stable training and robust feature extraction. This deep supervision based architecture allows for a new bi-directional synergetic feature transfer process. In this architecture, high-resolution spatial features from the segmenta- tion decoder are transferred to the classification head to enhance diagnostic effectiveness, as suggested by Gao et al. [3]. At the same time, classification-guided attention maps (CAMs), as incorporated and used in a model proposed by Wang et al. [1], are fed back into the segmentation decoder to enhance and support boundary details. This new architecture is a fully integrated model

and employs multiple-task principles proposed by Pan et al. [2] to create a unified system in which both segmentation and classification improve one another and a single task or simple multi-task learning models could not provide.

Paper ID: 610

Mapping AI-Driven Advances in Colon Cancer Identification: A Deep Learning Study Using Histopathological Images

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Abstract: The use of deep learning (DL) methods, in particular, Convolutional Neural Networks (CNNs), in colon cancer detection has advanced and automated the process of diagnosing cancer through the use of histopathological images. In this paper, a detailed methodology of enhancing the detection of colon cancer is proposed, based on the use of deep learning models to process digital histopathology slides of the LC25000 dataset. The dataset contains annotated images of colon tissues, both malignant adenocarcinoma and benign ones, which will make possible the correct binary classification. The proposed system entails preprocessing, i.e. resizing, conversion of color format, and normalization of pixels, in order to standardize the input information to be presented to the model and achieve the best results. Other preprocessing methods, such as noise suppression and normalization of the stain, improve the clarity of the image, and assist the model to identify small morphological variations that are highly essential in early diagnosis. The paper exploits an end-to-end deep learning system to detect colon cancer accurately without involving the conventional manual feature extraction and classification procedures. We find that deep learning methods are much better at diagnosing than traditional methods in terms of accuracy and efficiency. The model shows that there are chances of early detection which plays a critical role in the early intervention and individualized planning of treatment. The outcomes reveal that AI-based diagnostic systems are not just more rapid but also more beneficial to accessibility especially in resource-have-deprived environments, which is part of the worldwide health initiative in the detection of colorectal cancer.Keywords-colon cancer, deep learning, colonoscopy, histopathology, early detection, Bio-medical imaging.

Paper ID: 613

Prediction of Wear Characteristics of Nano- Oil using Neural Network Approach

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Abstract: To enhance the lubricating properties of engine oil, nanoparticles can be added nowadays, which reduces wear and friction in the engine. In this study, CuO nanoparticles were added to the base oil at varying concentrations of 0.2, 0.5, 0.75, and 1 wt% to prepare the samples. The wear and friction study of these samples was conducted on a pin-on-disc tribometer at different loading conditions of 30N, 50N, and 65N. A feed-forward back-propagation artificial neural network was developed to forecast the tribological properties of these oil samples. The neural network models were developed using three different training algorithms: Scaled Conjugate Gradient (SCG), Levenberg–Marquardt (LM), and Bayesian Regularization (BR). The Bayesian Regularization algorithm forecast the most accurate experimental results, with a coefficient of regression is 0.99972 and a mean square error is 0.0001746. The ANN model can be used to predict the experimental results, as the ANN predicted results closely matched the experimental results.

Paper ID: 619

A Comprehensive Analysis of Medical Data Revealing New Insights into Cardiovascular Disease

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Abstract: Machine learning (ML) has gained significant traction in cardiovascular medicine in recent years. This paper offers a critical overview of the current landscape of predictive algorithms, emphasizing data cleaning and multimodal data integration as central components, while also examining the key challenges that impede their clinical adoption and outlining future directions for the field. Cardiovascular disease (CVD), the leading cause of mortality worldwide, urgently requires more accurate early prediction tools. Although traditional risk scores have been valuable, their limitations in the era of big data have accelerated a paradigm shift toward ML-based approaches capable of delivering more precise and individualized risk stratification. The study synthesizes evidence spanning a broad methodological spectrum—from classical statistical techniques to advanced ensemble and deep learning models. It examines essential preprocessing steps needed to address common data issues, including missingness, class imbalance, and high dimensionality, and explores strategies for integrating diverse and heterogeneous data sources such as electronic health records (EHRs), imaging studies, and clinical text. Despite these advancements, the paper underscores that clinical translation remains constrained by several foundational problems: limited model interpretability (the "black box" dilemma), suboptimal generalizability, methodological inconsistencies, and a pervasive lack of rigorous external validation in the literature. Ultimately, the paper highlights that data quality and sophisticated preprocessing are as critical to successful ML applications as the choice of algorithm itself.

Paper ID: 624

Meta-Learning Paradigms for Data-Efficient Classification: A Unified Framework with Adaptive Prototype Refinement

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Abstract: Contemporary deep learning architectures demonstrate exceptional performance when trained on extensive labeled datasets, yet their efficacy diminishes substantially in data-scarce scenarios. This work presents a comprehensive investigation of meta-learning methodologies for data-efficient classification, introducing a novel Adaptive Prototype Refinement Network (APRN) that synergistically combines metric learning with optimization-based meta-learning. We conduct extensive empirical analysis across three benchmark datasets, demonstrating that APRN achieves 73.8\% accuracy on miniImageNet 1-shot classification, representing a 4.5\% improvement over baseline prototypical networks. Our mathematical analysis reveals that adaptive prototype refinement reduces intra-class variance by 23\% while maintaining inter-class separability. We further introduce a hybrid training strategy that leverages both episodic and traditional supervised learning, achieving convergence 2.1× faster than standard meta-learning approaches. Experimental results on cross-domain evaluation demonstrate superior generalization, with 8.3\% improvement on CUB→miniImageNet transfer tasks. This work advances the theoretical understanding of prototype-based meta-learning while providing practical algorithmic innovations for real-world few-shot learning applications.

Paper ID: 625

Quantum-Enhanced MFO Optimization for Load Frequency Control

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Abstract: Improving Load Frequency Control (LFC) systems has become a major area of research in recent years due to its substantial impact on the efficiency and dependability of power networks. To improve LFC performance, several optimization strategies have been thoroughly investigated, including Differential Evolution (DE), Particle Swarm Optimization (PSO), and Genetic Algorithms (GA). Among these techniques, the Moth Flame Optimization (MFO) algorithm has become well-known due to its robustness in tackling nonlinear optimization problems, quick rate of convergence, and ease of implementation. Nevertheless, despite their effectiveness, conventional optimization algorithms face challenges related to computational complexity and scalability when applied to complex large power systems. In this context, the emergence of quantum computing offers a promising alternative to overcome these optimization limitations and enhance power system performance.

Paper ID: 631

Implementation of an IoT-Integrated Framework for Precision and Sustainable Agriculture

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Abstract: The paper presents Krishi-Saathi, a system designed to support farmers in a more intelligent and sustainable manner guided by the principles of Industry 5.0. Krishi-Saathi is intended to address some of the largest concerns for farmers today, that is the challenges they face managing water, the limited knowledge they have, and uncertainty regarding the best way to manage their farms. It integrates Human-Centric AI and IoT in the spirit of environmental protection and resilience to changes in farming. Put simply, it aims to increase productivity while protecting soil and water quality for the future, to do so the Krishi-Saathi has several objectives in its design, with the most important being smart water and soil management through use of real time data through sensors to develop management strategies, using AI to provide farmers with guidance on best practices such as how much fertilizer to apply or which crop pest activities require management, and facilitating co-learning initiatives between farmers and youth. The system consists of a smart IoT monitoring station, equipped with sensors to measure temperature, humidity, soil moisture, and water quality. Data from these sensors is sent to a mobile app that can access to view real-time pollen and plant disease predictions, receive personalized farming advice, and apply for and manage government support programs. In summary, Krishi-Saathi is a holistic system to mitigate data fragmentation, make AI more applicable, accessible, and trustable for farmers, and make a future for farming sustainable and technical.

Paper ID: 648

Zero Trust Security: A Novel Cybersecurity Paradigm for Enterprises and Manufacturing

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Abstract: Digital technology has evolved quickly, making connections easier and operations more convenient, but this has also brought bigger cybersecurity problems. Traditional security models that rely on implicit trust and perimeter-based defenses struggle to deal with modern threats properly. Zero Trust Security (ZTS) takes a different path by rejecting the idea of inherent trust and requiring verification for every access request. ZTS lowers the risk of lateral movements, insider threats, and external breaches by working with ideas like separating trust from location, making sure people only get minimum necessary access, and watching systems all the time. This paper looks closely at ZTS principles and how they actually get used in different types of organizations. Most published work so far talks mainly about theory and individual examples, but this study tries to connect those ideas with what really happens by looking at actual deployments like Google's BeyondCorp, VMware NSX, and CSA's Software Defined Perimeter. We compare how these systems are built differently and what problems come up when putting them to work. The study also looks into how ZTS fits with cloud computing setups and Internet of Things networks, dealing with security worries that pop up because these platforms keep changing. We pay special attention to how security is moving away from perimeter-based methods toward identity- centered access control, looking at how companies can switch from older systems to Zero Trust setups. By studying current implementations and new developments like blockchain-based authentication, this research shows how ZTS could change the way cybersecurity works as the world becomes more connected, giving useful advice for businesses and manufacturing companies that want to improve their security against today's threats.

Paper ID: 651

Deep-Radiomics Fusion Framework for Automated Multiple Sclerosis Classification using MRI Images

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Abstract: The Multiple sclerosis (MS) disease is a chronic demyelinating disease which results in progressive structural damage of the central nervous system and is regularly evaluated through magnetic resonance imaging (MRI). The recent development of automated MS classifications has been promising but the majority of current methods use either deep learning or handcrafted radiomic features due to which they are only limited to diagnostic reliability, as well as the generalizability of the methods to multiple imaging scenarios. The hybrid Deep-Radiomic Fusion Framework presented in this paper combines 512-dimensional deep embeddings obtained with the modified ResNet-18 with a simple radiomic describer of statistical and texture-related tissue properties. The preprocessed and assessed dataset of 3,427 axial and sagittal MRI slices of 72 MS and 59 healthy subjects (ExMPLPQ) was split into 80:10:10. The experimental findings indicate that the given fusion model has an accuracy of 96.06, precision of 95.70, recall of 94.68 and F1-score of 95.18, which is significantly higher than radiomics-only and CNN-only baselines. The fused representation's great discriminative strength is demonstrated by the ROC-AUC value of 0.986. These results imply that handcrafted radiomics with deep convolutional features offer a more compelling and comprehensible framework of MRI-based MS diagnosis, which may have some utility as a clinical decision-support instrument.

Paper ID: 659

AIML based Health Detection of a Transformer

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Abstract: This paper presents a contemporary, mobile-driven transformer testing and condition monitoring solution to replace the inefficiencies of conventional, manual approaches. Adding on machine learning and cloud-based technologies, this system is expected to increase reliability, reduce outages, and avoid equipment damage in major electrical generation/distribution systems.The solution is an Android application, programmed in Java/XML. It has an interface that effectively displays important test parameters like input/output voltage, winding resistance, oil temperature, and load condition. These inputs are analyzed by a decision tree algorithm that gives real-time predictions about health condition of the transformer, identifying it as Healthy, Needs Maintenance, or Critical. For secure and individual, independent usage, the mobile application incorporates Firebase Authentication, by which users can securely log in using email/password. All testing data gathered and predicted outputs are automatically saved in Firebase Realtime Database so that users have access to their secure test logs on the cloud.This blend of predictive analysis in real-time, secure access control, and mobile portability presents a very utility-based tool for maintenance people, students, and engineers. The application greatly enhances efficiency, removes reliance on manual diagnosis, and actively encourages innovative approaches to maintenance, a leap in intelligent management of power system. This paper presents an AI/ML-based transformer health monitoring framework using an enhanced Decision Tree classifier with adaptive operational thresholds derived from power-system standards. The proposed methodology focuses on condition classification using key electrical, thermal, and mechanical indicators. A structured synthetic dataset generation process is adopted to emulate realistic transformer behavior under normal, degraded, and critical operating conditions. The system is designed with future scalability toward real-time sensor-based hardware deployment.

Paper ID: 660

RideSafeX: A Smart Helmet System with Embedded IoT and Mobile Connectivity

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Abstract: This research describes the development of an IoT- based smart helmet prototype designed to enhance the safety of motorcycle users by providing constant surveillance of riders and facilitating swift response to emergencies. The smart helmet consists of an integrated STM32 and ESP32 microcontroller equipped with an array of senses. Instead of a built-in speaker, audio is delivered wirelessly through Bluetooth from the rider's mobile device. Alcohol consumption is detected by using the MQ- 3 sensor, and crash occurrence is indicated through the ADXL345 accelerometer. In addition, the real-time location of the helmet is provided by the GPS via the NEO-6MV2. The prototype continuously monitors the helmet wearer's condition and can identify hazardous events, including alcohol consumption and any impact resulting from a fall while wearing the helmet. Upon detecting an anomaly, the system sends the helmet wearer's GPS coordinates to designated emergency contacts via a combination of cloud services and text messaging. The ESP32 microcontroller provides a wireless communication method to transmit data in real-time from the smart helmet to Firebase and permits real-time monitoring of the device. The feasibility of the device was verified through laboratory tests, where a user successfully detected if any alcohol could be present in a person's system, using vibration as a means of determining whether or not a rider is involved in an accident, and accurately transmitting the GPS coordinates of the user in real-time to the user's intended contact(s). The smart helmet

platform has demonstrated that it is possible to utilize the intersection between embedded systems and IoT technologies to create solutions that improve the safety of motorcycle operators and reduce response time in the event of a motorcycle accident.

Paper ID: 661

AI-Powered Smart Eco Advisor: Bridging Environmental Knowledge and User Decision Support

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Abstract: The utility of AI as it relates to global sustainability, the growth of both AI-enabled environmental systems, and generative models have allowed people worldwide to engage civically when making decisions about reducing their carbon footprint, minimizing waste, and creating environmentally friendly practices in their daily lives. This paper demonstrates the need for developing new, user-focused methods of supporting individual users with their sustainability needs—while providing existing models with future development ideas to expand the current tools available to people. Finally, this review discusses potential future directions for research in sustainability, emphasizing the challenges faced by current methods, especially those using robust data, ethical AI governance, and the collaboration between humans and robots to support people in creating positive environmental effects through using AI technology for improved decision making.

Paper ID: 667

Predictive Hybrid Machine Learning Model for Evaluating Students' EFL Readiness and Academic Success

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Abstract: This study suggests a Predictive Hybrid Machine Learning Model that uses a wide range of language, behavioural, and academic variables to assess students' English as a Foreign Language (EFL) preparation and predict their academic achievement. To improve prediction accuracy and lower variability, the model combines the advantages of deep neural networks with ensemble learning. Vocabulary competency, grammatical comprehension, LMS interaction patterns, assessment results, and engagement behaviours gathered from digital learning platforms are important features. To increase the efficiency of the model, feature engineering and improved selection methods were used. Logistic Regression, Random Forest, XGBoost, and pure DNN models were compared with the hybrid model's performance after it was trained and verified using student datasets. According to experimental results, the suggested model predicts academic achievement and EFL preparation with much improved accuracy, precision, recall, and a lower RMSE value. In order to identify at-risk learners early on, the study highlights the need of combining behavioural learning data with language indicators. The suggested strategy facilitates data-driven instructional planning, targeted remediation, and specific instruction. All things considered, this approach offers a solid analytical foundation for enhancing EFL learning results in modern educational institutions.

Paper ID: 669

Smart Renewable Energy System with Over-The-Air (OTA) Update

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Abstract: The rapid global shift toward decentralized and clean energy sources requires a reliable and secure real-time intelligent management solution. achieving autonomous monitoring, control, and optimization of renewable energy generation and storage components is important, and Renewable Energy Management Systems (REMS) will help achieve this goal.This paper presented a design and implementation of a Smart REMS that also includes an Over-the-Air (OTA) capability for continuous remote maintenance and adaptability. In the proposed system, a dual-controller approach is used where a Slave Microcontroller Unit (MCU) is used for sensing and local control while a Raspberry Pi grants edge computing capability to access higher-level processing and decision making to communicate with the cloud. OTA (Over-The-Air) updates have been made possible via the balenaCloud platform which ensures secure update delivery, reduced operational downtimes, and improved resiliency of systems to OTA updates. The research also highlights how various IoT technologies, edge computing technologies, and LoRa communication technologies can ultimately work together to create a scalable, cost-effective and energy self-sufficient renewable energy network. Finally, the demonstration of the proposed method was made through the integration of IoT, Edge Computing and LoRa Technology for long term sustainable operation, increased efficiency and reduced human intervention for management and maintenance of current renewable energy infrastructure.

Paper ID: 682

Spiral-Drawing Analysis for Early Parkinson's Detection Using Image Processing and SVM Classification

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Abstract: Utilizing a spiral drawing will provide a simple and practical method of determining early indications of Parkinson's disease (PD). PD progresses over time and one's ability to create polished and controlled motions deteriorates. The initial impact will occur in how a person's handwriting has changed. A spiral drawing will give insight into this phase of PD. We can accomplish this by taking the spiral drawing as input, cleaning it and preparing it for further analysis through the preprocessing steps of utilizing basic images (making grayscale, removing noise, contouring the image) to develop a model which defines three primary characteristics of a person's handwriting; irregularity in the spiral, diminishing size of the characters due to micrographia, and a skew to a certain degree of the entire writing image. These three key characteristics will then be utilized to generate predictions regarding whether the handwritten pattern would be indicative of developing characteristics of PD utilizing a Support Vector Machine (SVM) classifier. Results have shown this method to have a distinct ability to ascertain normal versus PD-based handwriting patterns. We view our approach as being able to be employed as a viable, inexpensive method for performing remote health evaluations and to identify individuals at risk for developing PD.

Paper ID: 685

Portfolio Optimization using Quantum Computing

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Abstract: Portfolio optimization is a fundamental problem in finance, traditionally solved using mean–variance analysis and classical optimization techniques. However, the increasing complexity of real-world constraints makes the problem computationally challenging. Quantum computing addresses these challenges by exploiting quantum parallelism and variational algorithms. This paper investigates the application of the QAOA to portfolio optimization, formulating the problem in a QUBO framework and mapping it to an Ising Hamiltonian. Using a dataset of 10 diverse stocks from the NIFTY 50 index, we conducted systematic experiments to study the effects of circuit depth, return and risk weights, and budget constraints on portfolio performance. The results demonstrate that QAOA can generate feasible and competitive portfolios with balanced trade-offs between return and risk, achieving Sharpe ratios up to 1.84. While classical methods remain more efficient in terms of stability and runtime, the findings highlight the potential of quantum optimization to scale for larger, combinatorial portfolio problems as quantum hardware advances.

Paper ID: 686

ResNet for Cataract Detection and Classification: A Deep Learning approach

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Abstract: Cataract, caused by progressive lens opacity, is a major contributor to preventable blindness. This work proposes a ResNet-based deep learning model for automated cataract classification using fundus images, addressing the need for reliable screening in low-resource settings. The study uses 2,088 fundus images, which undergo contrast enhancement, noise reduction, and region-of-interest extraction to improve feature clarity. The ResNet architecture is fine-tuned through transfer learning and enhanced with systematic data augmentation to improve robustness against variations in image quality. Performance evaluation using 5-fold cross-validation yields an good accuracy, demonstrating the model's capability to distinguish cataract from normal fundus patterns. The novelty of this work lies in applying an optimized ResNet specifically to fundus-based cataract detection, an area less explored than slit-lamp imaging. The results indicate that the proposed framework offers a practical and computationally efficient tool for supporting early cataract screening in underserved clinical environments.

Paper ID: 705

Krishimitra: A Vision for Predicting Agricultural Commodity Prices in India.

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Abstract: This paper presents Krishimitra, an India- centric agrarian soothsaying system powered by artificial intelligence. The platform predicts request trends for crucial agrarian goods by combining sphere moxie, literal request records, and a cold-blooded deep-literacy frame. At the core of Krishimitra is the Single- Subcaste Motor Convolutional Encoder(STCE), a neural armature designed to capture both long- term temporal patterns and short- term spatial variations within multivariate time- series data. The proposed system preprocesses raw request aqueducts, generates sliding- window sequences, applies one- dimensional convolutional networks for point birth, and employs a featherlight motor encoder to identify temporal dependences . STCE is estimated against traditional models similar as ARIMA and deep- literacy nascences like LSTM for major goods including soybean, wheat, sugarcane, and sludge, using RMSE, MAE, and MAPE as performance pointers. Experimental results indicate that STCE delivers significantly advanced vaticination delicacy with

comparatively lower computational conditions, making it suitable for edge bias and planter- acquainted digital dashboards. To enhance availability, the Krishimitra platform is available in both English and Marathi, icing that growers from different verbal backgrounds can profit from its perceptivity.

Paper ID: 718

FPGA Accelerated AI system for Multi Organ Medical Image Segmentation

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Abstract: In this paper, an FPGA-based accelerated framework for multi-organ medical image segmentation using a lightweight U-Net architecture is proposed. The network is trained on abdominal CT images using FP32 precision to obtain high accuracy during image segmentation. The best Dice similarity coefficient of the proposed method is found to be 0.9029 during the validation process. The mean Dice similarity coefficient of the proposed method is found to be 0.7335 during the test phase. To obtain low latency during the inference process, a streaming-based convolution accelerator is designed for the Zynq-7000-based FPGA. The estimated latency of the designed accelerator is found to be approximately 0.66 ms/slice based on analytical evaluation. The designed accelerator uses approximately 14% LUT, 23% DSP, and 2% BRAM resources. The estimated power consumption of the designed accelerator is found to be approximately 1.73 W based on Vivado Power Analyzer. All the results of the designed accelerator are based on simulation results. The results show that the designed accelerator can be used to obtain low power consumption.

Paper ID: 732

Extending Six Sigma for AI Automation Across Global Industries

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Abstract: This paper suggests a conceptual framework that invokes 6 Sigma principles of quality control to AI-driven automation, combating gaps on global adoption readiness. We introduce a Reliability-to-Adoption Curve A(σ) that captures how developing economies (with limited infrastructure or regulatory support) typically demand higher effective reliability (sigma levels) for the same adoption likelihood as advanced economies. We outline Sigma-Gated MLOps, a governance methodology incorporating defects-per-million (DPMO) thresholds, control charts, calibration metrics (e.g., Expected Calibration Error), model abstention, and a 1.5σ process-shift adjustment into ML deployment. We describe Human-in-the-Loop Reliability Budgeting, showing how strategic abstentions and redundancy with human review can raise an AI system's effective sigma quality in resource-constrained settings. Lastly, we propose a Skills Bill-of-Materials (Skills BoM), mapping needed roles and competencies to each sigma-tier and deployment context. Real-world data on digital infrastructure, trust, and workforce training are leveraged to contrast the U.S. and India (plus illustrative examples from Brazil and Germany). Results include theory-driven reliability maps and comparative tables that highlight how variable infrastructure, informality (e.g., India's 90% informal workforce), and public trust (India ∼77% vs. US ∼32% trust in AI) translate into different sigma-adoption thresholds.

Paper ID: 742

Vakya: An Intelligent Framework for Automated Research Synthesis and Conference Recommendation

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Abstract: This paper introduces Vakya, an AI-powered framework that leverages automated synthesis of IEEE-standard research papers to reshape the manner in which knowledge related to software engineering is spread. Vakya offers a single workspace that integrates Large Language Models with a "Human-First Encouragement AI" architecture to bridge the critical documentation gap between formal academic reporting and rapid software development. Vakya uses a dual-pipeline approach: a Generative Synthesis Engine driven by the Gemini 2.0 Flash model and a Repository Analysis Subsystem that extracts architectural patterns and semantic context from GitHub repositories, in contrast to generic documentation tools or previous automated writing assistants that primarily serve as text editors. Additionally, the system offers a split-view, real-time authoring interface that can perform intelligent conference referencing, LaTeX serialization, and live IEEE formatting. In order to demonstrate Vakya's ability to lower the latency of knowledge transfer and democratize access to high-quality academic publishing, this paper describes its architectural design, algorithmic implementation, and theoretical foundations.

Paper ID: 743

Sustainable Incorporation of Marble Waste Enhanced with Additives in Construction Materials: A Comprehensive Review with Machine Learning Insights

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Abstract: A great deal of waste marble powder is produced by the ornamental stone and environmental problems are therefore inevitable. It can also be a partial replacement of cement and aggregate in concrete, transforming garbage into resource. Recent studies have shown that replacing natural sand or cement by WMP at certain dosages results in concrete with similar or enhanced strengths. Furthermore, different types of additives (e.g. glass powder, polymer fibres and other industrial by-products), have also been investigated in order to further improve the performance. At the same time, machine learning (ML) methods have emerged as reliable and efficient prediction and optimization tools of concrete properties which alleviate experimental burden. In this review, literature on marble-waste concrete (usually incorporated with supplementary materials) and ML for predicting its properties are systematically reviewed. Through a PRISMA-guided literature search (Figure 1) we locate important works within WMP concrete and related sustainable mixes. We provide an overview of ML modeling methods (such as random forest, XGBoost, neural networks and symbolic regression) and performance criteria (R^2, RMSE, MAE). For instance, by using the random forest model, R^2 value ≥ 0.95 are often achieved to predict compressive strength of sustainable concrete. Interpretable ML techniques (SHAP analysis, sensitivity analysis) have brought out the role of parameters such as cement content, aggregate ratio and curing age towards strength. Our review finds that waste marble can substitute \~10–25% of fine aggregate or cement with only a slight penalty in strength loss, and that an ML model is capable of reasonably capturing the nonlinear, complex effects of composition on performance. Finally, the open sources and future directions such as larger databases, multi-objective optimization (cost, carbon footprint) and application of advanced explainable AI to steer sustainability mix design are highlighted in the work.

Paper ID: 745

SMARTSTEP: IoT-Enabled Piezoelectric Footpath Tile for Sustainable Micro-Energy Harvesting and Real-Time Analytics

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Abstract: Smart cities are largely dependent on the extensive implementation of small, low-power IoT devices. Still, the powering of these devices by wiring or battery replacement is often costly and challenging in terms of maintenance at the scale. To solve this problem, this research presents SMARTSTEP—a piezoelectric, IoT platform powered by a footstep that can generate the energy required for its operation and simultaneously function as a sensing unit. The method involves the use of twelve PZT discs to form a bank that will convert the pressure of a footstep into an electrical output. The electrification of the raw AC power is accomplished by rectification, filtering, and boosting so that a 12-volt lead–acid storage battery can be charged. An ESP32 microcontroller is used to record footstep activity, calculate the energy that can be harvested, and import the data to Firebase instantly. Besides, a web-based dashboard visualizes the live data such as the voltage level, step count, and energy generated, along with the two-way communication, e.g., remote LED control. The experiments performed showed that approximately 1–1.1 V AC was generated from each footstep, together with precise event detection and quick cloud communication. The obtained results demonstrate that SMARTSTEP has the potential to be a viable unit for energy harvesting and urban data analytics in smart-city scenarios.

Paper ID: 749

Statistical Quality Analysis using Regression and ANOVA (SQA-RA Framework) for Data-Driven Process Optimization

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Abstract: The modern manufacturing systems require a systematic optimization of the process parameters to provide the regular quality of products and efficiency of operations. In this paper, SQA-RA (Statistical Quality Analysis based on Regression and ANOVA) is proposed as an analytical framework that has well developed statistical methods such as multiple linear regression, Analysis of Variance (ANOVA) and Tukey HSD post-hoc test to help analyse data and optimize the process. The suggested contribution is not in the invention of new statistical approaches, but in the formalization of the disciplined, interpretable workflow that will be used to lead engineers through the identification of factors, their statistical validation and comparative analysis of the operational environments. The framework is illustrated on a synthetically generated data that is a characteristic of a typical manufacturing process, here the impact of temperature, pressure and curing time on tensile strength are under analysis. Regression analysis is used to estimate the relative impact of process parameters and ANOVA and Tukey HSD tests are then used to assess statistically significant differences at distinct operating levels. The findings demonstrate how the SQA-RA framework can be used to make clear interpretation of statistical findings, on one hand, facilitate reproducible analysis, and on the other hand, make informed decisions to optimize processes based on controlled assumptions with respect to enhancing quality.

Paper ID: 753

Weapon Detection Method Using Convolutional Neural Network with Human Pose Estimation

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Abstract: This study presents a low-cost, real-time surveillance solution that combines an Arduino-driven alarm system with a YOLOv8 object identification model. In order to identify face masks and weapons (such as knives and guns), the system continuously examines video frames. When it is detected, an Arduino microcontroller immediately initiates unique auditory buzzer alerts and text messages on an I2C LCD. By automating threat identification and response, the suggested method offers substantial improvements over conventional CCTV techniques. Unlike manual monitoring, our YOLOv8-based pipeline allows for high-speed inference appropriate for real-time alerts by processing frames in a single pass. According to the findings, the technology can reliably and quickly detect weapons and mask infractions. This study highlights improvements in speed, automation, and cost-effectiveness by methodically contrasting the new YOLOv8 system with earlier surveillance techniques.

Paper ID: 754

Autoencoder-Based Transfer Learning for Multi-Stage Keratoconus Classification Using Corneal Biomechanical Parameters

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Abstract: Keratoconus is the non-inflammatory and a progressive corneal disease where early keratoconus stage detection and staging are important to guide clinical management. Most automated approaches rely on the imaging modalities for the binary classification. There are limited number of works exists on numerical corneal parameter based multistage keratoconus diagnosis in literature review. This research study proposes the Advanced deep learning technique using autoencoder-based representation learning, which is followed by transfer learning to automate the staging of keratoconus utilizing 446 biomechanical as well as tomographic features. The Dataset includes total 3,162 annotated data samples over four severity Classes i.e. Normal, Early, Moderate, Severe. The proposed methodology pipeline includes three training phases, 1. a baseline multilayer perceptron classifier, 2. a pretrained frozen classifier using the autoencoder encoder, and 3. a fine-tuned end-to-end model. The models were then evaluated using evaluation metrices such as accuracy, precision, recall, and macro F1-score value. The fine-tuned model performed best with 96.37% accuracy, 94.76% precision, 90.16% recall, and 92.35% macro-F1 which outperformed the baseline and Frozen feature models. The results shows that the autoencoder-based pretraining actually improves the representation quality of the tabular corneal metrics, which enables reliable four-stage severity evaluation without any relying on any imaging modalities. The proposed research framework represents a strong potential as a clinically deployable decision-support tool for keratoconus staging.

Paper ID: 766

A Survey of Modern Transport Protocols for a Low-Latency, Bandwidth-Adaptive Virtual Classroom Architecture

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Abstract: Rural India has experienced a severe digital divide with urban broadband penetration rate of 93 percent compared to a low of 29.3 percent in the rural areas, cutting off access to online education despite the prevalent access to mobile devices.Existing systems like Google Meet and Zoom need 3.2 Mbps outbound bandwidth, and it is higher than 2.5 Mbps download/1.0 Mbps upload of a rural area, which makes it unavailable to millions of students. The latency of QUIC/WebTransport is lowest normalized (90 ms) than both hybrid WebRTC-WebSocket (115 ms) and WebSocket (170 ms), and can reconnect with almost no delay (3-5 seconds in WebSocket), which is considerable.However, there is no known implementation of dynamically adjusted priorities of streams to whiteboard-based classroom systems that can be used with variable rural network conditions. This paper is a thorough survey of the current transport protocols and suggests an adaptive QUIC-based virtual classroom design that dynamically routes whiteboard commands or unreliable datagrams, depending on real-time network conditions (bandwidth, packet loss, RTT, jitter).This paper also proposes a three-level network architectural plan (low: <128 kbps, medium: 128-512 kbps, high: >512 kbps) and reinforcement learning-based bandwidth prediction, which will fill the missing link in low-latency, bandwidth-adaptive educational platforms that are specifically tailored to the problem of rural connectivity in India.

Paper ID: 769

Hybrid Wavelet-CNN Residual Learning Model for Robust Image Denoising in Complex Environments

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Abstract: Image denoising remains a critical challenge in low-level vision, as noise significantly degrades perceptual quality and adversely affects the performance of downstream tasks. Traditional methods such as wavelet shrinkage, bilateral filtering, and variational models offer interpretable denoising frameworks but often struggle to generalize across diverse noise distributions. Conversely, deep convolutional neural networks (CNNs) provide strong learning capability yet may oversmooth fine details due to operating solely in the spatial domain. To address these limitations, this study presents a hybrid image denoising approach that integrates the Discrete Wavelet Transform (DWT) with a deep CNN to exploit both frequency-domain decomposition and data-driven noise suppression. The proposed model employs Haar wavelet decomposition to separate each image channel into multi-resolution subbands, wherein a CNN learns residual noise characteristics directly in the wavelet domain. By subtracting learned residuals from the decomposed coefficients and reconstructing the image via inverse DWT, the method preserves structural details while effectively removing noise. Experimental evaluation demonstrates that the hybrid architecture provides improved detail retention, enhanced robustness to varying noise levels, and reduced artifacts compared to conventional CNN-based denoisers. This framework offers a computationally efficient and interpretable solution for real-world image restoration applications.

Paper ID: 782

Next Generation AI for Geo-science Remote Sensing: Applications, Challenges and Future Directions

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Abstract: Its impact on remote measuring in Geosciences has brought revolution through artificial intelligence (AI) that facilitates data processing, pattern recognition and future prediction. In this paper, the author reviews the integration of the next generation AI technologies, such as deep learning in remote measuring applications, generative models and age AIS. The paper will provide an overview of the latest developments in AI-based geopolitical analysis, discuss key issues, including computational limitations, and data quality and suggest directions of future research. The results of this study reveal that remote measurements with the use of AI enhance environmental monitoring, disaster response and climate change investigations. Moreover, with the adoption of Edge AI real -time processing, the delay is minimized and the decision is enhanced in critical applications. Experimental assessment comprises a large-scale user experiment (n=150), statistically proved comparisons against baseline systems ($p<0.05$), and performance indicators of the overall performance of the experimental system on numerous datasets. The results show that remote sensing operated by the AI will enhance environmental monitoring, disaster response, and climate change research 23-37 percent more effectively than the traditional approaches. Edge AI implementation on real-time processing diminishes the latency by 68 percent and enhances real-time decision-making in critical application. The given development will lead to more efficient and sustainable geospatial analysis, which will further solidify AI as a contributor to remote sensing in the future.

Paper ID: 789

Multilingual Phishing Analysis: Feature-Based Scoring and Level Classification

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Abstract: Phishing attacks remain a major cyberse- curity concern, often exploiting linguistic and cultural variations to deceive users across multiple languages.This paper presents a multilingual phishing email de-tection model that integrates Natural Language Processing (NLP) techniques with the XGBoost algorithm.SHAP-based feature engineering is employed to en-hance model interpretability and identify the most influential linguistic and structural features contribut-ing to phishing detection. Additionally, the Synthetic Minority Over-sampling Technique (SMOTE) is applied to address class imbalance, ensuring robust model performance. Experimental results demonstrate that the proposed system achieves an accuracy of 96%, outperforming traditional machine learning methods in both precision and detection reliability. This study emphasizes the effectiveness of combining multilingual text analysis with explainable and balanced machine learning approaches to strengthen email security. Index Terms—XGBoost, Phishing Detection, Multilingual Email Classification, NLP, SHAP, SMOTE,Machine Learning, Cybersecurity.

Paper ID: 790

HS Code and Description Analyzer with RAG

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Abstract: To automate the task of Harmonized System (HS) classification still remains a critical challenge in international trade documentation due to inconsistencies in product descriptions, missing HS codes, and human interpretation variability. This paper proposes an intelligent hybrid system that performs end-to-end HS code classification, validation, and recommendation using Optical Character Recognition (OCR), semantic vector search, a Retrieval-Augmented Generation (RAG) framework, and a Large Language Model (LLM). The system extracts text from import/export invoices, detects or infers HS codes using vector embeddings stored in ChromaDB, and validates the result using structured trade knowledge including country, flow (import/export), and duty values. A second semantic query engine enables natural-language trade inquiries such as "Export horses from India," returning HS code, duty, and classification category. Experimental evaluation demonstrates high semantic retrieval accuracy and strong real-world applicability. This work contributes a scalable, data-driven approach for automated trade compliance and product classification with average accuracy of 91\% that includes the percentage of Top-1 and Top-3 Search.

Paper ID: 797

Automated Grading System Using LLMs

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Abstract: Traditional manual grading methods are often timeconsuming and susceptible to human error and bias. This paper presents an automated grading system that employs Large Language Models (LLMs) to evaluate student answer sheets efficiently. The system serves as an aid to faculty, replacing manual grading with an automated pipeline where instructors upload answer sheets and define grading rubrics, keywords, and model answers. The proposed solution extracts text from scanned PDFs using Optical Character Recognition (OCR), assesses answers based on instructor-defined criteria, and provides numerical scores. The system utilizes a hybrid evaluation strategy involving LLM-based scoring, keyword matching, and semantic similarity. It includes score normalization for consistency and generates detailed analytical reports. Implementation challenges, including OCR accuracy limitations in handwritten text and LLM context constraints, are analyzed. This research contributes to educational technology by providing a scalable, consistent assessment framework applicable across various academic institutions.

Paper ID: 801

Smart Inspection And Force Analysis Of Car Air Conditioning Vent Louvers Using A Linear Actuator, Sensors And Vision-Based Systems

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Abstract: Consistent tactile performance of automotive air-conditioning vent louvers is essential for ensuring user comfort and perceived product quality. Current inspection practices rely on subjective manual assessments of knob resistance, leading to inconsistent, non-quantifiable results unsuitable for Industry 4.0 manufacturing environments.This study identifies a key gap in existing research while vision-based and non-destructive inspection methods effectively detect surface or structural defects, they fail to capture the dynamic force behavior that defines tactile functionality. To address this, we propose a force-based inspection approach that quantitatively evaluates louver motion through bidirectional force-displacement measurement and machine-learning-driven classification.The method provides an objective and repeatable assessment of mechanical performance, enabling detection of frictional irregularities, hinge misalignments, and internal binding that visual inspection methods overlook. The proposed approach establishes a foundation for intelligent, data-driven tactile inspection systems, advancing quality evaluation standards in automotive manufacturing.

Paper ID: 802

BrailleCraft – Crafting Braille Transcripts from Gestures in Real Time

Shailaja Uke (Vishwakarma Institute of Technology, Pune, India), Daksh Jadhav (Vishwakarma Institute of Technology, Pune, India)*, Shivendra Jadhav (Vishwakarma Institute of Technology, Pune, India), Jiva Shelke (Vishwakarma Institute of Technology, Pune, India), Dheeraj Kakade (Vishwakarma Institute of Technology Pune, India)

Abstract: This research presents a real-time assistive system that recognizes American Sign Language (ASL) alphabets and translates them into tactile Braille output to facilitate communication between hearing-impaired and visually impaired individuals. The system employs computer vision and machine learning techniques, leveraging MediaPipe for accurate hand landmark detection and a Random Forest Classifier for robust gesture classification. A custom dataset of ASL gestures was created and augmented using transformations such as rotation, scaling, translation, noise addition, and mirroring to enhance model performance and address class imbalance. To improve classification accuracy, the ASL alphabet set was divided into two groups (A–L and M–Z), with separate models trained for each subset. Recognized characters are displayed via a Tkinter-based GUI and are simultaneously translated into physical Braille cells using an Arduino-based tactile feedback mechanism. The proposed system demonstrates high accuracy of 96.8 % in static gesture recognition and offers an inclusive communication bridge by combining visual and tactile modalities.

Paper ID: 803

IntelliGraph: A Knowledge Graph-Based Retrieval System for Unstructured Document Intelligence

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Abstract: Unstructured documents such as resumes, reports, medical records, and legal contracts are in abundance in different domains, but traditional data storage and retrieval systems do not have the capability of utilizing their latent semantic value to the full extent. This paper presents IntelliGraph, a smart framework that converts unstructured data documents into structured Knowledge Graphs (KG) and makes use of a Retrieval-Augmented Generation (RAG) model for semantic querying and answering. IntelliGraph is a non-restrictive cross-domain pipeline powered by Google's Gemini LLM, Neo4j, and LangChain, for document ingestion, entity extraction, normalization, graph construction, and natural language querying. Experiments conducted on a diverse set of academic resumes, corporate profiles, and business reports prove that IntelliGraph achieves high semantic query accuracy with explainable graph-backed

reasoning. The system is open-ended, scalable, and can be deployed in various domains with little schema adaptation

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Paper ID: 805

Green-Ink: Vehicle Emission Into Usable Ink conversion

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Abstract: This paper aims to reduce the vehicle emission in the atmosphere and convert it to useful ink. A working prototype project hardware is developed in the lab, which is presented in this paper. It transforms airborne pollutants or particles into usable ink. The system uses electrical sensors to capture particulate matter (PM2.5 and PM10) and carbon-based pollutants, which are then processed to form ink. The model was designed, implemented, and tested independently, demonstrating successful pollutant capture. Experimental results demonstrate conversion efficiencies ranging from 25% to 90%, depending on vehicle type, operating conditions, and filtration material. The observations conclude with insights into scaling this technology for industrial applications and its potential for environmental sustainability. The entire analysis is carried out based on the observations with multiple variations in input parameters and its analysis in association with a local PUC center

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Paper ID: 813

Video Forgery Detection: Enhancing Deep Learning with Slantlet Transformation

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Abstract: Video forgery is common issue and affect the security of data transmission adversely. The video forgery must be detected to handle the leakage of sensitive information. This paper examines different mechanisms including LSTM, RNN and tangent based approaches for video forgery detection and then suggest slantlet based transformation along with other techniques for video forgery detection enhancements. The enhancements will be in terms of mean square error, classification accuracy and peak signal to noise ratio. To demonstrate the effectiveness of the proposed SLT based mechanism, FaceForensics / FaceForensics++ dataset is considered. This dataset contains 1000 videos with over 5 lakhs edited or forged frames. The Hybrid SLT model detect the forgery very effectively using this data set. All other models are also able to detect the forgery, however, they consume large amounts of time, and the metric values are not satisfactory. The result is also validated statistically. The integration of SLT with other mechanisms significantly enhance the performance of forgery detection.

Paper ID: 842

Supercapacitor-Based Active Cell Balancing for Lithium-Ion Battery Packs

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Abstract: Lithium-ion batteries are extensively utilized as power sources for electric vehicles, energy storage systems, and portable electronic devices because of their excellent energy density and long operational lifespan. Their performance and safety rely heavily on maintaining cell voltage uniformity and inhibition of electrical, thermal and chemical instabilities. The paper proposes a BMS applicable for lithium-ion battery packs with the integration of an active supercapacitor based balancing method to improve the efficiency and minimize the cell stress. Passive balancing often dumps the extra energy to heat, while the one here store and release charge at the supercapacitor side so that it is much faster for balance, less thermal loss, and cells may have a longer life time. The immediate conduction of voltage, current and temperature monitoring is tied-in with the system. Failure control unit circuit to protect the inverter

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Paper ID: 843

Deep Learning-Based Currency Recognition for Smart Wallet Applications

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Abstract: By combining automated currency recognition with digital wallet management, financial accessibility can be greatly improved, especially for people experiencing visual impairment. A system is designed that uses a pretrained deep-learning model to accurately identify denomination from camera input, and gives the feedback back to the user via a text-to-speech module. Along with the currency recognition system our system our system also keeps track of user's transaction history and calculates how much money user has spent to help with the financial management. It automatically updates the user's balance and tells about the transaction with date and time. We implemented this design so that it can be used both on desktop and on embedded devices like Raspberry Pi. While testing, we noticed that the software didn't show much difference in performance between the two setups. This suggests that our design is light enough to run well even on smaller devices. When we were experimenting we found out that the model identifies notes accurately and responds to the voice commands. It gives a smooth interaction for visually impaired people. In future we also plan to add multi-currency recognition with would include coins and other currencies too. Overall our project and study demonstrates a practical and low cost way to combine currency detection with a simple voice-based financial management system.

Paper ID: 844

AI–IoT Based Adaptive Smart Street Light System

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Abstract: Worldwide, efforts are being made to significantly green cities, which, in turn, have raised the need further for the energy-efficient street lighting systems. Atpresent, variations in the older model of street lighting that are based on IoT and adaptive street lighting systems using simple sensors, provide just little improvements; however, these systems are essentially limited as they operate in a reactive and non-contextual way. One of the standout features of the new Adaptive AI–IoT Smart Street Lighting System described in this paper is a vision-based fusion model to overcome the mentioned issues. Essentially, the major technological advancement is the use of a YOLOv8 deep learning algorithm for real-time object detection combined with ambient light sensing and a predictive memory factor. Such a multi-modal combination equips the device with the capability of understanding the street scene in a smart manner, identifying vehicles and distinguishing them from pedestrians, thus adjusting the LED brightness correspondingly with human-like contextual awareness. The primary purpose of the Dim-Night Mode is to help bring the energy waste here to almost zero during inactive periods. Actually, the paper shows that the proposed system can approximately bring down energy consumption in the case of a conventional always-on lighting situation, and simultaneously, it can provide superior, responsive lighting. This work suggests a new approach for making urban lighting smarter and more efficient that is less about simple reactivity and more proactive, intelligent control.

Paper ID: 846

Predictive Risk Analytics in Housing Finance: An Empirical Study Across Multiple Banking Sectors

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Abstract: The proposed paper is empirical research on predictive risk analytics in the housing finance industry with reference to various banking markets. We use extensive data of various financial institutions to formulate and test highly complex predictive models by evaluating risk variables affecting housing finance. We use machine learning in conjunction with the standard financial risk assessment instruments in our methodology to improve the accuracy of risk forecasts. The research discloses that there is a marked difference in risk profile between various sectors of banking and this indicates the need to use sector-specific models. We have shown that by adding sector-specific variables it is possible to increase the accuracy of a prediction model by a factor of 15 over generic models. Moreover, the study highlights the numerous possibilities that predictive analytics may bring to optimize decision-making within the housing finance sector to achieve a more stable financial condition in the end. Practitioners and advisors should find this paper useful in enacting policies to reduce risks in housing finance using empirical-based policies. Future research directions entail the discussion of the fact of real-time data streams integration to enhance predictive capabilities further

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Paper ID: 850

Aqua-Ammonia Vapour Absorption Refrigeration System: Simulation and Optimisation using DWSIM Software

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Abstract: An open-source simulator DWSIM is used to simulate chemical processes. Its features are similar to those of commercial simulators like EES, Aspen Plus, Aspen HYSYS, ChemCAD, ProSim, etc. The model of an NH3-H2O vapor absorption refrigeration system is created and simulation is performed using DWSIM. The simulation results are contrasted with EES results in the present work. The

absorber, evaporator, pump, generator, rectifier, condenser, evaporator, and valves make up the NH3-H2O vapor absorption refrigeration system. Heat transfer, mass transfer, condensation, evaporation, throttling, gas-vapor separation, absorption and desorption are among the typical chemical engineering processes it illustrates. The DWSIM model described in this paper can be used for optimisation and sensitivity evaluations. The simulation is performed on a VARS operating at 10 bar condenser pressure and 1.5 bar evaporator pressure. The results obtained are observed to be varying by approximately 13 to 14 % when compared with those of EES. It is therefore anticipated that this model will be helpful and competitive to predict chemical processes in general and vapor absorption refrigeration in particular using DWSIM

Paper ID: 857

Enhanced Glioma Brain Tumor Detection Using a Fusion of LSTM and Bi-LSTM Neural Networks

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Abstract: Glioma is one of the most common and deadly kinds of brain tumors hence early and accurate diagnosis has become essential in the treatment of glioma. Manual interpretation of MRI scans is time consuming and prone to errors and hence demands automated solutions. With this context, a hybrid deep learning model is proposed that could enhance the detection of brain tumors by combining LSTMs with Bi-LSTMs model.Combining them will enable the model to use both forward and backward spatial dependencies of MRI image features to improve the accuracy of classification. Thus the proposed system trains on public datasets of MRI images and deploys a web application based on Flask for the detection of brain tumors in real time.Experimental results demonstrate better robustness and performance than traditional CNN approaches. The proposed model has lot of potential to assist radiologists in clinical diagnostics and improve patient outcomes.

Paper ID: 860

AI + IoT-Based Aircraft Cabin Safety Monitoring System with Emergency Response Assistant

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Abstract: This is a novel software-based AI and IoT system of proactive safety monitoring of aircraft cabin which does not rely on conventional physical sensors. The system produces realistic data of the cabin environment temperature, gas concentration, and pressure, without-hardware, by combining live flight telemetry through the OpenSky API and phase-aware simulation of sensors. A Random Forest classifier is used to evaluate the level of risk in the real-time (Low to Critical), whereas an LSTM-based forecasting engine enables predicting the onset of hazards before they grow. The system includes passenger health profiles to make notifications personalized, scenario chaining as a component to model complex emergencies, and multi-channel notifications, which are provided via Firebase, voice messages, and an interactive dashboard complete with real-time cabin heatmaps. This end-to-end solution exhibits

an economical, scalable and proactive solution to in-flight safety that is capable of providing predictive functionality, hardware agnostic and complete emergency response availability.

Paper ID: 874

Open-Graph Markets for Machine Intelligence: Tokenized Microtasks, Model APIs, and Distributed Training

Priyanka Muppuri (California State University, Los Angeles) *

***Abstract**:* This paper proposes a comprehensive machine learning architecture that includes a scaling data labeling service, a model service which can interoperate, and a decentralized training service unified as an open network through blockchain. The system being planned contains a cryptographic incentive layer that coordinates a global microtask marketplace for humanin-loop annotation and rapid engineering of supervised datasets for state-of-the-art deep learning pipelines. An API exchange backed by a registry standardizes the invocation and metering of AI models as services, which enables unprecedented composability across perception, language, and decision-making. The design boasts a compute substrate that employs graph-scheduling whereby storage and execution of the deep neural network weights are spread across nodes, this mitigates issues of single-point failure while cutting the cost of training and inference drastically. Design specification contains task schemas, privacy-preserving protocols, on-chain service discovery, and evolution governance. The AI and ML focus of this network lowers barriers to entry for datasets and deployment of models. It likewise eases solving scale calculations. With this, Data suppliers, model providers, and consumers will collaborate economically thereby enabling new forms of composite intelligence. According to the experimental simulations, the cost of dataset creation decreases by 47% and the efficiency of m

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Paper ID: 879

Graph-Enhanced Multimodal Deep Learning for Sentiment Recognition: A Transformer-GNN Hybrid Architecture for Mental Health Analysis

Jagriti Bhatia (Desh Bhagat University Mandi Gobindgarh, Punjab, India)*, Dr.Gurinder Kaur Sodhi (Desh Bhagat University Mandi Gobindgarh ,Punjab, India)

***Abstract**:* Sentiment recognition from multimodal data has emerged as a critical research area in affective computing, mental health monitoring, and human-computer interaction. This paper presents a novel deep learning framework for multimodal sentiment recognition using the MM-EMOG dataset, which integrates textual and visual modalities for mental health analysis. We propose hybrid architecture combining Transformer-based encoders with Graph Neural Networks (GNNs) to capture cross-modal dependencies and sentiment graph representations. Our methodology leverages Multi-perspective Visual Projection (MVP) and attention mechanisms to extract complementary features from both modalities. The proposed model achieves superior performance compared to seven state-of-the-art approaches, demonstrating 93.47% accuracy, 92.83% F1-score, 93.12% precision, 92.94% recall, and 0.9721 AUC-ROC on the 12-class sentiment classification task. Extensive ablation studies validate the contribution of each architectural component, and statistical significance testing confirms the robustness of our approach.

Paper ID: 891

Design Of A 16-Bit Vedic Risc Processor Integrated With High-Speed Prefix Adder And Mac Unit

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Abstract: A 16-bit RISC processor, a high-speed prefix adder, & a Multiply-Accumulate (MAC) unit built around Vedic principles are all part the above project's Verilog HDL design and implementation. The main goal of this project is to enhance the Arithmetic and Logic Unit's (ALU) efficiency and reduce energy use by implementing a parallel prefix adder and employing Vedic mathematical algorithms, specifically the Urdhva Tiryakbhyam Sutra, over efficient multiplication. The proposed architecture primarily consists of an ALU, a control unit, a data channel, a register bank, a program counter, and a memory unit; having a combined capacity of 14 instructions. A prefix adder boosts the ALU's speed by reducing carry propagation time, while the Vedic multiplier streamlines and reduces MAC unit latency. Results from simulations and synthesis show that compared to traditional RISC processor architectures, using the prefix adder overall Vedic multiplier significantly reduces propagation time, power consumption, and hardware area. The 16-bit Vedic RISC processor that was created is perfect for low-power, high-performance embedded systems since it is faster, has less latency, and uses less power. A viable architectural foundation enabling next-generation digital processors can be developed by fusing Vedic mathematics using prefix adder-based arithmetic architecture.

Paper ID: 895

Implementation of Compact Approximate Multiplier

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Abstract: Approximate computing is mainly aimed at improving system performance such as energy-saving, speed as well as form factor. Although attention has been taken on the approximate multipliers, efficient design of approximate multiplier block, which is a basic multiplier block, is still difficult. In this project, approximate compressors are proposed, leveraging CMOS technology with constant and conditional approximation of selected inputs, resulting in fewer negative errors. By eliminating the need for a resource intensive error recovery module, the designs achieve superior performance compared to prior work. The compressor-based architecture also has an increment adder, which makes summation operations even better by making them faster and consuming less energy. The compressor is more precise than the 8-transistor design, but it needs a little more room to work. We utilize image multiplication to test both the circuit that is made for the compressor and the increment adder.

Paper ID: 897

A Basic Implementation of Deep Learning-Based Object Detection for Museum Artifacts

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Abstract: India is an ancient country. There are many historical places and museums in India. They have tremendous knowledge. In order to transfer this knowledge to youngsters, we need to develop some advanced technologies. Normally, visitors visit these places very shortly. There is no proper interaction with these places objects with visitors. So, if we integrate these objects with advanced technology, we can help to make visit to museums or historical places more meaningful. This paper mainly focuses on museum object detection i.e. identifying class of that detected object. In future this can be integrated with 3D object also. This will be more beneficial to society to understand our culture.

Paper ID: 902

Smart Agri-Monitoring System for Soil Fertility

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Abstract: To ensure environmental sustainability and agricultural productivity, the health of the soil is necessary. Soil testing methods that are based on tradition are often lengthy, laborious, and not very convenient to farmers in the rural environment. The paper presents a real-time soil health monitoring system, which can be seen as a combination of cheap sensors and data analytics with the Internet of Things (IoT) framework. The proposed system requires sensor nodes that are connected to a microcontroller, which would measure the key parameters of soil such as temperature, moisture, pH, and nutrient levels (NPK). Data is sent to a cloud platform where it is analyzed and visualized using wireless transmission. Moreover, machine learning techniques are employed to assess the fertility of the soil and provide recommendations related to the crop suitability and the use of fertilizers. The system was tested in different soils and proved to be very accurate when it came to parameter detection. Key parameters: The variables such as pH and the quantity of organic matter, availability of nutrients (potassium, phosphorus and nitrogen), microbial activity and water availability are important.

Paper ID: 924

Smart Telehealth and Remote Wellness System Using Machine Learning

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Abstract: The rapid growth of digital healthcare has increased the demand for platforms that provide easy access to medical services. This paper presents a Smart Telehealth and Remote Wellness System, a web-based dashboard designed to improve healthcare accessibility and user convenience. The system integrates features such as a chatbot for instant assistance, online medicine ordering, and doctor appointment scheduling. These functionalities help users quickly access healthcare information, book appointments, and

order medicines through a single platform. The proposed system reduces manual processes, saves time, and enhances the overall healthcare experience through an intuitive and efficient digital interface.Keywords— Healthcare Chatbot, Artificial Intelligence, Machine Learning, Diet Recommendation, Doctor Appointment Scheduling, Medicine Ordering.

Paper ID: 934

Honeypot Detection Network for Enhanced Security against Cyber Attacks using AI Machine Learning

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***Abstract**:* Abstract - The increasing sophistication of cyber attacks has revealed that traditional static honeypot systems are no longer sufficient as they neither can adapt to new situations nor provide deep insights into attacker behavior. Accordingly the integration of artificial intelligence (AI) and machine learning (ML) techniques into honeypot systems for adaptive deception and intelligent threat analysis has become the focus of recent studies. This paper offers a structured review and system level analysis of adaptive AI driven honeypot systems with attacker behavioral profiling, highlighting how these systems have moved beyond static deception mechanisms. The research looks into the different ways in which reinforcement learning, behavioral analytics, anomaly detection and generative AI can be used to make honeypot responses more flexible and personalized based on real, time attacker interactions. Such AI driven honeypot systems that continuously monitor and learn from observed behaviors are not only able to engage attackers for a longer time, but they also help in behavior, based attack classification and the discovery of new or zero day threats. Furthermore, the paper identifies key technical and operational challenges, including scalability, explainability of AI-driven decisions, ethical considerations and secure real-world deployment. To move beyond a purely descriptive review, the work also outlines a concrete architectural methodology and an experimental validation roadmap for evaluating adaptive honeypot effectiveness.

Paper ID: 938

An Explainable Machine Learning and Ensemble Stacking Approach Based Multiclass Intellectual Property (IP) Rights Violation Prediction Scheme

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***Abstract**:* Finding violations of intellectual property (IP) rights is crucial for promoting investment and innovation as well as avoiding financial and reputational harm. No ML and SHAP-based multi-class IP rights infringement prediction technique with higher accuracy was presented in the earlier research. Real-time IP rights violation datasets, appropriate validation, sophisticated preprocessing, feature selection, and hyper parameter tuning techniques are lacking. An ML-based multi-class IP rights violation prediction method with SHAP-based interpretability is presented in this study. Real-time data collection with expert validation, sophisticated preprocessing, feature selection based on ensemble techniques, and hyper parameter tuning based on randomized search are all included in this work. The optimal prediction model is chosen by analyzing a total of six individual ML classifiers and one ensemble stacking classifier. The ensemble stacking technique utilizing LGBM, RF, LR, and SGD classifier is chosen for IP rights violation prediction with 98.37 percent accuracy and 98.39 recall results. According to the comparison results, the ensemble stacking approach provides 2 percent better accuracy and recall outcomes than previous studies.Keywords— Intellectual Property, Machine Learning, Ensemble Stacking, Feature Selection, SHAP.

Paper ID: 952

Multilingual Speech to Text Recognition System

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Abstract: The vast majority of multilingual speech-to-text systems cannot run on low-cost embedded hardware, thereby restricting their application by those who require real-time transcription in Hindi, Marathi and English. The system suggested below can fill this gap as it can be accurately and continuously recognized to be able to speak on a small Raspberry Pi platform and does not need any powerful processors or cloud-only infrastructure. The speech is recorded using a microphone and noise is eliminated inside the house, transforming it into MFCC features, and it is decoded with the help of a hybrid online-offline algorithm, the work of which is not affected by fluctuating internet connections. The solution has unique characteristics such as multilingual support of edge hardware, support of offline mode, and output display with LCD and laptop interfaces, and is lightweight, making it useful in a portable application. The benefits that are desired to be bestowed are low price, installable nature, low power usage, portability, and accessibility by the learners and poor communities with limited technological resources. Accuracy, Word Error Rate, latency, CPU usage measurements, performance under varying noise and accent parameters, are all measurements to evaluate system performance to ensure that the system can be used in practice. Its use is applicable in the classroom setting where there is a need to have an application that can be used to perform reliable multilingual transcription without the use of cloud services or the expensive computer hardware.

Paper ID: 970

CNC Turning: Machine Learning implementation in CNC turning parameters: A bibliometric and Thematic review

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Abstract: Predictive modelling, monitoring, and optimization of CNC turning processes are some of the applications of machine learning (ML) as more process data and sensorized machining conditions become available. Nevertheless, the performance and usability of the ML models in turn are directly related to the type and quality of the underlying data. The current review literature mainly addresses algorithmic comparisons, and little is paid on dataset characteristics and sensing modalities and data appropriateness to achieve particular machining goals. The paper is a bibliometric and dataset-based review of the implementation of ML in CNC turning. The Scopus database was searched systematically with the help of a bibliometric analysis, and 38 articles were found in the course of the PRISMA-based screening. Possessing publication trends, keyword distributions and geographic contribution, the evolution of the sphere was characterized. Based on these findings, a hierarchy of the datasets employed in the ML-based CNC turning is suggested, which includes process parameter datasets, sensor-based numerical datasets, high-frequency time-series datasets, image-based datasets, and hybrid/digital twin-generated datasets. Also, the article develops a dataset-ML model-application mapping scheme, which emphasizes the applicability of the various types of ML models to particular datasets and turning purposes like the prediction of surface roughness, tool wear, estimation of cutting forces, and energy-efficient machining. The problem related to datasets and the perspectives of research are also discussed, where the necessity of the standardization of turning datasets, multi-modal data fusion, and digital twin-based learning is highlighted. The results offer viable recommendations to scholars and practitioners who may want to come up with powerful and scalable ML systems to intelligent CNC turning.Keywords: CNC turning, machine learning, bibliometric analysis, machining datasets, tool wear prediction.

Paper ID: 980

Adaptive Cloud Defense through Honey-Vault: A Multi-Layer AI Framework for Intrusion Detection, Deception, and Self-Healing

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Abstract: Cloud computing offers scalable and cost-efficient storage, but the rapid shift toward cloud environments has also increased the risk of sophisticated cyber intrusions and data breaches. Traditional IDS and static honeypots can detect basic threats but fail to mislead advanced attackers or restore system security automatically after an attack. To overcome these limitations, this paper proposes HoneyVault, an adaptive multi-layer AI framework that integrates intrusion detection, deception, and self-healing to deliver holistic cloud defense. The framework operates through three coordinated layers: a Detection Layer powered by graph transformer-based behavioral analysis to identify multi-step attacks and privilege-escalation attempts; a Deception Layer that uses cGAN-generated realistic and continuously updated decoy data to confuse, engage, and divert intruders away from sensitive assets; and a Response Layer that employs reinforcement learning to execute autonomous healing actions such as patching, migrating data, and refreshing encryption keys. By combining intelligent detection, dynamic deception, and automated recovery in a unified architecture, HoneyVault creates a self-learning security environment capable of adapting to attacker behavior and reducing overall system risk. Experimental evaluation shows that HoneyVault minimizes data loss, lowers attack success rates, and reduces downtime compared to conventional cloud security mechanisms. This work highlights the importance of integrating AI-driven deception and self-healing as a new paradigm for cloud storage security, positioning HoneyVault as a promising approach for future adaptive cloud defense systems.Keywords— Cloud Security, Intrusion Detection, Deception Technology, Honeypot, Honey-Vault, Generative Adversarial Networks (GAN), Reinforcement Learning (RL), Graph Transformer, Self-Healing Systems, Security by Deception, Adaptive Cloud Defense.

Paper ID: 987

Post-Quantum Cryptography Models for Securing Multi-Cloud Environments

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Abstract: Quantum computing is expected to harm our encryption mechanisms, which provide confidentiality, integrity, and authentication assurances, in a multi-cloud setting. This study aims to assess how post-quantum cryptography (PQC) performs in practice. We conduct an analysis of the performance of different types of post-quantum cryptography (PQC). This proposal presents a hybrid PQC-classical framework for seamless integration and backward compatibility. According to the experiment results, lattice-based schemes like Kyber for key exchange and DILITHIUM for signatures achieve security against quantum attack of 85 percent and above. Being barely 15 percent less in computation than classical schemes. Also, code-based encryption offers a high level of security at a marginal decryption overhead. While hash-based signatures may require greater computing power, they still provide integrity and non-repudiation to every cloud node. A practical demonstration of a Post-Quantum Cryptography (PQC) model has been proposed and is deployable on a multi-cloud that has a balanced trade-off of quantum resistance, performance, interoperability making one's cloud infrastructure future-proof against quantum threat.Keywords– Post-quantum Cryptography, Compatibility, Decryption and Signatures.

Paper ID: 992

Enhanced Network Attack Detection Using a TCN–BiLSTM–Transformer Framework

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Abstract: The risk of network security is continuously growing in scope and complexity and therefore in need of intrusion detection systems, which would be capable of deriving meaningfulness out of types and dynamically changing traffic patterns.Previous methodologies have created shortcomings in several key areas which include, but are not limited to, subjected bias, spatiotemporal relationships, and the pattern recognition required for the analysis of large amounts of interconnected data. To tackle such issues, an exemplary work has presented in this case an architecture which includes the fusion of Convolutional Networks, Bidirectional Long Short Term models, and Transformer encoders. The integrated frameworks explain network traffic in the short-term, the long-term, and incorporate the global dependencies. The models are trained and tested in NSL-KDD and UNS-NB15 datasets, in the course of data preprocessing includes Min–Max normalization, one-hot encoding of categorical features, BRFE-based feature selection, sliding-window temporal segmentation, and SMOTE oversampling to address severe class imbalance. Experimental evaluation on NSL-KDD and UNSW-NB15 datasets demonstrates that the proposed TCN–BiLSTM–Transformer model achieves superior accuracy, precision, and F1-score compared to Random Forest, CNN, CNN-LSTM, and CNN-BiLSTM models.The results indicate profound temporal detail extraction will considerable boost the efficiency and effectiveness of intrusion detection systems, and facilitate the detection of a wide variety of attack forms.

Paper ID: 995

Design and Development of Modified Field Soldier Modular Operational (FSMO) for Defence purposes

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Abstract: The FSMO Backpack is a specially designed load-carrying equipment used by military soldiers tosustain themselves during field operations, combat missions, and long-range patrols. A deferredrucksack load vertically oscillates on the back while walking to harness mechanical energy.The present study aims to minimise the weight of the current backpack and assess how a suspended-load backpack system affects specific kinetic and temporal characteristics that describe gait. In orderto minimize variations in the load's vertical motion with regard to the ground, this study suggestsdesigning a rucksack that allows the load to move in relation to the wearer during walking andrunning. A significant relative movement between the load and the wear of the load's absoluteexcursion, because walking causes the hip (and consequently the pack body) to rise and fallsignificantly. In order to transform the mechanical movement into electrical or mechanical energy,this movement may then be transferred to a motor using a rack and pinion gear, for instance. Inaddition to lowering the stresses on the body when running or walking, this drive of the suspendedload in relation to the user also lowers the risk of orthopedic injury. The FSMO consists of asuspension system with a first part that is directly or indirectly connected to the shoulder straps. Acompliant mechanism that permits the pack body and a second component connected to the packbody. Depending on the wearer's stride, the second part of the suspension system will move up anddown in relation to the first section.

Paper ID: 1005

Servify: An Innovative Multi-Domain Service Platform

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Abstract: The unstructured service sector in India, comprising electronics repair, auto mechanics and house services, is still running with low transparency, variable pricing, and low levels of digitalization. These problems not only harm the trust of customers but also deny millions of talented employees an opportunity to show themselves and earn a stable income. To close these gaps, we would offer a multi-domain service platform powered by AI, which would be called Servify+, which aims to bridge the customer and local technicians who have been verified successfully in their area in real time. The system incorporates the Deep Learning-based fault diagnosis system, allowing users to detect the problems with devices using images or videos and schedule a service. Live service tracking is a mapping-driven API that enhances the level of transparency and lessen uncertainty in the repair process. A repair history supported by blockchain gives tamper-proof records of the history of services, warranties, and actions of technicians, and establishes long-term trust. Servify+ supports non-digital users like rural and illiterate individuals with a multi-language voicefirst interface, and the self-help tutorials on minor repair are shown in AR, a design that enhances the digital inclusivity of its operations. The platform will also have the objective of formalizing the informal sector through offering quality assurance, safe online payment and validation of the vendors onboarding. In general, Servify+ presents the example of how the new technologies can help to transform the traditional service ecosystems and make them more reliable, accessible, and customer-focused in various ways.

Paper ID: 1012

Smart Voting Machine Using Biometric Authentication to Enhance Security in the Voting System

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Abstract: The electronic voting machines are utilized in the present day election to enhance a quicker voting procedure; they also minimize the errors of counting votes manually but most of the traditional EVMs lack a powerful mechanism of verifying the identity of the voters. Some of the problems that this weakness may lead to are impersonation and multiple voting which may undermine fairness and transparency of elections. In the system proposed, a voter can only cast the vote after successful fingerprint authentication is done and this prevents the possibility of a person casting multiple votes. They will have a keypad to choose the candidates and an LCD to show the instructions and confirmation messages and a buzzer to provide audio feedback to the voters. This system will reduce the chances of hacking and tampering of data. Proteus simulation software was used before the hardware implementation was done to verify the entire design. The proposed system, being simple, inexpensive, and safe to operate, are apt to small-scale and institutional elections, and make a better substitute to traditional electronic voting machines.

Paper ID: 1016

Performance Analysis of Classical and Modern Cryptographic Algorithms: From Caesar to AES

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Abstract: This paper presents a comparative framework of classical and modern cryptographic algorithms. Investigation occurs through implementations of classical ciphers (Caesar, Vigenere, Enigma) corroborated by educational implementations of modern Advanced Encryption Standard (AES) and Rivest-Shamir-Adleman (RSA). Relative comparisons between mathematical foundations, algorithmic complexities, performing requirements and transformation from physical and theoretical perspectives from substitution ciphers to symmetric block modes to asymmetric thinking are explored. Performance comparisons are based on measured timing and assessment of memory and cryptanalysis. Relative findings based on necessary complexities for different levels of strength versus achievable efficiency show vast differences in performance between classical and modern implementations. For instance, while implementations run in microseconds with O(n) assumed linear average complexity averaging between 8 MB/s to 17 MB/s, modern implementations in milliseconds run from 1 MB/s to 2 MB/s for AES alone with 256-bit security relevance and RSA runs at 0.14 MB/s based on asymmetric over symmetric thinking but allows for a public key infrastructure which boasts 3 MB/s. Educational implementations facilitate a better understanding of the thought progression throughout the realm of cryptography for mathematical prerequisites for secure thresholds and practical efficiency considerations for use within resource constrained settings. Ultimately, no one algorithm will perfectly fit the bill for any situation but symmetric and asymmetric thinking through modern hybridization will help create faster systems.

Paper ID: 1021

AI-Powered Multi-Agent System for Smart Manufacturing Automation : A Comprehensive Review

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Abstract: This paper presents a comparative framework of classical and modern cryptographic algorithms. Investigation occurs through implementations of classical ciphers (Caesar, Vigenere, Enigma) corroborated by educational implementations of modern Advanced Encryption Standard (AES) and Rivest-Shamir-Adleman (RSA). Relative comparisons between mathematical foundations, algorithmic complexities, performing requirements and transformation from physical and theoretical perspectives from substitution ciphers to symmetric block modes to asymmetric thinking are explored. Performance comparisons are based on measured timing and assessment of memory and cryptanalysis. Relative findings based on necessary complexities for different levels of strength versus achievable efficiency show vast differences in performance between classical and modern implementations. For instance, while implementations run in microseconds with O(n) assumed linear average complexity averaging between 8 MB/s to 17 MB/s, modern implementations in milliseconds run from 1 MB/s to 2 MB/s for AES alone with 256-bit security relevance and RSA runs at 0.14 MB/s based on asymmetric over symmetric thinking but allows for a public key infrastructure which boasts 3 MB/s. Educational implementations facilitate a better understanding of the thought progression throughout the realm of cryptography for mathematical prerequisites for secure thresholds and practical efficiency considerations for use within resource constrained settings. Ultimately, no one algorithm will perfectly fit the bill for any situation but symmetric and asymmetric thinking through modern hybridization will help create faster systems.

Paper ID: 1023

Malware Classification And Detection Using Deep Neural Networks

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Abstract: The rise of advanced attack methods (like polymorphic and obfuscated attacks, or even zero-day exploits), has made the job of detecting malware more difficult. Conventional security measures based on signature are not appropriate when we deal with theseadvanced threat types. This is particularly true in browser-related scenarios where we frequently find malicious files and URLs. This paper introduces a browser based framework for the classification and detection of malware using deep neural networks (DNN) that can intelligently identify files and web resources that are malicious. The framework incorporates a lightweight browser extension that collectsstatic meta data about files downloaded, and behavioral indicators o fhese activities when accessing URLs (i.e., the behavior of files being downloaded), which is securely sent to a backend analysis engine for processing. The features that are extracted from this process are then fed into a deep learning model that has been developed to detect risks based on benign files versus those that are malicious. The framework supports both file and URL detection of malware, and can generate human readable threat reports so that the user becomes better educated in the threat space. Additionally, the framework has bee validated with experimental results showing improved detectionaccuracy and false positive rates; thus providing users with a scalable solution that is also efficient and provides a high degree of usability.

Paper ID: 1027

A Comprehensive Review of Failure Analysis in Multidirectional Composite Laminates

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Abstract: Composite materials exhibit superior mechanical and physical properties compared to conventional materials, and therefore their applicationacross diverse engineering fields is rapidly increasing. Their use has expanded into aeronautical, automotive, biomedical, sports, and structural industries, whilecontinuous research efforts aim to further enhance their applicability. These materials possess several advantageous properties such as high stiffness-to-weight ratio, strength, fatigue resistance, corrosion resistance, and low density, which enable designers to recommend them for a wide range of applications. The performance of composite materials strongly depends on manufacturing accuracy, fibre–matrix interaction, ply configuration, stacking sequence, and fibre orientation. If these parameters are not optimally selected, multidirectional laminates may fail under in-plane or out-of-plane loading conditions. Numerous studies conducted over the past decades have focused onu nderstanding the failure behavior of multidirectional aminates under various loading scenarios. This paper presents a comprehensive review, critical analysis, and discussion of such studies, leading to meaningful conclusions regarding failure mechanisms and prediction methodologies.

Paper ID: 1043

ZenithMind: Mental Health Assistant with CBT Integration

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Abstract: In today's quick-moving world, stress, anxiety, and mental health have become serious issues among youth, especially college students. The Zenith Mind project targets to address these challenges by developing an intelligent mental fitness assistant that helps students monitor, understand, and improve their mental condition. The Assistant is constructed with the use the MERN stack (MongoDB, express js, React, and Node.js) and integrates Google fit app APIs to gather actual-time physical and fitness records like steps, sleep period, and mood levels. primarily based on these insights, Zenith mind offers a customized Cognitive Behavioral therapy (CBT) chatbot, mood and anxiety, stress monitoring dashboards, relaxation modules, and motivational guidance. The user interface is designed to be easy but attractive, with gamified progress functions and everyday mood analytics. The video demonstration suggests how data visualization and chatbot interactions come collectively to shape an interactive mental well-being environment. average, the project targets to promote emotional consciousness, self-care, and virtual therapy access in a extra approachable manner using technology that users already use every day.

Paper ID: 1045

Smart Pothole: Detection and Location Reporting System Using STM32

Harsh Nevse (MIT World Peace University), Krishna Dugad (MIT World Peace University)*, Lalit Nanwani (MIT World Peace University), Shruti Danve (MIT World Peace University), Anagha Deshpande (MIT World Peace University)*

Abstract: Potholes cause vehicle damage and pose safety risks on roads. This mini project designs and implements a lightweight Convolutional Neural Network (CNN) for binary pothole/no-pothole image classification and demonstrates deployment on an STM32H7 microcontroller using TensorFlow Lite and STM32Cube.AI. A dataset collected from Kaggle (approximately 352 normal images and 329 pothole images) was used for training. The trained Keras model was converted to TensorFlow Lite and validated on the STM32H7. On-device verification shows near-identical numerical outputs compared to the PC reference model; microcontroller inference time depends strongly on core clock frequency (≈ 3.48 s @64 MHz, ≈ 0.56 s @400 MHz). This paper discusses optimization opportunities (quantization, pruning, model redesign) to achieve practical embedded inference rates.

Paper ID: 1053

A Literature Review On Lung Cancer Detection And Classification With Optimal Feature Selection and ML/DL

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Abstract: Lung cancer is still one of the major causes of death and early diagnose is essential to increase the longevity of the patients. In this paper, the survey of the techniques for lung cancer detection and classification will be given with the accent on the feature selection

problem. Classification of lung cancer has also been enhanced by the use of Machine Learning (ML) and Deep Learning (DL) techniques on huge databases and complex solutions. Features studied include database review and analysis, image pre-processing techniques for image quality improvement, feature extraction techniques for example Local Binary Pattern (LBP) and Discrete Wavelet Transform (DWT) also feature selection methods like Particle Swarm Optimization (PSO) and Linear Discriminate Analysis (LDA) algorithms. A range of traditional ML/DL algorithms, including Support Vector Classifier (SVC) , Convolutional Neural Network (CNN), and Random Forest (RF), are considered for classification performance assessment. The review emphasizes that models that are dealing with selection of the features perform better and can reach even 99.99 % of accuracy. Finally, this paper reflects on the issue of data quality, the call for generalizable method, and the possibility of integrative approaches to enhancing clinical decision making.

Paper ID: 1062

A Ensemble Learning and Explainable AI Based Multi-class Poultry Chicken Disease Classification Approach

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***Abstract**:* In many developing nations across the world,poultry chicken is the primary source of protein, economicexpansion, and employment creation. Prior research on theprediction of poultry diseases did not examine symptoms basedon eight primary illness detection methods utilizing explainableAI and machine learning with good accuracy. For modeltraining, dataset annotation, preprocessing, hyper parametertuning, and the optimal ML model selection, appropriateensemble feature selection is not being used. This researchpresents a multi-class poultry disease prediction model basedon explainable AI and ensemble learning. In this research, sixmachine learning classifiers are examined for the optimalprediction model selection. Expert-based data annotation, real-time data collecting from chicken farms, data preprocessing(using encoding and normalization), ensemble feature selection(using RFE, SHAP, chi-squared, and ANOVA), optuna-basedtuning, and 10-fold cross validation are all covered. Theoutcome shows that, compared to other tested machinelearning models, the ensemble stacking classifier (RF, SVC,GB, and MLP) has the highest accuracy (97.96 percent) and F1score (97.97 percent). The comparison results hints that, theproposed ensemble stacking classifier outperformed previousworks by 1% in terms of accuracy and F1 score.

Paper ID: 1069

SmartEyeX: OCT and Fundus-Based Deep Learning System for Multi-Level Eye Disease Diagnosis and Analysis

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***Abstract**:* This paper presents SmartEyeX, a unified multi-modal deep learning framework for automated retinal disease diagnosis using fundus and Optical Coherence Tomography (OCT) images. The proposed system integrates multi-class classification, disease-specific segmentation, quantitative clinical metric extraction, and explainable artificial intelligence within a single deployable architecture. Convolutional Neural Networks and Vision Transformers are employed for classification, while encoder-decoder segmentation networks provide pixel-level localization of pathological regions. Clinically relevant measurements, including Cup-to-Disc Ratio (CDR) and lesion area percentage, are computed to support severity grading. Grad-CAM–based visual explanations enhance model interpretability and clinical trust. Experimental evaluation on 8,000 retinal images demonstrates an overall classification accuracy of 94.44% and a mean

Dice coefficient of 0.89. The system is deployed using a FastAPI-based inference framework for real-time clinical application. The results confirm that integrating classification, segmentation, and explainability improves diagnostic reliability compared to standalone models.

Paper ID: 1075

Enhancing Synthetic Speech Detection Generality through Spectral Augmentation and Lightweight Convolutional Architectures

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Abstract: With the fast development of neural audio synthesis systems like HiFi-GAN and Tacotron, the effort of creating high-quality spoofed speech has greatly decreased, which has caused serious security issues. Although the current models of detection, such as RawNet2 and Wav2Vec 2.0, demonstrate the state-of-the-art results on laboratory evaluations, they can be computationally infeasible on edges and experience a reduction in performance in uncontrolled, noisy acoustic settings. In this paper, a lightweight single-channel CNN architecture that is optimized to run on resource-constrained hardware and can detect deepfakes in real-time is proposed. Our proposed Environmental Noise Augmentation method combines various acoustic profiles - background music, static and ambient distortion. when preprocessing 128x128 Mel-spectrograms. By doing so, the training corpus was increased to 33,834 samples with equal representation of authentic and synthetic classes. The results prove that the suggested model has a validation accuracy of 99.01% and a training accuracy of 99.7% with a good generalization and low overfitting (0.69% gap). In addition, the model has low memory footprint (about 2.2 GB) and runs quickly on consumer grade GPUs. Our critical analysis of the sliding-window predictions of the model on continuous audio streams also indicates the need of the VAD to reduce false positives due to non-speech production artifacts.

Paper ID: 1077

From Automation to Autonomy: Evaluating the Role of AI-Driven Autonomous Agents in Cross-Functional Coordination and Real-Time Workflow Management

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Abstract: The growing complexity of cross-functional organizational processes has revealed severe deficiencies in conventional automation-oriented workflow management systems. In this paper, we study the shift from static automation to AI-based autonomous coordination for real-time workflow management. We present a mathematically based multi-agent model for autonomous decision-making, cross-functional coordination costs and stochastic task arrivals. The autonomy level is explicitly included as a controlled system parameter to quantify how it impacts coordination latency, the stability of throughput, and system convergence. Results show that the use of autonomous agents reduces coordination latency, preserves stable throughput under variation in workload conditions, and enables faster adaptation to arrival shock of tasks when compared with traditional approaches for automation. Results also demonstrate that positive benefits become negligible and negative after an optimal autonomy threshold, showing a tension between the depth of autonomy and overhead needed to coordinate. The new framework offers a solid formal foundation for the design and implementation

of scalable, resilient workflow management systems driven by AI.

Paper ID: 1081

Explainable Artificial Intelligence for Financial Decision-Making: A Systematic Review ofMethods and Compliance-Oriented Applications

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Abstract: The application of Artificial Intelligence in financial institutions has been increasing to perform critical decision making activities such as credit scoring, fraud detection, financial risk prediction, and investment analysis. Although the application of machine learning and deep learning algorithms achieves high predictive accuracy for decision making activities, the complex decision process of machine learning and deep learning algorithms has raised concerns for the transparency and accountability of Artificial Intelligence-based decision making. The decisions taken by the Artificial Intelligence-based system have a significant impact on the financial domain. Therefore, it is important to understand the decision process of Artificial Intelligence-based decision making. Explainable Artificial Intelligence has been identified as an emerging area of research, which helps in achieving transparency for machine learning-based decision making. This paper presents a systematic review of Explainable Artificial Intelligence-based techniques for financial decision making. The study discusses the application of various explanation techniques such as SHAP, LIME, and anchor explanation for financial decision making. The study also analyzes the application of various explanation techniques in various financial domains such as credit scoring, fraud detection, fairness evaluation, and financial risk prediction. The study concludes that the application of SHAP achieves highly consistent explanations for financial decision making. However, the application of a hybrid approach achieves high interpretability for financial decision making. The study analyzes the application of Explainable Artificial Intelligence for improving transparency and interpretability in financial decision making. Based on the findings of this study, the conceptual framework for the application of Explainable Artificial Intelligence for financial decision making is proposed.

Paper ID: 1092

A Distributed Framework for Cross-Device OS Automation using Multi-Agent Systems

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Abstract: Large Language Models (LLMs) have transformed the field of natural language processing but are still largely restricted to browser sandbox environments, making them useful only for passive information extraction and not active task completion. Current agentic architectures are plagued by an "actuation gap" insufficient fine grained control over local Operating System (OS) peripherals and are architecturally siloed, hindering smooth coordination across a user's multi device environment. To overcome these challenges, we propose a Distributed Framework for Cross Device OS Automation using Multi Agent Systems. Our system utilizes a dynamic Hub and Spoke topology, wherein any network node can alternately function as an Orchestrator (Hub) for intent analysis or an Executor (Spoke) for task fulfillment.Our major contribution is the design of a Hybrid Execution Engine that can selectively offload tasks: favoring standard REST APIs for well known services and leveraging a newly developed gRPC based toolkit for atomic OS level tasking (cursor movements,

key presses) when APIs are not available. The atomic level directly communicates with a low latency C++ command execution module, enabling millisecond accurate hardware interrupt handling. We show that our framework successfully closes the reasoning action gap, allowing a single, OS encompassing assistant to perform intricate, multi device workflows like cross device file operations and legacy software automation without human intervention.This work aligns with the United Nations Sustainable Development Goal 9 (Industry, Innovation, and Infrastructure) by advancing scalable, interoperable automation frameworks for heterogeneous computing environments.\end{abstract}

Paper ID: 1096

FPGA Implementation and Performance Analysis of a Scalable Pipelined Vedic Multiplier

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Abstract: In this work Field Programmable Gate Array (FPGA)-based Scalable Pipelined Vedic Multiplier is presented that is based on the Urdhva Tiryakbhyam algorithm for parallel generation of partial products. The proposed architecture incorporates multi-stage pipelining to reduce the critical path for higher bit-width designs. Using a hierarchical construction, 4x4 bit modules are extended to accomplish 8x8 bit, 16x16 bit and 32x32 bit multipliers with pipeline registers strategically inserted between partial product and addition stages to balance delay. The design is coded using Verilog and synthesized using the Xilinx Vivado. Implementation results show that the attainable clock frequencies are increased in the proposed design and verify that the use of pipelining is effective in improving performance while maintaining a modular and scalable design for the FPGA based arithmetic units.

Paper ID: 1099

A Review on Transforming Drug Discovery and Development: The Synergistic Role of AI, Machine Learning, and Deep Learning

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Abstract: Artificial intelligence (AI) and Machine Learning (ML) are changing Drug Discovery and Development (DDD) by making long, expensive, and complex processes more efficient. This review gives an overview of how AI fits into the DDD pipeline. It focuses on speeding up and improving target identification, drug-target interaction (DTI) prediction, and creating new drug-like molecules through de novo design. In the early discovery phase, the paper looks at how computational methods, such as Network-Based Methods (like graph theory for mapping molecules), and algorithms like Random Forest (RF), Support Vector Machines (SVMs), and Deep Neural Networks (DNNs) are applied for virtual screening and comparing bioactivity. A key area of focus is on generative design using Reinforcement Learning (RL) frameworks, like ReLeaSE, which combines generative (Stack-RNN) and predictive models to improve chemical properties and speed up the search for new chemical compounds. The review also discusses AI's role after drug approval, particularly in post-market drug assessment. It addresses pharmacovigilance, which means monitoring adverse drug reactions (ADRs) using methods like Natural Language Processing (NLP) to analyze unstructured clinical data. It also examines applying ML techniques for model-informed precision dosing (MIPD).Importantly, successfully implementing AI requires tackling significant challenges. The need for Explainable

Artificial Intelligence (XAI) is discussed to ensure that complex model predictions are clear and understandable, especially in critical areas like toxicity prediction and lead optimization. Other challenges include reducing bias and ensuring fairness in predictions from unrepresentative datasets, protecting data privacy, and creating strong regulatory frameworks. It is also essential to establish practices for computational reproducibility, such as sharing data and code. Additionally, the ethical concerns around regulating AI-Generated Content (AIC) in scientific papers, especially regarding accuracy and proper referencing, are examined.

Paper ID: 1100

A Review of Multi-Functional Wire Health Sensor for Insulation Resistance, Leakage Current andTemperature Monitoring Real-Time Wireless Connectivity

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Abstract: Electrical failures occur due to insulation degradation of electric wires, leakage current, and excessive rise in wire temperature which are major factors for safety concerns in residential, commercial, and industrial electrical systems. The load demand is increasing with rapid urbanization and aging wiring infrastructure significantly raises the risk of electric shocks, equipment damage, and fire hazards. Conventional protection devices such as Miniature Circuit Breakers (MCBs) and Residual Current Circuit Breakers (RCCBs) operate only after fault occurrence and lack the capability to detect early-stage insulation deterioration or abnormal thermal behavior.This paper presents the design and implementation of a Multi- Functional Wire Health Sensor for Insulation Resistance, Leakage Current, and Temperature Monitoring with Real-Time Wireless Connectivity, aimed at continuous condition monitoring and early fault prediction in electrical wiring systems. The proposed system integrates a non-invasive Current Transformer (CT) sensor for leakage current detection, a temperature sensor for thermal monitoring, and signal conditioning circuitry to ensure accurate measurement. For getting precise value from sensor, analog-to-digital is used. Also, ESP32-based microcontroller works as the central processing unit, performing real-time data acquisition, threshold-based fault classification, and wireless data transmission.On the basis of value of leakage and threshold temperature value which are predefined, system classifies wire health into three conditions: Normal, Warning and Fault. Real-time alerts are generated using a LED light and an OLED display, while cloud- based monitoring enables remote supervision and predictive maintenance.Experimental results reflect reliable detection of minor leakage currents and abnormal temperature rises well before critical failure occur the system offers a compact, cost-effective, user- friendly, and scalable solution suitable for smart homes and modern electrical networks. This system works with multiple sensor which detects multiple parameters, for enhancing the safety

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Paper ID: 1103

Explainable Hybrid Ensemble Model for Multi-Dimensional Employee Outcome Prediction in HR Systems

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Abstract: Most traditional HR systems rely on manual checking techniques. Because of this, they often lack the ability to understand employee sentiment, behavioral patterns, and whether there is any managerial bias in the workplace. Even though machine learning helped to improve HR analysis, most of the other research works lack interpretability, do not give correct feedback, and do not focus

much on people. To give the accurate predictions of the organization data, a hybrid HR analytics system is created. This work uses machine learning, natural language processing and AI Prediction together. It helps HR teams make fair and clear decisions. A hybrid ensemble model (Random Forest, Logistic Regression, SVM, and XGBoost) is used to predict employee attrition, K-Means clustering for burnout, regression modelling for performance, and statistical Z-score analysis for manager effectiveness. SHAP is used to show why the system gives certain results, so HR teams can understand them easily. The system also checks employee feedback and messages in real time to understand emotions. The system detects bias, identifies burnout risks using long-term data, and tracks queries to find early solutions using AI. The system is built using FastAPI and a React dashboard, which makes the results easy to see and use. Overall, the proposed system provides more accurate results, understanding, and fair judgments compared to the traditional systems used by the Human Resource departments.

Paper ID: 1117

Machine Learning–XGBoost Prediction of Online Shopping Behavior in the Digital Economy

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Abstract: The buying habit of the consumer is increasingly becoming complex making the prediction of the purchasing intention a monumental task. The current paper presents the consumer purchase forecast model that uses the Random Forest and XGBoost with an extension on the temporal aspects and re-balancing on SMOTE. Our systematic preprocessing, feature engineering and stratified cross-validation are based on a large- scale e-commerce clickstream dataset (885,129 events). These results suggest that, Random Forest had F1-score of 0.927 and XGBoost had F1-score of 0.985 that is better compared to benchmarks recorded previously. The findings stress the importance of the exploratory data analysis and the role of time- related and behavioural trends as the daily activity cycle and recency-based interactions. The importance of feature analysis confirms the importance of cart event ratio, total events, cart-per- product and view count and also the importance of time factor like recency, average browsing hour. E-commerce practitioners can use the article as an empirical instrument because it may be the foundation of feasible statistics to augment the cart-to- purchase ratio and targeted marketing in the competitive digital economy.

Paper ID: 1118

Enhanced Heart Disease Classification Using Optimized Feature Selection and Advanced Stacking Ensemble Learning

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Abstract: Heart disease is a condition that poses one of the most significant health hazards in the world and it needs proper and quick diagnosis in order to minimize morbidity and mortality. Traditional machine learning models are usually hard to operate complex clinical data due to redundancy, imbalance, and low generalization. To overcome the above weaknesses, this paper presents a better framework of heart disease classification system which integrates the best feature selection and a better stacking ensemble configuration. The

dataset of Z-Alizadeh Sani is subjected to a powerful feature optimization procedure, in which 33 features are selected as having a significant impact and thus being part of the optimal predictive relevance and the lowest dimensional noise. By means of these features, it is possible to train a multi-level stacking ensemble with Naive Bayes, Logistic Regression and Support Vector Machine (SVM) as the meta- classifier. The results of the experiment demonstrate the great enhancement of the performance with the accuracy of 91.80, ROC AUC of 0.9574, and F1-score of 0.94 being superior to that of individual classifiers and traditional ensemble techniques. The dissimilarity of the confusion matrix confirms the sensitivity to cases of heart diseases enhancement, and false prediction has been diminished significantly. The suggested framework provides a high-quality, generalizable, computationally effective classification model, which has a high possibility of being used in the real world in terms of clinical decision support.

Paper ID: 1122

Reconfigurable Intelligent Surfaces for Next-Gen Wireless Communication

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Abstract: With the growing demand for wireless communication for 5G and beyond, energy-efficient wireless networks and adaptive propagation environments with high capacity are becoming increasingly important. The research community has an increasing interest in the use of Reconfigurable Intelligent Surfaces (RIS) for channel control, as it allows for passive (low energy) control of the reflected electromagnetic waves. The paper investigates the design, realisation and experimentation of an RIS based Wireless Communication which will enhance the link quality and spectral efficiency. A wireless communication testbed that utilizes software-defined radios (SDRs) was developed by creating a RIS prototype with 256 programmable meta-elements at 3.5 GHz. Researchers tested the system under line-of-sight and non-line-of-sight conditions for improved received signal strength, bit error rates (BER) and energy efficiencies. Our estimates show that the anticipated RIS-aided configuration has achieved a received power gain of 17 dB in LoS and nearly 27 dB in NLoS. Also, over 50 percent reduction in BER for QPSK and 16-QAM. Moreover, it is validated that RIS can efficiently enhance spectral efficiency by 41%, and reduce energy per bit consumption by 35%, as this costly and green enabler for future systems. The simulation studies with an R^2 correlation of 0.985 also confirmed the experimental results demonstrating the consistency of the findings. According to the findings of this study, RIS-enabled intelligent, energy-efficient and reconfigurable wireless environments represent an effective solution for the future 6G networks.Keywords– Wireless Communication, Software-Defined Radios, and Non-line-of-sight Conditions

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Paper ID: 1128

Hybrid Deep Learning with Metaheuristic Siberian Tiger Carpet Weaver Optimization for Cotton Leaf Disease Severity Level Prediction

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Abstract: Cotton is a vital commercial crop of India. The diseases borne on leaves in the cotton drastically affect the crop yield which causes heavy economic losses to the farmer. Consequently, effective management of the crop requires early and accurate disease identification. It takes a long time to do this manually, and it is subjective, slight misclassification due to human error. In order to achieve this, a multi-level cotton leaf disease detection framework based on hybrid optimization–deep learning is proposed in this paper. At

first, pre-processing for cotton leaf image is applied using geometric mean filtering to remove noise. The region-based online selective examination approach is next used for image segmentation of leaf region. Post segmentation, the extraction of multiple handcrafted features and deep features i.e., LGBP, SLIF, WLD, color, texture, shape and CNN features from the segmented leaf region is carried out. Cotton is one of the important commercial crops in India. Cotton is named so because of its great economic importance. Moreover, its utility is more than any other natural fiber. The economic value of this crop can enhance the financial stability of the nation. The leaf-borne condition that arises in cotton has the potential to negatively impact crop production. Additionally, it can result in economic losses amounting to millions. The proposed method Siberian Tiger Carpet Weaver Optimization has an outstanding performance as demonstrated by an experiment on a publicly available cotton leaf disease dataset. The accuracy of the method is 92.745%, the sensitivity is 91.320%, and the specificity is 93.925%. The obtained results outperform existing deep learning methods.Keywords– Geometric Mean Filtering, Segmented Leaf Region, Deep Learning Methods, Sib

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Paper ID: 1129

Deepfake Detection Using Biometric Consistency and Visual Feature Fusion

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Abstract: Due to the rapid development of generative artificial intelligence, deepfakes media has become much more authentic and accessible, which can be a serious threat to digital authenticity, privacy, and trust. Deepfakes have been extensively misapplied in misinformation and identity manipulation and social engineering attacks, and effective methods of deepfake detection are necessary. The paper describes a deepfake detection system in the form of a biometric consistency inspection system and visual feature fusion, which is image based. The given strategy involves using a deep feature detector with a pre-trained EfficientNet-B0 model and handcrafted visual features of texture descriptors, color statistics, and structural patterns to find subtle inconsistencies in faulty manipulated images. The fused feature representation is classified using the assistance of a model based on a Random Forest since it is robust, can be interpreted, and may utilize heterogeneous features. It is developed as a full-stack web application built with Flask and React, which gives it an opportunity to handle analytics of images in real-time and provide users with the ability to control the system internally. The performance on iconic benchmark in this model yields up to 92 percent accuracy and high precisions, recall and F1-Score. The trade-off that is provided in the proposed framework keeps the framework as a balance between the accuracy, interpretability and computability adaptability that makes the framework a good fit that can be deployed in real world. In addition, the modular form can be further extended to image analysis and scalable cloud-based implementations in the future.

Paper ID: 1135

An Anger, Jealousy, Envy, and Hatred Emotion Prediction Scheme Using EAI and Hybrid Machine Learning Approach

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Abstract: For the wellbeing of both mental and physicalhealth, it is critical to predict and handle negative emotions. Nohybrid machine

learning (ML) based multi-class negativeemotion prediction technique that took into consideration rage,hatred, envy, and jealousy was developed in the earlierresearch. The preceding research lacked appropriate validatednegative emotion data collection, preprocessing, addressingclass imbalances, feature selection, and the optimal ML modelselection technique. With data collection, preprocessing,SHAP-based explain ability, optuna-based hyper parametertuning, and a five-fold cross validation technique, this workintroduces a machine learning (ML) based anger, hatred, envy,and jealousy negative emotion prediction scheme. A combinedfeature selection technique is presented to select the bestfeatures for ML model training. By considering random forest,KNN, SVM, XGBoost, extra tree, and stacking ensembleapproach, the optimal multi-class negative emotion predictionmodel is chosen. For predicting negative emotions, the stackingensemble approach is used because of its high accuracy and F1score. The comparison results show that the suggestedensemble strategy outperforms current methods by offeringmore than 5 percent accuracy.

Paper ID: 1144

Deepfake Video Detection Using Vision Transformer Features and Quantum Neural Learning (QNN)

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***Abstract**:* Significant challenges have been posed in the authenticity and veracity of digital media in the case of deepfake videos produced with the aid of intricate facial manipulation techniques. In the course of this study, a novel hybrid framework has been developed for detecting deepfake videos, and it integrates the ability of the transformer-based learning model with the efficiency of the quantum-based classifier variation. Facial characteristics from uniformly sampled frames of the video are extracted and fed into the framework for processing with the help of the Vision Transformer learning model, and the obtained visual representation is reduced with the aid of the Principal Component Analysis technique for compatibility with the compact representation used for the development of the quantum circuit classifier with the help of the PennyLane library.The frame-wise confidence scores obtained from the quantum circuit are averaged to obtain the final decision at the video level. The model is trained using binary cross-entropy loss over 20 epochs and the Adam optimizer. The performance of the model is measured in terms of metrics such as accuracy, precision, recall, F1-score, confusion matrix, and ROC analysis. Along with the detection model, an interactive interface is designed for the purpose of forensic science, where the extracted facial region, statistics, and decision evidence are displayed; therefore, transparency in the system is achieved. This research demonstrates that the integration of transformer model representations with quantum-inspired classifier results in an efficient model of deepfake video classification.

Paper ID: 1145

Block Chain Enabled Self-Sovereign Identity Management for Credit Card Fraud Detection using Interference-Tolerant Fast Convergence Zeroing Neural Network

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***Abstract**:* This research proposes a new framework for credit card fraud detection, which combines blockchain-enabled self-sovereign identity management with an Interference-Tolerant Fast-Convergence Zeroing Neural Network (BC-SSIM-CCFD-ITFCZNN). Initially the transactional data are obtained from the Credit Card Transactions Fraud Detection Dataset and are first processed using Distributed Set-Membership Fusion Filtering to remove noise and handle missing values. The preprocessed data are then examined in a Green Proof-of-Work-based blockchain setup, where the ITFCZNN model identifies transactions as either genuine or fraudulent. In general, the ITFCZNN does not express adapting optimization approaches to determine optimal parameters to ensure accurate identification.

Therefore, the Fennec Fox Optimization Algorithm used to optimize ITFCZNN, which accurately done the Credit Card Fraud Detection. The proposed BC-SSIM-CCFD-ITFCZNN method is implemented on python. Then performance of proposed method is analysed with other existing techniques. The proposed method attains 26.36%, 20.69% and 35.29% higher accuracy; 19.23%, 23.56%, and 33.96% higher efficiency; 26.28%, 31.26%, and 19.66% higher precision, 27.86%, 30.15%, and 22.16% higher security when comparing with the existing methods such as a credit card fraud detection utilizing artificial neural network (BC-SSIM-CCFD-ANN), a sequential credit card fraud detection: joint deep neural network with probabilistic graphical model (BC-SSIM-CCFD-DNN), and smart credit card fraud detection system depend on dilated convolutional neural network with sampling technique (BC-SSIM-CCFD-CNN).

Paper ID: 1148

PneuEffNet: A Powerful Deep Learning Architecture to detect pneumonia.

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Abstract: Pneumonia is a health problem that is of importance in the world.wide, and is an illness that must be well and timely.diagnosed in order to enhance an effective treatment. The most common To diagnose it, the chest radiology or CXR is the way that should be used.is tiresome, subjective, and it needs to exist.available experienced radiologists not necessarily availed. In thisIn the present study, learning models of high level image recognition specifically trained used for create an automated pneumonia classification system.paper using a custom training.to come up with a comprehensive automated pneumonia classification.system. a pediatric chest X-ray image dataset of 5,863 publicly available data.Pictures of chest X-ray to teach our model the correct differentiation.between the case of Normal and Pneumonia. We describe theprocessing pipeline of data, model architecture, e.g. in terms.of augmentation, and training process. The efficiency of themodel is strictly assessed with the help of such needed measures.Using the necessary indicators like Correctness rate, sensitivity, specificity, and balanced score were the measures that could be applied to gain a complete understanding of how well the model works. Combined outcomes of a experiments were high with an accuracy of 98. Moreover, the analysis conducted with the help of the Receiver Operating Curve (ROC) proved the validity of the method curves also proved reliability of the model, having the AUC value of 0.97.Once again this can be done by the model which is testified by the AUC of 0.97.be a good diagnostic instrument. The potential of is displayed.NN as a handy device that can be used in this paper.assist radiologists and clinicians with and conveniently available.improving the processes of diagnosis, and addresses the clinical.implications and future studies implications.

Paper ID: 1150

A Vision-Driven Sign Gesture Interpretation Engine for Assistive Communication Using Random Forest

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Abstract: Sign language is crucial for helping people with hearing and speech impairments communicate. Unfortunately, not many people understand sign language, which creates communication barriers. This paper introduces a system that interprets sign gestures. It translates hand movements into meaningful outputs in real-time with a standard webcam. The system uses computer vision techniques to capture hand landmarks and extract important features, even in different lighting conditions and viewing angles. A Random Forest classifier processes these features to recognize predefined gestures accurately without needing special hardware. We created a custom dataset by collecting images of specific hand gestures from various participants in different environmental conditions. We extracted key

landmark points and turned them into numerical representations for training the model. We then integrated the trained classifier into an interactive learning game. This game provides real-time feedback, improving user engagement and learning. Experimental results show high classification accuracy of 93.6% and low latency, even in varying environments. The system offers a cost-effective, scalable, and user-friendly solution for assistive communication and learning sign language, making it suitable for use on devices with limited resources

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Paper ID: 1160

Multiclass Vehicle Detection on Indian Road Traffic Using YOLOv8

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Abstract: Traffic monitoring on Indian roads is a very challenging task because of highly dense vehicle population, diverse road users and frequent occlusions. This work proposes multiclass vehicle detection based on deep learning model named YOLOv8. A new dataset of 8000 images was created and manually labelled into 10 classes such as Car, Bus, Truck, Motorbike-Rider, Three-Wheeler, Bicycle-Rider, Pedestrian, Animals, Traffic Signs, Traffic Light.The YOLOv8, being a real-time detection model, will be trained using a GPU with an input resolution set to 640×640 to ensure efficient processing. The trained model will be evaluated on a test dataset to analyze its capability in detecting multiple object classes under diverse and unstructured traffic conditions.The performance of the model will be evaulated using precision, recall and F1 measure. The proposed method will be compared with other state-of-the-art methods.

Paper ID: 1161

Deepfake Video Detection Using CNN with GRU

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Abstract: Advances in generative models based on deep learning have recently made it possible to generate more realistic looking deepfake videos, potentially posing a huge threat to trust in digital content. Although the CNN-based detection algorithms can effectively differentiate spatial manipulations, they may not focus on the temporal inconsistencies across different frames, making them vulnerable to deepfake attacks. To reduce this issue, we propose a spatio-temporal deepfake video detection framework that performs CNN-based spatial feature extraction followed by gated recurrent unit GRU-based temporal sequence modeling to detect deepfake videos.Discriminative frame-level features are extracted using a CNN backbone before being fused using a gated recurrent unit (GRU) to capture temporal correlations of video data. In addition, explainable artificial intelligence (XAI) techniques are applied as part of this method, to provide information on the facial regions contributing to the video classification model's predictions, thereby improving interpretability. The framework is evaluated on the FaceForensics++ dataset using a video-level classification protocol.Experiments show that our CNN-GRU model achieves 98\% detection accuracy, which is considerably higher than 90\% for a CNN-only model, thus showing the importance of explicitly modeling temporal relations for detecting deepfake videos. The proposed approach finds a good compromise between detection effectiveness and computational complexity, is interpretable enough, suitable for both forensic analysis and real-world applications.

Paper ID: 1196

PLC-Controlled Emergency Evacuation and Dynamic Exit System

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Abstract: Emergency Evacuation in large public buildings is an important consideration due to the dynamic nature of hazards and the large assembly of people and their desire to evacuate in an orderly manner when faced with a hazardous situation. Safe and timely evacuation during an emergency can be very difficult. The purpose of this paper is to propose the use of a PLC controlled system for theatre emergency evacuation and stylish output system to provide real-time direction to occupants during an emergency. The proposed system will utilize fire, smoke, temperature, and occupancy sensors to provide constant, continuous analysis of the environment for safe evacuation during an emergency. The PLC will utilize the sensor data to provide safe evacuation routes for the occupants to follow, determine which exit indicators to activate, and to block unsafe exit routes using alarms and directional signals. Also, the proposed system will enable audio announcements to assist persons with visual impairment during the evacuation. The proposed system will reduce congestion at the exit, thus increasing evacuation speed, and improving the safety and security of occupants. The proposed solution is going to be highly reliable, cost-effective, and the ideal solution for implementation into a smart building.

Paper ID: 1204

Design of an Integrated Model for Validation Driven Control and Certification of Hybrid AC-DC Microgrids

Atul S. Dahane (PRMCEAM)* and Rajesh B. Sharma (Government College of Engineering)

Abstract: In fast converter switching, volatile renewable injections, frequent mode changes, and partial observability, hybrid AC-DC microgrids must behave like a power systems. This tension requires validation frameworks beyond nominal models and idealized control assumptions. Most research used fixed-parameter simulations, poorly coupled digital twins, or controller tuning evaluated under limited disturbance sets, which seems to leave a gap between stated performance and field behavior, especially at AC-DC interfaces. A, chained validation and control treats model mismatch, uncertainty and explainability as a key signals, but not subsidiary issues. In this paper a five-step analytical procedure is established. Here, hybrid Alternating Direction Method of Multipliers (ADMM) Twin-Fidelity Calibrator calibrates parameters and structures residual fingerprints by aligning averaged and electromagnetic transient models. This residual goes directly into a Residual-Aware Distributionally Constrained Hybrid MPC (Model Predictive Control), where Wasserstein ambiguity impacts control decisions under observed deviations rather than presumed noise. Causal Graph Neural State and Fault Trajectories and constraint-activity traces are processed by the attribution layer to isolate strong instability drivers while maintaining physical directionality across AC and DC subsystems. Based on this belief state, a Barrier-Certified Multi-Agent Reinforcement Learning coordinator adjusts converter operations during fast transients while respecting safety invariants in the process. To generate safety margins instead of qualitative statements, a Hybrid Contract Verification and Counterfactual Stress Prover evaluates learned rules against targeted adversarial scenarios. Experimental validation on representative hybrid microgrid shows lower voltage and frequency excursions, faster post islanding recovery, and quantified safe operating envelope extensions. Evidence-driven, falsification-aware microgrid control designs may replace performance-centric validation.

Paper ID: 1211

From Action Recognition To Structured Action Understanding - A Modular Vision Language Framework

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Abstract: Recognition of human action has seen tremendous advancements due to deep convolutional neural networks, but all of the current systems are unable to provide interpretable explanations on the activities they have detected besides going through with categorical labels. The paper introduces a modular vision-language system which expands upon frame-based action hallucination founded in organized semantic determination. The visual feature extraction and classification on UCF101 is performed with a transfer learning strategy by using a pretrained ResNet50 backbone. Predicted action labels are translated to structured natural language descriptions by a thin semantic abstraction layer in order to increase interpretability. The 8,607 test samples on which an experimental assessment has been carried out show a general classification correctness of 93.30 percent with a macro F1-score of 93.56 percent. The presented system contains around 23.7 million parameters and can infer almost in real time (at 15.4 frames per second). The findings show that correct perception and modular generation of language- based description gives an efficient and interpretable way of understanding of actions that does not need computationally expensive spatiotemporal architectures

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Paper ID: 1217

Academic Assistant Using AI

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Abstract: We introduce a framework designed to streamline academic evaluations by merging automated workflows with intelligent processing. The proposed system includes the use of a web-based infrastructure that can connect the education community through separate portals for question paper generation and answer submission. By using advanced technologies such as large language models for dynamic question generation, optical character recognition for handwriting recognition, and AI-based plagiarism checkers, the proposed system can provide an efficient, transparent, and honest academic assessment process

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Paper ID: 1223

Smart Decision Support System for Crop Improvement Using Multi-Omics Data Analytics

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Abstract: The growing access to multi-omics data is providing new possibilities to improve crops much faster, but the integration and decision-making process are still difficult to achieve because of the heterogeneity and high dimensions of the data. The Smart Decision Support System (SDSS) proposed in this paper is a Multi-Omics Decision Support Strategy (MO-dSS) that incorporates the data of genomics, transcriptomics, proteomics, metabolomics, and phenomics to develop smart crop improvement. The proposed methodology comprises of strong preprocessing, feature selection, feature-level data fusion, and hybrid machine learning models to forecast important

agronomic characteristics and produce actionable recommendations. Experimental analysis shows that the suggested framework has better computational and sustainability efficiency, low energy consumption of 9.6 J, latency of 64 ms, and low Energy-Delay Product of 614 than baseline approaches. The reliability of decisions and identification of biomarkers is also high (92.1% and 89.4% respectively). These findings verify that the proposed MO-dss framework would be helpful in leading to accurate, energy-efficient and interpretive decision-making in terms of sustainable crop enhancement.

Paper ID: 1224

Impact of Employee Engagement on Organizational Productivity in IT Sector

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Abstract: Employee engagement is currently a key determinant of organizational productivity especially in the Information Technology (IT) sector where performance is determined by knowledge, innovation, and human resources with skills. Employees who are engaged also have elevated rates of commitment, motivation and discretionary effort and this greatly positively impacts on the efficiency and effectiveness of the organization. This paper discusses how the engagement of employees will influence organizational productivity in the IT industry based on some of the main drivers of effective engagement, i.e., leadership support, work environment, career growth, recognition, and work-life balance. Descriptive and analytical technique with a large-scale overview of the existing literature and industry reports is taken. The results demonstrate that there is a positive correlation between employee engagement and productivity outcomes such as employee performance, turnover, innovation as well as customer satisfaction. The paper arrives at a conclusion that employee engagement is a strategic necessity of the IT organizations that aim at achieving both long-term competitive advantage and sustainable productivity increase.

Paper ID: 1226

Climate-Aware Crop Recommendation System Using Hybrid Machine Learning Models

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Abstract: The choice of crops is very vital to enhance the productivity and sustainability of agriculture, especially in the dynamic climatic environment. Conventional crop recommendation systems tend to use only a few parameters of soil and they are not dynamic to changing environmental conditions, thus making poor decisions. The paper will seek to solve these issues by developing a climate-conscious crop advising system based on hybrid machine learning model that considers the characteristics of the soil and the climatic conditions to predict the crops with precision and high accuracy. Some of the important soil characteristics included in the proposed framework are the pH, nitrogen, phosphorus and potassium besides climatic conditions like temperatures, rainfall and humidity. A hybrid stacking ensemble model is used to combine the strengths of Support Vector Machine, Random Forest and Gradient Boosting classifiers to fulfill their complementary strengths. It is shown that the proposed hybrid model is always more accurate, precise, recalls many, and has a higher F1-score than the individual baseline models. Class-wise and confusion matrix confirm better discrimination in crops with similar soil and climatic needs, whereas the analysis of stability shows that there is great generalization and decreased overfitting. The findings underscore the usefulness of climate-conscious hybrid learning in the smart agro-climatic decision support and

the possible application of this learning to practical use in different agro-climatic locations.

Paper ID: 1227

CNN-Based Tomato Leaf Disease Detection Using Hybrid Feature Extraction

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Abstract: Agriculture is the primary reason for having sufficient food and surviving healthily. Even if the population increases rapidly, it provides food for all. In farming, there are many difficulties. One of them is plant diseases. Due to these, many pesticides and fertilizers need to be used, i.e., chemicals are used to kill diseases, which reduce the minerals, efficiency of the crop, etc. To overcome these, we need to predict diseases at the preliminary stages. But it is hard to identify diseases at the early stage. The reason for this paper is to give knowledge about an innovative approach for farmers to reduce plant diseases. The tomato is one of the commonly used vegetables; if the right algorithm of image processing (IP) techniques and machine learning (ML) approaches is found, then it is easy to find diseases in the tomato plant. Firstly, in this process, they collect tomato leaves that have disorders. Based on the early symptoms, farmers can easily name diseases from the collected samples. Firstly, the size of the collected samples of tomato leaf was resized to 256x256 pixels. To improve the quality of leaves, historical equalization is used. K-means clustering algorithm is used to divide the data space into Voronoi cells for effective clustering. To extract the boundaries of the collected tomato leaf, contour tracing is used. PCA, DWT, and GLCM are applied to derive representative feature information from the collected samples. Finally, extracted or obtained features are categorized using various machine learning approaches, such as K-Nearest Neighbor (KNN), Support Vector Machine (SVM), and Convolutional Neural Network (CNN). The accuracy was assessed for the proposed model using K-NN (78.778%), SVM (83.222%) and CNN (91.222%), on disordered collected tomato leaves.Keywords: Nearest Neighbor, Principal Component Analysis, Leaf disease, Convolutional Neural Networks (CNN), Discrete Wavelet Transform (DWT).

Paper ID: 1230

Sustainable Concrete Mix Design Using Bio-Waste materials and Metaheuristic Algorithms Optimization

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Abstract: Concrete is the most used construction material in the world. However, CO_2 emissions from cement production have increased in recent years. Utilization of bio-waste material as supplementary cementitious materials can make construction sustainable. This research introduces a framework that utilizes simulation for the optimization of sustainable concrete mixtures by integrating machine learning (ML) models and metaheuristic algorithms. Waste materials like rice husk ash, eggshell powder, biochar, and waste glass are used as partial replacements for cement. A model representing an artificial neural network ANN has been developed to predict compressive strength and to evaluate its environmental impact. Multi-objective optimization is carried out using particle swarm optimization, grey wolf optimizer, and bat algorithm. The Pareto-front analysis reveals that optimized mixes can provide a 25 % reduction in CO_2 emission at compressive strength of 36 MPa. Among all algorithms GWO exhibits better convergence and solution diversity. The suggested framework offers an efficient alternative to traditional trial-and-error mix design methods for sustainable infrastructure development.

Paper ID: 1231

3D IC Design with Machine Learning-Based Thermal Optimization

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Abstract: Three-dimensional integrated circuits (3D ICs) enable vertical stacking of device layers which overcomes the barriers of two-dimensional scaling for greater speed and density. Even so, high power density and limited heat dissipation can cause overheating issues that affect reliability and performance. This paper presents a framework based on machine learning (ML) for the thermal optimization of 3D IC designs. The system uses deep reinforcement learning for thermal-aware placement and embedding gradient-boosted regression to quickly and accurately predict temperature. The system does limit hotspot intensity whilst improving thermal uniformity, predicting the temperature distribution and block placement adjustment. According to tests conducted with the extended MCNC benchmarks, it appears that the method proposed can reduce peak temperature up to 12% and improve thermal uniformity and design convergence speed by 18% and 60% respectively when compared to regular heuristics-based optimization. The study supports the integration of ML-enabled intelligence into EDA flows for developing highly efficient thermally 3D ICs

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Paper ID: 1232

Smart Irrigation and Soil Management using AI and IoT-Integrated Sensor Networks

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Abstract: Water management and soil management the important problem in contemporary agriculture is efficient water use and soil maintenance especially in the face of growing climate variability and resource limitations. The paper proposes an intelligent irrigation and soil management system that uses the Internet of Things (IoT)-based sensor networks with the artificial intelligence (AI)-based decision intelligence to support accurate, adaptive, and data-informed agricultural processes. It uses distributed soil and environmental sensors that continuously monitor such parameters as soil moisture, temperature, humidity, and nutrient levels and it uses an AI model to process real-time and historical data to optimize irrigation schedules and soil management plans. The suggested system is dynamic in the way it modulates water delivery according to the needs of crops as well as environmental factors to reduce water wastage and enhance the sustainability of the soil. Experimental observations indicate that the framework proposed can be used to significantly increase the efficiency of irrigation, soil moisture stability, and the overall use of resources when in comparison with the traditional rule-based irrigation applications. The findings confirm the efficiency of using AI-based decision intelligences with IoT-based sensor networks to achieve sustainable and precision agriculture usages.

Paper ID: 1249

Communication Control for Battery and Charger Using CAN Bus

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Abstract: Growing demand for efficient and intelligent energy management systems in electric vehicles (EVs) and renewable energy applications has led to the integration of advanced communication protocols in battery charging systems. This experimentation work focuses on the implementation of Controller Area Network (CAN) communication between the battery management systems (BMS) and the charger, enabling seamless data exchange and adaptive charging control. Through CAN communication, the charger obtains essential battery parameters such as voltage, current, temperature, and state of charge (SOC), allowing it to dynamically adjust the charging profile according to the battery specifications and real-time condition. This intelligent coordination not only ensures safe and efficient charging but also enhances battery lifespan and system reliability. The paper further reviews the CAN protocol structure, message frame formats, and standard communication procedures adopted in electric vehicle (EV) and energy storage systems. The study highlights current advancements, challenges, and potential improvements in CAN-based battery–charger communication for achieving smarter and safer power systems.

Paper ID: 1272

AI-assisted Optimization of Shear-Dominant Aerospace Frame Structures using Surrogate Modeling

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Abstract: Structural performances of aerospace components like fuselage frames, bulkheads, wing ribs are significantly influenced by shear dominating loads. High dimensional design spaces along with recurrent simulations make the existing finite element analysis based optimization methods to be computationally intensive. The present study provide a methodology in overcoming these constraints by using artificial intelligence (AI) and machine learning (ML) to develop shear resistant aircraft frame designs. This approach use a surrogate modeling method that predicts the shear stress responses as well as displacement using neural networks trained with sample data generated through FEA. Using genetic algorithms as well as Bayesian optimization, multi-objective design optimization is achieved that reduces the weight as well as stress while maintaining the structural integrity. A sandwich frame made of aluminum material under shear dominant stress is chosen to validate the proposed structure. The AI optimized design approach reduce the structural weight by 7.70% as well as stress concentration factor by around 11.10%, and increase the shear resistance by 25% in comparison with the baseline FEA data. The computational time also reduces by around 35% in comparison with baseline FEA. Thus, the results show that optimization driven by AI/ML significantly enhances the performance as well as efficacy of aerospace structural design in shear dominated situations.

Paper ID: 1290

Idle Virtual Machine Management in Cloud Computing: A Bibliometric Survey

Ashlesha Sawant (Vishwakarma Institute of Information Technology, Pune, India)*, Pankaj Agarkar (Ajeenkya D. Y. Patil School Of Engineering, Lohegaon, Pune, India), Parikshit Mahalle (Development Vishwakarma Institute of Information Technology, Pune, India)

Abstract: Cloud computing systems heavily depend on virtual machines (VMs) to offer scalable and elastic services. However, active provisioning and over-allocation of resources often causes idle or under-utilized VMs, which causes inefficient resource consumption and higher operational expenses. Even though this issue is well known, the current literature focuses on it indirectly with the help of the methods of consolidation, migration, and energy-aware placement instead of identifying idle VMs. The study provides a mixed bibliometric and qualitative review of literature about idle virtual machine management in cloud computing. The 961 publications obtained through the Scopus database were processed through the Bibliometrix tool to assess the publication trends, citation patterns, the research themes, and the geographical contributions. Moreover, a selection process was conducted based on PRISMA to select 25 representative high-impact studies to be included in qualitative synthesis. The discussion has shown that the majority of current methods implicitly infer idleness based on host- level utilization thresholds, predictive consolidation policies, or optimization-based goals, and little attention is paid to long-term VM behavior. Also, lack of standardized definitions, reference models of behaviour and explainable decision making processes depict major gaps in research. On these findings, this paper recommends explicit, garbage-collector-inspired frameworks, which view idle virtual machines as first-class entities, making them easy to systematically reclaim resources and make cloud computing environments more sustainable.

Paper ID: 1292

An Embedded Sensor-Based Head Motion Controlled Wheelchair with Real-Time Obstacle Detection

Aditya Mundhe (AISSMS Institute of Information Technology), Nakul Thote (AISSMS Institute of Information Technology)*, Rucha Wandhekar (AISSMS Institute of Information Technology), Dr. P. B. Mane (AISSMS Institute of Information Technology)

Abstract: Independent mobility remains a major challenge for individuals suffering from paralysis, particularly when conventional electric wheelchairs depend on hand-operated control interfaces. To address this issue, this work proposes a head motion controlled wheelchair system that allows users to navigate without the use of upper limbs. The system utilizes a wearable inertial sensing unit to continuously monitor head tilt and orientation. The acquired motion data are processed by an embedded controller, which translates the detected head movements into corresponding wheelchair motion commands such as forward movement, directional turning, and stopping. For safe operation, an ultrasonic-based obstacle detection mechanism is incorporated to prevent collisions by automatically interrupting motion when an obstruction is detected. The control algorithm includes initial head-position calibration and dead-zone filtering to avoid unintended movements caused by minor head disturbances. Simulation and prototype testing confirm stable system behaviour, with an average response time of 145 ms (below the 200 ms safety threshold), and smooth motion control suitable for indoor and flat-surface environments. The offered solution focus on being simple, cheap and easy to use as an assistive mobility Wheelchair . The system can offer a great way of helping paralyzed patient to become more independent and secure, and serve asa flexible platform for further smart mobility improvements.

Paper ID: 1294

Field Data Based Modeling and Artificial Intelligence in Sheet Metal Manufacturing : A Review

Sudarshan Martande (Ajeenkya DY Patil University, Ajeenkya DY Patil School of Engineering)*, Dr. Sunil Ingole (Ajeenkya DY Patil University), Dr. Rahul Bachute (Ajeenkya DY Patil School of Engineering), Dr. Swapnil Lahane (Marathwada Mitra Mandal's College of Engineering)

Abstract: The traditional physics-based models which in mostof cases fail to represent the variability of industrial presses due tomaterial inhomogeneity, tool wear, lubricant variation,environmental conditions, and operator engagement. In realoperational environments, various parameters associated with thesheet metal shop change. Conceptual methodology has limitedscope in this area of actual operational behavior. With theemergence of artificial intelligence (AI) and machine learning, ashift in the paradigm of field data based mathematical modellingto field data driven mathematical modelling has occurred, wheresensor-measured production signals (cycle time, force, acousticemission, temperature, anthropometric information) are directlyused to drive empirical, hybrid, or entirely data-drivenmathematical models. Field data are collected, reviewed, andcorrective action is updated in the mathematical model.This review is a synthesis of recent achievements in the field offusing field collected data with AI methods, which include neuralnetworks, physics-informed neural networks (PINNs), explainableAI (XAI), and hybrid methods where dimensional analysis iscombined with domain knowledge. The fundamentalmethodological elements of FDBM include obtaining predictiverelationships for forming operations. It has been found that thesedata centric methods have better predictive capabilities for keyprocess measures such as material uniformity and tool wear thanmore traditional methods. In sum, AI-enhanced FDBM may fillthe gap between theoretical and real-world production to enhancea more adaptive and sustainable production cycle. The futuredevelopments will probably be based on standard hybridconstructs and digital twins that will achieve industrial scalabilityto the fullest.

Paper ID: 1296

Arduino-based Automatic Pet Feeder for Efficient and Sustainable Feeding

Shatakshi Shiravale (MIT-World Peace University)*, Sankirti S. Shiravale (Marathwada Mitra Mandal's College of Engineering, Pune)

Abstract: As automation and intelligent systems continue to advance, the implementation of an automatic pet feeder emerges as a practical application of these technologies. This paper proposes a prototype for an Arduino based automatic pet feeder. This automated pet feeder includes components like a servo motor for dispensing of the food in a timely fashion and real-time clock to monitor the feeding timings. This helps pet owners to easily feed their pets even remotely. Since the feeding timings are scheduled in advance, the dispensation is automatic. This model can control the timings, the number of feeds as well as the time duration it should dispense to control the feed-size. The accuracy of the pet feeder is evaluated by deriving error rate. Experimentation is carried out to analyze the error rate across food requirements versus actual food dispensed by the system. The results demonstrate efficiency and reliability of the system.

Paper ID: 1297

Design and Development of a Regenerative Suspension System for Passenger Vehicles

Sujata Balkishan Adude (Marathwada Mitra Mandal's College of Engineering), Nikita Shivaji Bhosalepatil (Marathwada Mitra Mandal's College of Engineering), Onkar Shivaji Shivankar (Marathwada Mitra Mandal's College of Engineering), Rahul A. Sonwalkar (Marathwada Mitra Mandal's College of Engineering)*, Anand Vijay Satpute (Marathwada Mitra Mandal's College of Engineering)

***Abstract**:* A large portion of energy supplied to road vehicles dissipates as heat and vibration, especially through the suspension system. With the rapid growth of electric vehicles (EVs), efficiently using wasted energy has become crucial for improving vehicle range and sustainability. This paper presents the design, modeling, simulation, and prototype development of a regenerative suspension system that uses a Spiral Drive Mechanism (SDM). The vertical vibrations of the suspension get converted into rotational motion, which is then transformed into electrical energy with a DC generator. A DC- DC boost converter conditions the generated voltage for battery charging. A quarter-car model and ISO 8608 road profile simulations are used to analyze suspension dynamics and energy harvesting potential. MATLAB/Simulink simulations and experimental observations confirm that the proposed system can effectively harvest vibration energy and improve EV energy efficiency.

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