4th International Conference on Artificial Intelligence and Applications



November 19-20, 2026

Editor(s)

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Chairman

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(A STATUTORY BODY OF THE GOVT. OF INDIA)
(Ministry of Education, Govt. of India)
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Message

I extend my heartiest greetings and best wishes to the organisers, delegates, researchers, academicians, industry professionals, and students participating in the 4th International Conference on Artificial Intelligence and Applications (ICAIA 2026), being organised by Maharaja Surajmal Institute of Technology (MSIT), New Delhi, on 19–20 November 2026. The technical sponsorship of the IEEE Delhi Section reflects the conference's commitment to fostering meaningful research dialogue and advancing scholarly engagement in the rapidly evolving field of Artificial Intelligence.

Artificial Intelligence (AI) is emerging as a transformative force in the modern world, redefining the way we learn, work, innovate, and address complex societal challenges. Its growing applications across education, healthcare, agriculture, manufacturing, and governance present immense opportunities to accelerate inclusive growth and strengthen India's technological capabilities. As India advances towards the vision of Viksit Bharat, nurturing a robust ecosystem of AI-driven innovation, interdisipilinary research, and responsible technology development assumes paramount importance.

I congratulate MSIT for providing a valuable platform for the exchange of ideas, presentation of research findings, and exploration of emerging opportunities and challenges in AI and its applications. I am confident that the deliberations and research contributions at ICAIA 2026 will encourage new perspectives, strengthen collaboration between academia and industry, and inspire innovative solutions to real-world problems.

I wish the organisers and all participants a productive, enriching, and successful conference. May ICAIA 2026 contribute meaningfully to the advancement of Artificial Intelligence research and to India's journey towards becoming a global hub of knowledge, innovation, and technological excellence.

With warm regards.

(Yogesh Singh)
27/10/26

Prof. (Dr.) Mahesh Verma

MDS, MBA, PhD, DSc (hc), FDSRCS(Eng), FDSRCS (Edin), FDS RCPSG (Glas)

Vice Chancellor

- *Padma Shree Awardee*
- *Dr. B.C. Roy Awardee*
- *National Science & Technology Awardee*

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NEW DELHI

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MESSAGE

It gives me immense pleasure to learn that Maharaja Surajmal Institute of Technology (MSIT), New Delhi, is organising the 4th International Conference on ***"Artificial Intelligence and Applications (ICAIA 2026)"*** during 19–20 November, 2026.

I am pleased to note that this edition of ICAIA is being organised as an International Conference for the first time, co-sponsored by IEEE and ISTE, and is a Scopus-indexed event. This marks a significant milestone in the continued growth and academic stature of the conference series and is a matter of great pride for MSIT.

Artificial Intelligence is transforming virtually every sphere of human endeavour and emerging as a powerful enabler of innovation, informed decision-making and societal progress. By bringing together researchers, academics, industry professionals and practitioners, ICAIA 2026 will provide a vibrant platform for sharing cutting-edge research, exchanging ideas and exploring the transformative potential of AI in addressing contemporary challenges across society, the economy and governance.

On behalf of Guru Gobind Singh Indraprastha University, I appreciate the dedication and efforts of all those associated with the organisation of this important academic endeavour. I extend my warm greetings and best wishes to the organisers, distinguished guests, delegates and all the participants for a fruitful, enriching and intellectually stimulating meeting.

Wishing ICAIA 2026 resounding success and continued growth in the years ahead.

30th September, 2026
New Delhi

Prof. (Dr.) Mahesh Verma
Vice Chancellor



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Prof. (Dr.) M. N. Hoda

MCA, PhD, FCSI, FIETE, FIITP, SMIEEE, SMACM, LMISTE
Founder Editor-in-Chief, BJIT
Founder Director, BVICAM, New Delhi
Former Chairperson, IEEE Delhi Section



Message from the General Chair, ICAIA 2026

It gives me immense pleasure to extend my warm greetings and best wishes to the organizers, participants, researchers, academicians, and industry professionals associated with the International Conference on Artificial Intelligence and Applications (ICAIA 2026).

Artificial Intelligence is transforming the way we perceive, develop, and deploy technology, creating new opportunities for innovation across diverse domains. Conferences such as ICAIA provide an important platform for researchers and practitioners to exchange ideas, present emerging research, foster collaborations, and address the challenges associated with the responsible and impactful adoption of AI.

I am particularly pleased that ICAIA 2026 is being technically sponsored by the IEEE Delhi Section. This edition also marks a significant milestone as it is the first time that the IEEE Delhi Section is extending technical sponsorship to the ICAIA conference series. We look forward to this association contributing to the academic and professional enrichment of the conference and strengthening its engagement with the broader IEEE community.

I appreciate the efforts of the organizing committee in bringing together a diverse community of researchers and professionals working in the areas of Artificial Intelligence and its applications. I am confident that the technical sessions, keynote addresses, paper presentations, and discussions at ICAIA 2026 will stimulate meaningful exchange of knowledge and encourage innovative solutions to contemporary technological and societal challenges.

I wish ICAIA 2026 great success and hope that the conference serves as a catalyst for new ideas, collaborations, and impactful research in Artificial Intelligence.

(Prof. M. N. Hoda)

Place: New Delhi
Date: 05-11-2026

दिल्ली प्रौद्योगिकी विश्वविद्यालय
DELHI TECHNOLOGICAL UNIVERSITY
(Formerly Delhi College of Engineering)

Message from the General Chair, ICAIA 2026



It is my great pleasure to welcome you to the International Conference on Artificial Intelligence and Applications (ICAIA ’26). It is an honour to present this edition of the conference proceedings, which bring together valuable contributions from researchers, academicians, industry professionals, and practitioners working in the rapidly evolving field of Artificial Intelligence.

Artificial Intelligence has emerged as one of the most transformative technologies of our time, influencing diverse sectors and creating new possibilities for innovation, automation, decision-making, and societal development. ICAIA’26 provides a platform for sharing recent advancements, exchanging ideas, discussing emerging challenges, and fostering meaningful collaborations towards responsible and impactful applications of AI. This edition of ICAIA holds special significance as the conference is being technically sponsored by the IEEE Delhi Section. This collaboration reflects our shared commitment to promoting high-quality research, technical excellence, innovation, and knowledge dissemination in the field of Artificial Intelligence and related technologies. The association with IEEE Delhi Section and ISTE will further strengthen the academic and professional outreach of the conference.

I take this opportunity to express my sincere appreciation to all the authors who have contributed their research to ICAIA’26. I also extend my gratitude to the keynote speakers, reviewers, technical committee members, session chairs, organizing committee, volunteers, and all those who have worked diligently to make this conference possible. Their collective efforts have been instrumental in maintaining the quality and spirit of this academic forum. I am confident that the technical deliberations and interactions during ICAIA ’26 will inspire new research directions, encourage interdisciplinary collaboration, and contribute towards developing innovative and responsible AI solutions for real-world challenges.

I wish all the participants an enriching and rewarding conference experience and hope that ICAIA ’26 becomes a memorable platform for learning, collaboration, and innovation.

Prof. S. K. Garg
Professor of Mechanical Engineering and Former Pro Vice-Chancellor
Delhi Technological University
General Chair, ICAIA ’26

Message from the Chief Guest, ICAIA 2026



It gives me immense pleasure to learn that Maharaja Surajmal Institute of Technology (MSIT) is organising the International Conference on Artificial Intelligence and Applications (ICAIA 2026) on 19–20 November 2026, with technical sponsorship from the IEEE Delhi Section.

Artificial Intelligence is transforming the landscape of education, research, industry and society. Conferences such as ICAIA 2026 provide an important platform for academicians, researchers, industry professionals and students to exchange ideas, share innovative research, and explore emerging technologies and their practical applications. Such academic initiatives play a vital role in fostering interdisciplinary collaboration, promoting innovation and strengthening the research ecosystem in technical education.

I appreciate MSIT's efforts in providing a meaningful forum for knowledge sharing and research dissemination. I am confident that the deliberations and contributions presented during this conference will inspire new ideas, encourage impactful research and create opportunities for meaningful academic and industry engagement.

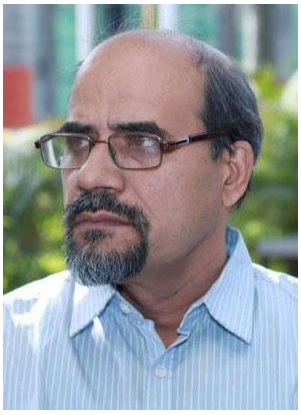
I extend my best wishes to the organizers, distinguished speakers, delegates and participants for the grand success of ICAIA 2026. May the conference achieve its objectives and contribute significantly to the advancement of Artificial Intelligence and its applications for societal progress.

With best wishes,

Amit Dutta

Director, Scholarship & Grants Bureau (SAG)
All India Council for Technical Education (AICTE)
Nelson Mandela Marg, New Delhi

Message from the Guest of Honor, ICAIA 2026



It gives me immense pleasure to extend my warm greetings and best wishes to the organisers of the International Conference on Artificial Intelligence and Applications (ICAIA 2026), being organised by Maharaja Surajmal Institute of Technology (MSIT) on 19–20 November 2026.

Artificial Intelligence is ushering in a new era in medical sciences by transforming the way diseases are diagnosed, monitored, and treated. Its applications in clinical decision-making, medical imaging, early disease detection, predictive healthcare, and personalized treatment are opening new possibilities for improving patient outcomes. In specialties such as Otorhinolaryngology (ENT), AI-driven technologies have significant potential in areas such as automated analysis of medical images, hearing assessment, voice and speech analysis, and early identification of disorders. However, the true success of these technologies lies in their responsible integration with clinical expertise, medical ethics, and patient-centric care.

Conferences such as ICAIA 2026 provide an important platform for fostering interdisciplinary collaboration between technologists, medical professionals, academicians, and researchers. Such interactions are essential to translate technological innovations into practical solutions that address real-world healthcare challenges and contribute to the advancement of society.

I sincerely appreciate the efforts of Maharaja Surajmal Institute of Technology and the organizing committee in bringing together experts and researchers from diverse domains. I am confident that the deliberations and research contributions presented during this conference will inspire meaningful collaborations and pave the way for innovative applications of Artificial Intelligence across various sectors, particularly healthcare.

I extend my best wishes to all the participants and organizers for the grand success of ICAIA 2026.

With best wishes.



Dr. Ishwar Singh
ENT Specialist
Head, Department of ENT
Maulana Azad Medical College

Message from the President, SMES



It gives me immense pleasure to extend my warm greetings to all the participants, researchers, academicians, industry professionals, and distinguished guests attending the International Conference on Artificial Intelligence and Applications (ICAIA ’26).

The Surajmal Memorial Education Society (SMES) is a non-profit educational organization committed to promoting quality education and creating opportunities for academic and professional development. Established in 1972 in the memory of Maharaja Surajmal, the Society has been dedicated to advancing education at both school and professional levels, with a particular emphasis on technical and professional education. Today, SMES manages several educational institutions, including Maharaja Surajmal Institute of Technology (MSIT), and continues to encourage academic excellence, innovation, research, and holistic development.

It is a matter of great satisfaction that MSIT is hosting ICAIA’26 on 19–20 November 2026. Artificial Intelligence is transforming virtually every sphere of human activity and has emerged as a key driver of technological and socio-economic development. Providing platforms where researchers and practitioners can share their ideas, present new developments, and discuss the responsible application of emerging technologies is therefore of considerable importance.

I am particularly pleased that ICAIA ’26 is being technically sponsored by the IEEE Delhi Section. The association with this eminent professional body adds significant academic and technical value to the conference and reflects the commitment of MSIT and SMES towards promoting high-quality research and innovation in emerging areas of technology.

I congratulate the conference leadership, organizing committee, faculty members, reviewers, authors, and student volunteers for their dedicated efforts in bringing this conference to fruition. The inclusion of diverse and contemporary research contributions in these proceedings is a testament to the growing interest in Artificial Intelligence and its applications.

I extend my best wishes for the successful conduct of ICAIA ’26 and hope that the conference proves to be a memorable and intellectually rewarding experience for all its participants.



Shri Kaptan Singh
President, Surajmal Memorial Education Society (SMES)

Message from the Secretary, SMES



The Surajmal Memorial Education Society (SMES) has been dedicated to the advancement of education and the holistic development of students for over five decades. The Society continues to promote academic excellence, innovation, and professional education through its institutions, including Maharaja Surajmal Institute of Technology (MSIT).

It is a matter of great pleasure to extend my warm greetings to all participants, researchers, academicians, industry professionals, and distinguished guests of the International Conference on Artificial Intelligence and Applications (ICAIA ’26), to be held on 19–20 November 2026 at MSIT. We are particularly pleased that ICAIA’26 is being technically sponsored by the IEEE Delhi Section. The association with these prestigious professional bodies adds to the academic and technical significance of the conference and supports our endeavour to provide researchers and students with opportunities to engage with current developments in technology and research.

I commend the conference organizers, technical committee members, reviewers, authors, faculty members, and student volunteers for their sincere efforts in organizing the conference and compiling these proceedings. The quality and diversity of the research contributions reflect the growing interest in Artificial Intelligence and its potential to address real-world problems.

I am confident that ICAIA ’26 will stimulate meaningful academic discussions, encourage innovative thinking, and inspire young researchers and students to contribute to the evolving field of Artificial Intelligence. I hope the conference will provide all participants with an enriching experience and lasting academic value.

I extend my best wishes for the successful conduct of ICAIA ’26 and hope that the conference contributes significantly to research, innovation, and the responsible advancement of Artificial Intelligence.



Shri Ajit Singh Chaudhary
Secretary, Surajmal Memorial Education Society (SMES)

MAHARAJA SURAJMAL INSTITUTE OF TECHNOLOGY

(Approved by AICTE & Affiliated to Guru Gobind Singh Indraprastha University)

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Message from the Director, MSIT



It gives me immense pleasure to welcome you all to the International Conference on Artificial Intelligence and Applications (ICAIA ’26) and to present these proceedings, comprising valuable research contributions from academicians, researchers, industry professionals, and technology enthusiasts.

Artificial Intelligence is rapidly transforming the technological landscape, with applications across education, healthcare, industry, governance, cybersecurity, sustainability, and numerous other domains. ICAIA ’26 provides an important forum for sharing recent research, emerging developments, innovative ideas, and practical perspectives in Artificial Intelligence and its applications. We are pleased that ICAIA ’26 is being technically sponsored by the IEEE Delhi Section. This association strengthens the technical and academic dimensions of the conference and reflects a shared commitment to advancing research, innovation, and excellence in technical education.

I extend my sincere gratitude to the IEEE Delhi Section and ISTE, the conference leadership, keynote and invited speakers, technical committee members, reviewers, authors, session chairs, organising committee members, volunteers, and supporting staff for their valuable contributions towards making ICAIA ’26 possible. I particularly appreciate the dedicated efforts of everyone involved in ensuring the smooth organisation of the conference and the timely preparation of these proceedings. The quality and diversity of the papers presented at ICAIA ’26 demonstrate the growing interest in addressing emerging challenges and opportunities in Artificial Intelligence. I hope that the technical deliberations and interactions during the conference will inspire further research, innovative solutions, and meaningful professional engagements.

I wish all participants an enriching and rewarding conference experience. May ICAIA ’26 provide an inspiring platform for knowledge exchange and contribute to the continued advancement of Artificial Intelligence for the benefit of society.

Prof. Avanish Kumar Srivastava
Director, MSIT

Message from the Convener, ICAIA 2026



It is my distinct privilege and honour to welcome you all to the 4th International Conference on Artificial Intelligence and its Applications (ICAIA 2026) , Technically sponsored by IEEE Delhi Section on 19th-20th November 2026 .

Artificial Intelligence has evolved from a futuristic concept into the definitive vector for modern technological advancement. We are entering an era where technology is no longer just a tool for efficiency, but the foundational architecture for solving humanity's greatest challenges. ICAIA-2026 serves as a vital ecosystem for academic rigor, industrial innovation, and emerging trends in research. This year, the conference has witnessed an overwhelming response to our call for papers, receiving a record number of submissions from researchers, scholars, and academicians across India and abroad. Each paper included in the proceedings has undergone a rigorous, double-blind peer-review process ensuring the highest standards of technical quality, originality, and conceptual depth. The selected works featured herein represent critical advancements across our key tracks, including Next-Generation AI Architectures, Internet of Things (IoT), Advanced Robotics, Cyber-Physical Systems, and Deep Learning Applications and others. An academic gathering of this scale is always a collective triumph.

I express my heartfelt gratitude to IEEE Delhi section for extending technical support to ICAIA 2026 and collaboration with MSIT. This is indeed a significant milestone for MSIT. I also extend my profound acknowledgement to AICTE, New Delhi for providing the prestigious grant under Grant for Organizing Conference (GOC) scheme to host the conference. Further, I convey my sincere gratitude to CSIR, New Delhi for sanctioning a grant for organizing the conference. Also, I extend thankfulness to National Association of Software and Service Companies (SSC-NASSCOM), Indian Society for Technical Education (ISTE) and Society for Pathways to Sustainability for supporting the conference.

I express deep gratitude to our Patron management, Advisory committees, Co-Conveners, Organizing team, Reviewers, Keynote Speakers and Track chairs for their unwavering support. Most importantly, I thank the authors for choosing ICAIA-2026 as the platform to share their valuable research findings and knowledge. I hope that the conference proceedings shall inspire new research, build meaningful collaborations and continue to push the boundaries of AI for the greater good of society. I wish the conference great success and hope the participants have an enriching and memorable experience.

With best wishes,



Prof. Archana Balyan
Convener, ICAIA -2026

PREFACE

The International Conference on Artificial Intelligence and Applications (ICAIA 2026), being organized by Maharaja Surajmal Institute of Technology (MSIT), New Delhi, on 19–20 November 2026, aims to provide an international platform for researchers, academicians, industry professionals, scientists and technology enthusiasts to present their original research contributions and exchange innovative ideas, experiences and advancements in the diverse domains of Artificial Intelligence and its applications.

The conference seeks to foster meaningful interaction between academia and industry, encourage interdisciplinary research, and facilitate the dissemination of emerging technologies and innovative solutions to contemporary scientific, technological and societal challenges. Through keynote addresses, invited talks, technical paper presentations and interactive discussions, ICAIA 2026 aspires to promote knowledge sharing, research collaboration and the development of future-ready technological solutions.

This edition of ICAIA holds special significance as it is technically sponsored by IEEE Delhi Section, marking an important milestone in the journey of the ICAIA conference series. This association reflects our continued commitment to promoting research excellence, strengthening professional engagement and providing researchers with a wider platform for sharing their scholarly contributions. The conference also acknowledges the valuable support of the All India Council for Technical Education (AICTE), Council of Scientific and Industrial Research (CSIR) and the Indian Society for Technical Education (ISTE).

We have received an encouraging response to the call for papers from researchers and academicians across India and abroad. The submitted manuscripts have undergone a rigorous peer-review process to ensure the quality, originality and relevance of the research contributions included in these proceedings. We sincerely appreciate the valuable time, expertise and dedicated efforts of our reviewers and members of the Technical Program Committee (TPC), whose contributions have been instrumental in maintaining the academic standards of the conference.

We extend our heartfelt gratitude to the eminent keynote speakers, invited speakers, distinguished guests, authors and participants for their valuable contributions and enthusiastic participation. We also acknowledge the dedicated efforts of the Organizing Committee, faculty members, staff and student volunteers whose commitment and teamwork have played a vital role in bringing this international conference to fruition.

Our sincere appreciation goes to the Surajmal Memorial Education Society (SMES) for its continued encouragement, visionary leadership and generous support in providing the necessary institutional resources to organize this conference. We also express our gratitude to IEEE Delhi Section and ISTE for their valuable association and support in strengthening the academic and professional objectives of ICAIA 2026.

We firmly believe that ICAIA 2026 will serve as a stimulating and enriching academic gathering, offering opportunities for intellectual exchange, new collaborations and meaningful research outcomes. We hope that the ideas and insights shared during the conference will contribute to further advancements in Artificial Intelligence and its applications and inspire future research endeavours. We warmly welcome all the delegates to ICAIA 2026 and wish them a fruitful, engaging and memorable conference experience in New Delhi, India.

Organizing Committee
ICAIA 2026
Maharaja Surajmal Institute of Technology
New Delhi, India

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NASSCOM FUTURESKILLS

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13	**Reception Committee**	Dr. Navdeep Bohra (Chair), Dr. Gitanjali, Dr. Rashmi, Ms. Jasmine, Ms. Neha
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17	**Electricity Committee**	Mr. Sachit Rathi (Chair), Mr. Ashvini

PROGRAM SCHEDULE

Day 1 – November 19, 2026 (Thursday)

TIME	EVENT			VENUE
9:00 – 11:00 am	Registration			In front of Auditorium
9:00 – 9:30 am	High Tea			Conference Room Room no. 10
9:30 am – 12:15 pm	**Opening Ceremony (Inaugural Session)**			Auditorium
9:30 – 9:40 am	Lamp Lighting by Dignitaries, Saraswati Vandana			
9:40 – 9:50 am	Welcome Address by **Prof. Avanish Kumar Srivastava**, *Organising Chair ICAIA 2026 and Director, MSIT*			
9:50 – 10:00 am	Conference briefing by **Prof. Archana Balyan** , Department of ECE, MSIT *Conference Chair, ICAIA 2026*			
10:00 – 10:10 am	Address by **Sh. Kaptan Singh,** *President, Surajmal Memorial Education Society and Chairman , Governing Body, MSIT*			
10:10 – 10:20 am	Address by **General Chair: Prof. M. N. Hoda**, Director, Bharati Vidyapeeth's Institute of Computer Applications and Management, New Delhi			
10:20 – 10:40 am	Address by **Guest of Honour: Prof. S.S. Agrawal,** Director General , KIIT College of Engineering, Gurugram			
10:40 – 11:00 am	Address by **Guest of Honour: Prof. Prem Vrat** Pro-Chancellor, Professor of Eminence and Chief Mentor, North Cap University, Gurugram			
11:00 – 11:05 am	Release of ICAIA 2026 Abstract Booklet			
11:05 – 11:35 am	Address by **Chief Guest: Sh. Sanjeev Kumar** Chairman and Managing Director, Telecommunications Consultants India Limited (TCIL), New Delhi			
11:35 – 12:05 pm	Address by **Keynote Speaker: Prof. Satoshi Nakamura** Presidential Chair Professor, School of Artificial Intelligence (SAI) Chinese University of Hong Kong, Shenzhen, Hong Kong			
12:05 – 12:15 pm	Vote of Thanks by **Dr. Deepshikha Yadav,** Assistant Professor, Department of IT, MSIT *Co-Convener, ICAIA 2026*			
12:15– 2:00 pm	**Lunch**			Ground Floor, Law Building
2:30 – 3:00 pm	Address by **Keynote Speaker: Dr. Kiran Gulia,** Scientist and Academic in Materials, Advanced Manufacturing and Artificial Intelligence, University of Wolverhampton, United Kingdom			**Conference Room, Room no. 10**
2:00 – 3:30 pm	**Paper Presentation Sessions (Parallel Tracks)**			
Paper Session 1 Seminar Hall #06	**Paper Session 2 Seminar Hall #206**	**Paper Session 3 Seminar Hall #406**	**Paper Session 4 Seminar Hall #106A**	**Paper Session 5 Room No. 111**
Paper Session 6 Room No. 310	**Paper Session 7 Room No. 411**	**Paper Session 8 Room No. 407**	**Paper Session 9 Room No. 410**	**Paper Session 10 Room No. 107**

Day 2 – November 20, 2026 (Friday)

TIME	EVENT			VENUE
9:00 – 9:30 am	Address by Keynote Speaker: **Ms. Sumita Singh** Executive Vice President U.S. News & World Report, New Jersey, USA			Conference Room Room no. 10
9:30 – 10:00 am	Address by Keynote Speaker: **Juan Pablo Velasquer** Cardona, University of Southern Denmark, Denmark			
10:00 – 10:30 am	Address by Keynote Speaker: **Prof. Qian Chen** University of Science and Technology of China, China			
10:30 – 11:00 am	Address by Keynote Speaker**: Dr. Deepika Koundal**, Senior Researcher University of Eastern Finland			
11:00 – 11:30 am	Address by Keynote Speaker: **Mr. Pradeep Kumar Balyan,** Co-Founder & Chief Marketing Officer, Blueprint360, Chennai, India			
10:00 am – 1:00 pm	Paper Presentation Sessions (Parallel Tracks)			
Paper Session 1 **Seminar Hall #06**	**Paper Session 2** **Seminar Hall #206**	**Paper Session 3** **Seminar Hall #406**	**Paper Session 4** **Seminar Hall #106A**	**Paper Session 5** **Room No. 111**
Paper Session 6 **Room No. 310**	**Paper Session 7** **Room No. 411**	**Paper Session 8** **Room No. 407**	**Paper Session 9** **Room No. 410**	**Paper Session 10** **Room No. 107**
1:00 – 2:00 pm	Lunch			Ground Floor, Law Building
2:00 – 4:10 pm	Valedictory Function			Auditorium
2:00 – 2:10 pm	Welcome Address by **Prof. Avanish Kumar Srivastava**, Organising Chair, ICAIA 2026 and Director, MSIT			
2:10 – 2:20 pm	Conference Report by **Prof. Archana Balyan**, Department of ECE, MSIT Conference Chair, ICAIA 2026			
2:20 – 2:30 pm	Address by **Sh. Kaptan Singh** President, Surajmal Memorial Education Society and Chairman, Governing Body, MSIT			
2:30 – 2:40 pm	Address by **Smt. Esha Jakhar**, Senior Vice-President, Surajmal Memorial Education Society, New Delhi			
2:40 – 3:10 pm	Address by **Sh. Ajit Singh Chaudhary** Secretary, Surajmal Memorial Education Society, New Delhi			
3:10 – 3:30 pm	Certificate Distribution by Dignitaries			
3:30 – 3:40 pm	Address by General Chair**: Prof. S.K. Garg**, Director , East Delhi Campus at Delhi Technological University (DTU), New Delhi			
3:40 – 3:50 pm	Address by Guest of Honour**: Prof. Ishwar Singh**, Professor Maulana Azad Medical College, New Delhi			
3:50 – 4:00 pm	Address by Chief Guest: **Dr. Amit Dutta** Director, Scholarships and Grants Bureau, AICTE, New Delhi			
4:00 – 4:10 pm	Vote of Thanks by **Prof. Rinky Dwivedi**, Department of CSE, MSIT Co-Convener, ICAIA 2026			
4:10 pm onwards	High Tea			Conference Room Room no. 10

KEYNOTE SPEAKERS



Prof. Satoshi Nakamura
Presidential Chair
Professor
The Chinese University of
Hong Kong, Shenzhen

Title: Challenges and Progress in Automatic Speech-to-Speech Translation: Bridging the Gap to Human Simultaneous Interpretation

Abstract: Automatic speech-to-speech translation has long been a dream technology for humanity. Through numerous breakthroughs over decades of research, we have now reached the stage where speech translation services are available on smartphones. However, many challenges remain before we can achieve translation quality comparable to that of a trained simultaneous interpreter. Key issues include how to translate across languages with different word orders, such as English and Japanese, without waiting for the end of a sentence or utterance; how to balance latency and content fidelity; and how to capture the speaker's intent conveyed through intonation. Recent advances in large language models (LLMs) offer new opportunities to address these challenges. In particular, our recent research explores human interpreter-inspired strategies, including adaptive sentence segmentation, selective omission, summarization, and pronominalization, to achieve more natural and timely simultaneous translation while preserving essential meaning. Drawing on decades of research in speech translation, this talk will review key developments in the field and introduce our recent work toward bridging the gap between automatic speech translation and human simultaneous interpretation.



Dr. Kiran Gulia
University of
Wolverhampton, UK

Title: Green Loops: Closing the Critical Materials Loop - From AI-Driven Discovery to Real-World Circular Clean Energy Solutions.

Abstract: The global transition to clean energy is constrained by a critical materials bottleneck. Every year the world generates 62 million tonnes of e-waste, projected to reach 82 million tonnes by 2030, containing an estimated £91 billion worth of silicon, silver, gallium, rare earths and copper. In the UK alone, end-of-life photovoltaic modules represent a £7 billion recovery opportunity by 2030, yet most material continues to be landfilled. Recyclers can already achieve 90–98% recovery rates, but manufacturers lack practical tools to reintegrate these materials into high-performance products, resulting in 5–10-year R&D cycles and continued reliance on virgin imports.
Green Loops is the first initiative an end-to-end AI platform designed to close this circularity gap. The system combines green extraction processes that recover critical raw materials, rigorous materials characterisation and ECOMAT AI - a generative AI platform specifically built for recycled feedstocks, transforming them into engineered advantages such as plasmonic nanostructures and metamaterial light-trapping layers.
The platform enables the rapid design of next-generation solar cells, battery anodes and other energy materials, reducing R&D time from years to months while delivering substantial carbon and cost savings. By linking recyclers, manufacturers and researchers within a single digital loop that includes real-time carbon accountability, Green Loops offers a practical pathway to true material circularity, greater supply-chain resilience, and accelerated deployment of clean energy technologies.

KEYNOTE SPEAKERS



Ms. Sumita Singh
Executive Vice President and General Manager of Health
U.S. News & World Report

Title: Use of AI in Improving Healthcare Outcomes and Adoption by Consumers: A Perspective from the US Market, with Implications for India

Abstract: AI is changing healthcare from two directions at once. Inside hospitals, AI is starting to save lives by spotting conditions like sepsis and stroke earlier. In people's pockets, millions now ask AI chatbots about their health before they see a doctor. The US experience shows that adoption is racing ahead of evidence, regulation and trust. India is in a strong position to do better. It combines some of the world's highest consumer use of health AI with a national digital health infrastructure built for population scale. This keynote draws lessons from the US and sets out how Indian AI researchers can lead the next phase: AI that is proven to improve health, built for India's languages and settings, and trusted by the people who use it.

Three focus areas:

1. The patient now meets AI first. Health AI is no longer only a tool for doctors. Consumers are adopting it on their own, which shifts where care begins and who is responsible for getting it right.
2. Adoption is not impact. Use is growing fast, but evidence that AI improves health outcomes is still thin. Measuring real-world benefit is the field's biggest gap.
3. India can set the global standard. With its scale, digital public infrastructure and AI talent, India can show the world how to build health AI that is inclusive, safe and accountable.



Mr. Juan Pablo Velasquez Cardona
University of Southern Denmark

Title: Seeing Thickness with a Webcam: AI for Inline Inspection of Printed Perovskite Solar Cells

Abstract: Perovskite solar cells already passed 27% efficiency in the lab, but making them on large areas is a different story. Small nanometric variations in layer thickness during coating and drying change how the devices perform, and the usual way to check thickness, profilometry, is slow, measures one spot at a time, and damages the sample.

In this talk I will present work we did between the University of Antioquia (Colombia) and Swansea University (UK), where we replaced the profilometer with a webcam. Using transmitted light and a convolutional neural network trained on profilometry data, we predicted the thickness of $MAPbI_3$ and $FAPbI_3$ films. When we applied the thickness maps to flexible minimodules, the less uniform the perovskite layer, the lower the efficiency. We then installed the system on a roll-to-roll slot-die coating line to map films in real time as they were printed.

KEYNOTE SPEAKERS



Dr. Qian Chen
Special-term Associate Professor
School of Engineering Science,
University of Science and Technology of China (USTC)

Title: The AI-Era Double Helix: Cross-Chain Resonance Between AI and Semiconductor Equipment

Abstract: Something unusual is happening at the boundary of two industries. One is the semiconductor chain: equipment, fabs, advanced packaging, and the components and materials beneath them. The other is the AI chain: models, agents, and the compute that runs them. Each grew up with its own supply base and its own innovation logic. Now they are starting to couple. This talk examines that coupling in three moves.

First, the forward pull. Demand for AI compute has thrown semiconductor equipment into an unprecedented boom. The momentum travels through wafer fabs and advanced packaging, and it lands somewhere we did not expect to be looking: the critical components layer, where consumable parts and plasma-resistant materials have become strategic bottlenecks.

Second, the reverse empowerment. AI is now compressing the development cycles of the equipment and the components themselves. Materials and process development is moving off the empirical trial-and-error path toward mechanism-driven, multiscale simulation. The new anchor is fab-scale world models, run by multi-modal AI agents.

Third, the payoff. The two chains begin to accelerate each other, and together they build the infrastructure of the next industrial era.

The discussion concludes with implications for industry strategy and research priorities, and with three risks that warrant attention: energy demand, capital discipline, and geopolitical fragmentation.



Dr. Deepika Koundal
Senior Researcher
University of Eastern Finland

Title: Advancing Trustworthy AI: From Deep Learning Models to Real-World Intelligent Healthcare Applications

Abstract: Artificial intelligence, particularly deep learning, has achieved remarkable performance in medical imaging and clinical prediction, yet its adoption in real-world healthcare remains limited. A key barrier is trust: models must be accurate, but also robust, transparent, fair, and validated beyond the data on which they were developed. This talk examines the path from high-performing deep learning models to trustworthy intelligent healthcare applications. Drawing on work in neuroimaging, including longitudinal MRI-based prediction of neurodegeneration in Alzheimer's disease, it highlights lessons for building reliable systems: rigorous comparison with simple baselines, external validation on independent cohorts, statistical testing, uncertainty quantification, and careful interpretation of explainability methods. It also discusses common pitfalls such as overclaiming, data leakage, and confounding, and the distinction between predictive accuracy, clinical association, and clinical utility. Finally, the talk outlines future directions, including multimodal learning, multisite validation, and human-centred deployment, toward AI that clinicians and patients can genuinely trust.

KEYNOTE SPEAKERS



Mr. Pradeep Kumar Balyan
Co-Founder & Chief Marketing Officer
Blueprint360

Title: Beyond Prompt Engineering: Five Skills Every Engineer Needs in the Age of AI

Abstract: Using AI to generate an answer is not the same as learning effectively with it or building a system that others can rely on. This keynote explores five essential skills that help engineering students and faculty move beyond prompting towards purposeful, evidence-based and responsible AI use.

Drawing on the speaker's learning from the IITM Agentic AI programme and hands-on work with AI prototypes, the address focuses on problem framing, working with evidence, workflow design, testing and debugging, and human judgment. Each skill is illustrated through a different, relatable example: defining a campus project, investigating research literature, designing a laboratory learning activity, validating AI-generated code, and reviewing student project proposals.

The session highlights the decisions that remain essential even when AI can generate content, explanations or code. Participants will learn to identify meaningful problems, select trustworthy information, assign appropriate roles to AI and people, evaluate results, and recognise the limits of automation. The central takeaway is simple: move from accepting AI outputs to understanding, verifying and taking responsibility for the work done with AI.

CONTENTS

1	**Forewords**	i-x
2	**Preface**	xi
3	**Sponsors & Supporters**	xii
4	**Committees**	xiii
5	**Schedule**	xiv-xv
6	**Keynote Speakers**	xvi-xix
7	**Abstracts**	1-76

Paper Id	Paper Title	Authors	Page No.
482	CareerMate: A Multilingual AI-Powered Conversational System for Personalized Career Guidance and Job Recommendation	Mahika Harikumar, Debasmita Mishra, Priyanka Savedekar, Neha Arora, Chanti Vasavi, Nisarga A	1
551	Sentiment Analysis of Cyberbullying on Social Media	Shivika Singh, Mohit Goyal, Saisha Handa, Sanskar Mishra, Rinki Chauhan, Yasha Istwal	1
561	HEAL: Advanced AI System For Comprehensive Health And Eating Analysis Using Blood Reports Through Learning Techniques	Rakshitha, Minal Assadi, Disha D, Khyati S Suvarna, Rashmitha Shettigar	1
639	Cervical Cancer Prediction Using Hybrid Models: Integrating Urine and Blood Biomarkers	Seema Jakhar, Yogita Yashveer Raghav, Tanvi Chawla	2
660	High-Accuracy Multi-Class Cotton Leaf Disease Classification Using EfficientNet-B3 and Transfer Learning on the SAR-CLD-2024 Dataset	Gajanan Ankatwar, Chitra Dhawale, Supriya Narad	2
723	Transforming Critical Care: AI-Based Precision Sepsis Prediction Using Machine Learning	Kiran Preet Bedi, Aditi Kharga, Pritika Adhikari	3
757	Energy Efficient and Sustainable Infrastructure for Smart Home IIoT: A Swarm-Intelligence Enhanced DRL Intrusion Detection Model	Sundaram P, M. Jayaprakash	3

Paper Id	Paper Title	Authors	Page No.
845	An End-to-End MLOps Framework for Drift-Aware Scalable Predictive Analytics on Energy Consumption Forecasting	S. Venkatesh, Sriram S	4
850	Real-Time Crowd Density Estimation and Public Safety Monitoring Using YOLO-Based Deep Learning Framework	U. Sakthi, Datla Trilok Varma, Amarnath Devireddy	4
874	Soil-Centric Multimodal Learning for Plant Health Assessment in Precision Agriculture	Ilakshi Singh, Anuradha Chug, Amit Prakash Singh	5
878	Architecting the Next Generation of Semantic Plagiarism Detection: A Privacy-Preserving Framework Combining Local LLM Preprocessing, SBERT Embeddings, and Generative Validation	Sterlin S, S Gokulram, S Abirami	5
897	GitHub Issue Triage Bot	Ravi Sharma, Ananya Shakya, Ananya Singh.	5
909	Deep Neural Networks for Early Detection of Chili Leaf Diseases	Preeti, Ganesh Kr. Wadhwani, Pankaj Kr. Varshney	6
913	Integration of Artificial Intelligence in Agriculture	Rohit Singh, Ranjan Kumar, Neeraj Negi, Suman Paul.	6
915	PocketGenMol: Structure-Conditioned Molecular Generation via Masked Diffusion over SAFE Representations	Monika Kumari, Arun Singh Bhadwal, Soham Das, Kenneth Lobo, Navya Singh, Ritik Dwivedi	6
917	Locally-Global Synergistic Temporal Perception Network for Lightweight Video Summarization	Vaani Garg, Anil Singh Parihar	7
925	Drug Detection Using Applied Machine Learning Algorithms	Rupam Bhagawati, Lohith R, Rishabh Dev Shukla, Naren P, N Jeevani, Adya	7
929	Regenerative Braking System in Solar Assisted Electric Vehicle	Sunil Gupta, Nirbhay Tiwari, Sujal, Kartikeya Singh Negi	7
935	TF-IDF VS BM25 with BERT for Multi-Task Crisis Type and Urgency Classification	Basudev Nath, Ashok Sahu, Swati Sucharita Roy, Sampa Chau Pattnaik, Jogeswar Tripathy, Nilima Rani Das	8
938	A Robust Attack Type Detection Model Enhancing IoT Network Security	Shobha Chawla, Neha Gupta, Mridula Batra, Malkeet Singh	8
955	NeuroNote: A Knowledge-Tracing-Augmented Framework for Adaptive Note Retention and Personalised Spaced Review	Pokuri Rajesh Kumar, Shefali Sharma, Pooja P, Rohitha Mettu, Suraj Datta Narayana	9

Paper Id	Paper Title	Authors	Page No.
962	Integrating Machine Learning and Memory Forensics for Enhancing Cybersecurity in IoT-Enabled Energy Systems	Sonika Malik, Vedaang Chopra	9
972	A Deep Adversarial Adaptation Network with Efficient Net Backbone for Cross-Domain Plant Leaf Disease Detection and Reliable Classification	Aaftab Alam, Shabina Ghafir, Ihtiram Raza Khan	9
973	An Agentic AI Framework for Resolving Natural Language Ambiguity in Database Querying Through Semantic Validation	Tejinder Kaur, Rubika Walia, Ramesh Cheripelli, Kamna, Payala Krishnanjaneyulu, Kirti Sharma	10
974	A Hybrid Edge AI Framework for Real-Time Cyber Threat and Object Detection Using NLP, Behavioral Analytics, and Contextual Intelligence	Tejinder Kaur, Swathi Cheripelli, P. Prince, Scinthia Clarinda S, S.L Jany Shabu, Kumari Deepika	10
976	A Deep Learning Framework for Automated Insurance Advisory and Intelligent Decision Support	Tejinder Kaur, CS Jyoti Arora, Daljeet Kaur, Kiranpal Singh Virk, Karan Walia, Karan Mahajan	11
977	Automated Smart Parking and Cantonment Infrastructure Detection Using YOLOv11-Large, Computer Vision, Crowdsourcing, and Multimodal Vision–Language Reasoning	Tejinder Kaur, Shweta Joshi, Jaspreet Singh, Aakash Kumar, Shweta Gupta, Mansi	11
984	From Classical ML to Contrastive GNNs: A Systematic Review of Faux-Hate Detection Frameworks	Pooja Yadav, Rohit Beniwal	11
985	ProxiMix: A Prototype-Driven Proximity-Aware Meta-Embedding Framework for Faux-Hate Detection	Pooja Yadav, Rohit Beniwal	12
987	A Systematic Literature Review of Autonomous AI Agents Powered by Large Language Models	Pooja Yadav, Rohit Beniwal	12
990	Evaluating the Impact of Online Learning on Academic Performance: A Mixed-Methods Case Study of Undergraduate Students in Chennai	T.J.Nagalakshmi	12
993	Cyber Threat Detection in the Era of AI: A Systematic Review from Traditional Machine Learning to Autonomous LLM Agents	Sujyoti Jha, Manoj Kumar	13

Paper Id	Paper Title	Authors	Page No.
994	PhishScore: A Weighted Multi-Feature Phishing Email Scoring Framework for Human and AI-Generated Threat Assessment	Sujyoti Jha, Manoj Kumar	13
996	A Systematic Review of Hallucinations in Large Language Models: Detection, Mitigation, and Evaluation	Prince Chaudhary, Rohit Beniwal	13
998	Text-Based Emotion Classification using a Transformer and Deep Learning Models	Sorabh Gupta, Rattan Deep Aneja, Shipra Raheja, Vandana, Mrinal Paliwal	14
999	Ensemble based Fake News Detection with Transformers and Random Forest	Piyush Vashistha, Jai Anand, Aryan Malik	14
1004	ACMA: Affective Cross-Modal Attention for Sarcasm-Aware Cyberbullying Detection in Code Mixed Meme	Vinayak Suryavanshi, Manish Kumar, Ishika Rohilla, Vivek Mehta, Deepika Kukreja, Amarjit Malhotra, Rinky Dwivedi	15
1005	A Four-Tier Temporal Feature Engineering Framework for Meteorology-Only Urban AQI Forecasting	Harsh Garg, Sanjay Patidar	15
1013	A Hybrid Multi-Signal Framework for Hallucination Detection in Large Language Models	Prince Chaudhary, Rohit Beniwal	16
1016	Predicting Flight Delays via Multi-Relational Graph Attention Networks	Prajwal Gupta, N Parthiv Kumar, Ashwini M Joshi	16
1017	Comparative Analysis of Deep Learning Models for Osteoporosis Classification in Knee X-ray Images	Ankur Rai, Sanjay Patidar	16
1020	PPO Fine-Tuning for Poetic Generation in Compact Llama-Style Language Models: A Controlled Two-Scale Study	Prabhsurat Singh, Poonam Narang	17
1021	Integrating Machine Learning and Human-Computer Interaction for Accurate Early Dementia Detection	Jolly Parikh, Yugnanda Puri, Kirti Sharma, Sudesh Pahal, Manish Talwar, Urvi Maniar, Neetu	17
1032	Feature-Enhanced Handwritten Text Recognition Using CNN–BiLSTM with Attention and NLP Post-Processing	Anushree Raj, Sandhya Madhuri G, Aishwarya D Shetty, C. Naveeth Babu	17
1033	Machine Learning–Driven Diabetes Prediction Using Symptom-Based Clinical Features and Feature Optimization	Deepanshu Goyal, Apurva Vashist, Babita Deswal	18

Paper Id	Paper Title	Authors	Page No.
1034	AI-Powered IoT Healthcare Wearable Ecosystem for Real-Time Health Monitoring and Predictive Analytics	Neha Gupta, Mridula Batra, Shobha Chawla	18
1046	Framework for Precise Weed-Crop Detection in Distorted Potato Farm Dataset Using A Robotic Vehicle with Manipulator	Prince Singh, Sanjay Patidar	19
1055	Green Finance and Renewable Energy Investments: A Comprehensive Review of Technology-Driven Sustainability	Prabhjot Kaur, Damanpreet Singh	19
1056	Sequential Activity Analysis: Implementing LSTM-CNN Models for Behavioral Anomaly Detection	Ashish Kumari, Parveen Kumar, Navdeep Bohra, Neeti Sangwan, Naveen Dahiya	19
1057	CNN-Based Deepfake Detection Using Deep Learning Techniques	Mitu Sehgal, Sorabh Gupta, Suman Mann, Rashmi Makkar	20
1058	A Data-Driven Framework For Thermoelectric Cooling and Power Generation Tracking Using Clustering And Polynomial Thermal Analytics	Deepshikha Yadav, Prinkle Talan, Koyel Datta Gupta, Archana Balyan	20
1059	A Graph-Theoretic Multi-Agent Framework for Quantifying Emergent Collective Intelligence in Distributed Adaptive Systems	Saumya Maheshwari, Pranjal Sharma, Ritik Jha, Dev Ujalayan, Puneet Azad, Deepak Goyal	21
1064	Intelligent Medical Image Management System for Chest X-Ray Classification and Multimodal Clinical Retrieval	Ezeddin Hakami, Ali Alyatimi, Ali Hakami, Gargi Verma	21
1067	Deep Learning for ECG and EEG-Based Disease Detection: A Critical Survey of Architectures, Challenges and Emerging Trends	Jyoti Rani, Shilpa Gupta, Vikas Mittal	22
1071	Attention U-Net with Boundary-Aware Composite Loss for Urban Flood Detection from SAR Imagery	Rishabh, Amar Arora, Reena Gupta	22
1080	Imbalance-Aware Skin Lesion Classification Using EfficientNetB0 with Focal Loss and Gradient-Based Visual Explanations	Shubham Mall, Shweta Meena	22
1082	Design and Implementation of a High Concurrency Resource Booking System	Suman Lata, Pardeep Sangwan, Sachit Rathee, Ketan Gulati, Dinesh Sheoran	23

Paper Id	Paper Title	Authors	Page No.
1087	Machine Learning-Based Resource Allocation and Channel Assignment in Wireless Communication: A Survey	Prity Sinha, M. Gangadharappa	23
1088	Neural Network Architecture for Real-Time Warning Detection	Varsha Gupta, Neetu Settia, Shivani Duggal, Gagandeep Kaur, Suhani Duggal, Archna Priyadarshani	24
1089	SummarEase: An AI-Integrated Multi-Modal LLM Framework for Hierarchical Structural Parsing and Adaptive Academic Summarization	Anika Sharma, Pooja Gupta, Aayushi Chakraborty	24
1090	Predicting Cardiovascular Disease Vulnerability based on Lifestyle Factors Using Deep Learning	Nishtha Jatana, Koyel Datta Gupta, Kavita Sheoran, Shaily Malik, Divya Jatain, Geetika Dhand, Deepshikha Yadav, Prinkle Talan	25
1091	Disentangling Pollutant Dependency and Temporal Forecasting in Machine Learning Based AQI Prediction	Dhruv Yadav, Sonam	25
1092	Leveraging Machine Learning Models in sustainability and Business Valuation	Komal Khatri, Sushma Malik, Anamika Rana	26
1097	Optimizing Enterprise Performance through AI-Driven Digital Management Systems	H S. Abzal Basha, Indla Venkata Shreya, Vivek Veeraiah, Naim Shaikh, Rohit Anand, Ravinder Kaur, Neetu Sehrawat	26
1098	Transforming Organizational Decision-Making with Data-Driven Computing Frameworks	H S. Abzal Basha, Gorantla Sriya Vardhini, Mamatha G, Naim Shaikh, Shahanawaj Ahamad, Tina Rani, Tripti Rathee	26
1100	Strengthening Corporate Agility via Smart Information Systems Architecture	Gitanjali Shrivastava, Veera Talukdar, Vivek Veeraiah, Asfa Ahamad, Ankur Gupta, Tina Rani	27
1101	Redefining Business Process Efficiency through Intelligent Technology Integration Frameworks	Gitanjali Shrivastava, Veera Talukdar, Mamatha G, Asfa Ahamad, Ankur Gupta, Hardeep Kaur	27

Paper Id	Paper Title	Authors	Page No.
1102	Enabling Sustainable Organizational Growth using Data-Driven Intelligent Resource Planning Systems	A. Pankajam, Gitanjali Shrivastava, Vivek Veeraiah, Mamatha G, Ankur Gupta, Hardeep Kaur	28
1104	Reinventing Strategic Leadership through Predictive Analytics Algorithms	H S. Abzal Basha, Kedas Manikanth, Veera Talukdar, Naim Shaikh, Shahanawaj Ahamad, Vijesh Chaudhary	28
1106	The Illusion of Sources: A Comparative Study of Citation Fabrication in Gemini-3 and ChatGPT-5.2	Mehak Singh, Yessica Malhotra, Sukhvir Singh, Mayank Chaudhary	29
1108	An Extensive Deep Learning Approach for Dental Disease Detection: Evaluating Architectures with Class Imbalance Handling	Himanshu, Manish Upadhyay, Prince Pandey, Reena Gupta	29
1109	AMR-Layer: Cloudflare Dependency Analysis and Adaptive Multi-CDN Failover for Internet Resilience	Mansimaran Singh, Parag Ravikant Kaveri, Manisha Mittal, Anshpreet Singh Bindra, Anirudh Iyer, Reshma R	29
1110	Machine Learning Framework for Intelligent Career Prediction Using Academic, Behavioural, Personality, and Skill-Based Analytics	Vidushi, Yashika, Sneha Chandel, Shikha Jain, Sneha Ashiwal	30
1132	Deep Dental Gender-Net: A GAN-Augmented Segmentation-Guided CNN–Transformer Model for Forensic Gender Identification from Teeth Images	Bhawna Bhardwaj, Amit Prakash Singh, Ruchi Sehrawat, Jeyaseelan Augustine, Mahesh Verma	30
1133	Sustainable AI Systems: Evaluating the Impact of Model Compression and Transfer Learning Strategies	Palak Gupta, Vedang Wadhawan, Deepak, Vaani Garg, Sunita Kumari, Pallavi Ranjan, Sabnam Kumari	31
1134	A Smart IoT-Enabled Cyber-Physical Framework for Groundwater Surveillance and Control	Aakarsh Mishra, Vaani Garg, Bhawna Bhardwaj, Deepak, Divya Chaudhary, Sabnam Kumari	32
1138	An Efficient Deep Learning Framework Based on CNN–BiLSTM for Sentiment Analysis	Anamika Rana, Sushma Malik, Meena Siwach Rana, Prashant	32

Paper Id	Paper Title	Authors	Page No.
1139	Adaptive Cloud-Edge Task Offloading Using Reinforcement Learning in IoT Systems for Real-Time Optimization	Khushboo, Drishti Gulati, Raghav Garg, Ankit Singh Raghuvanshi, Puneet Azad	32
1140	Modbus-Based Digital Energy Meter with Dual-Core Cloud Telemetry	Rohini Sharma, Abhinav Kumar Singh, Khushboo, Srishti, Sunil Gupta	33
1142	Cluster-Oriented Sampling Methods for Imbalanced Data Learning: An Analytical Review of Algorithms, Challenges, and Innovations	Sangeeta Kapoor, Sumit Chopra, Prabhjot Kaur	33
1143	Performance Analysis of Classification Models for Breast Cancer Prediction on the Wisconsin Diagnostic Dataset	Shyla, Shalu, Ajay Dureja, Minakshi Tomer, Dhyanendra Jain, Mahesh Kumar	33
1145	A Parameter-Efficient Domain Adaptation Framework for Speech Recognition Using Synthetic Data	Golla Madhu, Srikar Janjirala, Ashish Lukka, Swaroop Mallidi, Shaik Afzal Elahi	34
1149	Eden: A Multi-Modal AI Orchestration Engine for Automated Misinformation Analysis	Swathi A, Mohammed Sahil, Madhava K S Puranik, Mithun Kumar B V, Mohammed Abu Sufiyaan	34
1150	Cloud Computing and IoT Framework for Electric Vehicle Wireless Charging Infrastructure	Pavithra M R, D Shofia Priyadharshini, V Jahnavi, H Azath, M Kotteeswaran, C Srinivasan	35
1151	Multi-Node PIoT Sensor Analytics for Smart Grid Fault Prediction Using XGBoost	Pon Harshavardhanan, M Vadivel, M Saraswathi, R Poornima Lakshmi, C Srinivasan, Oviya V	35
1152	Multilayer Perceptron Model for Electrochemical Pollutant Detection Using Carbon Nanomaterials	N Abirami, R Kamaraj, Hari Krishna Kalidindi, J Lenin, C Srinivasan, Monisha R	36
1153	Energy Aware GRU Framework for Robust IoT Network Intrusion Detection Systems	Sundara Kumar M R, Challapalli Suma, Pon Harshavardhanan, Dr Rajasekar Rangasamy, C Srinivasan, Santhosh M	36
1154	Predicting UAV Conflict Risk in Multi Traffic Environments Using Logistic Regression Model	A Saleth Mary Vetriselvi, S V Arun, P Madhuri, Kanmani Thirumalaisamy, C Srinivasan, Shally Grace Selvam	37

Paper Id	Paper Title	Authors	Page No.
1155	Edge Computing-Based Low-Latency Control for High-Gain DC–DC Converter Stability Improvement	S Vimali, R Leela Jyothi, R Srinivasan, D Amaravathi, Akhil Gupta, C Srinivasan	37
1156	A Comprehensive Review of Hybrid Intelligence, Retrieval-Augmented Generation, and Explainable AI Approaches for Healthcare Informatics and Clinical Decision Support System	Mounika N, Deepak Vats, Navjeet Kaur	38
1159	A Stacking Ensemble Framework for the Robust Sentiment Analysis of Assamese-English Code-Mixed Social Data	Himanshu Sayankar, Harshala Shingne, Sruthi Nair, Charanjeet Dadiyala	38
1161	Evaluating Seed Word Embeddings for Deep Learning Bugs Categorization	Gaurav Sandhu, Kamaldeep Kaur	38
1162	The Future Sensor Integration Applications for External Interface Devices and Artificial Intelligence	D.Geethamani, Jyothi D., Peddinti Neeraja, Ch V S Satyamurty, Venkatachalam, T. Sheela, Nishika M., A. Preethi	39
1165	Sequential Pattern Learning in Animal-Centric Motion Analysis and Surveillance: A Review	Sakshi M Maurya, Madhu Bala, Tanima Thakur	39
1167	Blockchain-Based IoT Network for Sustainable Farm-to-Fork Food Traceability and Certification	H Azath, Uma Devi T, Cheepurupalli Raghuram, T Akila, M Muthulekshmi, M Jagadeeswaran	40
1168	Cloud-Integrated IoT Electrical Substation Monitoring for Improved Smart Grid Reliability	Pavithra M R, B. Gopi, P Ravi Krishna, B Kannadasan, M. Muthulekshmi, Ishwarya M V M V	40
1169	Modeling and Optimization of Resonant Wireless Charging for Electric Vehicles with IoT Integration	S Kala, K Durga Bhavani, M Ravi Sankar, R C Karpagalakshmi, V Vidya Lakshmi, M. Muthulekshmi	41
1170	Random Forest-Based Detection of Abnormal Residential Electricity Usage in Smart Homes	Indhumathi M, Christuraja S, Vaithiyalingam Subramanian Manjula, Pasumarthy Rambabu, R. Poornima Lakshmi, M. Muthulekshmi	41

Paper Id	Paper Title	Authors	Page No.
1171	Wearable IoT Sensors for Real-Time Detection of Night-Time Breathing Irregularities through Edge Analytics	D Sasikala, Buddaraju Rekha Madhavi, S Kala, M Vadivel, M Muthulekshmi, Ishwarya M V	42
1173	A Hybrid CNN and Bi-LSTM Deep Learning Framework for Accurate Water Quality Index Prediction	Bhargav Ram Rayapati, Narra Anuhya, Faisal Mohammad, Manivarun Nethi	42
1174	A Deep Learning Framework for RGB-Thermal Image Denoising and Enhancement in Autonomous Unmanned Vehicle Navigation System	Bhargav Ram Rayapati, Kotla Sree Samyuktha, Shaik Shanawaz, Mohamad Shoyab Akhil	43
1177	A Bi-LSTM–Based Conversational Framework for Early Academic Risk Prediction and Student Mentoring	S.M.Krishna Ganesh, Guhan Balaji. C, Vinoth Kumar V, G Vinoth Chakkaravarthy, Dr R. Santhana Krishnan, Nishanthini S	43
1180	AI Based Healthcare Document Intelligence System for Medical Information Extraction and Semantic Search	Vignesh Manivannan, Balavigneshwar B, R. Vijayalakshmi	44
1181	A Novel Weighted Marine Health Index for Real-Time Coral Reef Biodiversity Monitoring with Cumulative Multi-Species Tracking	Shri Harsan M, John Deva Prasanna DS	44
1183	Scalable Electric Vehicle Battery Traceability System Integrating Blockchain and IoT	J. Venkatesh, Ahmed Shahebaaz, S N V P Ravi Teja, S Vimali, S Murugan, Ishwarya M V	45
1184	Digital Twin with Cloud Analytics for Personalized Treatment of Chronic Neurological Disorder Patients	V Srividhya, R Poornima, S P Vimal, N Mohankumar, R Meenakshi, S Murugan	45
1186	IoT-Based Fish Pond Water Contamination Analysis Using Random Forest Model	K Babu, Sugatha Kumari B, Shaik Subhan, V Balu, S Murugan, Ishwarya M V	46
1187	Cloud-Assisted Monitoring and Fault Diagnosis of Isolated DC–DC Converters in Distributed Power Systems	Christuraja S, Rajarajeshwari Kamaja, R Srinivasan, T Prasad, S Karthikeyan, S Murugan	46
1188	Remote Postpartum Maternal Health Monitoring Using Wearable and Cloud Technology	M Vadivel, B Kannadasan, Potturi Sandhya, Ajay Kumar Vegi, S Murugan, V Aruljyothi	47

Paper Id	Paper Title	Authors	Page No.
1189	Random Forest Regression for Predicting Tensile Strength of Composite Materials	Deepa Dasarathan, S Vimali, V Vijaya Baskar, P Siva Durga Rao, V Balu, S Sujatha	47
1190	A Scalable Edge-Enabled IoT Architecture for Monitoring Floating Solar Power Plants	S P Vimal, H Azath, Challapalli Suma, R Poornima, S Sujatha, Gunasundari B	48
1191	Robust Edge Controlled IoT Autonomous Agricultural Robot for Efficient Precision Farming Operations	Sanjith N, Akhil Gupta, R. Jagadeesh Kannan, Deepa Dasarathan, S Sujatha, Shushmitha S J	48
1193	Cloud-Integrated IoT Framework for Real-Time Control of SiC-Based EV Fast Charging Converters	R Kamaraj, Potturi Sandhya, P V V Satya Eswara Rao, R Jagadeesh Kannan, V Vidya Lakshmi, S Sujatha	49
1194	Random Forest-Based Assessment of Parkinson's Hand Tremor Using IMU Sensor Data	J. Christina Linsey, K. Vanishree, Challapalli Suma, N. Divya Sri, S. Sujatha, V. Aruljyothi	49
1195	Support Vector Machine-Based Clinical Blood Analysis for Early Dengue Detection	Nisha Rani D, Damodharan D, Rajarajeshwari Kamaja, Sujatha T, Indhumathi M, Sathishkumar V E	50
1197	KrishiSetu: Smart Soil Analysis & Weather-Based Fertilizer Recommendation System	Piyush Gawali, Shrirang Amle, Shriram Vyavahare, Harsh Mishra	50
1200	Deepfake Detection Using a Hybrid CNN–GRU Architecture with a Discriminative Distance Index	Riyanshu Akash, Isha Bharti, Nitish Kumar, Anish Kumar, Tanmoy Ghosh, Dishani Roy	51
1201	Explainable AI-Driven Clinical Decision Support for Personalized Drug Recommendation and Medication Discontinuation Planning	Asmitha Reddy P, Jayasri S, R. Ashwarya	51
1211	A Multimodal System for Emotion-Aware Music Recommendation and Generation	Prajyot Bhoskar, Smita Daware, Swati K, Pankaj Warule, Gautam Jha, Soham Kathalay, Chinmay Anjankar	52
1218	FAANet: A Fault-Aware Attention Network for Multi-Class Photovoltaic Defect Classification in Electroluminescence Images	Gaurav Kumar Sinha, Ritula Thakur	52

Paper Id	Paper Title	Authors	Page No.
1219	A Hybrid Neuro-Statistical Stacking Architecture for Evaluating Bengali AI-Generated Health Responses	Himanshu Sayankar, Harshala Shingne, Sruthi Nair, Charanjeet Dadiyala	52
1222	AI-Powered Digital Employee for Enterprise Helpdesk Automation Using Retrieval-Augmented Generation and Agentic AI	Nivetha R T, Prithisha S, Karishma S, Sahana P, Keerthana R	53
1229	AI-Driven Solar Power Forecasting for Sustainable Development: Random Forest vs. LSTM	Ganesh Valiachi, S. Ishwarya, K. Kalidasu	53
1230	When Prediction Becomes Reconstruction: Quantifying Endpoint–Input Circularity in Respiratory Machine Learning	Adishree Gupta and Mahitha G	54
1232	Agentic AI Based Local Student Support Assistant: An Autonomous Query Resolution System Using NLP and Machine Learning	Subodh Sharma, Anish Kumar, Dhruv Gupta, Chaitali Bhowmik	54
1238	An Optimized G–LSTM Framework for Option Price Forecasting	Shubhangi Porwal, Namita Srivastava, Manoj Jha	55
1243	Deep Learning-Based Malware Classification with Explainable AI and Adversarial Robustness	Nakul Bakchi, Md Azmir Bhuiyan, Anshu Vashisth, Md Imran Hossain, Gagandeep Kaur, Buddha Dev Sarker	55
1245	UAV Collision Avoidance: A Review of Strategies, Challenges and Algorithms	Himanshu Gandhi, Anshu Vashisth, Gagandeep Kaur, Bhupinder Kaur, Gurleen Kaur Walia	56
1249	Quantum-Based Learning for Heart Disease Classification: A Comparative Study with Classical Approaches	Riya Kharwal, Renu Dalal	56
1250	OpenCyberKAN: Attack-Dependent Open-Set Intrusion Detection with Uncertainty-Calibrated Kolmogorov–Arnold Networks	Charanjeet Dadiyala, Rashmi Welekar, Padma Adane	56
1256	Hybrid Quantum Deep Learning for Acute Lymphoblastic Leukaemia Detection: A Pipeline Utilizing MedSAM Segmentation, Vision Mamba and Parameterized Variational Quantum Classification	John Annish Colin J, Kanuri Tagore Sai, Surukanti Eshwar Reddy, R L Aadithyaa, Suma Kamalesh Gandhimathi	57
1269	Predictive Behavioural Analytics for Medical Tourists Using AI and Open Banking Data: A Domain Specific Feature Engineering and Fairness Governance Approach	Tejas Pawar, Ashwini Brahme, Ashwini Chavan, Smita Chavan, Nitin Ganeshar, Tushar Kathane, Vidya Ugare	57

Paper Id	Paper Title	Authors	Page No.
1271	The Charitable Attribution Bias in LLM Strategic Reasoning: Implications for AI Governance and Robust Multi-Agent Coordination	Ronald Lopes	58
1273	ELACHI: Construction, Preprocessing and Benchmarking of an In-Field Cardamom Pod Detection Dataset from Fixed-Camera Plantation Video	Aishwarya M F Prabhakar, Shilpa S Chaudhari	58
1276	MemCP: Context-Aware Memory Compression and Retrieval for Long-Horizon Large Language Model Agents	Viomesh Singh, Praneel Jain, Raj Bapat, Ayush Mahajan, Prachi Jamdade, Sundaram Waghmare	59
1277	Adaptive Ensemble of Transformers and XGBoost for Multi-Horizon NO2 Nowcasting in Urban Environments	Rohith A, Arikumar K S	59
1278	Lexora-An Intelligent RAG-Based Business Legal Assistant	Aditya Raj Upreti, Anshul Kumar, Ansh Bansal, Sonika Nagar	60
1279	Machine Learning-Based Alzheimer's Disease Detection Using Radiomic and Texture Features from Brain MRI	Anshu Vashisth, Mithun Das, Tanvir Ahmed, Khadija Slimani, Denesh Das	60
1281	Vision Transformer-Based Framework for Multi Stage Alzheimer's Disease Classification from Structural MRI	Anshu Vashisth, Tanvir Ahmed, Shahjadi Sultana, Khadija Slimani, Krima Ashokkumar Patel	61
1288	Artificial Intelligence and Evolutionary Optimization for Multi-Energy Microgrid Dispatch: A Systematic Review of Algorithmic Trade-offs, Edge Deployability, and Grid Stability	Akshay Raj, Vaibhav Sharma, Gaurav Rai, Sandeep Kumar Verma, Zoya Naaz, Zeba Rani	61
1291	WeighGuard: A Physics-Informed Redundancy Autoencoder Framework for Detecting Adversarial Tampering in Weighbridge Load-Cell Systems	Mohamed Azeem A, Partha Sharathy K, Shyni Vinse R P	62
1292	Cold-Start Inventory Replenishment Under Joint Demand and Supply-Yield Uncertainty: Yield-Aware Decision-Focused Meta-Learning	Nitin Kumar Mishra, Preeti Singh	62

Paper Id	Paper Title	Authors	Page No.
1310	Proximal Policy Optimization for Dynamic Obstacle Avoidance in Flapping-Wing Micro Aerial Vehicles	Vandana CP, Neelamegam G, N Varatharajan, Geetha V, Akshya J, M Sundarrajan, Mani Deepak Choudhry	63
1317	Pseudo-Multimodal MRI Representation Learning With Multi-Head Self-Attention Fusion for Alzheimer's Disease Classification	Shipra Raheja, Amit Kumar Bindal, Rattan Deep Aneja	63
1318	An Ensemble Learning Framework for Urban Traffic Slowness Prediction with a Proposed Multi-Agent Control Architecture	Dr Alisha Banga, Dr Monika Jain, Dr Amba Mishra, Ms Meenakshi Vishnoi	64
1320	A Smartphone based digital tool for health monitoring	Akash Singh, Abhinav Singh, Dheeraj Singh, Shivani Garg	64
1332	SecureIrisNet: Lightweight Deep Learning Framework for Robust Iris Recognition and Classification	Manoranjitham S, Jayshree Gorakh, Farooq Ahmad, Thinaharan N, Rasika Padegaonkar, Dharmadurai K	64
1334	Deep Learning and Explainable AI for Pancreatic Cancer Detection: A Review and Critical Analysis	Vishesh Tanwar, Bhisham Sharma	65
1336	Robust Multi-Objective Lightweight Deep Reinforcement Learning for Secure NOMA-Based Smart Grid Communications Under Imperfect Channel State Information	S. Senthazhai, R.J. Kavitha, S.P. Anbukodi, D. Ilakkiaselvan, D. Dhanalakshmi	66
1340	A Faithfulness Study of KernelSHAP and LIME on Large-Scale Anti-Money Laundering Transactions	Akshatha Srikantha, Manpreet Singh, Rohith Reddy Bellibatlu, Triveni Morla, Amandeep Kaur	66
1341	An AI-Driven Clinical Decision Support System for Automated Tumor Multi Classification Using MRI Images	Blesson Samuel D, Glory Precious J, Samuelraj Chrysolite G, Sameera Fathimal M, Sivaprasath K, Jothiraj Selvaraj	67
1342	Design of Optimized Hybrid Deep Learning Model Using Ensemble Learning for Attack Detection and Security Enhancement Using Encryption in IoT Network	Saya, Ajit Singh	67
1343	Renewable Energy-Based Feasibility Analysis for an Unelectrified Rural Village Using Load Survey Data	Shalom Irence LB, A Immanuel Selvakumar	67

Paper Id	Paper Title	Authors	Page No.
1364	AeroShield-AI: A Unified Data-Driven Architecture for Autonomous Flight Guidance, Navigation Resilience, and In-Time Operational Safety	Aashita Chhabra, Himang Tyagi, Aniket Verma	67
1365	An Explainable AI Framework for Automatic Analysis of Laboratory Report in Context	P.Swetha, S. Dharsin, D. Dinesh, S. Sri Vishnu Varthan	68
1366	A Stacking Ensemble Architecture for High-Resolution Multi-Output Spatiotemporal Load Forecasting Across Multi-Zonal Smart Grids	Himanshu Sayankar, Harshala Shingne, Sruthi Nair, Charanjeet Dadiyala	69
1371	Comparative Analysis of Production-Ready Time Series and Recursive Machine-Learning Models with Socio-Economic Covariates for Electricity Demand Forecasting in Delhi	Ankit Srivastava, Manish Jain, Devi Prasad Bhukhya	69
1373	Reimagining Animation Education in the Age of Artificial Intelligence: Challenges and Opportunities for Teaching and Learning	Sanjay Kumar, Pratap Rajpoot, Dhara Hans	69
1376	Spatially Transferable Machine Learning for Multi-Horizon Soil-Moisture Forecasting in Data-Sparse Smart Irrigation	Swaraj C M, Sasikumar A	70
1377	When Does BERT Help? A Cross-Domain Study of the Marginal Value of Text Embeddings Beyond Structured Features	Ayush Srivastava	70
1378	University Students' Utilization of Generative AI- Generated Solutions for Academic Problem Solving: An Extended Task–Technology Fit Model	Duy Vu Le, Anh Phan Ngoc Que	71
1381	Topological Vision Transformer for Severity Aware Lung Disease Classification	Tharun M, Saravanan S, Kotteeswaran Rangasamy	71
1383	HalluGuard-Med: An Explainable Framework for Grounded Medical AI and Clinical Claim Verification	Ramkrishna S. Bharsakade, Harshvardhan M. Patil, Rajvardhan P. Patil, Bhavesh M. Patil, Kartik N. Patil	72
1389	HalDetect: Entropy-Based Hallucination Detection for Medical LLMs	Harsh Kumar, Himanshu Kumar	72
1390	Technical Quality of AI-Enabled EV Charging Applications and Users' Charging Management Experience: Evidence from Consumers in Vietnam	Nguyen Dao Que Nhu, Duy Vu Le	72

Paper Id	Paper Title	Authors	Page No.
1391	A Hybrid OCR-CNN-LLM Framework for Automated Medical Prescription Analysis	Diya Saha, Reya Sharma, Mansi Bhagoria, Pooja Chaudhary, Suhaib Ahmad	73
1392	Federated CNN with Diffusion Augmentation and Differentially Private Gradient Centralization for Lung Disease Classification	Saravanan S, Tharun M, Kotteeswaran Rangasamy	73
1398	A Unified Trustworthy Framework for Tabular Decision Support with Conformal Calibration and Sandboxed Agent Execution	Vasu Dev Sharma, Gurleen Kaur, Kshem Dikshit, Angad Pal, Challa Vinod Reddy, Saumya Tripathi	74
1402	A Real-Time Multi-Engine Research Terminal for Precious-Metal Market Intelligence	Ramkrishna Bharsakade, Parth Dongre, Parth Birari, Atharv Patil, Aryan Patil	74
1404	AetherSea: AI-Powered Marine Debris Intelligence and Cleanup Route Optimisation	Amruta V. Patil, Ananya P. Kulkarni, Anushka A. Khot, Aditi V. Menbudle	74
1408	A Secure Transmission of Data Using A Token-Based Method Over Wireless Sensor Networks	K. Kowsalya, J. Swarnalakshmi, Kuruma Purnima, S. Navaneethan	75
1409	A Hybrid CNN–LSTM–DNN Framework for Electricity Theft Detection in Smart Grids	K Yuvaraj, M Lakshmi Prasanna, R Surekha, Kuruma Purnima, Vijayan P M, Shaik Hedayath Basha	75
1410	NSDFNet: A Neighbourhood and Self-Similarity Distance Fusion Network for Robust Image Denoising	V Tejovathi, Kuruma Purnima, Venkata Lakshmi Keerthi K, G Ravi Kumar, R Priyadharshini, C. Sushama	76

Paper id 482

Paper title CareerMate: A Multilingual AI-Powered Conversational System for Personalized Career Guidance and Job Recommendation

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Abstract The system faces major accessibility problems because users cannot understand the language. The system CareerMate uses artificial intelligence to create individual career guidance through four Indian languages which include English and Hindi and Punjabi and Kannada. The system uses natural language processing and speech recognition and machine learning to generate job recommendations and analyze resumes and create financial plans. The development of CareerMate used Flask backend technology with OpenAIGPT models to achieve 85% user satisfaction and 92% job recommendation accuracy during testing with 50 participants who spoke different languages. The system reduced consultation time by 60% when compared to traditional platforms.

Paper id 551

Paper title Sentiment Analysis of Cyberbullying on Social Media

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Abstract Cyberbullying on social platforms carries documented psychological cost, and the daily volume of user posts has made manual moderation impractical. Automated detection is consequently a requirement rather than a convenience, yet most published comparisons draw on surveys or single-model studies whose pipelines differ from one another, leaving the true ordering between classical, recurrent, and transformer classifiers hard to pin down. This paper reports a controlled comparison of six classifiers — Naive Bayes, Logistic Regression, Support Vector Machine, LSTM, GRU, and fine-tuned BERT — trained and evaluated under one fixed preprocessing pipeline, one data partition, and one metric set, using data drawn from Kaggle, Twitter, YouTube, and Formspring corpora labelled as bullying or non-bullying. Preprocessing retained emoji content and deliberate misspellings rather than stripping them, since both carry evidence of intent in this domain, and training used a cost-sensitive setup that weighs missed abuse more heavily than false alarms. BERT led on every metric (accuracy 0.95, precision 0.94, recall 0.93, F1 0.94), ahead of GRU (0.92 accuracy) and LSTM (0.91), while Naive Bayes trailed on recall at 0.74. Measured inference cost was 194 ms per sample for BERT against 18 ms for the SVM, a gap that points toward a tiered deployment in which a lightweight model screens routine traffic and the transformer is reserved for borderline cases.

Paper id 561

Paper title HEAL: Advanced AI System For Comprehensive Health And Eating Analysis Using Blood Reports Through Learning Techniques

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Abstract The research aims to develop an advanced AI-driven dietary recommendation system that analyzes individual blood test data to provide personalized nutritional advice. As chronic conditions like diabetes, hypertension, and cardiovascular diseases become more prevalent, many people find it challenging to adjust their diets to effectively manage these health issues. This system utilizes machine-learning algorithms to interpret specific biomarkers from blood tests, offering customized diet plans that emphasize beneficial foods while cautioning against those that could worsen health conditions. Alongside personalized dietary recommendations, the system features a chatbot for real-

time support, answering dietary inquiries and suggesting recipes tailored to the user's health profile. By incorporating real-time data, users receive timely recommendations, enabling them to enhance their health through improved dietary choices. This all-encompassing, AI- powered solution seeks to empower individuals with chronic health conditions to make informed decisions, foster wellness, and prevent disease progression. HEAL, an AI-powered health and eating analysis system, surpasses existing solutions MyFitnessPal and NutriSense by offering personalized dietary recommendations based on blood analysis and real-time support. Its advanced AI provides more comprehensive and adaptive nutritional guidance than other existing solutions.

Paper id 639

Paper title Cervical Cancer Prediction Using Hybrid Models: Integrating Urine and Blood Biomarkers

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Abstract Cervical cancer is a global health problem today. It is the main cause of deaths among women, particularly in areas with insufficient resources. In many of these places, there is limited access for screening and detection tools for cancer. This leads to late diagnoses of cancer. Pap smears and HPV tests are useful in detecting cervical cancer. Because they help doctors to diagnose this cancer timely. This means treatment can be started, and people have a chance of recovery from the disease. But not every woman gets these tests as they should. Some women find them uncomfortable, and others face challenges. These challenges are high costs, faraway clinics and feeling nervous about tests. This study presents a new approach to predicting cervical cancer. It also understands medical conditions of patents in a better way. We integrated machine and deep learning so that it can identify complex patterns in data quickly and accurately. This study focuses on non-invasive indicators that are found in urine and blood. We used advanced computer techniques like machines and deep learning to help the system in learning. This hybrid model identifies patterns effectively and provides accurate predictions. This review explores hybrid models which are currently being used to predict cervical cancer. These models combine data from urinary and blood-based markers. These biomarkers are like microRNAs, Macrophage Colony-Stimulating Factor (M-CSF) and Vascular Endothelial Growth Factor (VEGF). Both markers play important roles in the growth of tumors. The dataset consisted of numerical biomarker features categorized as Control or Cancer. To improve generalization, Gaussian noise and dropout are used. The ViT encoder generated compressed feature representations. These are classified using XGBoost with strong regulation and thresholding. Model achieved 95% accuracy and ROC AUC values above 0.95. Sensitivity and specificity were balanced, with recall above 0.93. Future work will focus on expanding datasets and explainability techniques to strengthen clinical trust.

Paper id 660

Paper title High-Accuracy Multi-Class Cotton Leaf Disease Classification Using EfficientNet-B3 and Transfer Learning on the SAR-CLD-2024 Dataset

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Abstract Cotton leaf diseases pose a significant threat to crop yield and quality, necessitating timely and accurate diagnosis to support effective disease management. Manual disease identification is labor-intensive, subjective, and impractical for large-scale farming environments. To address these limitations, this paper proposes a high-accuracy deep learning framework for multi-class cotton leaf disease classification using transfer learning with EfficientNet-B3. The proposed approach is evaluated on the publicly available SAR-CLD-2024 dataset, which comprises field-collected cotton leaf images exhibiting diverse illumination conditions, background complexity, and disease severity levels. The framework incorporates standardized image preprocessing, extensive data augmentation, and fine-tuning of an ImageNetpretrained EfficientNet-B3 backbone with a custom classification head. Experimental results demonstrate rapid convergence, stable training behavior, and strong generalization capability. The proposed model achieves an overall test accuracy of

98.14%, with consistently high precision, recall, and F1-scores across seven cotton leaf classes. Confusion matrix analysis indicates strong diagonal dominance, with misclassifications occurring primarily between visually similar disease categories, which are biologically explainable. The results confirm that EfficientNet-B3 offers an effective balance between classification accuracy and computational efficiency, making the proposed framework suitable for real-world deployment in precision agriculture systems aimed at early disease detection and reduced pesticide misuse.

Paper id 723

Paper title Transforming Critical Care: AI-Based Precision Sepsis Prediction Using Machine Learning

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Abstract Sepsis is an important and serious condition caused by systemic inflammation due to infections and can result in multiple organ failure, septic shock, and eventually cause death,if not managed properly. It is very important to detect sepsis early to increase chances of survival, minimize organ injury, and save money in healthcare costs especially in ICUs where patients are susceptible to various illnesses. There have been recent breakthroughs in the area the potential applications of ML and DL in the capacity to predict sepsis through analysis of big, complex electronic health records (EHRs) including vital signs, lab values, medical history, and clinical notes. The purpose of this research is to introduce and empirically compare ML algorithms for sepsis prediction using clinical data (data from Skaraborg Hospital in Sweden, 2012-2013; n=1,577) by considering structured physiological and lab information. Data preprocessing and feature selection are performed for better performance of ML models. The three algorithms such as Random Forest, Naïve Bayes, and k-Nearest Neighbours are tested based on metrics such as accuracy, precision, recall, F1 Score, log loss, and confusion matrix evaluation. Out of the three, the Random Forest algorithm performed best, with an accuracy score of 97.39% and the least value of log loss as well. It performed way better than Naive Bayes, which had accuracy around 88%, and KNN, whose accuracy was around 90%. This project describes the formal mathematics behind all the three models, the dataset used, and the reasons for the chosen features.

Paper id 757

Paper title Energy Efficient and Sustainable Infrastructure for Smart Home IIoT: A Swarm-Intelligence Enhanced DRL Intrusion Detection Model

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Abstract Smart home Industrial Internet of Things (IIoT) systems are now the focus of these attacks, with the amount of real-time data and the complexity of the threats faced making it difficult for traditional Intrusion Detection Systems (IDS) to cope. In this paper, a hybrid IDS is introduced to select features using Binary Particle Swarm Optimization (BPSO) algorithm and classify traffic in real-time using an agent based on Deep Reinforcement Learning (DRL) namely Deep Q-Network (DQN). In the Network Security Laboratory– Knowledge Discovery and Data Mining (NSL-KDD) dataset, the BPSO is able to cluster a total of 41 traffic features down to 5 (87.8% reduction) and the DQN agent learns the reward and penalty scheme. The model is then compared to the Random Forest baseline and a DQN baseline without feature selection. The proposed model reduces the latency of prediction for each sample by an average of approximately 17 times compared with the Random Forest model and approximately 1.8 times compared with the full-feature DQN model, and the recall of the model is the highest among the three models (63.93%). It is less accurate (75.22%) and less precise (89.55%) and has a higher false positive rate (FPR) (9.85%) than both the baselines. Swarm based feature selection can thus decrease the cost of DRL based intrusion detection on resource constrained devices in smart homes, while the quality of the intrusion

detection rule relies on the number of features eliminated. This study measures such a trade-off directly.

Paper id 845

Paper title An End-to-End MLOps Framework for Drift-Aware Scalable Predictive Analytics on Energy Consumption Forecasting

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Abstract To use machine learning models in production, it is necessary to have features like continuous monitoring, drift detection, and lifecycle management. Most modeling pipelines don't offer these features very often. We present a modelagnostic, all-encompassing MLOps framework for drift-aware predictive analytics, corroborated by the AEP hourly energy consumption dataset. The framework has a four-layer drift detection system that uses the Kolmogorov–Smirnov and Population Stability Index statistical tests, adaptive windowing (ADWIN), and a Virtual vs. Real Drift Classifier. This classifier reduces unnecessary retraining triggers by 71%, suppressing 17 of 24 monthly model checks and retaining only 7 actionable interventions. We examine two distinct architectures: Random Forest (RF) and Long Short-Term Memory networks (LSTM). Both models use data from 2015 to 2016 to train and data from 2017 to test. They also have 19 features that were made by hand. RF gets a test MAE of 146.13 MW with $R^2 = 0.9926$ and MAPE = 1.00%. LSTM has an MAE of 172.15 MW and a R^2 of 0.9900 (MAPE = 1.18%). LSTM has a lower baseline performance, but it is more adaptable. Its targeted retraining protocol (3 of 4 triggers, +4.59% average improvement) works better than RF (2 of 3 triggers, +1.58%). Our experiments demonstrate a crucial data sufficiency threshold of approximately 5,000–7,000 samples for efficient LSTM incremental learning. Above this threshold, catastrophic forgetting risk increases significantly. DVC makes it possible to reproduce the entire pipeline, while MLflow tracks it and Evidently and Streamlit dashboards keep an eye on it. We made the system work with Airflow-based orchestration. We are making progress in MLOps by combining multi-layer drift detection with model-comparative adaptive retraining on real-world data.

Paper id 850

Paper title Real-Time Crowd Density Estimation and Public Safety Monitoring Using YOLO-Based Deep Learning Framework

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Abstract The fast growing number of people in cities and mass gathering of people has greatly compounded the problem of handling crowds and security of the community. The conventional surveillance systems are mostly inefficient in terms of using manual monitors which lack the abilities to respond to the dynamic conditions of the crowd promptly and are prone to errors. To overcome such drawbacks, the current paper introduces a real-time crowd density estimation system, which relies on deep learning and computer vision methods. This system is proposed to use the model of Yolo-based object detection to find out the individuals in video streams and calculate the crowd density dynamically. Its methodology entails the video recording of the surveillance cameras, processing the frames, recognizing the people by the trained model, and calculating the density rates according to the quantity of people being identified. The system also categorizes the density of the crowd into preset levels, namely low, medium, and high, so that an alert can be issued in time in situations where there is congestion. Real-time processing renders the system to have minimal latency thus making the system fit in high traffic areas like railway stations, malls, and public events. The experimental findings indicate that the suggested system attains a good trade off of detection accuracy and does with respect to computational efficiency and surpasses a number of conventional techniques in real-time settings. The system helps to improve the situational awareness, decision-making process, and proactive approach to control crowds, which enhances the public safety infrastructure.

Paper id 874

Paper title Soil-Centric Multimodal Learning for Plant Health Assessment in Precision Agriculture

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Abstract Proper soil health assessment remains a significant challenge in modern crop production due to the complex interactions among nutrient content, moisture levels, and soil surface characteristics. Conventional soil testing and single-source data models often fail to capture these complementary relationships under real-world agricultural conditions. To address this limitation, a multimodal deep learning framework is proposed that integrates numerical soil measurements with soil surface images. Exploratory data analysis revealed substantial heterogeneity in soil properties and weak linear relationships, highlighting the need for advanced learning methods. A CNN– LSTM architecture with feature-level fusion was developed to learn complementary representations from visual and numerical soil data. The experimental results demonstrate that the proposed framework enhances the accuracy of plant health assessment over unimodal methods, achieving precision, recall and F1-score values of 0.97 and an overall classification accuracy of 97.08%, which is better than the individual CNN, LSTM, ResNet50 and EfficientNetB0 models.

Paper id 878

Paper title Architecting the Next Generation of Semantic Plagiarism Detection: A Privacy-Preserving Framework Combining Local LLM Preprocessing, SBERT Embeddings, and Generative Validation

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Abstract Due to generative AI capabilities, auto paraphrasing and translation-based rewriting have become extremely accessible, making traditional plagiarism detection algorithms based on lexical pattern matching less effective. In this paper, we present a five-step approach for detecting semantic plagiarism, in which a locally hosted LLM is used for document pre-processing, SBERT is used for dense semantic embeddings generation, cosine similarity is utilized for candidate extraction, and a smaller generative model Gemma is used for further semantic validation of potentially plagiarized text pairs. Generally speaking, the idea is that we make a fast and coarse-grained screening first and rely on slower and more fine-grained reasoning later, thus making the approach scalable in terms of institutional documents and capable of detecting paraphrased, restructured, and cross lingual plagiarism that is commonly missed by “similarity only” algorithms. Additionally, since all the stages work locally, the approach avoids transmission and compliancerelated problems of cloud-based detection systems. We regard this study as an architectural design and evaluation framework development. Specifically, not only the system is detailed but also the evaluation process of it is planned thoroughly, including the dataset preparation, baselines, metrics, and ablation studies, allowing future researchers to use it properly. For now, no experimental results are reported.

Paper id 897

Paper title GitHub Issue Triage Bot

Authors Ravi Sharma, Ananya Shakya, Ananya Sngh

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Abstract Issue triaging is one of the crucial activities in the domain of software maintenance. It is critical since the time consumed on issue triaging directly influences the effectiveness of issue resolution process and project scalability in large scale opensource software development projects. The increasing number of heterogeneous GitHub issues raises a need for effective and efficient automated issue classification. In this paper, we propose GitHub Issue Triage Bot – the framework for end-to-end issue classification based on GitHub issues mining, text preprocessing optimization, and transformer language modeling. In our study, we gathered 7,920 issues reported to public GitHub projects and divided them into five classes such as bug, enhancement, documentation, performance, and question. The proposed preprocessing includes issue validation, noise removal, deduplication, language filtering, and class balancing. We have examined eight issue classification models, both traditional and transformer-based. The experimental results show that transformer

models perform better than classical models with RoBERTa reaching the best accuracy of 83.59% and macro-f1 score of 83.52%, demonstrating their superiority in context understanding and generalization. The proposed approach can be used for automated issue triage

Paper id 909

Paper title Deep Neural Networks for Early Detection of Chili Leaf Diseases

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Abstract Plant diseases are an important reason why farms around the world are not as productive and why food is not as safe. Chili plants are particularly susceptible to a number of diseases that can significantly reduce the quality and quantity of the crop. It is important to detect these diseases early so that the crops can be managed well and major losses can be avoided. On the other hand, traditional methods of disease detection rely on manual observation of plants by agricultural experts. It takes a long time, is subjective and cannot be used on large areas of land. This study presents an automated system for detecting chili leaf diseases using different deep learning models such as Artificial Neural Network (ANN), Convolutional Neural Network (CNN), Recurrent Neural Network (RNN) and Long Short Term Memory (LSTM). We trained and tested the models on the PlantVillage dataset, which contains a large number of labeled plant leaf images. The proposed models automatically extract features from the leaf images for accurate classification. The performance is evaluated using metrics like accuracy, precision and recall. The experimental results show that the LSTM model gets the best performance among all the models. This system has great potential for detecting plant diseases in real time. With this, farmers will know about the problems in advance and will be able to take measures immediately. The proposed method helps to create AI-powered precision agriculture systems that are affordable and can be used on a large scale to monitor crop diseases.

Paper id 913

Paper title Integration of Artificial Intelligence in Agriculture

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Abstract The modern agricultural sector is experiencing increasing demands to balance the growing global food needs and the ever more limited natural resources available, climate variability and reduced arable land where traditional agricultural methods are ill-prepared, alone, to handle these issues. This paper methodically reviews how artificial intelligence is applied in major agricultural activities, such as crop surveillance, crop forecasting, pest and illness detection, precision irrigation and optimising the supply chain. The study assesses the practical applicability, scalability and limitations of AI-driven technologies in a variety of agronomic settings through the cross-sectoral reviews of the peer-reviewed literature and case analyses. Results indicate that integration of AI can significantly increase the accuracy of decisions and efficiency of resources and adaptability of the agricultural value chain, as well as reveal significant vulnerabilities in the rural digital infrastructure, access to data and the readiness to adopt AI by farmers. The research finding is that the transformative potential of AI in agriculture requires policy intervention, inclusive technology design, and ongoing interdisciplinary work between agronomists, technologists, and policymakers.

Paper id 915

Paper title PocketGenMol: Structure-Conditioned Molecular Generation via Masked Diffusion over SAFE Representations

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Abstract Structure-based drug design needs models that generate chemically valid, drug-like molecules conditioned on three-dimensional protein binding pocket geometry. PocketGenMol is a molecular generation system that shapes new molecules based on the unique geometry of protein binding sites. It builds on GenMol, a masked discrete diffusion model using SAFE representations. A lightweight

PocketEncoder distills each pocket's shape into a 768- dimensional embedding that conditions a BERT-based backbone via scaled additive conditioning. We train on CrossDocked2020 and MOSES, and introduce a fixed correction factor ($\alpha = 0.1$) to resolve an embedding-scale mismatch that otherwise destabilizes training. The model produces structurally diverse molecules: 92.2% unique, mean QED of 0.681, and 72.9% above the standard drug-likeness threshold.

Paper id 917

Paper title Locally-Global Synergistic Temporal Perception Network for Lightweight Video Summarization

Authors Vaani Garg, Anil Singh Parihar

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Abstract There is a growing abundance of video content on the Internet. Consequently, there is interest in automatic video summarization. Most existing summarizers either (i) rely on convolutions for short-range temporal modeling; or (ii) utilize transformer-based self-attention for long-range temporal dependency, but never both at the same time and never at a low complexity. Designs that use convolutions only fail to capture global narrative structure. Due to quadratic complexity costs, self-attention mechanisms based on transformers can't be deployed in resource-constrained settings. The LGSTP-Net, which stands for Locally-Global Synergistic Temporal Perception Network, is a lightweight architecture that synergistically combines these two conflicting modeling paradigms. Our network combines a depthwise temporal convolution branch that is efficient with a global attention branch with linear complexity, and these are softly bound through a novel Adaptive Gated Fusion Module that learns to what extent to rely on the local versus the global context at each temporal position. Our LGSTP-Net outperforms strong baselines on F-score on the SumMe and TVSum benchmarks while using about 60% fewer FLOPs compared to standard transformer-based models. In addition, it provides real-time throughput for full-length video on the NVIDIA Jetson Xavier NX edge device.

Paper id 925

Paper title Drug Detection Using Applied Machine Learning Algorithms

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Abstract At present, physicians use conventional popPK formulas based on parameters like body weight and age for the measurement of drugs like Vancomycin, Gentamicin, and Phenytoin. But these popPK formulae frequently fail in the context of sepsis because of the risk of acute renal failure from antibiotics or serious neurological disorders due to high levels of Phenytoin resulting from saturation of liver enzymes. To counter this problem, the suggested hybrid ML pipeline starts by estimating the drug concentrations using the conventional formula of linear (for antibiotics) and non-linear (for Phenytoin) regression, after which it uses present physiological information like albumin, creatinine, MAP, and bacterial burden from the MIMIC-IV database to predict and fix the residual error of the estimation. After comparing the effectiveness of Linear Regression, Support Vector Machines, XGBoost, and Random Forest algorithms, it is found that Random Forest works best and reduces the MAE of vancomycin to 1.23 from 1.78, gentamicin to 0.52 from 0.74, and phenytoin to 3.54 from 4.86.

Paper id 929

Paper title Regenerative Braking System in Solar Assisted Electric Vehicle

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Abstract The global shift toward carbon-neutral mobility is driven by the dire need to conserve natural resources and reduce environmental deterioration. In accord with the United Nation's 2050 net-zero emission targets, several countries are promoting electric vehicles (EVs) through subsidies and policies as an alternative to conventional internal combustion engine (ICE) vehicles. Regardless of their environmental advantages, Electric vehicles face challenges related to its driving range limitations, charging infrastructure scarcity, long charging durations, and periodic battery replacements. To resolve these issues, this study propose the integration of photovoltaic (PV) solar panels on the vehicle's roof with combination of regenerative braking. This approach enables extended driving range of approximately 12–15 km by 5–6 hours of solar charging which also enhances battery lifespan by ensuring a slow and continuous charging cycle. The system allows the battery to be charged both during vehicle's motion and stationary period, as a result, it reduces dependency on external charging networks. This concept offers a potential approach for improving EVs efficiency, reliability, and long-term sustainability

Paper id 935

Paper title TF-IDF VS BM25 with BERT for Multi-Task Crisis Type and Urgency Classification

Authors Basudev Nath, Ashok Sahu, Swati Sucharita Roy, Sampa Chau Pattnaik, Jogeswar Tripathy, Nilima Rani Das.

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Abstract During crisis events, social media like Twitter can deliver current information which supports effective emergency response and operational planning. As unstructured shortlength tweets make automated classification difficult, a hybrid multi-task classification system for disaster-related tweets is proposed emphasizing the identification of the crisis type and the prediction of the urgency level. The proposed model is a fusion of TF-IDF (Term Frequency-Inverse Document Frequency) and Bidirectional Encoder Representations from Transformers (BERT) to leverage both statistical significance of the keywords and deep contextual understanding. The fused feature representation is then fed to a Fully Connected Neural Network (FCNN) that has two output layers for simultaneously distinguishing between different crisis types and urgency. Furthermore, TF-IDF + BERT is compared with BM25 + BERT to explore the value of statistical representations in conjunction with contextual-embedding representations. Through experimental results, it can be seen that the proposed framework can achieve 91.26% accuracy for crisis type classification and 94.98% for urgency prediction, respectively, which outperforms BM25 + BERT and individual feature-based models. The proposed framework shows the effectiveness of the fusion of statistical and contextual features for real-time analysis of disaster tweets and prioritization of disaster responses.

Paper id 938

Paper title A Robust Attack Type Detection Model Enhancing IoT Network Security

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Abstract Traditional security techniques proved insufficient in addressing today's security threats in Internet of Things (IoT) environment. This paper critically analyzed the proposed models of existing studies for detecting the presence of an attack using machine learning and deep learning algorithms trained on the RT-IoT2022 dataset. The present work proposes a novel robust model that detects the type of attack rather than only predicting the presence of an attack that elevates the strength of IoT network security. This paper reviewed the performance of three tree-based classifiers—Random Forest, XGBoost, and CatBoost—trained on the RT-IoT2022 dataset. Further, the proposed study tuned the CatBoost classifier to design an efficient training model. The proposed model handles extreme imbalanced multi-class classification dataset. Class weights, manual weighting, target oversampling to extremely rare classes, and medium regularization have been employed to tune the model. In addition, the performance indicators of the proposed model included macro precision of 95 percent, macro recall of 99 percent, and macro F1 score of 97 percent. Furthermore, the False Negative Rate (FNR) per class has been observed as the major performance indicators to identify

how well the model is in detecting all the classes. The proposed model achieved a FNR of less than 2% across all classes. The low-rate FNR maintains balanced multi-class recall. Missing attack detection is too costly; therefore, the experimental results focused on balancing multiclass recall.

Paper id 955

Paper title NeuroNote: A Knowledge-Tracing-Augmented Framework for Adaptive Note Retention and Personalized Spaced Review

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Abstract Existing note-taking systems are mostly concerned with information storage with little functionality that facilitates retention of such knowledge by users over time. This gap between note taking and retention of the learned material becomes our target. We present NeuroNote -- an adaptive learning system which consists of unstructured note-taking and personalized spaced review features integrated into one product. NeuroNote automatically identifies concepts in user's notes, uses FSRS (Free Spaced Repetition Scheduler) augmented by knowledge tracing signals to model memory dynamics and creates review content like flash cards, quizzes, summaries, and mind maps on review occasions. Our scheduler includes such techniques as attention based decay, distribution aware mastery estimation, and context aware forgetting model, where we take into account study schedule regularity, timing of the day, and semantic interference. An additional offline reinforcement learning layer is used to optimize intervals. In order to test our predictive part of the framework, These experiments were performed using the ASSISTments 2017 and EdNet-KT1 benchmark datasets, and the performance of the model was seen in terms of AUC which came out to be 0.823 and 0.802, respectively, and better than many knowledge tracing benchmarks. In experiments related to simulated review scheduling, there was also a reduction of review load by 27% as compared to SM-2 while retaining the targets. This clearly suggests that NeuroNote may act as a good intermediary between note taking and memory-based revisions.

Paper id 962

Paper title Integrating Machine Learning and Memory Forensics for Enhancing Cybersecurity in IoT-Enabled Energy Systems

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Abstract Malware poses ongoing threats to individuals and organizations, despite antivirus and security tools. As attacks increase, systems are compromised, often resulting in costly data ransoms. This study presents an innovative, architecture-independent malware detection system targeting diverse malware types developed in languages like C, Python, and Java. By analysing commonalities in low-level machine code across malware families (e.g., ransom ware, Trojans), our system detects patterns in code signatures to identify a broad spectrum of malware. This approach advances malware detection research by offering a robust, architecture-agnostic mechanism, and strengthening cyber security defences.

Paper id 972

Paper title A Deep Adversarial Adaptation Network with Efficient Net Backbone for Cross-Domain Plant Leaf Disease Detection and Reliable Classification

Authors Aaftab Alam, Shabina Ghafir, Ihtiram Raza Khan

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Abstract The disease of plants is a serious threat to food security in the world, as the losses in crop yields are estimated to be 20-40% each year all over the world. Deep learning models trained on curated laboratory photos like PlantVillage may perform poorly in real-world field settings due to domain shift. To overcome this, we present a Deep Adversarial Adaptation Network (DAAN) that combines an EfficientNet-B0 backbone and a Gradient Reversal Layer (GRL)-based domain discriminator to effectively identify and detect plant leaf disease across different domains. The framework suggested uses compound-scaled feature extraction, a feature adaptation module that uses convolutional attention with a dynamic sigmoid-ramp lambda scheduling strategy to stabilize adversarial training. It is a model that simultaneously seeks to optimize a supervised classification task with an adversarial

domain alignment loss, allowing it to be trained on both labeled source and unlabeled target data to learn domain-invariant but disease-discriminative feature representations. Tested on the ten-class tomato disease benchmark based on PlantVillage, the DAAN-EfficientNet has a test accuracy of 97.70% and an AUC of almost unity across all disease classes, better than traditional CNN and ResNet-based adversarial adaptation baselines. Target-domain confusion matrix analysis has confirmed a mean classification accuracy of 98.9%, six of ten classes with perfect 100% accuracy, and t-SNE visualizations further confirmed effective domain alignment with all ten disease classes, maintaining distinct separability in the target feature space regardless of a 30–40% increase in intra-cluster variance in the feature space after adaptive learning. These findings indicate that the framework proposed a high level of generalization and can be practically deployed in the real-world agricultural disease monitoring.

Paper id 973

Paper title An Agentic AI Framework for Resolving Natural Language Ambiguity in Database Querying Through Semantic Validation

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Abstract Users are able to ask databases questions about data in natural language thanks to a Natural Language/SQL (NL2SQL) system. Currently, improvements in Large Language Models (LLMs) have made the use of LLMs less effective for handling the management of semantic ambiguities, accurately executing complex multi-table joins (5+ tables) and handling aggregations/subqueries accurately. This paper describes a multi-agent architecture called TALK2SQL which breaks NL2SQL into specialized agents, including a) Query Understanding Agent b) Schema Inspector c) Query Planner d) SQL Generator e) Validator f) Corrector. Evaluation across five Spider bench-mark databases demonstrates 83.33% accuracy and 95% semantic correctness, with zero syntax errors. The system achieves sub-6-second response times at $0.08 per query through strategic orchestration of GPT-3.5-turbo and GPT-4o. Key contributions include modular agent architecture enabling fault isolation, automated schema profiling for rapid deployment, execution-guided self-correction with bounded retry, and cost-performance optimization for production environments.

Paper id 974

Paper title A Hybrid Edge AI Framework for Real-Time Cyber Threat and Object Detection Using NLP, Behavioral Analytics, and Contextual Intelligence

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Abstract Real-time assistive systems on edge hardware face a problem that receives little to no attention: detection pipelines produce labels, but no one has taken the initiative to define what to do with those labels before the utterance. This paper tackles that rift through two purposely made parts. The Delta-Triggered Scene Filter (DTSF) omits narration when the current detection set is too closely related to the one before— cutting 61% of redundant speech instances while retaining full recall on hazard classes such as vehicles and pedestrians. The Priority-Weighted Contextual Narration (PWCN) function scores each identified object along three dimensions—how near it is, whether it is on the move, and how perilous its kind is— then sends only the top-ranked results to a template engine for narration. YOLOv8-nano (3.2 M parameters, Tensor RT INT8) handles detection; MMS-TTS with SSML markup handles speech. A knapsack-based dynamic-programming scheduler keeps GPU and CPU stages within their per-frame time budgets. Across Jetson Orin, Snapdragon 8cx, and Raspberry Pi 5, the end-to-end pipeline clocks at 35 MS, 52 MS, and 148 MS. PWCN narrations reach BLEU-4 of 0.78 on a 500-sample accessibility corpus, against 0.52 for a flat label-reading baseline. The outcome is a fully on-device, privacy-preserving pipeline whose modularity makes it practical experimental ground for future assistive edge AI work.

Paper id 976

Paper title A Deep Learning Framework for Automated Insurance Advisory and Intelligent Decision Support

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Abstract Scene classification is an important aspect in many applications of environmental monitoring, development of smart cities, and intelligent transportation systems. The paper introduces a powerful deep-learning architecture to classify scenes of multiple types with a fine-tuned ResNet50 network. The dataset, which was acquired on Kaggle, is a variety of natural and urban scenes into six categories. The suggested method employs transfer learning, data augmentation, and progressive fine-tuning to improve feature extraction and model generalization. Experimental evidence shows that the model has a high classification accuracy of 98.6 per cent. which is higher when compared to other baseline architectures. The effectiveness and reliability of the model is confirmed by comprehensive evaluation based on precision, recall, F1-score, and analysis of the confusion matrix. The findings show that it has an excellent generalization and few misclassification errors. The work helps in the formation of an effective and scalable system of classifying scenes in line with the sustainable development goals in the form of industry innovation and infrastructure, sustainable cities and communities, climate action, life on land, quality education, and responsible consumption.

Paper id 977

Paper title Automated Smart Parking and Cantonment Infrastructure Detection Using YOLOv11-Large, Computer Vision, Crowdsourcing, and Multimodal Vision–Language Reasoning

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Abstract The urban parking system has deteriorating inefficiencies that lead to increased congestion, wasted time, and emissions. The problem gets worse each time a driver has to walk around the city to find parking. The problem gets worse. This paper demonstrates the ASPS architecture and its real time functionalities, combining Computer Vision and Gamified crowd-sourcing to share parking data intelligence. The system integrated real time data and live parking availability over a responsive web app. The system allows users to search for parking data and share real time data about parking zones (public or private) for Gamified user incentives. The system intelligently combines technology and user input to achieve a targeted reduction in search time, a reduction in emissions, a reduction in traffic congestion, and the newly promoted stewardship of urban communities. The system collaborates to reduce daily parking frustrations and reallocate the parking resources to areas with more need.

Paper id 984

Paper title From Classical ML to Contrastive GNNs: A Systematic Review of Faux-Hate Detection Frameworks

Authors Pooja Yadav, Rohit Beniwal

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Abstract Faux-Hate detection in multilingual and code-mixed social media environments remains challenging due to noisy linguistic patterns, semantic ambiguity, and limited annotated datasets. Unlike prior surveys that address hate speech and fake news independently, this systematic literature review examined papers on Hate Speech Detection, Fake News Detection, and the combined Fake and Hate detection systems (Faux-hate). In the paper, a structured review process for ”Faux-Hate Detection” is explored, including specific research questions, search strategies, and study selection criteria to identify relevant studies from key digital libraries. The selected papers mainly focused on the process

of architectural evolution, evaluation practice, and frame works studied across multilingual languages. This study suggests that domain-adaptive transformers, multitask learning architec tures, and graph neural networks are replacing traditional ma chine learning and CNN/BiLSTM with contrastive cross-lingual frameworks. The analysis highlights crucial deficiencies, such as the absence of cross-language Faux-Hate benchmarks, limited code-mixed language support, and cost-sensitive evaluation for combined detection systems. Overall, this research provides a comprehensive overview of current advancements and future research directions for explainable and multilingual Faux-Hate detection.

Paper id 985

Paper title ProxiMix: A Prototype-Driven Proximity-Aware Meta-Embedding Framework for Faux-Hate Detection

Authors Pooja Yadav, Rohit Beniwal

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Abstract Faux-Hate detection in code-mixed languages is difficult owing to noise and label imbalance in data. Conventional methods have generally treated the task of hate speech identifi cation and fake news detection independently and have mostly focused on high-resource languages such as English. Therefore, we introduce ProxiMix, an embedding multitask method that is the proximity-based meta-embedding, which focuses on faux hate detection on low-resource languages such as code-mixed Hinglish language. In the proposed ProxiMix model, we introduce a proximity-aware label-balancing mechanism leveraging XLM RoBERTa with learnable prototype centroids, cross-attention fusion and Focal Loss function, due to which we achieved a Macro F1 score of 0.8700 with a high degree of stability (Std.=0.0064). In our experiments, ProxiMix systematically beats recent state-of-the-art models in the Faux-Hate detection tasks without jeopardizing the fair performance of the system in various linguistic subgroups.

Paper id 987

Paper title A Systematic Literature Review of Autonomous AI Agents Powered by Large Language Models

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Abstract Recent advancements in large language models (LLMs) have enabled the creation of autonomous AI agents that can think, plan, and interact with their environment using tools. This work describes a systematic literature review (SLR) conducted on recent works focused on agentic systems powered by LLMs. A structured method for reviewing literature was used, with research questions being formulated, a search strategy, and inclusion criteria for selecting papers from popular digital libraries. Papers related to LLM-powered agentic systems were analyzed in order to explore the architectural paradigm, inter action modalities, and key components for creating autonomous agents. Overall, this study provides a comprehensive overview of current developments and future research directions in LLM based autonomous agents.

Paper id 990

Paper title Evaluating the Impact of Online Learning on Academic Performance: A Mixed-Methods Case Study of Undergraduate Students in Chennai

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Abstract This study examines the impact of online learning on undergraduate academic performance in Chennai by comparing outcomes from traditional classroom instruction between 2010 and 2019 with online learning between 2020 and 2025. A mixed-methods approach was employed, combining quantitative data from grades, attendance records, and satisfaction scores with qualitative feedback from student reflections. The analysis covered seven subjects including English, Mathematics, Physics, Artificial Intelligence, Python, Java, and Semiconductor Design. Results indicate a modest

improvement in average grades, with increases of approximately three to four percent across most subjects, while attendance declined slightly. Student satisfaction averaged 7.2 out of 10, with female students reporting higher approval levels. Qualitative findings highlight flexibility, accessibility, and recorded lectures as key advantages, while the barriers noted were reduced peer interaction, technical challenges, and distractions at home. The study concludes that online learning has had a positive but uneven effect, improving academic outcomes through flexibility and resources but weakening interpersonal engagement. Recommendations include adopting blended learning models, strengthening digital infrastructure, incorporating interactive pedagogy and diversifying assessment strategies to better capture student learning outcomes.

Paper id 993

Paper title Cyber Threat Detection in the Era of AI: A Systematic Review from Traditional Machine Learning to Autonomous LLM Agents

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Abstract The rapid expansion of digital infrastructures, cloud-based services and interconnected devices has significantly increased the complexity of modern cybersecurity environments. Although signature-based and rule-based intrusion detection can work against known attack vectors, they have proven ineffective against sophisticated and evolving attack vectors like Advanced Persistent Threat (APT) attacks and insider attacks. As a result, there is a move towards behavioral threat detection techniques. This paper provides a comprehensive review of 18 research articles which focus on Machine Learning, Deep Learning, Large Language Models, and the emerging agentic system based on LLMs. The study reviews how threat detection evolved from feature extraction based ML techniques to automatic learning in DLtechniques, followed by semantic comprehension in LLM and finally autonomous reasoning in agentic systems. A comparative evaluation is done based on datasets used, performance measures, and feasibility. The findings are that LLM-based techniques have a superior contextual capability whereas agentic models can perform end-to-end threat detection.

Paper id 994

Paper title PhishScore: A Weighted Multi-Feature Phishing Email Scoring Framework for Human and AI-Generated Threat Assessment

Authors Sujyoti Jha,Manoj Kumar

Affiliation Department of Computer Science and Engineering Delhi Technological University, Delhi Delhi, India

Abstract Phishing attacks have become increasingly sophisticated, personalized and challenging to detect in recent years. Phishing attacks exploit human psychology, and recent advance ments in large language models (LLMs) have provided attackers with a means to produce phishing emails on a massive scale, thus bypassing legacy detection tools. This paper proposes PhishScore, an unsupervised weighted scoring system that categorizes emails into one of three classes — genuine, phishing, and AI-phishing based on twelve handcrafted features categorized under social engineering, structural, and stylometric characteristics. When tested on a balanced dataset of 2,139 emails (Enron, Nazario, Greco 2023), PhishScore delivers an ROC-AUC score of 0.8135 with a significant degree of class separability ($F = 313.62$, $p < 0.001$). Interestingly, stylometric features turn out to be better predictors than social engineering terms. PhishScore is fully interpretable and requires no supervised training, provides actionable risk tiers (Low, Medium, High) which makes it suitable for deployment in real-world email security pipelines

Paper id 996

Paper title A Systematic Review of Hallucinations in Large Language Models: Detection, Mitigation, and Evaluation

Authors Prince Chaudhary, Rohit Beniwal

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Abstract The progress of large language models in generating natural language output has been phenomenal, and they have been applied in several areas, such as question answering, summarization, conversational AI, and content generation. However, these models often produce erroneous, made-up, and illogical outputs known as hallucinations. These issues limit their reliability and accuracy,

especially in high-stakes environments like medicine, law, education, and scientific research. This paper offers a comprehensive systematic review on the topic of hallucinations in large language models through a PRISMA methodology. Hallucinations are categorized into intrinsic hallucinations, extrinsic hallucinations, fabrication errors, and logical inconsistencies. In addition, we offer a comparison between different techniques for detecting, mitigating, and evaluating hallucinations in LLMs. Detection techniques such as model-based, knowledge based, prompt-based, and machine learning-based are explored, while mitigation techniques include Reinforcement Learning with Human Feedback (RLHF), Retrieval-Augmented Generation (RAG), prompt engineering, and others. These issues include the lack of common evaluation frameworks, computationally intensive nature of the approaches, non-real time capability, poor adaptability to other domains, and the black box nature of some existing solutions. The comparative study reveals that hybrid and knowledge-driven approaches offer higher factual accuracy but are associated with increased computational burden. Lastly, the article discusses possible future research directions concerning lightweight real-time hallucination detection models, domain specific anti-hallucination approaches, techniques for explaining AI-based decisions, and hybrid architectures for better LLMs.

Paper id 998

Paper title Text-Based Emotion Classification using a Transformer and Deep Learning Models

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Abstract Fine-grained emotion recognition from text is an important part of applications like analyzing mental health, monitoring social media usage, conversational agents, and understanding customer feedback. However, it is difficult to precisely recognize the subtle and overlapping emotions because of the ambiguity of the context, informal language, and class imbalance in real-world data. This paper proposes a multi model framework for text-based emotion classification that is generalizable and includes classical machine learning (ML), deep learning (DL), hybrid architectures and transformer based models. The framework includes Multinomial Naive Bayes, LSTM, CNN-SVM hybrid and fine-tuned DistilBERT model in a consolidated experimental pipeline with consistent preprocessing, rule-based enhancement and explainability mechanisms. This is where experiments are performed on the GoEmotions dataset that consists of 27 fine-grained emotion categories and a neutral class. Comprehensive evaluation with the help of accuracy, precision, recall, and F1-score reveals that DistilBERT shows superior performance results as compared to other models due to the strong ability to represent the context. The introduction of a rule-based override engine helps to increase the robustness of short and explicit emotional expressions and explainable AI methods like LIME, SHAP, and saliency visualization help to increase the transparency and trust associated with model predictions. The proposed framework achieves the tradeoff between accuracy, scalability and interpretability, which is suitable for practical deployment for real-world emotion-aware applications.

Paper id 999

Paper title Ensemble based Fake News Detection with Transformers and Random Forest

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Abstract :Automatic fake news identification has become a crucial field of study due to the quick dissemination of false information via digital media channels. While more modern deep learning models are better at capturing contextual semantics, traditional machine learning techniques frequently rely on manually created textual characteristics. However, when applied to new domains, individual models can experience problems like overfitting or poor generalization. This article suggests an ensemble-based approach for detecting false news that uses a stacking meta-classifier to integrate a transformer-based deep learning model with a classical machine learning model. In the suggested system, contextual semantic representations are extracted using a DistilBERT transformer model, while statistical patterns in text are captured by a Random Forest classifier trained on TF-IDF characteristics. The final prediction is produced by combining the outputs of both models using an

XGBoost meta-classifier. Two popular datasets, the ISOT Fake News Dataset and the WELFake dataset, were used for the experiments. According to the experimental results, the ensemble model outperforms individual models with an accuracy of 98.65% on the WELFake dataset. Experiments further show that models trained only on the ISOT dataset perform poorly on unexplored data sources and display overfitting, underscoring the significance of ensemble learning and dataset diversity. In order to give transparency, the suggested architecture incorporates explainable AI algorithms that identify key phrases in the news articles that influence model conclusions. When they are used practically, the results indicate that combination of transformer-based and classical models is more reliable and better in detection of fake news articles.

Paper id 1004

Paper title ACMA: Affective Cross-Modal Attention for Sarcasm-Aware Cyberbullying Detection in Code Mixed Meme

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Abstract Cyberbullying through online memes has become an increasingly serious problem, yet it remains difficult to detect automatically because memes generally use a combination of images and text in sarcastic and ironic ways that only make sense when both are understood together. Most existing systems look at either the text or the image in isolation which is not enough to capture the full meaning. To address this, we propose Affective Cross-Modal Attention (ACMA), a multimodal framework that builds on XLM-RoBERTa-large for text and CLIP ViT-Large/14 for images, and extends them with three key capabilities: explicit sarcasm detection by measuring how much the text and image contradict each other, affective knowledge distillation that draws on emotion and sentiment signals from dedicated teacher models, and an adaptive gating mechanism that learns to focus on whichever modality is most relevant for each individual meme. We evaluate ACMA on two benchmarks. On the MultiBully benchmark of 5,722 Hinglish meme samples, ACMA achieves 75.64% accuracy, 75.23% macro F1-score, and 82.04% AUROC, outperforming the strongest baseline by 4.24% in accuracy and 4.06% in F1-score. We further evaluate on our own Custom Multilingual Meme Dataset—a new benchmark of 4,583 memes spanning Hindi, English, and Hinglish—where ACMA achieves 75.62% accuracy, 75.54% macro F1, and 83.62% AUROC, significantly outperforming all baselines on both the datasets. These results confirm that jointly modeling sarcasm, emotion, and cross-modal interaction leads to meaningfully better cyberbullying detection and generalises robustly across diverse multilingual meme distributions.

Paper id 1005

Paper title A Four-Tier Temporal Feature Engineering Framework for Meteorology-Only Urban AQI Forecasting

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Abstract Models that predict air quality index (AQI) currently work on readings from pollutants' sensors available at the same time. This creates a circular dependency, making these models non-useful in sensor-deficient situations or early warning circumstances. This paper proposes a four-tier temporal feature engineering framework for forecasting hourly AQI from meteorological inputs together with historical AQI context features. We evaluate the proposed framework on the basis of 52,536 hourly observations from the urban monitoring network of Delhi for the year 2025. It consists of cyclical temporal encoding, meteoro logical interaction features, lag features at 1h–24h horizons, and rolling window statistics at 3h–24h windows, with the proposed framework validated through an ablation study. Weather features only give R2 = −0.38; adding temporal autocorrelation features reduces RMSE by 81.8% over this benchmark. The stacked ensemble output produced under the prescribed framework achieves strong performance on a strictly held-out chronological test set: R2 = 0.9544 and RMSE = 7.55 AQI units. Random Forest achieves the best single model performance (R2 = 0.9684, RMSE = 6.29), showing competitive performance relative to published deep learning

approaches trained using pollutant sensor data. SHAP attribution and permutation importance both confirm that rolling AQI statistics act as dominant predictors, while Diebold-Mariano tests verify the validity of all pairwise model comparisons at $p < 0.05$.

Paper id 1013

Paper title A Hybrid Multi-Signal Framework for Hallucination Detection in Large Language Models

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Abstract Large Language Models (LLMs) such as GPT-4, LLaMA, and Gemini are capable of generating highly fluent responses across a wide variety of natural language tasks. However, LLMs are known to hallucinate facts and produce non-factual statements, which can critically undermine trust in their output, particularly in high-stakes domains such as healthcare, law, and scientific research. Existing detection approaches either depend on a single verification signal — such as retrieval grounding, semantic consistency, or model confidence — each of which fails in characteristic ways when used alone, or require expensive model retraining and labeled supervision that limits their practical deployability. In this work, we propose a lightweight, training free Hybrid Hallucination Detection Framework that combines three complementary signals — Wikipedia retrieval similarity, dense semantic similarity via Sentence-BERT, and token-level confidence scoring — into a unified weighted detection score. This framework employs a novel Adaptive Weight Optimizer where the weight of each signal is updated for each sample depending on how reliable this signal is for the particular claim under consideration, addressing the shortcomings of conventional fixed-weight models. The effectiveness of our framework is tested using the publicly available FEVER and VitaminC datasets, and we observe significant improvements over various single signal baselines across all experiments. It is shown that our proposed framework effectively differentiates between facts and hallucinations and delivers near perfect precision, meaning that whenever the model classifies a statement as factual, it is highly likely to be true. Our method does not involve any fine-tuning, labeling, and works on regular consumer devices.

Paper id 1016

Paper title Predicting Flight Delays via Multi-Relational Graph Attention Networks

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Abstract Predicting flight delays is a challenging task as delays do not occur flight by flight in isolation. A single late aircraft can set off a whole sequence of late departures, and a ground hold at one airline hub can ripple across dozens of airports simultaneously. Most graph neural network approaches for this problem only use direct route connections between airports and overlook other important coupling mechanisms. In this study, we present MR-GAT, a multi-relational graph attention network that captures three types of airport relationships together: direct scheduled routes (R1), airline-hub operational coupling where airports served by the same carrier influence each other during ground holds and crew changes (R2), and tail-chain cascade propagation where a delayed aircraft physically pushes its next scheduled leg to depart late (R3). Each relation gets its own independent three-layer GATv2 encoder. Rather than collapsing these three outputs with a single shared weight, we use a node-level MLP gate that generates per-airport softmax weights, so large hub airports can lean toward airline coupling while smaller regional ones lean toward cascade signals. Training was performed on the 2015 domestic U.S. flight dataset, which carries a roughly 17.9% positive delay rate. MR-GAT reaches a ROC-AUC of 0.9473 and an F1 score of 0.8105, achieving steady and repeatable gains over four deep learning baselines. We evaluated R1 alone, then progressively added R2 and R3, and observed a consistent improvement in performance at each step.

Paper id 1017

Paper title Comparative Analysis of Deep Learning Models for Osteoporosis Classification in Knee X-ray Images

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Abstract Osteoporosis is a hidden disease and a huge problem in the world with millions of people suffering from it unknowingly. In this paper, we assess multiple deep learning architectures to classify the knee X-ray images into Normal, Osteopenia and Osteoporosis classes. The same experimental conditions were applied to five tested models (custom CNN, VGG16, ResNet50, EfficientNetB0, Xception). The VGG16 model gained the best accuracy of 71.31% as well as the best macro F1 score of 0.7080 on a single held-out test set. However, the margin over the next best models is small relative to the test set size. We conduct a systematic benchmark study of various models to illustrate practical considerations for model selection in a limited-data medical imaging task. The following observations are for practitioners and not definitive proof of better architecture.

Paper id 1020

Paper title PPO Fine-Tuning for Poetic Generation in Compact Llama-Style Language Models: A Controlled Two-Scale Study

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Abstract We investigate Proximal Policy Optimization (PPO) as a fine-tuning mechanism for compact, Llama-style decoder only language models applied to poetry generation. While RLHF is well established at large scale, its behavior under constrained parameter budgets remains poorly characterized. We present a controlled two-scale study at 100M and 150M parameters. Each model is pretrained from scratch on Project Gutenberg using an architecture with RMSNorm, Rotary Positional Embeddings, Grouped Query Attention, and SwiGLU networks. PPO fine tuning uses an interpretable five-component reward function targeting line structure, repetition suppression, length, rhyme approximation, and lexical diversity. The 100M model achieves tight optimization stability but weak stylistic movement. The 150M model yields the largest reward improvement, with a first to-last segment delta of +5.54 and convergent KL and policy ratio behavior. We identify four failure modes and show that the 150M scale offers the most favorable capacity-stability tradeoff. Qualitative generation samples illustrate the behavioral shift induced by PPO at each scale.

Paper id 1021

Paper title Integrating Machine Learning and Human-Computer Interaction for Accurate Early Dementia Detection

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Abstract Dementia is a progressive neurological condition that affects memory, reasoning, and daily functioning. This study presents an integrated machine-learning framework combining eight conventional classifiers, hyperparameter optimization,stacking-based ensemble learning, and a prototype Human-Computer Interface (HCI) for dementiastatus prediction. Sixteen model configurations comprising eight baseline and eight tuned variants were evaluated on the OASIS Longitudinal MRI dataset, and multiple stacking configurations were compared. The best-performing stack, using Gaussian Naïve Bayes, Random Forest, and Support Vector Machine as base learners with Logistic Regression as the final estimator, achieved 96.00% accuracy, 96.30% precision, 92.86% recall, and 94.55% F1-score in thesessionlevel evaluation. The selected model was integrated into a prototype HCI for dementia-status prediction. Because the evaluation was session-level and included MMSE and CDR, thefindings should be interpreted as a proof-of-concept rather than evidence of subject-independent generalization or clinical validation.

Paper id 1032

Paper title Feature-Enhanced Handwritten Text Recognition Using CNN–BiLSTM with Attention and NLP Post-Processing

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Abstract Recognizing handwritten text is a problem that has occupied document-analysis researchers for decades, largely because handwriting itself is so inconsistent: stroke thickness, letter shape, spacing, and background noise all shift from one writer to the next. Deep learning has pushed recognition accuracy considerably higher over the years, yet character-level confusions and word-level context errors are still common, particularly when the handwriting is unconstrained. In this paper we build a feature-enhanced HTR pipeline that brings together CNN-based spatial feature extraction, Bidirectional Long Short-Term Memory (BiLSTM) sequence modeling, a Hierarchical Recurrent Neural Network (HRNN) for multi-scale feature refinement, a soft attention layer, and an NLP post processing stage for correcting contextual word errors. The system is trained and evaluated on the IAM Handwriting Word Dataset, with images passed through a preprocessing pipeline of grayscale conversion, Gaussian noise filtering, Otsu binarization, and pixel normalization before reaching the network. Decoding is handled by Connectionist Temporal Classification (CTC), which avoids the need to segment characters explicitly. Our results show a Character Error Rate (CER) of 0.0102, and NLP correction cuts the Word Error Rate (WER) by roughly 44%, from 0.1525 down to 0.0847.

Paper id 1033

Paper title Machine Learning–Driven Diabetes Prediction Using Symptom-Based Clinical Features and Feature Optimization

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Abstract Millions of people worldwide suffer from diabetes, a chronic metabolic disease. Because of its increasing frequency and significant healthcare implications, it presents a significant health risk. Early and accurate diabetes prediction can help with disease management and timely intervention. This study looks at how well machine learning algorithms predict diabetes using the Sylhet Diabetes Hospital dataset, which includes clinical records from 520 patients. A range of feature selection methods, including Recursive Feature Elimination (RFE), Pearson correlation analysis, Genetic Algorithm, and Chi-Square test, were used to identify the most biologically significant predictors associated with the onset of diabetes. Five Machine learning algorithms have been trained and validated for this prediction task using different cross-validation techniques: Logistic Regression, Random Forest Algorithm, Decision Tree Algorithm, K Nearest Neighbours Algorithm, and Support Vector Machine Algorithm. Of all the techniques used, the Random Forest Algorithm showed the overall best results with an accuracy of 94.70% and an AUC-ROC score of 98.22% for distinguishing between the presence and absence of diabetes.

Paper id 1034

Paper title AI-Powered IoT Healthcare Wearable Ecosystem for Real-Time Health Monitoring and Predictive Analytics

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Abstract The combination of wearables, IoT, and machine learning technologies made a tremendous contribution to predicting and diagnosing various diseases. In this paper, we propose a framework that can help predict the level of risk by classifying patients' data gathered through wearable sensors and categorizing them into two groups – High Risk and Low Risk patients. Human vital signs dataset, downloaded from Kaggle, includes information about 200,020 patients and has 17 features such as heart rate, respiratory rate, body temperature, oxygen saturation, systolic/diastolic blood pressure, age, gender, weight, height, BMI, MAP, and so on. During the process of data processing, feature selection, label encoding, and data scaling were applied to obtain Standard Scaler values. First,

random forest was used to assess feature importance, and then XGboost was optimized via grid search cross-validation with 3-fold validation.Accuracy, precision, recall, F1-score, AUC-ROC, confusion matrix, and SHAP were considered during the process of performance assessment. As a result, the optimal accuracy of classification achieved by XGBoost model was 99.77%, and its precision, recall, and F1-score were also 99.77%. Additionally, its ROC-AUC was 1.00, and its mean cross-validation accuracy was 99.78%.

Paper id 1046

Paper title Framework for Precise Weed-Crop Detection in Distorted Potato Farm Dataset Using A Robotic Vehicle with Manipulator

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Abstract In precision agriculture, the detection of weeds is an important stage to reduce yield losses and unnecessary herbicide use. The conventional practices are done by hand or by tillage without selectivity. These are labour-intensive and environmentally hazardous techniques, like the spraying of herbicides. Methods of Deep Learning are effective. This is done through automation and targeting technology to identify weed. This is a weed detection system for potato in the field was proposed. in various parts of India with a DenseNet backbone trained. on a modified set of data. Data augmentation rotation, Scaling, shear, zoom and horizontal flipping were used to transform. To improve the generalisation of the model. To achieve robustness and To prevent over fitting, cross validation was implemented with 10 folds. The A trained model is put on a Robotic Vehicle and tested. in real agricultural fields, demonstrating its effectiveness in Weed detection in real-time under an environment changing condition. Experimental results show that the proposed approach successfully differentiates weeds from crops, achieving reliable classification performance. The results show the feasibility la-bor, and accurately identifying weed species.The potential of deep learning for weed detection automation, labor saving, and accurate weed species identification. The development of weed management strategies and labour. Future work will utilize self-supervised learning methods for further improvements of the model. Improve detection accuracy and adaptability in various farm operations environments.

Paper id 1055

Paper title Green Finance and Renewable Energy Investments: A Comprehensive Review of Technology Driven Sustainability

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Abstract The targeted use of green bonds and sustainability linked loans (SLLs) has recently become prevalent in the renew able energy market for financing green projects. Green bonds are used to fund projects focused on carbon emission reduction, while SLLs connect borrowing capacity to the successful imple mentation of sustainability initiatives that support environmental improvement. In addition, it is reported that modern technologies such as blockchain and AI help increase the efficiency and accountability of green financing initiatives. The optimistic and radical manner in which technology has changed this field is demonstrated by the combination of blockchain, which ensures traceability, and AI, which aids in predicting renewable energy output. This paper studies the importance of green finance in accelerating investment in renewable energy, focusing on recent developments in the financing market and also discusses various technologies to implement SLLs. Apart from that it also discuss the role of China in the Green finance sector

Paper id 1056

Paper title Sequential Activity Analysis: Implementing LSTM-CNN Models for Behavioral Anomaly Detection

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Abstract The identification of behavioral anomalies in surveillance videos has gained significant importance in the context of ensuring public safety and enabling intelligent surveillance systems. But it is difficult to accurately identify anomalous events because of complex human activities, dynamic background and temporal variations in video sequences. In order to tackle these challenges, this paper presents a Long-term Recurrent Convolutional Network (LRCN) framework which leverages the spatial feature extraction ability of Convolutional Neural Network (CNN) and the temporal sequence learning ability of Long Short-Term Memory (LSTM) networks. The proposed model is trained and tested with the UCF-crime dataset with a variety of realistic surveillance scenarios and anomaly categories. CNN layers are used to learn discriminative spatial features from the video frames, and LSTM layers are used to learn temporal features between sequential frames to model the behavioral patterns. The embedded spatial-temporal architecture provides a reliable recognition of anomalous activities in surveillance environments. The performance of the proposed framework is evaluated via experiments and shown to be accurate at 97.45% which is better than the conventional approaches used for abnormal event detection. The study demonstrates the success of the LRCN model in delivering accurate, efficient and scalable detection of behavioural anomalies, which serves as a promising approach for implementing real-time intelligent surveillance and security systems

Paper id 1057

Paper title CNN-Based Deepfake Detection Using Deep Learning Techniques

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Abstract Deepfake technology is among the most remarkable uses of Artificial Intelligence (AI) & Deep Learning (DL), with the capability to produce authentic-looking fake images and videos. Virtual reality has many applications, including entertainment and virtual platforms, but deepfakes pose risks of deception, scams, stolen identity, political deception, and digital fraud. Thus, developing reliable and efficient deepfake detection systems is an essential research issue. The study proposed a new CNN-based framework to detect manipulated and authentic media content from both images and videos. For better robustness and detection performance, various preprocessing methods are included in the performance, various preprocessing methods are included in the proposed framework such as face detection, image resizing, normalization, data augmentation, and noise reduction. CNN detects the subtle manipulation artifacts from existing deepfake datasets by learning the spatial features from facial regions. Various benchmark datasets are used to test and train the model. The proposed system achieves an overall accuracy of 96.2%, precision of 94.71%, recall of 96.52%, F1-score of 95.56% and an AUC-ROC of 0.9801 which outperforms existing ML and DL approaches. Moreover, the proposed framework is well suited for real-time applications in digital forensics, cybersecurity, social media content moderation, journalism and identity verification systems as it offers a substantial balance between detection accuracy and computing efficiency. The proposed system could further be enriched by incorporating Transformer-based and LSTM architectures for further enhancing temporal analysis and defense against adversarial deepfake generation techniques in the future.

Paper id 1058

Paper title A Data-Driven Framework For Thermoelectric Cooling and Power Generation Tracking Using Clustering And Polynomial Thermal Analytics

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Abstract In integrated electronics, industrial systems, medicinal technology, and renewable energy applications, thermoelectric cooling systems have surged in prominence offering a modest thermal management solution. The performance of thermoelectric cooling and power generation leveraging intelligent embedded sensing and machine learning assisted thermal analytics is carefully examined analytically in this work. For real-time thermal monitoring and predictive analysis, the suggested framework incorporates PT100 resistance temperature detectors, DHT11 environmental sensors, Arduino UNO acquisition hardware, data processing modules, and Python-based analytical software. The influence of airflow rate, heat sink geometry, ambient conditions, and electrical supply on thermal stability and cooling efficiency is illustrated with experimental findings. Further, the study

examines machine learning regression techniques for intelligent thermal prediction, such as random forests, decision trees, support vector regression, and linear regression.

Paper id 1059

Paper title A Graph-Theoretic Multi-Agent Framework for Quantifying Emergent Collective Intelligence in Distributed Adaptive Systems

Authors Saumya Maheshwari,Pranjal Sharma, Ritik Jha , Dev Ujalayan, Puneet Azad, Deepak Goyal

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Abstract People have been experimenting with multi-agent systems for a long time, and at some point they noticed something unusual: agents that are not especially capable on their own begin solving meaningful problems once they work together. Nothing about the individual agents changes, but the interaction between them creates something stronger. Each agent only sees part of the environment, often incomplete or noisy information, and shares what it knows with nearby agents. No single agent has the full picture or acts as a leader, yet through local communication the group slowly forms a better understanding than any individual could achieve alone. Researchers describe this as collective intelligence because the system begins reaching conclusions that none of the agents could have produced independently. Tests showed that when communication worked properly, decisions improved, tasks were completed more effectively, and overall system performance increased beyond what a single agent could manage. However, too much communication caused problems as well. Agents started repeating the same information, messages became redundant, and performance dropped because the system spent more time circulating information than solving tasks. The important result was not simply that communication helps, but that the quality and amount of communication matter greatly. Too little communication leaves agents uncertain, while too much creates confusion and inefficiency. This changes the way difficult problems can be approached. Instead of relying only on a single more powerful system, intelligence can emerge from multiple smaller agents connected in a thoughtful way, each contributing useful knowledge.

Paper id 1064

Paper title Intelligent Medical Image Management System for Chest X-Ray Classification and Multimodal Clinical Retrieval

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Abstract Chest X-ray interpretation is among the most frequent diagnostic procedures in clinical practice, but the large volume of X-rays to review and reports to prepare are time-consuming and require specialist expertise. In this paper, an intelligent medical image management system is proposed for radiology support which not only realizes the automated chest disease classification automatically but also has image-based retrieval and text-based retrieval functions. The system consists of four modules which are integrated in the system namely chest X-ray classification, image similarity search, semantic radiology report retrieval and retrieval of radiology reports based on keywords. The classification component consists of a DenseNet-121 backbone trained for multi label prediction of 14 thoracic diseases through convolutional deep learning, inspired by the CheXNet architecture. Deep visual embeddings are used for similar-image search, semantic reports are encoded using BERT embeddings, FAISS-based nearest neighbor ranking is used for searching, and TF-IDF with cosine similarity is used for keyword search in cleaned radiology reports. The underlying study is based on the NIH ChestX-ray14 dataset which consists of over 112K frontal chest X-ray images from 30,805 patients and an associated report dataset of 3,955 reports. Noisy records, including 997 samples with no findings, were removed during the report preprocessing and the text from the reports was normalized. Paired image inputs, for patients with multiple scans, were prepared during the report preprocessing. Experiments demonstrate that the framework can be used for the classification of diseases and for practical retrieval tasks in a single environment. Atelectasis, in one of the classification experiments, and pneumonia, in another, were recognized and effusion was recognized in one more experiment; receiver operating characteristic analysis provided class-wise AUC values of 0.52, 0.56, and 0.52, respectively. In the semantic report retrieval, the most similar report was

produced as the same report in all three examples demonstrated and the keyword-retrieval of "pneumonia" resulted in the highest cosine similarity scores between 0.4000 and 0.4389. The findings from these results show that combining diagnosis-oriented prediction with multimodal retrieval can facilitate quicker and more enlightened decision making by the radiologists as they access similar cases and textual findings.

Paper id 1067

Paper title Deep Learning for ECG and EEG-Based Disease Detection: A Critical Survey of Architectures, Challenges and Emerging Trends

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Abstract Cardiovascular diseases (CVDs) and neurological disorders together are among the top causes of global mortality and disability, so it really indicates the urgent need for diagnostic tools that are highly accurate, precise, interpretable, and scaleable. Non invasive biomedical signals mostly the electrocardiogram (ECG) and electroencephalogram (EEG) carry a lot of physiological information that deep learning can analyze very well. This Survey highlights systematic deep learning (DL) approaches for the detection of cardiovascular and neurological diseases using ECG and EEG Signals. It follows PRISMA 2020 and covers papers from year 2021 to 2025. Starting from 1,842 publications, collected across leading databases such as IEEE Xplore, Science Direct, Pub Med and Web of Science, approx 187 studies found that satisfied all inclusion requirements.This survey gives a detailed technical critique of CNN, LSTM, Transformer, GNN, self-supervised, GAN, and hybrid DL paradigms. Quantitative reasoning has been incorporated to explains the performance differences across various studies, along with a unified five-dimensional taxonomy. There is a comprehensive twenty five study comparison table with real data set names,AUC values and computational cost estimates. Additionally this survey reported an architecture performance comparison matrix along with quantitative trend analysis of publication volume, architecture adoption and distribution of clinical application over time .There is also a full PRISMA methodology, with explicit inclusion/exclusion criteria and a quality assessment protocol along with few precisely defined advanced research gaps such as foundation models, domain adaptation,continual learning, uncertainty quantification, digital biomarkers, regulatory pathways, and clinical validation. Overall, this analysis indicates a clear trajectory from single-signal benchmarking.

Paper id 1071

Paper title Attention U-Net with Boundary-Aware Composite Loss for Urban Flood Detection from SAR Imagery

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Abstract Floods lead to significant environmental consequences, including loss of human life and infrastructure. This paper proposes a pipeline framework for multi-temporal SAR-based flood detection that employs an Attention U-Net architecture with a multi-scale dilated bottleneck and soft attention gates. A 10-channel input representation is constructed by combining pre-event, co-event, and post-event SAR intensities, coherence information, and temporal differences. A composite loss function consisting of cross-entropy, Dice, and edge losses is implemented to address class imbalance and improve boundary delineation. An ablation study presents the contribution of each architectural and training component, improving mIoU from 0.5778 to 0.6154 (+6.5%). Consistent improvements are observed in both Flooded Open (FO) and Flooded Urban (FU) classes. Our model demonstrated competitive performance compared with recent studies despite different experimental setups, demonstrating its effectiveness for real-world urban flood detection.

Paper id 1080

Paper title Imbalance-Aware Skin Lesion Classification Using EfficientNetB0 with Focal Loss and Gradient-Based Visual Explanations

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Abstract Automating skin lesion classification from dermoscopy images is crucial for clinical purposes, but challenges include class imbalance, black-box model behaviour, and fluctuating image quality. This paper presents an explainable, class imbalance-aware deep learning framework for 8-class skin cancer classification on the ISIC 2019 benchmark (25,331 images; maximum imbalance ratio 53.9:1). A five-step preprocessing pipeline, including Contrast Limited Adaptive Histogram Equalization (CLAHE), is applied uniformly across all classes. Four ImageNet pretrained architectures are systematically benchmarked under identical experimental conditions: MobileNetV2, EfficientNetB0, EfficientNetB3, and DenseNet121, with EfficientNetB0 achieving the best baseline performance of 65.70% test accuracy and 65.17% weighted F1-score on 20,000 balanced training im ages.The proposed enhancement integrates augmentation-based oversampling to 2,500 images per class, class-weighted Focal Loss (γ = 2.0 with per-class α weighting), and hard example mining on 627 misclassified samples (fine-tuned at a learning rate of 1×10^{-5}), improving accuracy to 67.79% and weighted F1-score to 67.01% (+2.09% absolute improvement).A controlled compo nent ablation confirms that augmentation-based oversampling contributes +4.47% accuracy over the unaugmented baseline, Focal Loss adds +0.82%, and hard example mining adds a further +1.27%. Per-class Area Under the Curve (AUC) scores range from 0.83 (BKL) to 0.98 (VASC), with DF achieving an AUC of 0.95 despite a 53.9:1 imbalance ratio. Critically, this work is the first on the ISIC 2019 8-class benchmark to combine class-weighted Focal Loss, hard example mining, and GradCAM explainability within a unified framework. Grad-CAM heatmaps demonstrate that prediction confidence correlates with spatial focus quality, validated quantitatively across all 1,099 test samples (Pearson $r = 0.634$, $p < 0.001$), providing a deployable uncertainty indicator for clinical triage systems.

Paper id 1082

Paper title Design and Implementation of a High Concurrency Resource Booking System

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Abstract This paper explains a high-concurrency resource booking system which is implemented in the form of a movie ticket booking platform and aims to address the real-world concurrency scenarios that occur when multiple users try to access the same resource. The system is implemented using MERN stack and uses the concept of MongoDB database transactions to maintain data integrity. Along with that pessimistic seat locking mechanism was adopted in order to apply temporary locks on selected resource to make it inaccessible for other users. The frontend of the application was made using React.js and provides necessary tools and methods for users to interact with the proposed system. The tools allow selecting preferred movies, theatres, seats, and perform the booking. The system was tested for its ability to handle concurrent booking attempts. The tests have demonstrated that the resource allocation system reliably handles concurrency issues and avoids unsafe booking operations. Thus, the importance of proper backend design and concurrency management for such platforms was proved.

Paper id 1087

Paper title Machine Learning-Based Resource Allocation and Channel Assignment in Wireless Communication: A Survey

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Abstract Wireless communication systems have been growing at very fast speed. The importance of advanced multiple-access and resource allocation techniques has increased massively for the performance of 5G and future wireless networks system. They are not only helping to improve the data efficiency but also support a greater number of users and provide faster communication. One of the key goals for these systems is to manage resources efficiently and increase the network performance at the same time. And these problems are more complex than it sounds. These methods involve discrete valued decisions, which are very difficult to solve using traditional optimization methods in real-time systems. Some traditional optimization methods, like convex optimization, give desirable results, but they are computationally expensive and time taking, which makes them difficult for any real-time use. Various Machine Learning (ML) methods include Convolutional Neural Networks (CNN), Feed-Forward Neural Networks (FNN), Random Forest (RF), Gated Recurrent Unit (GRU), and Recurrent Neural Networks (RNN) have shown significant potential in reducing computation time while maintaining good performance. Ensemble learning combines multiple ML models, which helps to further improve prediction accuracy and robustness. Recently, Graph Neural Networks are gaining popularity in wireless systems, because of their capability of modelling users and channels as a graph-like relationship. This paper reviews the existing work on machine learning-based resource allocation and channel assignment in wireless communication systems. The paper also discusses key ML based models, ensemble learning methods, and GNN-based approaches. It also identifies different challenges in the implementation of ML models in wireless systems, such as scalability, imperfect Channel State Information, computational complexity, and real-time deployment.

Paper id 1088

Paper title Neural Network Architecture for Real-Time Warning Detection

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Abstract In modern transportation systems, the timely recognition of traffic signs is critical to maintaining highway security and maximizing traffic flow. During this study, we offer a method for real-time traffic sign identification based on a neural network-driven hazard recognition system. Use the power of deep learning, namely convolutional neural networks (CNNs), our system accurately detects and identifies various traffic signs with high precision. The architecture employs Python programming language and relevant libraries for efficient implementation. We detail the design, training process, and evaluation of the neural network model, emphasizing its robustness to environmental conditions and diverse traffic sign designs. Through experimentation and validation on real-world datasets, we showcase the efficiency as well as reliability of our strategy to achieve accurate traffic sign identification. The proposed system holds promise for integration into intelligent transportation systems, contributing to enhanced road safety and efficiency in urban and highway environments.

Paper id 1089

Paper title SummarEase: An AI-Integrated Multi-Modal LLM Framework for Hierarchical Structural Parsing and Adaptive Academic Summarization

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Abstract Students face difficulties concentrating on and retaining information in traditional learning settings due to an overwhelming volume of content. Existing large language models (LLMs) can summarize text effectively; however, most of them neglect the hierarchical structure of academic documents and generate flat, non-"scaffolded" summaries. In this paper, we propose a system, SummarEase, which addresses this challenge. Utilizing an innovative, hybrid architecture powered by state-of-the-art AI for deterministic structural parsing, subject-aware knowledge representation (SAKR), and learning-objective-conditioned summarization (LOCS), SummarEase translates non-"scaffolded" academic documents into multi-modal learning content with hierarchical organization to assist human learning and comprehension. Based on extensive experiments, our system improves summary readability, content coverage, and user satisfaction while reducing reported study time.

Paper id 1090

Paper title Predicting Cardiovascular Disease Vulnerability based on Lifestyle Factors Using Deep Learning

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Abstract Cardiovascular diseases (CVD) are a major global health issue, leading to a high number of early deaths worldwide. Due to lifestyle changes, CVD has become much more common in the global population. This has increased the need for effective early detection and prevention strategies. Accurate and timely CVD risk prediction can help healthcare providers take preventive steps, improve treatment plans, and ultimately reduce the social and economic impacts of CVD. This research seeks to test six deep learning models for predicting CVD risk by analyzing lifestyle-related risk factors using the Framingham Heart Study dataset. The models include Light Gradient Boosting Machine (LightGBM), Tabular Neural Network (TNN), Tabular Network (TabNet), Neural Decision Forest with Disjunctive Normal Form (Net DNF), Feature Tokenizer and Transformer (FT Transform), and Deep Neural Decision Trees (DNDT). Results showed that LightGBM reached the highest accuracy (93%), followed by TNN (90%), with TabNet and Net DNF achieving 88%, and FT Transform and DNDT at 87% and 87.5%, respectively. These results highlight LightGBM as a leading model in CVD prediction, demonstrating the value of both new and advanced deep learning models in improving prediction accuracy and helping healthcare providers with early diagnosis and treatment planning.

Paper id 1091

Paper title Disentangling Pollutant Dependency and Temporal Forecasting in Machine Learning Based AQI Prediction

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Abstract Air quality index (AQI) forecast models are prevalent, and their performance usually appears to be excellent in cases when pollutants are included in the model. Given the direct correlation between the index value and pollutant concentrations, this performance may be more reflective of reconstruction than forecasting. The presented research investigates the phenomenon, analyzing the performance of XGBoost, LSTM, ANN, SVR, PLR, MLR and ENIT models on the basis of hourly AQI measurements at NSIT Dwarka, Delhi, from 2020 to 2025. There were three types of data used as input to the models: based on pollutants, only temporal, and lagged data. Results show that the inclusion of pollutant variables yields almost perfect performance (XGBoost: MAE = 0.87, RMSE = 1.32, R2 = 0.9999). At the same time, exclusion of these variables decreases the accuracy significantly (MAE = 214.46, R2 = -1.62), confirming the dependence on pollutants. On the other hand, temporal-only models with lagged features perform well (R2 = 0.96 to 0.97), due to the persistence principle. PCA analysis also shows that the 10 components explain 95% of feature variance, with the dominant component strongly correlated with AQI (r = 0.95) and driven primarily by pollutant concentrations and lagged AQI values, while a PCA-reduced feature set retains high predictive accuracy (R2 = 0.9883). These observations suggest that AQI forecasting accuracy is largely influenced by predictable dependencies and autocorrelation in the data, rather than atmosphere forecasting skills. The importance of feature exclusion and analysis is demonstrated by the study.

Paper id 1092

Paper title Leveraging Machine Learning Models in Sustainability and Business Valuation

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Abstract The growing focus on sustainable development has heightened emphasis on sustainability performance and Business performance using different advanced modelling techniques. As the past studies have presented mixed outcomes on the relationship between sustainability and business performance through empirical testing. But to find new insights into said relationship, employing machine learning algorithms such as random forests, decision trees, and logistic regression, adds new knowledge to existing knowledge base. The findings present that random forest classification is the most suitable model in defining the sustainability and business valuation relationship, with a moderate to strong level of predictive performance in the case operations. The scope of the study is limited to the capital market and machine learning algorithms; however, other methods for measuring the relationship between sustainability and business performance are also available. This study would contribute to sustainability literature by providing new insights using machine learning algorithms. The study's findings have several implications for professionals and practitioners in the delivery of earnings information.

Paper id 1097

Paper title Optimizing Enterprise Performance through AI-Driven Digital Management Systems

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Abstract The pressure on businesses in the contemporary world is growing to enhance efficiency, minimize the costs of operation, as well as respond quickly to the fluctuating market conditions. This study introduces a unified digital management system that can be used to enhance the work of an enterprise with the help of a combination of IoT monitoring, AI analytics, and automatic decision-support mechanisms. The suggested model presents an EPI that is mathematically defined, and a hybrid optimization algorithm, which is able to process real-time data and detect bottlenecks of the processes, as well as produce smart suggestions. Extensive outcomes, backed by various performance indicators and comparative studies indicate that there were great gains in productivity, cost effectiveness, reliability, and speed of decision making. Other major obstacles considered in the study, which include disjointed data flows and operational visibility, are mitigated by providing an integrated and scalable and automation-capable digital transformation model. On the whole, the current study offers a viable and innovative input that can contribute to the effectiveness of organizations and can form a strong basis on the development of the enterprise digital management in the future.

Paper id 1098

Paper title Transforming Organizational Decision-Making with Data-Driven Computing Frameworks

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Abstract In the era of accelerated digital transformation, data is becoming a strategic resource that organizations are turning to make vital decisions. This paper explores the emergence and deployment of data-driven computing frameworks that would improve accuracy, efficiency, and strategic intelligence in organizational contexts. The framework proposed combines the sophisticated analytical models, real-time data processing, and intelligent decision-support mechanisms to address a weakness of the traditional and the intuition-based decision-making process. Using machine learning algorithms, predictive analytics, and scalable computing architectures, system helps organizations to discover hidden trends, predict their results, and streamline their organizational operations. The paper also tests the efficacy of the framework based on comparative analysis and shows that the decision accuracy, the response time and the use of resources have increased significantly. The results show the transformational possibility of data-driven computing to empower organizations to make evidence-based, transparent, and proactive decisions. The study is related to the further evolution of smart organizational systems and represents groundwork to be used in further investigations in automated decision-making and digital management environments.

Paper id 1100

Paper title Strengthening Corporate Agility via Smart Information Systems Architecture

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Abstract Organizational agility is nowadays key factor of competitiveness and survival in the fast-changing business world. This paper introduces a SISA that can be used to improve corporate agility through the incorporation of agile data acquisition, real-time analytics, automated decision making and adaptive learning. The suggested framework is based on the application of predictive and prescriptive analytics, mathematical optimization, and intelligence based on AI that can allow organizations to react dynamically to market changes, operational disruptions, and strategic issues. The experimental examination shows that there are considerable benefits of operational efficiency, process reconfiguration time, workflow automation and forecast accuracy over existing company designs. The New Agility Index is a composite of operational, market and strategic performance, offering a consistent measure to track and improve performance over time. The findings indicate that SISA enhances an organization's performance, responsiveness and resilience with a reduced decision cycle. The project's fully data-driven architecture will be deployed across sectors replacing traditional decision-making with smart, scalable and future-ready organizational platforms.

Paper id 1101

Paper title Redefining Business Process Efficiency through Intelligent Technology Integration Frameworks

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Abstract The fast-changing digital technologies have had massive changes on the way organizations design, operate, and optimize their business processes. This paper examines how the innovative models of technology integration, such as AI, IoT, Cloud Computing, and Blockchain, can transform the organizational workflow and improve the efficiency of the operations. In its comparative study, the study has presented the finding that these technologies help in enhancing the speed, accuracy, scalability, transparency and decision-making intelligence of processes. Other important factors leading to low acceptance as highlighted in the paper include difficulty in integration, cybersecurity

concerns, high implementation costs and skills lack. Based on the current literature knowledge and a rigorous assessment technique, the study highlights how firms may strategically use digital technology for sustainable competitive advantage and long-term digital transformation. The findings provide practical guidance on how to choose the correct integration models that suit the organization's goals and technological maturity and add to academic knowledge and implementation potential.

Paper id 1102

Paper title Enabling Sustainable Organizational Growth using Data-Driven Intelligent Resource Planning Systems

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Abstract Good planning of resources is a must for contemporary organizations to improve organizational efficiency as well as fulfilling sustainability goals. This paper proposes IRPP that integrates Linear Regression, LSTM, Rule-Based Prediction and Hybrid Intelligence Model with an optimization framework to achieve intelligent resource allocation and sustainable growth of the organization. The proposed framework is evaluated using the Google Cluster Trace Dataset consisting of 50,000 resource utilization records to predict the future resource demand and optimize resource allocation based on CPU utilization, memory utilization, storage utilization, network bandwidth, task priority, execution time, energy consumption and carbon emission. The model was tested using 80:20 training-testing split in five separate experimental runs. The model was evaluated in terms of prediction accuracy, RMSE, MAE, reaction time, resource utilization efficiency, operating cost, energy consumption and carbon emission reduction. Statistical validation using the mean, standard deviation, 95% confidence intervals, and paired Student's t-test ($p < 0.05$) proved robustness and reliability of the proposed framework. Experimental findings reveal that proposed IRPP consistently outperforms traditional resource planning methods by enhancing the prediction accuracy and maximizing the consumption of resources, decreasing operational costs, and enabling environmentally responsible organizational decision-making.

Paper id 1104

Paper title Reinventing Strategic Leadership through Predictive Analytics Algorithms

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Abstract This study addresses the topic of Reinventing Strategic Leadership by means of Predictive Analytics Algorithms, with a focus on the introduction of data-driven procedures in decision-making in the leadership domain. Predictive analytics also helps leaders to predict trends, allocate resources optimally, and take proactive strategic choices at a greater level of precision. The research article has discussed the application of various predictive algorithms to enhance the performance of organizations, its operational efficiency and adaptability to the fluctuating conditions of the business environment. The findings indicate that predictive analytics can help strategic leaders to explore opportunities, mitigate risks, and exploit sustainable growth. The research educates regarding the tremendous role of the insights based on algorithms to help transform the traditional approaches to leadership into the progressive ones basing on evidence, becoming more competitive and benefiting the organization with the higher resilience.

Paper id 1106

Paper title The Illusion of Sources: A Comparative Study of Citation Fabrication in Gemini-3 and ChatGPT-5.2

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Abstract As artificial intelligence continues to transform academic research, the reliability of AI-generated citations remains a critical concern. This paper conducts a comparative study of citation hallucination between Gemini-3 and ChatGPT-5.2 across four major academic disciplines: Medical and Health Sciences, Psychology and Social Sciences, Computer Science and Technology, and Economics and Environmental Studies. A dataset of one thousand academic prompts was developed, with each prompt requiring three citations, yielding three thousand citations per model for evaluation. Citations were evaluated using an automated three-layer verification engine with consensusbased classification, and categorized as correct, partial, or fabricated. The Reference Hallucination Score (RHS), which weights fabricated citations at 1 and partially incorrect citations at 0.5, was used to assess the degree of hallucination, with Gemini-3 recording an aggregate RHS of 0.16 and ChatGPT-5.2 recording 0.20. Although 63–76 percent of citations were fully correct, and outright fabrication (3–8 percent) was markedly lower than the rates reported for GPT-3.5 and GPT-4-era systems, roughly one in four to one in three citations still contained a partial or complete
error, indicating that citation hallucination remains a nonnegligible occurrence in both models. The findings reveal domaindependent variation in hallucination rates, with ChatGPT-5.2 performing worse in Medical and Health Sciences and Economics and Environment, while Gemini-3 exhibited higher hallucination in Computer Science and Technology. These findings reinforce the need for improved citation grounding mechanisms in large language models and highlight the risks of relying on Aigenerated references without independent verification.

Paper id 1108

Paper title An Extensive Deep Learning Approach for Dental Disease Detection: Evaluating Architectures with Class Imbalance Handling

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Abstract Globally, dental diseases are a major public health issue. When left undiagnosed, these conditions can cause serious damage to billions of people. People living in under-served areas have limited access to dental professionals. This makes it hard to detect problems early and provide timely treatment. In this research work, we present a deep learning-based system for automatic identification of dental diseases. It aims to improve diagnostic reliability, especially for critical and minority classes. Using a transfer-learned ResNet-50, the model classifies dental images into six common conditions. A Weighted Cross-Entropy Loss to account for the imbalance in classes with appropriate augmentations robustly trains the network. Trained with a 70/15/15 split, the optimized model achieved strong validation accuracy and a macro-averaged F1 score. Hence, our proposed model achieves better reliability in detecting class-imbalanced dental diseases. Grad-CAM visualizations help provide interpretability, enhancing trust in AI-assisted dental screening.

Paper id 1109

Paper title AMR-Layer: Cloudflare Dependency Analysis and Adaptive Multi-CDN Failover for Internet Resilience

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Abstract Cloudflare handles DNS resolution, content delivery, and DDoS mitigation for over 38 million domains, meaning single-provider failures like the July 2024 BGP misconfiguration and January

2025 firewall outages completely disrupt global platforms including ChatGPT, Discord, Binance, and DoorDash. This paper first maps Cloudflare dependency across 927 stratified websites from the Tranco Top 10,000 ranking, finding that 45% rely on Cloudflare at the DNS, CDN, or routing layer. Second, it formally demonstrates that partial layer dependency carries identical risks to full dependency since any single broken layer causes a total service blackout. Third, it introduces and evaluates AMR-Layer, an open-source, Adaptive Multi-CDN Routing architecture that polls endpoints every 500 ms and executes cross-provider failover within 700 ms. Live network telemetry shows baseline median latencies of 44.3 ms for Google CDN, 59.9 ms for Cloudflare, and 75.9 ms for AWS CloudFront. Simulations over 1,000 requests per scenario prove that AMR-Layer restores availability to 99.80% (versus 85.00% without it), cutting downtime by 98.7%. Structured comparison against commercial tools like AWS Route 53, Cloudflare Load Balancing, Fastly, and IBM NS1 Connect confirms that AMR-Layer is the only zero-licensing framework combining sub-second detection with true cross-vendor switching.

Paper id 1110

Paper title Machine Learning Framework for Intelligent Career Prediction Using Academic, Behavioural, Personality, and Skill-Based Analytics

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Abstract Career prediction and educational guidance have become very important for educational systems today. The array of career options available has increased, and a student's profile contains a number of parameters that can influence his or her career in a number of ways. While traditional career counseling can be effective, it lacks the edge that a systematic and in-depth analysis of a student's profile can provide. Moreover, such counseling methods depend heavily on general observations and manual analysis. Therefore, there is a pressing need to incorporate the use of machine learning in order to develop intelligent systems that can provide accurate and explainable career prediction. In this paper, we have proposed a framework for intelligent career prediction that uses four different datasets. These include academic data, personality traits, behavioral patterns, and the various skills that a student possesses. We have conducted a number of experiments using two different models, i.e., Decision Trees and LightGBM, and have used four different feature selection methods, including SHAP values, Mutual Information, Boruta, and Random Forest feature importances. Our results indicate that after tuning the hyperparameters of the LightGBM model, it was able to perform better than the baseline models for most of the evaluation metrics. In terms of the various feature selection methods that we had used, the results indicated that the best model was the MI + LightGBM Tuned model. This model achieved the highest AUC score of 0.933 and thus was able to provide the best classification performance. We have also used a number of XAI techniques in order to analyze the importance of features used by the model and to increase transparency of the decision making process of the proposed system. The framework proposed in this paper can be used for a number of purposes including helping institutions, counselors, and students in making career choices and also for implementing early intervention by enhancing skills of students who are at risk of not performing well academically.

Paper id 1132

Paper title Deep Dental Gender-Net: A GAN-Augmented Segmentation-Guided CNN–Transformer Model for Forensic Gender Identification from Teeth Images

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Abstract Forensic gender identification plays a vital role in human identification, particularly in criminal investigations, disaster victim identification, and forensic examinations. This study proposes Deep Dental-Gender-Net, a novel hybrid deep learning framework for automated gender classification using panoramic dental X-ray. The model utilizes the Gender Labelled Panoramic dental X-ray Dataset containing 979 images, which are divided into training, validation, and testing subsets. Initially, image preprocessing techniques including resizing, noise removal, normalization, contrast enhancement, and data augmentation are applied to improve image quality. A Generative Adversarial Network (GAN) is employed to generate realistic synthetic dental images, increasing dataset diversity and reducing overfitting. Subsequently, a Convolutional Neural Network (CNN) extracts local anatomical features such as tooth contours, crown morphology, enamel patterns, and root structures, while a Vision Transformer (ViT) captures global contextual relationships among dental regions through self-attention mechanisms. The extracted local and global features are fused to form a comprehensive representation for classification. Experimental results demonstrate superior performance with 99.12% accuracy, 98.96% precision, 98.84% recall, 98.90% F1-score, 99.36% specificity, and an AUC of 99.50%. Comparative analysis confirms that Deep Dental-Gender-Net outperforms existing approaches, providing a robust, reliable, and highly accurate solution for forensic gender identification from dental radiographs.

Paper id 1133

Paper title Sustainable AI Systems: Evaluating the Impact of Model Compression and Transfer Learning Strategies

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Abstract Deep learning models are increasingly being used in many practical applications, such as healthcare, educational systems and smart systems, where energy consumption and environmental impacts are of concern. Sustainability of deep learning has become an important research question as the amount of danger it poses to the environment in the form of large amounts of CO2 release or the amount of freshwater it takes for cooling down. The usage of electricity by the data centres is increasing exponentially and is comparable to a single nation's electricity use. So, making AI sustainable is an immediate cause of concern. Therefore, this paper in accordance with the principles of Green AI provides a comparative assessment of two sustainability-focused strategies, Reduce and Reuse, on the MNIST dataset to act as a normalized, common benchmark. We compare a baseline convolutional neural network (CNN) trained from scratch to two different sustainability strategies: post-training quantization which acts as the Reduce approach, and transfer learning, which is a Reuse strategy. These strategies aim at optimizing the different stages of model training and inference: quantization for deployment efficiency and transfer learning for training efficiency. The MNIST handwritten digit dataset was selected due to its simplicity, wide adoption, and suitability for controlled experimentation. According to experimental findings, post-training quantization reduced the model size from 0.90 MB to 0.27 MB by roughly 67.8% without compromising classification accuracy. It shows the highest sustainability score, throughput, energy accuracy tradeoff and the lowest inference latency score among all the three models. On the other hand, of all the models tested, the transfer learning model achieves the highest accuracy while drastically cutting training time by almost 80%. It shows a higher sustainability score than the baseline model. The confusion matrix analysis was also performed on the models and they both had strong diagonal values. The off-diagonal values were relatively fewer in the Transfer Learning model which showed that it was better at identifying and predicting the digits and is a better choice in generalising the digit pairs. These results show that Reduce and Reuse tactics enhance sustainability in a number of ways, including training and storage efficiency and that too without compromising the current performance. The study emphasizes how important it is to pick eco-friendly approaches that fit available computing power.

Paper id 1134

Paper title A Smart IoT-Enabled Cyber-Physical Framework for Groundwater Surveillance and Control

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Abstract The unsustainable extraction of groundwater due to various reasons, coupled with climate stress and urban expansion, is a huge challenge. Current sensing monitoring solutions often analyze data in real time but after-events only. This research presents a cyber-physical framework for groundwater management that involves the use of IoT-enabled sensing, edge control, and machine learning-based prediction. A distributed sensing layer consists of smart pump meters that capture extraction behavior and field sensors that capture aquifer conditions. An LSTM model forecasts groundwater dynamics as a time-dependent process using hydro-climatic and usage variables. The predictive layer integrates pump-level control mechanisms for adaptive allotment under distress conditions. An NLP interface enhances transparency by converting system outputs into human interpretable advice, while preserving human in the loop. Evaluation of different scenarios and based on literature benchmarks, embedding predictive analytics with real-time cyber-physical monitoring can mitigate over-extraction risk, aquifer instability and groundwater unsustainability. The presented architecture provides a scalable IoT-based decision support system for distributed environmental resource management.

Paper id 1138

Paper title An Efficient Deep Learning Framework Based on CNN–BiLSTM for Sentiment Analysis

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Abstract With the dramatic increase in user-generated data on social media, reviews and discussion forums, sentiment analysis has become one of the key research areas in Natural Language Processing (NLP). Hence, they cannot learn semantic and contextual dependencies on input text as done in traditional ML methods. In this paper, we propose a hybrid model that combines CNN and BiLSTM for sentiment classification. The CNN model learns semantic representations from sequences of text, whilst the BiLSTM model captures long-term inter-dependencies in both forward and backward directions. We experiment with various standard benchmarks for sentiment analysis such as IMDb, Sentiment140 and SST-2. 91.00% respectively yielding 92.35% accuracy for the model thus leaving behind not just traditional Machine learning variances but individual deep learning models (CNN and LSTM only) too.. This demonstrates an empirical ability of the hybrid framework at capturing spatial and sequential features, which are really important components in practical sentiment analysis tasks.

Paper id 1139

Paper title Adaptive Cloud-Edge Task Offloading Using Reinforcement Learning in IoT Systems for Real-Time Optimization

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Abstract Task offloading in Industrial and Internet of Medical Things (IIoMT) scenarios is challenged critically with regard to real-time deadline constraints, energy efficiency, and Quality of Service (QoS) guarantee. Classic heuristic and static offloading methods tend to fail when subjected to dynamic workloads, and traditional Deep Q-Network (DQN)-based approaches are prone to suffering from overestimation bias and limited dynamism. To overcome these problems, this paper puts forward a lightweight adaptive cloud–edge task offloading framework based on a revised Reinforcement Learning (RL) model. It combines Dueling Double DQN with Prioritized Experience Replay (PER) and introduces a multi-objective reward function that balances latency, energy efficiency, and Service Level Agreement (SLA) adherence simultaneously. It verifies the proposed model using a real-world IoMT task offloading dataset, and results show prominent improvements of both learning performance and system efficiency. Experimental results reveal that the proposed scheme can achieve up to 30% reduced energy consumption and 25% improved SLA adherence when compared with baseline strategies of local-only, edge-only and plain DQN methods. The lightweight

neural architecture makes the framework suitable for deployment in resource-constrained IoT environments.

Paper id 1140

Paper title Modbus-Based Digital Energy Meter with Dual-Core Cloud Telemetry

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Abstract This work details the development of a low-cost, Wi-Fi-enabled energy monitoring node designed to bridge the gap between monthly billing and real-time consumption auditing. The system interfaces a PZEM-004T-V4 digital sensor with an ESP32 microcontroller, leveraging the sensor's industrial Modbus-RTU protocol to retrieve six pre-calibrated AC parameters (Voltage, Current, Power, Energy, Frequency, and Power Factor). A key architectural feature is the utilization of the ESP32's dual-core processor to separate tasks: Core 1 handles continuous sensor polling while Core 0 manages network telemetry, thereby eliminating data loss caused by Wi-Fi blocking. Telemetry is transmitted to the ThingSpeak cloud platform for historical analysis, with experimental results validating the prototype's precision across resistive and inductive loads.

Paper id 1142

Paper title Cluster-Oriented Sampling Methods for Imbalanced Data Learning: An Analytical Review of Algorithms, Challenges, and Innovations

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Abstract There is always a pervasive challenge of Class imbalance in machine learning because traditional classifiers are biased towards overrepresented class which leads to poor underrepresented class recognition. There are various Imbalance mitigation approaches but due to the specific ability to preserve structural information during sampling, cluster-based methods have emerged as a promising strategy. This review paper presents a survey of imbalance mitigation approaches specifically cluster-based under-sampling, oversampling, hybrid sampling. The study also examines recent methods, including noise-aware, overlap-aware, cluster-based synthetic sample generation, density-aware sampling, and structure-preserving hybrid frameworks. Furthermore, the present review analyses major advantages, limitations, research gaps, and potential future directions related to cluster-based methods. The review highlights the gradual evolution of cluster-based imbalance learning from conventional sampling techniques toward adaptive frameworks designed to preserve underlying data structures while improving minority class representation.

Paper id 1143

Paper title Performance Analysis of Classification Models for Breast Cancer Prediction on the Wisconsin Diagnostic Dataset

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Abstract Breast cancer remains one of the most frequently diagnosed and most deadly diseases for women around the world. Identifying breast cancer as early as possible and accurately identifying it provide better chances for successful treatment and longer lives for many women. In recent years, machine learning (ML) has become the preferred technique for research into many areas of medicine to help improve diagnosing diseases and predicting future disease risk. The K-Nearest Neighbors (KNN),

Decision Tree, and Multiple Regression algorithms are examples of the various approaches available for developing ML models for diagnosing breast cancer, but the accuracy with which these models can be used varies from algorithm to algorithm and oftentimes between studies. In this research, the authors proposed that combining the various algorithms will provide an XGBoost-an Extreme Gradient Boosting algorithm, which will produce a more reliable way to diagnose breast cancer. This study adds to previous work that identified a possible way to increase the power of predicting breast cancer through combining different methods. By evaluating the Wisconsin Diagnostic Breast Cancer dataset, the authors found that the XGBoost-based ensemble model was able to predict breast cancer with a greater level of precision than a model that only used a single algorithm and, therefore, could be more useful in the clinical setting.

Paper id 1145

Paper title A Parameter-Efficient Domain Adaptation Framework for Speech Recognition Using Synthetic Data

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Abstract We propose a framework for synthetic data generation guided by keyword to adapt the Whisper automatic speech recognition (ASR) model, which incurs no real audio or manual annotation at all stages. In contrast to previous work using generic metadata-driven prompting, our lexically targeted synthetic corpora is produced via a new pipeline that selects seed words domain-specifically and injects these keywords directly into LLM system prompts, yielding better empirical closeness of vocabulary distribution to each target domain than existing methods. The outputs of the generated texts are transformed to speech by Tacotron2-DDC and low parameter fine-tuned using Low-Rank Adaptation (LoRA) for three domains defined in Music, Weather, Sports through Whisper-base decoder. They use the open-source Llama3-8B to generate text, an open-source TTS in common voice dataset for real-world evaluation and provide a fully end-to-end reproducible implementation with publicly available tools and datasets, to our knowledge this is the first synthetic-only ASR domain adaptation pipeline that is completely implemented via open-soure tools. Our evaluation on real-domain-specific test sets showed relative WER reductions of 29.3% (18.30% → 12.94%) and 19.9% (14.63%→11.72%), both larger than the 10–17% reported by the recent Domain Adaptation with Synthetic data (DAS) framework [1]. In the Sports domain, the improvement is only 4.4%(16.61%→15.88%) due to both high proper-noun density and vocabulary related mainly temporally so difficult to model in a synthetic corpus. One of the main empirical observations is that vocabulary structural regularity dominates over corpus size in controlling adaptation performance – the smallest corpus (Weather, 31K samples) obtains the largest WER improvement, and the largest (Sports, 46K samples) language model gives a worse result. These outcomes provide empirical recommendations for synthetic-only domain adaptation and motivate LoJA (Low-Rank Jacobian Adapter), the proposed extension to close gaps between synthetic-to-real in a proper-noun-heavy domain.

Paper id 1149

Paper title Eden: A Multi-Modal AI Orchestration Engine for Automated Misinformation Analysis

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Abstract You can find information on social media very easily, and it can be shared rapidly, which makes it challenging for fact-checkers to locate and prevent fake news. Current moderation methods are often not capable of analyzing short videos with a combination of speech, text and images. They might also identify content that is misleading or incorrect without providing a clear indication of the basis for their identification. In this paper, we propose an Artificial Intelligence based system called Eden that is able to analyze social media content to identify and verify potentially false claims. It segments videos into shorter segments, captures key frames, identifies and reads text from the screen (Optical Character Recognition) and transcribes speech into text. This information is then synthesized as a

group with the help of AI to find claims and link them to the corresponding sections of the video or audio. Background tasks are also used for media processing in Eden to achieve efficient and reliable performance. The system aims to handle various formats of social media content and maintain the analysis orderly and traceable. This could make it more straightforward to verify content, offer proof of what is being explored and help curb misinformation on social media.

Paper id 1150

Paper title Cloud Computing and IoT Framework for Electric Vehicle Wireless Charging Infrastructure

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Abstract The fast expansion of electric vehicles (EVs) demands effective, scalable, and intelligent charging systems. This paper presents a wireless EV charging framework that utilizes IoT and cloud technology for real-time monitoring, adaptive control, and energy efficiency. The system incorporates IoT sensors to gather data on battery state-of-charge, voltage, current, temperature, alignment, and ambient factors, while the cloud platform analyses this information for predictive scheduling, load balancing, and remote management. Conceptual findings demonstrate that optimal vehicle alignment attains 95% charging efficiency, whilst minor misalignment diminishes efficiency to 90%. Charging durations vary based on battery size, with a 30-kWh battery requiring roughly 2 hours and a 70-kWh battery necessitating around 5 hours. Sensor data indicates consistent voltage, current, and temperature patterns throughout operation, guaranteeing safety and enhanced energy transmission. The framework facilitates concurrent administration of many stations, minimizes energy losses, and allows for integration with renewable energy sources. The findings underscore the proposed system's capacity to provide secure, efficient, and user-friendly wireless EV charging, therefore enhancing sustainable urban mobility and facilitating the adoption of electric transportation.

Paper id 1151

Paper title Multi-Node PIoT Sensor Analytics for Smart Grid Fault Prediction Using XGBoost

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Abstract The increased complexity of modern smart grids makes the failure prediction systems complex so that they are reliable and minimize downtime. The provided paper presents a multi-node Power Internet of Things (PIoT) sensor analytics architecture based on the XGBoost to predict issues with the smart grid systems. This framework analyzes the simulated sensor readings, which consisted of 8, 543 samples on the various nodes in the form of voltage, current, frequency, power, temperature, and load. A Fault Label is assigned to each measurement, which could be normal operation or fault, which, in this case, could be voltage anomalies, frequency disturbance, and overloads. The system preprocesses data, obtains the information about time and place and trains the XGBoost model to provide the state of operations. The evaluation of the experiment demonstrates that the model can achieve an overall percentage accuracy of 99.95, that is, good at distinguishing between normal and fault states in multi-node data. Class-specific measurements have high accuracy, recall, and F1-scores of above 98 and confirm resilience in class imbalance. The offered system helps to monitor everything in real-time, predictive maintenance, and the stability of the grid. These findings highlight

the effectiveness of the combination of distributed PIoT sensing/ machine learning as a scalable and accurate method of identifying problems and predictive maintenance in highly developed power network.

Paper id 1152

Paper title Multilayer Perceptron Model for Electrochemical Pollutant Detection Using Carbon Nanomaterials

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Abstract Electrochemical sensing of carbon nanoparticles provides quick and sensitive identification of environmental contaminants. This research introduces a Multilayer Perceptron (MLP) model for the analysis of electrochemical signals derived from electrodes composed of graphene and carbon nanotubes. A dataset of 7,654 records, encompassing electrode composition, ambient variables, and signal responses, was used for model construction. The dataset had 1,000 samples per pollutant category and was partitioned into training, validation, and testing sets in a 70:15:15 ratio. The MLP attained a training accuracy of 98.50% and a validation accuracy of 98.33%, with precision, recall, and F1-score values of 98.66%, 98.00%, and 98.32%, respectively. The study of the confusion matrix revealed negligible misclassifications, including of 3 false positives and 2 false negatives. The model proficiently identified nonlinear correlations between sensor parameters and pollution detection results, exhibiting resilience to interference and noise. These findings underscore the capability of integrating carbon nanomaterial-based electrochemical sensing with machine learning to provide precise, real-time pollution monitoring, providing a scalable approach for environmental protection and sophisticated pollutant management systems.

Paper id 1153

Paper title Energy Aware GRU Framework for Robust IoT Network Intrusion Detection Systems

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Abstract The fast proliferation of Internet of Things (IoT) networks has heightened vulnerability to advanced assaults, but the constrained resources of IoT devices need energy-efficient security measures. A presented in this paper is an energy efficient intrusion detection architecture using Gated Recurrent Units (GRU) to perform effective and sustainable threat detection. The model is examined on a large scale of 4,000 samples and above 70 features (parameters of network traffic and energy consumption) in an IoT Network Security and Energy Dataset. The suggested scheme integrates energy optimization and time learning capabilities of GRU with the aim of enhancing the performance and reducing computing needs. His/her experimental results show that the model achieves an accuracy of 99.75, a precision of 99.83, a recall of 99.67 and an F1-score of 99.74. Using a confusion matrix, there are only 3 misclassifications out of 1200 test samples, which shows that there is high reliability. The model converged well after 10 epochs with the minimum loss and no overfitting. The results highlight the effectiveness of the proposed system in providing a scalable, energy efficient, and high-performance solution to protect IoT networks against different cyber threats.

Paper id 1154

Paper title Predicting UAV Conflict Risk in Multi-Traffic Environments Using Logistic Regression Model

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Abstract The increase in the number of Unmanned Aerial Vehicles (UAVs) in shared airspace has intensified the possibility of mid-air collisions particularly in cases of multi-traffic. This study is a logistic regression (LR) model predicting the risk of the UAV conflict based on the UAV Conflict Detection Dataset. The collection includes 4,000 samples identified based on geographical location parameters, velocity, proximity and signal-based parameters. To eliminate imbalance in the classes (3880 safe and 120 conflict incidences), SMOTE is applied to ensure that there are balanced data sets, and therefore learning by the model will be strengthened. The proposed model is evaluated on an 80:20 train-test split, where it achieves outstanding performance measures, including an accuracy of 99.16, precision of 99.23, recall of 99.10, F1-score of 99.16, and specificity of 99.22. The confusion matrix shows that there is not much misclassification and few false positives and false negative. The AUC value generated by the ROC curve is about 0.99 which indicates outstanding skill in classification. The results point to the fact that the proposed system provides a reliable and computationally efficient approach to the real-time identification of the UAV conflicts, thereby enhancing the safety and decision-making in the conditions of complex and dynamic airspace.

Paper id 1155

Paper title Edge Computing-Based Low-Latency Control for High-Gain DC–DC Converter Stability Improvement

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Abstract High-gain DC-to-DC converters are widely used in renewable energy systems, Electric cars, and distributed power systems due to their ability to achieve very large voltage conversion ratios. However, their performance is usually limited by instability, nonlinear dynamics, and delays in their controllability. This paper provides a new low-latency edge computing control method to enhance stability and dynamic behavior of high-gain DC-DC converters. The proposed solution eliminates control-loop latency by enabling real-time processing near converter equipment, thereby improving control. The simulation results show that the output voltage should be maintained at 100 V, with a steady-state variation of ±0.5 V. The rising time is 0.018 seconds, and the settling period is reduced to about 0.08 seconds. Overshoot is limited to 1-2%, but undershoot in response to load changes is controlled to 7-8% with a recovery time of less than 0.04 seconds. The current in the inductor settles at approximately 8 A with a ripple to a minimum of 1.5 App. The results confirm that the proposed approach can greatly enhance stability, reduce oscillations, and improve system performance, making it suitable for accelerating high-speed, high-efficiency power electronic systems.

Paper id 1156

Paper title A Comprehensive Review of Hybrid Intelligence, Retrieval-Augmented Generation, and Explainable AI Approaches for Healthcare Informatics and Clinical Decision Support Systems

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Abstract Artificial Intelligence (AI) has made great progress in the health care sector, especially in the Clinical Decision Support Systems (CDSS). Recent researches focus on Large Language Models (LLMs) for improving the AI-based health care systems. However, it is found that the standalone AI system lacks to generate efficient clinical decisions due to reasons such as hallucinations, outdated knowledge, limited domain knowledge, and lack of interpretability. Hence, there is an increased interest in recent studies to integrate components such as RAG, Multi-Agent AI(MAAI), and Explainable AI into CDSS for enhancing the factual grounding and decision-making support. Integration of these components into CDSS would enable specialized collaborative agents that mimic the clinical workflows of various healthcare disciplines. These agents are designed to work in unison to generate the best possible health care decisions. Moreover, the emergence of XAI has made it possible to generate interpretable reasoning, evidence attribution, and clinician-centered explanations. The review presents an overview of architectures, underlying technologies, and clinical applications of these emerging health care systems and highlights their strengths and weaknesses. A novel framework is proposed by integrating agentic knowledge retrieval, collaborative reasoning, explainability, and adaptive learning for the development of health care systems that are transparent, evidence-based, and continuously improving for effective patient care and improved clinical decision-making.

Paper id 1159

Paper title A Stacking Ensemble Framework for the Robust Sentiment Analysis of Assamese-English Code-Mixed Social Data

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Abstract The proliferation of digital communication in multilingual regions has resulted in the emergence of code-mixed data, which has posed significant challenges for natural language processing tasks, especially for the low-resource languages. The sentiment analysis of Assamese-English code-mixed text is quite complicated, owing to the linguistic heterogeneity, structural inconsistencies, and inadequacy of standardized lexicons. Therefore, in order to tackle these issues, a robust hybrid stacking machine learning framework is proposed for the automated sentiment classification of Assamese-English text. The framework utilizes the feature extraction power of TF-IDF vectorization and incorporates CatBoost and Multinomial Naive Bayes as base estimators, to model complex non-linear interactions as well as probabilistic linear dependencies. The (optimal) aggregation of base predictions is then carried out using a Logistic Regression meta-classifier. The proposed architecture is evaluated on a highly imbalanced dataset consisting of three classes, and the results demonstrate its effectiveness, with a classification accuracy of 96.16% and a macro F1-score of 0.92. Moreover, the proposed architecture achieved a high Cohen's Kappa (0.9272) and a Matthews Correlation Coefficient (MCC) of 0.9271, highlighting the predictive reliability and robustness for both minority and majority sentiment classes. The results corroborate the fact that the stacking ensemble performs relatively better than the other standalone models for low-resource code-mixed Assamese corpora.

Paper id 1161

Paper title Evaluating Seed Word Embeddings for Deep Learning Bugs Categorization

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Abstract Deep learning applications use has increased in today's world. This has become possible due to availability of deep learning (DL) frameworks which help to bridge gap between DL theory and implementation. This paper presents a study which help to understand the type of DL frameworks bugs and techniques used to identify these bugs based on bug reports. The study concentrates on DL

Model Building (DMB) bugs and finds 7 commonly occurring bugs like neural network construction bugs, mathematical operation bugs, computation graph faults etc. The bug reports processing needed to categorize the bug type requires seed words and their text embedding, along with reports before categorization. In this study, 6 text embedding techniques has been applied to seed words list to identify which embedding technique should be preferred. The embeddings generated are compared based on average inter class similarity and average closest cross class similarity. Further, similarity gap is calculated by subtracting average cross-class similarity from the inter-class similarity. Embedding model sentence-transformers/allMiniLM-L6-v2 achieved the highest average positive separation gap (0.03602) across all categories, making it the most suitable candidate for embedding textual data in seed-guided DMB bug classification. It was closely followed by sentence-transformers/all-mpnet-base-v2 with average positive separation gap (0.02755). Also a dataset comprising of 2068 rows, which contained issue_title column as text information and 7 subcategories is used to show effectiveness of text embedding techniques. Embedding technique allMiniLM-L6-v2 showed accuracy of 87.20% and macro F-1 score of 83.22%, followed by all-mpnet-base-v2 with accuracy of 86.23% and macro F-1 score of 81.01%.

Paper id 1162

Paper title The Future Sensor Integration Applications for External Interface Devices and Artificial Intelligence

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Abstract The applications of electronics tactile sensor a key technology for developing flexible electronics and artificial intelligence is tactile sensing. Although there is a lot of potential for magnetically based tactile sensors, previous studies have mostly concentrated on magnetic films, ignoring the optimization of the nonmagnetic elastic layer. This paper presents a supplementary design approach that optimizes the nonmagnetic elastic layer geometrically to improve performance. A sandwich-shaped flexible magnetic tactile sensor (FMTS) is introduced, and a methodical quantitative study is carried out to demonstrate how elastic-layer geometry influences sensitivity and measurement range. By comparing planar, hemispherical, and directionally anisotropic pyramidal microstructures and combining mechanical analysis and magnetic field modeling, a clear geometry-performance relationship is formed.

Paper id 1165

Paper title Sequential Pattern Learning in Animal-Centric Motion Analysis and Surveillance: A Review

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Abstract Due to increasing human-wildlife conflicts, wildlife presence in farms and livestock management challenges, there is a lot to be learned in the field of automated detection and monitoring systems. This systematic review summarizes and discusses 31 research papers published between 2023 and 2026 that highlight the use of deep learning models, including convolutional neural networks (CNNs), long short-term memory (LSTM) networks, bidirectional gated recurrent units (BiGRU) and object detection architectures based on YOLO. The application areas addressed encompassed wild-animal entrance detection, precision livestock management on farms, detection-and-warning systems employing UAVs and UAVintegrated IoT. An organized comparison table offers the methodology employed, data, evaluation criteria and conclusions of each study. A series of key empirical advances for each of these are reviewed and investigated, such as CNN-LSTM architectures, transfer learning, real-time implementation at the edge and multi-modal sensor fusion. Highly point out a number of

areas that require further research, including restricted night performance, scarcity of data, species-level generalisation, and transferability between domains. Lastly, the report suggests future opportunities like Explainable AI, Federated Learning, Integration of multi-modal sensors, and Evolutionary/bioinspired optimization techniques like Genetic Algorithms, Particle Swarm Optimization, Ant Colony Optimization (ACO) for architecture and IoT-network tuning, which serve as robust platforms for the academician to build intelligent animal monitoring and conflict prevention systems.

Paper id 1167

Paper title Blockchain-Based IoT Network for Sustainable Farm-to-Fork Food Traceability and Certification

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Abstract Transparency, sustainability and safety in food supply chains have become highly important given the increased consumer consciousness and the requirements of governments. Traditional systems are usually centralized, prone to errors and prone to fraud and as such, limit reliable traceability. This paper involves a Blockchain-based Internet of Things (IoT) network of food traceability between farm and fork and sustainability certification. IoT sensors measure the environmental and operational characteristics, including soil moisture, temperature, humidity, pH levels, and health of animals, on the fields, storage sites, and transport. Information is pre-processed at the edge gateways and is transparently recorded in a certified blockchain based on smart contracts, which allows automatic acquisition of sustainability. Test results indicate the presence of outstanding data integrity (98.7–99.8%) low traceability latency (1.7–2.1 s), fast blockchain recording (0.8–1.0 s), and the system efficiency is overall (more than 96 percent). Traceability and certification metrics ensure that every batch of products is in accordance with the standards, whereas real-time notifications help to prevent spoilage and handling errors. The solution allows customers to independently authenticate the provenance of goods and sustainability based on QR code or RFID tags. Those results highlight the effectiveness of integrating IoT with blockchain to ensure the safety, scalability, and transparency of the food supply chain, thus ensuring sustainable agriculture and enhancing the confidence of the stakeholders.

Paper id 1168

Paper title Cloud-Integrated IoT Electrical Substation Monitoring for Improved Smart Grid Reliability

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Abstract Contemporary electrical substations need clever surveillance to guarantee smart grid dependability. This study introduces a cloud-integrated Internet of Things (IoT) monitoring system for substations, allowing continuous realtime surveillance of electrical, environmental, and equipment metrics. IoT sensors installed on transformers, circuit breakers, and switchgear gather data on voltage, current, temperature, humidity, vibration, oil quality, and insulation integrity. Data are transported securely to a cloud platform, where real-time processing produces alarms, and historical analysis facilitates proactive maintenance. Implementation findings indicate that aberrant circumstances are identified within 5 seconds, as contrast to 15–30 minutes in traditional methods. The transformer's temperature increased from 75°C to 79°C during peak load hours, with current fluctuating between 118 and 122 A, and partial discharge occurrences of 5 to 7 pC were detected early. Voltage imbalances across phases reached 0.3 kV, while vibration levels corresponded with current fluctuations between 0.03

and 0.05 m/s². Alerts for overload, temperature, and partial discharge were sent with complete accuracy, while remote dashboards offered instantaneous operational visibility. The quantitative findings indicate that the suggested system significantly enhances fault detection speed, operational efficiency, and predictive maintenance, providing a scalable, secure, and economical solution for smart substation monitoring.

Paper id 1169

Paper title Modeling and Optimization of Resonant Wireless Charging for Electric Vehicles with IoT Integration

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Abstract The increased use of electric vehicles (EVs) requires efficient and convenient charging solutions extending their scope to more traditional plug-in methods. This article presents the modelling and optimisation of a resonant wireless power transfer (WPT)-system that links to the Internet of Things (IoT) to serve EV applications. The proposed system relies on the magnetic resonant coupling to enable effective transfer of various forms of energy without contact, thus saving on losses and improving the ease of use. Quantitative analysis of the system shows that the system can have a peak power transmission efficiency of 93% with optimal alignment and maintain an efficiency of about 81% with a misalignment of 6 cm. With a coil separation distance of 20 cm, efficiency is always above 80% which implies that the efficiency of this coil is strong in real operating conditions. It has a controlled output of 48 V and 18 A which is suitable for charging EV batteries and a system temperature of 42 C. Integration of IoT enables real time monitoring and adaptive control with problem detection, making them reliable and optimised to improve performance. The results confirm that the proposed system can be an efficient, reliable, and smart wireless charging system to support modern EV infrastructure.

Paper id 1170

Paper title Random Forest-Based Detection of Abnormal Residential Electricity Usage in Smart Homes

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Abstract The rapid advancement of smart home technology has enabled comprehensive monitoring of household power use, allowing detection of irregular consumption patterns that may indicate energy inefficiency, equipment malfunctions, or unauthorized use. This work presents a Random Forest (RF)-based approach for detecting abnormal power use in smart homes, using a synthetic, privacy-preserving domestic electricity dataset modeled after real-world consumption patterns. The dataset includes home characteristics, applianceuse statistics, ambient variables, and consumption-deviation measurements to accurately simulate domestic energy trends. The proposed system follows a systematic workflow comprising data collection, preprocessing, feature organization, and ensemble-

based categorization. The RF model adeptly identifies nonlinear correlations among variables and offers strong differentiation between normal and abnormal power use. Experimental assessment reveals exceptional classification efficacy, attaining an accuracy of 99.56%, precision of 99.62%, recall of 99.50%, F1-score of 99.56%, and specificity of 99.62%. The confusion matrix shows little misclassification in both use groups, while the ROC analysis yields an AUC of 0.999, indicating exceptional class separability. The proposed system facilitates dependable and scalable energy monitoring for smart homes, ensuring data privacy, and establishes a robust framework for intelligent energy management and forthcoming smart grid applications.

Paper id 1171

Paper title Wearable IoT Sensors for Real-Time Detection of Night-Time Breathing Irregularities through Edge Analytics

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Abstract Sleep disorders, including Sleep Apnea and Hypopnea, often go untreated because of the constraints of traditional clinical monitoring techniques. Wearable Internet of Things (IoT) sensors, combined with edge analytics, provide an effective solution for real-time identification of nocturnal breathing anomalies. This work introduces a non-invasive technology that continuously monitors physiological indicators, including breathing rate, SpO_2, heart rate, and body movement during sleep, to detect irregularities associated with Sleep Apnea and Hypopnea. The system utilizes IoT devices with Edge Computing to provide real-time, on-device data processing, hence minimizing latency and enhancing data privacy. The experimental findings indicate that the proposed system achieves an average detection accuracy of 95.8%, ranging from 92% to 99% across various test intervals. The mean reaction time is around 133 ms, facilitating swift detection and alarm issuance. The system reliably detects oxygen desaturation events, with SpO_2 values as low as 88% in extreme situations. The findings confirm that the system provides reliable, lowlatency, and continuous monitoring, making it a cost-effective and scalable alternative for the early identification and treatment of sleep-related respiratory issues in real-world home settings.

Paper id 1173

Paper title A Hybrid CNN and Bi-LSTM Deep Learning Framework for Accurate Water Quality Index Prediction

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Abstract The correct evaluation of water quality is key to the protection of the human population and the management of water resources in accordance with the principles of sustainability but the traditional methods of evaluating water quality, which are based on certain limits and the use of laboratory analysis, are not applicable to real-time and largescale measurements. This issue is important since the quality of water is affected by complicated and intertwined parameters whose joint impact cannot be always reflected in the classical mathematical models. In the given work, a deep learning model is designed in a hybrid model, which is CNN and Bi-LSTMAttention model to predict the Water Quality Index (WQI) by referring several important physicochemical parameters, such as pH, turbidity, temperature, nitrate, ammonia, dissolved oxygen, and manganese. The convolutional neural network looks for local association between the parameters of water quality, whereas, the bidirectional LSTM looks for the temporary changes in both forward (or backword), and attention mechanism (identify the most significant and effective features to be used in prediction). The outcomes of the experiment show that the proposed CNN and Bi-LSTM model are described in terms

of the quality of the predictive results, which is greater than for CNN and Bi-LSTM models. The model showed an average error or the result of Mean Absolute Error (MAE) as 2.41, Root Mean Square error (RMSE) as 3.12 and the results of Coefficient of determination ($R^2 = 0.96$), this index shows that the model predicted and actual value of Water Quality Index has good agreement with each other.

Paper id 1174

Paper title A Deep Learning Framework for RGB-Thermal Image Denoising and Enhancement in Autonomous Unmanned Vehicle Navigation System

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Abstract RGB and Thermal images acquired with the help of sensors are often affected by noise which is caused by multiple factors such as sensor manufacturing defects, low lighting and varying environmental conditions. This noise affects the visual clarity and structure of the image, making it hard for vision-based tasks to function properly. This is a critical issue in systems especially unmanned vehicles which rely on the visual cues to take actions, noise in such systems may lead to errors in higher operational levels leading unmanned vehicles to be less trusted. In order to resolve this issue, in this paper, we propose a modality-specific RGB-Thermal image denoising framework for UAV perception. The independently optimized denoising networks are tailored to the unique characteristics of RGB and thermal imagery. The framework consists of modality-specific synthetic noise modeling, KUST4K-domain fine-tuning and a common evaluation protocol to investigate the denoising performance in heterogeneous degradation settings. The Real Image Denoising Network (RIDNet) is trained in order to denoise the thermal image as it is more robust to complex noise in real world, whereas the Nonlinear Activation Free Network (NAFNet) is used for RGB image denoising as it has high restoration capacity and is usually very fast. Both models are fine-tuned on the KUST4K RGB-TIR UAV dataset under a parameterized mixed noise model. The experimental evaluation on the dataset shows the proposed system reaches 39.12 dB PSNR (SSIM:0.93) for RGB images and 34.5 dB PSNR (SSIM:0.86) for thermal images. The results indicate that modality-specific denoising can improve image reconstruction quality under the evaluated synthetic degradation conditions, providing a basis for further validation on real sensor noise and unseen UAV data.

Paper id 1177

Paper title A Bi-LSTM–Based Conversational Framework for Early Academic Risk Prediction and Student Mentoring

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Abstract An increase in the administrative functions at engineering schools has resulted in limited time for effective student counseling and academic guidance. It is important to note that professors are tasked with managing the attendance, academics performance, leave approval, accreditation documents, and campus reports among many other tasks while catering to numerous students at one time. Inefficient administrative procedures and late identification of academic problems often make mentoring less effective. This paper discusses a Conversational Campus Assistant that combines conversation, workflow management, longitudinal prediction of academic risks, and intelligent decision making

into an academic governance platform. Activities like attendance management, reporting, leave management, and retrieving information on academics are conducted via conversational command in order to eliminate dependence on traditional portal-based services. Longitudinal information of the academics is predicted using Bi-LSTM model to detect students who show signs of regression in terms of attendance, academic performance, and semesters. On-Duty and Leave validation systems operate under hierarchical approval procedures that involve authorization and validation in a series, while automated telephonic notifications ensure prompt communication to the relevant parties in case any academic risk behavior is observed. An academic risk scoring system through the use of gamification techniques allows for dynamic assessment of the level of academic stability of students and the deployment of proper interventions based on predicted risks. Through experimental evaluation, the proposed approach proves to have better prediction accuracy, high-risk detection capabilities, less workload on administration, and timely interventions than other deep learning approaches.

Paper id 1180

Paper title AI Based Healthcare Document Intelligence System for Medical Information Extraction and Semantic Search

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Abstract There are a lot of different documents produced by healthcare facilities, such as medical reports, lab test results, prescriptions, discharge summaries, and patient records. Accessing the necessary data is complicated due to the fact that documents can be scanned or have a complicated structure, and the traditional keyword searching approach is unable to comprehend the meaning of user queries. The proposed system AI Based Healthcare Document Intelligence System will combine Optical Character Recognition (OCR), Document Understanding, Information Extraction, and Semantic Search approaches. PaddleOCR will allow extracting text from scanned documents, and LayoutLMv3 will be used for capturing relations between text and document layout. Sentence-BERT will produce semantic representations for documents and user queries, and FAISS will provide the possibility of similarity based search. PII masking will help with protecting personal information.

Paper id 1181

Paper title A Novel Weighted Marine Health Index for Real-Time Coral Reef Biodiversity Monitoring with Cumulative Multi-Species Tracking

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Abstract Standard reef-fish monitoring relies on trained divers who can visit each site at most once or twice a year. That cadence is too slow to detect population shifts that develop over days, not seasons. We present a fully automated pipeline that closes this gap by producing reef health scores continuously from a single consumer GPU, with no cloud connection. A 5,201- image training corpus assembled from four ocean regions was used to train a YOLOv8s detector that achieves 95.1 % mAP@0.5 at 59.4 fps on an NVIDIA RTX 3050 (6 GB VRAM). Fish identities are tracked across frames using BoT-SORT for video and ByteTrack for image-batch inputs; a session-level counter records each confirmed individual exactly once, mirroring the AGRRA belt-transect tally convention. From those counts we derive Shannon H′ , Simpson D, Pielou J ′ , and ecologically weighted H′ w, which are fused with trophic-balance and apexpredator sub-scores into a five-component Weighted Marine Health Index (MHI) scaled from 0 to 100. Evaluated on a 364- image test set, the pipeline tracked 490 unique fish and returned MHI = 70.59/100 (Good–Healthy), with H′ = 0.942 and J ′ = 0.857. To the best of our knowledge, no single system in the reviewed literature combines species-weighted ecological scoring, trophicpyramid analysis, survey-protocol-aligned cumulative counting, and a live dashboard on hardware priced under USD 400.

Paper id 1183

Paper title Scalable Electric Vehicle Battery Traceability System Integrating Blockchain and IoT

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Abstract The fast proliferation of electric vehicles (EVs) has engendered an urgent need for transparent and secure lifetime battery management. This study presents a scalable EV battery traceability solution that integrates Blockchain and Internet of Things (IoT) technologies. IoT sensors included into battery packs continuously monitor voltage, temperature, state of charge (SoC), and state of health (SoH). Edge processing minimizes data overhead, while cryptographic hashes of sensor data are recorded on a permissioned blockchain to guarantee immutability. Hypothetical performance research suggests that the system can accommodate more than 50,000 batteries, with an average blockchain transaction delay of 1.5 seconds and an IoT data throughput of 500 records per second. Battery State of Health monitoring indicates a progressive reduction from 100% to 88% over 200 cycles, facilitating predictive maintenance and second-life evaluations. Smart contracts provide the automation of ownership transfer, warranty validity, and recycling certification. The proposed architecture guarantees comprehensive supply chain transparency, facilitates circular economy activities, and upholds data integrity. The findings illustrate the viability of a scalable, secure, and efficient traceability system for extensive EV battery networks.

Paper id 1184

Paper title Digital Twin with Cloud Analytics for Personalized Treatment of Chronic Neurological Disorder Patients

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Abstract Chronic neurological illnesses, such as Parkinson's disease, Alzheimer's disease, and epilepsy, pose considerable problems owing to individual patient diversity and intricate disease development. This research offers a Digital Twin (DT) coupled with cloud analytics for individualized therapy and ongoing monitoring. The technology gathers real-time physiological and behavioral data via wearable sensors and creates dynamic virtual patient models to mimic illness progression and treatment results. Experimental findings indicate a detection accuracy of 96–98%, a prediction accuracy of 95–97%, and a treatment success rate of up to 97%. The technology attains decreased reaction times between 100 and 150 ms, facilitating prompt intervention and enhanced patient safety. An average improvement rate of 85–92% is seen among tracked patients, indicating good tailoring of treatment techniques. The cloud platform guarantees scalable processing, safe data management, and real-time accessibility for healthcare professionals. The use of continuous input significantly improves system flexibility and precision. The suggested framework markedly enhances monitoring efficiency, decision-making, and clinical results, indicating its viability as a dependable and scalable option for the individualized treatment of chronic neurological illnesses.

Paper id 1186

Paper title IoT-Based Fish Pond Water Contamination Analysis Using Random Forest Model

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Abstract Water monitoring is important to successfully raise fish, as the effects of pollution are evident in fish fitness and fecundity. This study introduces a random forest algorithmbased IoT-based framework to analyze water pollution in fishponds. Sensors are attached to an arduino Uno and are used to capture real-time information which is provided to cloud storage to work with. The collection contains 74 758 records with necessary measurements such as temperature, pH, dissolved oxygen, turbidity, nitrate, ammonia and manganese. The samples of each class were selected to correct the imbalance in the classes hence there was a balanced dataset with 20,000 records. The training, validation and testing sets contained 70:15:15 proportions of data each. The suggested model attained an accuracy of 99.43%, precision of 99.47%, recall of 99.40%, F1-score of 99.43%, and specificity of 99.46%. The ROC curve returned an AUC of 0.999, which is excellent classification efficacy. The results demonstrate the effectiveness of the system in providing accurate real-time identification of the existence of water pollution in managing aquaculture more effectively.

Paper id 1187

Paper title Cloud-Assisted Monitoring and Fault Diagnosis of Isolated DC–DC Converters in Distributed Power Systems

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Abstract Isolated DC DC converters are being increasingly used to power distributed power systems to achieve efficient and effective energy conversion, voltage management, and electrical isolation. Maintaining the reliable operation of these converters is crucial, as failure can negatively affect performance and lead to system failures. This study presents a real-time real-life cloud-based fault monitoring and diagnosis system of isolated DC2DC converters. The proposed apparatus continually gathers the necessary data such as voltage, current, and temperature, and sends it to a cloud service to be analyzed. The experimental evaluation shows the system has a fault detection rate of 98, and the average response time is 0.8 seconds. Transmission latency of data is ensured to approximately 120 ms and this enables near real time monitoring. The system is very reliable with 99.2% availability during the operation. Abnormalities like voltage decreases and overheating are quickly realized and corrective actions can be taken immediately. Cloud-based architecture provides the ability to monitor multiple converters in a scalable fashion and provides remote access to operators. The proposed architecture significantly increases the dependability of systems, alleviates maintenance, and offers an efficient means of diagnosing the issues in distributed power systems.

Paper id 1188

Paper title Remote Postpartum Maternal Health Monitoring Using Wearable and Cloud Technology

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Abstract This research introduces a remote maternal health monitoring system for postpartum care, using wearable sensors and cloud technologies to continually track vital signs. The device tracks heart rate, blood pressure, oxygen saturation (SpO2), body temperature, and physical activity, delivering real-time data to healthcare professionals. A simulated assessment of seven postpartum moms revealed a heart rate of 76–95 bpm, blood pressure of 118–147/78–95 mmHg, SpO2 levels of 95–99%, and body temperature of 36.5–37.5 °C. Erroneous readings activated alarms, effectively informing clinicians for four out of seven patients, illustrating the system's responsiveness. Ongoing monitoring revealed temporal patterns, indicating that elevated heart rates are associated with increased activity levels, underscoring the need of activityaware evaluation. The cloud-based interface facilitated remote viewing and prompt action, minimizing needless hospital visits while safeguarding maternal health. The decision-driven process significantly reduced false warnings, directing attention to patients with essential metrics. The system successfully accomplished precise real-time monitoring with a 100% success rate in warning generation for anomalous occurrences, offering a scalable, dependable, and efficient option for enhancing postpartum maternal health outcomes in urban and rural environments.

Paper id 1189

Paper title Random Forest Regression for Predicting Tensile Strength of Composite Materials

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Abstract The precise prediction of tensile strength in fiberreinforced composite materials is crucial for design optimization and the reduction of expensive experimental testing. This study introduces a Random Forest Regression (RFR) model to estimate tensile strength utilizing a physics-inspired synthetic dataset containing 10,000 samples with essential material and processing parameters, such as fiber type, resin type, density, layer count, curing temperature, fiber volume fraction, and void content. Categorical variables were suitably encoded before model construction. The proposed RFR model attained a coefficient of determination (R^2) of 0.97 in training and 0.95 in assessment, indicating robust predictive performance and generalization. The model exhibited a Mean Absolute Error (MAE) of 6.8 MPa and a Root Mean Squared Error (RMSE) of 9.4 MPa. A comparative evaluation of Linear Regression, Decision Tree, and Gradient Boosting models demonstrated the greater efficacy of RFR, shown by decreased error rates and enhanced variance explanation. Feature significance analysis indicated fiber volume percentage and void content as the primary factors. These results confirm the efficacy of RFR for precise prediction of composite tensile strength.

Paper id 1190

Paper title A Scalable Edge-Enabled IoT Architecture for Monitoring Floating Solar Power Plants

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Abstract Solar power plants that are floated are one such possible solution to sustained energy generation; however, their proper operation requires reliable and real time monitoring in the changing environmental conditions. In this paper, we present a scalable edge-based Internet of Things (IoT) framework that will enhance the monitoring, control and optimization of performance of floating solar systems. The proposed system has numerous sensors to measure all the necessary parameters such as irradiance, temperature, voltage, current, water level, and tilt. Local data filtration, analysis and anomaly detection are done by edge processing devices and would greatly reduce the latency as well as transmission overhead. The experimental results suggest that the accuracy of detection lies between 95.9 and 98.1 at the same time as the reaction latency of 100 ms and 145 ms in the same period as the number of sensor nodes increases. The consumption of energy is 18 J to 80 J with increased transmission of data which means resources were used adequately. Also, there is high packet delivery ratio that drops down to 85 percent when communication distance is long. There is minimal loss of data at 0.7 percent that ensures reliable performance. The results confirm that the proposed design could be scaled, more efficient in terms of communication and stability of the system, and it would be suitable to implement floating solar power plants on a large scale.

Paper id 1191

Paper title Robust Edge Controlled IoT Autonomous Agricultural Robot for Efficient Precision Farming Operations

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Abstract The modern technology of agriculture is rapidly introducing itself into the industry to make it more productive in utilizing resources. This paper presents a Powerful EdgeBased Farmer Internet of Things (IoT) Autonomous completion farm robots to be used in precision farming. Use of IoT sensors, embedded controller and connection to GSM are included in the system to offer measable monitoring and autonomous field operation. Critical information, such as temperature, humidity, soil moisture, and light intensity are also continuously measured and processed locally to allow timely decision making. The experimental results show that the system maintains a temperature level between 28-30 C and humidity level between 57-65, thus offering the best climatic conditions to crops. The soil moisture is kept at approximately 45 percent hence, leading to potential water consumption reduction of about 30 percent through controlled irrigation. The level of sunlight taken at approximately 320 lux indicates that there is enough sunshine. The automated control system also has the effect of reducing the human input by up to 40%, and the efficient operation of pumps and actuators. The proposed system also has reliable performance, efficient use of resources and quality crop management. It provides a cost effective and expandable system to sustainably practice precision agriculture, improving production and reducing environmental footprint.

Paper id 1193

Paper title Cloud-Integrated IoT Framework for Real-Time Control of SiC-Based EV Fast Charging Converters

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Abstract The current rapid growth of the electric vehicles (EVs) requires efficient and advanced fast charging solutions. This study presents a cloud-based Internet of Things (IoT) system that can be used to manage Silicon Carbide (SiC)-based EV rapid chargers in real-time. The proposed system uses distributed sensors and edge controllers to test the important parameters such as voltages, currents, temperature, and power by providing dynamic control and stability to the system. It was found that the converter is increasing its efficiency, up to 97.9% with an increase in the output power, which runs to 29.4 kW, at the same time the power losses decrease to 617 W. In the system, the reaction time is very quick and ranges between 1.5-2.1 ms and it ensures continuous performance in varied loading conditions. Monitoring based on clouds reduces the 120 ms null to 85 ms and a higher system up-time to 99.7. In addition, the speed of defect detection (less than 815 ms) enhances system reliability. The proposed architecture ensures the maximum use of energy, reduced operative losses and increases the level of scalability which makes it a good choice in next generation EV rapid charging infrastructure coupled with smart grid solutions.

Paper id 1194

Paper title Random Forest-Based Assessment of Parkinson’s Hand Tremor Using IMU Sensor Data

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Abstract Hand tremor is one of the signs of Parkinson's disease (PD) and has an impact on living skills and quality of life. Conventional clinical evaluations often lack objectivity, prompting the need for automated, objective assessment techniques. This paper presents Random Forest architecture using IMU sensor data from 15 PD patients, which includes three-axis accelerometer and gyroscope signals. Features across many domains’ temporal, spectral, and statistically were extracted to delineate tremor dynamics. The suggested model attained an overall accuracy of 99.41%, overall precision, recall and overall F1-score of 99.11%. The mean ROC AUC was 0.996, indicating exceptional discriminating across Mild, Moderate, and Severe tremor classifications. Analysis of feature significance indicated that gyroscope signals, namely xGyro and zGyro, were the primary contributors to classification performance. The findings indicate that the framework is an exceptionally accurate, resilient, and interpretable instrument for assessing Parkinson's tremor. It may be incorporated into wearable monitoring devices, allowing doctors to conduct continuous, objective assessments and monitor tremor development for tailored treatment planning.

Paper id 1195

Paper title Support Vector Machine-Based Clinical Blood Analysis for Early Dengue Detection

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Abstract Dengue is a rapidly spreading mosquito-borne disease, and delayed diagnosis can cause severe complications. Confirmatory tests such as RT-PCR and NS1 ELISA are often costly or unavailable in resource-limited settings, whereas routine complete blood count (CBC) parameters are inexpensive and widely accessible. This study proposes a Support Vector Machine (SVM) with a Radial Basis Function kernel to predict dengue from hematological parameters, including platelet count, white blood cell (WBC) count, red blood cell count, hemoglobin, and platelet distribution width. The Dengue Detection Dataset (989 records) was preprocessed through imputation, duplicate removal, and z-score standardization; class imbalance was addressed with Random Undersampling, followed by a 70:30 train-test split. On testing, the model achieved 98.54% accuracy, 99.02% precision, 98.06% recall, 98.53% F1-score, 99.02% specificity, and an AUC of 0.99. Platelet and WBC counts emerged as the most discriminative features. The main contribution is a low-cost, interpretable screening tool that uses routine CBC data to support early dengue diagnosis and timely clinical decision-making.

Paper id 1197

Paper title KrishiSetu : Smart Soil Analysis & Weather-Based Fertilizer Recommendation System

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Abstract The accurate soil assessment, timing the fertilizer application and decision making based on meteorological data are critical for sustainable agriculture. Traditional soil testing technology depends on laboratory-based soil tests, which is expensive, time consuming, and out of reach for small and marginal farmers. This study proposes “KrishiSetu”, an intelligent agriculture system with soil sensing and image-based analysis system along with cloud data storage, machine learning, weather data analysis and intelligent guidance support based on Android OS. The proposed system integrates the real-time data from soil sensors, soil image analysis and weather forecasting with the pH strip image estimation to come up with an intelligent agricultural suggestion. This device is used for classification and prediction of Soil Nitrogen (N), Phosphorous (P) and Potassium (K), without using an actual NPK sensor by Random Forest. The model trained using these parameters achieved approximately 94% accuracy for NPK prediction in an independent set of 10000+ annotated soil samples and reduced response time by 60% compared with traditional systems. The system further integrates real-time weather forecast based fertilizer recommendation, weather alerts and crop lifecycle-based guidance.

Paper id 1200

Paper title Deepfake Detection Using a Hybrid CNN–GRU Architecture with a Discriminative Distance Index

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Abstract The evolution of generative AI has made the development of deepfakes more challenging to detect. Current deepfake detection algorithms are either based on spatial artifacts alone or use complex temporal structures without giving any indication about the separability of the learned features for the task at hand. In this work, we present a lightweight CNN-GRU model where an EfficientNet-B0 encoder learns spatial features for each frame while a GRU captures temporal discrepancies, including flicker and unnatural face movements.We further define the Discriminative Distance Index (DDI) as the ratio of the difference between the distance between the centroids of the real and fake classes to the sum of their intra-class distances. DDI has two separate roles: (i) during training DDI is used as an auxiliary differentiable regularizer that promotes discriminative embeddings at the video-level, and (ii) during evaluation, DDI is used as a diagnostic of feature separability. It is not used for decision making so the inference cost remains the same. On FaceForensics++ (c23), our model achieves an accuracy of 92.1% and AUC of 94.5%, outperforming a CNN baseline by 3.7 and 3.3 percentage points, respectively, while increasing mean DDI from 1.42 to 1.89. We also propose a cross-dataset evaluation protocol on Celeb-DF and DFDC.

Paper id 1201

Paper title Explainable AI-Driven Clinical Decision Support for Personalized Drug Recommendation and Medication Discontinuation Planning

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Abstract The field of artificial intelligence has greatly affected drug selection and dosing, but current clinical decision support systems are concerned almost exclusively about drug initiation. There is no chance for reconsideration, tapering or even safe termination of the therapy after the selection of the drug and its dose in a given system; clinicians have to use deprescription guidelines based on fixed percentage dose reduction within fixed time intervals without taking into account the individual patient's history and risk factors. Improperly conducted tapering of some drugs classes, such as benzodiazepines, opioids, corticosteroids and antidepressants, can lead to the occurrence of withdrawal syndromes, rebound effects, and recurrence of the primary disease. In this paper, we present TAPER-AI – an RL-based solution for deprescription and tapering process which is meant to be a downstream module of the existing drug recommendation frameworks with digital twin capabilities. It takes advantage of the existing base framework's components, such as transformer patient embedding, retrieval-augmented evidence access, digital twin simulator and SHAP-based explanation engine, and implements four additional modules – the discontinuation assessment gate, neural withdrawal hazard model, relapse risk classifier and the constrained RL-based tapering policy which is built using constrained MDP. The generated tapering schedules are checked using the digital twin in a read-only mode, together with generation of the case-level explanations. The work is presented at the design and proposal stage: the architecture, mathematical formulation, datasets and evaluation procedure are outlined, and empirical validation is left for the implementation phase.

Paper id 1211

Paper title A Multimodal System for Emotion-Aware Music Recommendation and Generation

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Abstract Emotion-sensitive music recommendation systems use either users' listening history or their explicit preferences, which limits their sensitivity to the current emotional state of users. This research work proposes a framework for emotion driven music recommendation and generation that consists of facial emotion recognition, personalized music recommendation, and AI-based music generation as components of an intelligent system. Specifically, the proposed framework uses a novel CNN model with spatial attention mechanism for recognizing the emo tional state of users from their facial expressions; it also includes a hybrid recommendation engine that combines Random Forest and deep learning models to recommend songs personalized to detected emotions and user preferences. Moreover, the music generation component of this framework uses transformer-based model to generate short music clips conditioned on the input of textual descriptions and the emotional context. Additionally, there are some auxiliary functions such as raga analysis, raga identification, regional music search, music visualization, and dashboard interface. Evaluation results show that the Random Forest model achieves the highest reported performance among the conventional machine-learning methods evaluated in this study, obtaining 88% accuracy, 88% precision, 93% recall, and 90% F1-score.

Paper id 1218

Paper title FAANet: A Fault-Aware Attention Network for Multi-Class Photovoltaic Defect Classification in Electroluminescence Images

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Abstract Electroluminescence (EL) imaging is widely used to inspect photovoltaic (PV) panels for manufacturing defects. Manual inspection, though, doesn't scale — panels are inspected in the thousands, and subtle defects like micro-cracks or finger interruptions are easy to miss by eye. This paper addresses PV defect detection and recognition, using bounding-box annotated EL images to localize and classify defects. This paper proposes a Fault-Aware Attention Network (FAANet), for multi-class classification and interpretable localization of PV cell defects. The framework uses an ImageNet-pretrained ConvNeXt-Tiny backbone for feature extraction and introduces a lightweight Fault-Aware Attention Module (FAAM) for feature refinement. Unlike sequential attention mechanisms, FAAM derives channel and spatial attention independently from the same feature map and applies them jointly. This preserves complementary information about what fault-related features are important and where they occur. The model is trained using label-smoothed cross-entropy together with center loss to improve inter-class discrimination and intra-class feature compactness. After filtering categories with insufficient samples, 7,789 defect crops from eight fault classes are retained. A source-image level split produces 6,252 training and 1,537 validation samples while preventing overlap between the two sets. FAANet achieves 98.50% validation accuracy, with a weighted F1-score of 0.9851 and a macro F1-score of 0.9717. Grad-CAM further provides visual evidence of the image regions contributing to individual predictions without requiring additional localization training. The results demonstrate that parallel fault-aware attention can support accurate and interpretable analysis of visually similar PV defects in EL imagery.

Paper id 1219

Paper title A Hybrid Neuro-Statistical Stacking Architecture for Evaluating Bengali AI-Generated Health Responses

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Abstract Online Health Information Seeking (OHIS) is a rapidly developing field with the advent of Large Language Models (LLMs) and it poses significant risks of medical hallucina tions and irrelevant health advice, particularly for low-resource regional languages such as Bengali. Although the existing eval uation metrics are automated and are used in order to address these risks, most of the existing

classification frameworks are either based on structural statistical models that lack semantic depth, or such standalone deep learning architectures which do not utilize explicit tabular metadata and heuristic features. To tackle this duality, this paper introduces a novel Hybrid Neuro Statistical Stacking Architecture for the purpose of rigorously evaluating and categorizing the relevance of AI-generated health responses in the Bengali language. Utilizing a dataset comprising over 15,300 ternary-labeled instances, the proposed methodology extracts structural intelligence—incorporating TF-IDF vectoriza tion, structural length counts, and categorical symptom gen res—using an optimized Extra Trees classifier. At the same time, the context semantics are extracted using the fine-tuned XLM RoBERTa transformer model. The fuzzy classification results of these conceptually distinct paradigms are then fused using a Logistic Regression meta-classifier, resulting in a very strong multi-dimensional decision boundary. Empirical results show that the proposed hybrid ensemble produces a remarkable accuracy of 93.66% and a Macro F1-Score of 0.9360 on the ternary relevance classes, overcoming the independent performances of the base models. Moreover, a Cohen's Kappa score of 0.9049 indicates an "almost perfect" prediction agreement, sets a reliable benchmark for establishing trust calibration in AI.

Paper id 1222

Paper title AI-Powered Digital Employee for Enterprise Helpdesk Automation Using Retrieval-Augmented Generation and Agentic AI

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Abstract Enterprise helpdesks handle large volumes of repetitive Information Technology (IT) and Human Resources (HR) requests, and much of this workload is procedural rather than genuinely novel, which motivates automation. This paper presents an AI-powered Digital Employee, a prototype enterprise helpdesk platform that goes beyond a conventional question-answering chatbot. The system combines Retrieval-Augmented Generation (RAG) over a synthetic enterprise knowledge base, an agentic decision layer that identifies employee intent and chooses between knowledge retrieval and controlled tool calling, and a human-in-the-loop approval mechanism restricted to actions that change enterprise state, such as leave requests and IT ticket creation, all mediated by authentication and role based access control (RBAC). The prototype is implemented using a React/Vite frontend, a FastAPI backend, and an SQLite database, and currently supports leave-balance lookup, a leave-application workflow, and IT troubleshooting retrieval through natural-language interaction. This paper describes the system architecture, the agentic workflow, a baseline comparison of candidate intent-detection approaches evaluated on the same test queries, and an evaluation methodology, and positions the contribution as the integration of retrieval, tool calling, and workflow control into a single enterprise helpdesk system rather than as a claim of a new underlying algorithm.

Paper id 1229

Paper title AI-Driven Solar Power Forecasting for Sustainable Development: Random Forest vs. LSTM

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Abstract The short-term forecasting of solar irradiance is the crucial issue for the integration, storage dispatch, and energy planning under Sustainable Development Goal 7 (Affordable and Clean Energy) for electricity grids. In this paper, we highlight a comparative benchmarking study of machine learning techniques for hourly solar power prediction from five years (2021-2026) of hourly meteorological and irradiance data from the Pune area in India from the NASA Prediction of Worldwide Energy Resources (POWER). We build a feature set that includes meteorological features (temperature, humidity, wind speed, cloud cover), engineered temporal features, and lagged value of the irradiance, and compare the performance of three different kinds of models: Linear Regression, Random Forest,

and a Long Short-Term Memory (LSTM) recurrent neural network. Despite increasing the LSTM training data by 5 times and the depth of the LSTM, the well-featured Random Forest (RMSE = 23.19 W/m2, MAE = 10.49 W/m2, MAPE = 8.94%) outperformed the well-tuned LSTM (RMSE = 30.76 W/m2, MAE = 15.93 W/m2, MAPE = 13.61%) consistently on time-series tasks, contradicting the common belief that deep sequence models outperform classical ensembles on such tasks. The strongly diurnal, quasi-periodic behavior of solar irradiance at a single site is indicated by the fact that a single engineered feature, irradiance at the same hour on the previous day, explains more than 95% of the predictive power of the Random Forest. We explain the implications of this result for practitioners using low-resource forecasting pipelines in the context of developing economies, where simplicity and interpretability of the forecasting pipeline are also important features to consider, even if they are not the ones that lead to the biggest marginal accuracy gains. A naive 24-hour persistence baseline evaluated on the same test set performs markedly worse than Random Forest (RMSE 57.94 vs. 23.19 W/m²), confirming that Random Forest's accuracy reflects genuine learned structure rather than simple reproduction of the dominant lag feature; these findings are specific to a single study site and should be validated independently elsewhere.

Paper id 1230

Paper title When Prediction Becomes Reconstruction: Quantifying Endpoint–Input Circularity in Respiratory Machine Learning

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Abstract High discrimination in physiological machine learning can be misleading when the evaluation endpoint is itself computed from the model's input signal. The hazard is well described qualitatively—as incorporation bias, target leakage, circular analysis, or shortcut learning—but its magnitude is rarely measured under controlled conditions. We report a same-cohort audit on 6,247 biochemically-confirmed adult never-smokers and 33,403 raw spirometry manoeuvres from NHANES 2007–2012, holding participants, inputs, splits and model families fixed while varying only the target across seven endpoints pre-specified at four levels of reconstructability. A closed-form ATS/ERS routine with zero learned parameters recovers the spirometry defined obstruction label at AUC 0.9773 (sensitivity 0.9953, NPV 0.9996); on identical validation participants a 1-D CNN exceeds it by +0.0077 AUC [−0.0014,+0.0162], with no statistically detectable incremental discrimination after multiplicity correction. Two waveform representations track reconstructability strongly (Spearman ρ = 0.954, exact permutation p = 0.0048), whereas a clinical-covariate control does not (ρ = 0.449, p = 0.319), and after Holm–Bonferroni correction the waveform advantage is significant only at the two reconstructable levels and null elsewhere. Discrimination must therefore be interpreted relative to how the label was constructed from the input before it is read as evidence of independent clinical prediction.

Paper id 1232

Paper title Agentic AI Based Local Student Support Assistant: An Autonomous Query Resolution System Using NLP and Machine Learning

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Abstract Student support in Indian engineering colleges is scattered – hostel issues go one place, academic queries go another, facility complaints go somewhere else entirely. First year and outstation students bear the worst of this, with no single system to turn to and no peer network to fall back on. Rule-based chatbots exist but they fail the moment a student types something slightly outside the script, and they never get better over time. AALSSA (Agentic AI based Local Student Support Assistant) solves these issues by handling four query domains- Accommodation, Academic Information, Facilities, and Complaints – through a Think-Plan-Act-Learn pipeline using NLTK preprocessing, TF-IDF vectorization, Logistic Regression classification, and Flask architecture based REST API backed by JSON data layer. A persistent feedback loop collects user feedback in JSON file for future refinement through manual retraining. On a 400 query dataset (100 per intent) spanning formal, informal, Hinglish (Hindi + English), and Gen-Z registers, Logistic Regression achieved an overall accuracy of 98.15%, outperforming Linear SVM, Naïve Bayes, and Random Forest under identical

conditions. The system runs on commodity hardware with no cloud dependency and at minimal deployment cost.

Paper id 1238

Paper title An Optimized G–LSTM Framework for Option Price Forecasting

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Abstract This study models the complex and nonlinear dynamics of financial markets by proposing a novel GRU augmented LSTM framework with Bayesian optimization (G LSTM+BO) for pricing European options on the NIFTY 50 index. To improve predictive performance, the proposed framework integrates a comprehensive set of technical indicators with input features, enabling the model to capture multiple dimensions of market behavior, including volatility, momentum, and trend characteristics that are essential for accurate option price forecasting. The proposed architecture combines the complementary strengths of Long Short-Term Memory (LSTM) with Gated Recurrent Units (GRUs) to efficiently model long-term temporal dependencies and short-term movements inherent in time-series data, thereby overcoming the limitations of conventional approaches in option pricing. To further improve training performance and prediction accuracy, Bayesian Optimization is incorporated for automated tuning of hyperparameters, enabling the identification of optimal model configurations through an efficient search of the hyperparameter space. Experimental results demonstrate that the proposed G-LSTM+BO framework consistently outperforms benchmark models, evaluated using various performance metrics for NIFTY 50 European option price prediction. Furthermore, to ensure the robustness, reliability, and generalizability of the proposed framework, a 3-fold time-series cross-validation strategy is employed, providing an unbiased evaluation of the models.

Paper id 1243

Paper title Deep Learning-Based Malware Classification with Explainable AI and Adversarial Robustness

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Abstract Malware is becoming more advanced and complicated over time, and its signatures are deceptively easy to defeat with today's sophisticated attacks. Often, advanced variants of malware use obfuscation, polymorphisms, packing, and adversarial input to bypass traditional security measures. The powerful ability of deep learning to automatically learn complex patterns from massive security data sets makes it an effective solution for the classification of malware. To overcome these challenges, this paper presents a Malware Classification framework with Explainable Adversarial Robust deep learning (DAR-XAI). The proposed framework combines static and dynamic malware feature extraction, deep feature learning with Convolutional Neural Networks (CNN) and Bidirectional Long Short-Term Memory (BiLSTM) networks, an adversarial training mechanism, and Explainable Artificial Intelligence (XAI) techniques. SHAP and LIME are used to give interpretable explanations to the classifications made by the malware, and select the most influential features leading to the decisions about the outcomes of the classification. The results of the proposed DAR-XAI approach attain an accuracy of 99.1%, a successful improvement over several conventional machine learning and deep learning methods; 98.8% precision and 98.6% recall, both improved upon by several conventional methods; and an F1-score of 98.7%, which is also improved. The framework is also well protected against adversarial attacks without sacrificing on being easily interpretable and transparent. The results showed that the proposed method could be a good solution for future anti-malware applications in terms of effectiveness, reliability, and interpretability..

Paper id 1245

Paper title UAV Collision Avoidance: A Review of Strategies, Challenges and Algorithms

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Abstract Path planning remains a major challenge for UAVs. Choosing the best route between two nodes is essential to preventing collisions when performing target actions. This paper examines the difficulties associated with path planning for Unmanned aerial vehicles (UAVs) and presents a number of solutions. UAVs are being used more often for jobs like search and rescue and environmental monitoring, but effective route planning is essential to their effectiveness. UAVs can adjust to changing conditions and optimise their flying paths for things like safety and battery life thanks to dynamic path planning. The study examines a number of paths planning algorithms, including global planning algorithms like Dijkstra's, A* Algorithm and more conventional techniques like Artificial Potential Fields. The limitations of these methods are also covered, and more sophisticated methods that can handle complicated environments.

Paper id 1249

Paper title Quantum-Based Learning for Heart Disease Classification: A Comparative Study with Classical Approaches

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Abstract Over the years,cardiovascular disease remains a persistent health concern worldwide.The application of machine learning techniques has shown considerable potential, particu larly for the disease prediction. Despite this, they face several challenges, such as complexity of healthcare data,feature selection and difficulty to capture complex nonlinear relationships.These challenges have encouraged researchers to investigate Quantum Machine Learning (QML) approaches. It integrates quantum computational methods with ML to design algorithms that can efficiently process and analyze data. To explore the application of these approaches in heart disease prediction, this study examines and presents a comparative evaluation of the performance of classical and quantum approaches. The UCI Cleveland Heart Dis ease dataset is used for the evaluation.For the analysis, classical ML models like- Artificial Neural Network (ANN) and Support Vector Machine (SVM) are evaluated alongside three quantum ML models- Quantum Support Vector Classifier (QSVC), Variational Quantum Classifier (VQC) and Quantum Neural Network (QNN). Experimental evaluation indicates that QSVC model obtained the highest accuracy of 88.52%, outperforming both SVM and ANN ,which achieve an accuracy of 85.24% each. VQC also shows competitive accuracy of 83.60%, while the QNN model achieves the lowest accuracy of 52.46% due to optimization and circuit design challenges.The performance of models is further examined through confusion matrix and ROC curve analysis.Overall, the results suggest that quantum kernel-based methods can improve classification performance in healthcare prediction tasks, although further research is needed for more enhancements in quantum circuit design and optimization.

Paper id 1250

Paper title OpenCyberKAN: Attack-Dependent Open-Set Intrusion Detection with Uncertainty-Calibrated Kolmogorov–Arnold Networks

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Abstract Even high closed-set accuracy does not ensure reliable intrusion detection in case of previously unknown attack categories. In this paper, we introduce OpenCyberKAN, which is an open-set

intrusion detection system based on leakage-resilient FastKAN representations and uncertainties computed through energy scores and nearest prototypes. In our approach, the fusion weight and rejection threshold are optimized on synthetic pseudo-unknowns and validation set, without any knowledge about held-out attacks, which are used only for final evaluation. We use the CIC-IDS2017 dataset and experimentally separate Web Attack and Bot categories across five different random seeds. For Web Attack, FastKAN increases AUPR-U from 0.4175 to 0.5990 but reduces the open set F1 score from 0.4620 to 0.3859 compared to the MLP model. MLP shows much higher performance for Bot, 0.8032 versus 0.5659 AUROC, and 0.2771 versus 0.1723 F1 for open-set. FastKAN is 2.75× larger than MLP and needs about 21% more training time; however, both architectures support more than 72,000 flows/s on NVIDIA T4 GPU. These results clearly show that the attack dependency of FastKAN's open-set ability affects its relative performance when it comes to unseen attacks and whether they are ranked or calibrated.

Paper id 1256

Paper title Hybrid Quantum Deep Learning for Acute Lymphoblastic Leukaemia Detection: A Pipeline Utilizing MedSAM Segmentation, Vision Mamba and Parameterized Variational Quantum Classification

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Abstract To ensure patient survival, it is imperative to conduct prompt and accurate diagnostic screening for Acute Lymphoblastic Leukaemia (ALL). Global attention-driven transformers and deep convolutional networks are the mainstays of current automated architectures. CNNs lack holistic cellular morphology and have limited local receptive fields. However, ViTs cause prohibitive quadratic bottlenecks in computation. In order to fill these important gaps, we suggest a three phase hybrid quantum-classical deep learning pipeline. In phase one, a Medical Segment Anything Model (MedSAM) is used to start zero-shot cellular segmentation. White blood cells are effectively removed from peripheral blood smear backgrounds in this way. The second phase is based on a state-space model backbone called Vision Mamba (Vim). Strict linear computational complexity is used to extract discriminative morphological characteristics. Binary classification is then carried out by a six-qubit Variational Quantum Classifier (VQC). By avoiding empty plateaus, a paral lel classical skip connection mitigates quantum gradient vanishing and stabilizes end-to-end training. We used an open-source Kaggle repository with precisely 3,242 stained peripheral smear micrographs to validate this pipeline. Our suggested pipeline eventually achieved testing accuracy of 99.18% and raised the ROC AUC score to an almost flawless 0.9942. Extensive ablation studies pinpoint the precise performance improvements that can be attributed to the classical skip bypass, the quantum classifi cation head, and the individual Vim backbone. The combination of quantum enhanced classification and state-space sequence modeling creates a scalable model for multi-class haematology in the future.

Paper id 1269

Paper title Predictive Behavioural Analytics for Medical Tourists Using AI and Open Banking Data: A Domain Specific Feature Engineering and Fairness Governance Approach

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Abstract Cost is consistently reported as a top factor in medical tourists' destination decisions and open banking has enabled financial behaviour prediction models with strong reported accuracy in domestic retail banking settings. However, no prior study combines open banking transactional data with the medical tourism population to predict financial affordability risk; the closest related work predicts a comparable outcome (unpaid hospital charges) using hospital administrative records rather than transactional data. We propose CB Afford AI, a pipeline engineering domain specific behavioural features (a cost to income ratio and a realized foreign exchange volatility measure), constructing a composite Affordability Risk Index (ARI) as a prediction target and evaluating a stacked ensemble

classifier against single model, survey only and generic banking baselines. The pipeline includes an algorithmic fairness auditing gate. Evaluation used two tiers: a real public credit dataset (n=1,000) for pipeline validation and a fully disclosed synthetic medical tourism cohort (n=6,000) for domain specific evaluation, since no combined real dataset exists. The domain specific feature pipeline outperformed a survey only baseline (AUC ROC 0.7536 vs. 0.6981) and an unmodified generic banking baseline (0.6166). The proposed stacked ensemble did not outperform its own constituent single models on either data tier, a pattern replicated across three random seeds. An initial fairness auditing gate was found to route all cases to manual review whenever a single subgroup failed a parity check; the underlying cause (unstable performance estimates from small subgroup positive case counts, a mechanism previously documented in credit scoring fairness research) was diagnosed and the gate was redesigned, reducing inappropriate routing from 100% to 32.9-72.3% while preserving detection of genuine subgroup disparities. Domain specific transactional features provide measurable value over survey derived or generic banking approaches for this task. The specific stacked ensemble architecture evaluated here is not supported as the preferred model by this study's evidence. The fairness gate redesign offers a concrete, transferable governance improvement. All findings are based on a synthetic evaluation cohort for the target population and require validation against real institutional data before any deployment claim can be made.

Paper id 1271

Paper title The Charitable Attribution Bias in LLM Strategic Reasoning: Implications for AI Governance and Robust Multi-Agent Coordination

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Abstract We examine whether large language models can distinguish strategic defection from execution errors when they report explicit beliefs about other agents. Multi-agent games with controlled action noise provide a setting for evaluating this behavioral approximation to Bayesian Theory of Mind. Agents must report both intended actions and noise attribution estimates— their stated beliefs about whether observed defections stem from intentional strategy versus random errors. Extending from classical 2-player Prisoner's Dilemma to 3-player settings across six languages and multiple model families, we report probabilistic forecasts (Brier scores 0.15–0.23 across the four models) and, for Llama-3.1-70B at $\epsilon = 0.1$, noise attributions for 62% of observed defections. This attribution frequency requires comparison with conditional ground truth, rather than the marginal noise rate. The observed charitable attribution tendency accompanies a Trembling Robustness Paradox: cooperation increases under noise (13 percentage points at $\epsilon = 0.1$ in the plotted Llama curve) when agents maintain explicit opponent models, a pattern consistent with charitable interpretations of ambiguous defections. In the Public Goods trajectories, cooperative agents continue contributing despite persistent free-riding, raising a separate concern about exploitation. We use the Trembling Robustness Score, noise attribution scoring, and Shapley-based welfare accounting to evaluate agent behavior. The ablation shows 85.3% cooperation with belief tracking versus 32.1% without it at $\epsilon = 0.1$. A separate reproducible synthetic experiment validates the attribution-scoring protocol. Our findings suggest implications for AI Governance: cooperation-oriented objectives may require complementary reciprocity safeguards to limit susceptibility to exploitation by strategically deceptive actors. RLHF is hypothesized as a possible contributor to this behavior, though the experiments do not definitively isolate it. We argue that governance frameworks for multi-agent AI systems should consider explicit robustness testing against strategic defection, calibrated uncertainty reporting, and reciprocity-aware reasoning. Furthermore, the ablations suggest that explicit belief scaffolding supports coordination in the tested conditions, while motivating runtime behavioral monitoring and adversarial evaluation. This work provides a controlled empirical setting for studying cooperative stability and defensive vigilance; generalization to deployed multi-agent ecosystems remains to be established.

Paper id 1273

Paper title ELACHI: Construction, Preprocessing and Benchmarking of an In-Field Cardamom Pod Detection Dataset from Fixed-Camera Plantation Video

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Abstract Cardamom is harvested by eye, pod by pod, in several rounds each season, and no public image dataset exists on which a detector for that judgement could be trained or compared. This paper describes how we built one. ELACHI (Elettaria cardamomum Harvest Imagery) was assembled from

video recorded by a single fixed outdoor camera inside a working plantation on several dates, so that the same plants appear at successive stages of maturity under natural light. We document each step of its construction: frame sampling and screening, a three-class annotation rubric (unripe pod, ripe pod, cluster) chosen to match what a camera at plantation working distance can actually resolve, the frame-level split, and the preprocessing and augmentation applied at training time, with the reasoning behind each choice. The result is roughly 500 annotated frames whose objects are small, chromatically close to foliage and heavily occluded. To characterise the dataset we benchmark two single-stage detectors trained on the same data, preprocessing and training budget on a CPU-only machine. YOLOv8s reaches a mean average precision of 0.50 at IoU 0.5 against 0.38 for YOLOv5s, and its per-class results show ripe pods (AP 0.61) are far easier to find than unripe ones (AP 0.37), a gap that measures the green-on-green problem directly. Both models were still improving when the training budget ran out, so these figures are a floor. The frames, labels, split files and training configuration will be deposited in a public repository at publication to give future work on this crop a common reference point.

Paper id 1276

Paper title MemCP: Context-Aware Memory Compression and Retrieval for Long-Horizon Large Language Model Agents

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Abstract Large language models operate within a fixed context window. In extended conversations, this causes earlier stated facts to be pushed out, redundant restatements to consume space, and stale facts to compete with current ones—failures collectively described as context rot. To overcome these drawbacks, MemCP acts as a memory management layer between an agent and its LLM, maintaining a compact data store of relevant memories for extended conversations. MemCP utilizes three primary mechanisms: an ingestion pipeline with a novelty detector to determine duplicate or overly similar entries, a hybrid retrieval engine fetching from vector storage (ChromaDB) and in memory graph storage (NetworkX), and a Heritage Node architecture that summarizes aging, low-value nodes into consolidated memories while retaining semantic and relational links. MemCP is exposed via JSON-RPC 2.0 under the Model Context Protocol to integrate seamlessly with local and cloud based LLMs. Evaluation was carried out on a labelled 500-entry long-horizon corpus with 125 distinct facts against baselines of standard memory management techniques and showed that MemCP reaches accuracy comparable to the strongest baseline on single-fact lookup (Recall@1 of 0.903 vs. 0.952 for vector retrieval), while storing 67% fewer memories and spending only 16.8% of the context window on duplicated content against 57.3% for vector retrieval. Testing cosine similarity thresholds identified 0.80 as optimal, absorbing 333 of the 500 entries with a merge precision of 0.991 and a compression ratio of 2.99:1, with a 65.5% reduction in stored text. The profitability threshold for LLM summarization of ingestion clusters was 13 memories per cluster.

Paper id 1277

Paper title Adaptive Ensemble of Transformers and XGBoost for Multi-Horizon NO2 Nowcasting in Urban Environments

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Abstract Predicting NO2 concentration on an hourly basis in cities is considerably more difficult than most existing literature suggests. We developed a hybrid system pairing a Transformer network with XGBoost, where the balance between the two models shifts automatically depending on how extreme pollution conditions appear at any given moment. We evaluated this on ten Chennai monitoring stations using 326,530 hourly measurements collected between 2021 and 2026, obtaining R2=0.831 at the 1 hour horizon and R2=0.590 at 24 hours. What stood out most during testing was the 6-hour result– XGBoost by itself dropped to R2=0.330 at that horizon, while our combined model held at R2=0.635, a gain of roughly 92.5%. The full inference pipeline completes in under 100ms, making it viable for real-time health alert systems as well as day-ahead planning applications.

Paper id 1278

Paper title Lexora-An Intelligent RAG-Based Business Legal Assistant

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Abstract Businesses around India, whether small or medium scale businesses like the new startups, face one issue which is not tech related but is legal ones like laws and questions regarding contracts, employment, and consumer laws. Most of these businesses are ran by students or people who lacks money/funds to afford a lawyer or corporate counsel. And if they think they can use common AI models to solve it they don't give full coverage of those legal queries and they just generate answers without any verifiable sources or citations. To address this large gap , the following research paper presents a business legal assistant designed to solve this existing gap. RAG, Qdrant, and the Neo4j knowledge graph are used in the system. The Business Legal Assistant works based on a custom dataset which uses legal Acts and judgements from actual sources, which make them verifiable and acceptable throughout India. This dataset is organized in terms of a Document Inventory, Document Structure, and Tag Vocabulary. The suggested hybrid retrieval system of this legal assistant can be defined by following: it uses a semantically relevant snippets in combination with graph traversing and relation information, where each of this task is then in turn used in the task-informed language model which then produces plain user-readable text which can answers based on these retrieved resources who are drawn based on relevant tags for each question in the context user gave to system. The contribution then additionally places the creation of suggested system design which is used for the context of the legal natural language processing and the legal RAG approaches, offers a systematic review of existing work that are further divided by main research areas and outlines creating an evaluation framework with seven dimensions including retrieval relevance, citation correctness, graph relevance, groundedness, answer quality, robustness, and latency. Comparisons with keyword based search, dense retrieval, transformer-based approaches in the legal domain, and graph-based retrieval indicate the relevance of combining vector-based and graph-based methods for representing both semantic similarity and explicit relationships among legal resources.

Paper id 1279

Paper title Machine Learning-Based Alzheimer's Disease Detection Using Radiomic and Texture Features from Brain MRI

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Abstract Alzheimer's disease (AD) is a progressive, neurodegenerative disorder that results in structural and textural changes in brain tissues that can occur before clinically apparent cognitive decline. Correctly classified patterns on imaging will help in early diagnosis and management of the disease. In this paper, a new approach for detection of Alzheimer's Disease (RTF-MLAD) based on structural brain Magnetic Resonance Imaging (MRI) is introduced through a Radiomic Textural Features-based Machine Learning (RTF ML) framework. The framework comprises a diagnostic pipeline for MRI preprocessing, region-of-interest extraction, radiomic feature computation, texture analysis, feature normalization, feature selection, and classification by machine learning. First-order statistical features, shape descriptors, morphological descriptors, Gray Level Co-occurrence Matrix (GLCM), Gray Level Run-Length Matrix (GLRLM), Gray Level Size Zone Matrix (GLSZM), and Neighborhood Gray Tone Difference Matrix (NGTDM) features are used to extract quantitative imaging characteristics. The redundant or weakly discriminative attributes are removed from the set prior to classification using a feature-selection mechanism. The performance of multiple machine-learning classifiers is evaluated to select an effective machine-learning classifier for the detection of Alzheimer's disease, namely support vector machine (SVM), random forest (RF), k-nearest neighbors (KNN), logistic regression (LR), and extreme gradient boosting (XGBoost). The proposed framework is evaluated based on the accuracy, precision, recall, specificity, F1-score, Area Under the Curve (AUC), confusion matrix, class-wise performance, and feature-importance analysis.

Paper id 1281

Paper title Vision Transformer-Based Framework for Multi Stage Alzheimer's Disease Classification from Structural MRI

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Abstract Alzheimer's disease (AD) is a chronic disease of the central nervous system that causes progressive decline in memory, intellect, and functioning. Correct diagnosis of each stage of AD is important for early clinical intervention, disease monitoring, and treatment planning. Therefore, this paper introduces an automated multi-stage classification system for Alzheimer's Disease classification based on structural brain Magnetic Resonance Imaging (MRI), namely the Vision Transformer Based Alzheimer's Disease Classification Framework (ViT-AD). The proposed framework is composed of several blocks: MRI preprocessing, data augmentation, patch generation, linear patch embedding, positional encoding, multi-head self-attention, a transformer for feature learning, and multi-class classification in a single framework. There are four stages of diagnosis for structural T1-weighted MRI: Cognitively Normal (CN), Early Mild Cognitive Impairment (EMCI), Late Mild Cognitive Impairment (LMCI), Alzheimer's Disease (AD). The Vision Transformer takes MRI images as inputs and breaks them into non-overlapping patches, as well as learns the long-range dependencies between various anatomical regions using the self-attention mechanism, unlike conventional Convolutional Neural Networks (CNNs), which are mainly used for learning hierarchical local features. Evaluation of the proposed ViT-AD framework is conducted on the basis of accuracy, precision, recall, specificity, F1-score, Area Under the Curve (AUC), confusion matrix, and class-wise performance analysis. Through analysis of the proposed framework using experiments, the results show that the framework has classification accuracy of 97.17%, precision of 97.20%, recall of 97.17%, specificity of 99.06%, F1-score of 97.16%, and macro-AUC of 0.994. The effectiveness of the transformer-based global representation learning for multi-stage AD classification is compared with conventional CNNs, VGG16, ResNet50, DenseNet121, and baseline ViT models. Structural MRI preprocessing combined with patch-based self-attention is an effective framework to differentiate between various Alzheimer's stages via computer-aided processing.

Paper id 1288

Paper title Artificial Intelligence and Evolutionary Optimization for Multi-Energy Microgrid Dispatch: A Systematic Review of Algorithmic Trade-offs, Edge Deployability, and Grid Stability

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Abstract Modern multi-energy microgrids present operational instability caused by renewable stochasticity, non-linear thermodynamic loads, and volatile power markets. To resolve these issues, optimal economic dispatch and unit commitment over multiple time scales are required. This study presents a review of the latest advances in deep predictive neural networks and evolutionary multi-objective approaches for addressing the distribution energy resource management task. We provide a formal description of the coupled dispatch problem, which accounts for the valve-point loading effects, non-linear battery degradation, and AC power flow security constraints. The basic principles of selected meta-heuristics (NSGA-II/III, PSO, DE) and deep learning sequence-to-sequence models (LSTM, TCN, Transformers) are discussed, with a particular focus on the mathematical formulation of the optimisation objective function, algorithm mechanics, and computational complexity. Moreover, beyond algorithm theory, we consider key implementation aspects that are critical for the practical deployment of energy management systems in real-world grids, such as edge-processor limitations, sensor aging, industrial communication delays (Modbus, DNP3, IEC 61850), and low-inertia

converter stability. Additionally, we propose a taxonomy of state-of-the-art methods based on their convergence rate, ability to handle constraints, and dispatch flexibility for different physical power networks. Finally, open research directions related to physics-informed neural surrogates, cyber-attack resilient optimisation, and decentralised multi-agent frameworks are highlighted.

Paper id 1291

Paper title WeighGuard: A Physics-Informed Redundancy Autoencoder Framework for Detecting Adversarial Tampering in Weighbridge Load-Cell Systems

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Abstract Weighbridges underpin many industrial transactions, yet once a ticket is issued there is no reliable way to verify that the weigh event occurred as recorded. Documented fraud includes a support wedged under the platform, an electrical bias in the load-cell signal path, a reading taken before settling, and a shifted zero point. These rarely give an obviously wrong final weight but leave a trace in the transient's shape and in how consistently the redundant load cells agree. Prior work on redundancy-based sensor diagnosis and smart-meter theft detection does not address weighbridge loading physics. This paper introduces WeighGuard, which pairs a lumped spring-damper model of the loading and settling transient with a redundancy-based autoencoder adapted from reference-free sensor diagnosis, plus a classifier that assigns a likely tamper category to flagged events. With no public tampering dataset, we describe a physics-based method for generating synthetic data across four tamper classes, with an evaluation plan and baselines. The preliminary evaluation uses only unvalidated simulator data and untuned hyperparameters. On a synthetic test set of 68 events, 32 normal and 36 tampered, the proposed detector reached perfect precision but only 33.3 percent recall, with an F1 score of 0.50 and an area under the ROC curve of 0.72, similar to an Isolation Forest baseline using the same features. These results do not support reliable tamper detection. The contribution is a physics-grounded feature layer, a redundancy-based detector, and an adversarial fault framing in a domain not yet addressed in the literature, with a first synthetic-data baseline.

Paper id 1292

Paper title Cold-Start Inventory Replenishment Under Joint Demand and Supply-Yield Uncertainty: Yield-Aware Decision-Focused Meta-Learning

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Abstract Cold-start inventory decisions are difficult because newly introduced items provide little demand history while supplier fulfilment may also be uncertain. We study sequential single-echelon replenishment in this joint-uncertainty setting and propose Yield-Aware Decision-Focused Cold-Start Meta Learning. The method combines a causal probabilistic demand model, prediction-head-only few-shot adaptation, leakage-safe cross-item normalization, and a monotone replenishment layer that incorporates predictive demand uncertainty together with expected supply yield and a supply-risk descriptor. Training couples causal probabilistic prediction loss with normalized downstream inventory cost. We evaluate the approach on constructed cold-start tasks derived from the public M5 retail dataset under four explicitly simulated supply-yield scenarios. Across 3,060 held-out test tasks evaluated in two replicates, the method shows conditional rather than universal advantages. It improves both primary cost and fill-rate measures relative to forecast trained and point-forecast alternatives, and its advantage over a deterministic-yield variant emerges under impaired supply. A classical base-stock comparator retains the highest service, while the proposed method provides a lower-cost Pareto-efficient operating point under the most severe simulated supply-risk scenario.

Paper id 1310

Paper title Proximal Policy Optimization for Dynamic Obstacle Avoidance in Flapping-Wing Micro Aerial Vehicles

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Abstract Flapping Wing Micro Aerial Vehicles (FWMAVs) are small, highly maneuverable and bio-inspired robotic flying vehicles with the ability of autonomous navigation in confined space and dynamically changing environment. Accurate avoidance of obstacles is hard to achieve, however, because of limitations in onboard computation, the nonlinear aerodynamics of these flying robots and the environmental disturbances encountered during flight and the fast wing motion. To solve this issue, a framework is proposed based on the Proximal Policy Optimization (PPO) algorithm, which has the FWMAV learn appropriate control action from the target information, obstacle state and proximity parameters, and flight dynamics. A multi-objective reward function encourages safe, smooth and efficient energy use without collisions or unstable behavior since it rewards both safe navigation and efficient energy use. Stationary and moving obstacles, different obstacle densities and speed and environment disturbances are simulated and navigational success, the rate of collision, clearance, efficiency of trajectory, energy consumption, and stability of control are evaluated. The implemented PPO framework is adaptive and robust solution to overcome obstacle avoidance and self navigation problem for FWMAVs to work in realtime environment.

Paper id 1317

Paper title Pseudo-Multimodal MRI Representation Learning With Multi-Head Self-Attention Fusion for Alzheimer's Disease Classification

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Abstract Alzheimer disease is a continuous growing neurodegenerative disorder described by deterioration in memory, cognition and functional abilities. Structural magnetic resonance imaging (MRI) is widely used for computer-aided AD analysis because it provides non-invasive anatomical information associated with neuro degeneration. However, conventional MRI-based deep learning approaches generally learn from a single image representation, while multimodal approaches often require additional imaging modalities such as positron emission tomography (PET), increasing acquisition cost and introducing missing-modality challenges. This paper proposes a Pseudo-Multimodal MRI Representation Learning (PMRL) framework that extracts complementary representations from a single structural MRI image. In addition to the original MRI, three derived representations—Local Binary Pattern (LBP), Fast Fourier Transform (FFT), and morphological gradient—are generated to emphasize complementary textural, frequency-domain, and structural boundary information. Each representation is processed independently through a parallel EfficientNet-B2 feature extractor. The resulting feature embedding's are treated as representation tokens and integrated using a Multi-Head Self Attention (MHSA) module. A fully connected classifier subsequently performs four-class AD-stage classification. The framework is evaluated using accuracy, recall, precision, F1 score, and confusion-matrix analysis. The proposed PMRL framework provides a practical alternative for conventional multimodal imaging by enhancing representation diversity while keeping single MRI acquisition.

Paper id 1318

Paper title An Ensemble Learning Framework for Urban Traffic Slowness Prediction with a Proposed Multi-Agent Control Architecture

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Abstract Urban traffic congestion is influenced by a variety of temporal and traffic-disruption factors, including vehicle breakdowns, accidents, road obstructions, flooding, and traffic-signal disturbances. Accurate prediction of traffic slowness can provide useful information for understanding and subsequently managing changing traffic conditions. This study presents an ensemble learning framework for predicting traffic slowness using temporal and incident-related traffic variables. The proposed prediction framework combines Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), Gradient Boosting Machine (GBM), and Transformer models through a stacking-based ensemble to exploit their complementary predictive capabilities. The prediction component is experimentally evaluated using a traffic dataset containing hourly information and multiple traffic-disruption indicators, with the percentage of traffic slowness considered as the prediction target. Experimental results demonstrate that the proposed ensemble achieves improved predictive performance compared with the individual models, obtaining an MAE of 1.92 and an RMSE of 2.85, with an overall reported prediction accuracy of 97.9%. In addition to the prediction framework, a multi-agent traffic-control architecture is proposed as a future extension, in which predicted traffic-slowness information can be provided to intersection-level agents to support decentralized traffic-signal decision-making. The multi-agent control component is conceptual in the present study and is not experimentally evaluated. Future work will focus on implementing and validating this prediction-to-control framework using traffic simulation and real-world traffic-control scenarios.

Paper id 1320

Paper title A Smartphone based digital tool for health monitoring

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Abstract As depression is becoming more natural, cognitive health monitoring solutions have to be scalable and sustainable to monitor beyond the traditional clinical assessments. In this study, a multi-modal approach to predicting depressive symptoms based on three aspects of behavior observed through a smart-phone sensing was proposed: Physical activity, social interaction (conversation metadata) and phone usage (screen lock patterns). Multiple features were extracted from the data: activity entropy, sleep fragmentation, circadian rhythm indicators, etc., in six-hour windows. Depression status was determined by the Patient Health Questionnaire9 (PHQ-9) with scores of 10 or higher suggestive of severe depression and sadness. Features of the data were used in a Random Forest baseline model and a seven-day behavioral sequence was used in LSTM model to do a comparative analysis. However, the LSTM model has improved the F1-score (0.600 vs. 0.444) and ROC-AUC (0.600 vs. 0.520) compared to the Random Forest model, underscoring the importance of temporal modeling in the field of depression detection. Sleep fragmentation, activity entropy and use of screens during the night were the most discriminative predictors as identified by feature importance analysis. The results demonstrates the multimodal digital phenotyping approach and underscore the promise of smartphone-based monitoring for early intervention.

Paper id 1332

Paper title SecureIrisNet: Lightweight Deep Learning Framework for Robust Iris Recognition and Classification

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Abstract Human irises are considered to be among the best biometrics due to their uniqueness, stability, and difficulty to forge, thus being widely used in modern biometric authentication systems. Due to increased demands for biometric-based secure identification, particularly in finance, healthcare, border control, and access control applications, robust iris recognition algorithms have become necessary. Classical approaches to iris recognition frequently involve hand-crafted features that can be less effective for illumination changes, occlusions, and degradation of image quality. Thanks to recent advances in deep learning technology, biometric-based recognition performance has been

significantly enhanced through the automatic learning of discriminative features from big data sets. Lightweight neural network architectures have attracted a lot of interest due to their ability to ensure high recognition rates while lowering computational requirements and memory usage. In light of the above limitations, this introduces a novel architecture known as SecureIrisNet, which is a combination of deep learning approaches based on MobileNetV3 and XGBoost. In evaluating this model, the CASIA-Iris-Thousand database with 20,000 images obtained from 1,000 participants was used to ensure detailed biometric analysis of iris images. MobileNetV3 will be utilized to extract strong texture and structural features, whereas XGBoost will improve efficiency in classification. It is worth noting that the proposed architecture achieves impressive recognition accuracy, precision, recall, and F1 score of 97.5%, 97.2%, 96.9% and 97.1%, respectively. Besides, it yields very low error rates as well as stable feature extraction within different iris classes.

Paper id 1334

Paper title Deep Learning and Explainable AI for Pancreatic Cancer Detection: A Review and Critical Analysis

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Abstract Pancreatic cancer remains one of the deadliest cancers worldwide, with a five-year survival rate in the single digits and mortality closely tracking incidence. Deep learning (DL) has been widely applied to detect, segment and classify pancreatic tumors on computed tomography (CT), magnetic resonance imaging (MRI) and endoscopic ultrasound (EUS), while explainable artificial intelligence (XAI) methods such as Grad-CAM, SHAP and LIME have been proposed to open these black-box models. This paper presents a structured narrative review and critical analysis of DL and XAI for pancreatic cancer detection. We review convolutional neural network (CNN), transfer-learning, Vision Transformer (ViT) and hybrid models; compare representative studies by dataset size and source, preprocessing, patient- versus image-level splitting, validation strategy and reported metrics; and appraise XAI methods, including how their explanations can be evaluated quantitatively for faithfulness, localization, robustness and stability. We identify recurring pitfalls—small single-centre datasets, patient-level data leakage, class imbalance, scarce external validation and incomplete reporting—and show that a saliency map is not, by itself, evidence that a model has localized the tumor. We then propose a trustworthy DL+XAI workflow spanning quality control, segmentation, classification, explanation and radiologist assessment, and outline research directions toward externally validated, interpretable and clinically evaluated systems.

Paper id 1336

Paper title Robust Multi-Objective Lightweight Deep Reinforcement Learning for Secure NOMA-Based Smart Grid Communications Under Imperfect Channel State Information

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Abstract Secure smart-grid communication requires confidentiality, energy efficiency, low latency and robustness to imperfect channel information. This paper proposes Robust Multi-Objective Lightweight Deep Reinforcement Learning (Robust MO-LDRL) for secure downlink NOMA resource allocation under imperfect channel state information (CSI). The framework explicitly exposes CSI-error variance to the learning policy and optimizes secrecy rate, secrecy energy efficiency, secrecy outage probability, latency and transmit-power expenditure through a normalized multi-objective reward. A progressive robustness curriculum moves the agent from accurate CSI toward severe estimation uncertainty, while a compact policy architecture reduces inference burden. The obtained simulation results show that Robust MO-LDRL reaches 5.95 bps/Hz secrecy rate at 30 dB, compared with 5.25 bps/Hz for IChOA-RL. Secrecy energy efficiency reaches 7.50 bits/J compared with 5.80 bits/J, while secrecy outage probability falls to 0.025 compared with 0.060. Under severe CSI error variance of 0.50, the obtained robustness index is 59.66%, compared with

42.86% for IChOA-RL. The reported convergence point is approximately 400 episodes, compared with 500 for IChOA-RL. Training runtime decreases from 724 s to 475 s and inference latency from 18.7 ms to 7.8 ms. The proposed model contains approximately 16.3k trainable parameters. These results demonstrate the potential of robustness-aware multi-objective DRL to improve the security-efficiency trade-off while reducing computational burden. The evidence remains simulation-based; therefore hardware validation and broader adversarial experiments are identified as necessary next steps.

Paper id 1340

Paper title A Faithfulness Study of KernelSHAP and LIME on Large-Scale Anti-Money Laundering Transactions

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Abstract Real-world financial crime monitoring relies heavily on unsupervised anomaly detectors because verified fraud labels are scarce, delayed, and expensive. Post-hoc explanation methods such as SHAP and LIME, however, were designed for supervised classifiers that emit calibrated class probabilities, and their behaviour when applied to continuous, unbounded anomaly scores (namely, autoencoder reconstruction error and Isolation Forest isolation depth) remains poorly characterised. We present a systematic empirical study of score-adapted KernelSHAP and LIME on the IBM Transactions for Anti-Money Laundering (AML) dataset, using all 5,078,345 real transactions (5,177 laundering, a 0.102% positive rate). Because no ground-truth feature-level causes exist for real illicit transactions, we evaluate explanations with model-relative deletion faithfulness, cross-explainer agreement, and repeat-run stability, aggregated over ten independent seeds. Both explainers substantially outperform a random-ordering baseline (deletion-AUC 0.61–0.72 vs. 0.39–0.45), with KernelSHAP consistently more faithful than LIME on both detectors. We further uncover a pronounced detector effect: explanations of the Isolation Forest score are markedly more stable (SHAP repeat-run $\tau = 0.945 \pm 0.053$) than explanations of autoencoder reconstruction error ($\tau = 0.525 \pm 0.139$), indicating that the geometry of the score function, not only the explainer, governs explanation reliability. We release our full pipeline to support reproducible explainability research in financial crime detection.

Paper id 1341

Paper title An AI-Driven Clinical Decision Support System for Automated Tumor Multi Classification Using MRI Images

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Abstract Brain tumor diagnosis relies on the accurate interpretation of Magnetic Resonance Imaging (MRI) scans, a process that is time-consuming and subject to inter-observer variability among radiologists. This study presents Braintumor classification-ai, an explainable deep learning framework for automated multi-class brain tumor classification from MRI images. The proposed system classifies brain MRI scans into four categories: glioma, meningioma, pituitary tumor, and no tumor using a comparative evaluation of three architectures: ResNet50, EfficientNet-B0, and Vision Transformer (ViT-B/16). The models were trained and validated on 7,200 MRI images (DS1) and further evaluated on an independent 560-image external test set drawn from the BRISC2025 dataset (DS2).

ViT-B/16 achieved the highest overall accuracy of all three architectures, with 97.25% validation and 98.93% test, outperforming EfficientNet-B0 (96.25% validation, 98.39% test) and ResNet50 (95.81% validation, 97.68% test), and exceeded the accuracy reported by comparable prior studies on this task. Grad-CAM was applied to the trained model to provide visual explainability, confirming that the predictions were driven by clinically relevant tumor regions rather than spurious artifacts. The system was deployed as a cloud-based clinical web application, enabling real-time MRI analysis with downloadable diagnostic reports.

Paper id 1342

Paper title Design of Optimized Hybrid Deep Learning Model Using Ensemble Learning for Attack Detection and Security Enhancement Using Encryption in IoT Network

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Abstract IoT networks faces many security problems due to open communication and limited resources. Attackers easily target IoT devices and cause data loss and service failure. This paper presents a review based design of an optimized Hybrid Deep Learning model with ensemble learning for attack detection. This work also discusses encryption based security for data protection. This paper does not propose a new model. This paper only compares existing methods from recent studies. Comparative analysis shows that Hybrid Deep Learning with ensemble learning gives better accuracy and stability than a single models. Encryption also improve data security and trust in IoT systems. This paper helps researchers to understand current trends and select suitable models for secure IOT networks. Comparative result analysis recent studies shows that hybrid CNN-LSTM model achieved up to 98% accuracy with reduced false rate. Encryption models like AES and ECC provide efficient data protection with low computational overhead for IOT systems.

Paper id 1343

Paper title Renewable Energy-Based Feasibility Analysis for an Unelectrified Rural Village Using Load Survey Data

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Abstract Accessing uninterrupted electric power still remains a major challenge for many remote rural villages. Pachinampathi, a rural newly migrated village remains unelectrified despite ongoing electrification initiatives. This research study dedicates a renewable energy–based feasibility analysis for electrifying this village using load survey data collected directly from the residents. A detailed face to face field survey was conducted to know the villagers' need in electricity and to estimate the electrical load demand based on anticipated appliance usage. The collected survey results were used to develop a representative load profile for the village. Renewable energy potential of this region, particularly solar and wind resources was also studied to evaluate their suitability for meeting the estimated demand. The feasibility study concludes that renewable energy–based systems, supported by appropriate energy storage solutions, can effectively solve the electricity needs of the village. The study focused on importance of survey-driven load assessment for realistic energy planning in unelectrified regions.

Paper id 1364

Paper title AeroShield-AI: A Unified Data-Driven Architecture for Autonomous Flight Guidance, Navigation Resilience, and In-Time Operational Safety

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Abstract Three forms of failure are becoming more common in modern flight operations that are multiplied: during high workload manoeuvres, the pilot may suffer cognitive saturation, during loss of position (due to GPS spoofing or GPS signal blackout), the pilot may not recognize a hazard, and when a sensor saturates, triggering an alarm system causes a delay in detecting a hazard. In most cases, these challenges are studied, developed, tested and implemented by themselves, with the result that the design boundaries fail to take into account necessary latencies between each of the subsystems, creating critical corners between these boundaries where the testing is omitted. In this paper, we envision a tri-tier, data-driven unification of attitude and guidance control with adaptive curriculum reinforcement learning and sensor-denied navigation with dead-reckoning estimation and a precursor-basedprobabilistic hazard monitoring that enables early isolation of hazards. We are developing the mathematical fusion of multi-objective telemetry optimization along with a function that predicts the state prior to exceeding, p_1, thereby allowing seamless transition between nominal control, degraded sensor recovery and pre-exceedance alerting without the inclusion of any discrete mode switching latency. Our system is tested via closed-loop simulation under nonlinear flight conditions, their faults being synthetically injected in GPS signals, and their fault-precursors in synthetic radio propagation for PN sequences. Evaluation in comparison with baselines sets of experiments reveals that AeroShield-AI can decrease the convergence time for attitude recovery from SINS error, increase the accuracy of attitude position hold in dead reckoning (DR) navigation during extended periods of no observed signals, and offer improved time advantage for detection of hazards over existing threshold-based monitors. Results show a promising potential for a reference architecture for an in-time aviation safety system for the aviation industry, especially when the system is deployed at various layers of control, navigation and monitoring in a reusable manner and not as an isolated system.

Paper id 1365

Paper title An Explainable AI Framework for Automatic Analysis of Laboratory Report in Context

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Abstract Patients now receive laboratory reports before they can discuss them with a clinician, yet the terminology, units, and reference ranges in these documents are hard to interpret, and a general-purpose language model asked to explain them can produce fluent but unverified statements. This paper proposes an explainable framework for context-aware analysis of scanned or photographed laboratory reports that keeps numerical decisions and language generation as separate, auditable stages. A locally hosted PaddleOCR engine extracts the text; rule-based table parsing with validation recovers the test name, value, unit, and reference range for seven report types; and a deterministic rule engine labels each value HIGH, NORMAL, or LOW. A retrieval-augmented generation (RAG) module supplies passages from trusted medical sources to a Groq-hosted large language model (LLM), which only explains the already-labelled results in plain language, and an explanation safety validator checks every explanation against the verified values, units, and labels before it is shown. A React and FastAPI web application with JWT authentication and an SQLite prototype database adds report history, comparison, and trend views. The contribution is the combination of these controls in one pipeline, together with an evaluation protocol that compares four pipeline configurations; the comparison figures reported are provisional and do not yet establish superiority. The framework is informational only: it does not diagnose, recommend treatment, or replace professional medical advice.

Paper id 1366

Paper title A Stacking Ensemble Architecture for High-Resolution Multi-Output Spatiotemporal Load Forecasting Across Multi-Zonal Smart Grids

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Abstract Short-term load forecasting (STLF) has become necessary in order to ensure the stability of smart grid operations, optimal dispatch of energy resources and to streamline the integration of renewable energy resources. However, the traditional predictive techniques often combine network demand into a single univariate target, intrinsically obfuscating essential spatial dynamics and hiding the anomalies during the peak demand at a local level. To overcome this limitation, the present paper introduces a novel spatiotemporal forecasting model that is based on high-resolution data of 10 minute interval smart meters within five distinct geographic zones. This distinct stacking ensemble framework comprises several structurally independent architectures that work together in order to reduce out-of-sample prediction errors, integrating: K-Nearest Neighbors, ElasticNet, Multilayer Perceptron, and CatBoost. This proposed architecture achieved a remarkable predictive accuracy, with a Mean Absolute Error (MAE) of 10.85, Root Mean Square Error (RMSE) of 16.25, Symmetric Mean Absolute Percentage Error (SMAPE) of 2.36% and a Coefficient of Determination (R2) of 0.9852. Moreover, the proposed architecture's error margin remains consistently low, staying below 2.7%, for all five zones at once, owing to the utilization of a Multi-Output regression framework to model the individual consumption profile per zone. The outcomes highlight that maintaining spatial dimensionality in STLF has a positive impact on the overall ability of the grid to predict overall traffic; providing operators with the granular visibility needed to proactively alleviate local network stress.

Paper id 1371

Paper title Comparative Analysis of Production-Ready Time Series and Recursive Machine-Learning Models with Socio-Economic Covariates for Electricity Demand Forecasting in Delhi

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Abstract Grid planners require a year's worth of demand estimates at the beginning of the year, before any observation of future demand or weather takes place. In our case, we consider the problem of forecasting daily demand for Delhi, using a daily data set (2014-2023), consisting of Delhi Transco Limited load information, Government of Delhi seasons and nineteen socio-economic indicators of Reserve Bank of India's handbook of statistics on Indian states. Nine forecasters – Seasonal naive, Holt-Winters, ARIMA, SARIMAX with yearly Fourier terms, Prophet, three tree ensembles, and an LSTM – were benchmarked on a holdout test-year under the availability constraint, where everything in the inputs must be known at the origin of the forecast: target lags were generated recursively, socio-economic indicators were projected using damped trend exponential smoothing and observed horizon temperature was replaced with training-period temperature climatology. Nine metrics for measuring error, bias, and fit were combined into a taxonomy-weighted composite metric, where each of the three measures receives one-third weight. SARIMAX outperformed all other methods on the nine metrics (RMSE=514.66, MAE=382.99, MBE=-17.14 MW) followed by Random Forest (RMSE=575.81) and XGBoost (RMSE=615.54). Further we observed that the SARIMAX model benefited (RMSE=1323.10 to 514.66) from the presence of the Fourier terms in the model which were added as the exogenous features.

Paper id 1373

Paper title Reimagining Animation Education in the Age of Artificial Intelligence: Challenges and Opportunities for Teaching and Learning

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Abstract The rapid evolution of Artificial Intelligence (AI), specifically Generative AI, significantly impacts the creative industries and animation production, learning, and teaching. Animation education, traditionally drawing, storytelling, 3D modelling, texturing, rigging, lighting, rendering, and post-production, are also seeing opportunities from AI-assisted technologies that can automate and speed up numerous p1256hases of the creative process. While this may create numerous opportunities for learning and teaching, including increased productivity, better personalization, and experimentation with new modes of visual storytelling, it also comes with pedagogical, technological, ethical, and

professional challenges. This paper explores the emerging role of AI in animation education and how educational institutions can adapt their curricula and teaching/learning practices to meet the new demands of the animation industry. Particular attention is given to challenges related to over-reliance on AI tools, originality, and creativity, plagiarism, copyright, and authorship, skill development, technological access, faculty preparedness, and the role of traditional animation skills. The study also examines opportunities for AI-assisted learning, including feedback, automated production support, generative visual development, personalization, and human–AI creativity. The paper argues that AI should not be seen as a substitute for conventional animation skills but as a complementary technology that can augment human creativity and problem-solving. There is a need for a transformation in pedagogy that combines technical proficiency with fundamental competencies, critical thinking skills, storytelling, creativity, and ethics. This study suggests a pedagogical approach towards animation training through integration with AI which will focus on proper adoption of AI, curricular design, teacher training, and skill development among other factors. It is anticipated that the results will be useful in ongoing debate about the preparation of animation students in an AI-dominated creative environment.

Paper id 1376

Paper title Spatially Transferable Machine Learning for Multi-Horizon Soil-Moisture Forecasting in Data-Sparse Smart Irrigation

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Abstract Soil-moisture forecasting is central to water-efficient smart irrigation, yet most data-driven systems are trained and evaluated at a single site, leaving open whether such models can be deployed in regions that lack their own historical sensor records. This paper presents an empirical study of the spatial transferability of machine-learning soil-moisture forecasting across agro-climatic zones. Using six years (2018-2023) of daily satellite-derived agro-meteorological observations spanning eight agro-climatic zones (17,368 modelling instances), we note that the forecasting target, root-zone soil wetness, is a modelled reanalysis (NASA POWER) product rather than in-situ sensor-probe data. We formulate a multi-horizon forecasting task at 1-, 3- and 7-day lead times and benchmark five predictors: a naive persistence baseline, ridge regression, a random forest, a long short-term memory (LSTM) network, and a histogram-based gradient-boosting model (HistGBM). Two evaluation regimes are used: a conventional chronological split, and a leave-one-region-out (LORO) protocol in which each zone is held out entirely and predicted by a model trained only on the remaining zones. HistGBM attains the best accuracy at every horizon (R-squared of 0.997, 0.980 and 0.928 at 1, 3 and 7 days), removing 13-32% of persistence error in skill-score terms, with the margin widening at longer horizons. Critically, the LORO experiment shows that a model predicting an entirely unseen zone matches, and at seven days slightly exceeds, the accuracy of a model that had seen that zone during training (mean R-squared of 0.996, 0.981 and 0.947; worst-zone 0.925). Feature-attribution analysis shows the forecasts rely on antecedent soil wetness and precipitation, whose relationship to future moisture is physically invariant across zones, explaining why transfer succeeds. These results provide quantitative evidence that spatially transferable models can extend smart-irrigation guidance to farms without local sensing infrastructure, reducing the data-collection barrier to large-scale deployment.

Paper id 1377

Paper title When Does BERT Help? A Cross-Domain Study of the Marginal Value of Text Embeddings Beyond Structured Features

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Abstract Adding a pretrained text embedding to a tabular model is practically a standard step in applied machine learning. However, we rarely ask whether the text embedding provides additional information beyond structured and metadata features. That is what we do in this study: We combine frozen DistilBERT embeddings, using the masked mean pooling technique, and domain-specific structured features and train Random Forest classifiers in four separate setups: popularity classification and topic classification for news articles and Reddit posts. For each setup we compute SHAP feature-group importance as well as group-level permutation importance as an additional robustness check. In addition, we compute paired-bootstrap 95% confidence intervals (with 2,000 bootstrap resamples) for the difference in accuracy between tabular-only and tabular+BERT setups.

The findings are quite specific: the two importance criteria agree on which structured feature group matters most in every setup. The BERT model brings statistically significant gain in only one of the four setups: for Reddit topic (subreddit) classification, in which case the accuracy increases by 17.8 percentage points (p less than 0.001). As for Reddit popularity prediction, the addition of BERT makes the classifier accuracy decrease by 2.9 points (p equals 0.008). Neither of the two news domain tasks shows any statistically significant change in accuracy (p between 0.06 and 0.08). The structural and metadata features remain the major contributors to per-feature importance in three out of four setups, regardless of adding BERT. The findings suggest an important boundary condition for frozen text embeddings. The additional dimensionality of their representation turns out to be justified only in case of lexical or topical target prediction tasks. Behavioral targets, or targets that are well-represented through structured features, are unlikely to benefit from adding BERT.

Paper id 1378

Paper title University Students' Utilization of Generative AI- Generated Solutions for Academic Problem Solving: An Extended Task–Technology Fit Model

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Abstract With the advent of Generative AI, it has become a widely used resource for academic assistance for university students. Students can leverage AI-generated solutions to gain insights into problems, brainstorm potential solutions, and formulate academic responses. But the use of generative AI doesn't guarantee the adoption of generative AI solutions. Students must evaluate if each solution fits with the academic problem. The purpose of this study was to explore how university students are using AI-generated solutions to solve academic problems. The study was an extension of the Task–Technology Fit theory with four antecedents. The antecedents were Academic Task Requirements, Generative AI Solution Quality, Interaction Quality and Explainability of AI-Generated Solutions. The data were obtained from 271 university students who had used generative AI in learning activities. An online questionnaire and convenience sampling were used for data collection. Partial least squares structural equation modeling was used for data analysis. The result indicated that all the four antecedents were positively influencing the Task–Technology Fit. The most powerful effect was seen for Generative AI Solution Quality, followed by Explainability of AI-Generated Solutions. Task–Technology Fit had a positive effect on Solution Utilization Level and mediated all four proposed relationships. Instead of focusing on the adoption of AI, the study focuses on the use of AI-generated solutions. The findings also offer insights for universities and educators on evaluating solutions, integrating responsibly and using generative AI in academic problem solving appropriately.

Paper id 1381

Paper title Topological Vision Transformer for Severity Aware Lung Disease Classification

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Abstract Radiological triage of pulmonary infection demands classifiers that separate 4 clinically distinct diagnoses. The label set covers coronavirus disease, unaffected anatomy, bacterial pneumonia and pulmonary tuberculosis. This work introduces a persistent homology pipeline that fuses topological descriptors with a chest X-ray pretrained trunk. Persistence extraction records connected component and loop counts across 8 sublevel filtration thresholds. A CheXNet pretrained DenseNet-121 convolutional neural network (CNN) anchors the trunk in the topological pipeline. An ordinal severity head enforces cumulative link ordering across the 4 clinical categories during training. Evaluation runs on 7135 radiographs from the public COVID-19 Radiography Database corpus under 5 fold stratified severity aware partitioning. The held out fold ordinal accuracy reaches 97.48% and macro F1 crosses 0.975 across the 4 severity categories. The 5 fold cross validation mean anchors at 95.17% with fold to fold standard deviation 0.40%. Ablation studies isolate the topological branch contribution against variants without persistence supervision on the 5 fold split. The persistent homology pipeline supports resource constrained radiological triage under United Nations Sustainable Development Goal 3.

Paper id 1383

Paper title HalluGuard-Med: An Explainable Framework for Grounded Medical AI and Clinical Claim Verification

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Abstract HalluGuard-Med integrates medical evidence retrieval, grounded answer generation, claim verification, and interpretable reliability reporting. We evaluate its text workflow on 300 source-attributed MedQuAD questions, distributed equally across six question types, using three variants under matched decoding: Raw MedGemma (no retrieved context), RAG-only (five retrieved candidates without pre-generation filtering or evidence-sufficiency context), and HalluGuard-Med (filtered evidence, evidence-sufficiency context, and claim-level post-generation audit), yielding 900 saved answers. A hybrid system audit against a common frozen evidence snapshot and a separate withheld-reference audit using a trained natural language inference model assess all outputs. System-audit strict support is 18.08% for Raw MedGemma, 61.86% for RAG-only, and 63.73% for HalluGuard-Med; the large increase occurs when retrieved context is introduced, while HalluGuard-Med adds only a descriptive 1.87 percentage points over RAG-only. These values measure agreement with an operational audit, not factual accuracy. Withheld-reference support is 30.98%, 29.09%, and 29.64%; the paired, stratified bootstrap difference between HalluGuard-Med and Raw MedGemma is −1.34 percentage points (95% interval [−4.53, +1.92]), which includes zero, so no improvement is established. Both audits are automatic proxies; the study establishes neither clinical accuracy nor clinical safety. The contribution is a reproducible experimental protocol for end-to-end audit and component comparison, with explicit limits on inference.

Paper id 1389

Paper title HalDetect: Entropy-Based Hallucination Detection for Medical LLMs

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Abstract Large language models (LLMs) deployed in medical question-answering systems are prone to hallucination — generating clinically reasonable but incorrect responses that pose serious risks to patient safety and clinical decision-making. Existing hallucination detection approaches are predominantly post-hoc, requiring complete response generation before assessment, rendering them unsuitable for real-time clinical applications. In this paper, we present HalDetect, a lightweight inference-time hallucination detection framework that attaches a calibrated uncertainty quantification head to a pre-trained biomedical LLM. During generation, HalDetect computes token-level Shannon entropy signals to identify and localise low-confidence spans indicative of hallucinated content — without requiring any external knowledge base or additional inference passes. We evaluate HalDetect on three medical QA benchmarks — MedQA, MedMCQA, and PubMedQA — demonstrating a hallucination detection F1 of 73.1%, balanced accuracy of 75.3%, and Matthews Correlation Coefficient (MCC) of 0.51, with 438ms latency overhead per query, outperforming perplexity-based baselines by 18.3 F1 points while remaining significantly faster than retrieval-augmented approaches. As part of ongoing work, we are extending this framework with a selective retrieval-augmented correction stage to form a complete hallucination detection and mitigation pipeline for clinical deployment.

Paper id 1390

Paper title Technical Quality of AI-Enabled EV Charging Applications and Users' Charging Management Experience: Evidence from Consumers in Vietnam

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Abstract The technical quality of the charging applications and a user's charging management experience for EVs in Vietnam with the support of AI are explored in this work. Five technical quality factors are studied. These factors are System Reliability, Charging Information Accuracy, Real-Time Responsiveness, AI Recommendation Quality and System Integration Quality. A quantitative research design was used. An online survey was used to collect data from 278 consumers in Vietnam. Convenience sampling was used. Reliability analysis and exploratory factor analysis were used to evaluate the measurement scales. Multiple linear regression was used to test the proposed relationships. The results show that all five technical quality factors have positive effects on Charging Management Experience. AI Recommendation Quality is most impactful. The second strongest effect is on System Integration Quality. There is also a significant impact on Charging Information Accuracy, System Reliability and Real-Time Responsiveness. The study contributes with evidence from the application layer of the electric vehicle charging ecosystem. It also offers a user-centric perspective on AI charging technologies in Vietnam. The results indicate that there is a need to enhance the intelligent recommendations, system integration, information correctness, application reliability, and the quality of real-time responses for developers and charging service providers. These enhancements can help make the charging management experience more enjoyable for EV users.

Paper id 1391

Paper title A Hybrid OCR-CNN-LLM Framework for Automated Medical Prescription Analysis

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Abstract Medical prescriptions are vital for healthcare professionals' and patients' communication but poor handwriting, poorly printed prescriptions, and manual interpretation can cause medication errors. Solving these challenges requires an automated and intelligent prescription analysis system. This work uses a hybrid framework and automatically analyzes handwritten and printed prescriptions by integrating deep learning, image processing, Optical Character Recognition (OCR), and Large Language Model (LLM). Transfer learning is used to train a Convolutional Neural Network (CNN) to identify drug names in handwritten prescriptions. Additionally, OCR techniques are used to retrieve text from printed prescriptions. A Large Language Model then processes the extracted text to retrieve structured medical information. Compared to conventional methods, this system increases accuracy and reduces manual effort.

Paper id 1392

Paper title Federated CNN with Diffusion Augmentation and Differentially Private Gradient Centralization for Lung Disease Classification

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Abstract Multi hospital deployment of chest X-ray classifiers requires patient level privacy during collaborative training. Federated learning removes central raw data pooling but leaves gradient exchanges vulnerable to inversion attacks. This work introduces a privacy hardened federated pipeline for chest radiograph classification across 3 clinical clients. The training loop combines differentially private gradient centralization with a diffusion style anchor MixUp augmenter. A CheXNet pretrained DenseNet-121 convolutional neural network (CNN) anchors the trunk on every federated client. A Renyi accountant composes the privacy budget across 25 communication rounds of federated learning. Evaluation uses 7135 federated client samples from the public COVID-19 Radiography Database federation with Dirichlet α 0.5 client partitioning. The federated held out fold accuracy reaches 97.34% and macro F1 crosses 0.976 across the 4 federated categories. The 5 fold outer partition mean anchors at 94.56% across the outer folds of the protocol. The federated privacy pipeline supports collaborative deployment under United Nations Sustainable Development Goal 3.

Paper id 1398

Paper title A Unified Trustworthy Framework for Tabular Decision Support with Conformal Calibration and Sandboxed Agent Execution

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Abstract We examine a decision-support pipeline where predictions, explanations, and code generated by an agent can each affect subsequent actions. The pipeline combines a gradient-boosted tree predictor, class-conditional Mondrian conformal calibration, a cost-sensitive human-review rule, and a ROAR assessment of TreeSHAP rankings. AST rules check generated SQL and Python before execution in a constrained container with rollback support. Pre-deployment stability checks and runtime action audits complete the workflow. The evaluation submitted with the paper reports 291,480 T20 ball-by-ball observations and 150,000 financial transactions with class imbalance. The provenance of these data and their split manifests have not been verified. For a nominal 90% target, minority-class coverage is reported as 89.8% ± 0.4%, compared with 28.6% ± 1.2% for marginal conformal prediction. The reported first-pass script success rates are 98.6% for ExecuGraph and 61.4% for the unconstrained agent. The reported rates of unsupported explanation claims are 1.8% with TreeSHAP grounding and 28.4% for unprompted LLM rationales ($\kappa = 0.84$). None of these results has been reproduced using documented splits. The contribution is an integration of established methods; the reported evidence does not show statistically significant gains over the class-conditional conformal baseline.

Paper id 1402

Paper title A Real-Time Multi-Engine Research Terminal for Precious-Metal Market Intelligence

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Abstract Market analysis frequently isolates price charts, orderbook observations, volatility estimates and risk calculations as independent tools. This paper presents Metals Terminal, a local application that gathers these measurements for the USDTdenominated gold and silver instruments XAUUSDT and XAGUSDT. A FastAPI service ingests historical candles and live WebSocket updates, runs an extensible registry of analysis engines, and sends finite, JSON-compatible snapshots to a browser interface. The terminal also provides technical overlays, an order-book view, bounded Monte Carlo scenarios, local telemetry and a desktoplaunch workflow. We analyze the weighted signal rule and its dependence on eight analytical families. Inspection of the available source reveals thirty-eight directly weighted engine outputs, with a The sum of the configured weights amounts to 1.41, and the trend/momentum factor accounts for 31.2% of it. This is a structural sensitivity finding rather than a prediction accuracy measure. Another validation reveals fifty-eight engines that have been registered, rather than seventy-one mentioned in the previous version of the paper; the specific historical validation revision could not be found. Implementation observations, computations from sources, and pending experiments are distinguished. A methodical reproducible approach to organizing multi-engine market analyses with local computing constraints is offered without making any claims about profitable trading.

Paper id 1404

Paper title AetherSea: AI-Powered Marine Debris Intelligence and Cleanup Route Optimisation

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Abstract Image denoising remains a challenging problem in image processing and computer vision, mainly because of complex textures, fine structural details, and high noise levels. Traditional methods like non-local means (NLM) and BM3D perform well under moderate noise but cause detail loss and artifacts in higher-noise cases because they rely on local pixel- wise similarity. By leveraging non-local self-similarity and perceptual losses, Deep learning-based approaches address some limitations; however, many problems require higher computational resources to balance noise removal and detail preservation. The present work introduces NSDFNet, a Neighbourhood and Self-Similarity Distance

Fusion Network for efficient, high-quality image denoising. NSDFNet uses three key modules in a multi-stage architecture. They are Neighbour Similarity Filtering, Non-Local Self-Similarity Distance, and an attention-based fusion module. The Neighbourhood Similarity Filtering (NSF) uses local variance to perform adaptive smoothing while preserving edges. The Non-Local Self- Similarity Distance (NLSSD) patch aggregation restores repetitive structures and textures by gathering perceptually and geometrically similar patches. The lightweight attention-based fusion and refinement module integrates outputs using channel attention and an encoder-decoder network. This technique delivers efficient results using datasets such as BSD500, Set12, and Kodak. The proposed method, NSDFNet, achieves superior performance across various metrics, including PSNR, SSIM, and LPIPS.

Paper id 1408

Paper title A Secure Transmission of Data Using A Token-Based Method Over Wireless Sensor Networks

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Abstract Wireless Sensor Networks (WSNs) consist of spatially distributed sensor nodes that cooperatively monitor physical or environmental conditions and transmit collected data to a base station. Efficient data transmission and energy conservation remain critical challenges because sensor nodes have limited power and computational resources. The Forward Token Method is a communication and coordination mechanism designed to enhance energy efficiency, reduce packet collisions, and improve network lifetime in WSNs. In the Forward Token Method, a control token is circulated sequentially among sensor nodes based on a predefined topology or dynamic routing structure. Only the node holding the token can transmit data, minimizing channel contention and redundant transmissions. After transmitting, the node forwards the token to the next eligible node in the network. This controlled-access mechanism ensures orderly communication, balanced energy consumption, and lower overhead than conventional contention-based protocols. The method can be integrated with clustering, routing, or duty-cycling strategies to optimize performance further. Simulation and analytical evaluations show that the Forward Token Method improves throughput, reduces latency in structured deployments, and significantly extends network lifetime, making it suitable for applications such as environmental monitoring, industrial automation, and smart infrastructure systems.

Paper id 1409

Paper title A Hybrid CNN–LSTM–DNN Framework for Electricity Theft Detection in Smart Grids

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Abstract Electricity theft continues to be a major contributor to non-technical losses in modern smart-grid distribution systems, affecting both operational reliability and
utility revenue management. Detecting this irregular consumption behavior has become increasingly challenging as smart meter data grows in scale and complexity. To address this problem, this work presents a hybrid deep-learning framework that combines convolutional neural networks (CNN), long shortterm memory (LSTM) networks, and deep neural networks (DNN) to identify abnormal electricity usage patterns in timeseries consumption data. The proposed architecture captures localized consumption variations through convolutional feature extraction while learning long-range temporal dependencies through sequential modeling. A structured preprocessing stage incorporating normalization and imbalance handling improves model robustness under heterogeneous consumption conditions. In addition, a monitoring interface supports real-time visualization and anomaly reporting to support utility-level decision-making. Experimental evaluation on large-scale smart meter datasets shows that the proposed hybrid framework achieves 94.6% detection accuracy, with improved precision–recall balance and reduced false alarm rates compared with conventional machine-learning and standalone deep-learning approaches. These results show that combining spatial and temporal feature learning within a unified architecture provides an effective, scalable solution for electricity theft detection in practical smart-grid environments.

Paper id 1410

Paper title NSDFNet: A Neighbourhood and Self-Similarity Distance Fusion Network for Robust Image Denoising

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Abstract Image denoising remains a challenging problem in image processing and computer vision, mainly because of complex textures, fine structural details, and high noise levels. Traditional methods like non-local means (NLM) and BM3D perform well under moderate noise but cause detail loss and artifacts in higher-noise cases because they rely on local pixel- wise similarity. By leveraging non-local self-similarity and perceptual losses, Deep learning-based approaches address some limitations; however, many problems require higher computational resources to balance noise removal and detail preservation. The present work introduces NSDFNet, a Neighbourhood and Self-Similarity Distance Fusion Network for efficient, high-quality image denoising. NSDFNet uses three key modules in a multi-stage architecture. They are Neighbourhood Similarity Filtering, Non-Local Self-Similarity Distance, and an attention-based fusion module. The Neighbourhood Similarity Filtering (NSF) uses local variance to perform adaptive smoothing while preserving edges. The Non-Local Self- Similarity Distance (NLSSD) patch aggregation restores repetitive structures and textures by gathering perceptually and geometrically similar patches. The lightweight attention-based fusion and refinement module integrates outputs using channel attention and an encoder-decoder network. This technique delivers efficient results using datasets such as BSD500, Set12, and Kodak. The proposed method, NSDFNet, achieves superior performance across various metrics, including PSNR, SSIM, and LPIPS.