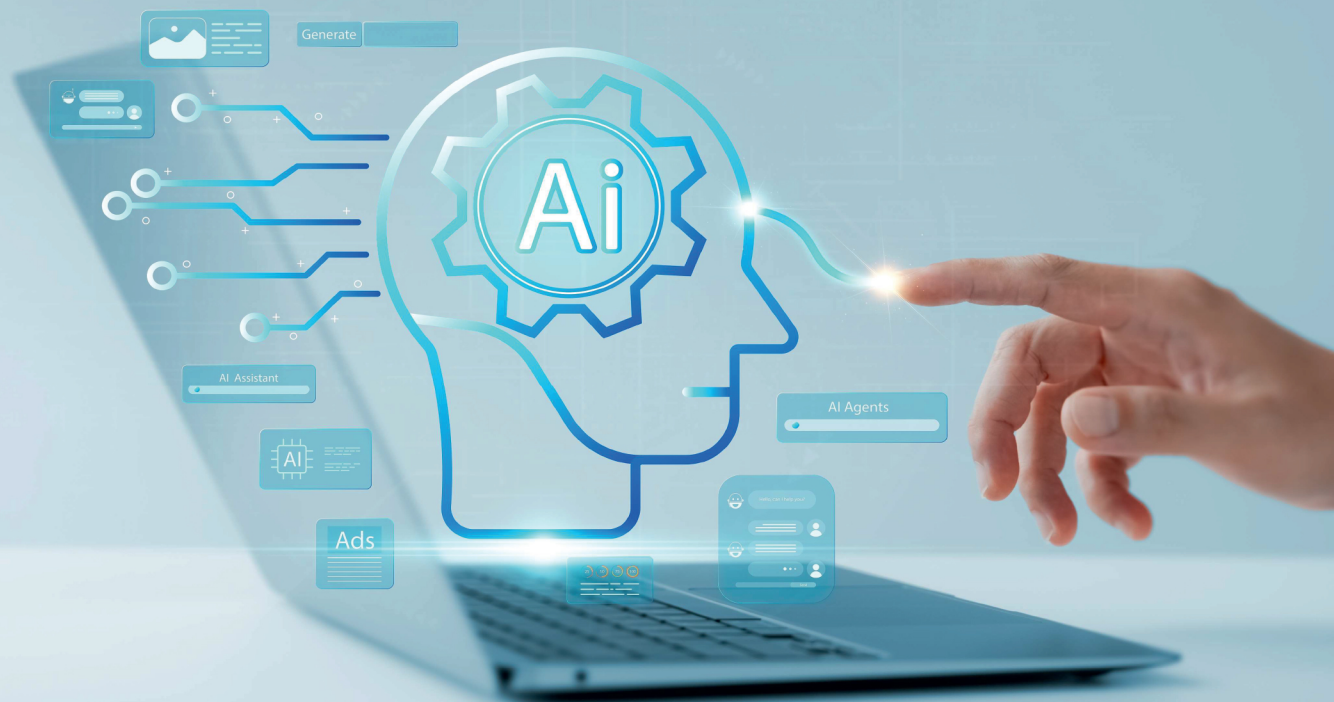


6th International Conference on Artificial
Intelligence-driven Computing, Analytics & Networks

ICAN²⁰²⁶

May 15 – 16, 2026 | Chitkara University, Punjab

Abstract Book



Organised by: Chitkara University Capacity Building Centre (CU-CBC),
Centre for Research Impact and Outcome (CRIO), Chitkara University

Publication Partner: Springer Nature

ICAN 2026

6th International Conference on Artificial Intelligence Driven Computing, Analytics and Networks

 **May 15th – 16th, 2026**

 **Chandigarh, India**

CALL FOR ABSTRACTS

Extended abstract submissions are due by **March 31st, 2026**

Theme and Topics

Transformative impact of AI on modern computing systems, data-driven analytics, and intelligent networked infrastructures

- ◆ Architectures, Agentic & Autonomous AI Systems
- ◆ Distributed, Federated & Collaborative AI
- ◆ Intelligent Networked Systems & AI-Driven Networking
- ◆ Trustworthy, Explainable & Responsible AI
- ◆ AI for Data Analytics, Smart Infrastructure & Sustainability

Why Submit to ICAN 2026?

- ◆ Guided abstract to journal publication pathway with expert support
- ◆ Engage with leading researchers from academia and industry
- ◆ Focused AI themes spanning agentic, distributed, and trustworthy AI systems
- ◆ Backed by a strong legacy of five successful editions
- ◆ Present high-quality research at a premier international forum and receive a presentation certificate

JOURNAL OF Transformative Technologies and Sustainable Development

Official Publication of Chitkara University



Publication Partner Springer Nature

Scopus indexed journals

Accepted and presented abstracts at ICAN 2026 will be invited to submit full-length manuscripts

SN Computer Science



A SPRINGER NATURE journal



Scan for more
details and to make
a submission

For detailed submission instructions, visit - www.chitkara.edu.in/cse-can
For queries, write to - cse-can@chitkara.edu.in



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Compiled by:

Dr. Sagar Juneja, Dr. Urvashi Tandon,
Dr. Renu Thakur, and Chanpreet Singh (Chitkara University)

Designed by:

Neeraj Pandey - Chitkara University

Student Team:

Suraj Thakur, Rajkumar, Tanya, and Lakshay Rana

About the Organizer – Chitkara University

Established in 1997 by the Chitkara Educational Trust, Chitkara University is a UGC-recognised Institution with campuses in Punjab and Himachal Pradesh. It has emerged as a premier centre for higher education, offering undergraduate, postgraduate, and doctoral programs across diverse disciplines, including engineering, management, healthcare, design, hospitality, and applied sciences.

Recognised for academic excellence, Chitkara University holds a NAAC A+ accreditation and features prominently in national and global rankings, including NIRF, QS, and Times Higher Education. Its strong industry-academia collaborations with global leaders like NVIDIA, SAP, Wipro, Infosys, and Dassault Systems ensure a curriculum that is research-driven, application-oriented, and aligned with industry needs. With over 300 international partnerships for student exchanges, research initiatives, and internships, the university provides a global learning experience.

Chitkara University is a leader in career readiness, with over 2,000 recruiters visiting annually and students securing top placements across industries. It fosters innovation and entrepreneurship through dedicated incubation centres, supporting start-ups and leadership development. With cutting-edge infrastructure, modern labs, and a strong emphasis on real-world learning, Chitkara University continues to shape future-ready professionals equipped to excel in a dynamic global landscape.



Overview of the ICAN Conference Series

The **International Conference on Computing, Analytics, and Networks (ICAN)**, initiated by Chitkara University in 2017, has evolved into a premier global forum for the dissemination and discussion of cutting-edge research in the domains of computing, data analytics, and networked systems. Conceived with the objective of addressing contemporary challenges in Computer Science and Engineering, ICAN has consistently brought together researchers, academicians, and industry professionals to foster innovation, collaboration, and knowledge exchange.

The inaugural edition, ICAN 2017, laid a strong foundation with international collaboration and publication support from Springer Nature, with proceedings published in the CCIS series. Building on this momentum, the second edition, ICAN 2020, marked a significant milestone by adopting a unique international format across two countries. It was jointly organized with National Chung Cheng University, Taiwan and received technical sponsorship from IEEE. The accepted papers were published on IEEE Xplore, with extended versions appearing in the SN Computer Science journal by Springer Nature, further strengthening the conference's global academic footprint.

Over the years, ICAN has witnessed remarkable growth in participation, attracting high-quality research submissions from across India and countries including the USA, France, Germany, Taiwan, Indonesia, Malaysia, Saudi Arabia, Nigeria, Morocco, Hong Kong, Korea, and Bangladesh. The conference has maintained a rigorous peer-review process supported by an extensive network of experts, often involving hundreds of reviewers, ensuring the selection of impactful and relevant research contributions. With hundreds of submissions and a competitive acceptance rate, ICAN has established itself as a credible platform for presenting high-quality scholarly work.

The conference has consistently featured participation from leading academic institutions such as Indian Institute of Technology Kharagpur, Indian Institute of Technology Indore, Indian Institute of Technology Ropar, IIIT Bangalore, University of Memphis, and Universiti Malaysia Pahang, alongside active engagement from industry leaders and practitioners from organizations such as Bose Corporation, Infosys, Coursera, Fractal Analytics, and Xenonstack. This strong academia–industry convergence has been a defining feature of the conference series.

ICAN has been organized in both hybrid and in-person formats, enabling broad global participation. Each edition features multiple technical sessions, thematic tracks, and interactive forums designed to encourage dialogue on emerging areas such as artificial intelligence, data engineering, cybersecurity, Internet of Things, and intelligent systems. The conference has also incorporated panel discussions, student symposiums, and collaborations with professional bodies such as ACM India and its regional chapters, further enriching the academic and professional experience.

A key strength of ICAN lies in its strong publication partnerships. Accepted papers have been disseminated through reputed platforms including Springer Nature journals and IEEE Xplore, many of which are indexed in leading databases such as Scopus. These collaborations have significantly enhanced the visibility, credibility, and impact of the research presented at the conference.

As the conference enters its sixth edition in 2026, it embraces a forward-looking vision by placing Artificial Intelligence at the core of its thematic focus. This progression reflects the evolving technological landscape and reinforces ICAN's commitment to staying at the forefront of research and innovation. By continuing to provide a dynamic and inclusive platform, ICAN aims to contribute meaningfully to the advancement of knowledge and the development of next-generation technologies.



Theme of ICAN 2026

The sixth edition of the International Conference on Artificial Intelligence-driven Computing, Analytics, and Networks (ICAN 2026), organized by Chitkara University, marks a significant progression in the conference series by placing Artificial Intelligence (AI) at the core of its thematic focus. It was held on May 15–16, 2026 in hybrid mode, ICAN 2026 builds upon the strong legacy of its previous editions while aligning itself with the rapidly evolving technological landscape.

The central theme of ICAN 2026 revolves around the transformative role of AI in redefining modern computing systems, enabling advanced data-driven analytics, and shaping intelligent networked infrastructures. As AI continues to emerge as the backbone of contemporary technological innovation, driving automation, enhancing decision-making, and unlocking new possibilities across industries, the conference seeks to explore both its opportunities and associated challenges in depth.

ICAN 2026 aims to serve as a premier platform for researchers, academicians, and industry practitioners to exchange ideas, present cutting-edge research, and deliberate on emerging trends in AI-driven systems. The conference emphasizes the design, development, and deployment of intelligent technologies that are scalable, efficient, and responsible, while also addressing critical concerns related to trust, ethics, and governance in AI.

The thematic scope of the conference encompasses a broad spectrum of contemporary research areas, including computing architectures for general, agentic, and collective AI; self-learning and autonomous systems; intelligent and AI-driven networking; distributed and federated AI paradigms; and large-scale data analytics and knowledge discovery. In addition, ICAN 2026 highlights the growing importance of trustworthy, explainable, and responsible AI, along with its applications in cyber-physical systems, smart infrastructure, sustainable computing, and business transformation.

By integrating academic rigor with industry relevance, ICAN 2026 will feature expert talks by leading researchers and practitioners, alongside technical sessions that provide a valuable platform for young researchers to showcase their high-quality and impactful work. Through this comprehensive thematic focus, the conference aspires to contribute meaningfully to the advancement of AI-driven technologies and their responsible adoption in solving real-world challenges.

An indicative list of topics covered in ICAN 2026 is as follows:

- Computing Architectures for General, Agentic, and Collective AI
- Agentic AI and Self-Learning Autonomous Systems
- Intelligent Networked Systems and AI Driven Networking
- Distributed, Federated, and Collaborative AI
- Trustworthy, Explainable, and Responsible AI
- AI for Large-Scale Data Analytics and Knowledge Discovery
- AI-Enabled Cyber-Physical and Smart Infrastructure Systems
- AI for Sustainable and Energy-Efficient Computing
- Trustworthy and Responsible AI Systems: Ethical and Governance Challenges
- AI for Sustainable and Efficient Computing
- AI-Driven Management and Business Transformation
- Advancements, Emerging Trends, and Practical Challenges of AI in Business Management

Reflections from the Core Team

Message from the Honorary Chairperson



Dr. Madhu Chitkara | Pro Chancellor, Chitkara University

I warmly welcome all delegates to the 6th International Conference on Artificial Intelligence-driven Computing, Analytics, and Networks (ICAN 2026) and to the campus of Chitkara University. As ICAN 2026 embraces an Artificial Intelligence-driven future, it reflects Chitkara University's strong commitment to advancing AI in both education and research. The University has actively integrated AI-focused programs, interdisciplinary curricula, and hands-on learning opportunities to prepare students for the evolving technological landscape. Alongside this, a growing emphasis on impactful AI research continues to drive innovation across domains such as computing, analytics, and intelligent systems. ICAN 2026 builds on this vision by creating a platform for meaningful dialogue and knowledge exchange. I extend my best wishes to all participants for a productive and enriching conference experience.

Message from the General Chairs



Dr. Rajnish Sharma | Vice Chancellor, Chitkara University, Himachal Pradesh

It is a privilege to welcome you to ICAN 2026, as we continue the journey of a conference that was envisioned in 2017 as a platform to bring together the global research community in computing, analytics, and networks. Over the years, ICAN has grown steadily in scale, scope, and impact thereby fostering meaningful collaborations, attracting high-quality research contributions, and building strong academic and industry linkages. Each edition has strengthened our commitment to academic excellence and knowledge exchange, and it is gratifying to see how the conference has evolved into a recognized international forum. As the technological landscape evolves, the inclusion of Artificial Intelligence as the central theme of ICAN 2026 is both timely and essential. AI now serves as a unifying force across computing, analytics, and networks, and this focus reflects our commitment to aligning the conference with emerging global priorities while fostering innovation and dialogue in AI-driven systems.



Dr. Amit Mittal | Pro-Vice Chancellor, Research Programs, Chitkara University, Punjab

I am delighted to welcome you to ICAN 2026, which marks a significant step forward with its focused emphasis on Artificial Intelligence as a central theme. As AI continues to transform the way we design systems, analyze data, and drive innovation across industries, this edition of the conference aims to explore its vast potential and emerging challenges. By bringing together researchers, academicians, and industry practitioners, ICAN 2026 seeks to promote meaningful dialogue on AI-driven computing, analytics, and intelligent networks. I am confident that this focused direction will not only enhance the relevance of the conference but also inspire meaningful research and collaboration among participants.

Message from the Technical Program and Publication Chair



Dr. Sagar Juneja | Associate Director, Research, Chitkara University, Punjab

I welcome all delegates to ICAN 2026. This year, the conference received a total of 858 submissions across three tracks from 16 countries, reflecting strong global interest in AI-driven computing, analytics, and networks. Following a rigorous evaluation process, 220 papers have been selected for presentation across 36 technical sessions.

I would like to express my sincere appreciation to the Track Chairs, Reviewers, and Session Chairs for their dedicated efforts in ensuring a fair, thorough, and high-quality evaluation process. Their contributions have been instrumental in curating a strong technical program for the conference. I look forward to engaging discussions and meaningful exchanges during ICAN 2026, and I wish all participants a productive conference experience.

Committees

Core Committee

Honorary Chairpersons	Dr. Ashok K Chitkara - Chancellor, Chitkara University Dr. Madhu Chitkara - Pro Chancellor, Chitkara University
General Chairs	Dr. Rajnish Sharma - Vice Chancellor, Chitkara University, Himachal Pradesh Dr. Amit Mittal - Pro Vice Chancellor, Research Programs, Chitkara University, Punjab
Technical Program and Publication Chair	Dr. Sagar Juneja - Associate Director (Research), Chitkara University, Punjab, India
Track Chairs	Dr. Deepali Gupta - Professor & Director (Research), Chitkara University, Punjab, India Dr. Vinay Kukreja - Professor & Director (Research), Chitkara University, Punjab, India Dr. Kalpna Guleria - Professor (Research), Chitkara University, Punjab, India Dr. Ashu Taneja - Professor (Research), Chitkara University, Punjab, India Dr. Rishu Chhabra - Dean (CSE), Chitkara University, Punjab, India Dr. Ruchi Mittal - Professor (Computer Applications), Chitkara University, Punjab, India Dr. Pradeepta K. Sarangi - Professor (CSE), Chitkara University, Himachal Pradesh, India
Outreach and Collaboration Chair	Dr. Balraj Verma - Associate Professor, DRC, CBS, Chitkara University, Punjab
Local Organizing Chairs	Dr. Urvashi Tandon - Dean, DRC, CBS, Chitkara University, Punjab, India Dr. Renu Ranjit Thakur - Professor (Research), Chitkara University, Punjab, India
Workshop and Tutorial Chairs	Dr. Shalli Rani - Director (Research), Chitkara University, Punjab, India Dr. Ayush Dogra - Assistant Director (Research), Chitkara University, Punjab, India
Track Co-Chairs	Dr. Saravjeet Singh - Associate Professor (CSE), Chitkara University, Punjab, India Dr. Rani Kumari - Associate Professor (CSE), Chitkara University, Himachal Pradesh, India Dr. Himanshi Babbar - Assistant Professor (Research), Chitkara University, Punjab, India Dr. Nikhil Srivastava - Assistant Professor (Research), Chitkara University, Punjab, India
Local Organizing Team Coordinators	Chanpreet Singh - Senior Project Manager (Research), Chitkara University, Punjab, India Namita Sharma - Manager (Research Programs), Chitkara University, Punjab, India Lovit Kumar - Assistant Manager (Research), Chitkara University, Punjab, India
Masters of Ceremonies	Dr. Tanvi Verma, Assistant Professor (CBS), Chitkara University, Punjab, India Dr. Renu Ranjit Thakur, Professor (Research), Chitkara University, Punjab, India Shefali Sharma – JRF, Doctoral Research Center, Chitkara University, Punjab, India

Advisory Committee

S. No	Name	Affiliation
1	Dr. Pao-Ann Hsiung	Professor, Computer Science and Information Engineering, National Chung Cheng University, Taiwan
2	Dr. Fausto Pedro García Márquez	Professor, ETSI Industrial, Universidad Castilla-La Mancha, Spain
3	Dr. M N Hoda	Founder Director, Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi, India
4	Dr. Neeraj Goel	Associate Professor, CSE, IIT, Ropar, Punjab, India
5	Dr. Bipin Kumar	Scientist 'F', Indian Institute of Tropical Meteorology, Pune, India
6	Dr. Sudarsun Santhiappan	Chief AI Scientist, BUDDI AI, Chennai, Tamil Nadu, India
7	Dr. Suman Roy	Consulting Member of Tech Staff, Oracle India Pvt Ltd., Bengaluru, India
8	Dr. Challa Rama Krishna	Professor and Head, CSE, NITTTR Chandigarh, India
9	Dr. Daniel Lai	Associate Professor, Deakin University, School of Information Technology, Australia
10	Dr. Chun-Hsiang Huang	Associate Professor (EE), National Changhua University of Education, Taiwan
11	Dr. Raman Singh	School of Computing, University of the West of Scotland, United Kingdom
12	Dr. Shubhajit Datta	Head, CSE (Data Science) Heritage Institute of Technology, Kolkata, West Bengal, India
13	Dr. Akhilesh Kumar Sharma	Head, Department of Data Science & Engineering, Manipal University, Jaipur, Rajasthan, India

Technical Program Committee (TPC)

The following members are listed in the order in which their consent to serve on the TPC was received.

S. No.	Name	Affiliation
1	Dr. Ashish Kumar	Chitkara University, Punjab
2	Jyotir Moy Chatterjee	Graphic Era University, Uttarakhand
3	Dr. Gaurav Gupta	Shoolini University, Himachal Pradesh
4	Sonu Pant	DIT University, Dehradun, Uttarakhand
5	Dr. Balwinder singh	C-DAC Mohali, Punjab
6	Dr. Amandeep Kaur	Chitkara University, Punjab
7	Jerwin Prabu A	Addverb Technologies, India
8	Dr. Simi Surendran	Amrita Vishwa Vidyapeetham, Kerala
9	Dr. Chetna Kaushal	Chitkara University, Punjab
10	Dr. Chintoo Kumar	GITAM, Bengaluru
11	Dr. Shyam Akashe	ITM University Gwalior, Madhya Pradesh
12	Dr. Jatin Arora	Chitkara University, Punjab
13	Dr. Deepak Kumar Verma	Marwadi University, Gujarat
14	Dr. Ekta Maini	Amity University, Hyderabad
15	Dr. Amrita	Patna Women's College, Patna University, Bihar
16	Dr. Mudita	IILM University, Greater Noida, Uttar Pradesh
17	Dr. Umesh Raut	Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra
18	Dr. Rajat Garg	DBS Global University, Punjab
19	Dr. Vandana Sharma	Christ University, Delhi NCR Campus, New Delhi
20	Dr. Sandip Sonawane	R. C. Patel Institute of Technology, Shirpur, Maharashtra
21	Dr. Gaganpreet Kaur	Chitkara University, Punjab
22	Dr. Dillip Rout	Royal Global University, Guwahati, Assam
23	Dr. Richa Makhijani	Indian Institute of Information Technology, Nagpur, Maharashtra
24	Dr. Renu Popli	Chitkara University, Punjab
25	Prakash Hegade	IIT Ropar, Punjab
26	Dr. Ashish Sharma	GLA University, Mathura, Uttar Pradesh
27	Dr. Sumedha Sirsikar	Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra
28	Prakash Velusamy	CVS Health, USA
29	Dr. Deepak Punetha	Motilal Nehru National Institute of Technology Allahabad, Prayagraj, Uttar Pradesh
30	Dr. Neha Sharma	Chitkara University, Punjab
31	Dr. Richa Vijay	IILM University, Punjab
32	Dr. Vatsala Anand	Akal University, Punjab
33	Dr. Shweta Sharma	Goswami Ganesh Dutta Sanatan Dharma College, Chandigarh
34	Dr. Veena Goswami	Kalinga Institute of Industrial Technology, Bhubaneswar, Odisha
35	Dr. Sarita Gulia	Amity University Haryana
36	Dr. Ashish Kumar Singh	Graphic Era (Deemed to be University), Dehradun, Uttarakhand
37	Dr. Amit Sinhal	JK Lakshmipat University, Jaipur, Rajasthan
38	Dr. Amanpreet Kaur	Chitkara University, Punjab

S. No.	Name	Affiliation
39	Dr. Nilesh Kumar Jain	Parul University, Vadodara
40	Dr. Jagreet Kaur	Xenonstack Private Limited, Chandigarh
41	Dr. Rajasekaran S	University of Technology and Applied Sciences, Ibri, Oman
42	Dr. Sangeetha Annam	Chitkara University, Punjab
43	Dr. Arpana Sinhal	Manipal University, Jaipur, Rajasthan
44	Dr. Kamal Saluja	Chitkara University, Punjab
45	Dr. Girish Sapra	Greenbrigade Pvt. Ltd., Punjab
46	Dr. Divya Singla	State Institute of Engineering & Technology, Panchkula, Haryana
47	Dr. Savita Wadhawan	Chitkara University, Punjab
48	Dr. S. Mahalakshmi	BMS Institute of Technology and Management, Bengaluru
49	Dhajvir Singh Rai	Dev Bhoomi Uttarakhand University, Uttarakhand
50	Dr. SSVR Kumar Addagarla	Nadimpalli Satyanarayana Raju Institute of Technology, Andhra Pradesh
51	Dr. Charu Jain	Xebia IT Architects India Pvt Ltd, Bengaluru
52	Dr. Tripti Sharma	Maharaja Surajmal Institute of Technology, New Delhi
53	Dr. Ajay Kumar Vyas	Adani University, Gujarat
54	Dr. Balasubramani S	Koneru Lakshmaiah Education Foundation, Andhra Pradesh
55	Dr. Htet Ne Oo	Chitkara University, Punjab
56	Dr. Susheela Hooda	Chitkara University, Punjab
57	Dr. Saroj Kumar	DCG Datacore Systems (India) Private Limited, West Bengal
58	Dr. R. Aiyshwariya Devi	RMK College of Engineering & Technology, Tamil Nadu
59	Dr. Vibhash Yadav	Rajkiya Engineering College, Banda, Uttar Pradesh
60	Dr. Ripal Ranpara	Marwadi University, Gujarat
61	Dr. Surbhi Sharma	Thapar Institute of Engineering and Technology, Punjab
62	Dr. Suresh Vishnudas Limkar	Central University of Jammu, Jammu & Kashmir
63	Dr. Kalpesh Popat	Marwadi University, Gujarat
64	Dr. Seema Rawat	Astana IT University, Kazakhstan
65	Dr. Narendra Kumar Dewangan	Telecom Paris, France
66	Dr. Sobia Habib	Amity University, Noida, Uttar Pradesh
67	Dr. Tanu Shree	ITS Engineering College, Uttar Pradesh
68	Nirmal Kumar Jingar	Wayfair, USA
69	Dr. Meena Pundir	Chandigarh University, Punjab
70	Dr. Shagun Sharma	VIT Bhopal University, Sehore, Madhya Pradesh
71	Dr. Sunil Kumar Chawla	Chitkara University, Punjab
72	Dr. Amit Gupta	Manipal University, Jaipur, Rajasthan
73	Dr. Sunita Tiwari	G B Pant DSEU Campus, New Delhi
74	Dr. Seema Gulati	Graphic Era Hill University, Dehradun, Uttarakhand
75	Dr. Dhavleesh Rattan	Punjabi University, Patiala, Punjab
76	Dr. Sushil Kumar	Delhi Skill and Entrepreneurship University, New Delhi
77	Dr. Nikhil Kumar Marriwala	UIET, Kurukshetra University, Kurukshetra, Haryana

Statistics and Highlights of ICAN 2026

The 6th International Conference on Artificial Intelligence driven Computing, Analytics, and Networks (ICAN 2026), the flagship AI conference of Chitkara University, reflects a significant milestone in the conference series with its strong global participation, rigorous selection process, and focused emphasis on Artificial Intelligence–driven research.

Building on its established legacy, ICAN 2026 has attracted substantial interest from the global research community, reaffirming its position as a credible platform for high-quality scholarly exchange in the domains of computing, analytics, and intelligent networked systems.

Key Statistics:

- Total Number of Submissions Received: 858
- Participating Countries: 16 (including India, Colombia, Egypt, Ethiopia, Finland, Ghana, Indonesia, Japan, Malaysia, Nepal, Singapore, USA, Uzbekistan, Vanuatu, Zambia, and Zimbabwe)
- Total Number of Papers Selected for Presentation: 220
- Total Number of Technical Sessions: 36
- Pan-India Participation: Submissions received from institutions across the country, representing diverse regions and leading academic and research institutions.

ICAN 2026 demonstrates a competitive selection process, ensuring that only high-quality and impactful research contributions are presented at the conference. The wide international representation highlights the growing global outreach of the conference, while strong participation from across India underscores its national significance.

With its focused emphasis on Artificial Intelligence and its applications across computing, analytics, and networks, ICAN 2026 continues to strengthen its identity as a leading platform for advancing AI-driven research and innovation.



Invited Speakers and Resource Persons of ICAN 2026



Dr. Sudatta Kar

VP & Head of Engineering,
Capgemini Engineering, India



Dr. Sudarsun Santhiappan

Chief Artificial Intelligence Scientist, Buddi AI
and Adjunct Faculty – Wadhvani School of
Data Science and Artificial Intelligence, IIT Madras



Dr. Pao-Ann Hsiung

Director of the Research Center on AI and Sustainability,
National Chung Cheng University, Taiwan



Kundan Das

Co-Founder, 4.0SmartIndustry Advisory
Solution Pvt. Ltd.



Dr. Sanjeev Kumar

Scientist F, Biomedical Instrumentation,
Professor, AcSIR, CSIR-CSIO, Chandigarh, India



Dr. Ranjan Jha

Scientist E, Biomedical Instrumentation,
Associate Prof., AcSIR, CSIR-CSIO, Chandigarh, India

Session Chairs

S. No.	Name & Affiliation
1	Dr. Surbhi Sharma (Thapar Institute of Engineering and Technology, Punjab)
2	Dr. Simranjit Singh (Punjab Engineering College, Chandigarh)
3	Dr. Jitendra Virmani (CSIR-CSIO, Chandigarh)
4	Dr. Roopali Garg (UIET, Panjab University, Chandigarh)
5	Jerwin Prabu A (Addverb Technologies, India)
6	Dr. S. Mahalakshmi (BMS Institute of Technology and Management, Bengaluru)
7	Dr. Rakesh Kumar (Central University of Haryana, Mahendergarh)
8	Dr. Kanu Goel (Punjab Engineering College, Chandigarh)
9	Dr. Sneha Kabra (University of Delhi, New Delhi)
10	Dr. Sudarsun Santhiappan (Buddi AI, Chennai)
11	Daljeet Singh (University of Oulu, Finland)
12	Dr. Muhammad Azeem Akbar (LUT University, Finland)
13	Dr. Ekta Maini (Amity University, Hyderabad)
14	Dr. Seemanthini K (B.M.S. College of Engineering, Bengaluru)
15	Dr. Meenakshi Anurag Thalor (AISSMS Institute of Information Technology, Pune)
16	Dr. Kapil Tomar (Thapar Institute of Engineering and Technology, Punjab)
17	Dr. Pardeep Mittal (Kurukshetra University)
18	Dr. Dinesh Singh (Deenbandhu Chhotu Ram University of Science and Technology, Murthal)
19	Dr. R. John Martin (Jazan University, Kingdom of Saudi Arabia)
20	Dr. Megha Bhushan (University of Seville, Spain)
21	Dr. Harpreet Kaur (Punjabi University, Patiala)
22	Dr. Sudesh Rani (Punjab Engineering College, Chandigarh)
23	Dr. Nirvair Neeru (Punjabi University, Patiala)
24	Dr. Rajasekaran S (University of Technology and Applied Sciences, Oman)
25	Dr. Balwinder Singh (C-DAC Mohali, Punjab)
26	Dr. Mamta Juneja (UIET, Panjab University, Chandigarh)
27	Dr. Maitreyee Dutta (NITTTR, Chandigarh)
28	Dr. Kiran Jyoti (Guru Nanak Dev Engineering College, Ludhiana, Punjab)
29	Dr. Anil Kumar Verma (Thapar Institute of Engineering and Technology, Punjab)
30	Dr. Sakshi Kaushal (UIET, Panjab University, Chandigarh)
31	Dr. Dhavleesh Rattan (Punjabi University, Patiala)
32	Dr. Sanjeev Sofat (Punjab Engineering College, Chandigarh)
33	Dr. Vikram Goyal (IIIT Delhi, New Delhi)
34	Dr. Nanhay Singh (Netaji Subhas University of Technology, New Delhi)
35	Dr. Arun Sharma (IGDTUW, New Delhi)
36	Dr. Tripti Sharma (Maharaja Surajmal Institute of Technology, Janakpuri, New Delhi)

Technical Program of ICAN 2026

Day 1: May 15, 2026

Timing	Program
9:30 AM – 10:00 AM	Registration and Tea Foyer, Ground Floor, Martin Luther Block
10:00 AM – 11:30 AM	Paper Presentations in 9 Parallel Tracks First Floor, Martin Luther Block
11:30 AM – 11:50 AM	High Tea Foyer, First Floor, Martin Luther Block
12:00 Noon – 1:00 PM	Inaugural Ceremony Carnegie Hall, Ground Floor, Rockefeller Block Introduction and Welcome: Dr. Sagar Juneja - Associate Director, Research, Chitkara University, Punjab Publication Chair and Convener, ICAN 2026 Lamp Lighting Words of Wisdom by: Dr. Madhu Chitkara - Pro Chancellor, Chitkara University Inaugural Addresses: Dr. Rajnish Sharma - Vice Chancellor, Chitkara University, Himachal Pradesh General Chair, ICAN 2026 Dr. Sandhir Sharma - Vice Chancellor, Chitkara University, Punjab Felicitation Ceremony Vote of Thanks: Dr. Amit Mittal – Pro VC Research Programs, Chitkara University, Punjab General Chair, ICAN 2026
1:00 PM – 2:00 PM	Keynote Talks Building AI Native Systems for a World in Constant Change by Dr. Sudatta Kar - VP & Head of Engineering, Capgemini Engineering, India How Should Students Become Ready for Facing AI as an Assistant, as a Partner, and as a Competitor? by Dr. Sudarsun Santhiappan - Chief Artificial Intelligence Scientist, Buddi AI and Adjunct Faculty – Wadhvani School of Data Science and Artificial Intelligence, IIT Madras
2:00 PM – 3:00 PM	Lunch Haveli, Ground Floor, IHM Block
3:00 PM – 4:30 PM	Paper Presentations in 9 Parallel Tracks First Floor, Martin Luther Block

Day 2 (D2): May 16, 2026: Virtual Mode on Zoom

Timing	Program
10:00 AM – 11:30 AM	Paper Presentations in 9 Parallel Tracks
11:30 AM – 11:45 AM	Break
11:45 AM – 12:45 PM	Invited Talks The \$100 Trillion Convergence: Energy, AI, and the Global Infrastructure Supercycle by Kundan Das – Co-Founder, 4.0SmartIndustry Advisory Solution Pvt Ltd. AI-based Law Enforcement in Smart Cities by Dr. Pao-Ann Hsiung - Director of the Research Center on AI and Sustainability, National Chung Cheng University, Taiwan
12:45 PM – 1:30 PM	Lunch Break
1:30 PM – 3:00 PM	Paper Presentations in 9 Parallel Tracks
3:00 PM – 3:30 PM	Valedictory

Zoom Link for the Entire Conference



Schedule of Paper Presentations

Day 1: May 15, 2026

Paper Presentations in 9 Parallel Tracks, Morning (M)				
Tracks 1.1, 2.1, 3.1, 1.2, and 2.2 to be held in Physical Mode (P)				
Tracks 3.2, 1.3, 2.3, and 3.3 to be held in Online (O) mode on ZOOM				
10:00 AM – 11:30 AM	Track 1.1 - Computing (P)(M)	Track Chair Dr. Ruchi Mittal	Session Chair : Dr. Pardeep Mittal (Kurukshetra University, Haryana)	CMT Paper IDs: 285, 411, 236, 59, 204, 283
	Track 2.1 - Analytics (P)(M)	Track Chair: Dr. Deepali Gupta	Session Chair: Dr. Balwinder Singh (C-DAC Mohali, Punjab)	CMT Paper IDs: 191, 199, 136, 186, 11, 15
	Track 3.1 - Networks (P)(M)	Track Chair Dr. Ashu Taneja	Session Chair: Dr. Surbhi Sharma (Thapar Inst. of Engg. and Tech., Punjab)	CMT Paper IDs: 702, 182, 811, 897, 547, 149

10:00 AM – 11:30 AM	Track 1.2 - Computing (P)(M)	Track Co-Chair: Dr. Himanshi Babbar	Session Chair: Dr. Sudarsun Santhiappan (<i>Buddi AI, Chennai</i>)	CMT Paper IDs: 653, 389, 576, 626, 544, 669
	Track 2.2 - Analytics (P)(M)	Track Chair: Dr. Kalpna Guleria	Session Chair: Dr. Anil Kumar Verma (<i>Thapar Inst. of Engg. and Tech., Punjab</i>)	CMT Paper IDs: 269, 296, 334, 222
	Track 3.2 - Networks (O)(M)	Track Chair: Dr. Pradeepta Sarangi	Session Chair: Jerwin Prabu A (<i>Addverb Technologies, India</i>)	CMT Paper IDs: 5, 50, 69, 68, 70, 47
	Track 1.3 - Computing(O)(M)	Track Chair: Dr. Rishu Chhabra	Session Chair: Dr. Harpreet Kaur (<i>Punjabi University, Patiala</i>)	CMT Paper IDs: 271, 305, 323, 58, 240
	Track 2.3 - Analytics (O)(M)	Track Co-Chair: Dr. Nikhil Srivastava	Session Chair: Dr. Vikram Goyal (<i>IIIT Delhi, New Delhi</i>)	CMT Paper IDs: 133, 128, 276, 244, 203, 2
	Track 3.3 - Networks (O)(M)	Track Co-Chair: Dr. Rani Kumari	Session Chair: Dr. Ekta Maini (<i>Amity University, Hyderabad</i>)	CMT Paper IDs: 465, 247, 115, 274, 462, 436

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Tracks 1.4, 2.4, 3.4, 1.5, and 2.5 to be held in Physical Mode (P)
Tracks 3.5, 1.6, 2.6, and 3.6 to be held in Online (O) mode on ZOOM

3:00 PM – 4:30 PM	Track 1.4 - Computing (P)(A)	Track Chair Dr. Ruchi Mittal	Session Chair: Dr. Dinesh Singh (<i>Deenbandhu Chhotu Ram Univ. of S&T, Murthal</i>)	CMT Paper IDs: 548, 494, 493, 533, 476, 598, 480
	Track 2.4 - Analytics (P)(A)	Track Chair Dr. Deepali Gupta	Session Chair: Dr. Mamta Juneja (<i>UIET, Panjab University, Chandigarh</i>)	CMT Paper IDs: 687, 673, 683, 458, 479, 541, 448
	Track 3.4 - Networks (P)(A)	Track Chair Dr. Ashu Taneja	Session Chair: Dr. Simranjit Singh (<i>Punjab Engineering College, Chandigarh</i>)	CMT Paper IDs: 652, 416, 709, 399, 643
	Track 1.5 - Computing (P)(A)	Track Co-Chair Dr. Himanshi Babbar	Session Chair: Dr. Sneha Kabra (<i>University of Delhi, New Delhi</i>)	CMT Paper IDs: 714, 758, 727, 649, 633, 752
	Track 2.5 - Analytics (P)(A)	Track Chair Dr. Kalpna Guleria	Session Chair: Dr. Sakshi Kaushal (<i>UIET, Panjab University, Chandigarh</i>)	CMT Paper IDs: 763, 698, 743, 885, 767, 781
	Track 3.5 - Networks (O)(A)	Track Chair Dr. Pradeepta Sarangi	Session Chair: Dr. S. Mahalakshmi (<i>BMS Inst. of T&M, Bengaluru</i>)	CMT Paper IDs: 569, 488, 514, 570, 513, 481
	Track 1.6 - Computing (O)(A)	Track Chair Dr. Rishu Chhabra	Session Chair: Dr. Sudesh Rani (<i>Punjab Engineering College, Chandigarh</i>)	CMT Paper IDs: 405, 324, 364, 379, 363, 439, 308
	Track 2.6 - Analytics (O)(A)	Track Co-Chair Dr. Nikhil Srivastava	Session Chair: Dr. Tripti Sharma (<i>Maharaja Surajmal Inst. of Tech., New Delhi</i>)	CMT Paper IDs: 846, 395, 400, 373, 287, 313, 371
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Day 2 (D2): May 16, 2026: Virtual Mode on Zoom

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10:00 AM – 11:30 AM	Track 1.7 - Computing (O)(M)D2	Track Chair Dr. Ruchi Mittal	Session Chair: Dr. R. John Martin (<i>Jazan University, Kingdom of Saudi Arabia</i>)	CMT Paper IDs: 440, 443, 473, 461, 492, 457
	Track 2.7 - Analytics (O)(M)D2	Track Chair Dr. Deepali Gupta	Session Chair: Dr. Maitreyee Dutta (<i>NITTR, Chandigarh</i>)	CMT Paper IDs: 451, 520, 497, 506, 517, 522
	Track 1.8 - Computing (O)(M)D2	Track Chair Dr. Ashu Taneja	Session Chair: Dr. Jitendra Virmani (<i>CSIR-CSIO, Chandigarh</i>)	CMT Paper IDs: 556, 664, 550, 561, 507, 526
	Track 2.8 - Analytics (O)(M)D2	Track Chair Dr. Kalpna Guleria	Session Chair: Dr. Dhavleesh Rattan (<i>Punjabi University, Patiala</i>)	CMT Paper IDs: 534, 559, 538, 540, 530, 523, 230
	Track 1.9 - Computing (O)(M)D2	Track Co-Chair Dr. Himanshi Babbar	Session Chair: Dr. Muhammad Azeem Akbar (<i>LUT University, Finland</i>)	CMT Paper IDs: 759, 670, 786, 701, 776, 717
	Track 2.9 - Analytics (O)(M)D2	Track Chair Dr. Pradeepta Sarangi	Session Chair: Dr. Rakesh Kumar (<i>Central University of Haryana, Mahendergarh</i>)	CMT Paper IDs: 568, 566, 563, 607, 564, 601, 682
	Track 1.10 - Computing (O)(M)D2	Track Co-Chair Dr. Saravjeet Singh	Session Chair: Dr. Nirvair Neeru (<i>Punjabi University, Patiala</i>)	CMT Paper IDs: 857, 841, 795, 837, 863, 864
	Track 2.10 - Analytics (O)(M)D2	Track Co-Chair Dr. Nikhil Srivastava	Session Chair: Dr. Arun Sharma (<i>IGDTUW, New Delhi</i>)	CMT Paper IDs: 647, 648, 612, 621, 654, 635
	Track 1.11 - Computing (O)(M)D2	Track Co-Chair Dr. Rani Kumari	Session Chair: Dr. Meenakshi Anurag Thalor (<i>AISSMS Inst. of I&T, Pune</i>)	CMT Paper IDs: 876, 868, 865, 882, 415, 446

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1:30 PM – 3:00 PM	Track 2.11 - Analytics (O)(A)D2	Track Chair Dr. Deepali Gupta	Session Chair: Dr. Kiran Jyoti (Guru Nanak Dev Engg. College, Ludhiana, Punjab)	CMT Paper IDs: 658, 688, 662, 674, 665, 667
	Track 1.12 - Computing (O)(A)D2	Track Chair Dr. Ruchi Mittal	Session Chair: Dr. Megha Bhushan (University of Seville, Spain)	CMT Paper IDs: 586, 498, 496, 580, 78, 354
	Track 2.12 - Analytics (O)(A)D2	Track Chair Dr. Kalpna Guleria	Session Chair: Dr. Sanjeev Sofat (Punjab Engineering College, Chandigarh)	CMT Paper IDs: 104, 730, 731, 740, 742, 704, 272
	Track 1.13 - Computing (O)(A)D2	Track Chair Dr. Ashu Taneja	Session Chair: Dr. Roopali Garg (UIET, Panjab University, Chandigarh)	CMT Paper IDs: 629, 592, 618, 134, 898, 625
	Track 2.13 - Analytics (O)(A)D2	Track Co-Chair Dr. Himanshi Babbar	Session Chair: Dr. Daljeet Singh (University of Oulu, Finland)	CMT Paper IDs: 895, 810, 746, 790, 808, 749
	Track 1.14 - Computing (O)(A)D2	Track Chair Dr. Pradeepta Sarangi	Session Chair: Dr. Kanu Goel (Punjab Engineering College, Chandigarh)	CMT Paper IDs: 557, 591, 584, 695, 201, 294
	Track 2.14 - Analytics (O)(A)D2	Track Co-Chair Dr. Saravjeet Singh	Session Chair: Dr. Rajasekaran S (University of Tech. and Applied Sci., Oman)	CMT Paper IDs: 831, 848, 858, 875, 839, 824
	Track 1.15 - Computing (O)(A)D2	Track Co-Chair Dr. Nikhil Srivastava	Session Chair: Dr. Nanhay Singh (Netaji Subhas University of Technology, New Delhi)	CMT Paper IDs: 241, 518, 589, 716, 801, 89, 49
	Track 2.15 - Analytics (O)(A)D2	Track Co-Chair Dr. Rani Kumari	Session Chair: Dr. Kapil Tomar (Thapar Inst. of Engg. and Tech., Punjab)	CMT Paper IDs: 787, 194, 525, 734, 349, 574

Pre-Conference Tutorials

AI and Bio-signal Integration for Healthcare Empowerment

Date and Time: May 7, 2026 | 12:00 Noon – 1:00 PM

Venue: Pierre Hall, Chitkara University, Punjab

Overview

AI and bio-signal integration is revolutionizing healthcare by enabling intelligent interpretation of bio-signals, advancing assistive technologies, and fostering improved quality of life and independence. These innovations empower patients and clinicians alike, creating personalized, adaptive solutions that enhance medical outcomes and redefine the future of human-centered healthcare.

Key Takeaways

- Technical understanding of how AI converts bio-signals into clinically actionable insights
- Exploration of next-generation devices that integrate bio-signal feedback for enhanced functionality
- Opportunities for cross-disciplinary work in AI, bio-medical engineering, and human-centered healthcare design

Robotics and AI in Healthcare

Date and Time: May 7, 2026 | 2:00 PM – 3:00 PM

Venue: Pierre Hall, Chitkara University, Punjab

Overview

AI and bio-signal integration is revolutionizing healthcare by enabling intelligent interpretation of bio-signals, advancing assistive technologies, and fostering improved quality of life and independence. These innovations empower patients and clinicians alike, creating personalized, adaptive solutions that enhance medical outcomes and redefine the future of human-centered healthcare.

Key Takeaways

- Insights into robotic-assisted surgery
- Understanding Bio3D printing for medical models
- Identification of interdisciplinary pathways linking robotics, AI, and bioprinting for translational healthcare innovation



6th International Conference on
Artificial Intelligence-driven
Computing, Analytics & Networks

ICAN 2026 | 15 & 16
May, 2026

Pre – Conference Tutorial
May 7, 2026

AI and Bio-signal Integration for
Healthcare Empowerment

Time: 12:00 PM to 1:00 PM
Venue: Pierre Hall

Dr. Sanjeev Kumar
Scientist F, Biomedical Instrumentation
Professor, Academy of Scientific and
Innovative Research AcSIR, CSIR-CSIO,
Chandigarh



Highlights

- Intelligent Interpretation of Biosignals
- Enhanced Assistive Technologies
- Improved Quality of Life & Independence



6th International Conference on
Artificial Intelligence-driven
Computing, Analytics & Networks

ICAN 2026 | 15 & 16
May, 2026

Pre – Conference Tutorial
May 7, 2026

Robotics and AI in Healthcare

Time: 2:00 PM to 3:00 PM
Venue: Pierre Hall

Dr. Ranjan Jha
Scientist E, Biomedical Instrumentation
Associate Professor, Academy of Scientific
and Innovative Research AcSIR, CSIR-CSIO
Chandigarh



Highlights

- Minimally Invasive & Robot Assisted Surgical Robots
- Bio3D Printers
- AI enabled optimized 3D Printing Parameters for SLA 3D printing

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aiGeneR 2.0: A Deep Network Model to Identify Antibiotic-resistance Genes in E.coli Using Augmented High-throughput Gene Expression Data

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Antimicrobial resistance (AMR) has been identified to pose a hazard to human health globally, and it is more complex due to Antibiotic resistance genes (ARGs) in bacteria (E. coli). Despite this, identifying and analyzing ARGs requires significant work utilizing next-generation sequencing (NGS) gene expression (GE) data. We hypothesized that the effective feature selection (FS) and deep learning (DL) classification make aiGeneR 2.0 a hybrid computational application for ARG identification with resistance and susceptibility classification. The minimum computational cost and identification of resistant strains are the power of aiGeneR 2.0. The tandem connection used Synthetic minority over sampling method SMOTE (for data augmentation). We evaluate various DL models namely AutoML, TabNet, VGG-16, VGG-19, ResNet-50 along with our proposed aiGeneR 2.0. The aiGeneR 2.0 is encapsulated with modified 1-D convolutional neural networks (CNN) which performs FS and classification. Experimental protocols such as learning rate, dropout, cross-fold validations, and several architectural modifications of 1-D CNN layers are used. We benchmark our proposed aiGeneR 2.0 model with a state-of-the-art traditional DL model that utilizes augmented GE data. The aiGeneR 2.0 identifies genes like *sulA*, *thyA*, *tyrS*, and *ufo*, which play an essential role in AMR. The aiGeneR 2.0 delivers notable results in accuracy (98%), sensitivity (98%), and specificity (100%) when it comes to resistance strain classification using SMOTE-enhanced GE data. This work showed that it is possible to predict ARGs utilizing NGS data and DL, making it appropriate for resistance strain identification. It also makes memorizing a reliable, generalized model for future AMR analyses.

MindCon 1.0: A Trauma-Sensitive Explainable Machine Learning Application for Early Detection of Mental Health Disorders in Indian Academic Population

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The importance of artificial intelligence (AI) used to conduct mental health screening has been rising due to increasing psychiatric disorders and limited access to trained providers in academic and institutional settings. Current AI methods mostly predict single disorders like anxiety or depression using limited features. MindCon 1.0 proposes a behavior-based ensemble model detecting seven conditions simultaneously. Data from Centurion University was processed with imputation, normalization, label-encoding and SMOTE. The pipeline ensures low complexity and efficient memory use, achieving 98.3% accuracy and outperforming others by 11%. It is deployed as a web-based application for preliminary explanations for users and clinical insight purposes.

Latency-Aware Real-Time Classical-quantum Control for Scalable and Practical Quantum Communication Networks

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Quantum communication networks enable information transfer with security guarantees rooted in quantum physical principles; however, their practical deployment is constrained by channel loss, detector imperfections, and time-varying environmental conditions. Existing approaches commonly rely on static configurations or idealized assumptions and largely neglect the impact of classical control latency, limiting their effectiveness in real-world systems. This paper proposes a latency-aware, real-time classical quantum control framework for scalable and practical quantum communication networks. The framework tightly integrates classical monitoring, decision-making, and feedback with quantum communication hardware, forming a closed-loop control system that dynamically adapts transmission parameters, entanglement generation strategies, and resource allocation in response to non-stationary network conditions. Unlike prior adaptive schemes, the proposed approach explicitly models classical sensing, processing, and signaling delays, along with realistic quantum channel loss and detector inefficiencies. Analytical modeling and simulation-based evaluation demonstrate that the proposed framework achieves 20–0% improvement in entanglement success probability, enhanced communication fidelity, and reduced effective latency compared with conventional static control strategies, while maintaining manageable classical overhead as network size scales. These results highlight latency-aware classical-quantum co-design as a key enabler for near-term, deployable quantum communication infrastructures and software-defined quantum networking architectures.

PID 47

**Hybrid Model for Enhanced Crypto currency Forecasting: Polygon (POL)
Price Prediction with XGBoost GRU and BiLSTM**

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Crypto currency price prediction has become a critical area of financial research because of the rapid growth and changes in the financial market, decentralized structure, and high susceptibility to external factors such as investor sentiment and macroeconomic trends. Existing traditional models are not capable of handling the complex and time-dependent patterns within such data. This research paper proposes a hybrid model which integrates XGBoost, Gated Recurrent Unit (GRU), and Bidirectional Long Short-Term Memory (BiLSTM) models to predict the forecasting of crypto currency. The dataset, sourced from the Coin Gecko API, includes 90 days of historical market data enriched with key technical indicators such as SMA-14, SMA-50, and RSI-14. XGBoost was employed for feature-level learning, while GRU and BiLSTM captured temporal dependencies and bidirectional context. Among all models, GRU exhibited the best performance with an RMSE of 0.2060, and the value of MAE with 0.1618, and MAPE with 0.71%, outperforming both XGBoost and BiLSTM.

PID 58

**Edge Computing and IoT Technology for Enhancing Crop Yield
inside Greenhouse Conditions**

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To address global food security challenges, this research explores the combination of Internet of Things (IoT) and Edge Computing technologies for real-time greenhouse condition monitoring and control to increase crop yield. The suggested system uses a miniature prototype with several sensors to measure temperature, humidity, light intensity, and soil moisture, introducing a novel method for automated plant monitoring within a greenhouse. Unlike conventional methods that rely on centralized processing, this system employs a Raspberry Pi 3B+ edge device to locally process sensor data, reducing latency and enabling immediate decision-making. After processing, the data is transferred to the ThingSpeak cloud for analysis and visualization. Coriander (*Coriandrum sativum*) was chosen as the test crop. Data was collected across four scenarios—two within the greenhouse and two outside. Four supervised machine learning models were implemented to predict crop yield: Multi-Layer Perceptron Regression (MLPR), Support Vector Regression (SVR), Random Forest Regression (RFR), and Linear Regression (LR). Results indicate that greenhouse-grown crops produced higher yields than those grown externally. Among the models, Linear Regression demonstrated the highest performance with an R^2 value of 0.93. This study confirms combining edge computing with the IoT offers a scalable, efficient solution for precision agriculture, reducing labor dependency and improving productivity through smart environmental control. The strategy lays the groundwork for upcoming developments in environmentally friendly greenhouse farming.

PID 59

**PhishGuard: A Unified Machine Learning Approach for Phishing
Detection Using Multi-Dimensional Feature Analysis**

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Phishing websites remain a persistent and evolving cybersecurity threat, employing increasingly sophisticated techniques to steal sensitive user information. This paper presents PhishGuard, a unified machine learning framework for phishing website detection that combines 154 features across seven complementary dimensions: URL obfuscation and typosquatting similarity (48), hyperlink behaviour (18), DOM tree structure (46), structural evasion patterns (12), linguistic social-engineering signals (10), security indicators (10), and cross-feature interactions (10). A novel six-metric typosquatting detection algorithm incorporating Levenshtein, Damerau-Levenshtein, Jaro-Winkler, homoglyph substitution, keyboard-adjacency, and token-similarity scoring is introduced. Statistical validation via McNemar's test and the Friedman test ($\chi = 28.33$, $p = 0.000191$) confirms that GBM's superiority is statistically significant across all experiments. This study demonstrates that multi-dimensional feature fusion substantially outperforms any individual feature group alone, providing a scalable, interpretable, and practically deployable solution for real-world phishing detection.

PID 68

Closed-Loop SDN Control for Matter Ecosystem

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This paper introduces a closed-loop SDN control framework for managing Wi-Fi 6 congestion in dense Matter IoT deployments. By grounding the system in Lyapunov drift-plus-penalty (DPP) optimization, the controller minimizes a bound on virtual latency-violation queues while optimizing airtime efficiency. Evaluation in OMNET++ demonstrates that the framework reduces mean video latency from 81.4 ms to 28.5 ms and increases SLA compliance from 62% to 96%, providing provable stability guarantees for mission-critical IoT traffic.

PID 69

Matter-Aware Multi-Radio Coexistence Governor for Wi-Fi 6/7, Thread, and BLE in Smart Hubs

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This paper introduces MR-Gov, a novel coexistence governor addressing cross-technology interference (CTI) in Matter-enabled smart hubs. By jointly optimizing Wi-Fi 7 Multi-Link Operation (MLO), Wi-Fi TWT, and Thread CSL based on application-layer SLAs, MR-Gov reduces Thread packet error rates by 58% and control flow latency by 47%. Evaluations in a hybrid ns-3/OMNET++ framework demonstrate that MR-Gov outperforms hardware PTA and machine-learning baselines, establishing a new benchmark for IoT resource management.

PID 70

SDN-Guided Proactive Handover for IoT Networks

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This paper presents a novel Software-Defined Networking (SDN)-guided framework for proactive fast handover in mobile Matter devices. By fusing cross-radio telemetry from Wi-Fi, Thread, and BLE into a centralized controller, the system anticipates network degradation. Evaluation in ns-3 demonstrates that the proposed MDP-based policy reduces average handover latency from 62.4 ms to 15.1 ms and achieves a 99.8% VoIP packet delivery ratio.

PID 89

Novel System Architecture for Solar Energy Harvesting and 5th Generation Enabled Remote Patient Monitoring System

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Performance, Security, Scalability and Reliability are the key features of a remote patient monitoring system while existent research and business technological solutions lack one of the features for the reasons being performance efficiency. Recent solutions have been focused on enhancing user performance while one of the key factors being security is compromised in exchange for performance efficiency. It is to observe that system is dependent on non - renewable power source which makes remote patient monitoring system environmentally unsustainable. It is the socio - environmental concern to focus over integrating self-generative renewable sources which makes the remote patient monitoring systems to be energy efficient and environmentally friendly. Existent literature has been critically reviewed to produce a novel system architecture focusing over solar energy harvesting for self-energy generation for a 5th Generation enabled remote patient monitoring system. with the evolving experimental innovation in 5th Generation, it had been theoretically integrated in to the novel architecture of the system with security techniques known to be dual characteristics of lightweight and secure. It is theoretically proven to be secure, scalable, reliable and power source independent. This research adds a theoretical foundational strength for further experiential implementation in real world cases for evaluation based on the key factors, Performance, Security, Scalability and Reliability for rhetoric and academic confidence for business deployment in the remote diagnostics landscape.

PID 95

Smartphone-Based Visible Light Communication Using Spatio-Temporal CNN

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Visible Light Communication (VLC) technology has gained significant attention in recent years as a promising solution to replace the conventional radio frequency (RF) communication technology due to increasing spectrum congestion, electro- magnetic interference, and security issues associated with RF communication technology. VLC technology utilizes the available unlicensed spectrum of visible light to offer high bandwidth availability and inherent security. Moreover, the availability of smartphones with LED flashlight and high-speed cameras provides a promising opportunity to implement VLC technology in a completely software-based manner without the need for any

hardware components. In this paper, a novel VLC technology implementation framework utilizing a smartphone's flash-light and camera as the transmitter and receiver, respectively, is proposed. The proposed VLC technology implementation framework encodes the text messages in ASCII and sends them to the receiver using On-Off Keying (OOK) modulation. To decode the received video frames and improve the reliability of the VLC technology implementation, a lightweight spatio-temporal convolutional neural network (ST-CNN) model is employed to process the received video frames. The experimental results show that the proposed VLC technology implementation framework can decode messages with an accuracy of up to 97% with a very low inference latency of 4.62 ms. The bit-level and sequence-level evaluation results and comparison with a CNN model confirm that the proposed VLC technology implementation framework can significantly improve the reliability of the VLC technology implementation by employing a lightweight ST-CNN model to process the received video frames.

PID 104

**From Corpus to Context: Pretraining a Language Model with
Linguistically-Aware Subword Tokenization for Enhanced Question Answering**

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Large-scale pre-trained language models have revolutionized NLP, yet their benefits remain limited for low-resource, morphologically complex languages. Assamese, spoken by over 15 million people, exemplifies this gap, lacking foundational generative models partly due to the inadequacy of standard subword tokenizers for its rich morphology. To the best of our knowledge, this paper introduces the first foundational, monolingual generative Pre-trained Language Model for Assamese, trained entirely from scratch on a curated 1.8 GB corpus. This was enabled by our novel Linguistically Aware Byte-Pair Encoding (LABPE) tokenizer, which incorporates linguistic knowledge via suffix-based pre-segmentation to produce a more coherent vocabulary. Intrinsic evaluations show LABPE yields superior tokenization efficiency and enables our 93M parameter model to achieve a 10.5% relative reduction in pre-training perplexity compared to an other state of the art model trained with standard BPE. Critically, the proposed LABPE-based model establishes a new state-of-the-art on a mixed Assamese Question Answering benchmark, significantly outperforming strong multilingual baselines and achieving +3.2 F1 points over the prior state-of-the-art monolingual encoder on the extractive subset. This work provides a crucial foundational resource, enabling diverse generative applications for the Assamese language community and presents a potential approach for other such languages.

PID 115

**Hybrid DDQN-ILP Framework for Intelligent Offloading
with Federated Edge Computing**

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The work proposes a hybrid framework that integrates a deep double Q-network (DDQN) and integer linear programming (ILP) to enable intelligent task or data offloading in a federated learning (FL) environment. The proposed framework has been implemented using a real time testbed consisting of 19 heterogeneous edge nodes and one cloud controller node, utilizing KubeEdge orchestration with private 5G network as access medium. Experimental results demonstrate a 20–0% reduction in average latency and a 28.6% reduction in overall energy compared to a baseline DDQN approach.

PID 128

**Music Genre Prediction Using Spectrograms and Mel
Frequency Cepstral Coefficients**

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Music is very vital to our daily lives, affecting emotions, culture, and entertainment. With the digital era now, the classification of musical genres is increasingly necessary for musical distribution purposes. This research investigates the possibilities of deep learning, more specifically, Convolutional Neural Networks (CNNs), which are very effective in modeling spatial patterns in spectrograms and Mel Frequency Cepstral Coefficients (MFCCs). CNNs, unlike traditional machine learning methods based on handcrafted features, learn hierarchical representations appropriate for music classification. Spectrograms and MFCCs were created from sound signals, insufficiently helping the CNN model to differentiate between genres by observing identifying patterns. The GTZAN dataset augmented with ten music genres was used for training purposes, obtaining 99% accuracy from the training data and 95% accuracy from the validation data, and thereby proving the model considerably useful for genre classification. The approach presented in this paper, with the help of deep learning, may enhance music recommendation systems, playlist generation, and music organization to keep the best user experience on digital platforms. The proposed architecture achieves optimal performance that helps isolate genre-timed dynamics across different frequency bands while accounting for shortcomings in prior research and retaining computational speed.

PID 133

Enhancing Organizational Protection through ML-Driven Insider Threat Detection

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Organizations use various digital services for data storage, data backup, disaster recovery, and infrastructure that supports quick application development and deployment. Businesses and employees store information in the cloud and access resources through the internet. However, they face serious security threats, with malicious insiders being one of the biggest concerns. Insiders may tamper with important information, destroy systems, or assist external attackers. In this paper, we suggest a machine learning-based approach for detecting insider threats by utilizing TF-IDF feature extraction alongside CERT' structured behavioural metadata. Our study utilizes Logistic Regression, SVM, and LightGBM algorithms in order to create a classification model that can detect malicious insider activities. The results show that the proposed TF-IDF-enhanced LightGBM approach demonstrates 99.84% accuracy and an F1-score of 0.96, this is a significant improvement over many existing methods. This approach effectively improves the accuracy of real-time anomaly detection within an organization.

PID 134

Smart Terrarium: An AI-Powered System for Real-Time Plant Health Monitoring and Environmental Control

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Traditional plant monitoring systems need improvement for controlling micro-environments like terrariums because of the fast integration between Artificial Intelligence (AI) and Internet of Things (IoT) in agriculture. An AI-based smart terrarium system will use deep learning models, including LSTM and CNN, which combine multi-modal data acquisition methods for automated plant health analysis and environment regulation. Environmental and soil metrics, which IoT sensors collect and enable the system to perform predictions through LSTM models. The vegetative health assessment of plants relies on CNN- based image processing simultaneously with the system. The customized dashboard enables users and real-time oversight through its display. Reinforcement learning enables dynamic control of humidity along with light and temperature through the added functionality in the model. Experimental observations reveal both efficient environmental compatibility and high predictive accuracy of the system, thus demonstrating its strong potential for self-operating sustainable micro-ecological control. The presented study demonstrates the effectiveness of an AI- based smart terrarium framework that autonomously monitors plant health and regulates micro-environmental conditions within confined indoor ecosystems using deep learning models.

PID 136

Transformer-based Network Intrusion Detection System

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This paper proposes a transformer-based Network Intrusion Detection System (NIDS) for analyzing tabular network flow data. Unlike traditional methods, the model uses a transformer encoder with attention mechanisms to capture complex feature relationships. The dataset contains 3,286 samples with significant class imbalance, addressed using weighted loss and stratified sampling. After preprocessing and feature encoding, the model achieved 92% accuracy on training and test data, demonstrating strong generalization and stability. Comparative analysis shows improved performance over existing models such as TabTransformer and FT-Transformer. The results highlight the effectiveness of transformer architectures in detecting network intrusions in structured cybersecurity datasets.

PID 149

MSTF-Net: A Reliability-Aware Multi-Spectral Temporal Fusion Network for Robust Deepfake Detection

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Deepfake detection systems degrade under video compression because static multi-stream fusion assigns fixed weights regardless of input quality, causing quality-induced fusion collapse. We propose MSTF-Net, combining an EfficientNet-B0 spatial stream, a ResNet-18 spectral stream with Frequency Attention Adapters and block-wise DCT, and an SRM noise analysis stream. Our Dynamic Spectral-Temporal Gating module conditions fusion weights on a differentiable Laplacian quality score Q_n , suppressing unreliable streams under compression. MSTF-Net achieves AUC 0.9792 on DeeperForensics-1.0 and outperforms EfficientNet-B0 by +0.0152 on FF++ C23. Under heavy C40 compression, MSTF-Net degrades 3.0× less than the baseline, proving quality-conditioned fusion prevents collapse.

PID 186

A Robust Hybrid Architecture for Brain Tumor Detection Using Magnetic Resonance Images

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The accurate classification of brain tumors from MRI is crucial for diagnosis and treatment. In this work, we present a hybrid deep learning model, which uses pretrained convolutional neural networks (CNN), AlexNet and EfficientNetV2B1 and classical machine learning (ML) classifiers, such as Support Vector Machine (SVM) and Logistic Regression (LR), for multi-class brain tumor classification. The CNN models are responsible for feature extraction, and the classifiers for decision making, enhancing generalization and computational efficiency. Hybrid models of EfficientNetV2B1-SVM and EfficientNetV2B1-Logistic Regression achieve higher accuracy, with the former obtaining 98% accuracy. The resulting performance improvement is statistically significant, and robustness analyses under noisy and blurred images show consistent performance, suggesting that the proposed approach is suitable to be implemented in clinical decision support systems.

PID 191

Enhancing Glaucoma Screening through Mobile Net-Based Transfer Learning Analysis of Fundus Images

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This study presents a learning framework for glaucoma detection using fundus images. By leveraging transfer learning with a pretrained MobileNet model on the limited Drishti GS1 dataset of 101 images, the approach achieves strong performance. It reports 96% training accuracy and 92% evaluation accuracy, with perfect specificity and precision of 1.0, and an AUC of 0.9286 after 40 epochs. The results demonstrate that transfer learning can effectively address data scarcity, enabling accurate glaucoma classification. This approach offers a practical, cost efficient, and timely solution for early diagnosis, particularly in resource constrained clinical settings for improving screening outcomes and patient care.

PID 194

Modeling Road Fatality Risk in India Using a State-Level Cox Proportional Hazards Model

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Road traffic crashes are one of the major public safety concerns in India. Alcohol consumption and speed are considered to be the main factors that contribute to road fatalities in India. In this research, a parsimonious time-based risk model is developed to examine how Indian states tend to move into a high alcohol fatality group between 2006 and 2015. For this purpose, official accident records maintained at the state level, available on the Government of India's open data portal (Data.gov.in), have been used. Instead of focusing on the sheer number of accidents, each state is considered a risk unit in this research. Survival analysis is conducted to estimate how long it takes for a state to enter high risk. High risk is defined in terms of percentile values of alcohol-related fatalities.

PID 203

MSCDRA-Net: Multimodal Skin Cancer Detection Using Rank Analysis with Explainable AI on 3D Total Body Photography Imaging

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Skin cancer detection has become a critical area of research due to its high prevalence and life-threatening nature. The traditional deep learning techniques for clinical image evaluation have shown promising outcomes. But often they lack interpretability and also fail to include medical metadata by restricting their functional application. This research proposes MSCDRA-Net, which is a multimodal deep learning architecture that integrates dermoscopic images and medical metadata for the detection of skin cancer. This framework enhances DenseNet-169 as the crucial support for processing of image using the rank analysis technique for the selection of features. To improve the transparency of the approach, explainable AI (XAI) methodology, along with Grad-CAM are combined to show the area of interest in the lesions, thereby enhancing the interpretability of the model. On examining the ISCI 2024 SLICE-3D dataset, the proposed study attained 0.97 of AUC, representing greater performance when compared with other advanced models. The outcome represents the capacity of multimodal techniques by addressing the imbalance of class and improving the accuracy of diagnosis. This provides physicians with a clear decision-making tool for efficient screening of skin cancer.

PID 204

**MSHTR-KE: Multi-Skewed Handwritten Text Recognition
and Knowledge Extraction Using Co-Training Learning and NER**

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This proposed approach integrates transformer-based information extraction, co-training-based visual and linguistic learning, adaptive preprocessing, and region-level skew correction into a single end-to-end framework. The experiments demonstrated that the system performed significantly better in terms of successful knowledge generation from unstructured handwritten content, reduced annotation dependency, and character and word recognition accuracy. The system transcends traditional OCR to intelligent document understanding by fusing strong perception with semantic interpretation. Although the method establishes a scalable, automated archival digitization foundation, intelligent record management, and data-driven decision systems, there are still lingering issues with processing severely degraded documents and running the algorithms effectively on low-power devices. The study shows that handwritten document processing can become a reliable and intelligent information extraction technology by co-learning deep models and natural language processing. Table 1 shows a comparison of handwritten text recognition studies.

PID 222

**Computationally Efficient Hybrid Deep Feature Framework for Multi-Class Alzheimer'
Disease Classification from MRI**

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Early and accurate diagnosis of Alzheimer's disease (AD) from structural magnetic resonance imaging (MRI) remains challenging. This study proposes a computationally efficient hybrid deep feature framework for multi-class AD classification, integrating EfficientNetV2-B1 and ResNet-50 with Support Vector Machines (SVM). Evaluation on 17,288 MRI images shows that SVM achieves 99.24% accuracy with EfficientNetV2-B1 and 99.33% with ResNet-50, with no statistically significant difference. However, EfficientNetV2-B1 reduces model complexity by over threefold while improving robustness to noise and blur. The framework also achieves higher throughput and lower latency, demonstrating its suitability for scalable, real-world clinical deployment scenarios.

PID 230

**Deep Learning-Based Variant Pathogenicity Prediction in Alzheimer'
Disease Genes Using Pangenome Graphs**

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Predicting pathogenicity of variants in familial Alzheimer's disease genes remains inadequate with linear reference genome-based tools, which discard haplotype diversity critical for identifying causal mutations. We construct pangenome graph representations of PSEN1, PSEN2, and APP, training a two-layer Graph Attention Network —four attention heads producing 128-dimensional intermediate representations, compressed to 32-dimensional embeddings —directly on these graphs. Allele-frequency-weighted softmax pooling summarises each haplotype path into a single vector, classified by an MLP under 5-fold stratified cross-validation over 220 balanced paths. Our framework achieves AUC-ROC of 0.9591 and recall of 0.9182, outperforming classical baselines by over 40 percentage points. SHAP explainability recovers biologically interpretable feature rankings requiring only raw DNA sequences.

PID 236

**Federated Knowledge Graph Construction Under Adversarial
Noise Through Iterative Trust-Weighted Consensus**

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Constructing Knowledge Graphs (KGs) in federated settings is challenged by structural inconsistencies and malicious data. We propose Trust-Weighted Consensus (TWC), a two-pass symbolic framework for secure KG aggregation without raw data sharing. TWC models aggregation as a truth-discovery problem, inferring client reliability from consistency patterns while preserving privacy via hashing. It combines conflict detection with an EM-style trust inference loop to resolve discrepancies. Experiments on 200k DBpedia triples across 10 clients show TWC outperforms majority voting, achieving 0.8162 F1 and perfect precision under adversarial conditions, demonstrating an efficient and robust approach for federated KG construction.

PID 240

Spike-Attention Guided Deep Neural Network for Recognition of Imagined Speech in Hindi

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This study introduces a Spike-Attention Guided Deep Neural Network for decoding imagined speech of Hindi words using EEG signals. By integrating CSP-based spatial features, an attention mechanism, deep fully connected layers, and a LIF spiking neural layer, the model attains strong and statistically validated performance enhancement. Ablation and baseline evaluations verify the contribution of attention and spiking dynamics. The results highlight the potential of hybrid deep-neuromorphic architectures for reliable Hindi imagined speech-driven brain-computer interface applications.

PID 244

LWNNNet-BCD: An Explainable Lightweight Neural Network for Breast Cancer Detection in 2D Ultrasound Images Using Feature Mapping

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Accurate segmentation of breast cancer from ultrasound images plays a vibrant role in early diagnosis and medical decision making. The prevailing strategies usually depend on complex and deep frameworks that require significant computational resources. This makes the model less suitable for lower-resource medical situations. In this research, a lightweight neural network model, namely LWNNNet-BCD framework is developed. This combines feature extraction by an enhanced VGG 16 framework using a Random Forest classifier. The dataset named Breast Ultrasound Image (BUSI) is trained by the model. This includes malignant, normal and benign ultrasound images required for the study. The major factor of this architecture is its efficiency in computational design. It ensures greater performance with condensed resource conditions. The explainable artificial intelligence (XAI) method is also used by enhancing Grad-CAM heatmap representation to focus the tumor region present in the images by improving interpretability and transparency of the model. The experimental outcomes show that LWNNNet-BCD attained greater performance with 99.97% of accuracy, 0.999 of dice coefficient and 0.998 of IoU by sustaining a numerically lightweight framework. This model demonstrates high ability in medical decision making by presenting both interpretable predictions and accurate segmentation.

PID 247

Adaptive Anomaly Detection in 5G Networks

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The deployment of 5G networks is changing the working of wireless communications. This advanced network offers ultra-low latency and high speed. At same time, it allows to connect a lot of devices. Due to this, we are able to make significant development in critical areas like healthcare, self-driving cars and smart buildings. But at the same time - the increased complexity and openness of 5G networks is also introducing new security threats that traditional protection. This project aims to design and build a single AI-powered tool that's tailored to 5G networks, with the focus being real-time anomaly detection.

PID 269

LightFinNet: Securing Financial Transaction Using Optimized Artificial Intelligent with Lightweight Cryptography

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The rise of digital banking transactions has led to a sharp increase in the threat of cybercrime and highlighted the need for strong security measures in the financial sector. The financial technology (FinTech) innovations are revolutionizing financial transactions, with global digital transactions expected to exceed \$10 trillion by 2025. However, fraudulent digital payments remain a serious problem for financial institutions and consumers. While technological advances have reduced security breaches to some extent, user awareness and engagement play a key role in preventing fraud. Despite improvements in security, traditional encryption methods incur high computational costs, which affect the transactions performance. This paper presents LightFinNet, a lightweight cryptographic framework integrated with artificial intelligence (AI) to securing digital transactions in the FinTech. The proposed lightweight crypto algorithm used to ensure secure encryption and distribution of transaction data, preventing data leakage and ciphertext forgery. To improve security and efficiency, a dual attention network (DANet) is used for feature extraction by capturing both high-dimensional and low-dimensional transaction patterns. The enhanced Archimedean optimization (EAO) algorithm is used to solve the data dimensionality issues to selects the best optimal features. The deep artificial intelligence active learning (DAAL) is used to analyzes transaction behavior effectively and distinguish legitimate transactions from fraudulent. Experimental validation shows that proposed LightFinNet method achieves 98.958%, 99.858%, and 99.315%

accuracy on the IEEE CIS Fraud, Paysim, and UCI credit card datasets, respectively, outperforming RXT-J by up to 3.162%. It also minimizes testing loss to 0.0584 and ensures the highest TPR across most FPR values, enhancing fraud detection efficiency.

PID 271

Automated Legal Judgement Processing Using Deep Learning

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Legal judgment transcription spans a lengthy duration since it helps create textual versions of legal decisions. An automatic system using deep learning methods should serve as the basis for legal judgment translation according to this study. The mentioned data set encompassed judgment texts obtained through a BERT based model from 50 files within IndianKanoon. The .flac audio version of 300–00-word texts were created from gTTS output and subsequently postprocessed to .wav format by using VAD with normalization and MFCC and LPC feature extraction. The models Whisper, Vosk and Wav2Vec 2.0 performed transcription on speech data which received evaluation based on Word Error Rate (WER), Character Error Rate (CER) and Accuracy.

PID 272

Unmanned Underwater Vehicle Systems, Underwater Drowning Detection and Victim Localization by Real-Time YOLOv11 and Depth Estimation

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Drowning is a significant safety issue of concern across the world especially in controlled water bodies like swimming pools where untimely detection and treatment are vital in averting death. Traditional surveillance methods such as lifeguard gains, surface-mounted cameras and so on may face drawbacks of delaying responses of humans and the impossibility to observe the situation of distress due to the low visibility of the water. To address these barriers, the present study suggests an artificial intelligence-based underwater drowning detection system comprising YOLOv11 to carry out real-time object detection and Depth Pro to carry out monocular depth estimation. Extensive data set of about 7,000 under water images was crafted and improved by data augmentation method to combat variation in illumination, turbidity and movement distortion that is frequently witnessed in under water conditions. The trained YOLOv11 model had a high level of performance through its detection: 98% accuracy at drowning detection and 97% accuracy at normal swimming identification. Moreover, Depth Pro was used in estimating the real-world distance of the people who were detected so that the real-world distance could be well localised in space so as to produce heatmaps that would enhance the situational awareness. The offered system will help to improve the safety of the aquatic environment by allowing to recognize drowning automatically and to provide a timely reaction by combining it with Unmanned Underwater Vehicles (UUVs) to provide rescue help.

PID 274

A Deep Learning–ased Adaptive Zero-Trust Framework for Secure and Trustworthy Healthcare IoT Systems

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The rapid growth of IoT devices introduces major security challenges due to heterogeneity, dynamic traffic, and increased vulnerability to advanced attacks. Traditional perimeter-based security and static intrusion detection systems are insufficient for distributed, resource-constrained IoT environments. To address this, the Adaptive Trust-Driven Deep Learning-Based Zero-Trust (ATDL-ZT) framework is proposed. It combines a hybrid CNN-LSTM intrusion detection model with dynamic trust scoring based on device behavior, context, and criticality. These trust scores enable adaptive zero-trust access control. Experimental results on the BoT-IoT dataset show improved detection accuracy, consistency, and statistically significant performance gains over existing methods, enhancing real-world IoT security.

PID 276

DroidFormer++: A Trustworthy Transformer Framework for Android Malware Classification with Dual-View Feature Fusion, Self-Supervised Pretraining, and Calibrated Explainability

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DroidFormer++ is a Transformer-based framework for trustworthy Android malware classification on the CICAndMal benchmark (10,854 samples, 42 families). It integrates dual-view static feature extraction, obfuscation-resistant API-group abstraction, self-supervised Masked

Token Modelling pretraining, class-weighted focal loss with attack-aware augmentation, temperature scaling calibration, and Integrated Gradients explainability. Under family-disjoint evaluation, DroidFormer++ achieves 96.8% accuracy (Macro-F1 = 0.918, MCC = 0.908) with best-in-class calibration (ECE = 0.012). It is the first Android malware classifier to simultaneously satisfy family-disjoint evaluation, calibrated output probabilities, and token-level explainability, establishing a new standard for trustworthy malware triage.

PID 283

Hybrid Deep Learning Model for the Classification of Psoriasis Disease

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Skin disease prediction is a crucial aspect of dermatological diagnosis, often requiring extensive knowledge and expertise. In this work, we propose a hybrid deep learning model based on the efficient net+LSTM architecture for skin disease prediction. The model is trained and tested on a dataset comprising seven classes of psoriasis: Erythrodermic, pustular, plaque, nails, inversus, healthy, and guttate. We compare the performance of three hybrid models: VGG16+LSTM, AlexNet+LSTM, and the proposed efficient net+LSTM. Results show that the efficient net+LSTM model achieves the highest accuracy of 86 percent, surpassing the performance of VGG16+LSTM (66 percent) and AlexNet+LSTM (68 percent).

PID 285

Hybrid Deep Learning Framework for Automated Prediction of Dental Conditions in Panoramic Radiographs

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Oral health issues are among the most common health conditions worldwide. Dental imaging plays a pivotal role in early detection of oral diseases, yet manual reading of radiographs remains a labor-intensive process prone to inter-observer variability. This study introduces a hybrid deep learning framework for real-time classification of multiple dental conditions i.e., cavities, implants, impacted teeth, and fillings using panoramic radiographs. The proposed architecture integrates Inception and ResNetV2 models to combine multi-scale feature extraction and residual learning, thereby enhancing representational efficiency and classification accuracy. A dataset containing 2,320 panoramic images was pre-processed through contour-based segmentation, noise removal, and morphological enhancement to emphasize dental structures and anomalies. The framework was evaluated using standard performance metrics, including accuracy, precision, recall, F1-score, and RMSE. Experimental results demonstrate that hybrid model achieves superior performance with a testing accuracy of 87.99%, outperforming individual CNN baseline models. The findings underscore the potential of hybrid architectures in computer-aided dental diagnostics by improving accuracy, scalability, and clinical applicability. The proposed system offers a viable approach for real-time, automated dental image interpretation, paving the way for enhanced diagnostic support and efficient oral healthcare delivery.

PID 287

Moments-Embedded Inception-iLSTM-ttention Network for Sleep Apnea Detection Using ECG-Derived CWT Spectrograms

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Sleep Apnea (SA) is a severe respiratory disorder characterized by recurrent cessation of airflow, resulting in hypoxia and autonomic imbalance. The Moments-Embedded Inception BiLSTM Attention Network (MIBAN) is introduced for electrocardiogram (ECG)-based apnea detection and evaluated against BiLSTM, CNN-BiLSTM and Vision Transformer (ViT) models. The Apnea-ECG dataset is processed through segmentation, normalization, and artifact suppression. The Continuous Wavelet Transform (CWT) is employed to generate scalograms, and features from the Gray-Level Co-Occurrence Matrix (GLCM), Convolutional Neural Network (CNN) are fused and optimized using Principal Component Analysis (PCA) with Minimum Redundancy Maximum Relevance (MRMR), selecting Top 100, 200, 300 feature subsets. The Top-100 MIBAN configuration achieves optimal performance, with 99.02% accuracy, 99.10% sensitivity, 99.25% specificity, 98.84% precision, 99.02% F1-score, 99.04% MCC, and 99.02% AUC. These outcomes exceed those of baseline models and indicate robust, generalizable apnea detection. Keywords: Sleep Apnea, ECG Signal Processing, Continuous Wavelet Transform, Attention-Based Deep Neural Networks, MIBAN Model, PCA-MRMR Feature Optimization

PID 294

Comparing CNN, LSTM, Transformer, and CNN–STM for Wearable Human Activity Recognition: Architecture Selection and Window Size Sensitivity

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Research Summary We compared four deep learning architectures CNN, LSTM, Transformer, and CNN–STM hybrid for Human Activity Recognition using wearable inertial sensors on the UCI HAR dataset under five-fold stratified cross-validation. The CNN–STM hybrid achieved the highest accuracy of 94.3 (AUC 0.971). A window-size sensitivity experiment across all four models confirmed 128 samples (2.56 s) as the optimal input length. These findings provide practical guidance for architecture selection in wearable health monitoring and elderly activity tracking systems. **2. Objective of the Study** Inertial sensor-based HAR is complicated by signals carrying information at two timescales simultaneously: brief local motion transients such as a heel-strike, and longer activity rhythms spanning full stride cycles. CNNs handle local patterns well but have limited receptive fields; LSTMs model sequential dependencies but lack local-shape priors. Hybrid CNN–STM architectures address this yet have rarely been compared against Transformer encoders under matched parameter budgets. Furthermore, the standard 128-sample window used in most HAR benchmarks has never been validated across different architectural families. This study fills both gaps with a controlled four-model comparison and an explicit window size sensitivity analysis on the UCI HAR benchmark. **3. Methodology:** The UCI HAR dataset was used —30 subjects, 50 s, six activity classes, 10,299 windows across nine sensor channels. Four models were built with parameter counts matched within 5%: a CNN (two Conv1D blocks, MaxPool, global pooling), an LSTM (two stacked layers), a lightweight Transformer (two encoder blocks, 4 attention heads, d_{model} = 4), and a CNN–STM hybrid where the convolutional stack feeds into a 64-unit LSTM. All models trained with Adam (lr = 0.001), batch size 32, early stopping, and a fixed random seed. Five-fold stratified cross-validation was used throughout. For the window experiment, raw signals were re-segmented independently at each target length before normalising not cropped from existing segments to keep the comparison clean.

PID 296

Pedagogically Informed Feature Engineering for Scalable MOOC Video Classification: Integrating Bloom's Taxonomy and Linguistic Complexity Metrics

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This study investigates whether pedagogically informed feature engineering specifically the incorporation of Bloom's Taxonomy cognitive verb patterns and instructional activity marker scan substantially improve the automated classification accuracy of educational videos on MOOC platforms compared to conventional text-based classification approaches. A comprehensive feature engineering pipeline was designed and evaluated on 12,032 educational video transcripts from Coursera. The pipeline extracts three categories of features: (1) Bloom's Taxonomy cognitive level indicators, (2) instructional context markers and pedagogical activity signals, and (3) multi-dimensional linguistic complexity measures. These were combined with TF-IDF and BERT semantic features and evaluated using Support Vector Machine, Random Forest, and Gradient Boosting classifiers. The addition of pedagogically-informed features to baseline semantic features produced significant classification improvements of up to 11.3% in macro F1-score. Bloom's Taxonomy features were the single most discriminative non-semantic feature category, contributing 6.8% F1 improvement when added to TF-IDF baselines. The Gradient Boosting classifier with combined features achieved 89.2% overall accuracy on 8-class and 81.4% on 40-class classification tasks. This paper makes the first systematic evaluation of Bloom's Taxonomy as a computational feature for educational video classification, providing empirical evidence for the discriminative value of educational theory-derived features.

PID 305

Evaluating Multilingual Transformer Models for Assamese News Classification

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Automatic news categorization is one of core tasks in the field of natural language processing and has been well fitted for big scale information access and retrieval. Although transformer-based models have shown strong performance for high-resource languages, their evaluation has been limited to low-resource ones. In this paper, we explored automated news classification in Assamese as a supervised multi-class text classification problem. We develop a novel annotated Assamese news corpus for ten topical classes via large-scale data collection and hybrid annotation methods that gives us around 65000 samples evenly distributed across topics. A few transformer-based architectures such as IndicBERT, mBERT, ALBERT and XLM-RoBERTa are fine-tuned and evaluated with multiple class-balanced cross-entropy loss and macro-F1 based early stopping. Model performance is evaluated in terms of accuracy, macro- and weighted-average precision, recall, and F1-score. XLM-RoBERTa attains the highest accuracy of 96.33% and macro-F1 of 96.31%, followed by mBERT (95.11%)

then IndicBERT (92.06%), with ALBERT acting essentially at random scoring 24.24%, confirming its inapplicability to any non-English script dataset. This work serves as a strong baseline performance to enable future research on the processing of low-resource Indic languages.

PID 308

Self-supervised Contrastive Change Detection for Timely Deforestation Monitoring

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Deforestation and quick changes in ecosystems make it necessary to have remote sensing systems that work quickly and accurately. However, operational satellite-based detection encounters considerable obstacles, notably the acute deficiency of high-quality pixel level labels and elevated false positive rates induced by seasonal phenological fluctuations. To solve these problems, this paper introduces a strong, multi-temporal change detection framework that connects high-performance supervised methods with label-efficient pretraining. We first create and test a custom UNet-based encoder-decoder architecture that is made to deal with seasonal changes by using both joint geometric spatial transformations and independent radiometric augmentations. The architecture processes bi-temporal image pairs by concatenating the two time-step inputs along the channels and passing them through a shared encoder with skip connections. This creates per-pixel change probability maps. This architecture demonstrates robust bi-temporal feature discrimination and precise surface change detection when evaluated on the OSCD dataset. This strong baseline is the basis for a suggested two-stage self-supervised learning (SSL) pipeline. The extended framework's goal is to greatly reduce the need for annotated masks by using a pixel-wise contrastive objective trained on the OSCD multi-temporal imagery. It also aims to create calibrated uncertainty maps via Monte Carlo Dropout for prioritizing field verification. The resulting pipeline is a scalable and efficient way to keep an eye on the environment in a region almost in real time.

PID 313

Can Interpretable Modeling Reveal Major Indoor Activities' Pollutant Sources?

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The presence of hazardous materials in enclosed areas, such as cooking, smoking, incense sticks or paper burning, and using air-cooler, is known as indoor air pollution. It has significant negative effects on health, including chronic cardiovascular disease. In our study, we thoroughly examine the impact of indoor activities and utilise LIME and SHAP models to identify the dominant pollutants, revealing that VOCs (>0.025) have higher impact than PMs and NO₂.

PID 323

Coreference Resolution for Low-Resource Languages: A Case Study on Assamese Using FastText Embeddings

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This paper investigates coreference resolution in Assamese- a low-resource language that is relatively under-studied in natural language processing research. Moreover, we also define a new dataset of annotated coreference chains, consisting of around 3600 sentences from roughly 200 biographical entries in Assamese Wikipedia, for preprocessing. Each annotation refers, such as names and pronouns concerning the same person in a paragraph. As far as we understand, this is one of the first initiatives to investigate coreference resolution in Assamese. We trained and evaluated multiple supervised learning models, including BiLSTM, GRU, and standard RNN architectures, using FastText word embeddings tailored for Assamese. Our experimental results highlight the relative performance of these models and help uncover key limitations and challenges in resolving coreference in a low-resource setting. We hope this work lays a foundation for future research in coreference resolution for Assamese and similar underrepresented languages.

PID 324

AutoGluon-WBAN: Driven Context-Aware Multimodal Anomaly Detection in Wireless Body Area Network

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Intelligent anomaly detection is performed over WBAN data using AutoML overwhelming the challenges that occurs in ML models. AutoGluon-WBAN is a health monitoring system containing 3 layered structures. AutoGluon enhance the model choice and tuning algorithms to automatically perform feature importance assessment, select best algorithms, identify number of training rounds, import features and add stacking and bagging to optimize the model detection accuracy. The results achieved with the accuracy 99.04% and 100% respectively for benchmark data and real-time detection. The scalable, real-time system for the detection of physiological anomalies offers hope for early diagnosis and future healthcare monitoring systems.

PID 334

Integrated HPS-GRU Model for Solar PV Forecasting in V2G Charging Applications

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The increasing integration of solar-powered Electric Vehicle (EV) chargers into smart grids requires accurate day-ahead power forecasting to ensure grid reliability and minimize operational costs. However, the intrinsic variability of solar irradiance often leads to significant imbalances during net metering and Vehicle-to-Grid (V2G) operations. This article proposes a hybrid physical-statistical (HPS) framework that integrates the Sandia Array Performance Model (SAPM) with a Gated Recurrent Unit (GRU) network. The SAPM provides a physics-constrained baseline, while the GRU is trained to identify and correct non-linear residual errors stemming from stochastic weather patterns. Validated against Photovoltaic Data Acquisition (PVDAQ) and NSRDB datasets, the HPS model achieved a 25.14% forecast skill score, significantly outperforming standalone physical and statistical benchmarks. To demonstrate application relevance, a V2G simulation was conducted, showing that the HPS model reduces day-ahead declaration imbalances by 22% compared to persistence models. This enhanced accuracy provides a reliable foundation for Energy Management Systems (EMS) to optimize EV charging schedules and V2G grid interactions.

PID 349

SLM as a Service: An Autonomous Platform for the Industrialization of Specialized AI Utilizing the PyTorch Lightning Ecosystem

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The SLMaS platform addresses industrial LLM barriers—cost, latency, and data sovereignty—by automating the creation of specialized Small Language Models (SLMs). Utilizing a four-module framework (Data Generation, Validation, Creation, and Hosting), it leverages PyTorch Lightning to streamline a complex seven-stage fine-tuning pipeline. By employing PEFT techniques like DoRA and QLoRA, SLMaS produces models under 20B parameters that achieve an impressive 0.92 F1 score. This specialized approach slashes total ownership costs by over 1,000x and reduces inference latency by 68%. Ultimately, SLMaS provides a scalable, secure, and economically transformative blueprint for decentralized, high-performance enterprise AI.

PID 354

Using Convolutional Neural Networks (CNNs) to Analyze Medical Images to Automatically find Pneumonia in Chest X-rays

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Pneumonia is a common and potentially life-threatening lung infection that requires timely diagnosis and monitoring; however, traditional methods such as chest X-ray (CXR) interpretation and physical examination depend on expert judgment, making them time-consuming, subjective, and often inaccessible in resource-limited settings. To address these limitations, this project proposes an automated pneumonia detection system using Convolutional Neural Networks (CNNs), leveraging a state-of-the-art architecture with ImageNet pre-trained weights to efficiently learn subtle and complex visual patterns in chest X-ray images. The model is designed to identify early signs of infection, including minor opacities and texture variations that may be overlooked by human observers, and is enhanced through extensive data augmentation techniques such as rotation, flipping, and zooming to improve robustness and generalization across diverse clinical data. Experimental results demonstrate high accuracy, recall, and F1-score, even on unseen images, indicating strong performance and reliability. The system enables healthcare professionals to upload chest X-ray images and receive instant predictions (normal or pneumonia) along with confidence scores, thereby accelerating diagnosis and supporting clinical decision-making. Overall, this AI-based approach offers a scalable, efficient, and user-friendly solution for early pneumonia detection, particularly beneficial in regions lacking access to specialized radiologists, ultimately contributing to improved patient care and healthcare outcomes.

PID 363

Generative Multimodal Federated Learning (GMFL): A Theoretical Framework for Decentralized Multimodal Systems

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Multimodal data has led to increased expressiveness and context-awareness in intelligent systems. Federated Learning (FL), as a decentralized approach, supports the ability to collaboratively train models without having to share the raw data among clients. The chapter presents a theoretical framework for Generative Multimodal Federated Learning (GMFL), built to accommodate heterogeneity and

non-IID (non-identically independently distributed) data, and where each client may have partial access to modalities. This framework decomposes into three components; generative reconstruction, modality-aware aggregation, and cross-modal alignment, for providing model robustness and consistency. Although purely theoretical, the proposed GMFL framework provides a basis for future implementations.

PID 364

AI-Powered Multilingual Skincare and Nutrition Recommendation System

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This paper presents an AI-powered multilingual skincare and nutrition recommendation system designed to provide personalized health and wellness solutions. The system utilizes machine learning algorithms to analyze user inputs such as skin type, dietary habits, and environmental factors. It generates customized skincare routines and nutritional plans in multiple languages, improving accessibility and user engagement. The model integrates natural language processing to support multilingual interaction and enhances usability. The proposed solution aims to bridge the gap between dermatological advice and everyday health practices, offering an intelligent, user-friendly platform for individuals seeking effective and personalized skincare and nutrition guidance.

PID 371

An Adaptive Hybrid Siamese Framework for Protein Similarity Prediction Integrating Chemical and Structural Features

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The work proposes a weighted hybrid siamese framework for protein similarity classification that addresses the scalability limitations of traditional alignment-based methods. The model integrates physicochemical and structural features, dynamically balancing their contributions through a monte carlo based weighting strategy. The framework achieves 83.28% accuracy, offering a scalable and biologically interpretable approach to protein similarity prediction.

PID 373

Enhancing Sentiment Prediction and Interpretation Using Balanced Training and Explainable AI for Coursera Reviews: A Multi-Class Imbalance Dataset

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This study aims to build an efficient sentiment analysis model for a multi-class, large-scale educational dataset. Particularly, the challenge is to overcome a large class imbalance, as seen in Coursera feedback, which has 1.45 million reviews with more than 90% of Positive cases, dominant over Negative and Neutral polarities. The current approaches of converting the problem into binary classification, generating a balanced dataset, or using multiple models create a hindrance to comparison, due to reduced size and a lack of interpretability resulting from loss of generalization. The proposed methodology introduces a novel balanced training approach to mitigate bias in a large test set and provides better interpretability through a single model, multiple performance metrics, and Explainable Artificial Intelligence (XAI).

PID 379

Enhancing Non-Invasive Blood Glucose Prediction Accuracy Using a Hybrid Framework by Integrating Microwave Resonator Data with Deep Learning Architectures

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Continuous non-invasive blood glucose monitoring (NIGM) is very challenging due to signal degradation from physiological variation and body motion. To this end, our work presents a new multi-modal framework based on the 2.45 GHz microwave sensor combined with the integrated convolutional neural network (CNN) architecture and long short-term memory (LSTM), named CNN-LSTM. We propose an Adaptive Motion Artifact Suppression (MAS) unit, that is triggered by a Binary Motion Flag, in order to mitigate the deformation of the resonant frequency caused by the physical motion. This MAS feature applies a Temporal Moving Average (TMA) filter to standardize 10 s sequences of sensor data prior to deep learning processing. At the same time, a parallel 1D-CNN is applied to learn the spatial morphological features to address the skin thickness (0.8 mm–.5 mm) and dielectric constant discrepancies. The Bidirectional LSTM network is then employed to model temporal dependency for a stable signal. Our experimental results demonstrate that this system is capable of faithfully representing glucose concentrations over an important clinical dynamic range of 17.4 mg/dL to 394.8 mg/dL. Additionally, transient motion artifacts are well compensated for by the hardware-software co-design, predicting variance is limited to less

than 7% even when the subject is experiencing physical motion. These results demonstrate the power of this spatial-temporal scheme and provide a very robust and accurate architecture for continuous non-invasive wearable monitoring devices.

PID 395

A Novel Hybrid Feature Fusion Framework for Robust Brain Tumor Classification

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There has been a significant shift from single-level to multi-level feature extraction for brain tumour classification, with an emphasis on graph-based neural networks. The study aims to investigate feature relevance across tumour classes; in particular, it examines the relevance of individual features (Convolutional Neural Network (CNN), Local Binary Pattern (LBP), Grey-Level Co-occurrence Matrix (GLCM), Partial Differential Equation (PDE), and Wavelet) and their combinations. Integrated deep CNN features with handcrafted descriptors for brain tumour classification across meningioma, glioma, and pituitary cases were implemented on 3064 T1-weighted images, and the models achieved a 5% increase in accuracy compared to the hybrid CNN with GAT baseline. The CNN + Wavelet_GLCM model achieved the highest accuracy of 92.16%.

PID 400

UrbanEye: AI-Powered Satellite-Based Urban Encroachment Monitoring

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UrbanEye is an AI-powered satellite-based urban encroachment monitoring system developed to detect urban growth, land-use changes, and possible encroachment activities in Mumbai and its suburbs. The system utilises multi-temporal Sentinel-2 imagery and Google Earth Engine (GEE) for urban change analysis. A U-Net deep learning model segments satellite images into categories such as buildings and vegetation to identify potential encroachment zones and generate early warnings for further investigation. The detected changes are visualised through a web-based dashboard with analytical report generation. Experimental results achieved 98.36% accuracy and an F1-score of 0.80, demonstrating the effectiveness of UrbanEye for urban planning, monitoring, and encroachment detection applications.

PID 405

Deep Learning Driven Personalized Music Synthesis Using Maternal EEG and Fetal Heart Rate

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UrbanEye is an AI-powered satellite-based urban encroachment monitoring system developed to detect urban growth, land-use changes, and possible encroachment activities in Mumbai and its suburbs. The system utilises multi-temporal Sentinel-2 imagery and Google Earth Engine (GEE) for urban change analysis. A U-Net deep learning model segments satellite images into categories such as buildings and vegetation to identify potential encroachment zones and generate early warnings for further investigation. The detected changes are visualised through a web-based dashboard with analytical report generation. Experimental results achieved 98.36% accuracy and an F1-score of 0.80, demonstrating the effectiveness of UrbanEye for urban planning, monitoring, and encroachment detection applications.

PID 411

An Explainable Machine Learning Model for Multiple Lung Disease Classification from Chest X-Ray Images Using Feature Selection

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The research introduces a feature-based transparent framework for categorizing chest X-ray pictures into four different classifications, including normal, pneumonia, tuberculosis, and COVID-19. HOG, ORB, and Haralick—three handcrafted descriptors—were retrieved, and then feature fusion was used, which helps to make it more useful for distinguishing between things. We looked at other ways to choose features such as variance threshold, knowledge-based approaches, PCA, and LDA, utilizing 1000 and 100 components as examples. The results showed that combining PCA with other features always gave the best testing accuracy, best ROC/PR AUC values, and generalization performance compared to using HOG and ORB descriptors on their own. The t-SNE visualization clearly showed that it is easier to separate classes with the following fusion and PCA reduction. Also, SHAP-based analysis made things clearer by finding the most important aspects that helped make decisions. Overall, the suggested method is a fast and easy-to-understand way to diagnose multiple medical conditions. The results show that PCA-based feature selection on combined descriptors is the best way to go, laying the groundwork for real-time computer-aided diagnosis systems.

PID 415

**MOFS-ArousalNet: Multiobjective Feature Selection and Hierarchical CNN
for Sleep Arousal Detection from Multichannel PSG Signals**

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Detecting sleep arousals automatically from polysomnography (PSG) recordings remains difficult due to their low occurrence rate, brief duration, and physiological heterogeneity. This paper introduces MOFS-ArousalNet, a multimodal deep learning framework for non-apnea sleep arousal detection that leverages multi objective feature selection and a hierarchical convolutional neural network architecture. The method was applied to the PhysioNet 2018 Sleep Arousal Challenge dataset utilizing all 13 PSG channels with 5-fold cross-validation, and achieved AUROC 0.96 and AUPRC 0.55. Compared to prior solutions utilizing PSG data, the proposed framework not only increases predictive performance but also reduces feature redundancy while yielding a more compact and interpretable solution for clinically impactful sleep-event detection.

PID 416

Predicting Air Pollution Using ML Models for Smart City Applications

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Air pollution is a major global concern affecting human health and the environment. This study proposes a machine learning-based approach to predict air quality using historical pollution and meteorological data. Various models including linear regression, random forest, XGBoost, and deep learning techniques are analyzed to capture complex patterns in data. The performance of these models is evaluated using standard metrics, showing that ensemble and deep learning models provide better accuracy than traditional methods. The proposed system can help in early prediction of air quality levels, enabling smart city applications, improving environmental monitoring, and supporting decision-making for sustainable urban development.

PID 436

Agentic Federated Retinal Biometrics for Trustworthy Authentication in Intelligent Networks

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We present an agentic federated retinal biometric framework for secure and trustworthy authentication in intelligent networked smart infrastructure. At each edge node, three geometrically independent high-entropy keys (RDDM, ROTD, and DRID) are locally generated from retinal vessel endpoints. These keys drive an agentic AI module for autonomous session authentication and real-time decision-making. Model updates are aggregated at a central server using SHAP-weighted federated learning without sharing raw biometric images. Experimental results on a 10-node smart-city simulation show 99.2% authentication accuracy, 96.5% robustness under 30% Byzantine attacks, full-space key-guessing resistance exceeding 10^{150} years, and a SHAP explainability score of 0.95. This approach enables privacy-preserving, explainable, and responsible AI for sustainable smart infrastructure.

PID 439

SAD-Focused Empathetic Chatbot for Cognitive Reframing

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This paper presents a dual-engine AI system designed to support individuals with Social Anxiety Disorder (SAD) through Cognitive Behavioral Therapy (CBT)-based reframing. The system integrates a DistilBERT classifier to detect cognitive distortions in user input and a large language model to generate structured, empathetic responses. Unlike general-purpose LLMs, the proposed system explicitly identifies thinking patterns and provides concise, guided reframing. Experimental results demonstrate effective classification with Top-1 accuracy of 57.03% and Top-3 accuracy of 82.52%. The approach highlights the importance of structured reasoning in AI-driven mental health support systems.

PID 440

XAI Enabled Hybrid Deep Learning Model for Detecting Cross Site Scripting (XSS) Attacks

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Modern XSS detection models struggle with the high dimensionality, sparsity, class imbalance inherent in XSS datasets & their black-box

nature limits trust. This study proposes a novel XAI-driven hybrid deep learning framework. A multi-stage feature selection technique consisting of variance thresholding, ANOVA F-test, & a hybrid neural network that uses batch normalization, residual connections, & progressive dropout has been utilized and evaluated on a large-scale recent dataset, achieved promising results with an accuracy & precision of 0.99, & an AUC-ROC score of 0.9994, XAI analysis reveals that statistical entropy, special character frequency, & JavaScript keyword presence are the most influential features driving predictions. The study bridges the gap between detection efficacy & interpretability, providing relevant insight on the model's decisions for deploying AI-driven defenses in real-world environments.

PID 443

LLM Guided Semantic Path Planning Using Vision-Based SLAM

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Most autonomous robots navigate competently but understand nothing. They build maps of walls and floors without any sense of what's in the room. This project takes a different approach: an autonomous robot that combines SLAM, object detection, and an LLM so it can respond to natural language commands with actual spatial reasoning behind them. The hardware is an RGB Depth camera. It feeds real-time V-SLAM for localization and mapping while a vision-language model identifies and labels objects in parallel. Those labels get merged with the spatial data, so the map does not just record geometry. It knows there is a table in the corner, a door on the left or an unexplored region ahead. When a user sends a command like "move towards the table" or "explore areas with unknown tags," the LLM interprets it against that semantic map and produces a navigation target. The path planner handles the rest, routing around obstacles using the SLAM data and semantic context. None of this runs on ROS. Dropping the middle-ware was completely intentional as it removes a consistent source of latency and keeps data flow between perception, reasoning, and actuation deterministic and easy to debug. The system is a proof of concept for something that is harder than it sounds: making a robot that can take a plain English instruction and actually figure out where to go. The proposed system demonstrates how vision, language, and spatial intelligence can be integrated to enhance autonomous exploration, supporting SDG 9: Industry, Innovation, and Infrastructure by promoting innovative, intelligent, and sustainable robotic technologies.

PID 446

An Ensemble of Transfer Learning Models for Feature Extraction and Classification of Banana Plant Diseases

Ashish K. Patil¹, Deepak Kumar Yadav², Rajesh Kumar Nagar³

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This study offers a design of how to detect banana plant diseases by combining machine learning and deep learning methods. A sample of banana leaves were gathered in the agricultural land in Maharashtra in the Jalgaon region. The extraction of the features was conducted with the help of four transfer learning models EfficientNetB0, VGG16, MobileNetV3, and ResNet50 and the extracted features were later merged. On the merged feature set, the classification with machine learning algorithms has been conducted. The experimental evidence shows that the combined feature approach made the highest accuracies of 92.70% with K-Nearest Neighbors (KNN) classifier and 92.40% with XGBoost, which are greater than using feature extractors. These results show that combining features that are obtained using several transfer learning models can significantly enhance the precision of plant disease prediction.

PID 448

An Artificial Intelligence Driven Framework for Phishing Detection Using Instruction-Tuned Large Language Models

Ankit Kumar Jain¹, Rohan Khandewal², Dharmendra Yadav³, Sanyam Khapra⁴

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With technical advances, phishing has become the leading cybersecurity threat, exploiting security loopholes to steal private and sensitive information from fake websites. Existing phishing detection systems often struggle to generalize to evolving attack patterns and obfuscated URLs, limiting their real-world effectiveness. In this paper, we explore an instruction-tuned large language model (LLM) for phishing URL detection, treating URLs as structured language sequences and reasoning over their elements. We test the proposed approach on different non-overlapping subsets sampled from the PhiUSIIL dataset to evaluate robustness and generalization on a few data points. Experimental results show that the instruction-tuned LLM provides table detection performance across different data subsets.

PID 451

Comparative Evaluation of YOLOv8 Models for Automated Crop-weed Detection in Soybean Agriculture

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Weed infestation significantly affects soybean yield, increasing labour and herbicide use. To address this, a deep-learning-based crop-weed detection system was developed to identify bean, soybean, and weed classes. A dataset of 3014 annotated images was preprocessed and

augmented for robustness. Multiple YOLOv8 models were trained and evaluated using standard metrics. Results show that YOLOv8n achieved the best balance between accuracy and efficiency, with 95.4% precision, 93.5% recall, and 98.1% mAP@0.5. The system enables accurate real-time detection, supporting precision agriculture by reducing chemical usage, labour costs, and environmental impact while improving sustainable farming practices.

PID 456

AI-Powered Network Intrusion Detection Using Deep Learning and Big Data Analytics: A Survey of Opportunities, Challenges, and Future Directions

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This survey reviews 83 peer-reviewed studies from 2019 to 2025 on deep learning for network intrusion detection. Following a PRISMA-guided process, each paper was coded by architecture, dataset, data platform, and deployment maturity. Hybrid CNN-LSTM models routinely reach F1-scores above 0.98, while transformers and graph neural networks are gaining ground. However, only 12% of studies test adversarial robustness, cross-dataset accuracy typically drops 8-15 points, and streaming deployments remain rare. The paper argues that further progress depends on adversarial benchmarking, honest cross-dataset validation, and closer integration of deep learning with streaming big data, with federated edge architecture the most promising direction.

PID 457

Topology-Aware Hybrid Graph Neural Networks for Cross-Event Rumour Detection with Confidence-Guided Human Intervention

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This study proposes a topology-aware hybrid graph neural network framework for cross-event rumor detection using the multi-event PHEME dataset. The proposed approach integrates Graph Convolutional Networks, Graph Attention Networks, and Graph SAGE to capture heterogeneous propagation structures in social media reply cascades. TF–DF-based node representations and reply-graph construction are used to model structural and semantic relationships simultaneously. Experimental evaluation demonstrates that hybrid architectures outperform individual graph neural baselines, achieving stable Macro-F1 performance with narrow confidence intervals. A confidence-guided human intervention mechanism is additionally introduced to route uncertain predictions for crowd-assisted validation, improving reliability while maintaining lower computational complexity than transformer-based approaches.

PID 458

Performance Evaluation of Deep Learning Models for the Detection of Diabetic Retinopathy

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Diabetic Retinopathy (DR) is leading cause of vision loss, making early detection and accurate staging critical. This study presents a Deep Learning (DL) based framework for multiclass DR classification using retinal fundus images. Three models CNN, EfficientNetB0 and Swin Transformer are implemented and compared. Images are preprocessed and augmented to improve quality and generalization. While CNN captured basic features and EfficientNetB0 enhances performance, the Swin Transformer outperforms both by effectively learning local and global patterns through attention mechanisms. It achieves the highest accuracy (97.2%) and better precision, recall and F1-scores, demonstrating superior capability in distinguishing DR severity stages for reliable automated diagnosis.

PID 461

SimuDrones: A Browser-Based 3D Virtual Laboratory for Drone Design, Rule-Based Hardware Validation, and Physics-Simulated Flight

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This paper presents SimuDrones, a browser-based 3D virtual drone laboratory requiring no local installation. Built on Next.js 16, React Three Fiber, and Zustand the platform allows users to assemble drones from real-world components in an interactive 3D environment, validate builds using a 19-rule hardware-compatibility engine, wire e-compatibility engine, wire flight controllers through node-graph circuit builders, fly assembled drones in a physics-based simulator. The platform eliminates hardware cost and flight safety risk. Controlled testing confirmed 100% detection accuracy across all 19 failure modes, and physics dynamics deviated from theoretical Newtonian models by only 4.2% across five drone weight classes.

PID 462

A Quantum-Enhanced Blockchain Security Framework for the Internet of Vehicles Using Quantum Key Distribution

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The rapid growth of the Internet of Vehicles (IoV) enables real-time communication but raises serious security concerns, especially with emerging quantum threats. This paper proposes a secure IoV framework integrating quantum key distribution (QKD), specifically the BB84 protocol, to generate reliable shared keys. It combines digital signatures, HMAC-based authentication, and blockchain-based smart contracts to ensure secure, authenticated, and tamper-proof communication. The decentralized architecture enhances trust and resists attacks such as eavesdropping and replay attacks. Experimental results show reduced computation, communication overhead, and latency, making the proposed solution efficient, scalable, and quantum-resistant for next-generation intelligent transportation systems.

PID 465

Hybrid Learning-Based Detection of DDoS Attacks and Game-Theoretic Proof-of-Work Mitigation in SDN

Amit Kachavimath¹, Narayan G²

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The Distributed Denial-of-Service (DDoS) attacks will reduce the availability and reliability of network services by flooding them with excessive malicious traffic. We propose a hybrid DDoS detection and mitigation framework for Software-Defined Networking (SDN) that combines SHAP- and LIME- based feature selection, entropy-based routing, XGBoost classification, and Agglomerative unsupervised clustering to detect unknown malicious traffic. The reputation-based Proof-of-Work (PoW) mechanism, modeled using a game-theoretic approach, enables adaptive mitigation against suspicious nodes. Experimental evaluation conducted on benchmark InSDN dataset, emulation environment using Mininet, and a private OpenStack cloud deployment and the proposed framework achieves an accuracy exceeding 99%.

PID 473

AI-Driven Adaptive ROI-Based Secure Medical Image Authentication Using U-Net Segmentation and Hybrid DWT-CT Watermarking

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This work proposes an adaptive ROI-based secure medical image authentication framework for AI-driven healthcare systems. The approach uses a combination of U-Net-based tumor segmentation, DWT-DCT hybrid watermarking as well as chaotic encryption so that embedded watermarks are robust and unnoticeable. Experimental studies show high-quality images ($\approx$ PSNR = 48 dB; $\approx$ SSIM = 0.99); the method also demonstrates strong robustness (NC > 0.9 against noise and compression attacks), ensuring safe communication and reliable clinical diagnoses in smart health environments.

PID 476

LAG-Net: Lightweight Attention-Guided Deep Neural Network for Brachial Plexus Nerve Segmentation

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In this work, a Lightweight Attention-Guided Deep Neural Network (DNN) is designed for the segmentation of brachial plexus (BP) nerves from the ultrasound images. The lightweight attention mechanism, which consists of channel attention followed by Spatial attention is integrated into the residual learning-inspired UNet architecture to highlight the informative features from complex and low-contrast images by suppressing the noise to improve the segmentation accuracy. The proposed LAG-Net has obtained a Dice score of 80.56 and an IoU of 69.45, reflecting its superior performance as compared to existing counterpart methods.

PID 479

Public Transport Tracking with Predictive Routing in Low-Infrastructure Small Cities

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Public transport tracking in real time is still a technological challenge in small and infrastructure-poor cities with limited connectivity, financial resources and no centralized data systems. This paper presents a new framework, which uses edge computing and lightweight machine learning models in order to provide localized, real-time tracking and predictive routing, independent of cloud infrastructure. The system collects GPS and user data on public vehicles and terminals using the low-power edge computing devices to draw conclusions about the traffic behavior and predict delays and provide recommendations regarding the optimal paths based on the offline-trained models. This decentralized approach provides low latency, network-independence and continued operations in densely populated areas and scalability. The framework is then validated in a simulated environment that represents small urban areas, and results demonstrate the improvement in the accuracy of the data, the commuter satisfaction and resilience of the system.

PID 480

Transformer-Driven Feature Learning with Kernel ELM for Waste Classification

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The study introduces a new method for classifying waste to increase resource management and sustainability. Waste can be classified as either organic or recyclable waste, and then further classified into hazardous or non-hazardous waste. The process involves combining the use of a Swin Transformer (ST) model for feature extraction and the Kernel Extreme Learning Machine (KELM) model for effective classification. The multistage hierarchical approach allows for more precise classification. The results of the experiments conducted demonstrated increased accuracy, generalization, and decreased training time. In addition, provide transparency to users through the use of Explainable Artificial Intelligence (XAI) for efficient sorting of waste and creating sustainable waste management systems in general.

PID 481

ATWA: Attack-Aware Trust-Weighted Aggregation for Robust Federated Intrusion Detection in IoT Networks

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This study proposes an Attack-Aware Trust-Weighted Aggregation (ATWA) framework for robust intrusion detection using federated learning in an Internet of Things (IoT) environment. Our framework integrates median-based reference estimation, distance-driven reliability scoring, adaptive clipping and temporal trust evolution to address poisoning attacks under non-independent and identically distributed (non-IID) data. Experimental evaluation on the TON IoT dataset demonstrated that ATWA achieves an F1-score of 0.938 under 30% malicious clients, outperforming baseline aggregation methods.

PID 488

Mitigation of DDoS Attacks Using Unsupervised Learning and Proof of Work in OpenStack Environment

Amit Kachavimath¹, Sudarshan Naik², Pritesh Kotur³, Mallikarjun Paroji⁴, Pratik Shetty⁵, Narayan G⁶
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Distributed Denial-of-Service (DDoS) attacks on cloud environments have increased in recent days. We have proposed a DDoS mitigation methodology deployed in a multi-node OpenStack cloud environment using multiple virtual machines. The captured traffic was converted to 83 features using CICFlowmeter, and the most significant attributes were selected using Local Interpretable Model-agnostic Explanations(LIME).Balanced Iterative Reducing and Clustering using Hierarchies(BIRCH) based unsupervised clustering achieved separation with high silhouette scores, while the overall detection rate exceeded 96%.The reputation-based Proof-of-Work(PoW) mechanism was integrated to enable adaptive traffic control using Game Theory.

PID 492

Golden Dorado Optimization Algorithm: A Novel Nature-Derived Method for UAV Path Planning

Sagnik Sarkar¹, Dipayan Sinha², Partha Ghosh³
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Unmanned Aerial Vehicles (UAVs) have emerged as a vivid paradigm in a variety of applications such as urban reconstruction, ocean

monitoring, precision agriculture, disaster management and many more. The authors in this paper have specifically focused on the domain of UAV path planning which has witnessed growing demand according to recent developments. Many distinct techniques were applied in earlier works in order to address this path planning problem which consisted of deep reinforcement learning, linear programming or other gradient-driven techniques. However, it was later observed from some promising works that nature-inspired metaheuristic algorithms deliver more effective and optimized solutions. In this paper, a novel metaheuristic algorithm called Golden Dorado Optimization Algorithm (GDOA) is applied to tackle this problem which is then evaluated on a set of benchmark functions as well as on simulated environments with different complexities to validate the accuracy of GDOA. Based on these evaluation, the results show that GDOA is able to demonstrate efficient and streamlined solutions, and along with that, it mitigated some of the major problems faced by other metaheuristic algorithms, which include, low convergence accuracy, incompleteness towards global optima and parameter sensitivity. Hence indicating GDOA has strong potential for solving complex real-world problems.

PID 493

Beyond the Single Panel: A Multimodal Deep Learning Approach to Narrative and Emotion in Comics

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Understanding comics involves the integration of visuals, text and background elements across panels where meaning is derived from narrative continuity. In this paper, we introduce a multimodal approach that fuses facial expressions, dialogue and background information to detect emotions while retaining modality-specific details. It uses a temporal transformer to model the evolution of emotions across panels and employs prediction based on expectations to model consistency and change. This work consists of five steps: feature extraction, temporal modeling, emotion prediction, consistency check, and final output generation. The approach demonstrates the benefits of multimodal fusion and temporal modeling, achieving 0.91 accuracy, versus without temporal understanding.

PID 494

Fuzzy-based Multimodal Gait Emotion Recognition Using Deep Learning and Hybrid Fusion Framework

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This paper presents a Fuzzy-based Multimodal Gait Emotion Recognition (FMGER) system that identifies human emotional states by analyzing their walking patterns. The framework combines five gait modalities, 2D and 3D gait skeleton representation, silhouettes, optical flow, and contour maps, to address the spatial and temporal motion of the gait. Such modalities are learned based on high-level deep learning models, including ST-GCN, 3D CNN-BiLSTM, and Transformer-based models. A fuzzy decision-based fusion mechanism is used to integrate modality-wise predictions and address classification uncertainty. The results of the experiments prove that the offered model has an accuracy of 94.2%, which is higher than the existing state-of-the-art methods and demonstrates great resilience to various classes of emotions. The framework brings into focus the usefulness of multimodal learning and intelligent fusion to provide stable recognition of emotions in the real world. The framework has high potential in its application in healthcare, surveillance, and human-computer interaction, with future research work aiming at the real-time application.

PID 496

Steganalysis Detection in Digital Images Using Machine Learning and Deep Learning on BOSSbase 1.01

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Steganography basically means hiding secret stuff inside digital pictures so you can't tell anything is wrong just by looking at them. It is a real problem for cybersecurity and figuring out digital crimes. Then there is steganalysis which tries to spot if data is hidden like that. In this work they came up with a whole setup to test steganalysis and they used this dataset called BOSSbase 1.01. It has ten thousand grayscale images all at 512 by 512 pixels. To make the paired sets of normal and stego images they embedded using LSB method with a payload of 0.4 bits per pixel.

PID 498

Hybrid STL Learning Approach for Blood Demand Forecasting

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Blood reserve management in healthcare institutions is challenging due to the perishable nature of blood and fluctuating demand driven by seasonal trends, emergencies, and calendar variations. Traditional forecasting and machine learning models often fail to capture these

patterns effectively. This study proposes a Hybrid STL-MLP Blood Demand Forecasting Model that uses Seasonal-Trend Decomposition via Loess to separate data into trend, seasonal, and irregular components. A neural network predicts the irregular component. Incorporating temporal features further improves accuracy. Experimental results show the proposed model significantly outperforms existing methods, achieving a forty eight percent reduction in mean absolute error.

PID 506

**Green-IoMT framework Using RF Energy Harvesting, Predictive Modelling
and Reinforcement Learning-based Energy Management System**

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In this paper, we present a unified framework of energy consumption prediction, reinforcement learning and optimization strategies for energy-efficient scheduling in Radio Frequency Energy Harvester-enabled Internet of Medical Things systems (RF-EH-IoMT). Our proposed model combines XGBoost-based energy prediction with a Double Deep Q-Network (DDQN) scheduler, further optimized using Particle Swarm Optimization (PSO), achieving a peak reward. We benchmark our framework against classical scheduling heuristics, standalone Reinforcement Learning (RL) models and other metaheuristic-optimized variants across multiple performance metrics. The results demonstrate that our integrated approach significantly outperforms existing methods in terms of energy efficiency for scalable and intelligent Green-IoMT systems.

PID 507

**A Game Theory-Based Model for an Efficient and Secure Consensus
Algorithm in the Ethereum Blockchain**

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Ethereum 2.0's Proof of Stake consensus faces centralization issues and lacks a mechanism to handle malicious nodes. While Delegated Proof of Stake with Downgrade (DDPoS) addresses centralization and adds a downgrading mechanism, it only targets static nodes and offers no reward system. To overcome these limitations, we propose DRPoP-GT, a Delegated Reputation-based Proof of Probability consensus mechanism built on a game theoretic model. Experiments on a private Ethereum network demonstrate that DRPoP-GT outperforms DDPoS in transaction latency, fairness, block latency, and security, all with minimal overhead. Results are further validated through simulation.

PID 513

**A Novel Adaptive Deep Fusion Framework for Multi-Modal Biometric Authentication
Using Fingerprint, Face, Iris, and Voice Traits**

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The continuous evolution of digital technologies in healthcare, finance, and intelligent systems has elevated the need for secure, privacy-preserving, and user-friendly authentication mechanisms. Conventional unimodal biometric systems—depending solely on a single trait such as fingerprint, face, iris, or voice—offer from vulnerabilities to spoofing, illumination variation, noise interference, and sensor degradation. These limitations increase the False Acceptance Rate (FAR) and False Rejection Rate (FRR), particularly under unconstrained environments. Recent advances in multimodal biometric authentication (MMBA) combine multiple physiological and behavioral features to improve recognition reliability and resist adversarial manipulation. However, most existing approaches rely on static fusion rules or independent classifier ensembles that fail to adapt dynamically to environmental fluctuations. To address these issues, this research proposes an Adaptive Deep Fusion Framework (ADFF) integrating fingerprint, face, iris, and voice modalities. The model exploits hybrid Convolutional–recurrent architectures for hierarchical feature learning, Ant-Colony-Optimization-based adaptive weighting for environmental robustness, and multi-layer cancellable template protection to preserve privacy. The ADFF framework enhances verification accuracy, lowers Equal Error Rate (EER), and ensures secure identity representation for deployment across mobile, IoT, and cloud infrastructures.

PID 517

**Continuous Specification of Voluntary Actions in Basal Ganglia
Under the Context of Reinforcement Learning**

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A Computationally Efficient Reinforcement Learning Model for Continuous Specification of Voluntary Actions in Basal Ganglia. The bidirectional relationship between machine learning and neuroscience is specifically evident in the study of the brain's reward and

punishment system governed by reinforcement learning (RL) principles. The voluntary actions in human beings are characterized by different mechanisms like motor planning and initiation, adjustment and fine-tuning, inhibition of unwanted movements, and feedback loops. Prior studies have typically examined these individual components in isolation. Although different brain regions such as motor cortex, Basal Ganglia (BG), and cerebellum are involved in movement, the proposed study is limited to the part of the brain namely the basal ganglia. The proposed RL model incorporated the different mechanisms that govern movement and explored an efficient computational approach to simulate them. The Bayesian ensembled model showcased the benefits of uncertainty quantification. To assess the performance of the novel posterior probability-based reinforcement learning model, it was compared against Deep Q-Network trained with a robotic arm dataset. It was observed that the standard Deep-Q Networks achieved an accuracy of only 79% in selecting the pathways of the BG circuitry. However, the proposed extended Bayesian ensembled D-Q-N (EDQN) with Thompson sampling for exploration-exploitation trade-off exhibited a higher accuracy of 98%. It was observed that Thompson sampling kept a better probability distribution over possible rewards to adapt to uncertainties, compared to greedy approach. The EDQN carried out better exploration-exploitation trade-off and converged to a better accuracy with high rewards easily, compared to standard DQN. The model is scalable and can be altered to include the dynamics of each type of neurons in the Basal Ganglia. Research shows that signals from BG can be interpreted to create smoother and more natural control of prosthetic arm. Thus, prosthetic arm powered by this novel approach can learn new tasks over time and adapt prosthetic control through user interaction, similar to how BG enable skill acquisition and reward-based learning.

PID 518

Design and Performance Evaluation of 5G Network Slicing for Healthcare Applications

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In this paper, we propose an IoT-based smart health monitoring system using 5G network slicing technology to increase the reliability and speed of medical information transmission. It monitors the patient's crucial physiological indicators, such as SpO2, body temperature, heart rate, and body movement, which are crucial indicators of the patient's condition. In traditional systems, the patient's information is transmitted through a single channel, meaning that no priority is given to any information being sent, thereby wasting precious resources and causing delays in the transmission of crucial patient information. To mitigate this, we propose a smart system that uses an ESP32 microcontroller, a pulse sensor, a temperature sensor, and an accelerometer to monitor the patient's health condition, using a Random Forest algorithm to classify the patient's condition. Depending on the classification results, the system dynamically switches between the URLLC or mMTC slice in the 5G network to ensure efficient and effective transmission of patient information. From the experimental results, we find that the system attains 90–2% accuracy in real-time data transmission and 91% accuracy in synthetic data, thereby proving the effectiveness of the proposed system using the integration of IoT technology and 5G smart healthcare systems.

PID 520

Adaptive Machine Learning–ntegrated Firewall Framework for Real-Time Phishing URL Detection Using Structural Feature Intelligence, DNS Resolution Analysis, and Automated Threat Mitigation

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The URL structural obfuscation and DNS manipulation techniques are abused by phishing attacks to overcome traditional blacklist defenses, and attack users both on the web and email fronts. The paper outlines an adaptive ML-based firewall architecture that is the first configuration that integrates structural URL feature inspection, DNS resolution validation, and Random Forest classification along with automated UFW implementation a combination unseen in previous systems. The system was trained on the PhishDump dataset with stratified sampling, thereby obtaining 98.7% accuracy, 98.5% precision, 98.9% recall, and 98.7% F1-score, which allowed it to prevent phishing subliminal at an autonomous network level in real time.

PID 522

5G-Enabled Adaptive Imbalance Aware Federated Learning with Explainable AI for Multi-Class Skin Lesion Classification

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This paper proposes a 5G enabled adaptive imbalance aware Federated Learning (FL) framework for multi class skin lesion classification using the ISIC 2019 dataset. Severe class imbalance is addressed through a three-stage pipeline integrating SMOTE-ENN, Mix-up augmentation, and Focal Loss, improving minority class representation and robustness. A non-independent and identically distributed FL setting with multiple clients is implemented, where models are aggregated on a 5G Mobile Edge Computing (MEC) server. Efficient Net B3 achieves performance with 80.21% accuracy and 0.9628 AUC. Furthermore, Explainable Artificial Intelligence (XAI) techniques, including Grad CAM, Score CAM, and Integrated Gradients, provide interpretable and clinically reliable predictions.

PID 523

Robust Detection of Cashew Apples in Unstructured Orchard Environments Using Object Detection Models

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Accurate detection of cashew apples in orchard environments is vital for yield estimation and precision agriculture, yet real-world images are highly cluttered. This study evaluates DL object detection models for this task using a custom dataset of 900 annotated images from ICAR-DCR, India. Five models—OLOv8, YOLOv11, YOLOv26, Faster R-CNN, and RetinaNet—were trained under baseline, augmented, and masked setups. Masking achieved the best performance, with mAP@[0.5:0.95] up to 0.99. YOLO models showed superior efficiency, with YOLOv8 offering the best balance of accuracy and speed, while Faster R-CNN and RetinaNet were computationally expensive and less suitable for real-time applications.

PID 525

A Mobile Application for Mental Health Analysis in College Students Using Multimodal Learning with LSTM Autoencoders and Fuzzy Inference

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The increasing prevalence of mental health issues among students necessitates data-driven and personalized approaches for early detection and intervention. Traditional methods relying on static surveys fail to capture dynamic behavioral patterns. This study proposes a hybrid framework that integrates multimodal student data, including sensing, ecological momentary assessment (EMA), educational, and survey-based inputs. Sensing and EMA data are modeled as time-series sequences to capture temporal variations, while educational data are transformed into graph embeddings to preserve structural relationships. An LSTM-based autoencoder is used to learn latent representations from the multimodal data, followed by clustering to categorize students into low, moderate, and high-risk groups. Additionally, standardized psychological models, including the Big Five, Flourishing Scale, Loneliness Scale, and PANAS, are implemented to extract key psychological features. These features, along with behavioral indicators, are integrated into a fuzzy inference system to generate personalized and interpretable recommendations. The proposed approach demonstrates the effectiveness of combining deep learning, clustering, and fuzzy logic for scalable and continuous mental health assessment.

PID 526

Secure Medical Image Transmission Using Post Quantum Cryptography

Satabdee Mahapatra¹, Asha Devi², Pranati Mishra³, Ranjan Kumar Dash⁴
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This research suggests an effective methodology to analyze medical images using Autoencoder, Quantum Artificial Neural Network (QANN), and Post-Quantum Cryptography (PQC). Firstly, brain MRI images are preprocessed using grayscale transformation, image resizing, and normalization techniques to make sure that there are no inconsistencies. Then, an autoencoder algorithm is implemented to compress the input image size and extract features from the images. These extracted features are fed into a QANN model to classify brain tumor types accurately. However, since there are some serious threats related to quantum computing technology, it is suggested to use PQC algorithms to encrypt sensitive medical data.

PID 530

AI-Driven Multimodal Mental Health Screening System Using Behavioral Fusion Intelligence

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This project uses AI to improve early mental health screening by analyzing user behavior across multiple modalities. It evaluates facial expressions using Vision Transformers, language patterns through BERT-based models, and voice along with response activity to detect changes. Instead of assigning fixed labels, it develops a behavioral profile by tracking emotional patterns and engagement over time. User interaction is supported through questionnaires and a conversational interface. Data from all sources is integrated using a fusion model to generate a report with a confidence score, delivered via a real-time web application built with React and FastAPI.

PID 533

**The Living Digital Fabric (LDF): A Field-Native, Ecologically Bounded,
and Self-Governing Framework for Distributed AI Infrastructure**

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This paper introduces the Living Digital Fabric (LDF), a framework that reconceives digital infrastructure as an active, energy-bounded state field —inspired by biological and thermodynamic principles rather than classical computing assumptions. Where existing systems centralise intelligence, store raw data, and treat energy as a cost, LDF distributes intelligence across autonomous nodes, encodes information in field-wide configurations, and makes energy the primary architectural variable. Four integrated pillars —field-native architecture, ecological energy dynamics, emergent distributed cognition, and adaptive governance —are formally specified and simulation-validated. Results demonstrate self-organising cognitive modules, structural privacy without cryptography, Lyapunov-stable energy balance, and a DESI composite health score of 0.82 against a federated learning baseline of zero.

PID 538

**K-TARPlan: An Explainable AI and Augmented Reality Framework for
Kidney Tumor Preoperative Planning Using Deep Segmentation**

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Accurate assessment of tumor size, shape, spatial relation to adjacent renal structures is important for preoperative planning before surgery of kidney tumors. Surgeons are restricted to analyzing two-dimensional computed tomography (CT) slices one by one during conventional review, which is challenging when interpreting the 3D complex renal anatomy if tumors have irregular boundaries or are located at difficult sites. This research presents a novel augmented reality (AR)- assisted preoperative planning workflow that integrates deep-learning-based kidney and tumour segmentation, patient-specific 3D reconstruction, and interactive AR visualisation to enable accurate interpretation of kidney tumor anatomy.

PID 540

**CBAM-CenterNet: Wild Elephant Detection in Thermal Images Using Attention Mechanism
and Object Detection Towards Sustainable Environmental Monitoring**

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The migration of elephants had been a concern, leading to human-elephant conflicts and crop raiding. Artificial Intelligence-based elephant detection will be an effective approach to mitigate human-elephant conflict. The objective is to implement robust elephant detection in the thermal images, even under low-light and nighttime environmental conditions. The proposed CBAM-CenterNet-based object detection framework integrates Convolutional Block Attention Module (CBAM) with an augmented ResNet50 backbone to improve multi-scale feature extraction and attention-driven refinement. The model is trained using the benchmark dataset - arribada human wildlife conflict dataset. The proposed method achieved a mean Average Precision (mAP) of 97% and facilitates the early detection of wild elephants.

PID 541

Explainable Graph-Enhanced Sepsis Prediction Using Patient Similarity Graphs

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Early sepsis detection in ICU remains clinically challenging due to the complexity & heterogeneity of patient data. Existing approaches treat patients as isolated data points, ignore inter patient relational information & also lack interpretability. This work addresses these gaps by proposing a graph-based deep learning framework for early sepsis prediction using eICU dataset that models clinical similarity across patients and integrates XAI to make predictions transparent. A structured preprocessing pipeline handled missing values, and class imbalance. Feature selection was performed in two stages. Firstly, statistical tests including the Mann-Whitney U test and the Chi-square test were applied. These were then passed through LASSO regularization step to further refine the final feature subset. SOFA score was computed for all patients, as it is a clinically validated metric for sepsis severity assessment. A patient similarity graph was constructed with ICU patients as nodes, and edges were drawn between patients based on cosine similarity across selected features. A GCN was trained on this graph to utilize the relational structure. To ensure clinical transparency, SHAP was integrated post-training. Baseline comparisons were conducted against traditional classifiers trained without graph-based relational information. The proposed GCN-based framework outperformed SOTA methods, achieving the highest AUROC of 0.913 and recall of 0.827. SHAP analysis revealed that serum lactate, albumin, and SOFA score were the most influential predictors, aligning closely with established sepsis pathophysiology. The prominence of

SOFA score is particularly meaningful, as it directly quantifies multi-organ dysfunction which is the hallmark of sepsis progression. This work demonstrates that combining patient similarity graphs with GNN-based learning and SHAP explainability produces a sepsis prediction framework that is accurate, interpretable, and clinically actionable.

PID 547

GRAID: Graph-based Reinforcement Learning Approach for Intrusion Detection

Rajeev Shekhar Niranjani¹, Sushil Kumar²

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As cyber threats grow in volume and sophistication, traditional Intrusion Detection Systems (IDS) fail to provide the adaptability and contextual awareness required to protect modern networks. Existing IDS suffer from three critical limitations. First traditional ML-based IDS approaches treat network flows in isolation, ignoring topological relationships between communicating endpoints that are essential for detecting coordinated attacks. Second, existing systems produce only binary outputs, they provide no response mechanism. Third, RL-based IDS that do incorporate adaptive responses rely on flat feature vectors, losing all graph structural context. Our proposed approach, GRAID addresses all three gaps by fusing inductive graph learning with cost-aware RL, contributing scalable, explainable, and deployment-ready autonomous IDS framework. GRAID operates as a three-stage pipeline trained and evaluated on flows taken from UNSW-NB15 dataset across 10 attack categories. In stage 1, network traffic is modeled as a heterogeneous. In Stage 2 a three-layer Graph SAGE model is trained on edge level attack classification, producing node embeddings which captures local traffic statistics and global neighbourhood behaviour. In stage 3, a DQN agent receives state vectors and selects from four actions. Asymmetric reward shaping penalizes missed attacks. Furthermore, SHAP analysis provides post-hoc explainability for individual decisions. GRAID achieves 99.97% TPR, 0.10% FPR and SHAP analysis reveals that both raw traffic features and GNN-derived graph embeddings meaningfully contribute to BLOCK_IP decisions. GRAID outperforms existing SOTA methods including CNN-based IDS, GCN classifiers, and RL-flat-feature agents. In conclusion, GRAID demonstrates that combining inductive GNN with RL produces a highly accurate, explainable, and operationally realistic IDS and establishes a strong foundation for autonomous, adaptive network security systems.

PID 550

A Quantum-Driven Hybrid Temporal Model for Complex Time Series forecasting

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This work presents a quantum enhanced hybrid framework for time series forecasting, integrating decomposition based learning and ensemble deep models inspired by prior sequence decomposition and ensemble forecasting approaches. The method combines quantum preprocessing, SSA based signal separation, and advanced architectures including BiLSTM, PatchTST, and TFT with bio inspired optimization. Experimental results show significant improvements, achieving MA E reductions to 0.42 (univariate) and 0.1505 (multivariate), demonstrating enhanced accuracy, robustness, and scalability for real world energy and environmental forecasting applications.

PID 556

Surrogate-Assisted Multi-Objective Neural Architecture Search with Memory-Aware Constraints for Efficient Image Classification

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MAS-NAS is a surrogate-assisted multi-objective neural architecture search framework that jointly minimises classification error, inference latency, and INT8 memory via MOEA/D Tchebycheff decomposition. Using 64-point Sobol initialisation and a gradient-boosted surrogate gated by generation-level Kendall-tau consistency ($\tau > 0.95$), the search evaluates 130 architectures in 8.76 GPU-hours with zero out-of-memory failures. The accuracy-optimal Pareto champion (0.95M parameters, 0.91 MiB INT8) achieves 73.46% on CIFAR-100, 93.26% on CIFAR-10, and 97.08% on SVHN, exceeding the best constrained random-search candidate by +5.16 pp. On Exynos 1380 (TFLite INT8, AArch64), the champion delivers 1.76 ms and approximately 568 FPS.

PID 557

APPLICATION OF AI in ZIMBABWE' POWER UTILITY SCADA SYSTEM

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This paper presents the Application of AI in Zimbabwe' power utility SCADA system. Existing literature does not cover the use of AI in developing countries which are heavily affected by loadshedding. This research paper addresses this gap by proposing a locally adaptable AI enhanced SCADA framework. The model for integrating AI in Zimbabwe' SCADA system is aimed at enhancing fault detection, grid analysis and decision-making efficiency. The AI model is developed in Python using algorithms such as Logistic

Regression, Random Forest and XG Boost. Model testing is conducted in a JavaScript-based simulation environment emulating real-time grid parameters for example voltage.

PID 559

HireIQ: A ReAct-Driven Multi-Agent Framework for Recruitment Automation

Gopika Sabu¹, Irene Anna Sijo², Jisha P Abraham³, Richu Shibu⁴, Arsha Amal⁵
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HireIQ is a multi-agent AI recruitment platform that automates end-to-end hiring using a ReAct (Reasoning and Acting) orchestration framework built on Lang Graph. Five specialized agents—Resume Screener, Background Verifier, Candidate Ranker, Calendar Scheduler, and Communication Agent collaborate through dynamic, context-aware workflows driven by semantic job description analysis. The system achieves 86.7% routing accuracy, 100% pipeline reliability with Lang Graph, and a 43% improvement in workflow efficiency over unstructured LLM loops, offering a scalable solution for high volume recruitment. Existing AI recruitment solutions predominantly follow static, monolithic pipelines that process all candidates uniformly regardless of role-specific requirements, lack adaptive reasoning, and fail to integrate verification, scheduling, and communication in a unified framework. Multi-agent systems have shown promise but remain limited by rigid orchestration. HireIQ addresses these gaps by introducing ReAct-based dynamic orchestration that reasons about job characteristics for enabling agents, implementing a distributed multi-agent architecture integrating five specialized agents.

PID 561

A Hybrid WOA-CA-MF-YOLOv8 Framework with Explainable AI for Real-Time Crop Disease Detection

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Accurate and timely identification of crop leaf diseases is of vital importance to ensure food security, increase agricultural productivity, and promote farmers' livelihoods. In this regard, this research proposes a novel and efficient method of identifying guava leaf diseases in real-time scenarios. The proposed method is called WOA-CA-MF-YOLOv8. The proposed method utilizes Coordinate Attention (CA) to improve spatial-channel feature representation and utilizes Multi-scale Feature Fusion (MF) to efficiently identify leaf disease features. The proposed method is optimized to ensure its efficiency through the use of the Whale Optimization Algorithm (WOA). The WOA optimizes the proposed method to adaptively optimize the hyperparameters of the model. The proposed method is enhanced to ensure that class imbalance is addressed through the use of Generative Adversarial Networks (GANs).

PID 563

Intelligent Real-Time Crowd Monitoring for Emergency Response and Public Safety: A Deep Learning Approach with Attention-Guided Edge Inference

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Accurate and timely identification of crop leaf diseases is of vital importance to ensure food security, increase agricultural productivity, and promote farmers' livelihoods. In this regard, this research proposes a novel and efficient method of identifying guava leaf diseases in real-time scenarios. The proposed method is called WOA-CA-MF-YOLOv8. The proposed method utilizes Coordinate Attention (CA) to improve spatial-channel feature representation and utilizes Multi-scale Feature Fusion (MF) to efficiently identify leaf disease features. The proposed method is optimized to ensure its efficiency through the use of the Whale Optimization Algorithm (WOA). The WOA optimizes the proposed method to adaptively optimize the hyperparameters of the model. The proposed method is enhanced to ensure that class imbalance is addressed through the use of Generative Adversarial Networks (GANs).

PID 564

Uncertainty Guided Selective Computation for CPU Efficient Brain Tumor Segmentation

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Accurate brain tumor segmentation plays a crucial role for tumor diagnosis and treatment. Deep learning models have achieved remarkable results on medical image segmentation. But these models process all the pixels equally without considering confident predicted regions. Running such models on resource-scarce environment without a GPU (e.g., computers in small clinics or developing countries) is time-consuming. In this paper, we propose an UGSC framework for efficient brain tumor segmentation. A baseline 2D U-Net is first trained to generate pixel-wise probabilities from given MRI slices. Ambiguous regions identified by Shannon entropy form the SoftMax outputs, Keeping the confident predictions intact. The refinement is done to pixels exceeding the uncertainty threshold (τ). Segmentation Accuracy improved notably after refinement of fewer than 1% of pixels.

PID 566

Ensemble Learning-Based Intelligent Diagnostic Framework for Sleep Disorder Classification: A Hybrid Random Forest and Gradient Boosting Approach with Web-Deployed Clinical Decision Support

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The project is design to create an early detection system for sleep disorders using machine learning. It starts with 400 patients with 13 health indicators. It uses various machine learning algorithms such as Gradient boosting, Random Forest and K-Means clustering to discover patterns. An ensemble model achieves maximum accuracy and precision. The system is developed as a web app with Django, allowing user-friendly access. It shows improved efficacy over conventional approaches as it offers quicker, affordable and reliable diagnosis, aiding physicians and individuals in early detection and improved health outcomes.

PID 568

YOLOv8-Based Real-Time Detection of Downy Mildew and Powdery Mildew in Grapevines: A Deep Learning Approach for Smart Vineyard Management

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This paper presents a YOLOv8-based automated grapevine disease detection system for real-time spatial localization and four-class classification of Downy Mildew, Powdery Mildew, Bacterial Rot, and Healthy Leaves. A curated dataset of 2,422 annotated images with data augmentation and ImageNet transfer learning was used to train the model over 100 epochs. The system achieves an overall mAP@0.5 of 0.514, recall of 0.79, precision of 1.00 at 0.807 confidence, and a near-perfect Healthy Leaves mAP of 0.995. Deployed via dual-mode Django and OpenCV interfaces, the system provides farmers with a scalable, cost-effective, real-time alternative to manual disease scouting in commercial viticulture.

PID 569

Intelligent Task Offloading in 5G-Enabled Edge Cloud Continuum: A Hybrid MILP and Deep Q-Learning Approach

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This work proposes an intelligent task offloading mechanism that combines Mixed-Integer Linear Programming (MILP) and Deep Q-Learning (DQL) to schedule tasks with deadlines and traffic sensitivity in a three-tier 5G-enabled edge cloud continuum. Initially, task placement is formulated as an optimization problem that minimizes latency while satisfying per-task deadlines across the device, edge, and cloud layers. Later, reinforcement learning is used to dynamically choose the least utilized edge/cloud nodes based on resource usage, queue length, and task attributes. The proposed work is implemented and evaluated on an experimental 5G-enabled edge-cloud testbed which consists of private 5G testbed, kubernetes-based edge and OpenStack-based cloud. The experimental results with heterogeneous workloads reveal that average end-to-end latency decreases by 24.5% and throughput increases by 43.6% and response time decreases by 32.1% compared to existing work.

PID 570

Mitigation of DDoS Attacks Using Unsupervised Learning and Proof of Work in Private 5

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We have proposed a DDoS detection and mitigation framework deployed in a pNetwork traffic was captured and transformed into 83 flow-based features, from which the most significant attributes were selected using Local Interpretable Model agnostic Explanations (SHAP). Balanced Iterative Reducing and Clustering using Hierarchies (BIRCH) based unsupervised clustering achieved superior separation with high silhouette scores compared to alternative methods, while the overall detection rate exceeded 96%. Furthermore, a reputation-based Proof-of-Work mechanism was integrated to enable adaptive traffic control private 5G environment.

PID 576

FakeXtract: Deepfake Media Detection System Using Efficient Net-B7 Ensembles

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Looking at the recent enhancements in deepfakes and fraud misinformation, we developed FakeXtract, a robust detection framework using EfficientNet-B7 ensembles. While modern forgeries evade standard pixel-based analysis, our system identifies hidden structural

inconsistencies through a strategic 30% face-crop margin and MTCNN-based landmark alignment. By integrating "hardcore" augmentations like landmark blackouts and SSIM mask differences, the model prioritizes structural anomalies over simple noise. Optimized via pruning and quantization, the system maintains a real-time 30 FPS inference rate. Evaluated on Face Forensics++ and Celeb-DF v2, FakeXtract achieved a peak accuracy of 95%, offering a scalable, trustworthy solution for media verification in high-stakes digital environments.

PID 580

Latency-Aware Retrieval-Augmented Generation on CPU-Only Systems

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Looking at the recent enhancements in deepfakes and fraud misinformation, we developed FakeXtract, a robust detection framework using EfficientNet-B7 ensembles. While modern forgeries evade standard pixel-based analysis, our system identifies hidden structural inconsistencies through a strategic 30% face-crop margin and MTCNN-based landmark alignment. By integrating "hardcore" augmentations like landmark blackouts and SSIM mask differences, the model prioritizes structural anomalies over simple noise. Optimized via pruning and quantization, the system maintains a real-time 30 FPS inference rate. Evaluated on FaceForensics++ and Celeb-DF v2, FakeXtract achieved a peak accuracy of 95%, offering a scalable, trustworthy solution for media verification in high-stakes digital environments.

PID 584

Hybrid and Transformer-Based Models for MRI Brain Tumor Detection and Analysis

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Magnetic Resonance Imaging (MRI) plays a vital role in accurate brain tumor diagnosis and treatment planning. This study compares and integrates four deep learning models—NN+RNN, CNN+ViT, and Swin Transformer—or MRI analysis. CNN+RNN captures spatial and sequential features, while CNN+ViT combines local and global context. Swin Transformers provide superior multi-scale modeling and achieve the highest accuracy (~96%). Results show each model has unique strengths, making them complementary rather than competitive. However, challenges like high computational cost, domain variability, and limited interpretability remain. Future work should focus on lightweight, robust, and clinically adaptable models for reliable real-world deployment.

PID 586

An efficient hybrid deep learning for detecting DDos attacks

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This paper presents a hybrid framework for detecting Distributed Denial of Service (DDoS) attacks in Internet of Things (IoT) environments using transformer-based models. The approach integrates Mutual Information Gain for feature selection to reduce dimensionality and enhance discriminative power, followed by a novel tabular-to-text transformation enabling contextual learning with transformer architectures. Multiple models, including DistilBERT, PruneBERT, BioBERT, RoBERTa, and ELECTRA, are evaluated. Experimental results demonstrate high detection accuracy, with BioBERT achieving the best performance at 99.83%. The proposed method improves accuracy, reduces computational complexity, and offers a scalable solution for modern cybersecurity challenges in IoT systems.

PID 589

Protocol Encapsulation-Aware Robust Vulnerability Recognition Along with Risk Mitigation in IoT-Network Using ZT-Fuzzy And TLGLTPRSEU

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The rapid expansion of Internet of Things (IoT) networks has introduced significant security challenges due to heterogeneous devices and multi-protocol communication. Traditional intrusion detection systems fail to analyze protocol encapsulation (PE), limiting their ability to detect sophisticated attacks arising from mismatched protocol combinations, leading to increased risks such as unauthorized access and spoofing. To address this issue, this study proposes a protocol encapsulation-aware vulnerability detection and risk mitigation framework using ZT-Fuzzy and a Transfer Learning-based Gated Laplace Tikhonov Prior Recurrent Soft Exponential Unit (TLGLTPRSEU). The methodology (as illustrated in Fig. 1) includes data preprocessing, Sankey diagram-based feature analysis, feature extraction, and feature selection using the Fossa Optimization Algorithm (FOA). Protocol encapsulation and spoofing are detected using ZT-Fuzzy, followed by classification using TLGLTPRSEU. The model is evaluated on benchmark datasets such as BoT-IoT and ToN-IoT. Experimental results show

high performance, achieving 99.69% accuracy on BoT-IoT and 99.55% on ToN-IoT, with an overall accuracy of 98.78%. A comparative analysis is presented in Table 1. The proposed framework enhances IoT security by combining accurate detection, explainability, and efficient risk mitigation, making it suitable for real-world applications such as smart cities and industrial IoT.

PID 591

Camouflaged Military Asset Detection Using YOLOv8

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Camouflaged object detection (COD) remains a difficult problem in computer vision due to the minimal visual contrast between objects and their surroundings. Unlike conventional detection tasks, camouflaged targets exhibit strong similarities with the background in terms of color distribution, texture patterns, and structural appearance, which complicates their identification. Although deep learning techniques have significantly improved detection performance, models relying solely on RGB data still face challenges under complex camouflage conditions. This study proposes an efficient detection framework for camouflaged military assets based on the YOLOv8 architecture. A custom dataset of annotated military objects is prepared in YOLO format and divided into training and validation subsets. To improve model robustness, various preprocessing and data augmentation techniques are applied, incorporating variations in scale, orientation, and environmental conditions. The proposed system is evaluated using standard object detection metrics, including precision, recall, and mean Average Precision (mAP). Results demonstrate that the model effectively detects and localizes military assets across complex backgrounds. The model achieves an mAP@0.5 in the range of 0.83–.94, with precision values between 0.87–.94 and recall between 0.82–.92, depending on dataset characteristics and model configuration. These results highlight the suitability of the approach for real-time surveillance applications. Overall, the proposed YOLOv8-based framework offers a reliable and scalable solution for detecting camouflaged objects, demonstrating the effectiveness of modern deep learning techniques in addressing complex visual recognition challenges in defense applications.

PID 601

Multi-Backbone Attention Framework for Betel Leaf Disease Detection

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This paper designates a hybrid multi-backbone deep learning model to detect betel leaf disease through the combination of ResNet50, EfficientNet-B3, MobileNetV3, and DenseNet121 and attention-type feature fusion. FixMatch and Mean Teacher are improved by a semi-supervised strategy that improves generalization with labeled and unlabeled data. The accuracy of the model is 96.32 with good precision, recall, and F1-score. Grad-CAM brings an enhanced interpretability, whereas severity estimation is applicable to the practical decision-making in agriculture. Current studies on betel leaf disease detection have mostly concentrated on a single deep learning model, including CNNs and EfficientNet, which attain decent accuracy, but are generally not robust and do not detect intricate disease patterns. The transformer-based methods enhance the early detection but necessitate increased computational complexity. Although attention mechanisms are included in some studies and explainable AI is also involved, they are usually restricted to single-model frameworks. Besides, semi-supervised learning and severity estimation are yet to be explored in a single system. To overcome such shortcomings, the proposed research features a hybrid multi-backbone framework combining several CNNs, FT-based attention, semi-supervised learning, and explainable AI to achieve improved accuracy, generalization, and interpretability.

PID 607

APQD: Automated PDF Quality Detection Using Machine Learning

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This work presents a cost-effective method, APQD, for PDF Quality Detection using an integrated Machine Learning approach. APQD combines NLP, computer vision, Laplacian variance analysis, ResNet50 deep features, and an XGBoost regression model for accurate quality assessment. A dataset of PDF documents with an 80-20 train-test split was used to evaluate 11 machine learning algorithms. Results show that XGBoost achieved the lowest MAE and RMSE with the highest R² value. The FastAPI-based APQD system processes uploaded PDFs, extracts OCR text, analyzes image quality, and generates quality scores, enabling reliable automated document processing workflows.

PID 612

ForensAI: A Novel Facial Sketch Recognition System

Abhinav Swaminathan¹, Aditya Ahuja², Ganesh Gupta³, Sai Rane⁴, Rohini Sawant⁵
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Forensic investigations commonly rely on manual, artist-dependent methods for facial sketch creation and comparison, which can introduce delays and subjectivity. This paper presents ForensAI, a unified, secure system supporting suspect identification. An integrated framework having a component-based interactive canvas for composite generation with a conditional latent diffusion model for realistic refinement is proposed. A deep convolutional neural network (CNN) to extract high-dimensional embeddings for sketch-to-database matching is used. The proposed system achieves a Top-K accuracy of 87.3% at Rank-3, with an average execution time of 96 seconds. Secure access controls, robust data persistence, and a dual synthesis-recognition engine are combined to improve identification, minimize dependency on artistic expertise, and enhance accuracy.

PID 618

Enhanced RSSI-Based Localization Using Tuned Support Vector Regression

Gayatri Naik¹, Priyanka Panigrahi², Sasmita Behera³
^{1,2,3}*Veer Surendra Sai University of Technology, Burla, Odisha, India*

This study focuses on localization in Wireless Sensor Networks (WSNs), particularly in environments where the Global Positioning System (GPS) is limited by cost, energy consumption, or indoor constraints. Traditional methods such as Linear Regression provide simple solutions but fail to capture complex relationships in RSSI data. Support Vector Regression (SVR) offers improved flexibility, but its performance depends on proper parameter selection. To address this, a Tuned SVR (TSVR) approach is proposed using feature scaling, noise-based data augmentation, and Grid Search optimization. The proposed model improves prediction accuracy and reduces localization error, making it a reliable solution for practical WSN applications.

PID 621

Banana Ripeness Stage Identification Using Transformers

Rudresh Arabekar¹, Anant Sawant², Sahil Goes³, Vollny Coelho⁴, Kedar Sawant⁵, Tanvi Dharwadkar⁶
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This study focuses on localization in Wireless Sensor Networks (WSNs), particularly in environments where the Global Positioning System (GPS) is limited by cost, energy consumption, or indoor constraints. Traditional methods such as Linear Regression provide simple solutions but fail to capture complex relationships in RSSI data. Support Vector Regression (SVR) offers improved flexibility, but its performance depends on proper parameter selection. To address this, a Tuned SVR (TSVR) approach is proposed using feature scaling, noise-based data augmentation, and Grid Search optimization. The proposed model improves prediction accuracy and reduces localization error, making it a reliable solution for practical WSN applications.

PID 625

Hobby-Aware Personalized AI Learning Platform

Yogesh Kadam¹, Sameet Patil², Siddhant Ingole³, Samruddhi Shende⁴, Kartik Dani⁵
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This work introduces EveAI, a hobby-aware personalized AI learning platform that combines intelligent scheduling with tutoring based on Retrieval-Augmented Generation (RAG) in a multi-agent architecture. The system, which was developed with React, FastAPI, PostgreSQL, and Qdrant, uses learners' interests to customize daily study schedules and explanations. Improved educational effectiveness and learner well-being were demonstrated by a 48-participant controlled study that showed significantly higher learning gain (+6.5), retention (+9.4), increased motivation ($p < 0.001$), and reduced cognitive load ($p < 0.01$).

PID 626

A Comprehensive Review of Audio Deepfake Detection Techniques

Pardeep Arora¹, Manish Kumar², Rajkumar Tekchandani³, Khushboo Rana⁴
^{1,2,3,4}*Punjabi University, Patiala, Punjab, India*

This study reviews 18 audio deepfake detection approaches, including machine learning, deep learning, and self-supervised models, evaluated on datasets such as ASVspoof, Deep Voice, and Fake-or-Real. The analysis shows that advanced models, particularly transformer and contrastive learning approaches, achieve high performance, with accuracies up to 99.32% and EER as low as 0.03. These findings demonstrate the effectiveness of modern techniques and highlight the need for robust and generalizable detection systems.

PID 629

Hybrid ConvNeXt-win Transformer Model for Diabetic Retinopathy Detection

Shriya Kamat¹, Sanket Deshbhandari², Sohan Raut³, Jason Rodrigues⁴,
Ashish Narvekar⁵, Lyzandra D'souza⁶

^{1,2,3,4,5,6}*Agnel Institute of Technology and Design, Assagao, Goa, India*

Diabetic retinopathy (DR) grading is essential for early blindness prevention. This paper proposes ConvTransGFusion, a hybrid deep learning framework combining ConvNeXt-Tiny for local lesion feature extraction and Swin Transformer Base for global retinal structure modeling. An Adaptive Global Feature Fusion module with learnable weighting and squeeze-and-excitation attention enhances complementary feature integration. Evaluated on the APTOS 2019 and IDRiD datasets, the model achieved Quadratic Weighted Kappa scores of 0.8540 and 0.6476, respectively, with a combined score of 0.7577. Results demonstrate strong grading accuracy and promising cross-dataset generalization for automated retinal screening.

PID 633

WAT-M³F: Wavelet-Attention Transformer-Based Multi-Modal Multi-Focus Framework for High-Quality Image Fusion

Amanpreet¹, Vinay Kukreja²

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Multi-focus image fusion (MFIF) combines partially focused images into a single all-in-focus image, overcoming depth-of-field limitations. This paper proposes M³F-Net, a hybrid framework integrating discrete wavelet transform with attention-based deep learning. Wavelet decomposition captures multi-scale structural and detail information, while gradient and Laplacian measures identify salient regions. A transformer-inspired attention module models long-range dependencies, and cross-scale attention enhances feature interaction. Adaptive fusion and guided filtering improve spatial consistency and reduce artifacts. Experimental results on the Lytro dataset demonstrate superior performance, achieving MI (15.4321), QAB/F (0.7685), AG (7.1023), EN (7.8126), VIF (1.6428), SD (58.4217), SCD (5.8421), and CC (0.9785).

PID 635

Comparative Analysis of Different Sampling Techniques to Balance The Dataset for Maternal Health Risk Prediction

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The digitization of various fields produces huge volume of data that can be analyzed and useful insights can be obtained. Healthcare industry is one such industry that generates bulk of data in different formats which are difficult to analyze due to data missing and interpretability issues. Acquisition of real world medical data is also a tough task in terms of ethical concerns. AI helps in discovering useful information from these minimal and missing data generating the related data by finding the correlation between the existing features. Sampling techniques and Synthetic data generation helps in generating the supporting data that can be used for the prediction or classification processes. The work aims to compare the different sampling strategies and synthetic data generation for increasing the size of the dataset with equal number of instances for all class labels and applying them on to the most commonly used 11 machine learning (ML) models. The performance of the models on these sampling methods were analyzed and found hybrid sampled data along with RF and XGB gives the consistent performance in terms of metrics such as accuracy, precision, recall and F1-score.

PID 647

Automated Detection and Severity Classification of Age-Related Macular Degeneration

Pavan Kumar Varma Kothapalli¹, Naga Jaya Sri Thota², Kiran Babu Usarathi³,
Ravishankar Saiteja Bonam⁴, Pulavarthi Naga Narasimha Krishna Sanjay⁵

^{1,2,3,4}*SRKR Engineering College, Bhimavaram, Andhra Pradesh, India*

This study presents an automated deep learning-based system for detecting and classifying retinal diseases using Optical Coherence Tomography (OCT) images. The model categorizes images into four classes: CNV, DME, DRUSEN, and NORMAL, enabling early identification of vision-threatening conditions. Multiple architectures, including CNN, ResNet50, MobileNet, and Vision Transformer (ViT), are trained and evaluated to identify the most effective approach. The selected model leverages advanced feature extraction and attention mechanisms to improve classification performance. A user-friendly interface provides real-time predictions with confidence scores and clinical insights, supporting ophthalmologists in efficient diagnosis and facilitating scalable retinal screening in diverse healthcare environments.

ID 648

**Towards Transparent DR Screening: An Explainability-Lightweight CNN
with CBAM Attention and Grad-CAM for Diabetic Retinopathy Grading**

Jind Saini¹, Sania Jain², Arhaan Motiwala³, Viraj Choudhary⁴, Hima Deepthi Vankayalapati⁵
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In the modern era, explainability plays a key role in the analysis of medical images especially in diabetic retinopathy, as decisions directly affects the patient's vision. The majority of current deep learning methods rely on large pre-trained architectures that are computationally costly and lacks clinical transparency. This makes them difficult to deploy on resource-constrained devices. Although lesion-relevant features can be highlighted by Convolutional Block Attention Module (CBAM) attention mechanisms, their integration with systematic explainability frameworks in lightweight, scratch-built architectures has not received enough consideration. To fill this research gap, a compact CNN with embedded CBAM attention and Grad-CAM (Gradient-weighted Class Activation Mapping) as a transparency-first system is implemented. We introduced LEARN-Net (Lightweight explainable Attention-based Retinal Network) and CNN that integrates CBAM for automated four-class diabetic retinopathy grading by integrating Grad-CAM visualizations. APTOS 2019 fundus images are pre-processed using Contrast Limited Adaptive Histogram Equalization on the LAB L-channel and resized. To address the class imbalance and clinical overlap, classes 3 and 4 were merged into a single Severe category. LEARN-Net uses a design with a two-layer stem followed by three LightCNNBlocks, each enhanced with CBAM to focus on key retinal regions through channel and spatial attention. LEARN-Net scored a QWK of 0.9097, an AUC of 0.9459, and 82.51% accuracy on the held-out test set. LEARN-Net stands out with just 2.26M parameters (8.63 MB), nearly half the size of EfficientNet-B0' 4.34M (16.54 MB), a 48% reduction. Grad-CAM showed both models focused on the right areas, but LEARN-Net zoomed in more precisely on hemorrhages and microaneurysms, fitting CBAM's spatial gating strategy. The web interface made Grad-CAM explainability accessible to clinical users, proving its practicality in a real-world setting.

PID 649

**MRI Based Deep Learning Framework for Detection of Alzheimer's
Disease with Grad CAM Visibility**

Amita Salaria¹, Vikas Khullar², Surya Narayan Panda³
^{1,2,3}*Chitkara University, Rajpura, Punjab, India*

Magnetic Resonance Imaging (MRI) based classification of Alzheimer's disease has become a crucial area of research for early diagnosis and effective treatment. Traditional diagnostic procedures often suffer from high inter-observer variability and limited sensitivity to early pathological changes. To address these limitations, this study aims to enhance the detection and classification of Alzheimer's disease using advanced deep learning models, contributing to the development of reliable computer-aided diagnostic systems in clinical practice. Recent progress in deep learning has enabled automated MRI image analysis with improved accuracy and efficiency. In this work, several deep learning classifiers were trained on discriminative MRI features to categorize brain scans into four stages of Alzheimer's disease: Non-Demented, Very Mild Demented, Mild Demented, and Moderate Demented. Experimental results demonstrate that the CNNPlusPlus model outperformed other architectures such as CNN, EfficientNetB3, ResNet50, DenseNet121, MobileNetV2, Xception, and Vision Transformer, achieving 98% accuracy and precision rate. These findings highlight the high learning capability of CNNPlusPlus and its potential to enhance the reliability of Alzheimer's diagnosis. Overall, the proposed deep learning models prove effective for the classification and detection of Alzheimer's disease from MRI images.

PID 654

**From Low-Resource Translation to High-Resource Speech:
A Comparative Study of MT and TTS Systems**

Narottam Bhattacharjee¹, Rishik Baishya², Harshit Ratusaria³, Sanghamitra Nath⁴
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Magnetic Resonance Imaging (MRI) based classification of Alzheimer's disease has become a crucial area of research for early diagnosis and effective treatment. Traditional diagnostic procedures often suffer from high inter-observer variability and limited sensitivity to early pathological changes. To address these limitations, this study aims to enhance the detection and classification of Alzheimer's disease using advanced deep learning models, contributing to the development of reliable computer-aided diagnostic systems in clinical practice. Recent progress in deep learning has enabled automated MRI image analysis with improved accuracy and efficiency. In this work, several deep learning classifiers were trained on discriminative MRI features to categorize brain scans into four stages of Alzheimer's disease: Non-Demented, Very Mild Demented, Mild Demented, and Moderate Demented. Experimental results demonstrate that the CNNPlusPlus model outperformed other architectures such as CNN, EfficientNetB3, ResNet50, DenseNet121, MobileNetV2, Xception, and Vision Transformer, achieving 98% accuracy and precision rate. These findings highlight the high learning capability of CNNPlusPlus and its potential to enhance the reliability of Alzheimer's diagnosis. Overall, the proposed deep learning models prove effective for the classification and detection of Alzheimer's disease from MRI images.

PID 658

Aerial Fire Extinguisher System with Projectile Mechanism

Wakchaure Pramod Somnath¹, Yash More², Harshad Bagul³, Suchita Jadhav⁴, Santosh Sancheti⁵
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Magnetic Resonance Imaging (MRI) based classification of Alzheimer's disease has become a crucial area of research for early diagnosis and effective treatment. Traditional diagnostic procedures often suffer from high inter-observer variability and limited sensitivity to early pathological changes. To address these limitations, this study aims to enhance the detection and classification of Alzheimer's disease using advanced deep learning models, contributing to the development of reliable computer-aided diagnostic systems in clinical practice. Recent progress in deep learning has enabled automated MRI image analysis with improved accuracy and efficiency. In this work, several deep learning classifiers were trained on discriminative MRI features to categorize brain scans into four stages of Alzheimer's disease: Non-Demented, Very Mild Demented, Mild Demented, and Moderate Demented. Experimental results demonstrate that the CNNPlusPlus model outperformed other architectures such as CNN, EfficientNetB3, ResNet50, DenseNet121, MobileNetV2, Xception, and Vision Transformer, achieving 98% accuracy and precision rate. These findings highlight the high learning capability of CNNPlusPlus and its potential to enhance the reliability of Alzheimer's diagnosis. Overall, the proposed deep learning models prove effective for the classification and detection of Alzheimer's disease from MRI images.

PID 662

Harnessing Deep Learning for Automated Insurance Advisory Systems

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The increasing demand for digital banking and insurance services has created an urgent need for the development of intelligent, secure, and transparent financial decision support systems, as traditional rule-based and isolated predictive models are not capable of offering personalized recommendations, fraud protection, and interpretable results. This research work aims to propose the development of an integrated deep learning-based automated insurance and financial advisory system that incorporates secure user authentication, loan and insurance eligibility prediction, fraud detection, customer segmentation, and conversational support in a single intelligent system. The system incorporates a structured data pipeline with comprehensive preprocessing, normalization, and encoding techniques to offer robustness to the system. Ensemble machine learning models that include Logistic Regression, Random Forest, Gradient Boosting, and Extreme Gradient Boosting are trained using grid search optimization and five-fold cross-validation to enhance generalization performance. The proposed models offer prediction accuracies ranging from 96.2 percent to 98.1 percent for various loan and insurance services, and the Random Forest-based fraud detection module offers an accuracy of 98.6 percent. Hierarchical clustering is utilized to further segment customers into four behavioral groups for offering personalized advisory support. The proposed system offers high accuracy, enhanced interpretability, improved security, and real-time intelligent financial decision support.

PID 664

ChurnSense: A Tri-Layer Intelligence Framework for Retail Product Churn Forecasting via Hybrid Transformer Ensemble, SHAP-Based Explainability, and Gemini LLM Strategy Synthesis

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ChurnSense presents a tri-layer serverless intelligence framework for retail product churn prediction, unifying a hybrid TimevGPT—emporal Fusion Transformer (TFT) forecasting ensemble, SHAP-driven post-hoc explainability, and Gemini Large Language Model (LLM) strategy synthesis. Trained on a 15-feature multivariate Kaggle retail time-series dataset, the framework achieves RMSE = 0.0650, MAE = 0.0450, MAPE = 7.50%, and R2 = 0.9481, outperforming six state-of-the-art baselines and producing interpretable, retail-ready intervention strategies without human-in-the-loop pretraining. Index Terms—product churn prediction, retail analytics, time-series forecasting, Temporal Fusion Transformer, TimeGPT, SHAP, explainable AI, large language models, Gemini LLM, hybrid ensemble, serverless AI.

PID 665

AI-Driven Automated Modeling of Epileptic Pathways with LLM-Based Clinical Insights

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Epilepsy is a complex neurological disorder, with very limited models that help link the biological mechanisms to clinical decision making. This paper proposes a unified framework that combines biochemical simulations, knowledge graphs and large language models to model and interpret epileptic pathways. This was achieved by first simulating the key processes in epilepsy like ion homeostasis, neuro

inflammation, among others. A knowledge graph is made from literature to capture relationships between biomarkers, pathways and treatments, while considering temporal and causal relations between them. These will then be integrated with a retrieval augmented LLM for question answering. By incorporating the patient specific biomarker data found using lab test, it identifies affected pathways to generate actionable insights. This proposed approach integrates mechanistic modelling and AI to support personalized and meaningful clinical analysis for effective treatment.

PID 667

Hybrid Transformer-QNet for Contextual Test Case Prioritization with Genetic Optimization and Anomaly Filtering

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Regression testing plays a vital role in maintaining software reliability during continuous development; however, its effectiveness is often hindered by redundant test executions and suboptimal prioritization strategies. Conventional approaches struggle with unstructured test artifacts, noisy or irrelevant test cases, and the dynamic nature of continuous integration environments, limiting their practical applicability. To address these challenges, this study introduces a Hybrid Transformer-QNet framework that integrates semantic modeling, reinforcement learning, and evolutionary optimization. The proposed framework employs a Transformer encoder to extract contextual representations from unstructured inputs such as commit logs and test documentation, enabling a deeper understanding of relationships among test artifacts. These representations are utilized by a Q-learning-based network to prioritize test cases based on their fault detection potential. To enhance data quality, clustering-based anomaly detection is applied to identify and eliminate outliers and low-impact test cases. Furthermore, a Genetic Algorithm is incorporated to optimize Q-network parameters and refine the reward mechanism, ensuring adaptability across varying testing scenarios. A voting ensemble strategy is also adopted to combine multiple learning models, thereby improving the stability and robustness of prioritization outcomes. The framework is evaluated on benchmark datasets reflecting real-world continuous integration settings, demonstrating notable performance gains with an APFD of 0.97, Precision of 0.98, Recall of 0.99, F1-score of 0.985, and nDCG of 0.9863. These results indicate a substantial improvement in early fault detection and resource efficiency. Overall, the proposed approach offers a scalable and intelligent solution for test case prioritization, contributing to more efficient regression testing and improved software quality.

PID 669

Automated Waste Segregation System Utilizing Deep Learning for Recycling Optimization

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This paper presents an Automatic Waste Segregation System (AWSS) using deep learning for image-based waste classification. The system applies a hierarchical approach, first separating waste into biodegradable and non-biodegradable categories, followed by finer sub-classifications such as organic, paper, recyclable, and non-recyclable waste. Recyclable materials are further identified as glass, plastic, or metal. Multiple deep learning architectures, including CNN, ResNet50, MobileNetV2, and EfficientNetB0, were evaluated, achieving over 98% accuracy in binary classification and 93% in final material recognition. The modular framework supports scalable retraining and enables low-cost deployment without specialized sensors.

PID 670

DMSAF-Net: Directional Multi-Scale Asymmetric Fusion with Sigmoid-Gated Modulation for Medicinal Plant Classification

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This work proposes DMSAF-Net for accurate medicinal plant identification. This is a deep learning framework that improves feature representation using Directional Multi-Scale Asymmetric Fusion (DMSAF) blocks. The model uses an EfficientNet-B0 backbone, selected for its optimal accuracy–efficiency trade-off, with two stacked DMSAF blocks to enhance discriminative ability for species-level classification. A lightweight sigmoid-gating mechanism is incorporated, where sigmoid activation generates adaptive feature weights to modulate features through element-wise multiplication. DMSAF-Net is evaluated on six publicly available datasets, i.e., BDMediLeaves, DIMPSAR, CHM-Morph-50, Leafsnap, Bangladeshi medicinal plant dataset and Medicinal Leaf Dataset and the results demonstrate DMSAF-Net’ robustness and generalizability across datasets.

Deep Learning based Acoustic Decision Support System for Automated Estrus Detection in Water BuffaloesSugandha Sharma¹, Virender Kadyan², Shareef Babu Kalluri³^{1,2,3}UPES, Dehradun, Uttarakhand, India

Accurate estrus detection in water buffaloes remains a persistent challenge due to the reliance on subjective, labor-intensive methods that often fail to identify silent estrus, leading to delayed insemination and economic loss. The proposed framework addresses key limitations of existing methods by introducing a speaker-independent approach, leveraging statistically significant feature selection, and benchmarking a diverse set of models across multiple data representations. This study proposes a deep learning-based decision support system for automated, non-invasive estrus detection using buffalo vocalizations. A dataset comprising 103 Murrah buffaloes and 411 utterances was analyzed, including 61 non-estrus and 42 estrus cases. Audio signals were processed at both speaker and utterance levels, and acoustic features were extracted and refined using Cohen's d effect size, resulting in 25 highly discriminative features. To ensure robust and generalizable performance, both classical machine learning models and deep learning architectures including ResNet and MobileNet2D along with sequence models like LSTM and BiLSTM were evaluated. Experimental results demonstrated that utterance-level analysis achieved superior performance, with F1-scores of 0.9912 using SVM and 0.9824 using LSTM and BiLSTM models. MobileNet2D achieved high F1-scores of 0.9912 and 0.9685 for utterance-level and speaker-level data, respectively, indicating that buffalo vocalizations contain strong reproductive cues. Additionally, a fusion model combining MobileNet2D and ResNet2D yielded F1-scores of 0.9823 (utterance level) and 0.9375 (speaker level). This study establishes the potential of acoustic signal analysis as a scalable, animal-friendly solution for automated estrus detection, contributing to improved reproductive management, livestock welfare, and economic efficiency in precision dairy farming.

Centrality-Guided Dynamic Subgraph Refinement for MRI and Parkinson' Disease ClassificationAsha Ashok¹, Sri Sujith Reddy Dagada², Gopavarapu Sivathmika³, Kurupati Bhavya⁴, Manusha Nair⁵^{1,2,3,4,5}Department of Computer Science and Engineering, Amrita School of Computing,
Amrita Vishwa Vidyapeetham, Amritapuri, India

MRI-based diagnosis of neurological disorders requires models capable of capturing both spatial patterns and inter-sample structural relationships. This study presents a four-stage ablation framework that integrates the extraction of two-dimensional discrete wavelet transform (2D-DWT) features with Graph Convolutional Networks (GCNs) for the classification of neuro-related MRI images associated with Brain tumor (both binary and multi-label) and Parkinson' Disease. Four progressively augmented pipelines are evaluated across these clinical datasets. The proposed adaptive node-pruning variant (Pipeline D) through extensive cross-validation experiments attains 87.3% accuracy and 0.861 macro-F1 on Parkinson' detection, 92.1% accuracy on binary brain tumour classification, and 79.8% on four-class tumour grading.

Deep Learning Based Analysis of Multichannel ECG Signals During Oral Glucose Tolerance Test for Metabolic Syndrome ClassificationMiguel A. Mejia¹, Oscar J. Suarez², Gilberto Perpiñan³, Leinier Barba-J⁴^{1,2}Universidad de Pamplona, Pamplona, Norte de Santander, Colombia^{3,4}Universidad Popular del Cesar, Cesar, Colombia

Metabolic syndrome (MetS) is associated with autonomic dysfunction and altered cardiac dynamics that may become more evident during metabolic stress. This study evaluated deep learning models for non-invasive MetS classification from multichannel electrocardiographic (ECG) recordings acquired during an oral glucose tolerance test (OGTT). Forty men (15 MetS, 10 controls, 15 marathoners) underwent five OGTT stages (0, 30, 60, 90, and 120 min), with 12-lead ECG recorded after each blood extraction. Signals were segmented into 10-s windows with 5-s stride, resampled on-the-fly to 500 Hz, and analyzed using CNN-ResNet1D, CNN-BiLSTM, and CNN + Attention under subject-wise GroupKFold validation. All three models achieved identical patient-level accuracy (0.9250) and macro-F1 (0.8713). However, CNN + Attention provided the most favorable probabilistic discrimination, reaching a patient-level macro-AUC of 0.9766 ± 0.0328 and window-level accuracy, macro-F1, and macro-AUC of 0.9069, 0.8587, and 0.9594, respectively. These findings support the potential of OGTT-ECG deep learning as a non-invasive strategy for cardiometabolic classification and motivate future validation in larger, clinically diverse external populations.

Dual-View Cross-Attention Framework for Explainable Detection of Explicit and Implicit Hate SpeechNitika¹, Dhavleesh Rattan², Manpreet Kaur³^{1,2,3}Punjabi University, Patiala, Punjab, India

Metabolic syndrome (MetS) is associated with autonomic dysfunction and altered cardiac dynamics that may become more evident during metabolic stress. This study evaluated deep learning models for non-invasive MetS classification from multichannel electrocardiographic

(ECG) recordings acquired during an oral glucose tolerance test (OGTT). Forty men (15 MetS, 10 controls, 15 marathoners) underwent five OGTT stages (0, 30, 60, 90, and 120 min), with 12-lead ECG recorded after each blood extraction. Signals were segmented into 10-s windows with 5-s stride, resampled on-the-fly to 500 Hz, and analyzed using CNN-ResNet1D, CNN-BiLSTM, and CNN + Attention under subject-wise GroupKFold validation. All three models achieved identical patient-level accuracy (0.9250) and macro-F1 (0.8713). However, CNN + Attention provided the most favorable probabilistic discrimination, reaching a patient-level macro-AUC of 0.9766 ± 0.0328 and window-level accuracy, macro-F1, and macro-AUC of 0.9069, 0.8587, and 0.9594, respectively. These findings support the potential of OGTT-ECG deep learning as a non-invasive strategy for cardiometabolic classification and motivate future validation in larger, clinically diverse external populations.

PID 687

Development of a Predictive Capability Model for Demand Forecasting in Value-Based Food Supply Chains Using PLS-SEM

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In value-based supply chain this study develops a predictive capability to examine the factors of demand forecasting. Some traditional forecasting techniques often focuses on machine learning models and statistical models often neglects technological and organisational factors that influence forecasting effectiveness. The proposed framework integrates information integration, technological infrastructure, data analytics capability and supply chain collaboration of a conceptual framework. Both structural and measurement model is evaluated in this study by using survey-based data and partial least squares structural equation modeling (PLS-SEM). The outcome shows that technological infrastructure enhances information integration, refines data analytics capability and supply chain collaboration.

PID 688

Positional Analysis of Self-Attention in DCGAN with Instance Normalization and WGAN-GP

Rudresh Shirwaikar¹, Jai Mali², Parth Kapare³, Rohan Mandlik⁴, Shradha Chavan⁵

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Generative Adversarial Networks (GANs) suffer from training instability and mode collapse at textbook scale. This paper presents a positional ablation study of a single self-attention module within a DCGAN trained using WGAN-GP and Instance Normalization on CIFAR-10 at 32×32 resolution. Four configurations are evaluated no attention, early (4×4), mid (8×8), and late (16×16) across 90 epochs. The no-attention baseline achieves FID 47.37; the late-attention variant achieves IS 6.18 ± 0.18 , both substantially outperforming the textbook DCGAN baseline (FID ~70–00). Results show WGAN-GP and Instance Normalization are the primary quality drivers at this scale, with self-attention contributing to perceptual diversity rather than fidelity.

PID 695

Transparent Endometriosis Prediction Using Explainable White Box Machine Learning Model

Sivapraveena Palanisamy¹, Santhosini M², Arockia Alvita J³

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Endometriosis is a chronic disease in the human reproductive system characterized by delayed diagnosis, symptom overlap and invasive confirmation procedures, leading to clinical burden. While the recent studies have explored machine learning approaches which majorly focuses on accuracy over interpretability. This study proposes a transparent white-box machine learning model for endometriosis prediction using clinical and MRI imaging derived features. Starting from 21 original input variables from the endometriosis dataset, 10 domain-informed features were extracted using ratio metrics, composite symptoms, discretization and interaction terms that expanded the feature space to 31 variables. Six feature selection methods were implemented to identify the most predictive subset. And three interpretable machine learning algorithms- Logistic Regression, Symbolic Regression and Linear SVM were trained and evaluated. The result demonstrates that the domain-informed feature engineering has enhanced the prediction by preserving the interpretability reasoning. The proposed framework has facilitated transparent patients risk identification and established a risk factor for endometriosis which is more suitable for practical implementation in real-world clinical decision-making.

PID 701

Claim-Xpert: AI-Driven Vehicle Insurance Claims Automation with Fraud Detection and Severity Assessment

Devansh Harsha¹, Dhruva S², Hemanth Gowda C³, Syed Fuzail Hassan⁴

^{1,2,3,4}*Bangalore Institute of Technology, Bengaluru, Karnataka, India*

The vehicle insurance sector continues to face challenges in automating claim assessment, fraud identification, and cost estimation while ensuring reliability and fast processing. This study presents Claim-Xpert, a multimodal framework designed to streamline end-to-end vehicle insurance claim handling. The key contribution of this work is a confidence-based fusion strategy that integrates image-derived

damage severity, structured compensation prediction, and fraud likelihood into a unified claim score, ensuring consistency across decision modules rather than treating them independently.

PID 702

Graph-Driven RAG-LLM Pipeline for Windows Malware Analysis and Detection

Rahul Yadav¹, Shweta Sharma²

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Recent advances in Large Language Models (LLMs) have opened new avenues for malware detection by enabling a semantic understanding of code and behavior. This paper proposes a hybrid framework that integrates graph representations with LLM-based analysis to improve detection accuracy and generalization. Our approach leverages abstract syntax trees (ASTs), data flow graphs (DFGs), and decompiled C code to extract structural and semantic features from executable files. We also create a payload dataset using msfconsole, x32dbg, and the compiler. The decompilation of executable files has done with the help of Ghidra and tool. Experimental results on decompiled real-world dataset demonstrate that our method outperforms many existing models, particularly in the detection of obfuscated and polymorphic malware. LLM gives results 96.66% when we integrate RAG into it, results increased to 96.82% which shows significant improvement. However, our proposed Graph-RAG-LLM model outperforms these existing models with an accuracy of 98%, which shows that the graph can be proven important aspect in the area of cybersecurity.

PID 703

A Trust-Aware SDN Framework for Real-Time Detection and Mitigation of Topology Poisoning Attacks with Secure Rerouting

Priya. L¹, Narendran Rajagopalan²

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Software-Defined Networking (SDN) offers centralized control but is highly vulnerable to topology poisoning attacks (TPA), where malicious nodes inject false topology information, resulting in routing errors and network disruption. This paper proposes a trust-aware SDN framework for real-time detection and mitigation of TPA using a dynamic trust database and intrusion detection mechanism. Suspicious topology updates are identified through trust evaluation, and secure rerouting is performed to maintain reliable communication paths. The proposed framework is implemented in a Mininet-based SDN environment using the Ryu controller. Experimental results demonstrate improved detection accuracy, enhanced throughput, and reduced latency compared to existing methods.

PID 704

Semantic-Aware Agentic AI for Energy-Efficient Model Selection in Sustainable Computing

Yashraj Patil¹, Harikrishnan Ramachandran², Amol Shakadwipi³, Monika Surse⁴, Rushikesh Gangurde⁵, Sridhevi Sundararajan⁶

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A semantic-aware agentic framework for energy-efficient NLP model selection is proposed using Sentence-BERT embeddings and adaptive multi-agent decision policies. Logistic Regression, SVM, and Random Forest were evaluated on the AG News dataset using accuracy, runtime, and CO₂ emissions. Three agents - rule-based, semantic-aware meta-agent, and energy-aware agent were designed to select models under different computational constraints. Results show that SVM achieved the highest accuracy, while Logistic Regression remained computationally efficient. The findings indicate that improvements in predictive performance are associated with increased computational and environmental cost, highlighting the need for balanced, sustainable, and context-aware AI decision strategies.

PID 714

ForensiMedia Pro: An Interpretable Cross-Modal Forensic Framework for Synthetic Media Detection

Narayanam Venkata Varshith¹, Guruju Harika², Chinthoju Sri Pranay³, Yellapu Rakesh⁴

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AI-generated content & deepfake technology are growing too fast for us to verify the authenticity of digital media as a result of these rapid developments. As a result, this work describes ForensiMedia Pro (a lightweight, interpretable forensic framework that is used to detect synthetic media under real-world constraints), which combines a set of heuristic feature-based approaches to OpenCV with a structured scoring mechanism for determining if there are any inconsistencies in noise, blur, and texture. The interpretability of the framework's outputs gives the user the ability to better understand what the rationale behind a model's predictions were. Future work with this model is planned for detection of synthetic media through audio and video means.

PID 716

AI-Powered Road Accident News Insights and Trend Analysis for Goa

Krishvi Kerkar¹, Narayan Sutar², Suhani Mahesh Parab³, Vedant Laad⁴, Sagar Naik⁵, Sweta Kamat⁶
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This paper presents an AI-driven framework for road accident analysis in Goa by integrating structured FIR records with unstructured social media data. OCR extracts text from images, while BERT-based NER identifies entities such as location, vehicle type, and causes. Logistic Regression and SVM perform binary and multi-class classification, with SVM achieving superior performance. SHAP enhances model interpretability by highlighting key predictors. DBSCAN clustering identifies accident hotspots using geospatial data. The system also supports safe route planning, GPS-based alerts, and interactive dashboards for authorities and travellers. By combining diverse data sources, the framework enables comprehensive insights, improving road safety analysis and decision-making.

PID 717

Emotion-aware Manglish-to-English Neural Machine Translation: A Multi-Model Benchmarking Study

Leela Nayan Kanjirapully¹, Rithwik Yalamanchili², Rushikesh Yadav Vadlakonda³, Thara S⁴, Prajisha AK⁵
^{1,2,3,4,5} Amrita Vishwa Vidyapeetham (Amritapuri), Kollam, Kerala, India

Manglish refers to code mixed text interleaving Romanized Malayalam vocabulary with English, commonly found in social media. This study fine tunes three multilingual transformer models: No Language Left Behind (NLLB-200), mBART-large-50, and mT5-base on an annotated Manglish corpus and evaluates them on translation fidelity and emotion preservation. Using Optuna driven hyperparameter optimization across 20 trials, the best model achieved BLEU 19.27 and emotion preservation score 0.890, outperforming an untuned baseline (emotion-preservation 0.748) and Google Translate (emotion-preservation 0.611) on affective metrics. Results confirm that targeted fine tuning on 1,997 samples can yield strong emotion-aware translation for low-resource code mixed language pairs.

PID 727

Identification of disease in tomato-based image leaf through Machine learning framework: An Agriculture production enhancing platform

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In food security major significant risks is disease in plant leaf. Therefore, it reduced the production of many agricultural systems. Disease in crops are directly impacting on economic system. Generally, the identification of disease at early stage should be detected at the initial phase of stage to ensure the enhancement of quality and the quantity of crops. Nowadays, the findings of the disease in tomato leaf are very time-consuming process through traditional system. However, there is need to develop a machine learning framework with integration of the collection of data, visualization of infected features and detection of disease in tomato leaf. It collaborates with the edge-based segmentation method, Image Camp and Heat Map for the visualization of the disease in tomato leaves so, there is no requirement of masking method to distinguish the disease. Additionally in manuscript shows the effect of transfer learning on "customized model" and base line model viz. Inception Resnet, Mobile net, Resnet-50 and Vgg-19. Furthermore, the proposed model achieves the highest accuracy i.e., 99.14% compared to the base line model. Also, the proposed framework consumes 80 sec which shows minimum time-consuming process to detect the disease in contrast to the baseline model.

PID 730

Super Resolution of Lunar Surface Features from Chandrayaan-3 Navigation and Rover Images Using Patch Bridge Transformers

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The morphology of the lunar surface is the subject of detailed analysis that is essential in the study of the planets, planning missions and also in the navigation of rovers. Nevertheless, because images taken using lunar navigation and rover cameras have low spatial resolution, it is common to find out fine surface textures, rock structures, and micro-craters hidden. This paper will address this drawback by proposing a model that is a Patch Bridge Transformers (PBT) to use in super resolution reconstruction of lunar images obtained during the Chandrayaan-3 mission. The given framework makes use of a patch-based hierarchical attention system that proves efficient in learning spatial dependencies and revisiting high-frequency details, to be precise, the structure of surface textures with low

resolution observations. The model fills in the characteristics of the neighboring patches of images, sharpens edges, promotes structure continuity and contextualization across the lunar terrain. The experimental assessment of Chandrayaan-3 rover data sets prove that the reconstructed images show better quality of perception and quantitative results using measures of PSNR and SSIM. The super-resolved results produced by the desired PBT structure can find a good application in extremely precise lunar mapping, feature recognition, and terrain recognition and safe route planning in autonomous rovers. In general, this study has furthered the research of the lunar surface in relation to transformer-based deep learning, offering more precise and more detailed graphical data on the lunar surface to future lunar exploration missions.

PID 731

Lightweight Facial Expression Recognition System Using Multi-Scale Anisotropic Features and Disentangled β Variational Autoencoder

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The proposed work presents a lightweight, robust Facial Expression Recognition (FER) framework integrating a lightweight MobileNetV3 backbone with a Region Attention Network (RAN) to adaptively focus on salient facial regions that contribute highly discriminative features for expression classification. A novel Multi-Scale Anisotropic Convolution (MSAC) module captures directional, fine-grained features from salient facial regions, which are integrated and passed through a β Variational Autoencoder (VAE) disentangled bottleneck to separate expression-related features from identity/pose biases. The model is optimized using a hybrid loss that combines KL divergence for distribution alignment and cross-entropy loss for discriminative classification. The proposed method achieves a classification accuracy of 98.7% on CK+, 91.58% on RAF-DB and 90.87% on FER+ with reduced computation complexity, offering state-of-the-art robustness and generalization.

PID 734

VMR-NIM: A Generative AI Framework for Profit-Optimal Credit Risk via Latent Manifold Reconstruction and Counterfactual Reasoning

Ameya Umesh Naik¹, Darsh Patel², Yash Bhattad³, Yatharth Shivhare⁴, Ravi Nahta⁵

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This treatise formalizes VMR-NIM, a sophisticated architectural paradigm employing Tabular Variational Autoencoders (TVAE) for the topological reconstruction of latent manifolds within sparse, high-cardinality credit distributions. By circumventing the stochastic saturation of the 0.0937 AUPRC baseline via latent-space densification and CatBoost-driven gradient boosting, the framework yields a statistically robust 0.5194 AUPRC. Integrating Counterfactual Reasoning (DiCE) with Net Interest Margin (NIM) maximization, the model identifies a 0.1106 profit-optimal decision boundary while ensuring regulatory-compliant algorithmic recourse.

PID 738

PHYT-FL: Persistent Homology-Based Topological Trust Framework for Robust Federated Learning in Industrial IoT Security

Vasundhara Devi G¹, Karthik N²

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PHYT-FL proposes a topology-driven aggregation scheme for federated learning that scores client weight updates using Betti-0 persistent homology (H_0), suppressing Byzantine gradients without any reference dataset. Tested on SECOM (industrial fault detection) and UNSW-NB15 (network intrusion detection) under hybrid attacks across up to 100 clients with 10–0% Byzantine fractions, PHYT-FL achieved 97.27% and 95.11% balanced accuracy—the only method rated High on both benchmarks.

PID 740

A Multimodal Fusion Framework for Correlation Analysis of Physiological and ECG Signals in Sports for Sudden Cardiac Arrest Detection Using Bio-Inspired Optimization in Machine Learning

Vinodhini M¹, Karthik N²

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This research proposes the correlation analysis framework for Sudden Cardiac Arrest (SCA) in sports community. The novel approach integrates early fusion, Canonical Correlation Analysis (CCA) and PSO optimization algorithm using the Pro-Football 12-lead Resting Electrocardiogram Database (PF12RED). Physiological and ECG markers are fused using early fusion, CCA gives three important canonical components. PSO selects optimal features, and proposed model achieves high accuracy of 98% in detecting SCA among athletes.

PID 742

Mitigating AI-augmented Phishing Using Multimodal Behavioural Signals

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Phishing has taken a new dimension in which attackers are applying more applications of generative artificial intelligence to create persuasive text, believable brand images, synthetic voice, and context-based impersonation workflows on a scale that undermines the traditional content filters and inertial URL defences. Existing defences continue to be based on message content, reputation of the sender or destination, but most successful attacks occur in human-computer interaction, clues that indicate uncertainty, deception and increasing risk levels prior to credentialing. The study tested multimodal fusion of content, structure and behavioural cues as a way of early phishing detection over content-only baselines. The study models AI-text, AI-image, AI-voice, URL and DOM indicators, visual similarity cues, and behavioural variables such as dwell time, hesitation time, hover time, mouse jitter, focus switching, backtracking, scrolling depth, and typing error. 600 instrumented email and web interaction sessions using 56 variables were used through a late-fusion machine learning framework, where modality-specific detectors were pooled together to create a meta-classifier to score real-time risks. The approach is based on the previous literature on phishing, deception, behavioural biometrics, and multimodal security. Findings show that multimodal fusion offers significantly better phishing discrimination compared to single-modality and content-only baselines, especially for AI-generated attacks and hybrid phishing attacks. The results further indicate that behavioural signals can enhance pre-submission warning capacities and do not compromise the levels of false alarms and user burden. These results align with a privacy-conscious design direction of secure enterprise email and web clients in computer engineering, in which highly protecting phishing defence must not be solely a content classification problem, but also a multimodal interaction intelligence problem.

PID 743

Explainable AI-Driven Fuel Efficiency Prediction Using Ensemble Learning and Vehicle Configuration Data

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The current project is an artificial intelligence framework that uses machine learning for vehicle fuel efficiency prediction based on different features of automobiles. Various variables including cylinders, horsepower, vehicle weight, engine displacement, vehicle acceleration, and year are used to predict the fuel efficiency of vehicles. Ensemble machine learning models are used in this project through the use of both Random Forest and XGBoost machine learning algorithms for increasing prediction accuracy and model stability. Explainable artificial intelligence (XAI) techniques are implemented in order to make the machine learning model more understandable by visualizing the importance of variables used in predictions.

PID 746

An Integrated Deep Learning Approach for Fish Detection and Species Recognition

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Underwater fish detection is challenging due to poor visibility, color distortion, and complex marine environments, making manual monitoring impractical at scale. This work leverages YOLOv8, a state-of-the-art real-time object detector, trained on the FishNet dataset to achieve accurate fish detection and species-level recognition. A rigorous preprocessing pipeline incorporating CLAHE and white balance correction addresses inherent underwater image degradation, while targeted augmentation strategies tackle class imbalance and improve generalization. Three-fold cross-validation ensures statistically robust evaluation across mAP50 and mAP50-95 performance metrics. The resulting system delivers a computationally efficient, deployment-ready solution for marine biodiversity monitoring and fisheries management.

PID 749

Explainable AI for Athlete ECG Classification Using 12-lead Signals

Mikhila V¹, Sailaja G², Karthik N³

^{1,2,3}Mikhila V, National Institute of Technology Puducherry, Karaikal, Puducherry, India

This work proposes an explainable AI-based framework for the classification of normal and abnormal ECG signals in athletes using a 12-lead Norwegian ECG dataset. Our framework uses the ECG signals to segment and transform them into features, followed by a classification using XGBoost with patient-level validation. Experimental evaluation of the model provides an F1-score of 0.54 for abnormal detection, and on the other hand, SHAP-based explainability highlights clinically relevant leads such as V1, V4, and V5, ensuring interpretability.

PID 752

Hybrid Deep Learning Framework- ENCT (Efficient Net CAB Transformer) for Eye Disease Detection Using Fundus Images

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This study presents a novel hybrid structure that uses retinal fundus pictures to identify and classify retinal disorder by combining transformers with Convolutional neural networks (CNNs) enhanced by attention processes. We introduce a new and powerful deep-learning architecture that uses colour fundus images to account for the pathological features of eye disorders. The suggested hybrid design can accurately identify the local characteristics on the one hand, identify the peripheral abnormalities of the particular eye disease on the other, and use this information to diagnose the corresponding eye disease. Through hierarchical self-attention processes, the hybrid architecture improves global contextual comprehension while offering strong local feature extraction. With an accuracy of 78.64 and an area under the receiver operating characteristic curve of 84.36 on the IDRID_Edema dataset, the hybrid ENCT structure surpasses a number of state-of-the-art methods. The importance of attention mechanisms and the complementary usage of spatial and temporal graphs are highlighted by ablation research

PID 758

Personality-Aware Hybrid Learning Framework for Stress Detection

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In today's world, prolonged stress has a significant impact on human health. The paper proposes a two-stage framework for stress detection using personality traits and linguistic features extracted from social media. MBTI-based personality prediction and GloVe-LSTM-based text features are integrated for stress classification. Additionally, a mode-based aggregation is employed for robust estimation at the user level. The proposed model is validated on two datasets, MBTI-500 and Reddit, achieving an accuracy of 77.46% in personality prediction and 93.34% in stress detection. The results demonstrate that the framework enables reliable, efficient, and early-stage stress monitoring across diverse user groups.

PID 759

Multi-Component Automotive Failure Prediction Using Hybrid Attention-LSTM and Ensemble Learning with RCA Module Integration

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This research proposes a hybrid predictive maintenance system for automobile systems such as the engine, brakes, and battery. The model combines the Attention-LSTM architecture for modeling temporal patterns and Ensemble Learning for Modeling feature interactions. The use of physics-informed synthetic data helps address class imbalance issues, resulting in an F1-score > 99% and a 72% reduction in false positives. The addition of Root Cause Analysis and customer notifications closes the gap between theory and implementation, which can save up to \$210 million for large fleets.

PID 767

A Low-Power Device for Acoustic Illegal Logging Monitoring in Remote Tropical Forests

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Illegal logging is a serious threat to tropical forests causing deforestation, climate change, and loss of biodiversity. Because rangers cannot monitor every remote area, there is a need for automated systems that can catch chainsaw activity the moment it starts. This paper proposes a TinyML-based detector that listens for chainsaws and flags illegal logging in real time. The goal is to create a low-power, stand-alone sensor that hears the unique sound signature of chainsaws and instantly sends an alert over long-range radio. The system is built with SenseCAP K1100 kit that runs a TinyML acoustic classification model and communicate over LoRa. A lightweight TinyML model was trained on audio data made from chainsaw recordings mixed with forest sounds such as wind, birds, and distant voices to improve robustness. After quantizing with TensorFlow Lite for Microcontrollers, the model fits inside the microcontroller's memory. The device listens continuously through an on-board microphone, when the model detects a chainsaw, it transmits an alert via LoRaWAN module which provides kilometer-scale coverage while drawing very little energy and makes device run for weeks on a single battery. The system sends only alert message, it saves bandwidth and power, key advantages for remote deployments. Results show reliable detection of illegal-logging acoustics, about 95% accuracy with few false alarms, and an average inference time of 125 ms. All processing is done on the microcontroller, proving that real-time inference is possible within limited memory and low energy. This TinyML solution offers a practical, low-cost tool for forest conservation, giving authorities near-instant warnings and enabling quicker response to illegal felling. Combining edge AI with LoRa IoT networks demonstrates a powerful model for environmental protection; future work will explore solar charging, smarter sleep cycles, and extra classes (e.g., vehicle engines or gunshots) to extend the device's monitoring capabilities.

PID 776

Intellectual Decision Support Approach for Crop Recommender and Yield Estimator with XG-Boost and Agro-Climate Data

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In this work, to identify crops, a modified XGBoost classifier is employed, while a modified XGBoost regressor is used to predict the expected yield. Crop classification achieved 98.20% accuracy while yield prediction exhibited R² of 0.827, with associated MAE of 0.335, MSE of 0.178 and RMSE of 0.422. A web application is deployed for farmers enabling real time inference that integrates crop recommendations, per hectare yield prediction, NPK requirement and deficit, fertilizer cost estimation relied on cultivation area and comprehensive output including total yield prediction and income estimation by utilizing land area and prevailing market price.

PID 781

DeepSense-MH: A Hybrid CNN-MLP Framework for IoT-Based Passive Depression Detection

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This work presents DeepSense-MH, an IoT-based passive depression detection framework leveraging smartphone behavioral data. Unlike prior hybrid architectures that apply CNN to image or sequential data, this work is the first to employ CNN-based local feature extraction on behaviorally structured tabular IoT data for mental health detection. The key novelty contributions are: (1) first application of 1D-CNN for local behavioral pattern extraction on tabular mental health IoT data; (2) a jointly optimized CNN-MLP fusion that outperforms both standalone Deep MLP and TabNet on structured data; and (3) integration of SHAP-based feature importance for model interpretability. The framework is evaluated on a custom smartphone behavioral dataset comprising 1,000 samples (70/30 train-test split) collected from passive sensing streams. Results show that the Hybrid CNN-MLP achieves an F1-score of 0.9416 and AUC of 0.9906, outperforming most deep learning models while maintaining high robustness, demonstrating its effectiveness for scalable mental health monitoring. Designed for edge deployment, future work includes real-time IoT validation.

PID 786

Hybrid Learning Approach for Detecting Fake News with Machine Learning and Deep Learning Models

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Fake news poses serious threats to social credibility and data security. This work proposes a hybrid ensemble framework combining machine learning classifiers (SVM, LR, RF) and deep learning models (RNN, LSTM, GRU) for fake news detection. Using TF-IDF features and pre-trained embeddings, model predictions are fused through probability averaging to improve robustness. Evaluated on benchmark datasets, the SVM+GRU ensemble achieved high accuracy and F1-score, outperforming individual models and showing strong generalization. The proposed approach balances computational efficiency with high performance, making it suitable for real-world automated misinformation detection and practical deployment across diverse online media platforms.

PID 787

Community-Driven Smart Environmental Monitoring and Waste Reporting System

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Naramsetti Krishna Chaitanya⁵, Bommali Aryan⁶, Akula Gangadhara Saimitra⁷

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The Community Driven Smart Waste Management System (GO Clean) is a web-based system for reporting and monitoring waste-related issues through active community engagement. The system enables citizens to report problems like overflowing bins, damaged dustbins, and illegal dumping by scanning the QR codes placed on bins or by submitting complaints through the website if QR codes are not available. The system collects information such as images, location, type of issue, and time, and stores it in a database. The reported complaints are visible through the admin dashboard, where admins can verify and update the status for complete transparency. The system has features like user login, language selection, complaint tracking, and rewards. we offer 'Green Coins' which can be used to buy eco-friendly items such as plants, garbage bags, dustbins, and certificates, etc. The website includes additional features like suggestion for recycling different types of waste, opportunity to participate in municipal cleaning/awareness events, Share user story, etc. By using simple technology such as QR codes, GPS, image upload, and a web dashboard, rather than IoT, the site has made the service more affordable. The GO Clean service has improved the relationship between the public and the authorities, as well as the environment.

PID 795

Green NLP: Benchmarking Carbon Emissions and Accuracy of BERT-Family Transformers with a Novel Modified Green Efficiency Score

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Five transformer models from the BERT family are tested in a series of 45 controlled experiments on three NLP benchmark datasets, in terms of accuracy, time, and CO₂ emissions. A Modified Green Efficiency Score (MGES) is introduced to overcome inefficiencies of current efficiency measures by combining accuracy, carbon emissions and time. Findings demonstrate that RoBERTa has the highest accuracy, but that TinyBERT has the highest baseline efficiency. Moreover, INT8 post-training quantization of TinyBERT yields the proposed TinyBERT-Q model, which cuts CO₂ emissions by 38% with negligible loss in accuracy, and has the highest MGES. The research demonstrates that quantization can be used to build sustainable and efficient NLP systems.

PID 797

Delay-Aware and Energy-Optimal Computation Offloading in Cloud-dge Collaborative MEC Environments

Sweta Dash¹, Jibitesh Mishra²

^{1,2}*OUTR*

The growing demand for delay-sensitive and computation-intensive mobile applications has accelerated the adoption of Mobile Edge Computing (MEC) to overcome the limitations of resource-constrained devices. However, achieving optimal computation offloading in real-world MEC systems remains challenging due to dynamic wireless conditions, multi-user resource contention, heterogeneous device capabilities, and the need to preserve user privacy. Existing learning-based solutions rely primarily on centralized or single-agent reinforcement learning, which suffer from scalability issues and require direct access to user data. To address these limitations, this paper proposes a Multi-Agent Federated Reinforcement Learning (MA-FRL) framework for adaptive task and computation offloading in a cloud-dge collaborative environment. In the proposed approach, each mobile device employs a reinforcement learning agent to independently learn offloading strategies, while federated learning enables privacy-preserving model updates across distributed devices. Edge servers perform local model aggregation, and the cloud conducts global optimization to enhance scalability and stability. The framework jointly optimizes offloading decisions and resource allocation to minimize end-to-end delay, energy consumption, and network congestion. Federated Learning enables privacy-preserving model aggregation through a hierarchical cloud-dge architecture and multiple mobile devices act as reinforcement learning agents that learn optimal offloading policies locally. Faster convergence and significant improvements in delay-energy reward compared to random and greedy policies, achieving near-centralized RL performance while reducing communication overhead reflected from simulation results. The proposed MA-FRL framework achieves near-centralized performance (~92%) while maintaining privacy, scalability, and faster convergence in dynamic MEC environments.

PID 808

Edge Deployable Custom Convolutional Neural Network for QRS Complex Detection in Electrocardiogram

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Electrocardiogram (ECG) based QRS complex detection is essential for reliable cardiac monitoring and early diagnosis of cardiovascular conditions. However, existing methods either rely on computationally intensive deep learning models or fail to maintain robustness under noisy and varying signal conditions, limiting their suitability for edge deployment. To address this, a two-phase framework is proposed. In Phase 1, a custom 1D Convolutional Neural Network is developed for robust QRS detection under noisy conditions through effective feature learning. In Phase 2, a lightweight edge device implementation is designed using logistic regression on an ESP32 microcontroller for real time classification. The system extracts QRS peaks, computes RR intervals and heart rate, and performs efficient inference. The proposed approach is evaluated on benchmark datasets including MIT BIH, INCART, NSTDB, and European ST T, achieving accuracy up to 99.57%, high sensitivity, and strong positive predictive value across noise levels.

PID 811

Adaptive Multi-Directional Attention U-Net for Road Network Extraction from High-Resolution Remote Sensing Images

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In this work, an adaptive multidirectional attention-guided deep neural architecture (MD-UNet) is presented for the extraction of road networks from high-resolution satellite images. The proposed architecture follows UNet-based encoder-decoder frame work in which an

adaptive multi-directional attention-guided (ADMAG) module is introduced at the skip connection. The main issue in road network extraction from high-resolution satellite images is to handling multiple road segments merging or diverging in different directions, resulting in high geometric and topological complexity. To handle this issue in this work, an ADMAG module is designed which can effectively extract the road network at complex junctions and enhance the completeness of the extracted road network. ON two publicly available road dataset (massachusetts and Google Earth) the MD-UNet has obtained an F1-score of 81.91 and 91.05, whereas on IoU the proposed method has obtained the score of 69.36 and 83.58 by improving the road connectivity as compared to counterpart methods.

PID 824

Multimodal German Sign Language Video Translation Using CNN-BiLSTM with Neural Attention

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Using the RWTH-PHOENIX Weather 2014 T, a deep learning-based Gesture Recognition System for Continuous Sign Language Translation is shown in this research. The suggested design combines a Bidirectional Long Short-Term Memory (BiLSTM) network for temporal modeling, an Attention based LSTM decoder for sequence creation, and a Convolutional Neural Network (ResNet-18) for spatial feature extraction. The hybrid framework produces logical German textual translations to English while efficiently capturing spatiotemporal connections in sign language video sequences. Cross-entropy loss with AdamW optimization was used to train the model. The training loss dropped from 6.67 to 0.15 during 40 epochs, indicating sustained convergence in the experimental data. The system successfully learned the semantic and contextual links between sign movements and associated written output; it achieved BLEU score of 0.76.

PID 837

ECG-Based Stress Detection Using Graph Neural Networks and Machine Learning Models

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Stress detection using ECG signals is explored by comparing graph neural networks and traditional machine learning models on the WESAD dataset. The signals were segmented and relevant statistical features were extracted before training different models. Graph-based approaches such as GCN, GAT, and GIN were evaluated but showed lower performance. In contrast, traditional methods performed better, with Random Forest achieving around 88% accuracy, followed by SVM. The findings indicate that feature-based methods remain more reliable for multi-level stress classification. This work also suggests that improved graph construction and better feature design could enhance the effectiveness of graph neural networks in future studies.

PID 839

A Hybrid Deep Learning Framework for Intracranial Hemorrhage (ICH) Detection in CT Images with Grad-CAM Explainability

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This study presents a hybrid Deep Learning (DL) framework, named as Hybrid CTModel, combining of Convolutional Neural Network (CNN) and Residual Network (ResNet-18) for automated detection of intracranial hemorrhage (ICH) using two datasets. The first dataset is publicly available and consists of 82 patients, whereas the second dataset has been collected and curated by us from a tertiary hospital in North-East India and consists of 33 patients. The model integrates feature fusion and Grad-CAM explainability. Experimental results show 95.21% accuracy, 85.40% recall, and 96.80% AUC.

PID 841

Comparative Analysis of Machine Learning Models for Employability Prediction among Engineering Graduates

Yogita Desai¹, Yashraj Patil², Suchita Jadhav³, Gunjan Deshmukh⁴
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This research is centered around using ensemble techniques & machine learning to predict the likelihood that an engineering student will be placed into an engineering job. Using a dataset (comprising 83 students) which contained data related to both students' academic performance as well as a student's activities related to placement, pre-processing techniques were used on the dataset to ensure proper formatting (e.g., normalisation of data, handling of missing values, SMOTE based model balancing). For the purpose of this study, 3 different modelling approaches were tested (Logistic Regression, Decision Tree and Random Forest). Of the three, the Random Forest algorithm exhibited the greatest predictive capability (86.0% accuracy). However, in an effort to improv predictive capability even further, the researcher used a Stacked Classifier that combined results from all three methods in an effort to capture both linear and non-linear patterns. By using the combined results of the three classifiers in a Single Stacked Classifier, the ensemble classifier demonstrated even greater predictive capability (88% accuracy), therefore demonstrating greater reliability than the individual classifiers. Ultimately, the framework from this research will allow institutions to identify students who may be at risk for not attaining successful placements

significantly earlier in the placement process, therefore allowing institutions to implement data-driven strategies in order to optimize students for future success in obtaining full-time placements.

PID 846

**A Federated and Explainable AI Framework for Scalable Learner
Performance Prediction in Gamified Education**

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Gamified education raises attainment ($g \approx .50$) but involves privacy concerns, lack of model transparency and little reward-based learning. Our research offers a federated, explainable AI approach to predict academic mastery across campuses. We trained five classifiers using 2,500 instances (18 non-IID distributed features) with 5-fold cross-validation, both with centralized and federated (FedAvg) communication rounds. Federated XGBoost reached 93.1% accuracy (F1 0.92, AUC 0.96) - just 1.1% lower than centralized. SHAP highlighted quiz, simulation quality, and sessions common factors, indicating a successful privacy-utility trade off and explainability.

PID 848

Graph-Based Contextual Data Modeling with NLP-Driven Semantic Query Interface for Enterprise Systems

Manan Bhutiani¹, Satyam Singh², Tishya Ghosh³, Arkodeep Chatterjee⁴, Soumita Mallick⁵, Akanksha Singh⁶, Bijoyini Bagchi⁷
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This study examines Enterprise Resource Planning (ERP) systems, focusing on complex domains like SAP Order-to-Cash (O2C), where fragmented relational data limits intuitive exploration, flow tracing, and end-to-end visibility. It introduces a full-stack system that unifies distributed enterprise data into an interactive property graph model using a document-store database, eliminating the need for a graph engine. The system incorporates a multi-step natural language processing (NLP) interface that converts user intent into deterministic queries. It features dynamic visual feedback for graph traversal, along with enterprise-grade reliability such as adaptive query fallbacks and topological constraints, enabling accessible analysis, flow tracing, and anomaly detection across complex datasets.

PID 849

**AGERA: Algebraic–eometric Energy-Aware Rule Aggregation, a Mathematical
Approach to Flow Generalization in SDN**

Sibananda Behera¹, Namita Panda², Sudhansu Shekhar Patra³
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This work presents AGERA, a new framework that uses ideas from algebra and geometry to make flow rule management in Software-Defined Networks (SDNs) more efficient, representing flow rules as organized regions in a Boolean space and applying an energy-aware greedy algorithm to merge them effectively, which reduces TCAM usage by 47.8% and cuts energy consumption by 72.8% on the GERMANY50 network while performing better than existing methods, and at the same time it ensures correct data forwarding, keeps false positives under control, and reduces frequent rule changes, making it a practical approach for building scalable and energy-efficient SDN systems.

PID 857

An Integrated Approach to FTS Forecasting Using Decomposition and Gradient Boosting

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This study introduces a novel hybrid fuzzy time series (FTS) framework for forecasting data characterized by trend and seasonality. The proposed approach decomposes the series into trend and seasonal components, applies overlapping fuzzy partitioning, and performs defuzzification via multi-membership midpoint aggregation to generate an initial estimate. A Gradient Boosting Regression model is then employed to learn nonlinear interactions between the defuzzified components. To further enhance accuracy, a controlled residual-based error feedback mechanism is incorporated. The model is evaluated on Beer Consumption and Airline Passengers datasets, demonstrating superior performance in RMSE, MAE, MAPE, and R2. The proposed framework effectively combines interpretability with nonlinear learning capability.

PID 858

**A Hybrid Machine Learning and Deep Learning Framework for Real-Time
Traffic Congestion Prediction Using Multimodal Data Integration**

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Urban traffic congestion is a persistent challenge in modern cities, requiring accurate and timely forecasting for effective management. This project presents a hybrid traffic forecasting and congestion prediction framework that integrates machine learning and deep learning

techniques using multimodal data, including historical traffic patterns, weather conditions, and holiday indicators. Models such as Random Forest, Support Vector Regression, LSTM, and GRU are combined to capture both nonlinear relationships and temporal dependencies. The system supports real-time prediction, 24-hour and 7-day forecasting, congestion classification, and interactive dashboard visualization with map integration. Experimental results demonstrate improved accuracy, stability, and practical usability, making the framework suitable for intelligent transportation and smart-city applications.

PID 864

**Integrating Pareto-efficient Algorithm and Layered Language Retraining
to Boost Sentiment Prediction of Code-Mixed Hinglish Dataset**

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A binary classification problem is presented in this study to detect non-hate (0) or hate (1) emotions in a Hinglish, code-mixed dataset. The dataset contains 29,550 text paragraphs, along with corresponding 0 or 1 labels. Logistic Regression (LR), a classical Machine Learning (ML) algorithm; Long Short-Term Memory (LSTM), a Deep Learning (DL) algorithm; and Multilingual representations for Indian Languages (MuRIL), a transformer model, are employed to compare their performance on multilingual text. Mention that the LR model is combined with Word2Vec, whereas LSTM uses Global Vectors for Word Representation (GloVe) for word embedding to boost the efficiency. On the other hand, MuRIL manages word embeddings on its own with an attention mechanism, following the encoder-only model principle. MuRIL outperforms other models with consistent, reasonable results across all performance metrics, except for Precision and Specificity, which consider negative cases. Our study yields results superior to those of existing studies, though the difference is marginal; nevertheless, the use of multiple metrics makes our approach more interpretable and reliable. This study is helpful for other code-mix language sentiment analysis, especially for Indian languages, which are often treated as low-resource languages.

PID 865

Quality-Aware Enhancement for Underwater Images

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Low contrast, distorted colors and non-uniform lighting reduce image quality and hinder analysis in underwater images. Existing techniques such as Histogram Equalization and Contrast Limited Adaptive Histogram Equalization (CLAHE) lead to over-enhancement or affect natural appearance. Our proposed method uses a quality-aware adaptive patch-based approach with a learning-based patch size predictor. Patch classification and selection are predicted by features like entropy, variance, edge and spatial frequency, allowing targeted enhancement of low-quality patches while avoiding over-enhancement. Results demonstrate better perceptual quality (lower NIQE 3.95 and BRISQUE 20.8) and comparable UIQM (248.90), which reduces over-enhancement and maintains natural appearance.

PID 868

**A Composite Soil-limate Health Index for Analyzing Long-Term Soil
Degradation and Yield Dynamics in Finger Millet Systems**

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The proposed work introduces a Composite Soil-limate Health Index (CSCHI) for assessing soil degradation over time and the effects of climate change on finger millet. The approach uses multi-source data (LTFE 1978-2022, field 2017-2022) with entropy weighting and TOPSIS ranking. Resulting statistics (Mann-Kendall, ANOVA) and explainable machine learning (EBM, SHAP) show that soil nutrients are the major drivers of yield. Findings reveal a high CSCHI-yield correlation in FYM systems ($r = 0.702$, $p < 0.001$) and low correlation in mineral systems ($r = 0.158$, $p > 0.05$), indicating system-specific soil resilience, and informing climate-smart agriculture.

PID 875

Clear Consent: Enhancing Medical Consent Clarity Using Large Language Models

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This research presents Clear Consent, a module-based pipeline using large language models to convert intricate medical consent texts into easily readable patient-centric communication. It utilizes PDF files, intelligent text segmentation, context-based summarization with the

LLaMA 3.1 8B model, translation to the Tamil language, and speech synthesis with the Gradio platform. It attained BERTScore F1 0.824, ROUGE-1 F1 0.900, and Macro-F1 0.760 on 30 medical consent documents with nearly 2 minutes of processing time per document.

PID 876

**Adaptive Audio Steganography: A Perceptual Fuzzy Logic based approach
to Optimizing Capacity and Imperceptibility**

Ayush Ghosh¹, Swapnanil Adhikary², Shinjan Chowdhury³, Koushik Dutta⁴
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Audio steganography aims to conceal secret information inside an audio cover while preserving perceptual transparency and robustness. In this work, we propose a context-aware steganographic framework that selects embedding regions using a fuzzy inference system designed to approximate perceptually favorable audio segments. The method evaluates frame-level audio characteristics such as energy, spectral flatness, local signal-to-noise ratio, spectral centroid, zero-crossing rate, and spectral flux to estimate embedding suitability, and then adaptively assigns hidden data to highly favorable regions while avoiding low-quality regions to maintain imperceptibility. Unlike conventional sequential least-significant-bit embedding, the proposed approach introduces an explainable decision process in which the selected embedding locations are justified through fuzzy rule activations. This makes the hiding strategy interpretable and allows the embedding policy to be analyzed across different music genres. Using audio from the GTZAN dataset, the framework supports a genre-aware study of embedding capacity, since musical structure, spectral density, and temporal variation can affect the number and quality of regions available for covert insertion. Experimental evaluation demonstrates that the proposed fuzzy selection strategy improves payload placement while preserving audio fidelity. The results indicate that context-aware fuzzy embedding can provide a practical balance among capacity, imperceptibility, and interpretability, making it a promising direction for secure and explainable audio steganography.

PID 882

**T-HMOF: A Multi-Objective Optimization Framework for
Crop Planning Using Agricultural Statistics Data**

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Sustainable agricultural planning requires balancing economic returns with efficient resource utilization under multiple conflicting objectives. a multi-objective optimization problem is formulated using data available in Agricultural Statistics at a Glance 2024-25 (DA&FW) for rice, wheat, and maize crops. To develop a comparative framework in solving the formulated multi-objective problem, conventional multi-objective optimization techniques like Multi-Objective Linear Programming (MOLP), Preemptive Goal Programming (PGP), Multi-Objective Evolutionary Programming (MOEP), and Particle Swarm Optimization (PSO) are employed in solving the problem. However, these techniques face various limitations in solving multi-objective problems due to fixed parameters in decision variables, limited exploration of Pareto optimal solutions, and inability to cope with uncertainty in real-world problems in agricultural planning. To cope with these limitations in conventional multi-objective optimization techniques, a new framework called T-HMOF (Tab Net-driven Hybrid Multi-Objective Framework) is employed in solving the formulated multi-objective problem in agricultural planning. The T-HMOF framework is a hybrid multi-objective framework based on a weighted sum approach, goal programming, NSGA-II, and fuzzy decision-making. The results show that the proposed approach outperforms existing approaches significantly. The framework attains the best average satisfaction score of 0.91, hypervolume value of 0.80, and the lowest generational distance of 0.05. This proves the performance of the approach in terms of convergence and diversity. In addition, the performance score is 0.90 for profit and cost, 1.00 for resource efficiency, and 0.83 for sustainability, validating the performance of the approach in attaining sustainable agricultural decision-making.

PID 885

**Legal Finance App: A RAG-Powered Compliance Assistant for Indian Startup
Regulatory Navigation Using FAISS Vector Search and Gemini LLM**

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Indian startup founders face complex regulatory obligations across multiple government bodies, with no affordable and hallucination-resistant AI tool for compliance guidance. Legal Finance App is a Retrieval-Augmented Generation system that ingests 25+ authoritative Indian government PDFs, indexes them using FAISS vector search with 384-dimensional Sentence Transformer embeddings, and answers natural-language queries by grounding LLM responses exclusively in retrieved document context. The system enforces a zero-hallucination policy through prompt engineering, deployed entirely on free-tier cloud infrastructure at zero monthly cost. Evaluation across six compliance domains demonstrates 82% answer accuracy, sub-8-second response times, and correct out-of-corpus detection.

PID 895

Computer Vision-Guided Autonomous Forklift System for Advanced Material Handling in Zimbabwean Industries

Charewa William Takudzwa¹, Rudo Duri²

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This research proposes a low-cost, vision-guided autonomous forklift system designed for Zimbabwean industries to improve material handling efficiency. Utilizing YOLOv8 and YOLOv11 deep learning architectures, the system identifies pallets and fork holes through single-camera perception, translating 2D data into 3D actionable coordinates. This retrofittable framework provides a scalable alternative to expensive sensor-heavy models. Expected results indicate at least 80% accuracy, significantly enhancing productivity and safety by reducing human error. Ultimately, the study offers an economically sustainable pathway for industrial digital transformation.

PID 897

Anomaly-Intelligence Driven Enforcement (AIDE) for Privacy Preservation in 6G Edge-Cloud Networks

Chandramohan Dhasarathan¹

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A unique framework utilizing Federated Learning with the help of adversarial generative networks while implementing differential privacy as a method to ensure user data is protected in edge-cloud networks based on 6G technology. The Anomaly-Intelligence Driven Enforcement AIDE-6G framework was tested on a 6G simulation testbed and achieved an incredible success rate of 98.7% at detecting privacy attack attempts, while also maintaining a differential privacy budget (ϵ of 0.5 for limiting data leakage to third parties). It can reduce communication overhead by 42% and provide low-latency, privacy-preserving data protection for critical applications operating in 6G environment.

PID 898

AI-Driven Threat Detection & Automated Incident Response in Cloud Networks

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This paper presents an AI-driven system for threat detection and automated incident response in cloud networks. The proposed solution implements a Random Forest model using Scikit-learn for accurate intrusion detection. The system is developed using Flask and integrates modules for data preprocessing, anomaly detection, incident classification, and real-time prediction. It also features automated alert generation and a web-based dashboard for monitoring network activities. Experimental results demonstrate an accuracy of 99.85% in detecting malicious traffic. The system provides a scalable, efficient, and cost-effective approach for intelligent cloud security and automated threat mitigation.

Summary of the Past Editions

ICAN 2025

The 5th edition of Chitkara University's flagship Engineering Conference - **International Conference on Computing, Analytics, and Networks (ICAN 2025)** - was successfully held at Chitkara University, Himachal Pradesh, on **July 18, 2025**. The conference was jointly organized by Chitkara University, Himachal Pradesh, and Chitkara University, Punjab.

Attended by nearly 200 delegates from various parts of the world, ICAN 2025 brought together a vibrant community of academicians, researchers, industry practitioners, and students from the fields of AI, Data Science, Information Technology, IoT, and more, fostering meaningful knowledge exchange.

The conference featured three invited talks

- Dr. Neeraj Goel (Associate Professor, CSE, IIT Ropar, India) spoke on *Computing for the Social Good: Opportunities in AgriTech*, presenting a case study and research work on smart cattle monitoring by his team.
- Dr. Lipika Dey (Professor, Ashoka University, India; Former Chief Scientist, TCS Research; ESP Speaker, ACM India) delivered a talk on *Agentic Systems*.
- Prof. (Dr.) Anirban Sengupta (Professor, CSE, IIT Indore) presented an expert talk on *Hardware Security and its Need*.

The paper presentations were held in three tracks and presented papers were considered for publication in the *Journal of Transformative Technologies and Sustainable Development* [a Chitkara University publication in collaboration with Springer Nature]. An ACM-sponsored Student Symposium was also held alongside ICAN 2025, featuring poster presentations. The best posters were given an opportunity to publish their work in the *Journal of Technology Management for Growing Economies* [a Chitkara University publication].



ICAN 2024

The 4th edition of the flagship engineering conference titled the **International Conference on Computing, Analytics, and Networks – ICAN 2024**, was jointly organized by Chitkara University, Punjab and Himachal Pradesh at Chitkara University, Rajpura, Punjab on **September 24-25, 2024**. Close to 300 delegates from different parts of the world attended the conference in the hybrid mode that featured presentations of 93 research papers in 15 sessions. The accepted and presented papers were published by Springer Nature in two special issues of the *SN Computer Science Journal*, which is Scopus indexed.

In ICAN 2024, a total of 619 research papers from 13 countries, including USA, France, Germany, Taiwan, Indonesia, Malaysia, Saudi Arabia, Nigeria, Morocco, Hongkong, Korea, Bangladesh and of course India, were received in the theme areas including Data Engineering; Cyber-physical, Embedded, & IoT systems; Computer & Information Technology; and Security & Privacy. Within India the conference witnessed phenomenal reach with papers coming in from all parts of the country ranging from Jammu Kashmir to Tamil Nadu and Gujarat to Assam, with many top institutions of the country submitting their quality work.

One of the key highlights of the conference was a panel discussion session entitled *Impact of GenAI on Education, Research, and Industry - A 360° Perspective*, which was held in the inaugural ceremony. The esteemed panellists were Dr. Sandhir Sharma (Vice Chancellor, Chitkara University, Punjab), Prof. (Dr.) Meenakshi D'Souza (Professor, and Head, CSE, IIIT Bangalore), Mr. Raghav Gupta (Managing Director, India & Asia



Pacific, Coursera), Mr. Rasesh Shah (*Chief Practice Officer, Fractal Analytics*), and Mr. Samit Sawal (*Product Technical Architect, Infosys Center for Emerging Technology Solutions, Infosys Chandigarh*). Inaugural ceremony also featured a keynote talk entitled Testing of large-scale IoT Applications by Prof. (Dr.) Meenakshi D'Souza. In addition, the conference featured two invited talks on each day by Prof. (Dr.) Kamal Z. Zamli (*Universiti Malaysia Pahang, Malaysia*), Dr. Abhijat Vichare (*Operations Manager, ACM India*), Dr. Sunil Gupta (*Professor, UPES Dehradun*), and Dr. Bonny Banerjee (*Associate Professor, The University of Memphis, USA*).

In addition to Springer Nature as the publication partner, the conference was also ably supported by Coursera as Knowledge Partner, Chandigarh ACM Professional Chapter, Chitkara ACM Chapter, and Coding Ninjas are partner technical societies.

ICAN 2022

On **November 18 and 19, 2022**, Chitkara University organized the third edition of its flagship engineering conference the ***International Conference on Computing, Analytics, and Networks (ICAN 2022)*** with technical sponsorship from IEEE. The prime objective of organizing this conference was to provide a platform for young researchers to share their research work with the community and obtain feedback from the leading experts of the world in the domains of computing, analytics and networks. The conference witnessed 58 paper presentations by these young researchers that were evaluated by the leading experts including academicians and industry professionals. These 58 papers were shortlisted after a rigorous peer review process from a total of 252 submissions that were received from more than 16 different states of the country and 5 foreign countries. More than 250 reviewers were involved in the review process. The conference was attended by a total of 200 delegates from all over the world and it was held at Chitkara University, Rajpura, Punjab on November 18 and in virtual mode on November 19.



The conference featured two invited talks by Dr. Pao-Ann Hsiung (*National Chung Cheng University, Taiwan*) and Mr. Aswini Thota (*Bose Corporation, USA*). The titles of their talks were Trustworthy AI for Sustainable Smart City Development and Cold-start Forecasting: A Deep Learning Approach, respectively.

Day 1 of the conference featured 18 paper presentations in two parallel tracks, and each track also featured an expert talk by Dr. A.K. Sharma - *Principal Scientist, ICAR, NDRI* and Dr. Jagreet Kaur Gill - *Director, Xenonstack Pvt. Ltd.*, respectively. Day 2 began with a session wherein two leading researchers one each from India and USA were invited to share their expertise and give research direction to the budding researchers. Dr. Aneek Adhya from IIT Kharagpur spoke on the topic Use of Machine Learning in Communication Networks: Some Use Cases and Dr. Bonny Banerjee from The University of Memphis, USA delivered his talk on the topic Predictive Coding Agents. Finally, there were 40 paper presentations conducted in 6 tracks and each of these tracks was chaired by an expert from academia.

ICAN 2020

Chitkara University, Punjab, India and National Chung Cheng University, Chiayi, Taiwan jointly organized the second edition of IEEE sponsored ***International Conference on Computing, Analytics, and Networks (ICAN2020)*** in February 2020. The four-day conference was held for two-days in Taiwan, on **February 7-8, 2020** and for two-days in India, on February 14-15, 2020. We envisioned the concept of twin-nation conference so as to provide a platform where a large number of like-minded professionals and researchers could engage and share their work, ideas and culture.



Collectively, ICAN2020 received 159 paper submissions from all over the world, of which 61 submissions were accepted and were presented during the conference. In addition to paper presentations, ICAN2020 also featured four keynote talks, four invited talks, two industry sessions, a panel discussion session and two tutorials. Around 200 delegates attended the conference.

ICAN 2017

International Conference on Computing, Analytics, and Networks - ICAN2017 was conducted by Chitkara University with technical support from Springer, New Delhi and in association with British Columbia Institute of Technology, NewGen Software and Student Chapters of IEEE, IETE and CSI on **October 27-28, 2017**. ICAN2017 was attended by around 100 delegates from five different countries. The conference featured four keynote talks by renowned researchers from different parts of the worlds, one Hands-on Tutorial and Paper Presentations in three tracks. The post-conference proceedings of ICAN2017 will be published by Springer in CCIS series.





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