

ICACIA 2025

International Conference on Advances in Computational Intelligence and Applications



Communication in Computer and Information Science
(CCIS Book series)

Nov 7 – 8, 2025

Organized by



Institute of Information Technology and Management

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ICACIA 2025

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ABOUT IITM

Institute of Information Technology and Management (IITM) was set up in 1999 under the aegis of **Mata Leelawati Shikshan Sansthan (MLSS)**, a registered education society engaged in various philanthropic activities, with Shri T.N. Chaturvedi - The well known Educationist, Parliamentarian, Ex-Governor of Karnataka and CAG of India and Padma Vibhushan Awardee as Founder President of both the Society and the Institute. The campus is located in serene pollution free salubrious surroundings in close proximity to Delhi Metro Rail. The Institute takes pride in having developed the faculty support and infrastructure imperative to effectively implement 'Outcome Based Education'- a technology-based, learner centric and result-oriented approach which enhances students' learning and performance capabilities. We are passionate about grooming the nation's youth to grow into good human beings and excellent professionals destined to become torch bearers of their respective domains. IITM conducts a plethora of short duration skill enhancement and syllabus enrichment workshops related to areas of management specializations and emerging technologies. We have a strong alumni network of over 5000 professionals working at various management levels in the leading corporate houses of the country.

VISION

“The Institute aims to be a Centre of Excellence, promoting value based quality education in the contemporary areas of advanced professional studies in Information Technology, Management and Media studies.”

MISSION

IITM endeavours:

1. To promote a learning environment that delivers students with up-to-date curriculum & pedagogy, equipping them with strong analytical mind, thinking ability, entrepreneurial and organizational skills required in a dynamic professional environment.
2. To foster strategic alliances with industry for real-time business exposure.
3. To inculcate human values like ethical, social, and moral values amongst students.



ABOUT DEPARTMENT OF COMPUTER SCIENCE

Department of Information Technology was established at Institute of Information Technology and Management Janakpuri in 1999. Department of Computer Science has research orientation in various fields of Information Technology such as Artificial Intelligence, Data Mining, Speech Mining, Computer Network, Ad-hoc Network, Wireless Network, Image Processing, Big Data, Natural Language Processing, Machine Learning, Deep Learning, Software Engineering and Software Testing etc. Department has currently 41 faculty members from prestigious Institutions. The Department has adopted best practices and undertaken various innovations to create a positive impact. The innovative practices and facilities have been introduced in the system with an objective to cater to quality enhancement, assurance and sustenance in the various spheres of the working of the department. Our BCA & MCA students have been performing consistently over the years securing top positions in university results.

VISION

"The Department of Computer Science aims to promote value based quality education to the students and impart skills and training in the field of information technology and allied areas to meet the industry demands."

MISSION

The overall mission of the Computer Science Department is to provide students with up-to-date curriculum and pedagogy in information technology and equip them with thinking skills, and prepare them to meet the growing demands for competent and trained professionals.

PREFACE

A Warm Welcome to all participants and delegates to International Conference on Advances in Computational Intelligence and Applications, ICACIA 2025 at Institute of Information Technology and Management, New Delhi, India held during 7th and 8th November 2025. The theme of the conference is Advances in Computational Intelligence and Applications and all the tracks are dedicated to the theme of the conference. The objective of this conference is to provide an international forum to interact, deliberate and stimulate the innovative minds to promote high quality research in Advances in Computational Intelligence and Applications and its concerned areas.

This is the fourth edition of the International Conference. The response to ICACIA 2025 was overwhelming. High quality papers are submitted in ICACIA 2025 from researchers from various parts of the globe and after the peer review process with the help of technical program committee members, we finally accepted 15 good quality papers for oral presentation with an acceptance rate of 20%. We have received around 100 submissions for a variety of different tracks and from overseas countries. The selected papers will be published in Springer book series "Communication in Computer and Information Science" (CCIS). CCIS is indexed in ICACIA Proceeding, DBLP, EI- Comendex, Scopus, INSPEC, Japanese Science and Technology Agency (JST) and Springerlink.

The conference is technically supported and promoted by Computer Society of India (CSI), International Society for Computers and their Applications USA (ISCA), Indian Society for Technical Education (ISTE).

The International Conference on Advances in Computational Intelligence and Applications (ICACIA-2025) will feature plenary talks, keynote sessions, tutorials, workshops, demonstrations, and parallel technical sessions. The current edition aims to foster collaboration and exchange of ideas among researchers, academicians, and professionals from India and abroad in the field of Information Technology.

Distinguished keynote speakers include **Prof. (Dr.) Rajkumar Buyya**, Director, Cloud Computing and Distributed Systems (CLOUDS) Laboratory, Australia; **Prof. (Dr.) Narayan C. Debnath**, Founding Dean, School of Computing and Information Technology, Eastern International University (EIU), Vietnam; **Prof. (Dr.) Jemal H. Abawajy**, Professor, Deakin University, School of Information Technology, Australia; **Prof. (Dr.) Sanjay Misra**, Senior Scientist at IFE, Halden, Norway; **Prof. (Dr.) Rytis Maskeliunas**, Kaunas University of Technology, Lithuania; **Prof. (Dr.) D. K. Lobiya**, Professor, JNU, Delhi; **Prof. (Dr.) Pravin Chandra**, Professor, GGS IP University, Delhi; **Prof. (Dr.) Vinod Sharma**, Director, Ramnagar Campus, University of Jammu, India; **Prof. (Dr.) Mansaf Alam**, Professor, Department of Computer Science, Jamia Millia Islamia, Delhi; **Prof. (Dr.) Amit Prakash Singh**, Professor, GGSIP University, Delhi; **Prof. (Dr.) Jemal H. Abawajy**, Professor, Deakin University, Australia; **Prof. (Dr.) M. P. S. Bhatia**, NSUT, New Delhi; **Mr. Amit Sharma**, Senior Principal Data Architect, Infosys, Gurugram; and **Prof. (Dr.) Renu Balyan**, State University of New York College, New York, United States.

The conference will also feature sessions chaired by eminent academicians and researchers, providing a vibrant platform for presenting innovative research contributions and discussing future trends in computational intelligence and related applications.

We are sure these keynote speakers and Invited talks provide a direction for delegates to take forward their research practices. We also recognize the efforts and valuable suggestions of our International and national advisory committee. Many eminent Academician and Researchers supported to review and select papers from different tracks of conference.

This Souvenir is a detailed compilation of various presentations to be held in the conference. It aims to be coveted memoir to the esteemed event but this must not be considered as conference proceedings. It contains Messages from our Patrons, Co-Patron, Director, Conveners and keynote speakers which are followed by details of various subcommittees under organization committee. Post that, track-wise ensemble of paper abstracts with author affiliations is provided. We sincerely hope that readers will find the souvenir useful and intuitive.

Prof. (Dr.) Ganesh Kumar Wadhwani,
Prof. (Dr.) Pankaj Kumar Varshney
ICACIA 2025 Convener

ACKNOWLEDGEMENT

The successful organization of a conference is the result of months of dedicated effort and seamless collaboration among numerous individuals. We extend our heartfelt gratitude to our publication partner, **Springer**, for agreeing to publish the conference proceedings in the “**Communications in Computer and Information Science (CCIS)**” series. The CCIS series is indexed in **ICACIA Proceedings, DBLP, EI-Compendex, Scopus, INSPEC, the Japanese Science and Technology Agency (JST)**, and **SpringerLink**, ensuring wide visibility and academic recognition.

We are also deeply grateful to our technical collaborators — the **International Society for Computers and their Applications (ISCA)**, USA, the **Indian Society for Technical Education (ISTE)**, and the **Istituto Calabrese di Politiche Internazionali (ISCAPI)** — for their valuable and continuous support.

Our sincere appreciation is extended to **Shri J.C. Sharma**, Chairman, IITM; **Mr. Shiva Sharma**, Executive Director, IITM; **Prof. Mahesh Verma**, Vice Chancellor, *Guru Gobind Singh Indraprastha University (GGSIPU)*, Delhi; **Prof. (Dr.) Ganesh Kumar Wadhwani**; and **Prof. (Dr.) Pankaj Kumar Varshney**, for their constant guidance and encouragement throughout the organization of **ICACIA-2025**.

We also express our profound gratitude to the **Keynote and Eminent Speakers** — **Dr. Rajkumar Buyya** (University of Melbourne, Australia); **Prof. (Dr.) Narayan C. Debnath** (Eastern International University, Vietnam); **Prof. (Dr.) Jemal H. Abawajy** (Deakin University, Australia); **Prof. (Dr.) Sanjay Misra** (IFE, Halden, Norway); **Prof. (Dr.) Rytis Maskeliunas** (Kaunas University of Technology, Lithuania); **Prof. (Dr.) D. K. Lobiyal** (Jawaharlal Nehru University, India); **Prof. (Dr.) Pravin Chandra** (GGSIPU, India); **Prof. (Dr.) Vinod Sharma** (University of Jammu, India); **Prof. (Dr.) Mansaf Alam** (Jamia Millia Islamia, Delhi, India); **Prof. (Dr.) Amit Prakash Singh** (GGSIPU, India); **Prof. (Dr.) M.P.S. Bhatia** (Delhi Technological University, India); **Mr. Amit Sharma** (Infosys, India); and **Prof. (Dr.) Renu Balyan** (State University of New York, USA) — for sharing their invaluable expertise and enriching the sessions with their scholarly insights.

Finally, we convey our sincere thanks to the **faculty members, coordinators, and students** whose tireless efforts, dedication, and teamwork have contributed immensely to making **ICACIA-2025** a grand success.

Prof. (Dr.) Rachita Rana
Director
IITM

MESSAGES

MESSAGE FROM PATRONS

Prof. (Dr.) Mahesh VermaMDS, MBA, PhD, DSc (hc), FDSRCS(Eng),
FDSRCS (Edin), FDS RCPSC (Glas)**Vice Chancellor**

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- Dr. B.C. Roy Awardee
- National Science & Technology Awardee


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Dated, the 06th October, 2025**MESSAGE**

I am pleased to learn that Institute of Information Technology & Management (IITM) is organizing the International Conference on **“Advances in Computational Intelligence and its Applications (ICACIA 2025)”** on 7th-8th November, 2025.

This prestigious conference promises to bring together a diverse and distinguished group of researchers, academicians, industry experts and students to exchange ideas, showcase innovations and explore the transformative potential of Computational Intelligence (CI) in addressing real-world challenges.

ICACIA 2025 aspires to be a vibrant platform for interdisciplinary collaboration, fostering the exchange of knowledge between theoretical foundations and practical applications. The ideas and relationships will undoubtedly contribute to the advancement of research and the creation of impactful, real-world solutions.

In today's rapidly evolving digital age, where artificial intelligence and computational technologies are influencing nearly every aspect of human life, it is more important than ever to address the ethical, sustainable, fair and inclusive development of intelligent systems. I am confident that this conference will encourage thoughtful dialogue and critical insights on these essential dimensions.

I deeply appreciate the organizing committee of IITM and volunteers for working tirelessly for organizing the ICACIA-2025. I extend my heartfelt congratulations and best wishes for the grand success of the Conference.

Prof. (Dr.) Mahesh Verma

**Shri J.C. Sharma,
Chairman
IITM
New Delhi, India**



I am delighted to announce that the Institute of Information Technology and Management (IITM) is organizing the International Conference on Advances in Computational Intelligence and Applications (ICACIA-2025) on 7th and 8th November, 2025. The Institute has a distinguished legacy of successfully hosting several National and International Conferences, which have received commendable contributions from eminent academicians, industry experts, research scholars, and budding professionals.

As a forward-looking institution, IITM consistently strives to foster academic excellence and research innovation. ICACIA-2025, themed “Advances in Computational Intelligence and Applications,” aims to provide a vibrant platform for academicians, researchers, professionals, and students to exchange visionary ideas, share groundbreaking research, and explore emerging technologies in the field of Information Technology. The conference aspires to stimulate intellectually rich discussions that bridge multidisciplinary domains and encourage future-oriented research in computational intelligence.

Guided by our motto “Nurturing Excellence,” we strongly believe in empowering the youth with innovative thinking, analytical capability, and technological proficiency — essential elements for shaping a progressive and self-reliant nation. I am confident that ICACIA-2025 will serve as an invaluable knowledge-sharing forum contributing significantly to the growth and advancement of the academic and research community.

I extend my best wishes to all the organizers, participants, and delegates for a highly successful and enriching conference.

MESSAGE FROM CO-PATRON

**Shiva Sharma,
Executive Director
IITM, Janakpuri
New Delhi, India**



The International Conference on **Advances in Computational Intelligence and its Applications (ICACIA-2025)**, organized by the Institute of Information Technology and Management (IITM), Janakpuri, Delhi, is a commendable initiative that brings together global experts, researchers, and practitioners to explore and deliberate on the emerging trends and innovations in Information Technology. The conference aspires to serve as a dynamic platform that fosters the exchange of knowledge, encourages collaborative research, and inspires creative problem-solving in addressing contemporary technological challenges.

The conference proceedings feature contributions from distinguished academicians and professionals worldwide, encompassing specialized tracks such as Intelligent Systems for Scalable Blockchain and Wireless Solutions and Computational Intelligence for Cybersecurity and Privacy Preservation. These scholarly works reflect the rapid evolution of intelligent technologies that are transforming the digital world through continuous innovation, adaptability, and integration.

With groundbreaking advancements in blockchain, wireless communication, cybersecurity, and privacy-preserving computation, the global research landscape is witnessing unprecedented transformation. Driven by data-centric intelligence and powered by artificial intelligence, disruptive technologies such as AI-enabled blockchain optimization, privacy-preserving machine learning, and intelligent cybersecurity systems are redefining the way industries and societies function.

The deliberations and insights emerging from ICACIA-2025 will, I am certain, pave the way for future research, foster global collaboration, and contribute significantly to the development of scalable, secure, and intelligent computing systems.

I extend my warm congratulations to the organizing committee, contributors, and participants for their dedication and effort in making ICACIA-2025 a successful and impactful academic endeavor.

MESSAGE FROM MINISTER OF INDUSTRIES

सरदार मनजिंदर सिंह सिरसा

उद्योग, खाद्य व आपूर्ति एवं पर्यावरण,
वन व वन्य जीव मंत्री

Sardar Manjinder Singh Sirsa

Minister of Industries, Food & Supplies
and Environment, Forest & Wild Life



Message

Prof. (Dr.) Rachita Rana ji,

I am delighted to learn that the Institute of Information Technology & Management (IITM) is organizing two prestigious academic events the Springer International Conference on "Advances in Computational Intelligence and its Applications (ICACIA-2025)" and the ICSSR Sponsored National Conference on "Synergizing Media, Management and Technology: Driving Integrity, Innovation and Entrepreneurship for Viksit Bharat@2047 (SMMT-2025)".

These initiatives truly reflect IITM's commitment to academic excellence, innovation, and nation-building. In today's dynamic world, it is through such platforms that our scholars, researchers, and industry experts can exchange ideas, foster creativity, and explore cutting-edge technologies that shape the future of a developed India. I extend my warmest congratulations to the organizers, faculty members, and participants for their efforts in bringing together academia and industry on a common platform of learning and innovation. May these conferences inspire young minds to think critically, act ethically, and contribute meaningfully to the vision of Viksit Bharat@2047. My best wishes for the grand success of both the conferences and for all future endeavors of the Institute.

With warm regards,

Prof. (Dr.) Rachita Rana,
Director,
Institute of Information Technology & Management
(IITM), D-29, Institutional, Area, Janakpuri,
New Delhi

(Sardar Manjinder Singh Sirsa)

राष्ट्रीय राजधानी क्षेत्र दिल्ली सरकार

Govt. of National Capital Territory of Delhi आठवां तल, 'ए' विंग, दिल्ली सचिवालय आई.पी.एस्टेट, नई दिल्ली-110002 8th Level, A-Wing, Delhi Secretariat, I.P. Estate, New Delhi-110002 Tele No.: 23392126, 23392127 E-mail: minfs-delhi@delhi.gov.in D.O.

MESSAGE FROM MINISTER OF PUBLIC WORKS DEVELOPMENT



प्रवेश साहिब सिंह
Parvesh Sahib Singh

कैबिनेट मंत्री राष्ट्रीय राजधानी क्षेत्र, दिल्ली सरकार
Cabinet Minister Govt. of NCT of Delhi

D.O. No.: Min PWD/R/2025/871
Namaste,

Date.: 03-11-2025

I extend my sincere thanks for your kind invitation to the upcoming conferences organized by the Institute of Information Technology & Management — the *Springer International Conference on "Advances in Computational Intelligence and its Applications (ICACIA-2025)"* scheduled for November 7–8, 2025, and the *ICSSR Sponsored National Conference on "Synergizing Media, Management and Technology: Driving Integrity, Innovation and Entrepreneurship for Viksit Bharat@2047 (SMMT-2025)"* scheduled for November 13–14, 2025.

It gives me great pleasure to know that your institute is taking commendable initiatives to foster academic excellence, research collaboration, and innovation in diverse domains of technology and management. Such platforms play a pivotal role in shaping the future of our nation by inspiring young minds and promoting interdisciplinary learning.

Please accept my best wishes for the successful organization of both conferences. I further convey my greetings and best wishes to all participants, delegates, and organizers.

(Parvesh Sahib Singh)

Prof. (Dr.) Rachita Rana
Director,
Institute of Information Technology & Management,
Janakpuri, New Delhi

मंत्री-लोक निर्माण विभाग, विधायी मामले, सिंचाई एवं बाढ़ नियंत्रण, जल, गुरुद्वारा चुनाव
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MESSAGE FROM DIRECTOR

Prof. (Dr.) Rachita Rana
Director
IITM, Janakpuri
New Delhi, India



The International Conference on **Advances in Computational Intelligence and its Applications (ICACIA-2025)**, organized by the Institute of Information Technology and Management (IITM), Janakpuri, Delhi, represents a significant step toward bringing together global thought leaders, researchers, and practitioners to deliberate on the emerging trends and advancements in Information Technology. The conference aims to provide a collaborative platform for professionals and academicians to discuss contemporary challenges, explore innovative solutions, and identify promising directions for future research.

The proceedings include invited contributions from eminent experts across the world, covering distinguished tracks such as **Intelligent Systems for Scalable Blockchain** and **Wireless Solutions, and Computational Intelligence for Cybersecurity and Privacy Preservation**. These research efforts highlight how intelligent technologies are reshaping the digital landscape through innovation, adaptability, and scalability.

Rapid technological progress in areas such as blockchain, wireless communication, cybersecurity, and privacy-preserving computation continues to redefine the global research and innovation ecosystem. Fueled by the exponential growth of data and empowered by advanced computational intelligence, these disruptive technologies — including AI-driven blockchain optimization, privacy-preserving machine learning, and intelligent cybersecurity systems — are transforming industries, enterprises, and societies alike.

The insights and research outcomes presented in this conference are expected to foster deeper understanding, promote meaningful collaboration, and inspire the pursuit of scalable, secure, and intelligent technological solutions. I am confident that ICACIA-2025 will provide a stimulating environment for scholarly exchange and serve as a catalyst for pioneering advancements in computational intelligence and its diverse applications.

I extend my heartfelt congratulations to the organizing team, contributors, and participants for their invaluable efforts in making this conference a platform of global relevance and academic excellence.

MESSAGE FROM CONVENER

Prof. (Dr.) Ganesh Kumar Wadhwani,
Deputy Director
IITM, Janakpuri
New Delhi, India



It gives me immense pleasure to extend a warm welcome to all participants of the International Conference on Advances in Computational Intelligence and its Applications (ICACIA-2025), organized by the Institute of Information Technology and Management (IITM), Delhi, on 7th–8th November 2025.

ICACIA-2025 provides an excellent platform for academicians, researchers, industry professionals, and students from around the world to exchange innovative ideas, discuss emerging trends, and explore cutting-edge developments in the domains of Computational Intelligence and Information Technology. Such events play a pivotal role in fostering interdisciplinary collaboration, promoting knowledge sharing, and bridging the gap between academic research and industrial innovation.

I would like to convey my sincere appreciation to the Organizing Committee, Coordinators, and Technical Team for their commitment and tireless efforts in ensuring the successful execution of this conference. My special thanks are also extended to our technical partners, sponsors, keynote speakers, and invited guests for their invaluable support and contributions.

Heartfelt gratitude is due to the Technical Programme Committee, student volunteers, and all participants whose enthusiasm and active engagement have been instrumental in making this event intellectually enriching and impactful.

I extend my best wishes to all participants for a fruitful, insightful, and inspiring experience at ICACIA-2025. May the discussions and deliberations during the conference pave the way for new perspectives, collaborations, and innovations in the years ahead.

MESSAGE FROM CONVENER

**Prof. (Dr.) Pankaj Kumar Varshney,
Professor
IITM, Janakpuri
New Delhi, India**



It gives me great pleasure to welcome all the distinguished delegates, academicians, researchers, industry professionals, and students to the International Conference on Advances in Computational Intelligence and its Applications (ICACIA-2025), organized by the Institute of Information Technology and Management (IITM), Delhi, on 7th–8th November 2025.

ICACIA-2025 provides an excellent platform to bring together experts and enthusiasts from diverse domains to share their innovative ideas, research findings, and experiences in the rapidly evolving fields of Computational Intelligence and Information Technology. The conference aims to promote meaningful interactions and foster collaborations that bridge the gap between theoretical advancements and their practical applications in today's digital era.

I take this opportunity to convey my sincere appreciation to the organizing committee, coordinators, and technical team for their relentless efforts and commitment in making this event possible. I would also like to express heartfelt gratitude to our technical supporters, sponsors, keynote speakers, invited guests, and promoters for their invaluable guidance and contributions.

I wish all participants a highly engaging and intellectually stimulating experience at ICACIA-2025, and I am confident that the deliberations and exchanges during the conference will pave the way for future innovations and collaborations.

ICACIA 2025 STEERING COMMITTEE

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**International Conference on Advances in Computational Intelligence and Applications –
2025**

Friday, 07th Nov 2025 (Day 1)

Program Schedule

Timing	Event
9:15 am–9:45 am	Registration
9:45 am–9:50 am	Inaugural Session - Welcome Address - Lamp Lighting, Saraswati Vandana - Welcome of dignitaries - Welcome Address [Prof. (Dr.) Rachita Rana] - Address by Convener Prof. (Dr.) Ganesh Kumar Wadhwani - Address by Keynote Speaker 1: Prof. (Dr.) Rajkumar Buyya Director, Cloud Computing and Distributed Systems (CLOUDS) Laboratory, Australia. - Address by Keynote Speaker 2: Prof. (Dr.) Narayan C. Debnath, Founding Dean, School of Computing and Information Technology, Eastern International University (EIU), Vietnam - Address by Chief Guest Prof. (Dr.) Mahesh Verma, Vice-Chancellor (VC) of Guru Gobind Singh Indraprastha University (GGSIPU) - Technical Session
9:50am–9:55am	
9:55am–10:05am	
10:05am–10:15am	
10:15am–10:25am	
10:25am–10:50am	
10:50am–11:15am	
11:15am–11:30am	
11:30am–11:55am	

Session II (Addresses by Keynote Speakers)	
11:30am–11:55am	Key Note 3: <i>Prof. (Dr.) D. K. Lobiyal, Professor, JNU, Delhi, India</i>
11:55am–12:20am	Key Note 4: <i>Prof. (Dr.) Pravin Chandra, Professor, GGS IP University, Delhi, India</i>
12:20am–12:45pm	Key Note 5: <i>Prof. (Dr.) Mansaf Alam, Professor, Department of Computer Science, Jamia Milia Islamia, Delhi, India</i>
12:45pm-1:10pm	Key Note 6: <i>Prof.(Dr.) Rytis Maskeliunas, Kaunas University of Technology, Lithuania</i>
1:10pm-1:20pm	Souvenir Release
1:20pm-1:30pm	Vote of thanks by <i>Prof. (Dr.) Ganesh Kumar Wadhwani</i>
1:30pm–02:30pm	Lunch
Paper Presentation	
2:30pm–4:30 pm	Venue Room No.304
4:30pm–05:00pm	Evening Tea & Refreshment

Paper Presentation Schedule for Day 1:

Session No./Venue	Chairs / Co-Chairs	Paper to be Presented
Session 1 Room No.103	Prof. Dr. Ptashant Prof. Dr. Pankaj Kumar Varshney	5,27,45,54,55,58,59,65



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**International Conference on Advances in Computational Intelligence and Applications –
2025**

Saturday, 08th Nov 2025 (Day 2)

Program Schedule

Timing	Event
9:30am -9:40am	- Welcome Address - Key Note 1: Prof. (Dr.) Renu Balyan, State University of New York College, New York, United States. - Key Note 2: Prof. (Dr.) Vinod Sharma, Director, Ramnagar Campus, University of Jammu, India - Key Note 3: Prof. (Dr.) Amit Prakash Singh, Professor, GGSIP University, Delhi, India
9: 40 am-10:10am	
10:10 am-10:35am	
10:35am-11:00am	
11:00am,-11:30 am	Morning High Tea & Refreshment
11:30 am–11:50pm	- Key Note 4: Prof. (Dr.) Jemal H. Abawajy, Professor, Deakin University, School of Information Technology, Australia - Key Note 5: Prof. (Dr.) M.P.S. Bhatia, NSUT, New Delhi, India - Key Note 6: Mr. Amit Sharma, Senior Principal Data Architect, Infosys, Gurugram, Haryana, India - Key Note 7: Prof. (Dr.) Sanjay Misra, Senior Scientist at IFE, Halden, Norway
11:50am–12:10pm	
12:10pm-12:35pm	
12:35pm -1:00pm	
1:00pm–2:00pm	Lunch
2:00pm–4:00pm	Paper presentation Venue Room No.304

4:00pm-4:45p.m	Valedictory Session
4:45pm-5:15pm	High Tea Break.

Paper Presentation Schedule for Day 2

Session No./Venue	Chairs / Co-Chairs	Paper to be Presented
Session 1 Auditorium		24,47,56,57,61,70,71
Session 2 Room no 304	Prof.(Dr.) Arshad Ali Prof.(Dr.) Masaf Alam	15,25,37,38,72

KEYNOTES



Prof. Raj Kumar Buyya

Prof. Raj Kumar Buyya is the Redmond Barry Distinguished Professor and Director of the Cloud Computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne, Australia, and CEO of Manjrasoft Pty Ltd, a spin-off commercialising cloud innovations. He earned his B.E. from the University of Mysore, M.E. from Bangalore University, and Ph.D. from Monash University, Australia. A world leader in cloud, distributed, edge, and IoT computing, he has developed influential software systems such as Aneka, CloudSim, and GridSim. Author of over 850 publications and several books, he has over 120,000 citations and an h-index above 150, and is a Highly Cited Researcher since 2016. A Fellow of IEEE and Academia Europaea, he has received major honors including the IEEE TCSC Medal and Scopus Researcher of the Year Award. He serves as Editor-in-Chief of IEEE Transactions on Cloud Computing and Software: Practice and Experience, and has delivered 600+ invited talks worldwide..



Dr. Narayan C. Debnath

Prof.(Dr.) Narayan C. Debnath is currently the Founding Dean of the School of Computing and Information Technology at Eastern International University, Vietnam. He is also serving as the Head of the Department of Software Engineering at Eastern International University, Vietnam. Dr. Debnath has been the Director of the International Society for Computers and their Applications (ISCA) since 2014. Formerly, Dr. Debnath served as a Full Professor of Computer Science at Winona State University, Minnesota, USA for 28 years (1989-2017). He was elected as the Chairperson of the Computer Science Department at Winona State University for 3 consecutive terms and assumed the role of the Chairperson of the Computer Science Department at Winona State University for 7 years (2010-2017). Dr. Debnath earned a Doctor of Science (D.Sc.) degree in Computer Science and also a Doctor of Philosophy (Ph.D.) degree in Physics. In the past, he served as the elected President for 2 separate terms, Vice President, and Conference Coordinator of the International Society for Computers and their Applications, and has been a member of the ISCA Board of Directors since 2001. Before being elected as the Chairperson of the Department of Computer Science in 2010 at Winona State University, he served as the Acting Chairman of the Department. Dr. Debnath received numerous Honors and Awards while serving as a Professor of Computer Science during the period 1989 to 2017. During 1986-1989, Dr. Debnath served as an Assistant Professor of the Department of Mathematics and Computer Systems at the University of Wisconsin-River Falls, USA, where he was nominated for the National Science Foundation (NSF) Presidential Young Investigator Award in 1989. Professor Debnath has made significant contributions in teaching, research, and services across the academic and professional communities. Dr. Debnath has been an active member of the ACM, IEEE Computer Society, Arab Computer Society, and a senior member of the ISCA.



Prof. (Dr.) Jemal H. Abawajy

Prof. (Dr.) Jemal H. Abawajy is a highly respected researcher and academic in the field of computer science, serving as a Professor at the School of Information Technology, Deakin University, Australia. He is a Senior Member of the IEEE Computer Society and an active contributor to professional technical committees focusing on scalable and dependable computing.

His research expertise covers distributed and parallel computing, cloud and fog computing, big data analytics, network and system security, Internet of Things (IoT), decision support systems, and database and algorithm design. Over his career, he has authored more than 250 publications, including peer-reviewed journal articles, conference proceedings, and book chapters, and has supervised numerous Ph.D. students and early-career researchers.

Prof. Abawajy's work emphasizes the development of efficient, secure, and reliable computing infrastructures for real-world applications. His research bridges theory and practice, with impactful contributions to cybersecurity solutions, smart healthcare systems, IoT-enabled applications, and large-scale data analytics. He has been a keynote speaker and invited expert at many international conferences and workshops, reflecting his global recognition in the computing research community.

In addition to his research, he plays a key role in academic leadership and mentorship, guiding students and faculty on research projects, curriculum development, and professional growth. He also serves on editorial boards of multiple international journals, further strengthening the quality and impact of computing research worldwide.

Prof. Abawajy is widely regarded for his ability to integrate advanced computing technologies into practical solutions, enhancing both academic scholarship and societal applications.



Prof.(Dr.) Sanjay Misra

Dr. Sanjay Misra is a Senior Scientist at the Institute for Energy Technology (IFE) in Halden, Norway, and a Senior Member of the IEEE as well as an ACM Distinguished Lecturer. Prior to his current role, he worked in the Department of Computer Science and Communication at Østfold University College, Halden, Norway. He holds a Ph.D. in Information & Knowledge Engineering (Software Engineering) from the University of Alcalá, Spain, and an M.Tech in Software Engineering from the Motilal Nehru National Institute of Technology (MNNIT), India.

Dr. Misra's expertise covers software engineering, software quality assurance, applied informatics, cyber security, health informatics, and intelligent systems using AI and other computational techniques. He has published extensively—around 150 papers in journal and conference venues—and has edited many books and special issues in his fields. His work has placed him among the top 2% of scientists globally (based on Stanford University's list) and he has received recognition for high-impact publishing and research leadership.

He serves in senior editorial roles for international journals (including titles such as *International Journal of Human Capital & Information Technology Professionals* and *IT Personnel and Project Management*), has delivered over 100 keynote or invited talks in more than 60 countries, and has supervised numerous doctoral students and research projects.

In his current capacity at IFE, Dr. Misra is advancing research that addresses large-scale and applied informatics problems—particularly how secure, intelligent software systems can support critical infrastructure, health and energy domains.



Prof. (Dr.) Rytis Maskeliūnas

Prof. (Dr.) Rytis Maskeliūnas is a distinguished academic and researcher in the field of Computer Science and Artificial Intelligence, currently serving as a Professor in the Department of Multimedia Engineering at the Kaunas University of Technology (KTU), Lithuania. He earned his Ph.D. in Computer Science from KTU in 2009 and has since established himself as a leading figure in multimodal signal processing, intelligent human–computer interaction, assistive technologies, and AI-driven healthcare applications.

Prof. Maskeliūnas’s research focuses on developing intelligent systems that integrate audio, visual, and physiological data for adaptive and assistive interfaces, particularly benefiting healthcare and rehabilitation. His recent projects include the development of an AI-based diagnostic model for early detection of Alzheimer’s disease, achieving an accuracy of over 99%, and an AI-supported rehabilitation system designed for post-stroke patients to monitor and enhance recovery outcomes. His work demonstrates a strong commitment to translating computational intelligence into practical, human-centered solutions. A prolific author, Prof. Maskeliūnas has published extensively in international peer-reviewed journals and conferences under leading publishers such as IEEE, Springer, and Elsevier. He has been involved in several EU-funded research initiatives and serves as a reviewer and editorial board member for multiple international journals. His scholarly impact is reflected in numerous citations and collaborations with global institutions in AI, neuroscience, and biomedical engineering.

Prof. Maskeliūnas has been recognized nationally for his scientific excellence, receiving honors such as the LRT “Discovery of the Year” Award and the Best Young Scientist Award in Lithuania. Through his research leadership, academic mentorship, and innovation, he continues to advance the integration of AI, data science, and human-computer interaction for the betterment of healthcare and society.



Prof. D.K. Lobiyal

Prof. D. K. Lobiyal is a Professor in the School of Computer and Systems Sciences (SC&SS) at Jawaharlal Nehru University (JNU), New Delhi, India. He earned his B.Tech. in Computer Science and Technology from the Institute of Engineering and Technology, Lucknow University in 1988, followed by an M.Tech. (1991) and Ph.D. (1996) in Computer Science and Technology from JNU. He began his academic career as an Assistant Professor at JNU in 1997, became an Associate Professor in 2004, and has been serving as a full Professor since 2010.

Prof. Lobiyal's research interests span wireless sensor networks, mobile ad-hoc networks, natural language processing (NLP), and video-on-demand systems. He has published extensively in reputed international journals and conferences, with notable works such as Impact of Interference on Coverage in Wireless Sensor Networks, A Multi-Level Strategy for Energy Efficient Data Aggregation in Wireless Sensor Networks, and Voronoi Diagram and Convex Hull-Based Geocasting and Routing in Wireless Networks. His research contributions have significantly advanced the understanding of network optimization and energy efficiency in distributed communication systems. He has also contributed to academic leadership, serving as Director of the Internal Quality Assurance Cell (IQAC) at JNU from 2016 to 2017 and participating actively in academic and administrative bodies of the university. Prof. Lobiyal is a Senior Member of IEEE and has been involved in professional organizations such as the Institution of Electronics and Telecommunication Engineers (IETE). Through his teaching, research, and service, he continues to make substantial contributions to the fields of computer science and communication networks.



Prof. (Dr.) Praveen Chandra

Prof. (Dr.) Pravin Chandra is a Professor in the University School of Information and Communication Technology (USICT) at Guru Gobind Singh Indraprastha University (GGSIPU), New Delhi. He holds a Ph.D. in Computer Science, with his doctoral research focusing on sigmoidal functions in feedforward artificial neural networks. He completed his M.Sc. in Physics from the University of Delhi and obtained his M.Tech. in Computer Applications from the Indian School of Mines, Dhanbad (now IIT Dhanbad).

Before joining GGSIPU, Dr. Chandra served as an Assistant Professor in Information Technology and Production & Operations Management at the Lal Bahadur Shastri Institute of Management (LBSIM), New Delhi, and later as an Associate Professor at the University of Delhi during 2010–2011. With extensive teaching and research experience, he has contributed to academia in multiple interdisciplinary domains bridging computer science, applied mathematics, and management. His areas of specialization include Artificial Neural Networks, Complex Systems, Algorithm Design and Analysis, Data Structures, Database Management Systems, Theoretical Computer Science, Computational Complexity, Multiple Criteria Decision Making, Stochastic Processes, and Programming Languages. His research emphasizes computational modeling, optimization, and intelligent decision-support systems. Dr. Chandra has published and presented research in reputed national and international forums and continues to mentor students in advanced areas of computer science. Through his teaching, research, and academic leadership, he contributes significantly to the development of theoretical and applied aspects of computing at GGSIPU.



Prof. (Dr.) Vinod Sharma

Prof. (Dr.) Vinod Sharma is a seasoned academic and researcher serving as a Professor in the Department of Computer Science and Information Technology at the University of Jammu, Jammu & Kashmir, India. He holds a Ph.D. in Computer Science, along with an MCA from VJTI Mumbai, and a B.Sc. His expertise lies primarily in the areas of Database Management Systems, Data Mining, and Artificial Intelligence.

Prof. Sharma has contributed significantly to both teaching and research, guiding numerous Ph.D. scholars, including work on e-Governance and the application of information technology in health and education sectors within Jammu and Kashmir. He has played key administrative roles as well, including serving as the Director of the Faculty of Mathematical Sciences at the Ramnagar Campus of Jammu University.

His research interests focus on the development and application of data-driven technologies to solve practical problems, especially in regional contexts. His scholarly work bridges core computer science disciplines with real-world challenges in governance, education, and health informatics.

Known for his academic leadership and mentorship, Prof. Sharma has also been involved in curriculum development, fostering research culture, and facilitating collaborations at the university level. His professional endeavors continue to support the growth of computer science education and research excellence in Jammu and Kashmir.



Prof. (Dr.)Mansaf Alam

Prof. (Dr.)Mansaf Alam has been working as a Professor in the Department of Computer Science, Faculty of Sciences, Jamia Millia Islamia, New Delhi- 110025. He has been awarded a Young Faculty Research Fellow, Miety, Govt. of India. He is the Editor-in-Chief of the Journal of Applied Information Science. He has published several research articles in reputed International Journals and Proceedings in reputed International conferences published by IEEE, Springer, Elsevier Science, and ACM. His area of research includes Artificial Intelligence, Big Data Analytics, Machine Learning and Deep Learning, Cloud Computing, and Data Mining. He is a reviewer of various journals of International repute, such as Information Science, published by Elsevier Science. He is also a member of the program committee of various reputed International conferences. He is on the Editorial Board of some reputed International Journals in Computer Sciences. He has published several books: Digital Logic Design by PHI, Concepts of Multimedia by Arihant, Internet of Things: Concepts and Applications by Springer, Big Data Analytics: Applications in Business and Marketing, and Big Data Analytics: Digital Marketing and Decision Making by Taylor and Francis. He recently got an International Patent (Australian) on an Artificial Intelligence-Based Smart Dustbin. He delivered highest Invited Talk 392.



Prof. (Dr.) Amit Prakash Singh

Prof. (Dr.) Amit Prakash Singh is a distinguished academic and researcher serving as a Professor at the University School of Information & Communication Technology (USICT), Guru Gobind Singh Indraprastha University (GGSIPU), New Delhi. He began his tenure at GGSIPU in 2001 and has advanced through various positions, including Lecturer and Senior Lecturer, before being appointed Professor in 2015.

He earned his Ph.D. in Information Technology from GGSIPU in 2011. He also holds an M.Tech in Computer Science & Engineering from Guru Jambheshwar University of Science & Technology, Hisar, and an M.Sc. in Electronics from Sardar Patel University, Gujarat.

Prof. Singh's primary research interests include Artificial Neural Networks, Embedded System Design, Digital System Design, Internet of Things (IoT), and Artificial Intelligence applications. He has actively led and collaborated on applied research projects, such as IoT implementations in agriculture and AI-driven tools for healthcare diagnostics, bridging the gap between theoretical research and real-world applications.

In his administrative and mentorship roles, he serves as Chief Mentor and Coordinator of the AICTE IDEA Lab at USICT, fostering innovation, entrepreneurship, and AI literacy among students. He is a member of professional organizations including IEEE, IETE, CSI, VLSI Society of India, and the Indian Microelectronics Society, reflecting his active engagement with the broader scientific community.

Prof. Singh has authored over 30 journal articles, presented research at international conferences in countries like the UK, Portugal, and Singapore, and guided numerous students in research and project work. His work emphasizes the integration of AI and embedded systems into practical applications, including smart devices, healthcare tools, and IoT-enabled solutions.



Prof. (Dr.) M.P.S Bhatia

Prof. M.P.S. Bhatia is a distinguished academic currently serving as Dean of the Faculty of Information & Communication Technology (FICT) and a full Professor in the Department of Computer Science & Engineering at Netaji Subhas University of Technology (NSUT), New Delhi. He earned his Ph.D. in Computer Engineering from the University of Delhi and has been active in teaching, research supervision, and academic administration for over two decades.

Prof. Bhatia's core research interests span data science, social media analytics, pervasive healthcare, cybersecurity, computer vision, data mining, machine learning, and semantic web technologies. He has supervised numerous M.Tech and Ph.D. students, published widely in national and international journals and conference proceedings, and contributed book chapters in his domains of expertise. As Dean of FICT, he plays a key institutional leadership role—oversight of academic programmes, research development, student welfare, industry interaction and innovation initiatives. His work bridges theoretical foundations (data structures, algorithms, machine learning) with applied areas (social networks, healthcare analytics, security) and aims to deliver research outcomes that respond to real-world societal challenges. Prof. Bhatia is a member of professional bodies including the Institute of Electrical and Electronics Engineers (IEEE) and the Computer Society of India (CSI). His scholarly contributions and academic leadership have established him as a leading figure in computing and information technology education at NSUT and beyond.



Mr. Amit Sharma

Mr. Amit Sharma, based in Gurugram, HR, India, is a seasoned technology leader with extensive experience in data and analytics. Currently serving as a Senior Principal Architect at Infosys, he has been a key contributor to the company's growth since 2008, progressing through roles in business intelligence, data warehousing, and big data analytics. With an MCA from Motilal Nehru National Institute of Technology and a B.Sc. (Hons) in Chemistry from Hans Raj College, Delhi University, Amit combines technical expertise with a strong analytical foundation. His career reflects a deep commitment to driving innovation and delivering impactful data-driven solutions.



Prof. (Dr.) Renu Balyan

Prof. (Dr.) Renu Balyan is an Assistant Professor of Computer and Information Sciences at SUNY Old Westbury. She was selected as part of the inaugural class of the State University of New York (SUNY) AI for the Public Good Fellows, recognizing her contributions in the fields of natural language processing, data mining, machine learning, and deep learning. Her research includes advanced work on summarization, question-asking and question-answering systems, as well as the development of computational tools aimed at health and educational applications.

Dr. Balyan's mission as an AI Fellow is to enhance AI literacy across SUNY by helping faculty integrate ethical and critical AI education into their curricula. She emphasizes creating learning environments where students not only acquire technical AI skills but also develop an awareness of AI's role in advancing equity and serving community needs.

Since joining SUNY Old Westbury in 2020, she has been a principal investigator or collaborator on several National Science Foundation grants focused on projects such as 5G-enabled IoT using reinforcement learning, privacy-preserving tutoring systems for low-literacy Hispanic populations, and programs aimed at boosting student research capacity in STEM.

Dr. Balyan earned her Ph.D. in Machine Translation Evaluation from the Indian Institute of Technology Delhi. Her work is recognized for balancing technical innovation with ethical considerations, contributing to both academic research and practical applications in AI for societal benefit.

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Integrating Machine Learning and Deep Learning: A Hybrid Framework for Student Success Prediction

Nawnit Kumar¹ and Kapil Madan

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Abstract. Recognizing student success is pivotal for both proactive engagement and educational intervention. While predictive models based on machine learning (ML) and deep learning (DL) technologies are powerful, they often yield context-specific, generalizable results. Here we introduce a novel framework called Hy-SLEP. Hy-SLEP integrates ML algorithms like Random Forest, Gradient Boosting, and Support Vector Machines with DL architectures like Recurrent Neural Networks and Multilayer Perceptrons to enhance predictions of educational outcomes. Hy-SLEP enhances machine learning by capturing structured data like grades and attendance. It also applies this data, along with unstructured data like LMS log data and time-on-task from DL. A well-defined pipeline for feature engineering ensures precise, accurate, and explainable outcomes after ensemble-based fusion finishing. Applying the model to secondary and tertiary education datasets shows it performs better than single-ML and single-DL models. The model achieves higher accuracy, F1 score, and AUC. The model is now recognized as scalable, interpretable, and accurate, and enables early detection of at-risk students. This enables timely interventions driven by collected evidence data. AI-driven Education models support adaptive curriculum creation. This, in turn, shapes learning pathways and refines institutional strategies and policies for AI-powered education.

Keywords: Grocery shopping, Inventory Management, Kitchen Genie, Radio Frequency Identification and Tag.

Review of Hybrid Deep Learning Techniques for Robust ECG Signal Classification by Addressing Noise and Class Imbalance

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Abstract This review paper presents a comprehensive analysis of recent advancements in hybrid deep learning techniques for automated electrocardiogram (ECG) signal classification, with a central focus on overcoming challenges such as signal noise and class imbalance. Given the pivotal role of ECG analysis in the early detection of cardiovascular diseases, there is a growing demand for intelligent, robust, and clinically deployable systems. The paper examines hybrid model architectures that integrate Convolutional Neural Networks (CNNs), Long Short-Term Memory (LSTM) networks, and attention mechanisms to effectively capture both spatial and temporal features of ECG signals. Key studies are reviewed in terms of their preprocessing strategies, feature optimization methods, and noise mitigation techniques. In addition to architectural insights, the paper outlines a structured taxonomy of hybrid approaches based on model composition, preprocessing methods, imbalance handling techniques, evaluation metrics, and deployment environments. It also explores emerging application areas, including real-time monitoring systems, telecardiology platforms, and clinical decision support tools. Common research limitations—such as computational complexity, limited interpretability, and real-world generalizability—are critically discussed. The review concludes with recommendations to guide future work toward scalable, explainable, and clinically relevant deep learning frameworks, ultimately aiming to support the next generation of intelligent cardiovascular healthcare systems.

Keywords: ECG Signal Classification, Hybrid Deep Learning, Noise Resilience Class Imbalance

Artificial Immune Algorithm Based Diabetic Retinopathy Image Class Prediction by TreeBagger Model

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Abstract. Growing population around the globe increases dependency on machines, as humans have limits. Hence medical field involves various technologies to reduce load. This paper proposed a model that diagnosis retinopathy image data to predict the class of image. Proposed model AIDRID (Artificial Immune based Digital Retinopathy Image Diagnosis) works on feature extraction and optimization algorithm. Input image is processed by artificial immune algorithm for image segmentation. Segmented image region is blocked to extract frequency and spatial feature from image. Extracted features were used for the training of Tree Bagger Model. Retinopathy real image dataset was used for the experiment and results show that proposed AIDRID (Artificial Immune based Digital Retinopathy Image Diagnosis) model has increased the detection accuracy.

Keywords: Retinopathy Image Classification, Genetic Algorithm, Feature Extraction, Machine Learning.

Human Activity Recognition in Smart Homes: Advancements and Future Trends with Edge Computing Integration and Ethical Frameworks

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ABSTRACT: Human Activity Recognition (HAR) in smart homes is a vital breakthrough in constructing intelligent systems for monitoring Activities of Daily Living (ADL). It improves healthcare, security, and minimizes energy requirements. This study utilizes ARAS data to construct and test sophisticated predictive models for multi-resident activity systems based on state-of-the-art machine learning classifiers, ensemble approaches, and deep neural network structures. We utilize advanced feature extraction and selection methods such as Information Gain, Recursive Feature Elimination (RFE), and Random Forest Importance to balance model performance and computational efficiency. Our work involves incorporating edge computing paradigms with ethical frameworks to respond to privacy issues and real-time processing needs. The hybrid architecture we put forth showcases improved performance with accuracy of 99.6% and 99.8% for households A and B respectively, while being low in latency and energy consumption. Additionally, we present thorough ethical guidelines and privacy-preserving methods to promote ethical deployment of HAR systems in home environments. Experimental verification on a variety of scenarios ensures the scalability and robustness of our method, qualifying it as a potential solution for next-generation smart home systems.

Keywords: Smart Homes, Edge Computing, Deep Learning, Ethical AI, Privacy Preservation, ARAS Dataset, Feature Selection, CNN-LSTM

FLARE: Federated Learning for Adaptive Cloud Resource Estimation with Blockchain Logging

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Abstract. Privacy-preservation while managing cloud resources efficiently is one of the crucial challenges faced by cloud computing providers. In this paper, an end-to-end system is proposed that combines trust-weighted aggregation, Federated Learning, auditability based on blockchain, AI-enabled auto-scaling, and Differential Privacy (DP) for the purpose of predicting and optimizing CPU usage in decentralized environments. Federated LSTM models have been used for forecasting CPU usage with a performance significantly matching that of the centralized LSTM models. Privacy-performance trade-off has been demonstrated with the inclusion of differential privacy. With an increase in the value of ϵ , the accuracy is increased with reduction in data protection. Furthermore, a blockchain logging mechanism has been used that makes use of Ethereum testnets in order to permanently preserve training metadata. By modifying the influence of malicious clients according to past error rates, trust-weighted federated aggregation successfully reduced their impact under hostile circumstances. The proposed approach significantly outperformed static and reactive baselines by simulating AI-guided auto-scaling policies powered by FL-based forecasts using SimPy. A comparative analysis of energy, bandwidth, and latency proxies is also presented. In order to show its suitability for resilient, privacy-conscious, and real-time cloud resource orchestration, an integrated pipeline comprising all the components was created and simulated. The proposed work offers a novel approach for intelligent cloud resource provisioning with benefits of privacy-preserving, secure and modular architecture.

Keywords: Cloud Resource Provisioning, Federated Learning, Differential Privacy, Blockchain, auto-scaling, forecasting, trust-weighted aggregation, LSTM.

A Survey on Secure and Scalable Cross-Chain Provenance Techniques for Digital Forensics

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Abstract: Investigations of cybercrime today require forensic architectures that natively traverse multiple blockchains with ease while protecting and scaling evidence processing. Although blockchains support tamper-evident logs, their original single-chain architecture limits cross-platform interoperability and forensic scaling. Recent developments have overcome these limitations such as zero-knowledge proofs supporting private but verifiable evidence verification, sharding architectures splitting state without compromising latency, and AI-based anomaly detectors identifying subtle tampering. But challenges remain like zero-knowledge proofs are computationally expensive, sharding poses intricate state-consistency problems and AI models need to be retrained constantly, incurring operational burden. Future research needs to make these pieces work for real-time, large-scale forensic applications by designing lightweight zero-knowledge constructs, self-tuning shard governance systems and compact AI with incremental-update threads. Integrating such abilities into single frameworks will offer privacy, scalability and security, supporting forensic processes for which courts will give credit in various, changing block-chain environments.

Keywords: Cross-Chain Interoperability, Digital Forensics, Blockchain Provenance, Security, Scalability.

Towards Resilient PLM Architectures: Cyber Threats, Security Mechanisms, and Industrial Implications

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Abstract. Implementation of Product Lifecycle Management (PLM) systems in firms from aerospace, automotive, and manufacturing industries helps in efficiently managing design, production, as well as the maintenance information of the company. PLMs help in managing the information at different levels and stages of the company. However, Exploitation of cloud computing, Internet of Things (IoT), and advanced supply chains poses these industries to multiple cyber threats. This document highlights the PLM applications lifecycle from design and development to production, maintenance, and eventual decommissioning, highlighting the impact of significant cyberattacks at each stage. We focus on real-world vulnerabilities and attack vectors, like CVE-2021-37161 and Teamcenter's CAD file tampering, SQLi in PTC Windchill, supply chain insider threats, and cloud misconfigurations. Analyzing breaches and defense frameworks reveals the application of ZTA (Zero Trust Architecture), AI-driven anomaly detection, and blockchain with integrity verification as viable countermeasure frameworks. We highlight the pressing importance of embedding security-by-design methodologies in PLM ecosystems while addressing the risks of AI-augmented cyber assaults and quantum computing. This research provides groundwork to aid industries and academicians in strengthening cyber defenses for PLM systems in the scope of a converging industry 4.0.

Keywords: PLM Security, Cyber-Physical Systems, Zero Trust, Supply Chain Attacks, Industry 4.0

A Novel approach on Blockchain-based E-voting System with Stealth Addressing and Blind Signature scheme

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Abstract. Voting is essential in a Democracy and an Ecosystem. Blockchain based E-voting has been proven to be superior than conventional and electronic Polling in terms of security, transparency, immutability, and usability. The blockchain-based e-voting is also implemented in some countries. In terms of security and anonymity, blockchain based framework still needs improvement. This research paper contributes to voter security and anonymity by applying the concept of a hardware wallet, blind signature and address hiding. The use of a hardware wallet secures the private key and makes transactions more secure. Blind signature and address-hiding concept improve the anonymity of the overall system. The proposed Blockchain based e-voting enhances Data integrity, non-repudiation, irreversibility of information, and the ability to resist counterfeiting attacks.

Keywords: Stealth Addresses, E-voting, Blind Signature, data privacy, blockchain.

Quantum Computing and Blockchain: Addressing Security and Scalability Challenges

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Abstract. This paper investigates the vulnerability of current blockchain technology, built on classical cryptography, to the emerging threat of quantum computing. It highlights how quantum algorithms like Shor's and Grover's pose significant risks to widely used cryptographic methods such as RSA and ECC, potentially undermining blockchain security and consensus mechanisms like Proof of Work and Proof of Stake. To address these challenges, the research explores the integration of quantum computing principles into blockchain technology. It introduces quantum-resistant cryptographic alternatives, including lattice-based post-quantum cryptography (PQC) and Quantum Key Distribution (QKD), to ensure secure communication and future-proof encryption. Furthermore, the paper examines novel quantum-enabled consensus protocols like Quantum Proof-of-Stake (QPoS) and entanglement-based consensus, which leverage quantum phenomena like superposition and entropy to enhance transaction throughput, reduce energy consumption, and promote decentralization. Simulation results demonstrate significant improvements in resource utilization and attack resilience within a quantum framework. The paper also discusses practical implementation considerations for quantum-resistant blockchains, such as computational overhead, compatibility with existing systems, and the need for standardization. Ultimately, this research proposes a foundation for future blockchain networks that are not only scalable and energy-efficient but also resilient against both classical and quantum cybersecurity threats by merging decentralized architectures with the principles of quantum mechanics.

Keywords: Quantum computing, blockchain, post-quantum cryptography, consensus mechanism

An Empirical Analysis of Univariate AQI Forecasting in Delhi Using LSTM Networks and Classical Statistical Models

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Abstract. Urban air quality remains a critical challenge in India, with Delhi frequently ranking among the world's most polluted cities. Accurate forecasting of the Air Quality Index (AQI) is essential for issuing timely health advisories and implementing responsive control measures. This study evaluates five univariate time series models for daily AQI prediction in Delhi between 2015 and 2020: Holt's Linear Trend, Adaptive Double Exponential Smoothing, Facebook Prophet, Vanilla LSTM, and Stacked LSTM. All models were trained and tested on identical dataset splits and evaluated using multiple metrics (R^2 , RMSE, MAE, MSE, and Maximum Error) to ensure fair and transparent comparisons. Results show that Vanilla LSTM consistently achieved the strongest performance, closely followed by Stacked LSTM. Holt's Linear Trend proved effective for short-term forecasting, while Prophet and Adaptive DES struggled with abrupt AQI fluctuations. The novelty of this work lies in providing one of the first systematic benchmarks of both statistical and deep learning models tailored to Delhi's volatile pollution dynamics. The study establishes clear performance baselines that can guide both researchers and policymakers in selecting appropriate models for operational use. While limited to Delhi's dataset, the findings underscore the need for broader validation across multiple cities and the inclusion of contextual variables such as traffic and crop burning for improved robustness. Future directions include hybrid statistical-deep learning approaches, lightweight real-time forecasting architectures, and improved interpretability to support actionable decision-making.

Keywords: Air Pollution, Air Quality Index (AQI), Forecasting, Statistical Models, Deep Learning Models, Facebook Prophet, Double Exponential Smoothing, LSTM, Time Series

A Blockchain-Driven Decentralized Framework for Secure and Automated Spectrum Trading in 6G Wireless Networks Using Automata Theory

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Abstract. The increasing complexity of the 6G wireless networks requires secure, transparent, and decentralized dynamic spectrum management solution. The given paper introduces a blockchain-based system automating the process of trading the spectrum and removing the need to depend on centralized systems. The framework presents each of the stages of the trading lifecycle bidding, validation, allocation, and settlement as deterministic state transitions to come up with a protocol that is not only correct but also verifiable applied in Finite State Automata (FSA). Smart contracts provide unsecure and inaccessible transactions, and spectrum assets are tokenized to be able to conduct trades conveniently. The framework would use Zero-Knowledge Proofs (ZKPs) to ensure that their privacy and trust remain intact by taking control of the access without making sensitive information known. Using automata theory formal methods on top of the transparency and decentralization benefits of blockchains, the presented system will also provide lower latency, greater trust, and resistance to fraud. Theoretical and experimental verification suggests that this architecture could find good use in supporting the new requirements of real-time spectrum trading in 6G scenarios, opening the door of a scalable and adaptive wireless communication infrastructure.

Keywords: Blockchain, 6G Spectrum Trading, Automata Theory, Smart Contracts, Zero-Knowledge Proofs (ZKPs)

A Neuromorphic-Quantum Hybrid Framework for Adaptive Cybersecurity in Post-Quantum Zero-Trust Environments Using Automata Theory

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Abstract: Due to the vulnerability of classical cryptographic systems in the context of quantum computing, there is an urgent demand in adaptive cybersecurity systems to face the onset of post-quantum attacks in an environment that complies with zero-trust ideals. The hybrid model of cybersecurity that is proposed in this paper combines neuromorphic cybersecurity based on the spiking neural network with the ability to detect anomalies in real time and quantum-resistant communication systems, which include the quantum key distribution and lattice-based encryption. This is done using state machines which are automata-theoretic in nature, which dynamically determines access control and policy of security enforcement. Through formalizing the security events into automata objects, the system is able to adapt in transitioning among modes of trust levels, based on behavior and threat patterns. The proposed architecture promotes a higher degree of resilience to classical and to quantum attack, continuous verification in zero-trust architecture, and makes intelligent response to emerging threats. Experimental simulations show that the accuracies of detection are higher, there are fewer false positives, and it is highly resistant to cryptanalytic backdoors that may be developed in the post-quantum world, making this framework a mature approach toward future-proof cybersecurity systems.

Keywords: Neuromorphic-Quantum, Zero-Trust Environments, Automata Theory, neural networks, Cybersecurity in Post-Quantum

A Finite State Automata-Based Neuro-Blockchain System for Dynamic and Secure Spectrum Access in Cognitive Radio Mesh Networks

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Abstract: Due to the burgeoning need of adaptive and high-speed wireless communications system, there has been an appearance of Cognitive Radio Wireless Mesh Networks (CR-WMNs) as the potential solution to dynamic spectrum usage. Nonetheless, decentralized character of the CR-WMNs offends their vulnerability to severe obstructions including unauthorized access, falsification of spectrum sensing data and inefficient spectrum usage. To deal with such complications, this study proposes a new Neuro-Block chain system that combines artificial neural networks (ANNs), finite-state machines (FSMs), and blockchain technology into a secure and intelligent spectrum access. The ANN element forecasts the availability of spectrum on real-time characteristics such as signal strength, SNR, BER, customer mobility and congestion. These predictions can be used in FSM that governs state transition to idle, sensing, requesting, transmitting, and blocked. At the same time, transactional use of blockchain smart contract verifies the spectrum access transactions, which encompass transparency, permanency and decentralized trust. The advantage of this three-layer technology is that it helps in making proactive decisions and avoids security threats in terms of Sybil attacks and unauthorized uses. The framework also increases accuracy, throughput, and attack resilience when evaluated on real RF datasets (Wi-Fi, LTE, 5G). The new Neuro-Blockchain architecture presents a scalable framework as a step towards secure, independent, and dynamic spectrum management in the next generation 6G, IoT, and smart cities.

Keywords: Neuro-Blockchain, Cognitive Radio Networks (CRN), Wireless Mesh Networks (WMN), Spectrum Access, Deep Learning, Blockchain Technology

Adaptive Context-Aware Cloud Resource Provisioning with Federated Learning

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Abstract. In order to balance cost, SLA compliance, and privacy, modern cloud platforms need to dynamically provision resources. A novel federated, context-aware deep learning system for predictive resource provisioning and decentralized CPU workload forecasting in multi-cloud settings is presented in this research. The approach facilitates client-specific training without data exchange by utilizing federated LSTM models with SLA-tier context vectors. The proposed method is validated by three experiments: (i) Forecast-based provisioning eliminated SLA violations over 100 time steps at a cost of 1946.03 units; (ii) context-aware federated forecasting achieved an MAE of 0.04 post-concept drift; and (iii) predictive scaling outperformed threshold-based autoscaling with two fewer scale-ups, 0.2 fewer average VMs, and a lower cost (1530.56 vs. 1533.56). Resilience was validated by a robustness test using drift and burst noise, which maintained zero SLA breaches with 12 scale-downs and 17 scale-ups. The outcomes validate the viability of federated forecasting for adaptive, scalable, and privacy-preserving cloud resource provisioning.

Keywords: Federated Learning, Adaptive Cloud Resource Provisioning, Federated Forecasting, Autoscaling, Predictive Controller, Privacy Preserving.

RDNet: A Refined Dynamics Network for Multivariate Time Series Forecasting

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Abstract. Multivariate time series forecasting remains fundamental across domains requiring accurate temporal predictions. We propose RDNet (Refined Dynamics Network), a novel architecture integrating adaptive patching with stacked temporal refinement blocks for enhanced forecasting performance. RDNet introduces three innovations: (1) an adaptive patching encoder segmenting time series into meaningful temporal patches, reducing computational complexity while preserving essential information, (2) multiple temporal refinement blocks utilizing multi-head attention for hierarchical feature extraction, and (3) reversible instance normalization (RevIN) for robust distribution shift handling. Extensive experiments on six benchmark datasets (ETTm1, ETTm2, ETTh1, ETTh2, Electricity, Weather) demonstrate state-of-the-art performance. RDNet achieves an average MSE of 0.2558 on a prediction horizon of 96, representing 41.7% improvement over baseline models and a 45.08% reduction compared to Transformer-based approaches. Notably, the model achieves R^2 scores of 0.7199 on ETTh2 and 0.8098 on ETTm2, demonstrating superior variance explanation. Comprehensive visualizations confirm RDNet's ability to capture both short-term fluctuations and long-term dependencies, with strong performance in tracking periodic patterns and handling regime changes. The compact architecture enables deployment in resource-constrained environments while maintaining competitive accuracy.

Keywords: Time Series Forecasting · Deep Learning · Attention Mechanism · Adaptive Patching · Temporal Modeling.

PrivacyGuard: A Blockchain-Backed Multi-Party Computation Framework for Secure Medical AI Training

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Abstract. Extensive use of Artificial intelligence (AI) in health care has opened a large potential to predict the disease, and gives personalized treatment and clinical decision-making. However, training such AI systems will need large amounts of data across different medical organizations, which is blocked by aggressive privacy laws and data storage. This paper is aimed at presenting an end-to-end PrivacyGuard framework based on blockchain that offers privacy- preserving multi-party computation (MPC) to enable secure and privacy- resistant training of AI models among untrusted institutions. PrivacyGuard is a blockchain-based approach that is jointly coupled with secure MPC protocols. It allows sharing training encrypted datasets without official access to sensitive data associated with patients by multiple hospitals and training a common model on the same data. Smart contracts verify the results of the computation, and keep audit records, and the blockchain network provides consensus, traceability and resolves tampering. On the MIMIC-III dataset, it is found that PrivacyGuard runs with an accuracy of 91.8% on sepsis, whose prediction is slightly less accurate as compared to the centralized approach (92.4%). Users equally enjoy extremely low risks of privacy (less than 5 %), and blockchain parameters indicate solid performance (100 transactions/second and 200 ms latency). The proposed work presents a new privacy-preserving architecture, the blockchain being included in it as a means of transparency and the MPC as a cryptographic-privacy means. In comparison to federated learning or homomorphic encryption solution, PrivacyGuard offers practice and compliant solution without significant computational trade-off. Its smart contract system is also modular, which provides flexibility to other AI oriented applications in healthcare.

Keywords: Blockchain in Healthcare, Multi-Party Computation, Secure Medical AI Training, Federated Learning, Privacy-Preserving Machine Learning, Hyperledger Fabric, Data Privacy in AI, Decentralized AI Framework.

Data Driven Decision Making in Higher Education Institute Selection: A Supervised Learning Perspective

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Abstract Students face difficulty in taking a critical decision of selecting a higher education institution (HEI) as selecting right college is very important not only for their future but also for growth of their personal and professional life. So it becomes important for them to consider various factors while selecting higher education institutions. During the study it is found that considering various factors helps them in both personal and professional development. Five major factors affecting their choice have been identified in this study namely Academic Facilities, Career Outcomes & Faculty Excellence, Institutional Performance, Financial Factors, and Institutional Engagement. For this pilot study a structured questionnaire based on 7 points Likert scale is distributed to the 270 students who are pursuing undergraduate courses. The response rate was 92.2 % with 249 responses. The reliability was (Cronbach's Alpha = 0.753). For this study supervised learning algorithms such as Random Forest, Decision Tree, K-Nearest Neighbor, Logistic Regression and gradient boosting are used to predict students' choice for educational institutions. The Gradient boosting model outperformed by achieving an accuracy rate of 82.7% in comparison to other models i.e. Random Forest Logistic Regression and K-NN model. According to this study career success combined with institutional participation is one of the essential factors that affect the choice of the institution. Educational institutions can improve their enrolment by utilizing these findings to align their offerings with student requirements.

Keywords: Academic Facilities; Career; higher Education Institution Selection; Random Forest; Supervised learning.

Event-Centric Knowledge Graphs for Recommenders through Modeling Seasonality, Promotions, and Demand Shifts

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Abstract. User demand in digital marketplaces is non-stationary: seasonality (weekends, holidays), short-lived promotions, and external shocks reshape both item exposure and purchase propensity. Most sequential and KG-based recommenders treat these effects as unstructured context, limiting robustness and business impact. This paper introduces EventKGRec, an *event-centric* knowledge-graph approach that model’s seasonality, promotions, and demand shifts as first-class nodes. EventKGRec performs event-gated heterogeneous message passing, couples a hierarchical seasonality encoder with temporalized relation embeddings, and employs a doubly robust exposure-correction objective to mitigate promotion-induced confounding. Evaluation follows time-based splits, rolling-window stress tests, and uplift-oriented metrics. On RetailRocket with strict time-based splits, EventKGRec improves NDCG@20 by +12.1% over T-ComplEx (0.158 vs. 0.141), Recall@20 by +11.2% (0.258 vs. 0.232), and MRR by +11.0%. For promotion targeting, AUUC rises by +21.0% (0.312 vs. 0.258) and rwNDCG@20 reaches 0.167. Robust tests show a halved degradation rate under demand shifts and a recovery time of 2.0 weeks (vs. 3.5), while P95 online latency remains ≤ 35 ms for 200 candidates. Results are reported on one public e-commerce dataset; we include full ablations and significance tests and outline cross-dataset generalization as future work.

Keywords: Recommender Systems, Knowledge Graphs, Temporal Modeling, Seasonality, Promotions, Demand Shift

An Intelligent Web-Based Predictive System for Academic Performance Using Stacked Ensemble with Integrated Automated Feedback

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Abstract. Predicting student performance with great accuracy is important for improving retention and academic success in higher education. In this paper, we introduce an intelligent web-based system that uses a stacked ensemble model, combining RF, GB, and SVR, to forecast course-level outcomes. The lowest errors achieved by the Ensemble in MAE, RMSE, and the highest R^2 result showcase superior accuracy among the base learners. After the prediction, the system was integrated with an automated feedback mechanism, sending timely motivational or advisory alerts through SMS and email based on student performance categories. Early testing proves its effectiveness and efficiency as a proactive support tool, providing a scalable, student-oriented approach to educational intervention.

Keywords: Stacked Ensemble, Student Performance Prediction, Educational Data Mining, Predictive Analytics, Academic Intervention, Automated Alerts, Support Vector Regression.

AI-Driven Predictive Models for Infrastructure Health Monitoring and Failure Prediction

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Abstract

I would like to start my paper with a focus on a rising concern. The concern is related to the infrastructure industry, which faces challenges due to aging infrastructure, urbanization, and environmental pressures. While traditional maintenance methods rely on occasional maintenance checks, AI-based predictive models utilize machine learning and structural health monitoring (SHM) to provide a comprehensive solution, detecting errors and predicting failures. The failure to detect the errors is clearly seen in the I-35W bridge collapse of 2007. Our article will dive deep to know the potential of AI in improving the infrastructure reliability in bridges, dams, and buildings in the United States, India, and Canada. We will use six case studies, like as the Golden Gate Bridge, Tehri Dam, and Confederation Bridge, to study the results of monitoring time, maintenance costs, and safety incidents. We will study data integration, environmental variability, and regulatory hurdles as key challenges. Along with this, technical advancements such as deep learning and digital twins are also studied, based on their scalability and adaptability. Our study also covers the global application of AI technologies in civil engineering. This will help us to know about the future developments of generative AI and the integration with Internet of Things (IoT) technology. These topics play a major role in sustainable and great infrastructure.

Keywords: AI, Infrastructure, Predictive Models, Structural Health Monitoring (SHM),