



***2025 the 5th International Conference on
Information Communication and
Software Engineering***

ICMAI

***2025 10th International Conference on
Mathematics and Artificial Intelligence***

December 12-14, 2025 | Chongqing, China

CONFERENCE PROGRAM

Conference Program

2025 the 5th International Conference on Information
Communication and Software Engineering
(ICICSE 2025)

2025 10th International Conference on Mathematics and Artificial
Intelligence (ICMAI 2025)

December 12-14, 2025 | Chongqing, China

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Welcome Message

On behalf of the Conference Committee, we are very glad to bring you to 2025 the 5th International Conference on Information Communication and Software Engineering (ICICSE 2025) and it's workshop 2025 10th International Conference on Mathematics and Artificial Intelligence (ICMAI 2025), held virtually during December 12-14. It's sponsored by Chongqing University, China, IEEE, and IEEE ComSoc.

ICICSE 2025 welcomes author submission of papers from any branch of the Communication and Software Engineering, and their applications or other topic areas. The areas covered by the include, but not limited to: Computer Information Science, Software development and design, Communication and Information Engineering, etc.

This year ICICSE received many submissions from members of universities, research institutes and industries. All papers were subject to peer-review by conference committee members and international experts. The acceptance of the papers is based on their quality and relevance to the conference. We hope that this conference proceedings will serve as a valuable reference for researchers, educators and developers.

This year, we are very grateful to have excellent speakers, they are:

- Prof. Yonghui Li, ARC Future Fellow, IEEE Fellow, The University of Sydney, Australia
- Prof. Rajkumar Buyya, Director, Cloud Computing and Distributed Systems (CLOUDS) Lab, The University of Melbourne, Australia
CEO, Manjrasoft Pvt Ltd, Melbourne, Australia
- Prof. Alfredo Cuzzocrea, Founder and Director, Big Data Engineering and Analytics Laboratory (iDEA Lab), University of Calabria, Italy
- Prof. Paulo Batista, University of Évora, Portugal
- Assoc. Prof. Hui Chen, University of Electronic Science and Technology of China, China

The ICICSE 2025 conference has been planned so that experts from industries and academia, students of universities, will share their knowledge and experiences. The field is enriched during keynotes and presentation sessions, as well as in informal conversations among colleagues from around the world.

On behalf of the conference committee, we would like to express our gratitude to all the authors, the reviewers, and the attendees for their contributions and participations in ICICSE 2025. Their dedication and expertise enable us to prepare this high-quality program and make the conference successful. Finally, we would like to wish all the presenters and participants having a productive and enjoyable conference.

Conference Organizing Committee

December, 2025

Online Conference Information

Password for all online room: 121314

Zoom Link	Date	Arrangement
https://us02web.zoom.us/j/87055109940	December 12, 13, 14	Zoom Test for Committee/Session Chairs/ Speakers; Opening Ceremony & Keynote Speech Online Session 1 & 3 & 5 & 6 & 7
https://us02web.zoom.us/j/89677684419	December 13	Online Session 2 & 4

Time Zone

China Standard Time (CST)

UTC/GMT+8

Please make sure that both the clock and the time zone on your computer are set to the correct China standard time.

Platform: Zoom

✓ For General Users

<https://zoom.us/>

✓ For Users from mainland China

<https://zoom.com.cn/download>



Sign in and Join

- ✓ Join a meeting without signing in: A Zoom account is not required if you join a meeting as a participant, but you cannot change the virtual background or edit the profile picture.
- ✓ Sign in with a Zoom account: All the functions are available.

Additional Suggestions

- ✓ A computer with an internet connection (wired connection recommended)
- ✓ USB plug-in headset with a microphone (recommended for optimal audio quality)
- ✓ Webcam: built-in or USB plug-in
- ✓ Stable Internet Connection
- ✓ Quiet environment
- ✓ Proper lighting

Online Oral Presentation Tips

- ✓ Duration of each Presentation: about 12 Minutes of Presentation and 3 Minutes of Q&A.
- ✓ Be in the meeting room at least 15 minutes before the session start.
- ✓ An excellent presentation certificate will be sent after conference by email.
- ✓ E-certificate will be sent to presenters after conference by email.
- ✓ Please unmute audio and start video while your presentation.

Rename your screen name before entering the room	Example
Authors: Paper ID-Name	T0001-San Zhang
Listener: Listener Number-Name	Listener- San Zhang
Keynote Speaker: Keynote-Name	Keynote- San Zhang
Invited Speaker: Invited -Name	Invited- San Zhang
Committee Member: Position-Name	Committee- San Zhang

Duration of Each Presentation

- ❖ Keynote Speech: 40 Minutes of Presentation including Q&A.
- ❖ Invited Speech: 20 Minutes of Presentation including Q&A.
- ❖ Regular Oral Presentation: 15 Minutes of Presentation including Q&A.

Daily Schedule

December 12, 2025 | Friday | GMT+8(Beijing Time)

Time	Activity	ZOOM ID		
Password: 121314				
10:00-11:00	ZOOM Test for Committee / Session Chairs / Speakers / Online Session 1 A5053, A5051, A4048, A3027, A6057, A4041	87055109940 ROOM A		
14:00-15:00	ZOOM Test for Online Session 2 & 3 B2007, B2013, B4030, B3022, B2017, B4036, B4050, B4042, B5059, B3020, A3020, A1008, A4038-A, A3032			
15:30-16:30	ZOOM Test for Online Session 4 & 5 A2013, A5049-A, A4035-A, A3028, A2016, A3031, A4037-A, A2015, B5062, B5071, B5054, B5064, A3021, A4036, B4048			
16:30-17:00	ZOOM Test for Online Session 6 & 7 B2003, B2014, B4031, B3029, B4032, B4053, B4043, B4047, B3027, B4035, B4051, B4041, B5061, B5056, B5055, B5060			

December 13, 2025 | Saturday | GMT+8(Beijing Time)

Time	Activity	ZOOM ID
Password: 121314		
Opening Ceremony		
Host: Assoc. Prof. Yueping Cai, Chongqing University, China		
09:30-09:35	Opening Remarks: Prof. Zhengchuan Chen, Chongqing University, China	
	Group Photo	
Keynote Speech		
09:35-10:15	Keynote Speech I: Beyond 5G towards a Super-connected World Yonghui Li , The University of Sydney, Australia ARC Future Fellow, IEEE Fellow	87055109940 ROOM A
10:15-10:55	Keynote Speech II: Neoteric Frontiers in Cloud and Quantum Computing Rajkumar Buyya , Director, Cloud Computing and Distributed Systems (CLOUDS) Lab The University of Melbourne, Australia CEO, Manjrasoft Pvt Ltd, Melbourne, Australia	
10:55-11:10	Break Time	
11:10-11:50	Keynote Speech III: Multidimensional Supervised Learning over Big Data: Models, Definitions, and Solutions Alfredo Cuzzocrea , Founder and Director, Big Data Engineering and Analytics Laboratory (iDEA Lab) University of Calabria, Rende, Italy	
11:50-13:00	Lunch Time	
Author Presentation Sessions		
13:00-14:50	Online Session 1 Artificial Intelligence Theory and Application Session Chair: Hui Chen, University of Electronic Science and Technology of China, China Invited Speech, A5053, A5051, A4048, A3027, A6057, A4041	87055109940 ROOM A

13:00-14:50	Online Session 2 Computer Information Science Session Chair: Paulo Batista, University of Évora, Portugal Invited Speech, B2013, B4030, B3022, B2017, B4036, B2007	89677684419 ROOM B
14:50-15:10	Break Time	
15:10-17:10	Online Session 3 Mathematical Foundations and Computer Information Science-1 Session Chair: TBA B4050, B4042, B5059, B3020, A3020, A1008, A4038-A, A3032	87055109940 ROOM A
15:10-17:10	Online Session 4 Mathematical Foundations and Computer Information Science-2 Session Chair: TBA A2013, A5049-A, A4035-A, A3028, A2016, A3031, A4037-A, A2015	89677684419 ROOM B

December 14, 2025 | Saturday | GMT+8(Beijing Time)

Time	Activity	ZOOM ID
Password: 121314		
10:00-11:45	Online Session 5 Intelligent Algorithms, Software Development, and Communication & Information Engineering Session Chair: Loc Nguyen, Sunflower Soft Company, Vietnam B5062, B5071, B5054, B5064, A3021, A4036, B4048	87055109940 ROOM A
11:45-13:00	Lunch Time	
13:00-15:00	Online Session 6 Software Development and Design Session Chair: TBA B2003, B2014, B4031, B3029, B4032, B4053, B4043, B4047	87055109940 ROOM A
15:00-15:20	Break Time	
15:20-17:20	Online Session 7 Communication and Information Engineering Session Chair: Mohammed Salman Arafath, King Khalid University, Saudi Arabia B3027, B4035, B4051, B4041, B5061, B5056, B5055, B5060	87055109940 ROOM A

Keynote Speaker



Prof. Yonghui Li, The University of Sydney, Australia ARC Future Fellow, IEEE Fellow

Speech Time:09:35-10:15

ZOOM Number: 87055109940 | Password: 121314

Speech Title: Beyond 5G towards a Super-connected World

Abstract: Connected smart objects, platforms and environments have been identified as the next big technology development, enabling significant society changes and economic growth. The entire physical world will be connected to the Internet, referred to as Internet of Things (IoT). The intelligent IoT network for automatic interaction and processing between objects and environments will become an inherent part of areas such as electricity, transportation, industrial control, utilities management, healthcare, water resources management and mining. Wireless networks are one of the key enabling technologies of the IoT. They are likely to be universally used for last mile connectivity due to their flexibility, scalability and cost effectiveness. The attributes and traffic models of IoT networks are essentially different from those of conventional communication systems, which are designed to transmit voice, data and multimedia. IoT access networks face many unique challenges that cannot be addressed by existing network protocols; these include support for a truly massive number of devices, the transmission of huge volumes of data burst in large-scale networks over limited bandwidth, and the ability to accommodate diverse traffic patterns and quality of service (QoS) requirements. Some IoT applications have much stringent latency and reliability requirements which cannot be accommodated by existing wireless networks. Addressing these challenges requires the development of new wireless access technologies, underlying network protocols, signal processing techniques and security protocols. In this talk, I will present the IoT network development, architecture, key challenges, requirements, potential solutions and recent research progress in this area, particularly in 5G and beyond 5G.

Bio: Yonghui Li is now a Professor and Director of Wireless Engineering Laboratory in School of Electrical and Computer Engineering, University of Sydney. He is the recipient of the Australian Research Council (ARC) Queen Elizabeth II Fellowship in 2008, ARC Future Fellowship in 2012 and ARC Industry Laureate Fellowship in 2025. He is an IEEE Fellow and Clarivate highly cited researcher. His current research interests are in the area of wireless communications. Professor Li was an editor for IEEE transactions on communications, IEEE transactions on vehicular technology and guest editors for several special issues of IEEE journals, such as IEEE JSAC, IEEE IoT Journals, IEEE Communications Magazine. He received the best paper awards from several conferences. He has published one book, more than 300 papers in premier IEEE journals and more than 200 papers in premier IEEE conferences. His publications have been cited more than 25000 times.

Keynote Speaker



**Prof. Rajkumar Buyya, Director,
Cloud Computing and Distributed Systems (CLOUDS) Lab,
The University of Melbourne, Australia
CEO, Manjrasoft Pvt Ltd, Melbourne, Australia**

Speech Time:10:15-10:55

ZOOM Number: 87055109940 | Password: 121314

Speech Title: Neoteric Frontiers in Cloud and Quantum Computing

Abstract: The twenty-first-century digital infrastructure and applications are driven by Cloud computing, Internet of Things (IoT), Artificial Intelligence (AI), and Quantum computing paradigms. The Cloud computing paradigm has been transforming computing into the 5th utility wherein "computing utilities" are commoditized and delivered to consumers like traditional utilities such as water, electricity, gas, and telephony. It offers infrastructure, platform, and software as services, which are made available to consumers as subscription-oriented services on a pay-as-you-go basis over the Internet. Its use is growing exponentially with the continued development of new classes of applications such as AI-powered models (e.g., ChatGPT) and the mining of crypto currencies such as Bitcoins. To make Clouds pervasive, Cloud application platforms need to offer (1) APIs and tools for rapid creation of scalable and elastic applications and (2) a runtime system for deployment of applications on geographically distributed Data Centre infrastructures (with Quantum computing nodes) in a seamless manner. This keynote presentation will cover (a) 21st century vision of computing and identifies various emerging IT paradigms that make it easy to realize the vision of computing utilities; (b) innovative architecture for creating elastic Clouds integrating edge resources and managed Clouds, (c) Aneka 6G, a 6th generation Cloud Application Platform, for rapid development of Big Data/AI applications and their deployment on private/public Clouds driven by user requirements, (d) experimental results on deploying Big Data/IoT applications in engineering, health care (e.g., COVID-19), deep learning/Artificial intelligence (AI), satellite image processing, and natural language processing (mining COVID-19 literature for new insights) on elastic Clouds, (e) QFaaS: A Serverless Function-as-a-Service Framework for Quantum Computing; and (f) new directions for emerging research in Cloud and Quantum computing.

Bio: Dr. Rajkumar Buyya is a Redmond Barry Distinguished Professor and Director of the Quantum Cloud Computing and Distributed Systems (qCLOUDS) Laboratory at the University of Melbourne, Australia. He is also serving as the founding CEO of Manjrasoft, a spin-off company of the University, commercializing its innovations in Cloud Computing. He has authored over 850 publications and seven textbooks including "Mastering Cloud Computing" published by McGraw Hill, China Machine Press, and Morgan Kaufmann for Indian, Chinese and international markets respectively. Dr. Buyya is one of the highly cited authors in computer science and software engineering worldwide (h-index=176, g-

index=384, i10-index=841, and 165,600+ citations). A bibliometric study by Stanford University and Elsevier since 2019 (for six consecutive years), Dr. Buyya is recognized as the Highest-Cited author in the Distributed Computing field worldwide. He graduated 60 PhD students who are working in world-leading research universities and high-tech companies such as Microsoft, Google, and IBM. He has been recognised as IEEE Fellow, a "Web of Science Highly Cited Researcher" for seven times since 2016, the "Best of the World" twice for research fields (in Computing Systems in 2019/2024 and Software Systems in 2021/2022/2023) as well as "Lifetime Achiever" and "Superstar of Research" in "Engineering and Computer Science" discipline twice (2019 and 2021) by the Australian Research Review.

Software technologies for Grid, Cloud, Fog, Quantum computing developed under Dr.Buyya's leadership have gained rapid acceptance and are in use at several academic institutions and commercial enterprises in 50+ countries around the world. Manjrasoft's Aneka Cloud technology developed under his leadership has received "Frost New Product Innovation Award". He served as founding Editor-in-Chief of the IEEE Transactions on Cloud Computing. He is currently serving as Editor-in-Chief of Software: Practice and Experience, a long-standing journal in the field established in 1970. He has presented over 750 invited talks (keynotes, tutorials, and seminars) on his vision on IT Futures, Advanced Computing technologies, and Spiritual Science at international conferences and institutions in Asia, Australia, Europe, North America, and South America. He has recently been recognized as a Fellow of the Academy of Europe. For further information on Dr.Buyya, please visit his cyberhome: www.buyya.com.

Keynote Speaker



**Prof. Alfredo Cuzzocrea,
Founder and Director,**

**Big Data Engineering and Analytics Laboratory (iDEA Lab)
University of Calabria, Rende, Italy**

Speech Time: 11:10-11:50

ZOOM Number: 87055109940 | Password: 121314

Speech Title: Multidimensional Supervised Learning over Big Data: Models, Definitions, and Solutions

Abstract: Supervised learning is an important task in Artificial Intelligence (AI) in various areas such as Computer Vision and Image Understanding, Data Mining (DM) and Knowledge Discovery, and so forth. In the era of big data, it faces critical challenges coming from the curse of dimensionality, heterogeneous data sources, and the need for scalable computation. To address these, Multidimensional Supervised Learning (MSL) has emerged as a formal paradigm that unifies multidimensional modeling with predictive analytics. This talk introduces theoretical foundations of MSL, along with rigorous definitions of multidimensional data, where facts, dimensions, hierarchies, and measures are explicitly represented to preserve structural and semantic richness.

Our approach for performing MSL over big data builds upon OLAP-based multidimensional modeling to organize large-scale datasets into interpretable and computationally efficient structures. On top of this modeling layer, we perform pattern discovery and pattern matching across data hierarchies to capture meaningful relationships and enhance predictive accuracy as well as intuitive visual exploration. By formalizing definitions, developing models, and presenting scalable solutions, this speech positions multidimensional supervised learning as a basis for next-generation big data analytics.

Bio: Alfredo Cuzzocrea is Distinguished Professor of Computer Engineering, and Founder and Director of the Big Data Engineering and Analytics Laboratory (iDEA Lab) of the University of Calabria, Rende, Italy. He also covers the role of Full Professor in Computer Engineering at the Department of Computer Science of the University of Paris City, Paris, France, as holding the Excellence Chair in Big Data Management and Analytics. He is Honorary Professor of Computer Engineering at the School of Engineering and Technology of the Amity University, Noida, India. He is also Research Associate of the National Research Council (CNR), Rome, Italy. Previously, he has covered the role of Full Professor in Computer Engineering at the Department of Computer Science, University of Lorraine, Nancy, France, where he held the Excellence Chair in Big Data Privacy and Cybersecurity. He is author or co-author of more than 900 papers in international conferences (including CIKM, EDBT, MDM, SSDBM, PAKDD, DOLAP), international journals (including TKDE, JCSS, IS, INS, JMLR, FGCS) and international books. He is recognized in prestigious international research rankings.

Invited Speaker



Paulo Batista, University of Évora, Portugal

Speech Time: 13:00-13:20

ZOOM Number: 87055109940 | ROOM A

Password: 121314

Speech Title: Information Science: Trust and Transparency

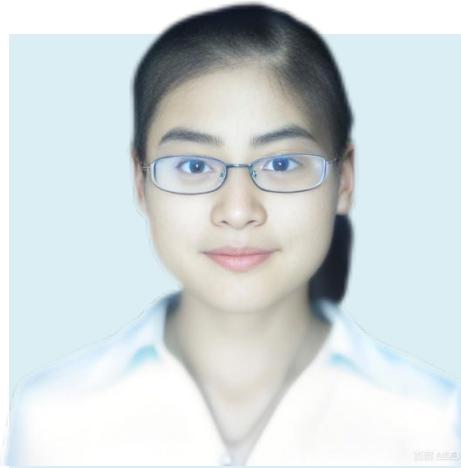
Abstract: Following the Second World War an explosion in the quantity of documentation led to a dramatic change in Archiving, or the profession referred to as records managers/records management and archivists/archives. Starting in the 1980s, however, archivists in Quebec began to make great progress by changing their approach and looking at the entire documentary cycle from current to definitive information. Carol Couture and Jean- Yves Rousseau made a crucial contribution towards the understanding of the Three Age Theory that viewed Archiving as an integrated discipline centered on a structural understanding of archives. In 1994, their work *Les Fondements de la Discipline Archivistique*, presented a new interpretation of Theodore Schellenberg's Three Age Theory. They called attention to the fact that the three phases of archival documents are not separate but, on the contrary, integrated. They argued that these three stages can even be looked at in a segmented way, provided the union between them is ensured. Their great innovation relative to Schellenberg's work lay, precisely, in critiquing the division and separation between the three ages of archival documents. Couture and Rousseau thereby brought together all the phases of the lifecycle of records, from production to dissemination, in opposition to the sterile distinction advocated by traditional archivists and document managers. In my opinion, however, the best approach to integrating information management is known as records continuum, which place archives in a post-custodial, informational, and scientific paradigm. This Australian concept arose in the 1990s amid the huge explosion of information, communication technologies and new media. This context forced Information Science to redefine its object of study. Records continuum is closely related to the integrated management model of Couture and Rousseau, while it carries their innovation further, perfecting it and replacing it with systemic dynamics and providing continuity between archives. In fact, records continuum means, literally, continuous management. It looks at the whole process from the production of records to their final archiving. Otherwise, we cannot speak of continuous management. That is why, when we speak of rigid archives – current, intermediate, and definitive, this approach is more theoretical than practical. There is, in fact, no separation between these phases, even less so from the point of view of the value of documents. The traditional distinction between information with probative and historical value ceases to exist. The information is simultaneous and is, in fact, the same.

Bio: Current director of the Arquivo Nacional Torre do Tombo, he was senior technician positions at the Instituto de Arquivos Nacionais/Torre do Tombo, Instituto Português do Património Cultural and

the Instituto Português do Património Arquitectónico. He has also worked as researcher at the Instituto de Investigação Científica Tropical – Centro de Estudos de História e Cartografia Antiga, and as professor at the MS program in Information Science and Documentation at Universidade NOVA de Lisboa (UNL). Paulo Batista is PhD Researcher at CIDEHUS.UÉ-Interdisciplinary Center for History, Cultures and Societies of the University of Évora, Portugal, where is the coordinator of the research group 2: Heritage and Literacies, and professor at the Autonomous University of Lisbon, where is coordinator and professor of the Postgraduate in Promotion and Cultural and Educational Dynamization of Archives and Libraries, and the Postgraduate in Architectural Archives. Paulo Batista holds a Ph.D. in Documentation (University of Alcalá, Madrid-UAH), an MS in Information Science and Documentation - Archival Studies (UNL), and an MA in Documentation (UAH). As part of his doctorate, he also received a Diploma of Advanced Studies in Bibliography and Documentation Retrospective in Humanities (UAH), and he also holds a postgraduate degree in Information Society Law (University of Lisbon) and Information and Documentation Science - Librarianship and Archival Studies (UNL), and a specialization in Good Practices in Patrimonial Management (UNL) and Information Science and Documentation - Archival Studies (UNL). He holds an undergraduate degree in History (University of Lisbon). Paulo Batista is the author of several books and about 90 papers published in international journals and conference proceedings. He was also keynote speaker and invited speaker at various international conferences (Portugal, Argentina, Belgium, Brazil, China, Ecuador, Egypt, England, Fiji, France, India, South Africa, Thailand, Türkiye and South Korea). More informations: <https://www.cienciavitae.pt/0618-CE7B-7145>.



Invited Speaker



Hui Chen,
University of Electronic Science
and Technology of China, China

Speech Time:13:00-13:20
ZOOM Number: 89677684419 | ROOM B
Password:121314

Speech Title: *AI-Driven Communication Signal Modulation Recognition and Radio Frequency Fingerprint Identification*

Abstract: This report focuses on the application of Artificial Intelligence (AI) in communication signal modulation recognition and radio frequency fingerprint identification (RFFI). It systematically investigates how deep learning and machine learning technologies are revolutionizing signal processing paradigms under complex electromagnetic environments. For modulation recognition, to address modulation classification challenges, a robust AI-based framework is proposed, incorporating: Handcrafted features, Deep learning features, Triplet network architecture for enhanced discrimination. This hybrid approach enables high-accuracy modulation recognition even under low signal-to-noise ratio (SNR) conditions or dynamic channel variations. For RFFI: For transmitter fingerprinting across different operational scenarios, the key challenge lies in domain shift—performance degradation caused by changes in channel conditions and environmental factors leading to data distribution discrepancies. To overcome this issue, two advanced methods are proposed: Domain Adaptation-Based Cross-Scenario Transmitter Identification, which aligns feature distributions between source and target domains to improve generalization. Contrastive Learning-Based Few-Shot Transmitter Identification, which enables effective model training with limited labeled samples from new transmitters. Both numerical simulations and real-world measured data validate the effectiveness of the proposed AI-driven models.

Bio: Hui Chen, Associate Professor at University of Electronic Science and Technology of China (UESTC), and Visiting Scholar at Columbia University. Her current research focuses on array radar signal processing, wireless communications, and artificial intelligence. She has published over 50 academic papers. First Prize for Outstanding Paper at the 13th National Radar Academic Conference, Second Prize in the 2025 China Aerospace Science and Technology Award. IEEE Member, Regular peer reviewer IEEE Transactions on Antennas and Propagation, IEEE Transactions on Aerospace and Electronic Systems, IEEE Internet of Things Journal and so on.

Online Session 1

Artificial Intelligence Theory and Application

- **Session Chair:** Hui Chen, University of Electronic Science and Technology of China, China
- **Time:** 13:00-14:50, December 13, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 87055109940 | **Password:** 121314 | **ROOM A**
- **Papers:** Invited Speech, A5053, A5051, A4048, A3027, A6057, A4041



Hui Chen,
University of Electronic Science and Technology of China, China

Speech Title: AI-Driven Communication Signal Modulation Recognition and Radio Frequency Fingerprint Identification

Invited
Speaker
13:00-13:20

Abstract: This report focuses on the application of Artificial Intelligence (AI) in communication signal modulation recognition and radio frequency fingerprint identification (RFFI). It systematically investigates how deep learning and machine learning technologies are revolutionizing signal processing paradigms under complex electromagnetic environments. For modulation recognition, to address modulation classification challenges, a robust AI-based framework is proposed, incorporating: Handcrafted features, Deep learning features, Triplet network architecture for enhanced discrimination. This hybrid approach enables high-accuracy modulation recognition even under low signal-to-noise ratio (SNR) conditions or dynamic channel variations. For RFFI: For transmitter fingerprinting across different operational scenarios, the key challenge lies in domain shift—performance degradation caused by changes in channel conditions and environmental factors leading to data distribution discrepancies. To overcome this issue, two advanced methods are proposed: Domain Adaptation-Based Cross-Scenario Transmitter Identification, which aligns feature distributions between source and target domains to improve generalization. Contrastive Learning-Based Few-Shot Transmitter Identification, which enables effective model training with limited labeled samples from new transmitters. Both numerical simulations and real-world measured data validate the effectiveness of the proposed AI-driven models.

A5053
13:20-13:35

A Technical Overview of Continuous and Discrete Diffusion-based Language Models
Author(s): Haiyang Zhao, Jian Huang, Shangsong Liang
Presenter: Haiyang Zhao, Sun Yat-sen University, China

	<p>Abstract: Diffusion-based language models (DLMs) have recently emerged as a non-autoregressive paradigm that departs from the strictly sequential generation of traditional language models. By iteratively refining noisy text representations in parallel, DLMs achieve faster inference and improved global coherence. The adaptation of this framework to discrete language data has resulted in two primary technical branches: Continuous Diffusion Models, which operate in a continuous embedding space, and Discrete Diffusion Models, which define the process directly on the token vocabulary. This survey provides a focused technical review of the core implementation aspects that underpin these two paradigms. We systematically deconstruct and compare foundational topics, including the methods for handling discrete variables ; the formulation of diffusion steps ; the design of noise schedules ; the evolution of objective functions for stable training ; and various sampling techniques for generation. By presenting a detailed analysis of these components, this work serves as a technical guide for researchers and practitioners, clarifying the principles and trade-offs essential for advancing this promising field.</p>
A5051 13:35-13:50	<p>NFT Pricing via Autoencoder Author(s): Qiyu Wang Presenter: Qiyu Wang, Zhejiang University of Finance and Economics, China</p> <p>Abstract: NFTs first burst out in 2017. By 2021, the technology had aroused a wide range of interest and had accumulated a lot of users. This paper uses autoencoder to price the NFTs, using common factors including total sale, buyer/seller, transfer, etc. We compare this method with long-short-term memory model, regularized regressions, trees, and neural networks. Using representative cryptopunks as head pictures in social communities, NBA top shot as real-world reflection in NFT world, autoglyphs, and bored ape yacht club, the generalization pricing ability of the autoencoder in the testing is superior. The empirical results confirm that the autoencoder successfully encodes the latent characteristics in the features and reflect their impact on NFT pricing.</p>
A4048 13:50-14:05	<p>Edge Intelligence in Civil Aviation: Paradigms, Techniques, and Applications Author(s): Wenbin Li, Zhongtian Liao, Bolin Liu, Yongjie Zhou, Jingling Wu, Xiaoyong Lin, Jing Chen Presenter: Wenbin Li, China Southern Airlines, China</p> <p>Abstract: Civil aviation is a safety critical and its operations, from flight decks and towers to ramps and maintenance, generate massive, heterogeneous data at the network edge. Yet cloud centric deployment of large Artificial Intelligence (AI) models often produces high task latency, lacks offline capability in communication denied environments, and requires centralizing sensitive data, raising privacy and sovereignty risks. Edge AI moves perception, prediction, and decision logic closer to the data producers via compression, collaborative inference, and split learning, thereby reducing latency, bandwidth, and exposure while enabling graceful operation during disconnections. This paper provides a panoramic view and a common understanding of edge intelligence tailored to civil aviation. We firstly articulate the operational motivations for edge AI, and then review recent techniques for edge inference and edge learning. We then introduce the organizational computing</p>

		<p>paradigms and the respective configurations in civil aviation environments; finally, we describe the emerging applications and the future research trends of edge intelligence in civil aviation. We argue that a refined edge solution can complement cloud foundations to deliver low-latency, privacy-preserving, and resilient AI services across the civil aviation lifecycle.</p>
A3027 14:05-14:20		<p>Causal Inference in Observational Education Data: A Comparative Study of Traditional and Machine Learning Methods Author(s): Kexin Guo Presenter: Kexin Guo, Cipher Trace, the United States</p> <p>Abstract: The study aims to estimate how special education services affect fifth-grade math performance from a causal perspective, by using the Early Childhood Longitudinal Study (ECLS-K) dataset. Given its significant class imbalance, we apply causal inference techniques to estimate the average treatment effect (ATE). Specifically, we use Inverse Probability of Treatment Weighting (IPTW), Ordinary Least Squares (OLS), Double Machine Learning (DML), and Bayesian Additive Regression Trees (BART). All four models produce negative estimated average treatment effects, suggesting that the specific education students received has a negative impact on fifth-grade math scores. Among the methods, DML and BART achieve greater precision than traditional methods, with lower standard errors and narrower confidence intervals. These results highlight the practical value of integrating machine learning into causal inference, especially in observational settings where traditional assumptions may not hold. We further conduct principal component analysis to reduce the 34 covariates into components explaining a substantial proportion of variance. Our findings provide insight into methodological performance while also pointing to areas for future research such as subgroup heterogeneity.</p>
A6057 14:20-14:35		<p>HNNet: Histogrammic Neural Network for Rapidly Detecting Diabetic Retinopathy with Retinal Fundus Images Author(s): Jinwang Feng, Xiaoli Cui, Yanmin Niu Presenter: Jinwang Feng, Chongqing Normal University, China</p> <p>Abstract: Diabetic retinopathy (DR), as a complication of diabetes, is still remaining a leading cause of vision loss and blindness globally. Although the convolutional neural network (CNN) methods have achieved a better result in medical image analysis, it is difficult for them to train a model that works efficiently and can rapidly diagnose the early DR patients from healthy people and individuals at another DR stages based upon retinal fundus images when the number of available samples is very small. Hence building a computer-aided DR quick diagnosis method with the small samples is necessary and helpful. To this end, this paper proposes a histogrammic neural network (HNNet) to rapidly detect DR patients with retinal fundus images. Specifically, a new histogrammic (H) layer is constructed in the HNNet to capture statistical distribution of macro patterns related to DR from the retinal fundus images, and simultaneously the H layer can to some extend alleviate pressures of the hyperparameter optimization when the number of available training samples is small. Additionally, a constrained rectified leaner unit (CReLU) activation function is designed to accelerate speed of the gradient descent algorithm and</p>

	<p>compensate for the defect that gradient of the ReLU activation function is zero when its input is smaller than zero. For output of the HNNNet, the sigmoid activation is followed by the final fully connected layer to detect the diabetic retinopathy patients from the healthy people. At classification stage, comparing experiments with traditional CNN methods are conducted to verify the performance of HNNNet in capturing statistical distribution of macro patterns related to DR, yet experiments comparing the HNNNet with ReLU, Leaky ReLU, and CReLU activation functions are performed to prove the feasibility of CReLU in accelerating the speed of the gradient descent algorithm. Results of comprehensive experiments demonstrate that the HNNNet can be a promising tool in helping clinical doctors to accurately and rapidly diagnosis the DR patients.</p>
A4041 14:35-14:50	<p>AviationLMM: A Large Multimodal Foundation Model for Civil Aviation Author(s): Wenbin Li, Jingling Wu, Xiaoyong Lin, Jing Chen, Cong Chen Presenter: Wenbin Li, China Southern Airlines, China</p> <p>Abstract: Civil aviation is a cornerstone of global transportation and commerce, and ensuring its safety, efficiency and customer satisfaction is paramount. Yet conventional Artificial Intelligence (AI) solutions in aviation remain siloed and narrow, focusing on isolated tasks or single modalities. They struggle to integrate heterogeneous data such as voice communications, radar tracks, sensor streams and textual reports, which limits situational awareness, adaptability, and real-time decision support. This paper introduces the vision of AviationLMM, a Large Multimodal foundation Model for civil aviation, designed to unify the heterogeneous data streams of civil aviation and enable understanding, reasoning, generation and agentic applications. We firstly identify the gaps between existing AI solutions and requirements. Secondly, we describe the model architecture that ingests multimodal inputs such as air-ground voice, surveillance, on-board telemetry, video and structured texts, and performs cross-modal alignment and fusion, and produces flexible outputs ranging from situation summaries and risk alerts to predictive diagnostics and multimodal incident reconstructions. In order to fully realize this vision, we identify key research opportunities to address, including data acquisition, alignment and fusion, pretraining, reasoning, trustworthiness, privacy, robustness to missing modalities, and synthetic scenario generation. By articulating the design and challenges of AviationLMM, we aim to boost the civil aviation foundation model progress and catalyze coordinated research efforts toward an integrated, trustworthy and privacy-preserving aviation AI ecosystem.</p>

Online Session 2

Computer Information Science

- **Session Chair:** Paulo Batista, University of Évora, Portugal
- **Time:** 13:00-14:50, December 13, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 89677684419 | **Password:** 121314 | **ROOM B**
- **Papers:** Invited Speech, B2013, B4030, B3022, B2017, B4036, B2007



Paulo Batista, University of Évora, Portugal

Speech Title: Information Science: Trust and Transparency

Invited
Speaker
13:00-13:20

Abstract: Following the Second World War an explosion in the quantity of documentation led to a dramatic change in Archiving, or the profession referred to as records managers/records management and archivists/archives. Starting in the 1980s, however, archivists in Quebec began to make great progress by changing their approach and looking at the entire documentary cycle from current to definitive information. Carol Couture and Jean- Yves Rousseau made a crucial contribution towards the understanding of the Three Age Theory that viewed Archiving as an integrated discipline centered on a structural understanding of archives. In 1994, their work *Les Fondements de la Discipline Archivistique*, presented a new interpretation of Theodore Schellenberg's Three Age Theory. They called attention to the fact that the three phases of archival documents are not separate but, on the contrary, integrated. They argued that these three stages can even be looked at in a segmented way, provided the union between them is ensured. Their great innovation relative to Schellenberg's work lay, precisely, in critiquing the division and separation between the three ages of archival documents. Couture and Rousseau thereby brought together all the phases of the lifecycle of records, from production to dissemination, in opposition to the sterile distinction advocated by traditional archivists and document managers. In my opinion, however, the best approach to integrating information management is known as records continuum, which place archives in a post-custodial, informational, and scientific paradigm. This Australian concept arose in the 1990s amid the huge explosion of information, communication technologies and new media. This context forced Information Science to redefine its object of study.

	<p>Records continuum is closely related to the integrated management model of Couture and Rousseau, while it carries their innovation further, perfecting it and replacing it with systemic dynamics and providing continuity between archives. In fact, records continuum means, literally, continuous management. It looks at the whole process from the production of records to their final archiving. Otherwise, we cannot speak of continuous management. That is why, when we speak of rigid archives – current, intermediate, and definitive, this approach is more theoretical than practical. There is, in fact, no separation between these phases, even less so from the point of view of the value of documents. The traditional distinction between information with probative and historical value ceases to exist. The information is simultaneous and is, in fact, the same.</p>
B2013 13:20-13:35	<p>Applying Recognition and Identification of Bakery Using YOLOv8n Object Detection Model for Point-of-Sale (POS) System Author(s): Bannawat Dahan, Natthawat Sompita, Wararat Songpan Presenter: Wararat Songpan, Khon Kaen University Khon Kaen, Thailand</p> <p>Abstract: The bakery recognition and identification using the YOLOv8 object detection technique aims to reduce the complexity of identifying various bakery items for store staff in bakery shops. The system uses cameras or image processing devices to identify the bakery through image scanning. The model was developed and tested with 16 types of bakery items, dividing the dataset into three parts: 774 images for training, 118 images for validation, and 77 images for testing. From the experimental results, the model's performance was evaluated using mAP50 and mAP50-95 metrics, achieving values of 0.994. Additionally, the overall precision and recall were 0.974 and 0.999, respectively. The developed model can seamlessly integrate with Point of Sale (POS) systems, enabling automatic operations. This integration enhances the efficiency of bakery stores by streamlining the identification process, reducing errors, and supporting real-time inventory and sales operations management</p>
B4030 13:35-13:50	<p>SwiftServe: Efficient Disaggregated LLM Inference Serving via Hierarchical Max-Flow in Heterogeneous GPUs and Network Author(s): Tao Zhang, Yan Hu, Shuangwu Chen, Zian Wang, Huihuang Qin, Ziyang Zou Presenter: Tao Zhang, University of Science and Technology of China, China</p> <p>Abstract: Large language models (LLMs) have achieved remarkable performance across a variety of tasks. Disaggregated LLM inference serving (DLIS), which separates the compute-intensive prefill phase and the memory-intensive decode phase, enables more flexible and efficient resource utilization in heterogeneous GPUs. However, deploying DLIS in real-world environments presents two significant challenges. Firstly, the heterogeneity of phase-specific resource requirements complicates the alignment of GPU capabilities with workload demands, often resulting in suboptimal performance. Secondly, transferring key value (KV) caches between the prefill and decode phases over heterogeneous links introduces substantial communication overhead, creating performance bottlenecks. To address these challenges, we propose SwiftServe, an efficient disaggregated LLM inference serving system for heterogeneous GPUs. SwiftServe</p>

	<p>models DLIS deployment as a hierarchical max-flow deploying problem formulated as a constrained mixed-integer nonlinear program accounting for hardware and phase heterogeneity. We design a hierarchical alternating max-flow optimization algorithm for effective resource deployment. Experiments show SwiftServe achieves up to $1.68\times$ higher throughput and $2.25\times$ lower latency than existing methods.</p>
B3022 13:50-14:05	<p>A new dynamical system with infinite coexistence attractor and its application in secure communication Author(s): Wandong Xue, Xiaoying Song, Xianyu Hu Presenter: Wandong Xue, Dalian Neusoft University of Information Dalian, China</p> <p>Abstract: To improve the resilience of secure communication systems, a sine function is embedded into the Sprott C model, resulting in a new dynamical system with infinitely many coexisting attractors. First, theoretical analysis verifies the system's complex dynamical properties and rich state evolution patterns, laying the foundation for its application in information processing. Second, circuit simulation using the Multisim demonstrates the system's feasibility and stability at the hardware level. Finally, the system is combined with an image encryption algorithm and experimentally verified in a secure communication scenario. The results demonstrate that the proposed method effectively improves the security and anti-interference capabilities of image encryption. This research provides new insights and references for the application of complex dynamical systems in information security and confidential communications.</p>
B2017 14:05-14:20	<p>Design and Implementation of a Ship Structural Ultimate Strength Prediction System Based on Smith Method Author(s): Yue Liu, Weizhen Kong, Junzhe Zhang, Nan Zhao, Yujie Gu, Na Xu Presenter: Yue Liu, China Ship Scientific Research Center, China</p> <p>Abstract: In order to solve the problem of high dependence of ship structure ultimate strength prediction software, this paper designed and implemented a ship structure ultimate strength prediction system based on gradual destruction Smith method. The system is deeply developed based on the general software SAM (Structure Analysis of Marine Structures, SAM). On the basis of inheriting the general function module of SAM software, the special core calculation module and pre and post processing module of ultimate strength prediction system are further developed. The core computing module adopts the gradual destruction Smith method, which is the most commonly used method for ultimate strength calculation, and the pre and post processing module is designed according to the calculation process of Smith method. The test results of typical examples show that the system developed in this paper can accurately and efficiently complete the import and display of the model, the pre and post processing and the solution calculation, and the calculation results are in line with expectations, which realizes the autonomous control of the ultimate strength prediction.</p>
B4036 14:20-14:35	<p>Deep-ISFC: A Deep Learning Framework for Extracting Inter-Subject Functional Correlations From Naturalistic fMRI Data Author(s): Xinchen Zhao, Le Xu Presenter: Xinchen Zhao, Beijing Jiaotong University, China</p>

	<p>Abstract: Naturalistic fMRI (e.g., movie fMRI) enables ecologically valid brain function analysis by capturing stimulus driven neural responses under real-world conditions, offering advantages over traditional resting-state paradigms. While Functional Connectivity (FC) has been widely adopted as a core representation for fMRI-based individualized prediction, its stimulus-independent nature limits its effectiveness for naturalistic paradigms. Alternatively, Inter-Subject Functional Correlation (ISFC) can better capture shared neural responses across subjects exposed to the same stimuli, improving prediction specificity. However, ISFC remains limited by its linear formulation and its sensitivity to variability across anchor subjects used in correlation computation. Recent advances in deep learning, particularly in Transformer architectures, provide new opportunities to model complex, nonlinear inter-subject relationships in naturalistic fMRI. To address these limitations, we propose Deep-ISFC, a novel deep learning framework that integrates consistency learning and Transformer-based modeling for effective ISFC extraction. The key innovation of Deep-ISFC lies in its two-stage learning strategy: a consistency-based self supervised pre-training module that aligns average time series across subject groups to reduce anchor-dependent variability, and a Transformer-based ISFC evaluation module that computes cross-attention between a target subject and anchor subjects to capture nonlinear inter-subject functional similarities. We apply this framework to individualized age and sex prediction using naturalistic fMRI data from the Cam-CAN dataset. Experimental results demonstrate that Deep-ISFC effectively captures both individual-specific and group-level brain patterns, offering a more powerful and generalizable approach for demographic prediction and advancing individualized neuroimaging analysis in naturalistic settings.</p>
B2007 14:35-14:50	<p>Factors Influencing the usage of Cloud Storage Services, A Case Study in an Indonesian Private University Author(s): Justin Joe Adiwidjaja, Steven Ong, Wahyu Wahyu, Yulius Lie Presenter: Justin Joe Adiwidjaja, Nusantara University, Indonesia</p> <p>Abstract: The growth of cloud storage and its usage has increased over the years and was further increased by the COVID-19 pandemic. Cloud storage is widely used to support daily activities, including those in higher education in Indonesia. This study explores the factors of cloud storage usage, specifically Microsoft OneDrive, in higher education in Indonesia. Using the Technology Acceptance Model (TAM) with modifications and a quantitative research approach, the following six key factors were analyzed: Knowledge Sharing (KS), Social Influence (SI), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Towards (AT), and Intention to Use (ITU). Data was collected from 418 respondents who actively use Microsoft OneDrive through an online survey and analyzed using SmartPLS. The results show that students are more likely to actively use Microsoft OneDrive if they find it beneficial, particularly for academic activities.</p>

Online Session 3

Mathematical Foundations and Computer Information Science-1

- **Session Chair:** TBA
- **Time:** 15:10-17:10, December 13, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 87055109940 | **Password:** 121314 | **ROOM A**
- **Papers:** B4050, B4042, B5059, B3020, A3020, A1008, A4038-A, A3032

B4050 15:10-15:25	<p>Nested Named Entity Recognition Method Combining Graph Convolutional Neural Networks Author(s): Jiaming Li, Jiali Xie, Xin Yang Presenter: Jiaming Li, Shenyang Ligong University, China</p> <p>Abstract: Sequence labeling is used method in nested named entity recognition (NER), but when sentences contain multiple nested entities, it often involves cross-span or even long-distance dependencies. Traditional sequence modeling struggles to fully capture such hierarchical structures. To address the limitation, a joint model BERT-BiLSTM-GCN-CRF is proposed. First, BERT is employed to obtain context-aware word vector representations. Subsequently, BiLSTM captures long-distance dependency information in the sequence to enhance the modeling of contextual semantics. Further, GCN is introduced to propagate information on the dependency tree graph structure. Finally, CRF is used to globally decode the label sequence, ensuring the consistency and rationality of the output. Experimental results on public datasets demonstrate that this model achieves high effectiveness and feasibility in nested NER tasks.</p>
B4042 15:25-15:40	<p>Bounding-Box Regression Pipeline for Weapon Detection in Surveillance Imagery Using WB-DETR Author(s): Usman Khan, Farhan Ud din Khan, Ahmad Ahmed, Uzair Azhar, Arfan Akbar, Rabia Najam Presenter: Usman Khan, SS-CASE-IT, Pakistan</p> <p>Abstract: This paper presents a bounding-box pipeline for weapon detection in surveillance imagery using Detection Transformers without CNN Back-Bone. Transfer learning approach is followed by utilizing a pretrained Transformer (google/vit-base-patch16-224-in21k) duly augmented with lightweight regression heads, which is trained through Adam optimizer with Huber Loss. The model is then evaluated on the “weapon-detection- v4 surveillance-perspective” dataset (2,523 images, YOLOv9 annotations, Roboflow export). We demonstrate the quantitative & qualitative performance through graphs of training, validation and test datasets which show smooth learning curve while reaching over 85 % test accuracy & also report the visually predicted bounding boxes demonstrating the promising weapon detection results. We discuss different design choices like robust regression, pathified self-</p>

	attention, early stopping to highlight their significance weapon detection in surveillance imagery.
B5059 15:40-15:55	<p>Design and Security Verification of Secure Elections Voting Protocol Using APTC Author(s): Jiatong Jiang, Guiping Dai, Yong Wang Presenter: Jiatong Jiang, Beijing University of Technology, China</p> <p>Abstract: Secure election protocols for electronic voting are very important for maintaining the fairness and efficiency of public affairs. Existing protocols use only traditional encryption for the security purpose, or are based on interleaving semantic-based formal verification tools, for example, ProVerif and Tamarin, but they cannot capture true concurrency in elections processes - the rationale for which is security holes in actual use. To remedy this, in this paper we use true concurrent process algebra to design and model a secure election protocol for electronic voting, and define a complete process workflow: "system preparation, voting, verification, voting publication". Moreover, this paper implements formal security analysis and verification of the protocol based on the axioms of true concurrent process algebra to ensure protocol completeness and security. The work also provides an example implementation process and a security theoretical basis for secure electronic voting in future elections.</p>
B3020 15:55-16:10	<p>An Efficient Method to Search Valuable Cubes for Trivium Author(s): Qing Xu, JiaXiang Zhang, Xiaodong Zhang, Xiaodong Yuwen, Jianxiong Wan Presenter: Qing Xu, Inner Mongolia University of Technology, China</p> <p>Abstract: The cube attack is currently the most effective attack against Trivium. The major bottleneck of cube attacks on Trivium is the time-consuming construction of mother cubes that yield many valuable subcubes. In this paper, we presented a novel framework to search for valuable cubes. We propose two algorithms that dramatically accelerate this process: one rapidly constructs mother cubes, and the other efficiently detects linear terms in superpolies. Using the resulting framework, we construct mother cubes at least 10X faster than the previous best method and find new valuable cubes for 820-, 825-, and 830-round Trivium.</p>
A3020 16:10-16:25	<p>Laplace Derivative Based-Granular Difference of Fuzzy-Number-Valued Functions Author(s): Laquan Li, Xiaomin Suo, Yabin Shao Presenter: Xiaomin Suo, Chongqing University of Posts and Telecommunications, China</p> <p>Abstract: The core contribution of this work lies in the theoretical extension from the classical Laplace derivative to a fuzzy Laplace derivative based on granular-difference. We first establish the definition and existence conditions for the fuzzy Laplace derivative, and then systematically investigate its fundamental properties. Through a representative example, it is demonstrated that this derivative possesses broader applicability compared to the granular derivative. Building upon this foundation, the framework of the first-order fuzzy Laplace derivative is further extended to n-th order fuzzy Laplace derivatives, thereby constructing a more comprehensive theoretical system.</p>

A1008 16:25-16:40	<p>Detection of Stochastic Orders in the Nonparametric Right Censored Survival Data Model Author(s): Tatiana Misharina, Sergey V. Malov Presenter: Tatiana Andreevna Misharina, Peter the Great St.Petersburg Polytechnic University, Russia</p> <p>Abstract: We create the statistical framework to select and confirm stochastic orders of random variables with a high reliability based on incomplete right censored survival data. The framework is based on the appropriate contrasts created from the corresponding values of survival functions in a certain set of checkpoints. The set checkpoints can be finite or an interval, and can be fixed or obtained from data. We create the hypothesis verification problem, that is closer related to the confidence estimation than to the hypothesis testing problem in sense of statistical conclusions. We use the central limit theorem for the contrasts to confirm one or several appropriate hypotheses on stochastic ordering simultaneously. As a result, we have developed a framework for statistically proving hypotheses on weak stochastic ordering of two or more distributions. Moreover, we analyzed the results of users' jobs processing at the supercomputer center and established some weak stochastic orders with a given confidence level.</p>
A4038-A 16:40-16:55	<p>Secure Rings Domination in Graphs Author(s): Allyssa Keith B. Galindo, Princess R. Gonzales, Emmanuel Philip F. David, Mark L. Caay Presenter: Allyssa Keith B. Galindo, Polytechnic University of the Philippines, Philippines</p> <p>Abstract: A set $D \subseteq V(G)$ of a graph $G = (V(G), E(G))$ is a dominating set of G if every vertex not in D is adjacent to at least one vertex in D. A secure dominating set S of a graph G is a dominating set with the property that each vertex $u \in V(G) \setminus S$ is adjacent to a vertex $v \in S$ such that $(S \setminus \{v\}) \cup \{u\}$ is a dominating set. The secure domination number $\gamma_s(G)$ of a graph G equals the minimum cardinality of a secure dominating set of G. A rings dominating set S of a graph G is a dominating set such that for every vertex $u \in V(G) \setminus S$, there exists at least two vertices in $V(G) \setminus S$ adjacent to u. The rings domination number $\gamma_{ri}(G)$ of a graph G equals the minimum cardinality of a rings dominating set of G. In this study, we introduce the secure rings dominating set which is defined as both a secure dominating set and a rings dominating set. The secure rings domination number $\gamma_{sri}(G)$ of a graph G equals the minimum cardinality of a secure rings dominating set of G. We determine this number in the presence of many simple graphs and those graphs formed by binary and unary operations.</p>
A3032 16:55-17:10	<p>Rings Domination Polynomial in Graphs Author(s): Mark L. Caay Presenter: Mark L. Caay, Polytechnic University of the Philippines, Philippines</p> <p>Abstract: A dominating set S of G is a rings dominating set if every vertex $v \in V(G) \setminus S$ is adjacent to at least two vertices in $V(G) \setminus S$. In this paper, we introduce the notion of rings domination polynomials in graphs. Let $\{D_i(G)\}_{i=1}^n$ be the family of rings dominating sets of</p>

$\$G\$$ which are $\$i\$$ -subsets and let $\displaystyle d_{\{ri\}}(G, i) = \left| \mathcal{D}_{\{ri\}}(G, i) \right|$. The $\text{rings domination polynomial}$ of $\$G\$$ is given by $\displaystyle D_{\{ri\}}(G, x) = \sum_{i=1}^{|V(G)|} d_{\{ri\}}(G, i) x^i$. We characterize the result by showing that in general, all graphs have rings domination polynomials of the form $\$x^n\$$ plus some polynomials of degree at most $\$n-3\$$. We also show that for a given polynomial, one can identify the graphs of some polynomials. We introduce the notion of rings-optimized graphs and determine the case when a graph is rings-optimized. Furthermore, we solve for the roots of the rings domination polynomials in graphs.

Online Session 4

Mathematical Foundations and Computer Information Science-2

- **Session Chair:**
- **Time:** 15:10-17:10, December 13, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 89677684419 | **Password:** 121314 | **ROOM B**
- **Papers:** A2013, A5049-A, A4035-A, A3028, A2016, A3031, A4037-A, A2015

A2013 15:10-15:25	<p>Computational Study of Heat and Mass Transfer in MHD Hybrid Nanofluid Flow Using ANN-Assisted Approach Author(s): Adil Darvesh, Sekson Sirisubtawee, Jeerawan Suksamran, Syed Zahir Hussain Shah Presenter: Adil Darvesh, King Mongkut's University of Technology North Bangkok, Thailand</p> <p>Abstract: Magnetohydrodynamics (MHD) flows over rectangular geometry with the influence of active-passive controls is highly influential in engineering applications. This research aims to implement an advanced artificial neural network (ANN)-based hybrid computational procedure to explore the heat and mass transport dynamics in a MHD hybrid nanofluids system confined within a rectangular frame under the influence of active and passive controls mechanisms. The physical model comprises governing partial differential equations (PDEs), which are further reduced into ordinary differential equations (ODEs) for numerical solutions using appropriate similarity variables. The resulting system is then solved using the well-known MATLAB bvp4c package and the obtained bvp4c solutions further serve as an input to an ANN-based predictive approach, a low validation error is obtained along with ideal regressions which ensure high accuracy and applicability of proposed model. Increasing nanoparticle concentrations can substantially enhance thermal transport in hybrid nanofluids with a degree of enhancement depending on nanoparticle volume concentration. In active control, higher Schmidt number slows solute diffusion and greater activation energy increases reaction sensitivity to temperature. In contrast, the concentration profile decreases in passive control due to higher values of Schmidt number and activation energy which suppress solute transport and reduce surface concentration.</p>
A5049-A 15:25-15:40	<p>Reconstructing Genomes Using Graph-Based Algorithms Author(s): Aaron Kuang Presenter: Aaron Kuang, Greenhill School, United States</p> <p>Abstract: Genome reconstruction is a crucial component of genome projects that aim to assemble an organism's complete genome sequence from short-fragmented DNA sequences. This task is fundamental and has wide-ranging applications in evolutionary research, medicine, conservation efforts, and synthetic biology. A</p>

	<p>common approach to genome reconstruction involves using graphs to identify overlapping sequences, known as k-mers, to recreate the entire genome. This study focuses on applying basic graph theory and Hierholzer's algorithm to efficiently identify Eulerian circuits and paths for genome assembly. The findings support the effectiveness of graph-based approaches as powerful tools in computational biology and genome research.</p>
A4035-A 15:40-15:55	<p>Transport Energy in Graphs Author(s): Emmanuel Philip David, Allyssa Keith Galindo, Princess Gonzales, Mark Caay Presenter: Emmanuel Philip F. David, Polytechnic University of the Philippines, Philippines</p> <p>Abstract: The Laplacian matrix of a graph $G = (V, E)$, denoted as $L(G)$ is defined as $L(G) = D(G) - A(G)$, where $D(G)$ is the diagonal matrix of G defined by $d_{ii} = \deg(v_i)$, for all $v_i \in V(G)$, and 0 elsewhere, and $A(G)$ be the adjacency matrix of G. Its Laplacian energy is defined as $L.E.(G) = \sum_{i=1}^n \mu_i - \frac{2m}{n}$, where μ_i are the eigenvalues of $L(G)$, $V =n$, and $E =m$. The Laplacian matrix captures the complexity of a graph and it applies on various applications such as stability of molecular structures and connectivity in neural networks. On this study, we introduce the Transport Energy of a graph G where it is a new spectral invariant that captures structural relationships based on convex dominating sets. The Transport Energy interprets to capture optimal distance in terms of connectivity of graphs and observe its complexities. The transport matrix $T(G) = [m_{ij}]$ is defined as $m_{ij} = \begin{cases} 1 & \text{if } v_i, v_j \in V(P_k) \wedge 0 \\ 0 & \text{otherwise.} \end{cases}$ where v_i, v_j are vertices of the shortest path graph $P_k \in S_i$ of order k for some $k \leq n$, such that S_i is a convex dominating set of G containing v_i. The Laplacian Transport Matrix $L_T(G)$ is defined by $L_T(G) = D(G) - T(G)$. The transport energy of G, denoted by $T.E.(G)$ is defined by $T.E.(G) = \sum_{i=1}^n \tau_i - \frac{2m}{n}$ where τ_i are the eigenvalues of $L_T(G)$ for $i = 1, \dots, n$. We analyze and compare Laplacian and Transport Energy across various graph classes and construct a lower bound for transport energy in graphs.</p>
A3028 15:55-16:10	<p>The 2-rank Classification Approach for Multiple Attribute Decision Making with Strategic Weight Manipulation and Its Application Author(s): Bixia Zeng, Haibin Xie, Fenglin Peng Presenter: Haibin Xie, Guilin University Of Aerospace Technology, China</p> <p>Abstract: In some real-world multiple attribute decision making (MADM) problems, on the one hand, the decision makers may prefer to divide the alternatives into two preference-ordered categories, which is called the 2-rank classification problem, on the other hand, the decision maker may try to manipulate attribute weights to persuade a particular rank order of the alternatives of his/her interest, which is called the strategic weight manipulation. In this paper, a novel 2-rank classification operator is defined based on the triple mean, which can overcomes the uneven distribution of attribute values. and then we use the proposed operator to divide the alternatives into 2-rank categories. Furthermore, regard to the strategic weight manipulation problem</p>

	<p>of MADM, we first construct a linear programming model to obtain the objective weight vector by maximizing deviation of attribute values. Then, by minimizing the Euclidean Distance between the manipulated weight vector and the objective weight vector, we formulate a nonlinear optimization model to get the optimal manipulated weight vector. In order to solve the nonlinear model above, we design a dynamic particle swarm optimization (DPSO) algorithm to search for the optimal solution. According to the optimal manipulated weight vector, we can obtain the desired 2-rank classification results for the decision maker with manipulation behavior. Finally, a numerical example for evaluation of diving competition is used to demonstrate the validity of our method.</p>
A2016 16:10-16:25	<p>Exact Traveling Wave Solutions of the Schamel-Kawahara Equation via the Modified Auxiliary Equation Method Author(s): Paiwan Wongsasinchai, Sekson Sirisubtawee, Khomsan Neamprem Presenter: Paiwan Wongsasinchai, King Mongkut's University of Technology North Bangkok, Thailand</p> <p>Abstract: In this paper, we investigate the exact solutions of the Schamel- Kawahara equation (SKE) using the modified auxiliary equation method. As a result, various types of exact solutions are obtained. The physical behavior of the solutions consists of bright and multiple soliton waves. The SKE solutions are in the form of exponential, rational, hyperbolic, and trigonometric functions. Graphical presentations of some selected solutions, plotted in terms of 3D, 2D, and contour graphs, are provided to characterize types of solution waves.</p>
A3031 16:25-16:40	<p>Task Allocation for Ammunition Resource Support in Land Battlefield Based on Improved Particle Swarm Optimization Algorithm Author(s): Rui Guo, Jun Chen, Tianqi Lv, Junxin Wang, Yu Liu, Xin Zhang Presenter: Rui Guo, Nanjing Research Institute of Electronic Engineering, China</p> <p>Abstract: A task allocation method based on improved particle swarm optimization algorithm is proposed for the problem of ammunition resource support task allocation in the land battlefield. By analyzing the ammunition support operational context, the task allocation problem is systematically characterized. An efficacy evaluation index system is established to assess ammunition support solutions, followed by the development of comprehensive allocation models integrating mission objectives and operational constraints. Key algorithmic enhancements include adaptive adjustment of inertia weights and learning factors, a group-based mutation strategy, and Pareto optimal solution set-guided particle search optimization. The proposed method is validated through case studies and comparative simulations, demonstrating significant improvements in solution feasibility and operational efficiency, thereby confirming its practical effectiveness for battlefield logistics optimization.</p>
A4037-A 16:40-16:55	<p>Notes on Characterization of Independent Equitable Rings Domination in Some Graphs Author(s): Princess R. Gonzales, Mark L. Caay, Emmanuel Philip F. David, Allyssa Keith B. Galindo Presenter: Princess R. Gonzales, Polytechnic University of the Philippines, Philippines</p>

	<p>Abstract: A subset $S \subseteq V(G)$ is said to be an independent equitable rings dominating set of a graph G if it is both an independent dominating set of G, an equitable dominating set of G and a rings dominating set of G. The minimum cardinality of an independent equitable rings dominating set is called an independent equitable rings domination number of G and is denoted by $\gamma_{\{eri\}}(G)$. An independent equitable rings dominating set S of G is called $\gamma_{\{eri\}}\text{-set}$ of G. In this paper, the authors give characterizations of an independent equitable rings dominating set of graphs and graphs formed under unary and binary operations. Furthermore, the independent equitable rings domination numbers of these graphs are determined, and the graphs with no independent equitable rings dominating sets are investigated.</p>
A2015 16:55-17:10	<p>Cross Ternary Nanofluid through Convergent-Divergent Channel: Combination of Bvp4c and Supervised Neural Network Author(s): Assad Ayub, Sekson Sirisubtawee, Surattana Sungnul, Syed Zahir Hussain Shah Presenter: Assad Ayub, King Mongkut's University of Technology North Bangkok, Thailand</p> <p>Abstract: Novelty: This study addresses a significant research gap as it is the first to explore the behavior of the Cross-fluid model within a convergent-divergent channel. Although previous work has analyzed Cross fluids in various geometries such as wedges, stretching sheets, and cylinders, no prior research has investigated their interaction with convergent-divergent channels. Purpose: This study explores the thermal and flow characteristics of a ternary nanofluid governed by the Cross-fluid model within a convergent-divergent channel. The velocity of a ternary nanofluid has been investigated under the influence of a magnetic field. The temperature of the nanofluid has been considered with thermal radiation. Methodology: Physical assumption-based PDEs are transformed into non-dimensional ODEs and the Matlab function bvp4c is utilized to obtain the numerical solution of the ODEs. Based on this solution, the Levenberg-Marquardt Neural Network (LM-NN) scheme is used to train the network and then combined with bvp4c. In this study, the interval of the domain is $[-1, 1]$. From $[-1, 0]$, the solution is obtained through bvp4c for each parameter, and LM-NN is then used to predict the solution for the interval $[0, 1]$. Findings: During training, errors in the histogram are noted as $-2.2e-06$ and the gradient is $2.8194e-07$ at 1000 epochs. The presence of the magnetic field induces a Lorentz force which acts as a resistive force opposing the motion of the electrically conducting ternary nanofluid. A higher value of the Weissenberg number (We) implies that the elastic effects of the fluid become more dominant. This results in an increased resistance to deformation which hinders the velocity of the ternary nanofluid. The Cross-fluid index elevates the effective viscosity of the ternary nanofluid.</p>

Online Session 5

Intelligent Algorithms, Software Development, and Communication & Information Engineering

- **Session Chair:** Loc Nguyen, Sunflower Soft Company, Vietnam
- **Time:** 10:00-11:45, December 14, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 87055109940 | **Password:** 121314 | **ROOM A**
- **Papers:** B5062, B5071, B5054, B5064, A3021, A4036, B4048

B5062 10:00-10:15	<p>Toward Fine-Grained Unknown Anomaly Detection in Microservice Systems based on Multimodal Data</p> <p>Author(s): Zian Wang, Yuxing Wei, Shuangwu Chen, Dong Jin, Jian Tan, Tao Zhang Presenter: Zian Wang, University of Science and Technology of China, China</p> <p>Abstract: The microservice architecture is crucial in modern software development, but its complexity and dynamism easily lead to cascading failures. Fine-grained anomaly detection is essential for system maintenance and fault tolerance, yet two key challenges persist: efficient integration of heterogeneous multimodal monitoring data (i.e., metrics, traces and logs) and handling of unknown anomalies due to the open-set nature of microservice anomaly detection. To address these challenges, in this paper, we propose a fine-grained anomaly detection method for classifying both known and unknown anomalies in microservice systems. Specifically, we design modality-specific feature extractors to fully capture information from different monitoring data types. Besides, we adopt a prototype learning-based training strategy to clarify decision boundaries between anomaly types, and introduce entropy regularization to enhance model confidence and robustness. Extensive experiments on multiple public datasets show that our proposed method outperforms existing detection approaches significantly, with an F1-score improvement of 30.3%-163.0%.</p>
B5071 10:15-10:30	<p>Development and Implementation of a Web-Based System for Monitoring Service Orders and Security in a Laundry</p> <p>Author(s): Joseph Christoffer Condori Murga, Kin Meng Ordaya Loo, Alex Ricardo Contreras Anton, Sario Angel Chamorro Quijano Presenter: Kin Meng Ordaya Loo, Universidad Continental, Perú</p> <p>Abstract: Currently, process digitization has become a fundamental tool for improving operational efficiency in various sectors. In this context, a project was developed focused on implementing a web-based management system to optimize the services offered by the laundry. The system was designed to control and monitor the receipt, processing, and delivery of garments, as well as to guarantee the security of customer data and internal operations. Through a digital interface, the web system allows employees to register orders, check the status of services in real time, and manage resources efficiently. The platform includes functionalities based on user</p>

		<p>management, inventory control, and order traceability. A quantitative, applied, and descriptive-explanatory methodology was used with a sample of 50 employees, collecting data through surveys, direct observation, and document review. The results showed a significant improvement in response times and a reduction in errors in order registration. Unlike other existing systems in laundry, this project addresses monitoring, achieving comprehensive service management. In conclusion, the developed web system represents an effective and scalable solution to improve the quality of service in small and medium-sized enterprises in the sector. confirm the system's positive impact on operational performance and user experience. Furthermore, the satisfaction index improved considerably, rising from around 60% at the start of implementation to between 80% and 90% in the most recent period. In addition, usage behavior indicators, such as an average of 60 interactions per user, demonstrate greater familiarity with the platform and a more efficient workflow. These quantifiable improvements mean that the system has effectively supported staff in their daily operations and continues to solidify its position as a reliable tool for managing and controlling service orders.</p>
B5054 10:30-10:45	Grid-Based Deep Neural Network for DOA Estimation Author(s): Wei Zhang, Fangyong Wang, Yuechao Cheng, Junlong Wang, Mai Wang, Wenbo Gao Presenter: Wei Zhang, Hanjiang National Laboratory, China	<p>Abstract: This paper proposes a deep neural network (DNN) and grid transformation-based Direction of Arrival (DOA) estimation method for underwater sonar signal processing. The approach constructs a feature extraction model to obtain numerical features from the array data covariance matrix, followed by angle estimation based on these features and a novel grid division strategy. Experimental results demonstrate that the proposed method outperforms traditional intelligent methods in both angular resolution and estimation performance under low signal-to-noise ratio (SNR) conditions. In the simulated dataset, the intelligent method achieves an estimation error rate of only 9.5%, representing an approximately 5% reduction compared to the 14.3% error rate of the conventional beamforming (CBF)-based method. Regarding angular resolution, the traditional CBF method achieves about 3°, whereas the intelligent method attains a resolution of 1°. Furthermore, between -25 dB and -12 dB SNR, the proposed non-uniform grid division method exhibits superior performance compared to traditional methods.</p>
B5064 10:45-11:00	Research on Application of TD-SVSWR Measurement Method for Anechoic Chamber Site Verification Author(s): Difei Li, Tieying Feng, Pan Huang, Lifeng Wang Presenter: Difei Li, National Institute of Metrology, China	<p>Abstract: The time-domain site voltage standing wave ratio (TD-SVSWR) measurement method is a new method proposed by the standard ANSI C63.25 in recent years to verify the radiation emission performance of electromagnetic compatibility anechoic chambers. Different from the CISPR Spatial Sampling measurement method, the TD-SVSWR method has the advantages of dense measurement frequency points, straightforward measurement process, and sensitivity to site characteristics. However, the measurement of TD-SVSWR relies on a vector</p>

	<p>network analyzer (VNA) with a time-domain option, which undoubtedly increases the hardware cost of the measurement. This paper presents a method based on frequency-domain data post-processing. The time-domain measurement process of TD-SVSWR can be completed using a VNA without time-domain option, which reduces the cost of the measurement hardware. Furthermore, an automated measurement software system has been developed to improve measurement efficiency. The paper analyzes the important factors that affect the measurement results, such as the time-gate width, window function setting, and the auto-correlation of data, and clarifies the parameter setting principles that are not specifically described in the standard. This provides a reference-worthy study for TD-SVSWR measurement application.</p>
A3021 11:00-11:15	<p>Extended Fermatean Fuzzy Aggregation Operator Based on Dempster-Shafer's Theory Author(s): Jiarui Cheng, Li Sha, Yabin Shao, Presenter: Jiarui Cheng, Northeastern University, United States</p> <p>Abstract: Fermatean fuzzy set (FFS) serves as a comprehensive framework for modeling and analyzing complex decision scenarios. In order to better address uncertain inference reasoning problems, we introduce Dempster-Shafer's theory within the FFS framework and modify the Dempster's combination rule. This leads to the development of two Fermatean fuzzy aggregating operators(DFFA/DFFG) capable of efficiently handling inference and evidence in FFS environments. Subsequently, we propose a novel method for solving multi-criteria decision-making (MCDM) problems. We conduct numerical experiments to illustrate the specific calculation process and algorithm execution. Finally, we apply our method to two different applications and compare its performance with other aggregation operators. The results consistently demonstrate the robustness, necessity, and superiority of our proposed methods, reaffirming the effectiveness of FFS in addressing complex decision-making challenges.</p>
A4036 11:15-11:30	<p>Improved Arithmetic Optimization Algorithm Incorporating Golden Sine Author(s): Huaiyu Ye, Ruixin Hao Presenter: Huaiyu Ye, Chongqing University, China</p> <p>Abstract: To address the issues of slow convergence rate, limited population diversity, and susceptibility to local optima in arithmetic optimization algorithm (AOA), an improved arithmetic optimization algorithm integrating golden sine (GSAOA) is proposed. Firstly, the good point set method is used to initialize the population and improve its uniform traversal; Secondly, improve the mathematical optimization accelerator (MOA) to coordinate the exploration and development process of the algorithm; Next, introducing the golden sine to improve the AOA search strategy and increase information exchange between populations; Finally, an adaptive Cauchy mutation strategy is proposed to perturb the current optimal solution, increasing the algorithm's ability to escape local optima. By performing optimization experiments on 23 classical test functions, the results show that GSAOA is better in convergence speed, optimization accuracy and stability.</p>
B4048 11:30-11:45	<p>A Two-Stage Agent-based Framework for Network Attack Detection And Categorization in IoT</p>

Author(s): Huy-Trung Nguyen, Tran Minh Hieu, Van-Hoang Le

Presenter: Huy-Trung Nguyen, Research Institute of Posts and Telecommunications, Data Governance Laboratory, Posts and Telecommunication Institute of Technology Hanoi, Vietnam

Abstract: This paper presents a method for detecting network attacks targeting resource-constrained IoT devices through the deployment of a lightweight software agent directly on such devices. The proposed agent is cross-platform, capable of being installed on heterogeneous IoT devices, and is designed to collect operational data from the device—including system calls, memory usage, CPU usage, process identifiers (PiD), process hashes, packet captures (PCAP), open ports, bandwidth utilization, and system messages. The agent incorporates a data filtering mechanism to eliminate records that do not exhibit abnormal behavior, thereby reducing processing overhead. The collected data is then analyzed and processed to identify potential network attacks. The proposed solution enables the acquisition of both system-level and network-level data from resource-limited IoT devices, facilitating efficient attack detection and significantly reducing the likelihood of successful cyberattacks on such devices.

Online Session 6

Software Development and Design

- **Session Chair:** TBA
- **Time:** 13:00-15:00, December 14, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 87055109940 | **Password:** 121314 | **ROOM A**
- **Papers:** B2003, B2014, B4031, B3029, B4032, B4053, B4043, B4047

B2003 13:00-13:15	<p>A Method for Managing and Optimizing Software Bill of Materials in Cloud-Native Environments</p> <p>Author(s): Lei Zhang, Yue Qian, Lingbin Zeng, Xueyin Fang Presenter: Lei Zhang, National University of Defense Technology, China</p> <p>Abstract: The advantages of elastic scaling and rapid iteration inherent in cloud-native environments render them a favored architecture for enterprise development. However, the security challenges posed by the diverse open-source software integrated within these systems can not be overlooked, and the Software Bill of Materials (SBOM) is a promising solution. This paper analyzes the challenges encountered in SBOM Management within Cloud-Native Environments and proposes management measures, including constructing a minimum SBOM, automated generation and updating of SBOM and integration with cloud-native tool chains. In addition, we also provide the following optimization methods, including mining potential associations through big data, enhancement of safety monitoring for SBOM, and establishing relevant mechanisms. Through the aforementioned methods, we reinforce the security risk control system throughout the entire software life cycle. Which not only promotes the standardization of software development but also guarantees a baseline quality for deliverables, thereby offering substantial support for software development in cloud-native environments.</p>
B2014 13:15-13:30	<p>Load-Aware Adaptive Sampling for Efficient System Monitoring Across Time, Events, and Similarity</p> <p>Author(s): Shay Horovitz, Guy Bar On, Yoav Rabinovitch Presenter: Shay Horovitz, College of Management Academic Studies, Israel</p> <p>Abstract: Fixed-interval polling remains the de-facto approach for system monitoring, yet it wastes bandwidth during idle periods and still overlooks short-lived spikes. We present an integrated adaptive monitoring framework that unifies three complementary ideas—time-of-day adaptive sampling, cross-resource anomaly triggers, and cluster-based group-wise sampling—under a single, budget-aware scheduler. Implemented entirely with standard Performance Counters, the framework profiles historical traces to learn variability patterns, builds peak- and variance-aware clusters of processes, and reallocates samples on-the-fly when one resource foreshadows volatility in another. On a four-week</p>

	<p>dataset of 216 process trajectories, we cut reconstruction error by up to 22%, capture 56% more memory peaks, and achieve the same accuracy with 35% fewer samples compared with fixed-interval and single-technique baselines. These results demonstrate that intelligently coordinating where, when, and why to sample delivers a step change in monitoring efficiency without sacrificing diagnostic fidelity.</p>
B4031 13:30-13:45	<p>Codeless and Scalable Solution For Micro service Test Automation Author(s): Abhirup Chatterjee Presenter: Abhirup Chatterjee, Visvesvaraya technological university, United States</p> <p>Abstract: With the rise of modern software delivery models and distributed microservice ecosystems, ensuring quality through automation testing has become increasingly complex. Traditional service-level test automation often suffers from fragmented implementations, duplicate logic, long execution times. This paper introduces a unified test automation framework that enables code-less service-level test development for largescale microservices. By leveraging Cucumber feature files and a configuration-driven design, the framework eliminates the need for custom test code in individual services, promoting re-usability and consistency across teams. To address the limitations of JUnit4, it uses JUnit5's parallel execution to significantly reduce test runtime. A key innovation is the ability of the framework to facilitate fully code-less automation projects, allowing users to design and execute service-level tests without writing code. It also supports run-time control over execution mode, sequential, or parallel. In addition, the framework includes a built-in, configurable rerun mechanism to automatically re-execute failed tests. It also features an advanced HTML reporting mechanism that captures complete request and response payloads—including headers, body, and status codes—for failed tests, eliminating the need to review extensive Jenkins logs and significantly expediting failure analysis. By addressing challenges in test duplication, maintenance, debugging efficiency, and execution time, this framework offers a robust, scalable solution to accelerate and standardize back-end test automation in enterprise environments.</p>
B3029 13:45-14:00	<p>Automating and Enhancing the Security of the Software Supply Chain Author(s): Shuwen Liu, Nikos Fotiou, Vasilios A. Siris, George C. Polyzos Presenter: George Polyzos, The Chinese University of Hong Kong, Shenzhen, China</p> <p>Abstract: Software is a pillar of the modern digital economy. It has become very complex and its supply chain involves many entities, components, and processes, of varying complexity, roles, value, and security, now including open-source and many independent developers software. Modern supply chain tracing techniques and transparency services promise to improve the security and trustworthiness of software. But this task entails many open, challenges. Firstly, the attack surface of the software supply chain is vast. Secondly, software involves a multitude of tools and external components. Thirdly, software development and maintenance governance is complex. Finally, supply chain attack detection and mitigation require access to diverse types of techniques and information. We develop processes and tools that provide responses to the following questions about transparency services: what information is recorded, who can record information, and how risks can be mitigated by extracted information. Outcomes allow software companies, developer</p>

	<p>communities, and end-users to make informed decisions related to the security of the software supply chain. Our approach integrates Decentralized Identifiers, Verifiable Credentials, and Relation-Based Access Control for improving the trustworthiness of software. We promote decentralization by empowering users to depart from the legacy Web PKI system, traditionally used for “signing” information related to software, as well as by enabling decentralized governance of transparency registries.</p>
B4032 14:00-14:15	<p>Integration Test CodeCoverage Report generator Author(s): Abhirup Chatterjee Presenter: Abhirup Chatterjee, Visvesvaraya technological university, United States</p> <p>Abstract: Code coverage is widely used to evaluate the effectiveness of unit tests, but the coverage achieved by integration tests—validating real component interactions, data stores, and network boundaries—remains largely invisible in most pipelines. This paper presents the Integration Test Code Coverage (ITCC) framework, which makes integration coverage measurable, actionable, and easy to integrate into continuous workflows. ITCC instruments the application under test with JaCoCo, performs a local deployment on Jenkins, executes the integration suite, collects coverage artifacts, and generates reports at statement, method, and class levels. These reports help quality engineers identify untested execution paths and design scenarios to close coverage gaps. ITCC is non-intrusive, requiring no code changes, integrating with a Jenkins pipeline job , and reusing standard JaCoCo formats. It enables (i) targeted expansion of integration scenarios, (ii) a quality gate to enforce minimum thresholds, (iii) trend tracking across builds, and (iv) pull-request feedback highlighting uncovered changes. While unit coverage remains essential for fast feedback, ITCC reveals whether end-to-end flows exercise critical paths—APIs, database calls, messaging, and security checks—helping teams detect high-impact defects earlier. The result is a balanced, data-driven test portfolio and greater confidence in production readiness.</p>
B4053 14:15-14:30	<p>EAGLE-X: Cross-Language Code Clone Detection via Enhanced Graph Learning and Dynamic Feature Fusion Author(s): Boshu Wang, Chengwan He Presenter: Boshu Wang, Wuhan Institute of Technology, China</p> <p>Abstract: Cross-language code clone detection (CLCD) is a critical task for ensuring the quality and consistency of multilingual software systems, yet state-of-the-art methods still face significant challenges. Sequence-based approaches often fail to capture explicit code structures, while graph-based methods are hampered by the structural heterogeneity and noise introduced by linguistic differences, and often lack effective mechanisms for multi-modal feature fusion.</p> <p>To address these limitations, we propose EAGLE-X, a novel multi-modal deep learning model. EAGLE-X employs a dual-path architecture to extract sequence and structure features in parallel. The sequence path utilizes the pre-trained model CodeBERT. The structure path leverages tree-sitter to generate a Concrete Syntax Tree (CST), which is then converted into a Semantic-Enhanced Graph via our designed normalization and enhancement strategies and encoded by a Graph Attention Network (GAT). We further introduce a dynamic feature fusion module that adaptively learns to combine multiple fusion strategies to optimally integrate the two</p>

	<p>modalities. The entire model is optimized end-to-end with a contrastive learning objective to learn a representation space that is robust to linguistic differences. Experiments on a public benchmark dataset indicate that EAGLE-X achieves competitive performance compared to existing state-of-the-art baselines. Furthermore, comprehensive ablation studies confirm that both our proposed semantic-enhanced graph and the dynamic fusion module make effective contributions to the model's final performance.</p>
B4043 14:30-14:45	<p>AI driven Test Scenario Generator Author(s): Abhirup Chatterjee Presenter: Abhirup Chatterjee, Visvesvaraya technological university, United States</p> <p>Abstract: Modern microservice ecosystems expose rapidly evolving REST APIs and complex interaction patterns that make manual Behavior-Driven Development (BDD) scenario authoring slow and difficult to scale. While Cucumber provides a clear, shared language for specifying behavior, writing and maintaining scenarios and step definitions by hand remains a major bottleneck. This paper presents an AI-driven framework that transforms machine-readable API contracts into executable BDD artifacts. This framework ingests Swagger/OpenAPI specifications, parses endpoints, schemas, and constraints, and applies user-defined rules encoding domain policies, compliance requirements, and negative-path priorities. A synthesis engine then generates standardized scenarios, deduplicates overlapping cases, and ensures consistent phrasing for traceability and reuse. A human-in-the-loop review further enriches test data, tunes edge cases, and finalizes assertions, focusing expert input where it adds the most value. Compared to manual approaches, this framework (i) produces readable, executable BDD scenarios directly from contracts, (ii) integrates rule-driven guidance with specification grounding to target domain-critical paths, and (iii) fits seamlessly into existing Cucumber/JUnit pipelines. Evaluation across internal services shows notable reductions in authoring time, improved negative path coverage, and stronger alignment between specifications and test suites, enabling scalable, maintainable automation for continuous delivery environments.</p>
B4047 14:45-15:00	<p>Research Status and Analysis of LLM-based Methods for Code Audit Author(s): Hong Lu, Yinan Bao, Haojie Yuan Presenter: Haojie Yuan, China Software Testing Center (MIIT Software and Integrated Circuit Promotion Center), China</p> <p>Abstract: Code audit aims to optimize code quality and reduce security risks through the careful analysis of source code. It is a crucial step in ensuring software security and plays a significant role in protecting user data. Code audit technology based on the large language model (LLM) has become a research hotspot due to its powerful semantic understanding and automated analysis capabilities. However, existing work has not systematically organized LLM-based methods and the workflow of LLMs for the main tasks of code audit. To this end, we systematically review the current research status of code audit technology based on LLM, analyze its application progress in four main areas, including vulnerability detection, code clone detection, code style analysis, and code comment generation, advancing the comprehension of LLM-based code audit. Then we discuss the key challenges and future research directions, including improving model interpretability, constructing high-quality</p>

datasets, combining program analysis techniques, and optimizing training and inference methods, offering insights for further research about LLM-based code audit methods.

Online Session 7

Communication and Information Engineering

- **Session Chair:** Mohammed Salman Arafath, King Khalid University, Saudi Arabia
- **Time:** 15:20-17:20, December 14, 2025 | GMT+8 (Beijing Time)
- **ZOOM Number:** 87055109940 | Password: 121314 | **ROOM A**
- **Papers:** B2003, B2014, B4031, B3029, B4032, B4053, B4043, B4047

B3027 15:20-15:35	<p>Reputation-Based Cooperative Spectrum Sensing Against Byzantine Attacks Author(s): Hong Du; Xiangqian Liu; Qian Tang; Suting Xu Presenter: Xiangqian Liu, Chongqing University of Technology, China</p> <p>Abstract: The open nature of wireless channels exposes cognitive radio networks (CRNs) to malicious users (MUs), posing severe threats to cooperative spectrum sensing (CSS) from Byzantine attacks. This paper presents a robust CSS scheme that integrates four synergistic mechanisms: confidence-gated reputation updates with asymmetric learning, soft weight mapping with state-dependent attenuation, weight-ordered sequential fusion with early stopping, and a hysteresis state machine for stable user classification. These components form a closed loop that effectively discriminates between occasional sensing errors and persistent malicious behaviors. Extensive simulations demonstrate that our algorithm significantly outperforms conventional methods by simultaneously reducing the global error probability and the average number of sensing samples required, substantially boosting the robustness and availability of CSS.</p>
B4035 15:35-15:50	<p>Spatial Correlation Channel Modeling of Wireless Leaky Coaxial Cables MIMO System with the Impact of Mutual Coupling Author(s): Kai Zhang, Xiang Wang, Yongjun Li, Qin Tian, Fenglei Zhang, Lei Lei, and Hongdan Song Presenter: Hongdan Song, Air force Engineering University, China</p> <p>Abstract: This paper proposes a spatial correlation channel modeling of wireless leaky coaxial cables (LCXs) multiple-input multiple-output (LCX-MIMO) system with the impact of mutual coupling (MC), and tries to explain the reason why the channel capacity of LCX-MIMO system is not highly dependent on the LCX spacing. The expressions of the channel correlation function (CF) of LCX-MIMO system without/with the impact of MC are derived. In addition, the mutual impedance between LCXs of LCX-MIMO system is simulated by high frequency structure simulator (HFSS) software, and the impact of MC between LCXs on channel correlation is analyzed. The numerical results show that when the LCX spacing is</p>

	<p>very small, the channel CF of LCX-MIMO system with MC is much smaller than that of LCX-MIMO system without MC, and the channel CF of LCX-MIMO system continues to decrease slowly with the increase of LCX spacing, which indicates that the channel capacity of LCX-MIMO system is not highly dependent on LCX spacing.</p>
B4051 15:50-16:05	<p>Joint Optimization of Inter-Layer Link Selection and Traffic Steering for Energy Efficient LEO-MEO Satellite Networks Author(s): Qing Deng, Yuxuan Pei, Yuxiang Lu, Haoyu He, Xiaoning Zhang Presenter: Yuxuan Pei, University of Electronic Science and Technology of China, China</p> <p>Abstract: Hybrid LEO-MEO satellite networks have garnered significant attention for their potential to provide seamless global connectivity. These networks face a critical energy-performance conflict, as the high orbital velocity of LEO satellites necessitates frequent, energy-intensive inter-layer handovers to maintain essential connectivity. However, traditional LEO-to-MEO link selection strategies are often myopic, prioritizing Quality of Service (QoS) metrics at the expense of total network energy consumption. To this end, this paper proposes a novel two-stage framework, the Energy and Context-aware Multi-Attribute Decision Making (EC-MADM) algorithm for the joint optimization of inter-layer link selection and traffic steering. EC-MADM formulates link selection as a joint optimization problem, leveraging the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) by uniquely using the core components of our physics-based energy model as direct decision attributes. Simulation results demonstrate that EC-MADM significantly reduces total energy consumption, achieving savings of 10.3%-13.4% compared to conventional strategies, while ensuring a superior and balanced QoS profile.</p>
B4041 16:05-16:20	<p>PLARR: A Spatio-Temporal Aware Routing Framework for Resilient LEO Satellite Networks Author(s): Kowiyu Okpeyerou Akambi Adekambi, Qing Deng, Jiayi Jiang, Yuxuan Pei, Xiaoning Zhang, Widad O. Adouke Bachirou Presenter: Kowiyu Okpeyerou Akambi Adekambi, University of Electronic Science and Technology of China, China</p> <p>Abstract: Low Earth Orbit (LEO) satellite constellations are essential for global broadband connectivity, promising to bridge the digital divide through ubiquitous coverage. However, their dynamic topologies with inter-satellite link reconfigurations every 15-30 seconds pose significant routing challenges that traditional terrestrial protocols cannot address. Existing approaches face a fundamental dilemma between control overhead and performance, with reactive protocols generating 150-200 KB/s of control overhead while static approaches achieve only limited path availability during polar crossings. To address these challenges, we propose a Spatio-Temporal Aware Routing Framework for Resilient</p>

	<p>LEO Satellite Networks (PLARR), which exploits the predictable physics of orbital mechanics and latitude-dependent network geometry. PLARR introduces a joint optimization approach that combines temporal prediction of topology changes with spatial awareness of varying inter-orbit distances. This approach is complemented by localized failure recovery, achieving 1.3-second convergence time versus 8.9 seconds for global reconvergence. Extensive simulation results show that PLARR achieves 18.6% latency reduction specifically for high-latitude routes (50°-80° latitude), 93.3% reduction in control overhead compared to OSPF, and 85.4% reduced convergence time (1.3s versus 8.9s for OSPF) compared to traditional approaches. PLARR maintains $O(B \cdot N \log N)$ complexity with $B \leq 17$ latitude bands in the worst case, and N the number of satellites.</p>
B5061 16:20-16:35	<p>Error Performance Analysis of MIMO-FSO Systems under MRC and EGC Merging Mode Author(s): Jianwu Xu, Xiguo Liu, Zhongyang Mao, Zhiyong Zhao Presenter: Jianwu Xu, Naval Aviation University, China</p> <p>Abstract: The bit error performance of MIMO-FSO communication systems under different combining schemes and channel conditions is a critical factor in system design. This study analyzes the bit error performance of the system under varying turbulence intensities when the receiver adopts either maximum ratio combining (MRC) or equal gain combining (EGC) for multiple signals, providing theoretical guidance for subsequent MIMO-FSO system design. A MIMO-FSO system model was established under three channel conditions: weak turbulence, strong turbulence, and moderate turbulence. The bit error performance of MIMO-FSO systems with MRC and EGC at different numbers of transceiver antennas and turbulence intensities was compared and analyzed. The bit error calculation expression was derived, and detailed simulation analysis was conducted. Simulation results show that EGC's performance improvement under weak turbulence remains limited with increasing antenna numbers, while under strong turbulence, EGC's bit error performance improves steadily with antenna number growth. For MRC, significant performance improvements were observed across all three turbulence intensities as transceiver antenna numbers increased. MRC demonstrated notable performance advantages over EGC under weak turbulence, with a 1-order difference in bit error rates at an average SNR of 40 dB.</p>
B5056 16:35-16:50	<p>Research on FPGA Acceleration of Transformer Model for Modulation Recognition Author(s): Jiyan Lan, Yifan Lin, Jinlong Zhuang, Shengliang Peng Presenter: Jiyan Lan, Huaqiao University, China</p> <p>Abstract: Deep learning-based modulation recognition employs deep neural networks to identify the modulation types of input signals and has been widely applied in both military and civilian fields. In recent years, Transformer-based deep</p>

		<p>learning models have achieved remarkable performance improvements in modulation recognition tasks. However, their high computational complexity poses challenges in terms of real-time processing and energy efficiency when deployed on edge devices. To address this issue, this paper proposes an FPGA-based acceleration scheme of transformer model for modulation recognition. A lightweight Transformer model is designed by exploiting the temporal characteristics of modulation signals. Our design not only leverages a systolic array to accelerate compute-intensive operations like self-attention and matrix multiplication, but also implements highly optimized hardware approximations for nonlinear operators, leading to a significant reduction in both hardware complexity and system latency. The entire design is implemented in hardware description language (HDL) and synthesized on a Xilinx FPGA platform. Experimental results demonstrate that the FPGA-deployed lightweight model achieves a 30.9\times speedup in inference compared with the NVIDIA RTX 4090, validating its potential for practical applications in communication systems.</p>
B5055 16:50-17:05		<p>Design and Implementation of Signal Processing Platform Based on GUI Author(s): Xiqian Lei, Tiantian Xu, Xiao Ma Presenter: Xiqian Lei, LanZhou Institute of Technology Lanzhou, China</p> <p>Abstract: Digital signal processing is widely used in various fields such as communication, electrical control, biomedicine, telemetry and remote sensing, geological exploration, aerospace, etc. The GUI based signal processing platform, as an effective tool, has certain applications in these fields. In order to facilitate researchers in data modification, file saving, and other operations, and improve experimental efficiency, a signal processing simulation platform is designed using a GUI visual interactive interface. The GUI based signal processing platform includes the generation of basic signals, signal analysis, and signal processing, and is applied in different fields such as speech signal denoising, sampling theorem, and echo cancellation system design and implementation. The user-friendly design of the interactive GUI interface facilitates the input of signal parameters, playback of voice signals, display of waveforms, and user interaction feedback.</p>
B5060 17:05-17:20		<p>A Survey for Marine Wireless Communication Resource Allocation Author(s): Zhongyang Mao, Jiahuan Geng, Faping Lu, Zhilin Zhang, Xiguo Liu, Zhen Xu Presenter: Jiahuan Geng, Naval Aviation University, China</p> <p>Abstract: Since marine activities of human beings experienced an exponential increase in recent years, the demand for high-speed, low-delay, and seamless coverage has driven the rapid development of Marine Wireless Communication (MWC), a wide range of marine applications of MWC requirements also calls for an efficient management of communication resources, especially the studies on Resource Allocation (RA) which aims to enhance the performance and stability of</p>

marine communication networks. Although an extensive number of review papers have been focused on resource management, few have specifically focused on MWC RA. In this paper, we provide a comprehensive review of RA from the perspective of MWC. First, we discuss and review the marine-related communication resource allocation researches. Next, we analyze existing methods for addressing the MWC RA problem, including both conventional and AI-enabled approaches. Finally, we highlight several challenges and future research directions in MWC.



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