2025 THE 5TH INTERNATIONAL CONFERENCE ON COMPUTER SYSTEMS

第五届计算机系统国际会议

5TH INTERNATIONAL WORKSHOP ON COMPLEX SYSTEM MODELING AND APPLICATION

第五届复杂系统建模与应用国际研讨会

ICCS 2025

Xi'an, China | September 26-28, 2025

Sponsored by

西安科技大学 XI' AN UNIVERSITY OF SCIENCE TECHNOLOGY | IEEE

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WELCOME MESSAGE

You are cordially invited to join us at the 2025 the 5th International Conference on Computer Systems (ICCS 2025) in Xi'an, China from September 26-28, 2025. It is sponsored by Xi'an University of Science and Technology, China; Organized by College of Artificial Intelligence & Computer Science, Xi'an University of Science and Technology, China; and Editorial Department of Journal of Xi'an Jiaotong University.

This annual conference aims to bring together researchers, academicians, and industry professionals in the field of Computer Systems. The conference hopes to attract high-quality technical sessions and a large number of Delegates from around the world.

The field of computer systems is rapidly advancing, with new hardware and software innovations being developed every year. This includes the design and optimization of systems for large-scale data processing, distributed computing, and parallel processing, as well as the development of new programming languages and compilers to improve efficiency. There is also a growing interest in computer systems security, including intrusion detection and prevention techniques. These advancements are critical for improving the performance and reliability of computer systems, with significant implications for various applications, from scientific computing to machine learning.

The accepted paper will be included into ICCS 2025 Conference Proceedings, which will be published in the International Conference Proceedings Series, which will be archived IEEE Xplore, and indexed by EI Compendex, Scopus, and other indexing services.

On behalf of the conference committee, we thank all the authors, reviewers, and attendees for their contributions and participation in ICCS 2025. Their dedication and expertise enable us to prepare this high-quality program to make the conference a success. Finally, we wish all the delegates a productive and enjoyable conference.

ICCS 2025 Conference Committee

September, 2025

ONSITE INFORMATION

❖ Time Zone: UTC/GMT+8, Beijing Time for the whole program.

❖ Conference Venue

西安科技大学（临潼校区骊山校园）

地址：陕西省西安市临潼区秦唐大道 48 号（临潼校区骊山校园）

Xi`an University of Science and Technology, China

Address: 48 Qintang Avenue, Lintong District, Xi'an City, Shaanxi Province (Lishan Campus, Lintong District)

❖ Temperature

Average Temperature in September in Xi'an: 12℃- 20℃

❖ Attention Please

♣ Please take care of your belongings in public area. For your personal and property safety, delegates are suggested to wear representative card during conference and not to lend it to those unconcerned to enter event rooms. Conference does not assume any responsibility for loss of personal belongings of participants.

♣ Don't stay too late in the city, don't be alone in the remote area. Be aware of the strangers who offer you service, signature of charity, etc., at scenic spots. You can search more Tourist Information and Security tips online.

❖ Oral Presentation Tips

♣ The duration of a presentation slot is 15 minutes. Please prepare your presentation for about 12 minutes plus about 3 minutes for questions from the audience;

♣ An LCD projector & computer will be available in every session room for regular presentations;

♣ Presentations should be uploaded at the computer at least 15 minutes before the session start.

❖ Emergency Call

Ambulance: 120 Police: 110

1. 煤炭科技中心二层报告厅 | Lecture Hall of the Coal Science and Technology Center (2nd Floor)
2. 用餐地点：骊绣苑 | Lunch & Dinner, Lixiu Yuan
3: 15号楼（人工智能与计算机学院）512会议室, 503-1会议室 | 15th Building, College of Artificial Intellegence & Computer Science, Room 512, Room 503-1

ONLINE INFORMATION

Room 1	https://us02web.zoom.us/meetings/89269524043	Online Test & Online Session 1 &3
Room 2	https://us02web.zoom.us/j/81511369554	Online Session 2 &4
Password: ICCS		

Note:
please join the online room 10-15 mins before your session starts and be prepared.
♣ For General Users: https://zoomus/support/download
♣ For Users from mainland China: https://wwwzoom.com.cn/download

Tips:

- ✧ Please unmute audio and start video while your presentation.
- ✧ It's suggested to use headset with microphone or earphone with microphone.
- ✧ E-certificate will be sent to presenters after conference by email.
- ✧ An excellent presentation will be selected from each session and announced on the website after conference. An excellent presentation certificate will be sent after conference by email.
- ✧ It's **Beijing Time** (UTC/GMT +8) for the whole schedule.

Rename your screen name before entering the room	Example
Authors: Paper ID-Name	CS0001-Sam Louis
Keynote Speaker: Keynote-Name	Keynote- Sam Louis
Committee Member: Position-Name	Committee- Sam Louis

❖ Duration of Each Presentation

- ✧ Keynote Speech: 50 Minutes of Presentation including Q&A.
- ✧ Regular Oral Presentation: 15 Minutes of Presentation including Q&A.

Scan the QR code and send "ICCS 2025" to add conference assistant Wechat

Online Pre-test Timetable and online sign in (September 26, 2025)

Zoom ID: 89269524043 Password: ICCS

Time	Items
10:00-12:00	Online Keynote Speakers & Session Chairs & Committees
15:00-16:00	Online Sessions 1-4

DAILY SCHEDULE

Day 1, September 26, 2025

14:00-16:00	**Onsite Sign in and Collect Conference Materials** **西安科技大学（临潼校区骊山校园）15号楼（人工智能与计算机学院）一层** **15th Building, First Floor of College of Artificial Intellegence & Computer Science, Xi`an University of Science and Technology, China, (Lishan Campus, Lintong District)**

Day 2, September 27, 2025

煤炭科技中心二层报告厅| Lecture Hall of the Coal Science and Technology Center (2nd Floor)
Zoom: https://us02web.zoom.us/meetings/89269524043 password: ICCS

	Host:
09:00-09:05	**Welcome Message**
09:05-09:10	**Opening Remarks**
	KEYNOTE SPEECHES
09:10-10:00	**Keynote Speaker I** **Prof. Anu Gokhale, Illinois State University, USA**
10:00-10:20	***Group Photo & Coffee Break***
10:20-11:10	**Keynote Speaker II**
11:10-12:00	**Keynote Speaker III**
12:00-14:00	***Lunch (骊绣苑 | Lunch & Dinner, Lixiu Yuan)***
	AUTHOR PRESENTATIONS
	15号楼（人工智能与计算机学院）15th Building, College of Artificial Intellegence & Computer Science
14:00-15:30	**Onsite Session 1 ..... 512会议室/Room 512** **Topic: Machine Learning Models and Applications** **CS341, CS223, CS338, CS348, CS473, CS342**
14:00-15:30	**Onsite Session 2 ..... 503-1会议室/Room 503-1** **Topic: Mobile Applications and Security Detection** **CS226, CS340, CS454, CS471, CS468, CS453**
15:30-15:45	***Coffee Break***
15:45-17:15	**Onsite Session 3 .....512会议室/Room 512** **Topic: Image based Intelligent Detection and Classification Technology** **CS220, CS229, CS230, CS347, CS463, CS472**

18:00-19:00	*Dinner (骊绣苑 | Lunch & Dinner, Lixiu Yuan)*

Day 3, September 28, 2025

ONLINE AUTHOR PRESENTATIONS

Room 1: https://us02web.zoom.us/meetings/89269524043
Room 2: https://us02web.zoom.us/j/81511369554
Password: ICCS

10:30-12:00	**Online Session A..... Room 1: 89269524043** **Topic: Information Retrieval and Service Platform** **Session Chair: Dr. Hassan Al-Qahtani, Saudi Electronic University, Saudi Arabia** **CS217, CS227, CS469, CS337, CS343, CS333**
10:30-12:15	**Online Session B..... Room 2: 81511369554** **Topic: Image Detection Models and Algorithms** **Session Chair: Dr. Burra Venkata Durga Kumar, Xiamen University Malaysia Campus, Malaysia & Dr. Gabriel Gomes de Oliveira, UNICAMP, Brazil** **CS208, CS209, CS452, CS455, CS215, CS464, CS450**
12:15-14:30	*Break Time*
14:30-16:00	**Online Session C..... Room 1: 89269524043** **Topic: System Simulation and Network Performance Analysis in Communication and Signal Systems** **Session Chair: Assoc. Prof. Sophia Rahaman, Manipal Academy of Higher Education, United Arab Emirates** **CS213, CS102, CS344, CS345, CS451, CS470**
14:30-16:00	**Online Session D ..... Room 2: 81511369554** **Topic: AI based Digital Image Processing and Intelligent Application of Information Systems** **Session Chair: Prof. Xin Biao Lu, Hohai University, China** **CS205, CS204, CS225, CS221, CS232, CS224**

KEYNOTE SPEECH

Prof. Anu Gokhale

Illinois State University, USA

Dr. Anu Gokhale serves as Professor and Chair of the Department of Computer Information Systems at Saint Augustine's University. She has been selected as a 2023-24 Convergence Fellow by the American Association of Colleges & Universities and was a Fellow with the Center for Advancement of STEM Leadership, 2022-23. Formerly, she served as a Distinguished Professor and Coordinator of the Computer Systems Technology program at Illinois State University. Gokhale has completed thirty years as faculty and has received several College and University research, teaching, and service awards. Having earned certifications in online delivery, she was recruited to mentor colleagues in online teaching beginning March 2020. Gokhale is honored with four prestigious Fulbright awards: Specialist in Data Analytics, Egypt, 2022; Specialist in Cybersecurity, India, 2017; Distinguished Chair in STEM+C, Brazil, 2016; and Scholar in Computer Engineering, India, 2003. She was a Visiting Professor in the College of Business at Shandong University in China in spring 2017 and a Faculty Fellow in Israel in summer 2017. She leads research teams in the U.S., and internationally in India, China, and Brazil. Her achievements encompass extensively cited refereed publications; groundbreaking externally funded research supported by a continuous 20-year stream of grants from state and federal agencies including the National Science Foundation; and elevation of the student experience through excellence in teaching, mentorship, and the creation of opportunities for students to get involved in research. Originally from India, she has a bachelor's from University of Mumbai, India; master's in physics–electronics from The College of William & Mary, and a doctorate from Iowa State University, USA. Dr. Gokhale authored a second edition of her book Introduction to Telecommunications, which has an international edition in Chinese. As an active volunteer in IEEE, she has served as MGA representative to the Educational Activities Board, Women in Engineering Coordinator, and R4 Educational Activities Chair. She was honored with the IEEE Third Millennium Medal and 2019 Region 4 Outstanding Professional Award. She consults for organizations to increase access and productivity while responsibly leveraging Artificial Intelligence (AI) systems. Dr. Gokhale continues to be an invited keynote speaker at various international conferences and has visited over 25 countries. She has delivered multiple workshops on hybrid teaching & learning, STEM public policy, algorithm design, data analytics, and AI applications across a range of sectors.

ONSITE SESSION 1

Machine Learning Models and Applications

- **Location: 512 会议室/Room 512**
- **Time: 14:00-15:30, Sep. 27th, 2025 | UTC/GMT+8**
- **CS341, CS223, CS338, CS348, CS473, CS342**

CS341
14:00-14:15

Title: Dynamic parameter screening and hierarchical optimization methods for heterogeneous federated learning
Author(s): Zimeng Wang, Yanyan Zhang, Nong Si, Qi Chang, Xiaoai Gu, Zikai Liu
Presenter: Zimeng Wang, Beijing University of Technology, China

Abstract: Federated learning is a machine learning solution for distributed entities that aims to build high-quality machine learning models using local data on dispersed end devices while protecting client privacy. However, in federated learning, differences in client computing power and the non-independent and undistributed nature of the data lead to model performance degradation problems. Therefore, this paper proposes a new federated learning algorithm, FIARSE-HL, whose core is to incorporate the dynamic parameter filtering mechanism of the FIARSE algorithm into the client-side hierarchical architecture. The client dynamically filters important parameters to form personalized layers and shared layers, and then uploads only the filtered parameters of the shared layers to the server aggregation. Experimental results show that, compared to existing federated learning algorithms, the algorithm proposed in this paper exhibits good robustness when aggregating datasets of varying degrees of heterogeneity, achieves better training accuracy in different computing power scenarios using the MNIST dataset, and improves model aggregation accuracy.

CS223
14:15-14:30

Title: A Deep Neural Network with Two Cascaded CNNs and Its Application in DOA Estimation
Author(s): Sa Lei, Qianqian Du, Bin Ren, Kun Jiang, Jiahao Li
Presenter: Sa Lei, The First Affiliated Hospital of Air Force Medical University, China

Abstract: This paper proposes a cascaded deep convolutional neural network (CNN) architecture consisting of a data pre-processing sub-network and a task-specific sub-network, forming a hierarchically collaborative framework. The core idea is to decouple data preprocessing and task execution into two independent modules, achieving end-to-end processing from the raw data to the final output through sequential cascading. After preprocessing, the dataset can approximate the characteristics of a complete dataset, thereby reducing the dataset size required for training the task-specific sub-network. The proposed network is applied to the direction of arrival estimation (DOA) task to demonstrate its superior performance than traditional methods.

CS338
14:30-14:45

Title: Research on Virtual Debugging of Beam Parameters in D-D/D-T Neutron Generators: A Hierarchical DRL Framework with Physical Constraints and Meta-Learning
Author(s): Yankun Li, Yuan Zhang , Chao Si
Presenter: Yankun Li, China Institute of Atomic Energy, China

Abstract: Abstract—D-D/D-T neutron generators are pivotal in medical BNCT, nuclear material detection, and fusion research, but their beam parameter debugging (energy, current, focusing magnetic field) suffers from long cycles (>72

	hours) and local optima due to empirical trial-and-error, caused by strong coupling of beam dynamics, heat conduction, and material irradiation. To address this, this study proposes a hierarchical Deep Reinforcement Learning (DRL) framework integrated with physical constraints, combined with a lightweight digital twin environment. The core innovations are: (1) A physics-constrained reward function that embeds engineering limits (e.g., target temperature <800°C) into DRL decision-making to avoid invalid exploration; (2) Dynamic state compression via PCA, reducing multi-dimensional physical field parameters (temperature, deuterium concentration) to low-dimensional vectors, improving exploration efficiency; (3) A meta-learning transfer strategy that enables cross-target material adaptation (e.g., Ti to Sc) with >90% performance retention, reducing sample demand. This framework provides a reusable solution for intelligent optimization of complex industrial systems with strong physical coupling, highlighting its significance to the global scientific community in advancing nuclear technology and AI-driven engineering.
CS348 **14:45-15:00**	Title: AI-Driven Optimization of Plaster Manufacturing Using Design of Experiments and Machine Learning Author(s): Prasert Aengchuan, Attasit Wiangkham Presenter: Prasert Aengchuan, Suranaree University of Technology, Nakhon Ratchasima, Thailand Abstract: This paper presents a two-stage framework for optimizing process control in plaster manufacturing under uncertain operating conditions, integrating Design of Experiments (DoE) and Machine Learning (ML) techniques. In the first stage, a full factorial 2k DoE was employed to evaluate four input parameters—roller mill current (M), blower hot air flow (F), classifier speed (S) and temperature (T)—with combined water (CW) as the system output. The analysis identified temperature as the most influential factor, while several multi-factor interactions also significantly impacted system behavior. In the second stage, three ML models—Decision Tree (DT), Support Vector Regression (SVR) and Gaussian Process Regression (GPR)—were implemented to predict CW. All models achieved strong predictive accuracy (R2 > 0.8), with mean absolute error (MAE) values ranging from 0.0860 to 0.0906. While SVR achieved the highest training R2 (0.862), GPR demonstrated the most consistent performance and lowest overall error. These results support a hybrid control strategy that leverages DoE for initial feature screening and ML for robust data-driven prediction. GPR was identified as the most suitable model among those tested for applications requiring high precision and reliability, due to its superior generalization and integrated uncertainty quantification.
CS473 **15:00-15:15**	Title: A Dynamic Game for Intelligent Radar-Jammer Interaction: Joint Carrier Frequency and Pulsewidth Allocation Using Reinforcement Learning Author(s): Xingchen Wang, Shenghua Zhou Presenter: Wang Xingchen, Xidian University, China Abstract: Carrier frequency and pulsewidth allocation stand as critical means in the interaction between the radar and jammer within electronic warfare. Meanwhile, machine learning algorithms are propelling the radar and jammer toward the evolution of intelligentization. Against this backdrop, this paper investigates the dynamic interaction of intelligent radar-jammer through joint carrier frequency and pulsewidth allocation. Specifically, we first model the interaction between the two as an extensive-form game (EFG) using dynamic game theory. Second, to effectively approximate the Nash equilibrium (NE) of the established EFG, a hybrid exploration strategy double deep Q-network-based algorithm is proposed. Finally,

	simulation results demonstrate the effectiveness of the proposed method in NE approximation and its superiority in terms of detection probability.
CS342 **15:15-15:30**	Title: A federated continuous learning framework based on hypernetworks and dual-domain distillation Author(s): Qi Chang, Yanyan Zhang, Nong Si, Zimeng Wang, Zikai Liu, Xiaoai Gu Presenter: Qi Chang, Beijing University of Technology, China Abstract: Federated learning, as an emerging paradigm in the field of distributed machine learning, can handle both "data silos" and privacy protection issues by jointly training global models with scattered data parties while ensuring that data from all parties remains locally at all times. However, it faces two significant challenges in Non-IID data scenarios: performance degradation due to client-side data heterogeneity and catastrophic forgetting caused by the continuous evolution of local tasks. To address these issues, this paper presents a new federated continuous learning framework that combines Hypernetwork Federated dynamic weight generation with Dual-Domain knowledge distillation (HFDD). Specifically, deploy the hypernetwork on the server side, generate personalized aggregated weights based on client features, and construct an initialization model that considers both global generalization and local characteristics. To address the problem of catastrophic forgetting, client-local training introduces a dual-domain knowledge distillation loss, providing information across and within domains without compromising leakage. Experimental verification shows higher training accuracy on the FashionMNIST and CIFAR-10 datasets compared to FedAvg and FCCL, effectively mitigating the effects of data heterogeneity and catastrophic forgetting.

ONSITE SESSION 2

Mobile Applications and Security Detection

- **Location: 503-1 会议室/Room 503-1**
- **Time: 14:00-15:30, Sep. 27th, 2025 | UTC/GMT+8**
- **CS226, CS340, CS454, CS471, CS468, CS453**

CS226
14:00-14:15

Title: Lightweight Latency Prediction Scheme for Edge Applications: A Rational Modelling Approach
Author(s): Mohan Liyanage, Eldiyar Zhantileuov, Ali Kadhum Idrees, Rolf Schuster
Presenter: Eldiyar Zhantileuov, University of Applied Sciences and Arts Dortmund, Germany

Abstract: Accurately predicting end-to-end network latency is essential for enabling reliable task offloading in real-time edge computing applications. This paper introduces a lightweight latency prediction scheme based on rational modelling that uses features such as frame size, arrival rate, and link utilization, eliminating the need for intrusive active probing. The model achieves state-of-the-art prediction accuracy through extensive experiments and 5-fold cross-validation (MAE = 0.0115, R^2 = 0.9847) with competitive inference time, offering a substantial trade-off between precision and efficiency compared to traditional regressors and neural networks.

CS340
14:15-14:30

Title: A Multi-Agent Architecture for Intelligent Electrical Engineering Design
Author(s): Yuan Zhang, Chao Si, Yankun Li
Presenter: Yuan Zhang, China Institute of Atomic Energy, China

Abstract: Electrical engineering design in nuclear facilities encounters challenges in equipment diversity and multidisciplinary coordination. This paper presents a novel multi-agent architecture integrating six specialized agents with Retrieval-Augmented Generation (RAG) technology for intelligent electrical design automation. The proposed four-layer hierarchical framework comprises user interaction, task orchestration, multi-agent execution, and knowledge enhancement layers. Six functional agents—task decomposition, consistency verification, document generation, equipment selection, protection coordination, and intelligent recommendation—operate collaboratively through mathematically formalized cooperative game theory models. The architecture employs multi-objective optimization formulations and dynamic knowledge retrieval mechanisms to address multi-constraint design problems. Theoretical analysis on nuclear power plant drive control systems demonstrates substantial performance potential: enhanced task decomposition completeness, improved consistency verification accuracy, superior documentation standard compliance, and significant reduction in design cycle time. This research establishes a quantitative framework for intelligent electrical engineering design, advancing automation capabilities in safety-critical industrial applications.

CS454
14:30-14:45

Title: Enhancing Intrusion Detection Systems with Transformer-based Sequential Flow Modeling
Author(s): Xibin Sun, Junyong Huang, Bin Li
Presenter: Xibin Sun, Guangdong Polytechnic of Science and Technology Zhuhai, China

Abstract: Modern network infrastructures face increasingly sophisticated security threats that demand intrusion detection systems (IDS) capable of learning complex

	behavioral patterns across sequential network flows. While conventional machine learning-based IDS achieve high accuracy on known attack signatures, their inherent limitations—including isolated flow analysis and dependence on handcrafted features—restrict their effectiveness against stealthy, multi-flow attack patterns. To address the limitations of conventional IDS in detecting stealthy multi-flow attacks, this paper proposes Transformer-SeqFlow, a lightweight Transformer-based framework that models temporal dependencies in network flow sequences. By integrating a sliding window mechanism with hybrid KNN-SMOTE resampling, our approach effectively mitigates class imbalance while capturing long-range attack patterns. Experiments on the CICIDS2018 dataset demonstrate that our method outperforms conventional machine learning baselines in detecting minority and stealth attacks.
CS471 **14:45-15:00**	Title: AI Optimization for Fair Personalized Learning Author(s): Bibigul Razakhova, Aizhan Nazyrova, Altynbek Sharipbay Presenter: Bibigul Razakhova, L.N. Gumilyov Eurasian National University, Kazakhstan Abstract: This article presents a concept for supplementing the ecosystem of smart textbooks in the Kazakh language (ontologies, thesauruses, grammar processor, knowledge and test bases, Internet portal) with AI-driven optimization. The goal is to continuously improve individual learning trajectories, content presentation order, assessment thresholds, the work of language analyzers and the quality of service (QoS) of the portal according to multi-objective (knowledge growth–fairness–time–resource) criteria. The project structure and stages (corpus creation → ontology/thesaurus/grammar processor → launch of smart textbooks on the portal) are taken as a basis
CS468 **15:00-15:15**	Title: MDLNet: A Real-Time Multi-Document Localization Method on Mobile Devices Author(s): Yaru Chen, Kun Xu, Mengyuan Zhao, Wensheng Hu Presenter: Yaru Chen, Chang'an University, China Abstract: Document localization constitutes a fundamental task in document digitization, serving as the critical prerequisite for subsequent text analysis and information extraction. There are three main challenges in document localization: firstly, the number of documents in natural scenes should not be limited, and most current methods focus on localizing single document. Secondly, due to the large amount of computation, existing document localization architectures are difficult to deploy on mobile devices. Thirdly, there is no publicly available annotated high-quality multi-document dataset which can serve as a benchmark for multi-document localization. In this paper, we collect the multi-document localization dataset named UnconMMDoc, which contains 4,012 images across various complex scenarios, including low-light conditions, background interference, and overlapping documents. Additionally, we propose a lightweight top-down multi-document localization architecture specifically designed for mobile deployment. The first stage utilizes a lightweight document detection module to localize the region of interest and the second stage integrates a lightweight feature extraction backbone with two attention mechanisms to achieve more accurate positon of document corners. Experimental results on UnconMMDoc and SmartDoc datasets show that our method is superior to other methods in terms of accuracy and inference time. Meanwhile, its lightweight design enables deployment on mobile devices. The code and dataset are available online soon.
CS453 **15:15-15:30**	Title: Log Anomaly Detection on Edge Devices Using Robust Principal Component Analysis

Author(s): Ruitao Yang, Fan Deng, Tao Liu, An Han
Presenter: Ruitao Yang, Xi'an University of Science and Technology, China

Abstract: The rise of IoT systems and edge computing creates an urgent need for efficient log anomaly detection on resource-constrained devices. Traditional centralized log analysis methods are unsuitable for edge deployment because of their high computational demands. This paper introduces RPCA, a lightweight framework designed for log anomaly detection on the edge that combines semantic-aware preprocessing with robust principal component analysis using an adaptive loss function. The framework uses FastText embeddings with TF-IDF weighting to produce distinctive log representations, followed by a robust PCA method that adapts to log pattern changes without requiring extensive computational resources. A cloud-edge collaborative architecture allows model updates while maintaining local processing capabilities. Experimental results show that RPCA achieves high detection accuracy on benchmark datasets and offers significant computational efficiency compared to traditional deep learning methods. Robustness testing indicates competitive performance against log variability, making RPCA suitable for dynamic IoT environments where log patterns frequently shift. The balanced trade-off between accuracy, robustness, and efficiency makes RPCA a practical solution for large-scale, edge-based log monitoring systems.

ONSITE SESSION 3

Image based Intelligent Detection and Classification Technology

- **Location: 512 会议室/Room 512**
- **Time: 15:45-17:15, Sep. 27th, 2025 | UTC/GMT+8**
- **Session Chair: Assoc. Prof. Prasert Aengchuan, Suranaree University of Technology, Thailand**
- **CS220, CS229, CS230, CS347, CS463, CS472**

CS220 **15:45-16:00**	Title: Risk2Scenario: LLM-Assisted Scenario Generation for Autonomous Driving Testing Based on Hierarchical Risk Analysis Author(s): Pin Wang, Junyan Ma Presenter: Pin Wang, Chang'an University, China Abstract: Ensuring the safety and reliability of autonomous driving systems requires rigorous testing across diverse and safety-critical conditions. Traditional mileage-based evaluations often fail to capture rare but high-risk scenarios that lie in the long tail of real-world distributions. To address this challenge, we propose Risk2Scenario, a scenario generation framework assisted by Large Language Models (LLMs). Our approach leverages real-world traffic accident reports and employs promptbased hierarchical analysis to extract structured risk factors, constructing a domain-specific risk factor database. These risk factors are then retrieved and integrated into the LLM, enabling the generation of semantically rich, high-risk test scenarios. To further enhance scenario diversity and coverage, we employ a genetic algorithm to explore and mutate the generated scenarios. We validate Risk2Scenario in the CARLA simulator using the Basic Agent, demonstrating its effectiveness in uncovering safety-critical situations and revealing potential vulnerabilities in autonomous driving systems.
CS229 **16:00-16:15**	Title: YOLO-3DCA: Lightweight Road Defect Detection with Multi-Directional Stereo Convolution Author(s): Xin Wang, Zhaoyong Mao, Yichen Wang Presenter: Yichen Wang, Northwestern Polytechnical University, China Abstract: Road defect detection is crucial for ensuring traffic safety and reducing maintenance costs. However, existing deep learning models struggle with multi-scale target recognition and background interference in complex road scenarios. To address these challenges, this paper proposes YOLO-3DCA, a lightweight framework for road defect detection. First, a Multi-Directional Stereo Convolution (MDSC) module is designed by integrating dilated, diagonal, and cross convolutions to expand the receptive field, enhancing feature extraction for irregular cracks and multiscale potholes. Second, the Convolutional Block Attention Module (CBAM) is introduced to dynamically focus on defect regions through dual channel-spatial attention, suppressing background interference. The YOLOv5 architecture is optimized with Multi- Directional Stereo Convolution and Convolutional Block Attention Module, achieving efficient collaboration between shallow details and deep semantics. Experiments on the GRDDC2020 dataset demonstrate that the proposed method outperforms mainstream models, providing a high-precision, cost-effective solution for road maintenance.
CS230 **16:15-16:30**	Title: Acr2Xodr: From Accident Reports to OpenDRIVE - Road Scenario Generation Using Large Language Models Author(s): Muhammad Umer Abbasi, Junyan Ma, Sali Moussa

Presenter: Muhammad Umer Abbasi, Chang'an University, China

Abstract: With the rapid advancement of autonomous vehicles, simulation-based testing has become crucial to ensure their safety and reliability. Accurate reconstruction of real-world accidents from textual reports is particularly valuable, as it provides realistic scenarios essential for effective autonomous driving system (ADS) validation. Existing accident reconstruction approaches predominantly focus on dynamic elements, such as vehicle trajectories and collisions, often neglecting the critical role played by road network topology and geometry. To address this limitation, we introduce Acr2Xodr, a novel framework that leverages Large Language Models (LLMs) to dynamically generate diverse and realistic road scenarios directly from natural language accident narratives. Acr2Xodr extracts critical road details—including lane configurations, road types, and connectivity—from unstructured accident descriptions, translating them into the widely adopted OpenDRIVE format. Preliminary evaluations demonstrate that Acr2Xodr effectively reconstructs road scenarios from real-world accident reports, generating structured representations that accurately reflect the underlying road layout described, thereby significantly enhancing scenario realism and diversity compared to traditional template-based or rule-driven methods, advancing automated, scalable, and realistic scenario generation for robust ADS testing and validation.

CS347
16:30-16:45

Title: Deep Learning-Based Aircraft Surface Painting Quality Inspection
Author(s): Shuting Qu
Presenter: Shuting Qu, AVIC manufacturing technology institute, China

Abstract: Aircraft surface painting quality inspection faces significant challenges in detecting micron-scale anomalies (e.g., pinholes, craters) and managing extreme class imbalance. To address these limitations, this study proposes an enhanced YOLOv8 architecture (YOLOv8-FC) with three key modifications: (1) Integration of a Convolutional Block Attention Module (CBAM) amplifying subtle defect features via channel-spatial dual-attention; (2) Replacement of PANet with a Bidirectional Feature Pyramid Network (BiFPN) optimizing multi-scale feature fusion; (3) A hybrid Focal-Class Balanced Loss (FC Loss) dynamically recalibrating sample weights to mitigate data imbalance. Validated on a proprietary dataset (7,592 annotated samples, 9 defect categories), YOLOv8-FC achieved 89.2% precision (+3.6 percentage points vs. YOLOv8n), 83.1% recall (+4.1 pp), and 89.7% mAP@0.5 (+2.6 pp) with only 1.04MB parameter overhead. Ablation studies confirmed synergistic contributions from all components, while cross-model comparison demonstrated 17.8-pp precision improvement over YOLOv5s, establishing robust applicability in aviation inspection scenarios.

CS463
16:45-17:00

Title: MixFormer: A Unified Vision Transformer for River Ice Semantic Segmentation of Multisource Remote Sensing Imagery
Author(s): Zining Zhu, Yuhai Qi, Haoxuan Li, Liang Chen, Chenxu Wei, Xiuwei Zhang
Presenter: Zining Zhu, Northwestern Polytechnical University, China

Abstract: River ice monitoring is crucial for flood prediction and climate studies but is challenged by the need to process heterogeneous data, such as UAV-based RGB and satellite-based multispectral imagery. These different data sources traditionally require separate processing models. We propose MixFormer, a unified semantic segmentation framework built on a Vision Transformer (ViT) that handles both data modalities within a single model. At its core is a novel channel adaptation module that standardizes 3-channel and 4-channel inputs into a shared feature space. This module strategically replaces the green channel in multispectral data with the

	Normalized Difference Water Index (NDWI) and utilizes 3D convolutions to model inter-channel correlations. These unified features are then processed by a shared ViT encoder and a Multi-Level Feature Aggregation (MLA) decoder. MixFormer demonstrates robust performance across diverse datasets, achieving a mean Intersection-over-Union (mIoU) of 89.22\% on NWPU_YRCC1 (RGB), 87.11\% on NWPU_YRCC2 (RGB), and 86.62\% on the NWPU_YRCC_MS (multispectral) set. MixFormer offers a practical tool for routine ice surveillance and flood-risk assessment, eliminating the operational overhead of maintaining multiple models.
CS472 **17:00-17:15**	Title: Research on Sentiment Classification of Online Reviews Based on Deep Semantic Analysis Author(s): Heping Gou, Yongxia Jing, Qiang Han Presenter: Heping GOU, Qiongtai Normal University, China Abstract: Sentiment in reviews is often embedded in complex inter-word or inter-sentence relationships. Traditional sentiment classification models struggle to effectively capture global semantics, and sentiment polarity may be reversed due to negation words, modifiers, or contextual cues. To comprehensively analyze global semantics and local features, this paper proposes a Chinese text sentiment classification model that integrates BERTand BiLSTM, adopting focal loss to dynamically adjust the weights of classification samples. The BERT pre-trained model is employed to obtain context-aware word embeddings, BiLSTM is utilized to capture long-range dependencies in text sequences, and the use of dynamically adjusted classification sample weights helps modulate the influence of salient emotional words on text classification. Experiments demonstrate that the proposed model effectively captures long-distance dependencies in text sequences, emphasizes local key sentiment features, enhances contextual comprehension, and significantly improves the accuracy of text sentiment classification.

ONLINE SESSION A

Information Retrieval and Service Platform

- **Room 1: https://us02web.zoom.us/meetings/89269524043 password: ICCS**
- **Time: 10:30-12:00, Sep. 28th, 2025 | UTC/GMT+8**
- **Session Chair: Dr. Hassan Al-Qahtani, Saudi Electronic University, Saudi Arabia**
- **CS217, CS227, CS469, CS337, CS343, CS333**

CS217 **10:30-10:45**	Title: HTR-GEN: A Structure-Aware Framework for Hierarchical Table Retrieval and Generation Author(s): Xiaohu Li , Tao Xue Presenter: Xiaohu Li, Xi'an Polytechnic University, China Abstract: To address the limitations of current Retrieval-Augmented Generation (RAG) systems in handling structured table data—specifically, incomplete information extraction and low retrieval efficiency—this paper proposes a structure-aware hierarchical RAG framework. The proposed approach introduces three key innovations: (1) a Transformer-based table semantic parsing model that integrates multimodal features, including cell text, spatial position, and data type, to jointly model structure reconstruction and semantic understanding; (2) a three-tier hierarchical indexing mechanism spanning document, table, and cell levels, which ensures efficient and fine-grained retrieval; and (3) a table-driven generation strategy that leverages structured summaries and prompt templates to guide large language models in producing structure-aware responses. Experimental results demonstrate that the proposed method not only significantly improves answer accuracy but also reduces retrieval latency, exhibiting strong structural awareness and system efficiency. The framework is well-suited for structure-intensive tasks such as financial analysis, knowledge-based question answering, and complex report interpretation.
CS227 **10:45-11:00**	Title: Test Case Prioritization Based on an Improved Particle Swarm Algorithm Optimization Author(s): Zhu Qianyi, Song yinglei Presenter: Zhu Qianyi, Jiangsu University of Science and Technology, China Abstract: Test case prioritization is an important problem in the field of software testing. Based on a proper priorization of test cases, the testing process of a software product can be optimized and its testing efficiency can be significantly improved. Test cases are often prioritized with the standard particle swarm optimization algorithm, which generally leads to slow convergence in later stages of optimization. This paper proposes a new method that can effectively prioritize test cases based on an improved particle swarm optimization algorithm. The proposed method initializes all particles in the swarm by tent mapping to enhance the quality of initial solutions. In addition,to ensure an efficient search of the solution space, an adaptive inertia weight adjustment method inspired by the genetic algorithm is introduced to update the velocity and position of each particle. Experimental results demonstrate that the proposed improved method exhibits advantages in terms of fault detection rate, test case statement coverage rate and computational efficiency.Test case prioritization is an important problem in the field of software testing. Based on a proper priorization of test cases, the testing process of a software product can be optimized and its testing efficiency can be significantly improved. Test cases are often prioritized with the standard particle swarm optimization algorithm, which generally leads to slow convergence in later stages of

optimization. This paper proposes a new method that can effectively prioritize test cases based on an improved particle swarm optimization algorithm. The proposed method initializes all particles in the swarm by tent mapping to enhance the quality of initial solutions. In addition,to ensure an efficient search of the solution space, an adaptive inertia weight adjustment method inspired by the genetic algorithm is introduced to update the velocity and position of each particle. Experimental results demonstrate that the proposed improved method exhibits advantages in terms of fault detection rate, test case statement coverage rate and computational efficiency.Test case prioritization is an important problem in the field of software testing. Based on a proper priorization of test cases, the testing process of a software product can be optimized and its testing efficiency can be significantly improved. Test cases are often prioritized with the standard particle swarm optimization algorithm, which generally leads to slow convergence in later stages of optimization. This paper proposes a new method that can effectively prioritize test cases based on an improved particle swarm optimization algorithm. The proposed method initializes all particles in the swarm by tent mapping to enhance the quality of initial solutions. In addition,to ensure an efficient search of the solution space, an adaptive inertia weight adjustment method inspired by the genetic algorithm is introduced to update the velocity and position of each particle. Experimental results demonstrate that the proposed improved method exhibits advantages in terms of fault detection rate, test case statement coverage rate and computational efficiency.

CS469
11:00-11:15

Title: An Intelligent Legal Consultation Service System Fusing Fine-tuning and Retrieval-Augmented Generation
Author(s): Guangming Chen, Kaifeng Ouyang, Hua Yin, Dan Ou, Xi Xu
Presenter: Guangming Chen, Guangdong University of Finance & Economics, China

Abstract: To address the challenges of low efficiency, high cost, and poor accessibility in traditional legal services, this paper designs and implements an intelligent legal consultation service system that synergistically integrates model fine-tuning with an advanced retrieval-augmented generation (RAG) architecture. The system, based on the Qwen2-7B-Instruct model, is optimized on the DISC-Law-SFT legal dataset using the efficient LoRA algorithm, which significantly enhances its legal understanding and reasoning capabilities. To mitigate model "hallucinations" and ensure the timeliness of knowledge, we constructed a dynamically updatable legal vector knowledge base and employed a "hybrid retrieval-rerank" strategy to achieve precise citation of legal articles. Our experiments demonstrate that the system effectively alleviates factual hallucinations and significantly outperforms existing legal models in factual accuracy, logical reasoning, and citation correctness, enabling it to provide users with reliable, efficient, and accessible legal services.

CS337
11:15-11:30

Title: An Improved Case Group Retrieval Strategy
Author(s): Chunxiao Zhang, Lin Zhou, Ruican Hao, Qingsong Zhu
Presenter: Chunxiao Zhang, Beijing Polytechnic University, China

Abstract: To address the limitation that the single case retrieval in Case Based Reasoning (CBR) cannot fully utilize the information in the case library, an improved case group retrieval strategy inspired by the collective cognitive capabilities of group decision-making is proposed. Firstly, a certain weight allocation method such as genetic algorithms is employed to generate multiple sets of weights, which are subsequently used for similarity measurement. Finally, a group retrieval result that satisfies the simple majority principle is obtained, thereby establishing a methodological foundation for achieving accurate matching and effective reuse of target cases. Experimental results demonstrate that the case retrieval strategy

	improved by group decision-making significantly enhances the accuracy of case retrieval, thereby improving the classification performance of case-based reasoning.
CS343 **11:30-11:45**	Title: Analysis of the Construction and Development Trends of Smart Library Cloud Platform in National Library of China Author(s): JingjingZhong Presenter: Jingjing Zhong, National Library of China, China Abstract: The construction of the Smart Library Cloud Platform is an important part of the National Smart Library System of China. Based on thoroughly investigating and analyzing the current applications of Cloud Computing in the library, this paper presents the overall architecture and current status of the Smart Library Cloud Platform, and analyzes and forecasts its future development trends.
CS333 **11:45-12:00**	Title: Batch SW-SVD on Sunway Processor Author(s): Qi Liu, Enming Dong, Yanfei Fang, Yanbing Li, Yunfei Wang, Feng Si Presenter: Qi Liu, National Research Center for Parallel Computer Engineering and Technology, China Abstract: Singular value decomposition (SVD) of matrices is a crucial method utilized across various disciplines like chemistry, signal processing and so on. Particularly in practical scenarios, it finds extensive use in simultaneously decomposing numerous small matrices. Researchers have developed specialized batch Singular Value Decomposition (batch SVD) algorithms for GPU acceleration to improve performance. These algorithms typically utilize a rapid SVD kernel that is executed by a single thread or multiple warps. However, they do not offer the most effective parallelism for decomposing a single matrix. Moreover, in addressing the challenge of handling matrices of varying sizes during batch processing, existing algorithms struggle to strike a balance between data locality and iterative convergence speed or involve intricate mechanisms. In this study, we introduce a batch SVD algorithm (batch SW-SVD) based on the one-sided Jacobi method tailored for numerous small matrices, leveraging the Sunway many-core processor. This algorithm examines the relationship between the computation time of batch SVD and the quantity of computing cores for a single matrix SVD, thereby delivering optimal parallelism for matrices of diverse dimensions. For matrices of varying sizes, we devise a zigzag SW-SVD kernel that adjusts to different levels of parallelism. The proposed algorithm was assessed on the latest Sunway many-core processor. The evaluation revealed that the batch SW-SVD algorithm achieved a maximum speedup of 224.2 times compared to the cuSOLVER implementation on the NVIDIA A100, and up to approximately 2.4 times compared to the state-of-the-art batch SVD algorithm, W-Cycle SVD, at the same peak. Additionally, the algorithm developed in this study was implemented on a quantum computing simulator, effectively addressing the computational bottleneck issue of the simulator and achieving a speedup ranging from 21 to 342 times for this specific application on the Sunway supercomputing system.

ONLINE SESSION B

Image Detection Models and Algorithms

- **Room 2: https://us02web.zoom.us/j/81511369554 password: ICCS**
- **Time: 10:30-12:15, Sep. 28th, 2025 | UTC/GMT+8**
- **Session Chair: Dr. Burra Venkata Durga Kumar, Xiamen University Malaysia Campus, Malaysia & Dr. Gabriel Gomes de Oliveira, UNICAMP, Brazil**
- **CS208, CS209, CS452, CS455, CS215, CS464, CS450**

CS208
10:30-10:45

Title: An Improved YOLOv11-based Algorithm for Foreign Object Detection on Coal Conveyor Belts
Author(s): Naining Wen, Sizhe Shang, Yunpeng Bai, Kaiyu Fan
Presenter: Sizhe Shang, Xi'an University of Science and Technology Xi'an, China

Abstract: Addressing the challenge of insufficient foreign object detection accuracy on mine coal conveyor belts, prevalent in environments characterized by low illumination and high noise, this paper proposes an improved YOLOv11n-based foreign object detection algorithm for coal conveyor belts. The algorithm aims to achieve high precision and high recall in foreign object detection while maintaining real-time performance. Specific improvements include: optimizing the backbone network structure by replacing the original C2PSA module with a Self-Calibrated Spatial Attention (SCSA) module; combining the RFA-Conv module with the Squeeze-and-Excitation (SE) module to enhance the extraction of local target features; and incorporating the Focaler-IOU loss function in the detection head to achieve adaptive fusion of multi-scale features and focus training on hard samples. Experimental results demonstrate that, compared to a high-performance baseline model, the proposed improved model achieved further enhancements across key metrics. Specifically, Precision (P), Recall (R), mean Average Precision (mAP), and F1-score reached 0.910, 0.902, 0.895, and 0.906, respectively. Notably, there was a significant improvement in recall, successfully reducing the miss detection rate to below 9.8%. With a parameter count of 2.67M, the model effectively reduces false and missed detections with almost no increase in parameters, providing a more efficient, accurate, and lightweight technical solution for foreign object monitoring on mine coal conveyor belts.

CS209
10:45-11:00

Title: Raf-YOLOv8: A Lightweight Network with Multi-Scale Feature Fusion for Aluminum Surface Defect Detection
Author(s): Jiaqi Shangguan, Tao Xue
Presenter: Jiaqi Shangguan, Xi'an Polytechnic University, China

Abstract: With the advancement of industrial manufacturing toward intelligent and high-precision processes, the detection of surface defects in aluminum profiles has attracted increasing attention. Traditional methods suffer from low efficiency and high false detection rates, making deep learning the mainstream solution in this domain. However, aluminum defect images often present challenges such as weak features, large scale variations, and complex backgrounds, which significantly limit the performance of existing detection models. To address these issues, this paper proposes an optimized defect detection model, Raf-YOLOv8, based on the YOLOv8 framework. First, a receptive field attention-based module, RF-C2f, is introduced into the backbone network to enhance feature extraction accuracy. Second, a lightweight multi-scale attention module, FA-Block, is designed by integrating partial convolution and self-enhancing attention mechanisms, effectively improving the representation of defect features. Lastly, a high-resolution detection layer is

	added to enhance the perception and localization of tiny defects. Experimental results on the NEU-DET metal surface defect dataset demonstrate that the proposed model improves the mean Average Precision (mAP@0.5) by 3.6% with only a slight increase in computational cost. Meanwhile, the inference speed reaches 116.1 FPS, significantly improving both detection accuracy and efficiency.
CS452 **11:00-11:15**	Title: SDC-YOLO: An Efficient Model for Steel Surface Defect Detection Author(s): Shengqiang Zhou, Zunbing Sheng, Shen Cong Presenter: Shengqiang Zhou, Heilongjiang University, China Abstract: Steel surface defect detection has always been a prominent research topic in the field of object detection. Previous studies have proposed advanced deep learning-based approaches to detect steel surface defects. However, these methods face challenges including insufficient training data, high computational complexity, and inadequate feature extraction capability. To address these issues, we leverage Stable Diffusion (SD) for data augmentation and propose a novel neck module called SDC-FPN based on YOLO backbone. The experimental results demonstrate that the proposed SDC-YOLO achieves a mean average precision (mAP) of 78.7\% in the detection of steel surface defects, representing a 3.6\% improvement over the baseline YOLOv8n, along with a 31.24\% reduction in the model parameters. Furthermore, the experimental results demonstrate that the proposed SDC-YOLO significantly improves the detection capacity of YOLOv8n, effectively addressing the industrial demand for high-precision and lightweight detection methods.
CS455 **11:15-11:30**	Title: A crop pest and disease detection algorithm based on multi-scale feature enhancement and adaptive convolution Author(s): Maosen Wang, Siyu Zhan Presenter: Siyu Zhan, Southeast University, China Abstract: Crop disease and pest detection accuracy critically impacts agricultural safety and economic outcomes. Traditional algorithms often fail to balance small-target detection and accuracy in complex field environments. To overcome this, we propose YOLO-MSFA, an enhanced YOLO-based detection framework.The approach includes: (1) a hybrid augmentation strategy with adversarial perturbations to improve robustness; (2) a multi-scale feature pyramid with residual connections and lightweight convolutions for better reuse and emphasis on small targets like disease spots; and (3) a dynamic fusion module using dual-branch dilated convolution with adaptive weighting to integrate multi-scale local features, enhancing performance in complex scenes. Experimental results demonstrate that, compared to other benchmark algorithms, the proposed method achieves an average mAP50 of 99.1% on the citrus dataset and significant improvements on tea, wheat, and rice datasets, exhibiting significant advantages especially on datasets with complex backgrounds.
CS215 **11:30-11:45**	Title: Research on Small Object Detection in Aerial Images Based on the RT-DETR Model Author(s): Pan Chai, Mei Wang, Yizhuo Jia, Xinyu Liu Presenter: Pan Chai, Xi'an University of Science and Technology, China Abstract: To address the challenges of multi-scene nighttime small object detection from UAV perspectives, this paper proposes an improved model, FSP-RTDETR, based on RT-DETR. The method constructs a lightweight backbone network, CG-FasterNet, to enhance feature extraction efficiency; introduces the SPDConv module to strengthen small object feature representation and optimize positional information fusion; combines the CSP structure with OmniKernel to form the CSP-OmniKernel module, improving multi-scale feature fusion capability; and employs

	a cross-attention mechanism to focus on target regions while suppressing background redundancy. Experiments on the VisDrone2019 dataset demonstrate that FSP-RTDETR outperforms the baseline model with improvements of 3.69%, 3.87%, 5.14%, and 3.85% in accuracy, recall, mAP@0.5, and mAP@0.5:0.95, respectively, validating its effectiveness in nighttime small object detection.
CS464 **11:45-12:00**	Title: Segmenting the Morphological Spectrum of Gallbladders in Neonatal Cholestasis: A MAF-UNet Approach for Biliary Atresia Assessment Author(s): Yuyao Li, Fan Fan Presenter: Yuyao Li, Xi'an University of Posts and Telecommunications, China Abstract: Biliary Atresia (BA) is the leading cause of liver transplantation in infants, making early diagnosis critical. While ultrasound is the primary screening tool, automated segmentation is challenged by the atrophic, irregular gallbladders with indistinct boundaries and low contrast common in BA patients. This task is further hindered by a key limitation in existing networks: skip connections often introduce background noise when fusing high-resolution details with high-level semantics, leading to failures in localizing weak boundaries. To directly address this fusion-related issue, we propose MAF-UNet, an architecture centered on our novel AttenFusionBlock (AFB). This cross-attention-based module leverages decoder features ("Query") to adaptively select and re-weight crucial details from encoder features ("Key/Value"), enabling precise, context-aware feature fusion. The complete MAF-UNet architecture also incorporates a MixStructure Block (MSB) to capture diverse morphologies and a cascaded dual-path gated prediction head to refine the final output. On a clinical dataset of 80 infants, MAF-UNet achieved an Intersection over Union (IoU) of 84.60%, significantly outperforming several state-of-the-art models. Ablation studies confirm that the performance gain is primarily attributed to our core AFB module. MAF-UNet effectively segments morphologically diverse gallbladders, providing a reliable quantitative basis for the early assessment of BA.
CS450 **12:00-12:15**	Title: BW-YOLO: small target vehicle detection based on improved YOLOv8 Author(s): Naining Wen, Qi Lu Presenter: Qi Lu, Xi'an University of Science and Technology, China Abstract: In the context of complex traffic scenarios, existing vehicle target detection algorithms encounter several challenges when dealing with small targets, including low detection accuracy, missed detections, and high computational complexity. To tackle these issues, this study presents an improved vehicle target detection algorithm, BW-YOLO, which is based on YOLOv8. The Star Block in the lightweight network StarNet is incorporated into the C2f module. This integration aims to enhance the model's capacity for extracting features of small targets amidst complex backgrounds. Introduce the bidirectional feature pyramid network in Neck to enhance the model's multi-scale feature fusion capability. Introducing WIoU as a new bounding box loss function to enhance the convergence speed and regression accuracy of the model for small objects. The experimental results show that compared with the YOLOv8n model, the improved BW-YOLO model has achieved mAP50 and mAP50~95 indicators of 91.4% and 65.3% respectively, which are 3.0 and 3.6 percentage points higher. Moreover, it demonstrates higher accuracy and stability in detection tasks under complex backgrounds. The research results provide new ideas for vehicle target detection and have good practical application prospects.

ONLINE SESSION C

System Simulation and Network Performance Analysis in Communication and Signal Systems

- **Room 1: https://us02web.zoom.us/meetings/89269524043 password: ICCS**
- **Time: 14:30-16:00, Sep. 28th, 2025 | UTC/GMT+8**
- **Session Chair: Assoc. Prof. Sophia Rahaman, Manipal Academy of Higher Education, United Arab Emirates**
- **CS213, CS102, CS344, CS345, CS451, CS470**

CS213 14:30-14:45	Title: A Cross-Platform Vehicle Trajectory Prediction Model Optimized for Edge Deployment Author(s): ZiPeng Mo, Meng Wang, RuiXing Bi, ZaiLong Chen, WenChao Liu, Zhu Wang Presenter: ZiPeng Mo, Xi'an Polytechnic University, China Abstract: With the development of intelligent transportation systems and edge computing, trajectory prediction plays a crucial role in autonomous driving, path planning, and traffic monitoring. However, mainstream LSTM-based methods are difficult to deploy efficiently on neural network processing units (NPUs) due to issues such as operator incompatibility. This paper introduces a novel lightweight trajectory prediction network featuring a dual-branch linear enhancement module designed to effectively capture complex nonlinear spatio-temporal dynamics in trajectories. Uniquely, it integrates a custom gating mechanism with multi-level residual connections to selectively amplify critical features while ensuring stable information flow. The model is specifically hardware-adapted for the Xiangteng Microelectronics HKN201 NPU, guaranteeing efficient and reliable operation on edge devices. Experiments show that on the NGSIM dataset, the model achieves approximately 26.7\% and 32.3\% reductions in MSE and MAE, respectively, compared to LSTM single-step prediction, despite its smaller parameter size, and maintains stable performance in multi-step prediction. After deployment on the NPU, accuracy only slightly decreases, validating the model's practicality and engineering application potential.
CS102 14:45-15:00	Title: A Chatbot-Assisted Intrusion Detection System for Network Traffic Analysis Using Machine Learning and Retrieval-Augmented Generation Author(s): Joyce Teng Min LI, Peter ChunYu YAU Presenter: Joyce Teng Min LI, University of Glasgow, United Kingdom Abstract: Traditional Security Information and Event Management (SIEM) systems rely on static rule-based detection, making them ineffective against evolving cyber threats. Machine Learning (ML)-based Intrusion Detection Systems (IDS) improve anomaly detection but lack interpretability, posing challenges for Security Operations Center (SOC) analysts. This paper proposes a chatbot-assisted IDS that integrates ML for real-time anomaly detection with Retrieval-Augmented Generation (RAG) to enhance explainability and threat intelligence retrieval. The system leverages ChromaDB for efficient threat data storage and an AI-powered chatbot for interactive security analysis. Evaluations demonstrate improved detection accuracy, reduced false positives, and enhanced interpretability for SOC analysts.
CS344 15:00-15:15	Title: Design and Realization of Simulation System for Error Analysis of Satellite Ground Link Measurement Radar Author(s): WANG Hong-ming, LIU Shu-zhi, LIU Xiao-lei

	Presenter: WANG Hong-ming, China Research Institute of Radiowave Propagation, China Abstract: In view of the difficulty, high cost and serious environmental constraints in the implementation of error analysis experiments for satellite-ground link measurement and control radar, various satellite orbit simulation models such as low Earth orbit (LEO), medium Earth orbit (MEO), and geosynchronous orbit (GEO) were constructed using various technologies such as 3D GIS and virtual reality. A simulation system was designed to support satellite-ground link scenario simulation, radar equipment deployment, and radar error analysis and evaluation. The system mainly realizes the functions of "satellite-orbit-radar-radiowave environment" information management, radar measurement and control task planning, simulation process deduction and playback, and real-time visual display of three-dimensional scenes of simulation elements. The simulation results show that the system can analyze and evaluate the error of satellite-ground link measurement and control radar, and provide lightweight and efficient demonstration design and simulation verification services for relevant personnel.
CS345 **15:15-15:30**	Title: Intelligent Drive-Based Optimization of Trajectory Tracking for the Deployment Mechanism of Fengyun Satellites Author(s): Hongting Zhang, Yu Zhou, Zhiliang Yu, Qingping, Yanfen Wang Huang, Guiru Jing Presenter: Zhiliang Yu, Aerospace System Engineering Shanghai, China Abstract: To address the trajectory tracking issues in deployment mechanism caused by external disturbances, an adaptive control strategy combining radial basis function (RBF) neural networks and sliding mode control (SMC) is proposed. Firstly, external disturbances are estimated using an adaptive RBF neural network, and the estimated values are fed into the control system for compensation. Subsequently, a rapid convergence sliding mode controller is designed based on tracking errors to enhance the response speed and tracking accuracy of the system. Finally, the stability of the control method is proven theoretically through Lyapunov function analysis, and verified by simulation and experimental results performed in the MATLAB/Simulink environment. Results confirm the proposed method's superior disturbance rejection capability and high control accuracy. Additional exploration is conducted into robustness analysis, energy efficiency, payload adaptability, and potential aerospace applications.
CS451 **15:30-15:45**	Title: Researcher on Low latency deployment method for underwater communication network nodes Author(s): Donglei Xu, Quanfeng Yao, Xianjun Peng, Hui Wan Presenter: Donglei Xu, Wuhan Fiberhome Technical Services Co., Ltd. Abstract: Due to the complexity and propagation characteristics of underwater environments, underwater communication networks have high deployment delays, making it difficult to achieve stable multi hop transmission and resulting in insufficient node deployment coverage. Therefore, this paper proposes a low latency deployment method for underwater communication network nodes based on multi hop clustering. Firstly, the underwater communication network architecture design is completed based on clustering. Then, multi hop transmission design is carried out for sink node data communication, that is, the improved ant colony algorithm is applied to solve the multi hop path. Finally, considering low latency, node depth position adjustment is completed to complete the node deployment scheme design. The experimental results show that applying the proposed method for node deployment results in a network coverage rate of over

	94.1% and a node connectivity rate of over 97.6%, enabling low latency data transmission and achieving good application effects.
CS470 **15:45-16:00**	Title: Decentralized Supervisory Control of Partially Observable and Controllable Petri Nets Under Replacement Attacks Author(s): Xionghu Zhang, Yanwei Fang, Xuya Cong Presenter: Xuya Cong, Xi'an University of Science and Technology Abstract: This paper proposes a decentralized supervisor that is effective in handling replacement attacks, resulting in fewer safety events being disabled in the system. First, the basis reachability graph method is used to process the unobservable transitions of each supervisor, dividing the system into multiple basis reachability graphs. Then, the replacement attack is introduced into the system and the system after the attack is modeled. Finally, by combining the transition sequences and the safety levels of those unsafe state in the system, the temporary safety level is computed based on the states reached by the observed transitions, and then the transitions are disabled. The decentralized supervisor proposed is not only applicable to the system with unobservable and uncontrollable transitions, but also can effectively control the system under attack and disable less safety events, thus the safety and robustness of the system under attack are improved.

ONLINE SESSION D

AI based Digital Image Processing and Intelligent Application of Information Systems

- **Room 2: https://us02web.zoom.us/j/81511369554 password: ICCS**
- **Time: 14:30-16:00, Sep. 28th, 2025 | UTC/GMT+8**
- **Session Chair: Prof. Xin Biao Lu, Hohai University, China**
- **CS205, CS204, CS225, CS221, CS232, CS224**

CS205
14:30-14:45

Title: TransAIFNet: Efficient Feature Fusion and Edge Enhancement via Transformer for Medical Image Segmentation
Author(s): Meng Cao, Tao Xue
Presenter: Meng Cao, Xi'an Polytechnic University, China

Abstract: Skin cancer poses a serious threat to human health, and accurate early segmentation and identification of lesions are crucial for reducing mortality rates. However, the diversity in skin cancer types leads to variations in lesion shapes and blurred boundaries, which presents significant challenges for segmentation tasks. In this paper, we propose a novel skin cancer segmentation method called TransAIFNet. This model integrates the Swin Transformer into the encoder, decoder, and Atrous Spatial Pyramid Pooling (ASPP) module to enhance global contextual modeling capabilities. Additionally, we design an Edge-Guided KAN (EGK) module to capture fine edge details and employ an improved Transformer-Induced Fusion (TIF) module to facilitate efficient feature fusion. These innovations collectively enable stronger feature integration and more precise segmentation of skin cancer lesion boundaries. We conducted experiments on the ISIC 2017 and ISIC 2018 datasets. The results demonstrate that, compared with existing state-of-the-art models, TransAIFNet achieves more accurate edge segmentation for skin cancer lesions, showing high potential for clinical application.

CS204
14:45-15:00

Title: Cascade Spatial Feature Transformation and Blur Kernel Estimation for Super-Resolution
Author(s): Jialu Li, Zhonghua Liu
Presenter: Jialu Li, Zhejiang Ocean University, China

Abstract: The research presents an innovative deep learning approach that employs a multi-stage convolutional network combined with deblurring mechanisms to achieve enhanced image super-resolution results. Compared to other CNN-based approaches, our method has two key advantages: (1) The cascade neural network retains its original structure even when the training set changes, reducing the occurrence of false textures during super-resolution reconstruction. Additionally, we introduce cascaded connections within residual networks to address feature mismatches. (2) The Spatial Feature Transform (SFT) layers are employed to handle multiple blur kernels, mitigating artifacts in image super-resolution. Consequently, our approach leverages blur kernel information to improve the robustness of convolu-tional networks while ensuring multi-level spatial feature trans-formations that preserve the original image characteristics. Finally, extensive experiments on both real and synthetic datasets validate the effectiveness of the pro

CS225
15:00-15:15

Title: Collaborative Optimization Method for Multi- Automated Guided Vehicles Task Scheduling and Path Planning
Author(s): Ming Si, Weiqiang Xing, Hao Wang, Mengfan Liu, Jiaman Liu
Presenter: Weiqiang Xing, Xi'an University of Science and Technology, China

Abstract: A hierarchical reinforcement learning-based method for task-path-control co-optimization is proposed to address congestion, deadlock, and collision issues in multi- Automated Guided Vehicles(AGVs) systems for intelligent warehousing. The Dueling Deep Double Q-Network Prioritized Experience Replay (D3QN-PER) algorithm is designed at the task layer to address convergence challenges and training instability inherent in traditional deep Q-networks. Dynamic adjustment of task priorities and implementation of an empirical replay strategy enable efficient AGV-task matching. The distributed Bidirectional Gated Recurrent Unit-Dueling Deep Double Q- Network-Convolutional Block Attention Module (BiGRU-D3QN-CBAM) algorithm, featuring dynamic communication, is introduced at the path layer. Issues of poor real-time AGV path planning and high path conflict probability are addressed by this algorithm. It enables conflict-free path planning for multiple AGVs. The control layer develops a dynamic sensing strategy for path time deviation. Local optimization issues in task scheduling and path planning are addressed by this strategy. Dynamic sensing and feedback between the task and path layers are enabled. Faster convergence of the task-layer D3QN-PER algorithm compared to traditional algorithms is observed after 60,000 training steps in simulation experiments. As a result, the task completion time is reduced by 41%. An average completion time of 1.08 seconds is achieved by the path-layer BiGRU-D3QN- CBAM algorithm, demonstrating a 37% improvement over the baseline method. A 99.05% task success rate is achieved in the control layer, marking a 53.5% increase relative to the PPO algorithm. Path length was optimized by 53.5%, and maximum completion time was reduced by 67.3%. The proposed method demonstrates significant advantages in enhancing intelligent warehousing operation efficiency and stability.

CS221
15:15-15:30

Title: MCT-SCINet: A Soil Moisture Prediction Model for Earthen Heritage Combining Mamba and Temporal Attention
Author(s): Jiaqi Li, Tao Xue
Presenter: Jiaqi Li, Xi'an Polytechnic University, China

Abstract: Soil moisture is a critical parameter for the stability protection of earthen heritage, whose dynamic changes are influenced by complex multi-scale coupling and lag responses to key events. Existing models have significant limitations in long-term dependency modeling, multi-scale feature collaboration, and the ability to focus on critical time steps. To address these issues, this paper proposes the MCT-SCINet model, which achieves accurate prediction of soil moisture in earthen heritage by integrating Mamba state-space modeling, a hybrid convolutional-state structure, and a temporal attention mechanism. The core innovations include: 1) Introducing the Mamba module to replace traditional recursive structures, capturing long-term trends and cross-time dependencies through a dynamic parameter adjustment mechanism; 2) Designing a hierarchical hybrid encoder (ConvMixer and MambaMixer) to extract local capillary action features (hourly scale) and global environmental coupling features (monthly scale) in blocks; 3) Proposing a lightweight temporal attention mechanism to explicitly enhance the weight allocation of critical events such as rainfall and evaporation. Experiments show that on a multi-sensor dataset including different soil depths (5m, 10m, 15m), the model's MSE is 4.4\% lower than SCINet (at 5m depth), with an R^2 of up to 0.85, and the error in predicting abrupt events is reduced by 18.6\%. This study provides an efficient technical solution for real-time moisture regulation in earthen heritage protection.

CS232
15:30-15:45

Title: An Accurate Coal Mine Gas Concentration Prediction System Based on EPSCA-Informer and Optimized Attention Scoring
Author(s): Naining Wen, Kaiyu Fan, Yunpeng Bai, Sizhe Shang

	Presenter: Kaiyu Fan, Xi'an University of Science and Technology, China Abstract: As the depth of coal mine excavation becomes deeper and deeper, the problem of risk prediction of gas concentration becomes more and more difficult. In order to improve the accuracy, efficiency, and real-time reliability of gas prediction, this study proposes EPSCA-Informer for the traditional Informer model so as to better adapt to the needs in the coal mine environment. To address the uncertainty of the probabilistic random screening process of the Informer model, the homogeneous interval sequence sampling method (HISS) is introduced to effectively select the key subset elements, improving computational efficiency—a key factor for timely predictions—while maintaining the uniform distribution of information. Aiming at the problem that the Informer model is over-sensitive to extreme values when dealing with long sequence data, a novel balanced skewness-enhanced self-attention scoring mechanism (BSE-SAS) is proposed to reduce the dependence on a single extreme value and enhance the robustness and overall prediction performance of the model. Aiming at the Informer model's insufficient consideration of spatial correlation when dealing with gas concentration prediction, this study significantly improves the accuracy and reliability of gas concentration prediction through the Enhanced Pearson Spatial Correlation Algorithm (EPSCA). The results show that EPSCA-Informer is able to utilize the spatial information more efficiently and selectively focus on the key regions related to the predicted nodes, thus improving the prediction accuracy. The results show that EPSCA-Informer achieved a Mean Absolute Error (MAE) of 0.0323, which is 51.21% lower than Informer and 63.99% lower than LSTM. Its R^2 score of 0.8924 further indicates that the prediction results match the actual curves significantly better.
CS224 **15:45-16:00**	Title: FALCON: An Induial Multi-Objective Fault Diagnosis Framework via LLMstr and Tree Search Author(s): Bin Wang, Tao Xue Presenter: Bin Wang, Xi'an Polytechnic University, China Abstract: Recent advances in large language models (LLMs) offer new possibilities for automating industrial decision-making. However, challenges remain in complex reasoning tasks like fault diagnosis, including limited search paths and poor multi-objective coordination. This paper proposes FALCON, an industrial multi-objective fault diagnosis framework that integrates semantic strategy generation, Monte Carlo Tree Search (MCTS), and multi-objective evaluation. FALCON constructs a candidate strategy pool from LLM-generated repair plans, employs MCTS for global path search, and uses Pareto front optimization to select optimal solutions. A collaborative LLM–MCTS mechanism enables dynamic strategy generation and feedback adjustment, enhancing adaptability in complex scenarios. Experiments on multiple datasets demonstrate FALCON's superior performance, robustness, and reasoning capability in industrial fault diagnosis tasks.