

CONFERENCE PROGRAM



**2026 THE 7TH WORLD SYMPOSIUM ON
ARTIFICIAL INTELLIGENCE**

WSAI 2026

Jinan, China | June 24-26, 2026

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Xiao Guoqing, Hunan University, China



WELCOME MESSAGE

2026 the 7th World Symposium on Artificial Intelligence (WSAI 2026) will be held in Jinan, China during June 24–26, 2026.

This conference provides opportunities for the different areas Delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration. We hope that the conference results constituted significant contribution to the knowledge in these up-to-date scientific field.

WSAI 2026 will place a special focus on artificial intelligence, and their cross-disciplinary applications to address real-world challenges. The event will feature oral presentations, poster presentations, workshops, keynote speeches by experts on state-of-the-art topics, and invited speeches. Our aim is to enrich the regular program with emerging topics of particular interest in the field of Artificial Intelligence. We encourage authors to expand upon their research and share their knowledge to contribute to the collective effort to artificial intelligence research and innovation.

On behalf of the conference committee, we sincerely thank all authors, reviewers, and attendees for your valuable contributions, hard work, and active participation in WSAI 2026. Your dedication, professional expertise, and insightful exchanges have laid a solid foundation for our high-quality academic program and made this conference a remarkable success. We greatly appreciate your continuous support and trust in WSAI. Finally, we wish all delegates a fruitful, inspiring, and pleasant conference experience!

WSAI 2026 Conference Committee

June, 2026



CONFERENCE VENUE



国家超级计算济南中心
NATIONAL SUPER COMPUTING CENTER IN JINAN



国家超级计算济南中心科技园区主楼

National Super Computing Center in Jinan

Address: Main Building, National Super Computing Center in Jinan, Caishi Street, Jingshi East Road, Licheng District, Jinan, Shandong Province, China

地址：山东省济南市历城区经十东路彩石街道国家超级计算济南中心科技园区主楼

推荐住宿酒店

东悦国际酒店(省科学院济南超算中心科技园店)

地址：济南市历城区超算中心科技园（蟠龙路东 100 米）

销售经理：王栋栋 联系电话：15615773652 导航链接：

<https://j.map.baidu.com/80/vwJK>

交通指引 (Transport Instruction)

国家超级计算济南中心，周边交通便利，距各大交通枢纽均有便捷接驳方式，同时周边有多条地铁、公交线路，为您的出行提供更多选择。

机场出行 By Airport

1. 济南遥墙国际机场：打车（推荐）：约 27 公里，40 分钟左右；公共交通：机场地铁 3 号线到 4 号线（清源大街方向），地铁超算中心站下车。

Jinan Yaoqiang International Airport: Taxi (Recommended): Approximately 27 kilometers, around 40 minutes' ride; Public Transit: Take Metro Line 3, transfer to Line 4 (towards Qingyuan Street), and alight at Supercomputing Center Station.

高铁站出行 By High-speed Railway Station

1. 济南西站：打车：约 40 公里，60 分钟左右；公共交通（推荐）：西站乘地铁 4 号线（清源大街方向），地铁超算中心站下车。

Jinan West Railway Station: Taxi: Around 40 kilometers, approximately 60 minutes; Public Transit (Recommended): Take Metro Line 4 at Jinan West Railway Station (towards Qingyuan Street), and get off at Supercomputing Center Station.

2. 济南东站：打车（推荐）：约 18 公里，30 分钟左右；公共交通：东站乘地铁 3 号线，安成街换乘 4 号线清源大街方向，地铁超算中心站下车。

Jinan East Railway Station: Taxi (Recommended): Around 18 kilometers, roughly 30 minutes; Public Transit: Take Metro Line 3 at Jinan East Railway Station, transfer to Line 4 (towards Qingyuan Street) at Ancheng Street Station, and get off at Supercomputing Center Station.

备注：以上信息仅供参考，具体行程及费用请以实际情况为准。

Note: The above information is for reference only, and the actual itinerary and costs are subject to on-site conditions.

PRESENTATION GUIDELINES

ORAL PRESENTATION

1. The duration of an oral presentation slot is 15 minutes. Please target your lecture for a duration of about 10 minutes for the presentation plus about 5 minutes for questions from the audience.
2. Your punctual arrival and active involvement in each session will be highly appreciated.
- Get your presentation PPT or PDF files prepared and backed up.
3. Laptops, projector & screen, laser sticks will be provided by the conference organizer.
4. Join the meeting room at least 15 minutes before the session begins.

ONLINE PRESENTATION | Password: 062426

Download zoom: <https://zoom.us/android/download>

For oversea: <https://www.zoom.com/>



Online Room Link: <https://us02web.zoom.us/jc/89478291613>

Room ID: 894 7829 1613

Password: 062426

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.

SECURITY

- 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.
- Emergency Call; Ambulance: 120 Police: 110

Assistant Wechat QR code, remark as WSAI 2026

添加会议秘书微信，备注 WSAI 2026



DAILY SCHEDULE

Day 1 - June 24, 2026 (Wednesday)

13:00-16:00	Registration, collecting conference materials
14:00-16:00	<p>Online Zoom Test</p> <p>Online Room Link: https://us02web.zoom.us/jc/89478291613</p> <p>Room ID: 894 7829 1613 Password: 062426</p> <p>Test for Online Session Chairs & Committees & Authors</p>

Day 2 - June 25, 2026 (Thursday)

<p>Room 645, 6 Floor, Main Building, National Super Computing Center in Jinan 国家超级计算济南中心科技园区主楼, 会议室 645, 6 楼</p>	
<p>OPENING CEREMONY</p>	
<p>Host: Xin Li, Shandong Computer Science Center (National Supercomputer Center in Jinan), China</p>	
09:00 - 09:05	<p>WELCOME MESSAGE</p> <p>Dawei Zhao, Shandong Computer Science Center (National Supercomputer Center in Jinan), China</p>
09:05 - 09:10	<p>OPENING REMARKS</p> <p>Steven Guan, Xi'an Jiaotong-Liverpool University, China</p>
<p><i>Group Photo</i></p>	
<p>KEYNOTE SPEECHES</p>	
09:10 - 09:50	<p>Keynote Speech I: Toward High-Performance Edge Computing Geyong Min, University of Exeter, UK</p>
09:50-10:30	<p>Keynote Speech II: Top Challenges in LLMs</p>

	Wenhong Tian, University of Electronic Science and Technology of China, China
<i>10:30-10:50</i>	<i>Coffee Break</i>
10:50-11:30	Keynote Speech III: NUIST-WE: A Large-Scale Weather Model Capturing Meteorological Correlations via Temporal Dynamics and Multivariate Interactions Feng Jiang, Nanjing University of Information Science and Technology, China
11:30-12:10	Keynote Speech IV: Multi-Source and Multi-Scale Remote Sensing Data Fusion Yanchao Zhang, Zhejiang Sci-Tech University, China
<i>12:10 - 14:00</i>	<i>Lunch</i>
AUTHOR PRESENTATION SESSIONS Room 436, 4 Floor, Main Building, National Super Computing Center in Jinan 国家超级计算济南中心科技园区主楼, 会议室 436, 4 楼	
14:00 - 15:45	ONSITE SESSION 1 Security, Code Intelligence, and Multi-Agent AI Session Chair: Hao Hao, Shandong Computer Science Center (National Supercomputer Center in Jinan), China PA3492, PA3700, PA432, PA310, PA6003, PA433(Online), PA312(Online)
<i>15:45-16:05</i>	<i>Coffee Break</i>
16:05-17:35	ONSITE SESSION 2 Resource-Efficient Computing and Cross-Domain AI Applications Session Chair: Fuqiang Yu, Shandong Computer Science Center (National Supercomputer Center in Jinan), China PA436(Online), PA3371, PA3698, PA3950, PA5001, PA208
<i>From 18:00</i>	<i>Dinner</i>



Day 3 - June 26, 2026 (Friday)

Password: 062426	Online Room Link: https://us02web.zoom.us/jc/89478291613 Room ID: 894 7829 1613
09:30-11:45	<p>ONLINE SESSIONS A</p> <p>Advancing Cyberspace Security with Neural Networks and AI</p> <p>Session Chairs: Wei-Yu Chen, Chinese Culture University, China; Wan Nor Shuhadah Wan Nik, Universiti Sultan Zainal Abidin, Malaysia</p> <p>PA4335, PA6002, PA311, PA4770, PA1002, PA4397, PA4603, PA3146, PA2032</p>
<i>11:45-14:00</i>	<i>Break Time</i>
14:00-16:15	<p>ONLINE SESSIONS B</p> <p>AI for Earth Sciences, Climate, and Autonomous Systems</p> <p>Session Chairs: Yuanzhe Cai, Shenzhen Technology University, China; Riktesh Srivastava, City University, Ajman, UAE</p> <p>PA4691, PA2154, PA3378, PA3568, PA3753, PA315, PA317, PA6001, PA429</p>
<i>16:15-16:30</i>	<i>Break Time</i>
16:30-18:45	<p>ONLINE SESSIONS C</p> <p>AI for Software Engineering, Data Analytics, and Intelligent Systems</p> <p>Session Chairs: Elankovan A Sundararajan, The National University of Malaysia, Malaysia; Wael Yafooz, Taibah University, Saudia Arabia</p> <p>PA4777, PA104, PA106, PA313, PA314, PA319, PA423, PA424, PA431</p>



KEYNOTE SPEAKER



Professor Geyong Min

University of Exeter, UK

Speech Time: 09:10 - 09:50, June 25

Location: Room 645, 6 Floor, Main Building, National Super Computing Center in Jinan

Boi: Professor Geyong Min is a Chair in High Performance Computing and Networking in the Department of Computer Science at the University of Exeter, UK. His research interests include Computer Networks, Cloud and Edge Computing, Mobile and Ubiquitous Computing, Systems Modelling and Performance Engineering. His recent research has been supported by Horizon Europe, UKRI, EPSRC, Royal Society, Royal Academy of Engineering, and industrial partners. He has published more than 200 research papers in leading international journals including IEEE/ACM Transactions on Networking, IEEE Journal on Selected Areas in Communications, IEEE Transactions on Computers, IEEE Transactions on Parallel and Distributed Systems, and IEEE Transactions on Wireless Communications, and at reputable international conferences, such as SIGCOMM-IMC, INFOCOM, and ICDCS. He is an Associated Editor of several international journals, e.g., IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Computers, and IEEE Transactions on Cloud Computing. He served as the General Chair or Program Chair of a number of international conferences in the area of Information and Communications Technologies.

Toward High-Performance Edge Computing

Abstract: This keynote examines recent advances in intelligent edge computing from a high-performance computing perspective. The talk presents novel edge server deployment architectures designed to enhance scalability while minimizing infrastructure costs. Hybrid deployment strategies are discussed to address the challenges of heterogeneous and dynamic computing environments, enabling flexible resource orchestration across distributed edge infrastructures. Furthermore, task-aware service placement and optimization mechanisms are introduced to improve workload execution efficiency, reduce communication latency, and maximize overall system performance. The keynote concludes by discussing future research opportunities.

KEYNOTE SPEAKER



Professor Wenhong Tian

**University of Electronic Science and Technology of China,
China**

Speech Time: 09:50-10:30, June 25

Location: Room 645, 6 Floor, Main Building, National Super Computing Center in Jinan

Boi: Wenhong Tian is a Professor and Ph.D. Supervisor at the University of Electronic Science and Technology of China (UESTC), and holds a Ph.D. in Computer Science from North Carolina State University (NCSU), USA. He currently serves as Director of the Advanced Computing Laboratory at UESTC and Executive Director of Sichuan Smart IoT Engineering Research Center. His research interests include computing resource optimization and scheduling for cloud computing and AI, optimization of large AI model training and inference, and natural language processing and image recognition based on deep learning and their applications. He has made innovative contributions to integrating NP-hard problems into resource scheduling. He is a Distinguished Member of the China Computer Federation (CCF) and an IEEE Senior Member. He was elected as a Foreign Member of the Serbian Academy of Sciences (2025), and has been selected for the first batch of the "Western Light" Talent Program of the Chinese Academy of Sciences and the Chengdu Distinguished Expert Program (Rongpiao Plan). With over 20 years of dedicated experience in industry-university-research integration, his research achievements have been deployed in the production processes or products of leading enterprises such as Huawei and Tencent, generating significant social and economic benefits. As the technical lead, he has spearheaded the development of multiple groundbreaking products with independent intellectual property rights, including intelligent data center optimization and scheduling systems, cloud aggregation intelligent agents, and intelligent psychological assessment systems. These innovations have been applied directly or indirectly at UESTC, Siemens Chengdu, Huawei Technologies, Chengdu Zhongke Yunji Information Technology Co., Ltd., and other institutions. He has successfully recruited 3 National Distinguished Expert and 3 provincial/municipal distinguished experts, while cultivating over 120 master's and doctoral students. Additionally, as a technical consultant to HuiXiang Xingchen (Chengdu) Technology Co., Ltd., he has facilitated the company's rapid growth over the past three years, with annual sales exceeding 10 million RMB, helping it achieve status as a specialized and innovative high-tech enterprise ("Little Giant" enterprise).

Top Challenges in LLMs

Abstract: In this talk a few top challenges in LLMs will be introduced and discussed, specially traditional Chines LLMs (WenyanLLMs) will be introduced again and discussed again.

KEYNOTE SPEAKER



Professor Feng Jiang

**Nanjing University of Information Science and Technology,
China**

Speech Time: 10:50-11:30, June 25

Location: Room 645, 6 Floor, Main Building, National Super Computing Center in Jinan

Boi: Feng Jiang (Senior Member, IEEE) received the B.S., M.S., and Ph.D. degrees in computer science from Harbin Institute of Technology (HIT), Harbin, China, in 2001, 2003, and 2008, respectively. He is currently a Professor with the School of Artificial Intelligence, Nanjing University of Information Science and Technology (NUIST), Nanjing, China, a Professor with the Department of Computer Science, HIT, and a Visiting Scholar with the School of Electrical Engineering, Princeton University, Princeton, NJ, USA. His research interests include computer vision, image and video processing, and pattern recognition.

NUIST-WE: A Large-Scale Weather Model Capturing Meteorological Correlations via Temporal Dynamics and Multivariate Interactions

Abstract: Against the background of carbon neutrality goals and the development of next-generation power systems, the large-scale integration of renewable energy, especially wind power, has created an urgent demand for energy-weather forecasting systems with high accuracy, strong generalization ability, and physical consistency. Although traditional numerical weather prediction models provide solid physical interpretability, they still face limitations in spatial-temporal resolution, local terrain representation, and coupling with wind power forecasting. Meanwhile, conventional data-driven models often rely heavily on historical samples and may suffer from site-specific overfitting and insufficient physical constraints.

To address these challenges, this report introduces NUIST-WE, a weather and energy forecasting foundation framework that integrates meteorological physical priors, multi-source heterogeneous data, and generative pre-training mechanisms. The framework consists of two core components. The first is NUIST-W, a meteorological foundation model designed to predict energy-related weather variables such as wind speed, wind direction, temperature, pressure, and humidity. By incorporating climatological statistical priors, physical-consistency constraints, and error-correction mechanisms, NUIST-W enables high-resolution and interpretable meteorological forecasting. The second is NUIST-Ewind, a wind energy forecasting model that uses dynamic tokenization for power sequences and cross-site generative pre-training to learn transferable wind power evolution patterns across different climate zones, terrain conditions, and wind farms. Overall, the proposed framework has important implications for improving renewable energy integration, supporting secure power grid operation, and accelerating the transition toward a low-carbon energy system.

KEYNOTE SPEAKER



Associate Professor Yanchao Zhang Zhejiang Sci-Tech University, China

Speech Time: 11:30-12:10, June 25

Location: Room 645, 6 Floor, Main Building, National Super Computing Center in Jinan

Boi: Master's Supervisor. Received a Ph.D. degree from Zhejiang University, followed by postdoctoral research at the same institution. Research interests focus on digital agriculture and farmland informatization, space-air-ground integrated remote sensing, and computational optics. Serves as the Principal Investigator (PI) for 1 National Natural Science Foundation of China (NSFC) project, 1 Zhejiang Provincial "San Nong Jiu Fang" Science and Technology Collaboration Project, and 1 Provincial Natural Science Foundation project. Additionally, has participated in 8 major projects, including the National Key R&D Program of China and the NSFC, and has published over 10 papers in top SCI journals. Currently serves as a reviewer for top-tier journals such as RSE, ISPRS, and CompAg. Also serves as an Editorial Board Member for SN Applied Sciences and BMC Artificial Intelligence, and as a Youth Editorial Board Member for Remote Sensing and Agriculture.

Multi-Source and Multi-Scale Remote Sensing Data Fusion

Abstract: Constrained by the inherent physical design limitations of optical sensors, a single remote sensing satellite cannot simultaneously achieve high spatial resolution and high spectral resolution imaging. Cross-sensor spatial-spectral reconstruction has therefore become a core technology supporting fine-scale Earth observation. The Gaofen-2 and Sentinel-2 imagery exhibit natural physical complementarity, and their fusion can effectively alleviate the mixed-pixel problem. However, existing reconstruction methods generally suffer from edge oversmoothing, difficulty in balancing spatial detail preservation and spectral fidelity, and high computational complexity, which restrict their practical applicability in geoscience applications such as water body extraction. In this paper, we propose a dual-domain spatial-spectral edge reconstruction network (DSER), which jointly models spatial structure and frequency-domain spectral dependencies through a dual-domain feature module, incorporates a multi-scale gated feature fusion mechanism to mitigate spectral drift, and introduces a gradient-guided edge refinement module to enhance high-frequency detail recovery, thereby achieving high-fidelity reconstruction from 4-band multispectral to 13-band hyperspectral imagery. The proposed method breaks through the accuracy bottleneck in heterogeneous remote sensing data fusion. The reconstructed 13-band imagery can effectively suppress shadow-induced spectral interference and significantly improve water body extraction accuracy in complex scenarios. This work provides high-quality spatial-spectrally integrated data support for operational applications such as water resource monitoring, water environment investigation, and land cover classification, demonstrating substantial engineering application value and promising potential for broader adoption.

ONSITE SESSION 1

- **Topic: Security, Code Intelligence, and Multi-Agent AI**
- **Session Chair: Hao Hao, Shandong Computer Science Center (National Supercomputer Center in Jinan), China**
- **Time: June 25, 2026 | 14:00-15:45**
- **Meeting Room: Room 436, 4 Floor / 会议室 436, 4 楼**
- **Order: PA3492, PA3700, PA432, PA310, PA6003, PA433(Online), PA312(Online)**

<p>PA3492 14:00-14:15</p>	<p>Learning Fine-Grained Code Semantics for Vulnerability Similarity Detection with Fix-Aware Verification Author(s): Hao Sun, Xingting Yan, Junyu Dong, Qiqing Deng, Xin Li, Dongmei Liu Presenter: Xingting Yan, Shandong Police College, China</p> <p>Abstract: With the increasing complexity of software systems and the widespread reuse of open-source components, vulnerability detection has become a critical challenge. Existing methods often suffer from insufficient semantic representation, limited generalization to vulnerability variants, and high false positive rates. To address these issues, this paper proposes a novel framework that combines fine-grained semantic modeling with similarity-based detection. Specifically, program dependency slicing subgraphs are constructed to capture precise vulnerability contexts, and UniXcoder is employed to encode semantic features. Furthermore, a similarity detection mechanism integrating both historical vulnerability semantics and fix code semantics is designed to improve detection accuracy and reduce false positives. Experimental results demonstrate that the proposed method outperforms existing approaches in identifying semantically similar but structurally diverse vulnerabilities.</p>
<p>PA3700 14:15-14:30</p>	<p>A Knowledge Graph-Based Personalized Recommendation System for Penetration Testing Author(s): Shangren Song, Zhengwen Li, Wenqi Jia, Boyang Gao, Wei Ding, Xin Li Presenter: Shangren Song, Qilu University of Technology (Shandong Academy of Sciences), China</p> <p>Abstract: Penetration testing training platforms serve as cornerstone environments for developing practical cybersecurity skills. However, existing platforms lack intelligent guidance mechanisms, leading to learner disengagement and unbalanced skill development across security domains. This paper presents a novel knowledge graph based personalized recommendation system designed specifically for penetration testing. We construct two complementary knowledge graphs: (1) a Skill Knowledge Graph encoding prerequisite and similarity relationships among 84 cybersecurity skills, and (2) a Challenge Knowledge Graph capturing relationships between penetration testing exercises based on category overlap, difficulty, and solution rates. A random-walk-based traversal combined with Random Forest regression computes challenge relevance scores, weighted by each learner's current proficiency stage to produce personalized recommendations. Experiments on a dataset of 312 learners and 1,847 penetration testing challenges demonstrate that our system outperforms collaborative filtering, content-based filtering, and graph-based baselines in Precision@10, Recall@10, and NDCG@10, while achieving a 54.2% improvement in cross-domain coverage. Our framework bridges recommender systems research with practical demands of cybersecurity education and penetration testing skill development.</p>
<p>PA432 14:30-14:45</p>	<p>Prompt-Template Based Named Entity Recognition in Legal Domain: A Case Study with DeepSeek Author(s): Laxmisha Rai Presenter: Laxmisha Rai, Palacky University Olomouc, Czech Republic</p> <p>Abstract: Named Entity Recognition (NER) in the legal domain is a foundational task for legal information retrieval, contract analysis, and automated reasoning. The emergence of Large Language Models (LLMs) and prompt engineering has transformed NER, enabling zero- and few-shot extraction with minimal annotated data. This paper presents a comprehensive analysis of prompt-template-based NER in the legal domain, focusing on DeepSeek with options to anonymize the responses. Through a detailed case study, we analyze prompt-template design</p>

	<p>for legal entity extraction, benchmark DeepSeek's performance, and it is found that DeepSeek is able to extract over 41 different types of entities from legal documents. A random manual crosscheck was conducted between the entities extracted by DeepSeek (default mode) and those identified manually. These findings demonstrate that DeepSeek is capable of accurately identifying and extracting named entities from legal documents using prompt templates. The proposed prompt-template driven framework for legal NER, formalizes legal entity extraction as a constrained natural language understanding task via structured prompt engineering. This study bridges prompt engineering and legal NLP, offering a low-cost, scalable, and maintainable solution for named entity recognition, extraction and synthesis tasks.</p>
<p>PA310 14:45-15:00</p>	<p>A Two-Stage Deep Learning Image Segmentation And Fine-Grained Breed Classification For Some Pet Dataset Author(s): Haoran Yang, Edward Y. T. Ho Presenter: Dr Edward Ho, Brunel University of London, UK</p> <p>Abstract: Fine-grained pet breed recognition is challenging because of many breeds look highly similar and real-world images often contain cluttered backgrounds, pose variation, and occlusion. To address this problem, this paper proposes a two-stage deep learning framework that combines semantic segmentation with breed classification, using Oxford-IIIT-Pet dataset. In the first stage, a U-Net model is trained to segment the pet foreground from the background using the dataset's trimap annotations, producing cleaner masks for downstream processing. In the second stage, the segmented pet regions are cropped and fed into a ResNet-18 classifier for 37-class breed recognition. The proposed pipeline is evaluated with mean Intersection-over-Union (mIoU) for segmentation and confusion matrices and accuracy-based metrics for classification. Experimental results show that the segmentation model can reliably capture the main pet silhouette, while the final breed classifier achieves strong performance with an overall accuracy of 92.6%. The results indicate that by removing background interference helps the classifier to focus on discriminative pet features and improves fine-grained recognition. Overall, the proposed framework provides a practical and interpretable baseline for segmentation-guided pet breed classification.</p>
<p>PA6003 15:00-15:15</p>	<p>A Two-Level Cache Scheduling Framework for Resource-Limited Video Analysis Author(s): Chaojin Lyu, Zhen Song, Ning Liu, Zitong Cheng, Fenghua Tong, Fuqiang Yu Presenter: Chaojin Lyu, Shandong University, China</p> <p>Abstract: When conducting online video query analysis on devices with limited resources, the data preparation stage encounters significant bottlenecks. The main reason is that the task requires reading frames from the storage, converting them into tensors, and transmitting the data to the GPU for processing. For frequently accessed video segments, this repetitive I/O and transformation pipeline imposes substantial computational and temporal overhead, leading to inefficient resource usage and higher latency, especially when multiple video analysis tasks are waiting for service. To solve this problem, we propose a novel two-level cache system that caches frequently used frames and their tensor representations in the memory and GPU cache, thereby eliminating the redundancy of low-level processing. Furthermore, we introduce a window-based overlap-aware task scheduling strategy that dynamically batches incoming queries and reorders their received queries based on real-time cache overlap. Experiments demonstrate that our system effectively reduces data preparation time, enabling efficient video analytics on resource-limited platforms.</p>
<p>PA433 (Online) 15:15-15:30</p>	<p>Message Masking and Curriculum Adversarial Training for Robust Emergent Communication in Cooperative Multi Agent Systems Author(s): Chamidu Himantha, Suresh Michael Peiris Presenter: Chamidu Himantha, Informatics Institute of Technology, Sri Lanka</p> <p>Abstract: Emergent communication protocols in cooperative multi agent reinforcement learning (MARL) are vulnerable to adversarial perturbation of the inter agent message channel. Prior work [1] confirmed that projected gradient descent (PGD) attacks degrade coordination and that basic adversarial training offers partial defence. Two mechanisms are proposed to close the remaining gap. Message masking zeros the clean message copy from the listener's</p>



	<p>own observation, forcing genuine reliance on the potentially attacked channel rather than a hidden shortcut. Epsilon curriculum learning gradually increases the training perturbation budget from $\epsilon=0.01$ to $\epsilon=0.50$ over the first 70% of training, preventing policy collapse before a usable communication protocol emerges. Applied to the Speaker Listener benchmark, the defended model reduces the robustness gap (clean minus adversarial reward) by 87.1%, from 18.49 to 2.38, and improves clean reward by 31% with no inference overhead. The defence holds at $\epsilon=0.70$, achieving 71% task success versus 3% for the undefended baseline, despite being trained only up to $\epsilon=0.50$. An ablation confirms that masking is what makes the defence work: without it, no meaningful robustness is acquired regardless of adversarial training.</p>
<p>PA312 (Online) 15:30-15:45</p>	<p>From Text to Code: A Comprehensive Review of Execution-Verified Reasoning and Multi-Agent Architectures for Automatic Prompt Optimization Author(s): Tharana Sheka Dissanayake Wanigaratne, Suresh Michael Peiris Presenter: Tharana Wanigaratne, University of Westminster, UK</p> <p>Abstract: Automatic Prompt Optimization (APO) has evolved from single-model search strategies into complex multi-agent architectures and self-referential evolutionary systems. Separately, programmatic reasoning methods including Scratchpads, Program-Aided Language Models (PAL), and Chain of Code (CoC) have demonstrated that grounding LLM outputs in executable code offloads precise computation to symbolic interpreters and significantly improves reliability. More recently, the field has begun to bridge these domains through automatic differentiation via text, where rich natural language feedback is backpropagated through computation graphs to optimize compound AI systems. Despite these advances, text-only multiagent APO remains vulnerable to specific failure modes, most notably cascading hallucinations, where misinformation propagates across the agent network, and context loss, where coherence degrades over extended interactions. In this paper, we present a comprehensive survey on the convergence of these research threads, without introducing new experimental contributions. It introduces a structured taxonomy across APO methodologies, programmatic reasoning strategies, and multi-agent orchestration frameworks, and identifies structural gaps in current state management.</p>

ONSITE SESSION 2

- **Topic: Resource-Efficient Computing and Cross-Domain AI Applications**
- **Session Chair: Fuqiang Yu, Shandong Computer Science Center (National Supercomputer Center in Jinan), China**
- **Time: June 25, 2026 | 16:05-17:35**
- **Meeting Room: Room 436, 4 Floor / 会议室 436, 4 楼**
- **Order: PA436(Online), PA3371, PA3698, PA3950, PA5001, PA208**

<p>PA436 (Online) 16:05-16:20</p>	<p>MemCode: A Hybrid Memory-Augmented Framework for Persistent and Adaptive Automated Code Review Author(s): Pamood Jayaratne, Kushan Bhareti Presenter: Pamood Jayaratne, Informatics Institute of Technology Colombo, Sri Lanka</p> <p>Abstract: Automated code review tools built on Large Language Models begin every session with no record of prior feedback, no awareness of project conventions, and no memory of which suggestions a team has previously accepted or rejected. This stateless design produces redundant and inconsistent reviews that gradually erode developer trust. This paper presents MemCode, a hybrid memory-augmented code review framework that formalises review as a Memory-Augmented Markov Decision Process (M-MDP). Past experiences are stored as state-action-reward tuples in a persistent episodic case bank and retrieved through a three-stage engine: a CodeBERT-based similarity search, a parametric Q-function that re-ranks candidates by learned usefulness, and a Neo4j graph expansion that surfaces experiences embedding similarity alone cannot reach. Developer feedback is continuously translated into reward signals without retraining the underlying language model. Evaluated on the CodeReviewer corpus, the Q-function achieves 96.20% accuracy, an AUC-ROC of 0.9975, an average precision of 0.9971, and 100% recall on a 2,000-pair balanced evaluation set. Across four ablation conditions on 100 held-out queries, retrieval precision at rank 3 improves by 58% over the similarity-only baseline, and the full pipeline achieves the highest LLM-judge composite score across all conditions.</p>
<p>PA3371 16:20-16:35</p>	<p>Cross-Sensor Remote Sensing Image Reconstruction via Spectral Prior and Frequency Decoupling Author(s): Toingxin Wei, YanchaoZhang, Xiwen Li, Yang Peng Presenter: Toingxin Wei, Zhejiang Sci-Tech University, China</p> <p>Abstract: Spatial-spectral reconstruction of heterogeneous remote sensing imagery is essential for fine-grained Earth observation. However, in highly ill-posed cross-sensor mapping tasks, existing deep networks often suffer from severe spectral distortion and spatial over-smoothing due to aggressive feature compression. To address these critical issues, we propose a novel spatial-spectral collaborative reconstruction network, termed SPFD-Net. Specifically, a lightweight Spectral Prior Injection Module (SPIM) is designed as a bypass branch to establish a stable global spectral reference, fundamentally ensuring the physical fidelity of the reconstructed target bands. Simultaneously, a Latent Frequency Decoupling Module (LFDB) is innovatively embedded at the deepest bottleneck layer. By performing explicit frequency-domain decoupling and lossless sub-pixel upsampling, the LFDB effectively isolates and protects high-frequency geometric structures from being submerged. Extensive experiments on real-world Gaofen-2 and Sentinel-2 datasets demonstrate that the proposed method significantly outperforms state-of-the-art approaches. Furthermore, it achieves superior spectral consistency in the challenging downstream task of NDRE-based vegetation index reconstruction, highlighting its profound potential for precision agriculture applications.</p>
<p>PA3698</p>	<p>Interplay Between Graph Algorithms and Microarchitecture on Modern Server CPUs Author(s): Jaime de Lacy, Lucia Pons, Julio Sahuquillo</p>



<p>16:35-16:50</p>	<p>Presenter: Jaime de Lacy Orellana-Pizarro, Universitat Politècnica de València, Spain</p> <p>Abstract: Graph applications exhibit complex behavior in modern architectures, as their scalability and efficiency are strongly influenced by irregular memory access patterns, inter-thread synchronization, and the architecture's ability to exploit parallelism. This paper presents the characterization of the GAP benchmark suite on two representative modern Intel and AMD server platforms. We analyze multiple algorithm-graph combinations while varying the number of cores and execution modes, considering both single-thread (ST) and simultaneous multithreading (SMT) configurations. Results show that scalability and the effectiveness of simultaneous multithreading (SMT) depend strongly on the algorithm, input graph, and the underlying architecture. Triangle Counting and Betweenness Centrality benefit most from parallelism and SMT, whereas PageRank shows limited gains. The cross-platform comparison reveals that memory-bound workloads achieve higher performance on Intel, while more core-dependent workloads favor AMD, highlighting that performance is determined by the interaction between application characteristics and microarchitectural features.</p>
<p>PA3950 16:50-17:05</p>	<p>Enhancing Classification Performance Through a Vision Transformer Model Approach for Alzheimer's Disease</p> <p>Author(s): Manop Phankokkrud, Sirirat Wacharawichanant Presenter: Manop Phankokkrud, King Mongkut's Institute of Technology Ladkrabang, Thailand</p> <p>Abstract: Alzheimer's disease is one of the most significant public health issues affecting the elderly, often accompanied by memory loss and cognitive decline. Accurate diagnosis is essential for slowing disease progression and reducing treatment costs. Since the medical image datasets are usually very large, creating an accurate classification model is important and challenging. This work proposed a Vision Transformer (ViT) model to classified of Alzheimer's disease. The proposed model classifies the Alzheimer's disease into four classes. We created the model and trained on the a large image dataset. In addition, we applied the data augmentation to enhance model generalization and prevent overfitting. Furthermore, this work conducted the hyperparameter optimization technique to obtain the significant parameters. The results indicate that the proposed ViT model achieved an accuracy of 97.48%, precision of 0.9749, recall of 0.9748, and F1-score of 0.9748, respectively. By considering the F1-score, the ViT model demonstrates robust performance, effectively classifying the different stages of Alzheimer's disease from image data. Moreover, the model achieved high AUC values across all classes, confirming its ability to reliably distinguish between positive and negative cases in each disease category.</p>
<p>PA5001 17:05-17:20</p>	<p>Resource Constraint-Oriented Risk Management Model for Green Computer Computing Power</p> <p>Author(s): Yang Liu, Wenting Fu, Tong Yu Presenter: Wenting Fu, Qilu University of Technology (Shandong Academy of Sciences), China</p> <p>Abstract: The nodes of the green Computer Computing Power system are interdependent; from the underlying architecture to the upper-layer applications, the nodes are highly correlated, showing characteristics such as intelligent linkage and integration. Node risks in the system have the characteristics of propagating and diffusing to the associated nodes, which has a negative impact on the entire Computer Computing Power. The stable operation of the system poses a threat, and the traceability and suppression of risk points and the analysis and isolation of risk links require high technology and resource costs. Therefore, an economically optimal green Computer Computing Power system risk regional response model under resource constraints is proposed. First, the response strategy of mixed-risk node power elastic compression and the overload node exit mechanism is designed to alleviate the aggregation of high-load system nodes in local areas. Secondly, from the perspective of resource constraints, regional risk evaluation indicators for green Computer Computing Power systems that take into account the best economics and highest security are constructed, green Computer Computing Power system regional emergency strategies are designed accordingly, and the response model is solved based on the idea of group adaptive global optimization. The differential evolution</p>

	<p>algorithm is used to achieve the suppression of hidden dangers in the system node area under optimal economic cost. Finally, simulation empirical analysis was conducted to verify the effectiveness of the proposed method.</p>
PA208 17:20-17:35	<p>One Person Company (OPC) AI Agents system with multi-modal fusion for health assistance Author(s): Xinzhi Li, Nanlin Jin, Wenning Ma, John R. Woodward, Steven Guan, Baibing Mi Presenter: Xinzhi Li, Xi'an Jiaotong-Liverpool University, China</p> <p>Abstract: This paper designs and implements a multi-agent system based on the One Person Company (OPC) AI architectural concept. This system leverages large language models (LLMs) and multiple agents, combining multi-modal information, with a new AI agent orchestration framework to coordinate multiple AI agents. The application is for high-altitude stroke management. Using our system, a single human physician directs six specialized agents to perform health assistance tasks. The system operates pre-screening on the risk of stroke, dynamic physiological monitoring, FAST screening, and data fusion. By processing various types of data, such as text, physiological signals, and audio-visual information, our OPC AI system achieves intelligent risk assessment while maintaining a human-led and AI-agent-executed workflow.</p>



ONLINE SESSION A

- **Topic: Advancing Cyberspace Security with Neural Networks and AI**
- **Session Chairs: Wei-Yu Chen, Chinese Culture University, China; Wan Nor Shuhadah Wan Nik, Universiti Sultan Zainal Abidin, Malaysia**
- **Online Link: <https://us02web.zoom.us/jc/89478291613>**
- **Room ID: 894 7829 1613 Password: 062426**
- **Time: June 26, 2026 | 9:30-11:45**
- **Order: PA4335, PA6002, PA311, PA4770, PA1002, PA4397, PA4603, PA3146, PA2032**

<p>PA4335 09:30-09:45</p>	<p>HTS4VC: Head-Tail Student Model For Vulnerability Classification Author(s): Chenyuan Zhao, Chunyong Zhang Presenter: Chenyuan Zhao, Shenyang University of Technology, China</p> <p>Abstract: Accurate identification of software vulnerability types is critical to prioritising the remediation of high-risk vulnerabilities and enhancing overall system security. Existing vulnerability classification methods merely identify whether a source code function contains a vulnerability, without further classifying its Common Weakness Enumeration (CWE) type. This paper proposes a method for finegrained classification of CWE types. Due to the significant imbalance in sample sizes across different CWE types, existing methods struggle to detect vulnerabilities in the minority class effectively. To address this issue, this paper introduces a vulnerability classification approach based on a head-and-tail student model (HTS4VC). The method first groups vulnerabilities according to their abstract types and constructs five teacher models based on the sample distribution within each group. It then designs separate head and tail student models, which acquire the ability to recognize different CWE types by learning from the corresponding teacher models through knowledge distillation. We conducted extensive experiments on a dataset of 8636 vulnerable functions. Compared to VulExplainer, HTS4VC improved the Weighted F1-Score by 6.4% and 13.8% for the tail-class abstract types (Variant and Deprecated), respectively.</p>
<p>PA6002 09:45-10:00</p>	<p>ChainPen: Multi-Agent Autonomous Penetration Testing with Attack Graph Reasoning and Self-Healing Exploits Author(s): Haiqing Wang, Siqi Han, Yili Chen, Shangren Song, Fuqiang Yu Presenter: Haiqing Wang, China Academy of Information and Communications Technology (CAICT), China</p> <p>Abstract: LLM-based penetration testing systems suffer from fragmented attack reasoning, context degradation (42% of failures), and brittle exploit execution. We propose ChainPen, a multi-agent autonomous framework with three innovations: (1) a Probabilistic Attack Graph (PAG) modeling attack chains as DAGs with expected utility optimization; (2) a Selective Memory Architecture (SMA) maintaining a persistent knowledge graph; and (3) a Self-Healing Exploit Engine (SHE) performing failure diagnosis and counterfactual reasoning. Four specialized agents---Reconnaissance, Vulnerability Analysis, Exploitation, Post-Exploitation---are coordinated through the SMA. On PentestEval (346 tasks), ChainPen achieves 52.3% E2E success (vs 6% VulnBot, 39% human-assisted PentestGPT). On HackTheBox, it reaches 73.1% subtask completion with zero human interaction.</p>
<p>PA311 10:00-10:15</p>	<p>How Does AI Adoption Affect Efficiency: A J Curve Pattern? Author(s): Yung-Jae Lee, Rahul Chachare, Xiaotian Tina Zhang, Xizhi Michael Liu Presenter: Xiaotian Tina Zhang, Saint Mary's College of California, USA</p> <p>Abstract: Artificial intelligence (AI) has been widely adopted in business practice, yet its</p>

	<p>performance implications remain unclear. This paper provides comprehensive empirical evidence based on AI adoption events among S&P 500 firms from 2009 to 2024. We find that AI adoption improves firm efficiency, primarily reflected in return on assets (ROA) and employment productivity (EP). Moreover, we reveal that these efficiency gains follow a J-curve pattern, indicating an initial adjustment period followed by sustained improvement. Our findings illuminate the dynamic process of AI value realization and identify several organizational and managerial factors that moderate these effects.</p>
<p>PA4770 10:15-10:30</p>	<p>A Scenario-Oriented Efficiency Evaluation Method for 5G Private Networks in Intelligent Manufacturing Workshops Author(s): Dan Yang, Wei Ni, Dongyao Wang, Guiming Zhu Presenter: Dan Yang, Jiangsu Institute of Automation, Lianyungang, China</p> <p>Abstract: As a core carrier of industrial digital transformation, intelligent manufacturing workshops impose rigid requirements on the capabilities of 5G private networks in terms of ultra-low latency, high reliability and high-density connectivity. However, existing 5G private network evaluation systems are highly generalized and can hardly adapt to the multi-scenario and differentiated service demands of intelligent manufacturing workshops. This paper presents a novel scenario-adaptive evaluation method for 5G private networks, focusing on four core scenarios: robot collaboration, AGV material handling, remote equipment monitoring and online quality inspection. Through scenario requirement analysis, adaptive indicator construction, differentiated evaluation optimization, and experimental validation, the proposed approach is demonstrated to be adaptable, accurate and practicable. Results show that it can better match actual requirements, significantly improve the evaluation performance, and provide theoretical support and practical guidance for wireless network optimization in intelligent manufacturing workshops.</p>
<p>PA1002 10:30-10:45</p>	<p>Optimization of Threshold-Based Clipping Kernels on Vector Processors Author(s): Zhezhuo Zhao, Yonghua Hu, Wei Cao, Zenghua Cheng, Shangfeng Mo, Yimin Xia Presenter: Zhezhuo Zhao, Hunan University of Science and Technology, China</p> <p>Abstract: Against the backdrop of the rapid convergence of artificial intelligence and embedded high-performance computing, threshold-based clipping kernels (e.g., clip and invclip) have become fundamental computational primitives in applications such as signal processing. However, on certain high-performance vector processors, vectorization of such kernels faces multiple challenges due to architectural constraints. This paper investigates two basic vectorization schemes—arithmetic composition and predicated execution—and reveals that their performance exhibits a pronounced dependence on data width: predicated execution is superior in 32-bit scenarios, whereas arithmetic composition is more advantageous in 16-bit scenarios. Building on this observation, we further integrate optimization techniques including double-word memory access, loop unrolling, multi-level cache optimization, and multicore parallel scheduling, and construct an efficient implementation framework targeting the FT-Matrix architecture. Experimental results show that, in strided memory-access scenarios, multi-level cache optimization improves performance by an average of 2.09x; under a 4-core configuration, multicore parallelism achieves an average speedup of nearly 2x over the single-core implementation. This work not only provides a high-performance implementation scheme for threshold-based clipping kernels, but also distills data-width-aware criteria for selecting vectorization strategies, thereby offering a decision basis for compiler-driven automatic vectorization on vector processors and providing practical guidance for the construction of high-performance kernel libraries.</p>
<p>PA4397 10:45-11:00</p>	<p>Integrating OpenClaw Agents with Zero Trust Architecture for Secure Multi- Tenant HPC Environments Author(s): Weiyu Chen Presenter: Weiyu Chen, Chinese Culture University</p> <p>Abstract: High-performance computing (HPC) platforms increasingly host heterogeneous</p>

	<p>tenants, AI workloads, and shared operational services, making perimeter-oriented trust assumptions insufficient. Agentic orchestration can improve job submission, troubleshooting, compliance inspection, and security response, but it also introduces risks associated with non-human identities, prompt-driven misuse, over-privileged automation, and cross-tenant data exposure. This revised paper proposes ZT-OpenClaw-HPC, a zero-trust integration framework that combines OpenClaw agents, workload identity, policy decision points, and tenant-aware enforcement for secure multi-tenant HPC operations. In response to the need for a more concrete evaluation, the paper specifies a Slurm-based prototype testbed, synthetic but reproducible agent-operation datasets, representative HPC workloads, three comparative baselines, and quantitative metrics for latency, false denial, unauthorized action success, policy blocking, audit completeness, and credential exposure. The prototype benchmark indicates that tenant-bound workload identity and per-action policy enforcement can reduce unauthorized cross-tenant execution to zero in the tested scenarios while adding bounded control-plane latency. The proposed approach aims to reduce cross-tenant blast radius, eliminate long-lived service secrets, and make agent-assisted HPC operations auditable and policy-verifiable.</p>
<p>PA4603 11:00-11:15</p>	<p>Intelligent Prognostics and Health Management of Optical Links in Data Center Networks Author(s): Chao Li, Fuli Yuan, Jinkun Jiang, Xiang Chen, Wenzhi Wang Presenter: Chao Li, IEIT SYSTEMS Co., Ltd. Beijing, China</p> <p>Abstract: We present a software-only early warning system for optical links, including monitoring plane, scoring plane and operation plane. During one-year real-world deployment (including 750+ modules), we achieve 100% recall and 85% precision.</p>
<p>PA3146 11:15-11:30</p>	<p>Automated Expansion of Open-Source Software Vulnerability-Fix Pairs: A Multisource Collaborative Crawling Framework Author(s): Hao Sun, Pengfei Zhao, Chaopeng Dong, Siyuan Li, Xin Li, Jiachi Zhang Presenter: Pengfei Zhao, Shandong Police College, China</p> <p>Abstract: The increasing complexity of software supply chains has amplified security risks from vulnerabilities in open-source components. Data-driven approaches, particularly those based on large language models, have emerged as promising paradigms for automated vulnerability detection. However, their effectiveness heavily depends on the availability of large-scale, high-quality vulnerability datasets. Constructing such datasets remains challenging due to fragmented vulnerability information across heterogeneous sources, limited verified patch data, and pervasive annotation errors in public datasets. This paper presents an automated framework for collecting, cleaning, and validating vulnerability-fix code pairs from open-source software. The framework integrates three key components: multi-source vulnerability and fix collection combining download-based and crawling-based acquisition; cross-version evolution modeling that captures vulnerability lifecycles across software versions; and IR-based function-level extraction with hash-based deduplication and cross-version label correction. Applied to Linux, OpenSSL, and Wireshark, the framework produced a dataset of 10, 541 functions covering 13 CWE types, demonstrating its capability to capture diverse vulnerability patterns. The resulting dataset provides a reliable foundation for training and evaluating data-driven vulnerability detection models.</p>
<p>PA2032 11:30-11:45</p>	<p>One-Class Autoencoder Anomaly Detection on CICIDS2017: Thresholding, Failure Modes, and an Entity-Time Aggregation Patch Author(s): Chang Liu, Zixuan Guo, Di Liu, Sunfanyu Meng Presenter: Chang Liu, Beijing Jiaotong University, China</p> <p>Abstract: Neural-network-based intrusion detection promises improved generalization to evolving threats, yet practical cyberspace defense often faces scarce labels and extreme class imbalance. One-class anomaly detection is therefore attractive: models learn benign behavior and flag deviations as suspicious. We study a one-class autoencoder (AE) for flow-based intrusion detection under a strict benign-only protocol for both training and threshold</p>



calibration on a CICIDS2017-based benchmark, focusing on a deployment-level question: how to calibrate reconstruction-error scores into alerts while maintaining coverage across heterogeneous attack families. We find that validation-normal reconstruction errors are heavy tailed, making mean-plus- k -standard-deviation rules ($\mu+2\sigma$, $\mu+3\sigma$) overly conservative and yielding zero recall across tested latent sizes, whereas quantile thresholds provide predictable control of alert volume and tunable precision–recall trade-offs. At the best operating point (latent dimension 24 with a $p90$ threshold), the AE achieves $AUC = 0.901$ and $F1 = 0.766$ (precision 0.901, recall 0.666). Per-attack analysis shows strong coverage for volumetric attacks (DoS recall up to 0.896; DDoS recall up to 0.637 under $p95$) but persistent blind spots for stealthier behaviors (brute-force and port scanning recalls near zero), indicating a weak-signal failure mode of per-flow reconstruction scoring. Finally, we evaluate a minimal post-hoc mitigation via entity–time aggregation in a cross day setting (train/validate on Monday benign traffic; test on Tuesday): windowed aggregation recovers detection for SSH brute-force (SSH-Patator detected in 2/2 attack windows at $p95$ with 10–30s windows), while overly short windows reduce recall.



ONLINE SESSION B

- **Topic: AI for Earth Sciences, Climate, and Autonomous Systems**
- **Session Chairs: Yuanzhe Cai, Shenzhen Technology University, China; Riktesh Srivastava, City University, Ajman, UAE**
- **Online Link: <https://us02web.zoom.us/jc/89478291613>**
- **Room ID: 894 7829 1613 Password: 062426**
- **Time: June 26, 2026 | 14:00-16:15**
- **Order: PA4691, PA2154, PA3378, PA3568, PA3753, PA315, PA317, PA6001, PA429**

<p>PA4691 14:00-14:15</p>	<p>PMFormer: Physics-guided Multi-scale Transformer for Global Weather Forecasting Author(s): Kai Geng, Chen Hui, Xianzhu Liu, Junwei Wu, Chenyue Song, Haiqi Zhu, Yachun Mi, Tong Zhang, Feng Jiang Presenter: Kai Geng, Nanjing University of Information Science and Technology, China</p> <p>Abstract: Accurate global weather forecasting is challenged by the computational inefficiency of Transformer-based models in handling high-resolution, multivariate data. Moreover, their prevalent approach of treating the atmosphere as a generic 3D grid neglects fundamental geographic and thermodynamic constraints, which can lead to predictions that are physically inconsistent. To address these issues, we propose a Physics-guided Multi-scale Transformer (PMFormer) for global multi-variable weather forecasting. Our framework introduces two key architectural innovations on a U-Transformer backbone: (1) A multi-scale feature extraction and fusion pipeline that leverages parallel patch-embedding branches with different granularities to capture atmospheric processes across scales, coupled with a lightweight attention-based fusion module that dynamically integrates these heterogeneous features. (2) A physics-guided window attention mechanism that explicitly encodes two fundamental atmospheric priors—the great-circle distance over the sphere and the pressure-level difference, as learnable biases within the attention calculation. This ensures spatial reasoning respects the geometry of the Earth and its vertical stratification. Extensive experiments on the ERA5 reanalysis dataset demonstrate that PMFormer achieves state-of-the-art performance in global multi-variable weather forecasting, outperforming conventional data-driven baselines in both accuracy and physical consistency. Our work provides a promising framework for building more reliable and physically-grounded weather forecasting systems through structured domain knowledge integration.</p>
<p>PA2154 14:15-14:30</p>	<p>Reconstruction-Free No-Reference Image Quality Assessment via Compressed Sampling Author(s): Yuanhua Wu, Chen Hui, Fan Yan, Yuang Zhang, Kai Geng, Siqiao Li, Chenyue Song, Haiqi Zhu, Feng Jiang Presenter: Yuanhua Wu, Harbin Institute of Technology, China</p> <p>Abstract: No-reference image quality assessment (NR-IQA) aims to predict perceptual image quality without access to reference images. Most existing deep NR-IQA methods rely on full-resolution images or densely cropped patches, which may introduce substantial computational redundancy or discard perceptually important regions. To address this issue, we propose ReS-IQA, a reconstruction-free NR-IQA framework that directly predicts image quality from compressed measurements. Instead of reconstructing the original image, ReS-IQA learns quality-aware compact representations in the compressed measurement domain. Specifically, a Compressed Sampling Module (CSM) first acquires compact block-wise measurements from the input image, and an Adaptive Embedding Module (AEM) maps variable-length measurements under different sampling ratios into fixed-dimensional tokens. These tokens are then processed by a hybrid transformer backbone, which combines a Vision Transformer and a Scale Swin Transformer Module (SSTM) to capture both global dependencies and local perceptual patterns. Finally, a Dual Branch (DB) predictor adaptively aggregates patch-level</p>

	<p>quality responses into the final image quality score. Experiments on multiple IQA benchmarks demonstrate that ReS-IQA achieves competitive or superior performance compared with state-of-the-art NR-IQA methods while relying only on compact compressed measurements. These results demonstrate the potential of compressed-domain representation learning for reconstruction-free NR-IQA.</p>
<p>PA3378 14:30-14:45</p>	<p>AI-Enabled Social-Media-Based Typhoon Disaster Perception: A Case Study of Typhoon Lekima Author(s): Diefan Lin, Jingwen Zhang, Jiting Tang, Weiping Wang Presenter: Diefan Lin, Beijing Normal University, China</p> <p>Abstract: Typhoon disasters often cause strong winds, torrential rainfall, urban waterlogging, and severe disruptions to daily life. Conventional emergency assessment mainly relies on meteorological, hydrological, and remote-sensing data, but these sources do not directly capture public-facing impacts during unfolding disasters. To address this gap, this paper proposes an AI-enabled social-media-based framework for disaster perception during typhoon events. Using Typhoon Lekima as a case study, we collect Sina Weibo posts from August 8 to August 14, 2019, align them with typhoon trajectory data and concurrent rainfall grades, and use rainfall grade as an operational proxy label for disaster severity. The framework integrates multi-source social media and contextual information, and combines GPT-4o-assisted annotation with a RoBERTa-base quality classifier to construct a high-quality dataset, which is then used to fine-tune ModernBERT model. Results show that sentiment signals reflect the typhoon impact process, emoji information provides small but stable gains, high-quality sample filtering substantially improves performance, and debiasing strategies further improve the objectivity of disaster perception. Overall, the proposed approach serves as a supplementary social-sensing method for disaster assessment and situational awareness</p>
<p>PA3568 14:45-15:00</p>	<p>Ultra-Short-Term Wind Power Forecasting based on a spatio-temporal CNN-BiLSTM-Attention Model Author(s): Mengting Wu, Feng Jiang, Wei Hu, Wei Ding Presenter: Mengting Wu, Anhui Jianzhu University, School of Electronics and Information Engineering, China</p> <p>Abstract: Ultra-short-term wind power forecasting is critical for stable and economic operation of modern power systems. However, accurately capturing abrupt power fluctuations and extreme ramping events remains a challenging task due to the high non-stationarity and spatio-temporal coupling of wind power sequences. This paper presents a hybrid Spatio-Temporal CNN-BiLSTM-Attention(ST-CBA) model that integrates spatio-temporal feature extraction and adaptive attention to capture dynamic spatial correlations and temporal dependencies. By employing a direct multi-step forecasting strategy, the model generates reliable 1-hour-ahead power predictions. Experimental results on real-world wind farm data demonstrate that the proposed model outperforms typical benchmarks including TCN and STGCN, effectively alleviates phase lag and peak distortion, and exhibits superior performance under extreme ramping scenarios. The model provides a robust and practical tool for real-time grid dispatch and intelligent wind farm management.</p>
<p>PA3753 15:00-15:15</p>	<p>CANet: Global Weather Forecast Network with Climatology-Aware Prior Constraints Author(s): Fan Yan, Yuang Zhang, Qintong Wang, Chenyue Song, Tong Li, Kai Geng, Chen Hui, Feng Jiang Presenter: Fan Yan, Nanjing University of Information Science and Technology, China</p> <p>Abstract: Traditional global weather forecasting relies on numerical weather prediction systems, and most deep learning methods similarly represent atmospheric variables as planar channels on spatial grids. This grid-based formulation is convenient for computation, but it tends to treat different variables and pressure levels mainly as stacked channels. Although efficient, this representation may limit the modeling of cross-variable and vertical interactions. Moreover, existing learning-based methods are often optimized mainly for forecasting error, with limited use of climatological constraints on predicted fields. To address these issues, we</p>



	<p>propose Climatology-Aware Network (CANet), a global weather forecasting framework that represents multiple atmospheric variables as a structured volumetric field. This representation enables CANet to capture interactions across variables and pressure levels. In addition, we introduce a climatology-prior (CP) loss that incorporates day-of-year climatological statistics into training, encouraging forecasts to remain consistent with historical atmospheric background. Experiments on ERA5 reanalysis data show that CANet improves short-range forecasting performance, and the CP loss provides further gains. These results indicate that combining volumetric atmospheric modeling with climatology-aware supervision is effective for short-range global weather forecasting.</p>
<p>PA315 15:15-15:30</p>	<p>Weather-Hardened Explainable AI for Autonomous Driving: Robustness Benchmarking of Post-Hoc Explanations for YOLOv8 Author(s): Fajr Noushad Ali, Omar Abdul Latif Presenter: Fajr Ali, RIT-Dubai, UAE</p> <p>Abstract: As deep object detectors become central to autonomous driving, eXplainable AI (XAI) is increasingly used to inspect their decisions, yet most benchmarks still assume clean images and stable sensing conditions. This paper addresses that gap by evaluating a YOLOv8m detector and twelve posthoc explanation methods under four adverse conditions: Gaussian noise, motion blur, night simulation, and sensor occlusion. We examine explanations through five complementary pillars: localization, sparsity, structural similarity, faithfulness, and Sensitivity-N. The resulting benchmark shows that explanation quality is method-dependent and condition-dependent, and that robustness cannot be inferred from clean-image performance alone. Across the tested explanations, LayerCAM, Integrated Gradients, HiResCAM, and SHAP repeatedly show strong structural stability and competitive faithfulness, while EigenCAM, XGradCAM, and LIME are more fragile under degradation. The analysis also reveals that some methods remain visually stable but lose localization accuracy, underscoring the need for multi-metric evaluation in safety-critical perception. The study frames explanation robustness as a requirement for autonomous systems operating in real-world weather and sensor-corrupted environments.</p>
<p>PA317 15:30-15:45</p>	<p>Anomaly Detection and Dynamic Adjustment of Measurement Discrepancies in Power Grids based on Inductive Graph Neural Networks Author(s): Ziwei Hong, Lu Cheng, Zhongheng Yang, Yaochong Chi, Qixiu Zhang, Lishih Yao and Yachen Tang Presenter: Ziwei Hong, Walmart, Bellevue, WA, US</p> <p>Abstract: To address the vulnerability of massive time-series data in active distribution networks (ADNs) to noise and cyber-attacks, an unsupervised anomaly detection and correction framework based on Inductive Graph Neural Networks (Inductive GNNs) is proposed. Unlike traditional transductive learning in Graph Convolutional Networks (GCNs), the framework uses aggregation functions to extract neighborhood features. This approach removes the dependency on a fixed graph matrix and allows for handling dynamic changes in network topology. Also, a trust mechanism based on spatial isomorphism is designed to perform real-time data imputation using hidden layer features upon anomaly detection. The performance was validated using real-world data from a SCADA-equipped smart grid building testbed at Lehigh University. Results demonstrate improved bad data detection and reduced reconstruction errors under high noise and changing topologies. The framework provides a robust deep learning solution for industrial spatiotemporal data analysis.</p>
<p>PA6001 15:45-16:00</p>	<p>Neuro-Symbolic Multi-Agent Vulnerability Detection via Code Property Graph Navigation and Semantic Debate Author(s): Dan Yan, Gezheng Li, Jinpeng Yang, Yili Chen, Dekai Zhang, Xin Li Presenter: Dan Yan, China Academy of Information and Communications Technology (CAICT), China</p> <p>Abstract: Traditional static vulnerability detection methods are often constrained by manually</p>

	<p>designed rules, while single large language models may hallucinate infeasible vulnerability paths or ignore existing protection conditions. To address these issues, this paper proposes a neuro-symbolic multi-agent vulnerability detection method based on Code Property Graph (CPG) navigation and semantic debate. The method uses Joern to construct CPGs for target functions and extracts structured evidence, including function bodies, source and sink candidates, null-pointer dereference candidates, conditional control blocks, and path clues. These evidence packages are used to constrain the reasoning process of large language models. Based on the extracted evidence, the system introduces two collaborative agents: a vulnerability analyst agent and a security auditor agent. The analyst generates an initial vulnerability judgment, while the auditor performs adversarial review from the perspectives of input controllability, path feasibility, boundary checking, null-value validation, and exploitability. The feedback is then used to refine the analysis through multiple rounds of interaction. Experiments are conducted on 200 vulnerability-fixing pairs from the MAVUL dataset, which are split into vulnerable and fixed versions, forming 400 function-level detection records. Under the MiMo-V2.5-Pro model, the proposed method achieves an Accuracy of 57.50%, a Precision of 57.73%, a Recall of 56.00%, and an F1 score of 56.85%. At the pair-wise level, the P-C score reaches 19.00%. These results show that the proposed method improves the interpretability and detection capability of function-level vulnerability analysis, although false positives on fixed versions remain a problem for future optimization.</p>
<p>PA429 16:00-16:15</p>	<p>Attention-Enhanced Convolutional Neural Networks for Interpretable Deep Learning in Breast Lesion Detection Author(s): T.M.O.S Bandara Presenter: Osara Bandara, Informatics Institute of Technology, Sri Lanka</p> <p>Abstract: Early detection of breast cancer through mammography significantly improves survival rates. Manual interpretation of mammograms is prone to human error and is time consuming, motivating the development of automated computer aided diagnosis (CAD) systems. In this study, we present a deep learning framework for the classification of breast lesions using the CBIS-DDSM dataset. EfficientNet-B0 is employed as the backbone network, enhanced with Convolutional Block Attention Module (CBAM) to refine feature representation both channel-wise and spatially. We utilize Grad-CAM for visual interpretability, providing clinical insight into the model's decisions. Experiments demonstrate the proposed model achieves 98% test accuracy with high precision and recall, outperforming baseline CNNs while maintaining clinical relevance through focused attention on discriminative features. Comprehensive analysis, ablation studies, and detailed methodological explanations validate the effectiveness of attention mechanisms in enhancing both performance and interpretability for medical image classification.</p>

ONLINE SESSION C

- **Topic: AI for Software Engineering, Data Analytics, and Intelligent Systems**
- **Session Chairs: Elankovan A Sundararajan, The National University of Malaysia, Malaysia; Wael Yafooz, Taibah University, Saudia Arabia**
- **Online Link: <https://us02web.zoom.us/launch/jc/89478291613>**
- **Room ID: 894 7829 1613 Password: 062426**
- **Time: June 26, 2026 | 16:30-18:45**
- **Order: PA4777, PA104, PA106, PA313, PA314, PA319, PA423, PA424, PA431**

<p>PA4777 16:30-16:45</p>	<p>Design of a Carton-Picking Robot and Inspection System for a Cigarette Factory Author(s): Yu Zhai, Shuen Li, Xuanming Xiao, Xiaobo Lyu, Hong Xiang, Yang Liu Presenter: Yang Liu, Yunnan China Tobacco Industry Co., Ltd. Hongta Tobacco (Group) Co., Ltd., China</p> <p>Abstract: To achieve high-resiliency automation in intelligent packaging manufacturing, this paper presents a comprehensive robotic picking and inspection system tailored for deformed, recycled cigarette cartons. Addressing the failure of conventional contour matching caused by crease degradation and specular glare, we propose a semantic-driven perception pipeline that shifts the visual anchoring strategy to stable surface printed patterns. The pipeline utilizes a two-stage Faster R-CNN framework integrated with a lightweight MobileNetV3-Large backbone and a Cross-Layer Attention Fusion (CLAF) module to enhance multi-scale feature representations under severe surface corruption. To satisfy tight production runtime boundaries, online knowledge distillation is executed for deep learning acceleration and inference, compressing edge computing processing latency down to 27 ms. Concurrently, a single-camera mobile vision framework mounted on a servo rail minimizes hardware procurement overhead while ensuring real-time industrial synchronous control via a high-speed EtherCAT bus. The physical handling is executed by an industrial manipulator equipped with an end-effector developed through the computational assisted design of flexible fixtures, incorporating three autonomous vacuum zones and an active folding linkage calibrated with a strict 50 N peak force limit to accommodate a wide multi-supplier carton-size adaptation range without fiber tearing. Rigorous 72-hour industrial trials involving 12, 560 cycles demonstrate an outstanding 99.6% recognition accuracy and a highly deterministic mean cycle time of 7.1 seconds (with a tightly bounded standard deviation of $\sigma = \pm 0.24$ s). Systematic ablation studies and multi-variable stress evaluations mathematically validate the system's repeatable localization rigidity, robust cross-supplier generalization, and long-term continuous reliability across harsh dynamic workshop environments.</p>
<p>PA104 16:45-17:00</p>	<p>Automatic Generation of Release Backlogs from Product Backlogs Using Generative AI: The Laraigo Case (Lima, 2025) Author(s): Sanandres Rojas, Edwin Eduardo, Bernal Moreno, Gabriel Adrian, Escobar Aguirre, Jaime Luis Presenter: Sanandres, Eduardo; Bernal, Gabriel, Universidad Peruana de Ciencias Aplicadas (UPC) Lima, Peru</p> <p>Abstract: Release planning in agile environments requires transforming a product backlog into a prioritized release backlog, an activity that is time-consuming and coordination-intensive. This work presents a web application that uses generative AI (Gemini 2.5 Pro) to automate this transformation from Gherkin-formatted user stories. The solution implements a workflow for structuring, enrichment, dependency identification, and prioritization (WSJF/RICE), producing an editable release proposal prior to export. The architecture integrates FastAPI, React, MongoDB, and Redis, with cloud-native orchestration. Validation measures time efficiency (target: >70% reduction vs. manual), output coherence (F1-score ≥ 0.80 for dependencies), and usability (SUS ≥ 80) in the Laraigo case, Lima 2025.</p>
<p>PA106 17:00-17:15</p>	<p>Random Walk-Based Community Detection Algorithm for Deep Sparse Autoencoder Author(s): Jian Ma Presenter: Jian Ma, Changzhi Medical College, China</p>

	<p>Abstract: Traditional community detection methods usually rely on predefined graph statistics or matrix decomposition, which are difficult to effectively capture the nonlinear structures and high-order topological features in complex networks. Autoencoders are a type of deep neural network designed to compress high-dimensional data into low-dimensional representations (encoding) through unsupervised learning and to reconstruct the original data as accurately as possible. By using network structures (such as adjacency matrices, node features) as input data, the encoder learns the low-dimensional, dense vector representations of each node. Therefore, this paper proposes a community detection algorithm based on random walk deep sparse autoencoder, which improves the accuracy of deep sparse autoencoders in discovering communities by processing high-dimensional adjacency matrices. First, the adjacency matrix is optimized to obtain a similarity matrix based on random walks, which not only reflects the similarity relationships between connected nodes in the network topology, but also reflects the similarity relationships between non-connected nodes. Then, a deep sparse autoencoder based on unsupervised deep learning methods is constructed to extract features from the similarity matrix and obtain a low-dimensional feature matrix. Finally, the learned node embeddings are clustered (such as K-Means) to obtain the community division results. Compared with six classic community detection algorithms, this algorithm can identify more accurate community structures. Moreover, this algorithm outperforms other algorithms in terms of accuracy.</p>
<p>PA313 17:15-17:30</p>	<p>Choosing LoRA Rank in a Fixed Benchmark: Post-hoc Rank-Sensitivity Analysis on Encoder-Only Architectures Author(s): Yaowen Sun, Qian Zhang, Hai Du Presenter: Yaowen Sun, Naval Submarine Academy, China</p> <p>Abstract: Low-rank adaptation (LoRA) is widely used in parameter-efficient fine-tuning, but rank selection is often still handled by ad hoc defaults. To investigate the stability and accuracy-parameter trade-off of fixed-rank selection, we designed and analyzed a large-scale controlled empirical matrix comprising 1, 680 fine-tuning runs. The matrix spans two encoder architectures (BERT-base and RoBERTa-base), four GLUE-style classification tasks (SST-2, MRPC, QNLI, RTE), six ranks (2--64), seven sample sizes (50--5000), and five random seeds per condition. All runs are evaluated using accuracy as the uniform metric, enabling consistent within-matrix rank comparisons across conditions. The analysis uses repeated-measures ANOVA, matched-seed paired tests with Holm correction, bootstrap confidence intervals, effect sizes, and descriptive scaling-fit summaries. Three evidence-backed findings emerge. First, LoRA rank has a statistically significant effect in 29 of 56 valid model--task--sample-size cells after false-discovery-rate correction. Second, unique optimum counts concentrate in the mid-to-high range, with ranks 32 and 64 winning most often and rank 16 also frequently competitive. Third, a fixed-rank heuristic evaluation over the 56 valid cells shows that rank 32 yields the lowest mean regret relative to the best observed rank (0.0102 accuracy points), whereas rank 64 is near-best more often but at substantially higher parameter cost. The resulting recommendation is conservative: use rank 32 as the strongest parameter-cost-aware default in this benchmark, consider rank 64 only when additional trainable capacity is acceptable, and avoid extrapolating these conclusions beyond the provided artifact set.</p>
<p>PA314 17:30-17:45</p>	<p>Pedagogical Hallucination in AI Tutoring: A Conceptual Framework for Learning Harm, Severity, and Governance Author(s): Sutharsan C.P. Saarathy, Sadia Riaz Presenter: Sutharsan Chiranjeevi Partha Saarathy, S P Jain School of Global Management, United Arab Emirates</p> <p>Abstract: Large language models are increasingly embedded in AI tutors used for explanation, feedback, scaffolding, and assessment support. Recent literature already shows five things: AI tutors can generate multiple forms of incorrect content; learners often detect these errors inconsistently; the harms extend beyond factual inaccuracy to trust, critical thinking, and academic integrity; retrieval-augmented and verification-based architectures can reduce hallucination risk; and pedagogical safeguards such as AI literacy and fact-checking remain necessary. What the literature does not yet do well is define a clear boundary between generic LLM hallucination and pedagogically consequential hallucination, explain why some errors produce deeper learning harm than others, or provide a severity logic that can guide design and governance across contexts. This paper addresses that gap by introducing pedagogical</p>

	<p>hallucination as a distinct construct: an AI-generated false, fabricated, or misleading instructional output that is incorporated into a learner's developing understanding under conditions of epistemic vulnerability. The paper contributes a formal definition and boundary model, a taxonomy of four forms, and a severity and governance framework for safer AI tutoring.</p>
<p>PA319 17:45-18:00</p>	<p>A Cognitive Architecture for LLM-based Automated Program Repair Author(s): Chamidu Jayanath Amarasinghe, Suresh Peiris Presenter: Chamidu Jayanath Amarasinghe, University of Westminster, UK</p> <p>Abstract: LLM-based agents for Automated Program Repair (APR) rely on rigid workflows or reactive feedback loops that lack formal working memory and dynamic cognitive control. We present CoPR, a cognitive architecture for LLM-based APR with three contributions: (1) a Cognitive State organizing four specialized memory stores for hypothesis-driven repair, (2) a Perception-Cognition-Action cycle with a tiered decision engine where 65-67% of routing decisions are resolved deterministically, and (3) a dual action space combining internal metacognitive tools with external code-environment tools. On 53 Defects4J bugs using GPT-5 mini, CoPR produces 28 correct patches (17% over the best baseline) at \$0.023 per bug. An ablation study holding the model constant confirms that both the cognitive cycle and memory architecture are independently essential.</p>
<p>PA423 18:00-18:15</p>	<p>Detecting Hallucinated Legal Authorities in LLM-Generated AI-Law Writing: A Bilingual NLP Benchmark for China-U.S. Synthetic-Content Governance Author(s): Yaofu Xue Presenter: Yaofu Xue, Jiangnan University, China</p> <p>Abstract: Large language models (LLMs) are increasingly used for legal research, legal drafting, and public-facing legal information services, yet legal authority errors remain a high-risk failure mode. This paper proposes a reproducible bilingual benchmark protocol for verifying legal authorities in LLM-generated writing about AI-generated content law. The legal scope is deliberately narrow: Chinese and U.S. materials on deep synthesis, generative AI services, synthetic-content labeling, platform takedown duties, and AI-generated political advertising. The benchmark represents each item as a claim-authority pair and annotates authority existence, article or section location, legal status, jurisdiction, proposition support, and error type. The proposed technical pipeline combines rule-based legal-reference extraction, bilingual authority normalization, BM25 lexical retrieval, dense sentence retrieval, reciprocal-rank-fusion hybrid retrieval, and a constrained LLM verifier that returns auditable JSON labels. The paper argues that legal hallucination is best operationalized as a relation among claim, authority, legal status, jurisdiction, and supporting passage. The expected contribution is a focused methods article and benchmark design that can support empirical evaluation without overstating what retrieval-augmented generation can guarantee in legal practice.</p>
<p>PA424 18:15-18:30</p>	<p>Research on the Effectiveness Evaluation Method for helicopter-borne UAV Command and Control Systems Author(s): Xiao-wei Wang, Jie Zhang, Yong-zheng Ma, Xu Liu Presenter: Jie Zhang, Army Aviation Academy, China</p> <p>Abstract: To address the challenges in evaluating the effectiveness of helicopter-borne UAV cooperative command and control (C2) systems in complex battlefield environments, such as the high correlation of indicators and the fuzziness of expert judgment, this paper proposes a comprehensive evaluation method based on combination weighting that integrates the Analytic Hierarchy Process (AHP), Cloud Model, and TOPSIS. First, based on the system composition and operational workflow, a four-level indicator system comprising 30 metrics is constructed, covering four dimensions: cooperative C2 communication terminals, UAV monitoring terminals, cooperative C2 processing and display units, and overall system comprehensive capability. Second, by deeply integrating AHP with the Cloud Model, the method utilizes the three digital characteristics of the Cloud Model (Expectation, Entropy, and Hyper-entropy) to effectively quantify the randomness and fuzziness of expert judgments, thereby achieving combined subjective and objective weighting. Finally, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) is introduced to calculate the relative closeness of each scheme to the ideal solution, completing the effectiveness ranking. Case study verification demonstrates that this method can objectively reflect the system's effectiveness level, providing</p>

	a scientific and quantitative basis for the design optimization and performance improvement of helicopter-borne UAV C2 systems.
PA431 18:30-18:45	<p>Research on Data-Driven Traffic Congestion Prediction Model Integrating Spatiotemporal Characteristics for Jinan City Author(s): Zhiling Li Presenter: Zhiling Li, Shandong Xiandai University, China</p> <p>Abstract: The road network structure of Jinan exhibits a typical pattern of being long and narrow in the east-west direction and constrained in the north-south direction, showing tidal congestion caused by commuting trips. To solve the problems of insufficient spatio-temporal feature mining and low prediction accuracy in traditional traffic congestion prediction models, this paper obtains measured traffic condition data through the Amap Web Service API, extracts a multi-dimensional dataset including temporal features, spatial features, and traffic operation features, and constructs a data-driven LightGBM traffic congestion prediction model integrating spatio-temporal features. To alleviate the extreme class imbalance in severe congestion samples, the model further introduces SMOTE to enhance the recognition ability of minority classes. Experimental results show the precision and recall of severe congestion are significantly improved, which verifies the effectiveness of the model for short-term urban traffic congestion prediction.</p>