Special Issue on

"AI-Empowered Intelligent Rail Transit in the Age of Digitalization"

IEEE Transactions on Intelligent Transportation Systems

Importance and Urgency

Recent years have witnessed the rapid development of advanced ICT technologies, such as 5G/6G, Space-Air-Ground-Integrated Communications, cloud & edge computing, digital twin, blockchain, AI, which have been successfully applied to many industrial sectors, e.g., energy, healthcare, industrial manufacturing and transportation. In particular, thanks to the convergence of these technologies, Rail transit systems have tremendous promises to be transformed towards intelligent, efficient, safe, secure and sustainable next generation. In fact, traditional rail systems are increasingly challenged by the need for higher operational efficiency, safety standards, enhanced passenger services and comfort, and the imperative to reduce carbon footprints. AI technologies, particularly foundation models and domain-specific large AI models, offer innovative solutions to these challenges through predictive maintenance, intelligent scheduling, real-time data analytics, enhanced cybersecurity, and green, low-carbon operations. The urgent need to modernize rail transit systems and align them with sustainability goals makes this special issue both important and timely.

Challenges to be Addressed

- **Operational Efficiency:** AI-driven predictive maintenance and fault detection can significantly reduce downtime and maintenance costs, ensuring smoother and more reliable operations.
- **Safety and Security:** Advanced AI algorithms can enhance safety by predicting, preventing, detecting, and effectively reacting to potential failures and cyber threats.
- **Sustainability:** AI can contribute to energy-efficient and low-carbon operations by optimizing resource utilization, reducing emissions, and implementing sustainable practices.
- **Passenger Experience:** AI can optimize scheduling, improve passenger flow management, and provide personalized services, thereby enhancing the overall user experience.

Current Research Gaps

While there is substantial interest in the application of AI in transportation, there remains a significant gap in focused research specifically addressing rail transit. Existing literature often emphasizes road and air transport, leaving rail transit underexplored despite its critical role in urban and intercity transportation networks. A special issue dedicated to this topic will fill this gap by providing a concentrated forum for the latest research findings and technological advancements.

Scope and Topics

This special issue will focus on a wide range of topics, including but not limited to:

- **Predictive Maintenance and Fault Detection**
  - AI-driven diagnostics and prognostics
  - Condition-based maintenance strategies
  - Real-time monitoring and anomaly detection

- **Train Scheduling and Routing**
  - Dynamic and adaptive scheduling algorithms
  - AI techniques for optimizing routing and dispatching
  - Real-time traffic management

- **Intelligent Control Systems and Automation**
  - Autonomous train operation
  - AI in signaling and control systems
  - Integration of AI in existing control infrastructure

- **Data Analytics and Big Data**
  - Leveraging big data for decision-making
  - Data fusion and analytics for operational insights
  - AI-enhanced safety and security measures

- **ICT Infrastructure and Cybersecurity**
  - Communication technologies for smart rail systems
  - Cybersecurity frameworks and AI-driven security solutions
  - Ensuring data integrity and privacy in rail networks

- **Energy Efficiency and Sustainability**
  - AI for optimizing energy consumption
  - Low-carbon and green operational practices
  - Environmental impact assessment through AI

- **Smart Ticketing and Passenger Information Systems**
  - AI in ticketing and fare collection

- Personalized passenger services and information
- Enhancing user experience with AI

– **Passenger Flow and Demand Forecasting**
  - AI models for predicting passenger demand
  - Crowd management and control
  - Optimizing service schedules based on passenger flow

Submission Guidelines

We invite researchers and practitioners to submit high-quality original research articles, comprehensive review papers, and case studies addressing the topics outlined above.

Submissions will undergo a rigorous peer-review process to ensure they meet the high-quality standards of the IEEE Transactions on Intelligent Transportation Systems.

Special Issue Timelines

- First submission deadline: 28 February 2025
- Notification of first decision: 28 May 2025
- First revision submission deadline: 28 July 2025
- Notification of final decision: 28 November 2025
- Final manuscript (camera ready) submission deadline: 28 December 2025
- Issue of Publication: February 2026

Proposed Guest Editors

- **Soufiene Djahel**, Coventry University, UK
- **Zonghua Zhang**, CRSC R&D Institute, China
- **Celimuge Wu**, The University of Electro-Communications, Japan
- **Guohui Zhang**, University of Hawaii, USA

Biographical Introduction of Guest Editors

- **Soufiene Djahel** (Senior Member, IEEE) holds a Ph.D. degree (2010) from USTL (FR), a Magister degree (2007- Distinction) from UAMB (DZ) and a State Engineering degree (2004 - Distinction) from UBMA (DZ). He is a Professor in the Centre for Future Transport and Cities at Coventry University (UK). His previous appointments include Senior Lecturer in Cyber Security then Reader in Connected and Autonomous Systems at the University of Huddersfield (UK), Senior Lecturer in Computer Science at Manchester Metropolitan University (UK), and Engineering Research Manager at University College Dublin (IE). His research interests include the design and evaluation of communication, planning, optimization and security algorithms and techniques to unlock the potential of emerging wireless connected and autonomous systems, such as CAVs and UAVs, in enabling smarter, safer, and more sustainable cities. His research aims to drive the innovation in the future mobility and other critical services in smart cities with a focus on enhancing the efficiency, sustainability and resilience to cyber threats. His research was supported by the Newton Fund, JSPS, EPSRC DTP, Transport Systems Catapult and the industry. He is the recipient of the FY2021 JSPS Invitational Fellowship for Research in Japan award from the Japan Society for the Promotion of Science.

- **Zonghua Zhang** is now working as a Chief Expert at CRSC Research & Design Institute Group Co., Ltd., China. A prior to the current position, he spent four and half years at Huawei Paris Research Center as a Chief Expert working on resilient and trustworthy applied AI in telecom sector. Before diving into the industry, Zonghua has spent more than 15 years in academia at different institutions (Professor at IMT, Researcher at NICT, INRIA, JAIST, University of Waterloo). He holds an HDR diploma (UPMC, France) in computer science, and a Ph.D. degree (JAIST) in information science. Zonghua has been actively working at the intersection of networking, security, and machine learning. He has contributed, as either PI or key contributor, to more than a dozen national and international research projects, with the topics ranging from anomaly detection, root cause analysis, and network forensics, to trust management, and eventually to autonomic Cyberdefense. These research projects have led to the publication of nearly 100 research articles at well-recognized international journals and conferences. He has received several best paper awards and JSPS overseas long-term invitational fellowship (2018). He has been also invited to serve as general chair or program chair for tens of international conferences, TPC member for numerous conferences, as well as the editorial board member for four international journals. He has also served as guest editors for several international journals. He is a Senior Member of IEEE.

- **Celimuge Wu** (Senior Member, IEEE) received his PhD degree from The University of Electro-Communications, Japan. He is currently a professor and the director of Meta-Networking Research Center, The University of Electro-Communications. His research

interests include Vehicular Networks, Edge Computing, IoT, and AI for Wireless Networking and Computing. He serves as an associate editor of IEEE Transactions on Cognitive Communications and Networking, IEEE Transactions on Network Science and Engineering, and IEEE Transactions on Green Communications and Networking. He is Vice Chair (Asia Pacific) of IEEE Technical Committee on Big Data (TCBD). He is a recipient of 2021 IEEE Communications Society Outstanding Paper Award, 2021 IEEE Internet of Things Journal Best Paper Award, IEEE Computer Society 2020 Best Paper Award and IEEE Computer Society 2019 Best Paper Award Runner-Up. He is an IEEE Vehicular Technology Society Distinguished Lecturer.

- **Guohui Zhang** (Senior Member, IEEE) received his PhD degree from the University of Washington. He is currently a Professor in the Department of Civil and Environmental Engineering at the University of Hawaii at Manoa. His research focuses on Cyber-transportation system, traffic detection, intelligent transportation systems, and smart city. He published more than 100 academic papers in the top internationally circulated journals and presented his contributions in the most prestigious international conferences. Dr. Zhang has served as a Conference Program Co-Chair for the First and Third Annual IEEE International Smart City Conference in 2015 and 2017; an Associate Editor for the International IEEE Conference on Intelligent Transportation Systems (2011-present). He has been an Associate Editor for Journal of Intelligent Transportation System, ASCE Journal of Transportation Engineering, Transportation Research Interdisciplinary Perspectives, Multi-modal Transportation; and has served a reviewer for about 60 academic journals in his research fields. He has delivered more 150 technical talks and presentations at well-recognized international academic conferences or symposiums. Dr. Zhang received numerous awards, including ASCE Follow, 2021 International Academy, Research, and Industry Association (IARIA) Best Paper Award, 2019 Transportation Research Board Best Young Researcher Paper Award, 2018 and 2022 College of Engineering Faculty Research Awards at the University of Hawaii at Manoa, and 2017 Transportation Research Board Greenshields Paper Award.