AI-Driven Optimization for Autonomous Vehicle Electronics

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Important Dates

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Second Round Submissions by:	**15 October 2025**
Second Round Reviews / Editorial Decision:	**15 December 2025**

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Artificial intelligence, optimization, and autonomous vehicles (SAE J3016, Levels 2–5) are three interrelated keywords that now occupy pivotal roles in advanced transportation research. AI-driven methods inherently address complex optimization problems, as training and deploying intelligent models often reduce to identifying optimal solutions under intricate constraints. In the realm of autonomous electric vehicles (AEVs, including battery-, fuel cell-, and hybrid-powered systems), coupling AI and optimization is especially promising. It can significantly improve system efficiency, operational safety, and overall reliability, yet introduces new challenges in ensuring stable real-time performance, robust sensor integration, communication latency control, and scalable computational infrastructures.

This Special Issue focuses on the fusion of AI-driven approaches with cutting-edge optimization techniques to tackle the versatile electronic systems within autonomous vehicles. The goal is to highlight novel frameworks, methodologies, tools, and real-world case studies that demonstrate how AI can facilitate, enhance, and exploit optimization processes to advance all aspects of autonomous vehicle electronics design, operation, and management. We invite submissions presenting original, state-of-the art research and technical contributions, surveys or tutorials, on any aspect of AI-driven optimization for autonomous vehicle electronics, including but not limited to:

- **AI-driven Optimal Power and Thermal Management**: Approaches that integrate AI-based forecasting and control algorithms with optimization frameworks for energy distribution, battery/fuel cell utilization, and thermal load balancing. Topics may include multi-objective optimization for extending energy source life, minimizing heat dissipation, and enhancing powertrain efficiency under dynamic driving conditions.
- **AI-enhanced Optimal Sensor Fusion and Perception Algorithms**: Methods employing AI-driven optimization to fuse LiDAR, RADAR, camera, and additional sensor data streams. Emphasis on optimizing sensor placement, data weighting, and feature selection to improve perception reliability, environmental understanding, and robustness in adverse conditions.

- **AI-based Optimal Motion Planning and Control Strategies**: Novel solutions in which AI acts as an optimization engine for trajectory planning, vehicle stability control, and real-time decision-making under uncertainties. This includes optimal waypoint selection, dynamic obstacle avoidance, and trade-offs among safety, comfort, and efficiency.
- **Optimized Hardware Acceleration and System Architecture via AI**: Techniques leveraging AI for optimizing hardware configurations, such as GPU, TPU, and FPGA resource allocation, to meet strict latency and power constraints. Contributions may discuss co-design methodologies for balancing computational throughput, energy efficiency, and system responsiveness.
- **AI-enabled optimization of In-Vehicle and V2X Communication Networks**: Strategies that use AI to optimize communication protocols, bandwidth allocation, and data routing. Focus areas include minimizing latency, ensuring robust V2V/V2I data exchange, and balancing performance across heterogeneous in-vehicle network standards (e.g., CAN, LIN, Automotive Ethernet).
- **AI-driven Real-Time Resource Allocation and Scheduling**: Dynamic optimization approaches for real-time scheduling of processing tasks, sensor updates, and safety-critical functions within resource-limited embedded platforms. Efforts may involve multi-resource optimization to ensure the timely execution of AI inference, collision avoidance routines, and onboard diagnostics.
- **AI-based Optimization for Vehicle Reliability, Fault Tolerance, and Safety Assurance**: AI-driven mechanisms that optimize fault detection, health management, and recovery strategies in autonomous vehicle electronics. Topics could include proactive maintenance scheduling, sensor redundancy optimization, and fail-safe reconfiguration to ensure continuous and secure operations.

Submission Guidelines: All manuscripts should present state-of-the-art materials in a tutorial or survey style, adhering to the IEEE Vehicular Technology Magazine (VTM) guidelines. Authors are encouraged to provide a clear connection between AI methods and the underlying optimization challenges they address in autonomous vehicle electronics. Contributions that include experimental validation, realistic test scenarios, and benchmark comparisons are strongly welcomed.

Guest Editors

1. Prof. Sousso Kelouwani, Université du Québec à Trois-Rivières (UQTR), Canda
2. Prof. Bai Li, Hunan University (HNU), China
3. Prof. Basilio Lenzo, University of Padova, Padua, Italy
4. Dr. Thanh Vo-Duy, Hanoi University of Science and Technology (HUST), Vietnam