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AUTONOMOUS VEHICLES: TECHNICAL SAFETY AND ALGORITHMIC CHALLENGES

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Annotation

Autonomous vehicles (AVs) represent a revolutionary shift in transportation technology. However, ensuring their technical safety and algorithmic reliability remains a key challenge. This paper analyzes the architecture of autonomous driving systems, focusing on sensor fusion, AI decision-making algorithms, and safety validation frameworks.

Keywords

Autonomous vehicles, AI algorithms, safety validation, sensor fusion, machine learning

Main Text

The development of autonomous vehicles combines mechanical engineering, computer vision, and artificial intelligence. The primary safety concern arises from the complexity of real-world environments where decision-making must occur in milliseconds.

Sensor fusion is central to safe navigation. LiDAR, radar, and camera data are integrated to create a real-time situational map. However, each sensor type presents unique limitations — for example, LiDAR's sensitivity to weather and camera reliance on lighting conditions.

Algorithmic safety challenges involve unpredictable human behavior, rare edge-case events, and ethical dilemmas in critical scenarios. Deep learning-based perception models often lack explainability, which complicates the certification of safety-critical systems. To address this, hybrid AI models that combine rule-based logic and machine learning are being developed.

Moreover, standards such as ISO 26262 and SAE J3016 define safety levels and testing protocols for autonomous systems. Future progress depends on simulation-driven testing and regulatory harmonization across nations.

References

1. Thrun, S. (2022). *Robotic Car Revolution: AI in Motion*. Springer.
2. SAE International (2023). *Levels of Driving Automation Standard J3016*.
3. Lee, C., et al. (2024). "Safety Assurance for AI-Driven Autonomous Vehicles," *IEEE Transactions on Intelligent Vehicles*, 9(2), 115–128.