Thesis Project Portfolio

Optimizing Real-Time Autonomous Vehicle Control through Advanced Neural Networks

(Technical Report)

Comparative Analysis of Autonomous Vehicle Regulation in the USA and South Korea

(STS Research Paper)

An Undergraduate Thesis

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Executive Summary

My two research papers focus on autonomous vehicles (AVs). The integration of AVs into public roadways represents a transformative advance in modern transportation. Due to their rapid evolution, these systems require optimization for safe and efficient operation and must also be accepted and regulated appropriately within society. As there are numerous hurdles and challenges remaining in both technical aspects and societal acceptance, my work addresses real-time environmental perception and legal frameworks. These technical and societal aspects are critical as they interplay with each other and are essential for the safe and widespread adoption of AVs. As AVs get closer to becoming a part of our reality, addressing these core aspects becomes increasingly urgent. My study aims to explore the enhancement of AVs' real-time operational capabilities and the impact of cultural values on regulatory practices. I hope this approach not only identifies the technical and societal barriers but also sets the stage for a broader discussion on the future of autonomous transportation.

The technical research focuses on optimizing real-time control of autonomous vehicles through advanced neural network architectures. The project addresses the need for improved environmental perception by leveraging multimodal sensor fusion of camera, lidar, and radar data. Using advanced simulation environments like CARLA and AirSim, the project generates comprehensive synthetic datasets to train and refine these neural network models. The results expect that this approach will significantly enhance perception accuracy and the autonomous system's ability to make real-time decisions, which are crucial for navigating complex driving environments. These findings underscore the crucial role of combining diverse sensor inputs and

cutting-edge machine learning strategies to advance the safety and efficacy of autonomous vehicle technologies.

The STS research explores the impact of cultural values on the regulatory frameworks for autonomous vehicles in the USA and South Korea. The comparative analysis reveals that cultural perceptions significantly influence the acceptance and development of AV policies. In the USA, an individualistic culture promotes a decentralized regulatory approach, emphasizing innovation and market-driven solutions. In contrast, South Korea's collectivist culture fosters a centralized approach, prioritizing societal safety and cohesive governance. The research highlights the critical importance of aligning AV development with prevailing societal values and legal frameworks, aiming to foster an adoption process that is sensitive to cultural variances while enhancing public safety and trust.

These two research projects demonstrate an understanding of the complexities associated with the development and societal integration of AVs. The technical research shows the enhanced real-time operational capabilities of AVs, proving the effectiveness of multimodal sensor fusion and advanced neural networks. The STS research provides insights into how AV technologies might be shaped by and shape societal norms and regulations differently across cultures. For the realistic and safe integration of AVs, real-world testing and detailed further research on AV policies are expected.