

# EE597 Reinforcement Learning Project Proposal

## Group Members:

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**Title:** Real-Time Autonomous Intersection Management Using Multi-Discount Q-Learning

## Abstract:

Addressing the critical issue of urban congestion, we propose a project to develop a real-time solution for autonomous intersection management. Leveraging cutting-edge Reinforcement Learning (RL) techniques, our project aims to innovate intersection control in the era of connected autonomous vehicles. With the advent of Connected Autonomous Vehicles (CAVs), the landscape of traffic management is poised for a transformative shift. In future traffic ecosystems, both CAVs and traffic infrastructure will serve as intelligent agents, collaborating seamlessly to alleviate traffic congestion in real time. By leveraging the symbiotic relationship between CAVs and traffic infrastructure, congestion at intersections, a critical bottleneck in road networks, can be significantly mitigated. Traditional traffic signal control methods struggle to adapt to dynamic traffic conditions, leading to congestion and delays. To overcome this challenge, we plan to use the RL algorithm Multi-Discount Q-Learning, designed to optimize time and speed adjustments for collision-free passage through intersections. Unlike previous approaches limited by known vehicle arrival times or simplifying scenarios, our solution enables real-time decision-making in complex traffic environments. Through a multi-agent architecture, our system learns to balance short-term and long-term goals, ensuring efficient collision-free speed control. Microscopic simulations demonstrate the effectiveness of our approach in achieving near-optimal performance, particularly in minimizing intersection travel times. By developing a scalable, efficient, and adaptable solution, our project aims to pave the way for safer, smoother, and more efficient urban transportation systems.

## References:

- [1] U.Gunarathna, S. Karunasekera, R. Borovica-Gajic and E. Tanin, "Real-Time Intelligent Autonomous Intersection Management Using Reinforcement Learning," 2022 IEEE Intelligent Vehicles Symposium (IV), Aachen, Germany, 2022, pp. 135-144, doi: 10.1109/IV51971.2022.9827188.
- [2] Karthikeyan P, Chen W-L, Hsiung P-A. Autonomous Intersection Management by Using Reinforcement Learning. Algorithms. 2022; 15(9):326. <https://doi.org/10.3390/a15090326>