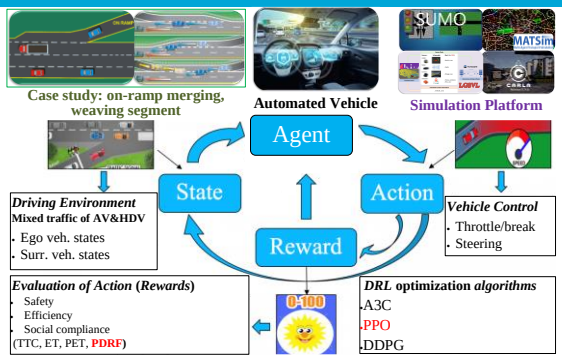
MSc. Thesis Project

Deep Multi-agent Reinforcement Learning for Vehicle-Traffic Light Federated Control and Optimization



Problem description

Deep Reinforcement Learning (DRL) has been applied in various domains, e.g., robotics, automated video game playing, and demonstrates its powerful ability. The most famous and successful use case might be AlphaGo, which beats the most excellent human Go players (including the world champion) by a big margin.

When it comes to transportation domain, DRL has been used for planning and control of Connected Automated Vehicles (CAVs) as well as for traffic light control separately. However, with vehicle to infrastructure connectivity, the information of traffic lights can guide CAVs with better speed control while the CAVs can serve as the probe for sensing the traffic status within the network. Thus, it is of great benefits to jointly optimize the control of traffic lights signaling and the driving of CAVs.

This master thesis research aims to try a primary study implementing Deep Multi-agent Reinforcement Learning for CAV-Traffic Light federated control and optimization through simulation. For training DRL models, open-sourced microscopic traffic simulation platforms (e.g., SUMO, VISSIM), as well as Automated Driving System (ADS) simulation tools (e.g., CARLA, LGSVL, Waymax, and Voyage DeepDrive) are available. The integrated tool, OpenCDA, which combine SUMO + CARLA, could also be a candidate platform for simulating and training the AV model. The outputs of this research will be very meaningful in providing insights for future DRL research in CAV and ITS domain.

Assignments

- Review and compare state-of-the-art DRL methods applied in various domains, especially in AV driving models;
- Select the dedicated driving maneuvers, preferentially involving both lateral and longitudinal control;
- Screen out the SOTA DRL methods suitable for selected driving maneuvers;
- Select and/or define suitable (integrated) evaluation metrics in terms of both safety and efficiency;
- Implement the DRL model and fine-tune it learning from scratch;
- Evaluate the DRL model's performance compared with baselines.
- Targeting high-quality publication.

Requirements

- Experienced in Python and TensorFlow/Pytorch;
- Experience with Deep Neural Network models and/or Reinforcement Learning;
- Prior knowledge and project experience of DRL would be a high priority but not a must.

Research group

Automated Mobility in Mixed Traffic; Transpiration AI; Transport & Planning

Thesis supervisors: Yongqi Dong (https://yongqidong.github.io/)

External supervisor and collaborator: Possibility with industry partners and PhD students

Information

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