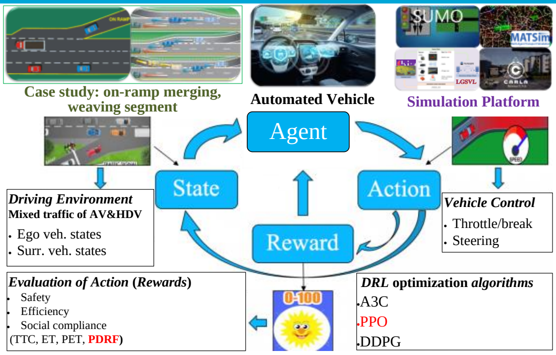
MSc. Thesis Project

Transport & Planning

Deep Reinforcement Learning for developing automated driving model learning from *tabula rasa*



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. AlphaGo Zero, which is the upgradation of AlphaGo, starting *tabula rasa*, and trained solely on DRL without any human data, guidance or domain knowledge beyond game rules, achieved superhuman performance, winning 100–0 against the previously champion-defeating AlphaGo. This is very surprising and amazing results. However, will this also work in the domain of training Automated Vehicle (AV) driving model? This research aims to try a primary study implementing DRL for selected driving tasks with both lateral and longitudinal control involved, e.g., on-ramp merging, lane-changing or overtaking, left turn at non-priority intersections, and learning from *tabula rasa*. 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, and Voyage DeepDrive) are all 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 AV 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.

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

Transport & Planning

Thesis supervisors:

Daily supervisors: Dr. ir. Haneen Farah; Ir. Yongqi Dong

External supervisor: Researcher from Netherlands Organisation for Applied Scientific Research (TNO)

Information

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