Learning of Costs for Socially Compliant Autonomous Navigations

MSc. Project Proposal at the Autonomous Multi-Robots Lab, Cognitive Robotics, TU Delft

Brief description: Humans, when driving in traffic, are able to weight traffic rules, which they are told by a driving instructor, and behaviors, which are either learnt by making experiences or by observing others. Recent advancements [1] allow us to solve nonlinear stochastic optimal control while requiring no derivatives of either the dynamics or cost. In this manner, we would like to develop a framework in which we can have Deep Neural Networks in our cost function, allowing us to learn specific behaviours that would otherwise be impossible to manually implement. In particular, it would be interesting to use Deep Learning to predict the probability of a given trajectory incurring in a right-of-way violation while crossing a complex intersection in the crowded canals of Amsterdam, and use that probablility as cost for the motion planner.

You would work within the TriLOGy project, a TU Delft collaboration with the Municipality of Amsterdam, the AMS Instutute and several other partners to achieve autonomous mobility in the Amsterdam's canals. You will have the oppurtunity of implementing your algorithms in both a quarter scale boat model developed at MIT [2] and a full scale model currently under development at AMS.

Desired qualities:

- Motivated and independent
- Good problem solving skills
- Experience/interest in Deep Learning and Reinforcement Learning
- Experience in Python, C++ and Robot Operating System (ROS)
- Knowledge of GPU programming is a big plus.

For further questions or to apply, please contact E. Trevisan <e.trevisan@tudelft.nl> or Ass. Prof. Dr. J. Alonso-Mora <j.alonsomora@tudelft.nl>. When applying, please provide a short motivation, up to date CV, a transcript of your current degree program and intended start date.

Group information: http://www.alonsomora.com/

Earliest Starting date: September 2021

References:

[1] Williams, Grady, et al. "Aggressive driving with model predictive path integral control." IEEE International Conference on Robotics and Automation (2016).

[2] Wang, Wei, et al. "Design. Modeling, and Nonlinear Model Predictive Tracking Control of a Novel Autonomous Surface Vehicle." IEEE International Conference on Robotics and Automation (2018).