Learning MPC control policies using neural networks

Project Summary

Model predictive control (MPC) is widely developed for the planning and control of autonomous driving systems. MPC can handle multi-objective optimization problems and has the features of good control performance and high robustness. However, the high computational complexity of MPC has restricted its application in real-time vehicle control. There are some solutions for this problem such as improving the hardware capacity or using an offline look-up table.

Project Type

- MA Thesis (6 months)
- Internship (3-6 months)

Required Qualifications

- Prior experience with MPC
- Prior experience with neural networks

Contact

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Detailed Description

The main purpose of the project is to learn the control policy of a nonlinear-MPC (NLMPC) using neural networks (NNs) to decrease its computational time. The NLMPC is designed to generate a desired velocity trajectory for the lower level controller while considering the energy consumption, safety and driving comfort. The designed NLMPC is then used as an offline planner to generate the training and testing data for the NN. Different driving scenarios are applied for this purpose.

References

- Siyi Zhang and Junzhi Zhang. Neural network optimized model predictive multi-objective adaptive cruise control. In MATEC web of conferences, volume 166, page 01009. EDP Sciences, 2018.
- Inkyung Sung, Bongjun Choi, and Peter Nielsen. On the training of a neural network for online path planning with offline path planning algorithms. International Journal of Information Management, 57:102142, 2021.