Lehrstuhl für Fahrzeugtechnik
Fakultät für Maschinenwesen
Technische Universität München

Semesterarbeit / Masterarbeit

Analysis of Racing Interaction Using Time-Optimal Sampling Strategies for Motion Prediction in Autonomous Vehicles

Are you intrigued by the complexities of autonomous racing and the challenge of predicting opponent movements? Engage in a groundbreaking thesis project that focuses on integrating a time-optimal sampling planner into the motion prediction module for autonomous racing. This project aims to analyze the interaction behavior between racing vehicles when utilizing this advanced planning approach, identifying scenarios where the approach may fail due to alternating evasive maneuvers between the ego vehicle and opponents. Your work will provide crucial insights into the limitations and strengths of this method in high-speed racing environments.

Description:
The TUM Autonomous Motorsport team develops software for the autonomous racecars of the Autonomous Challenge (IAC) and the Abu Dhabi Autonomous Racing League (A2RL). The team made history by winning the A2RL in 2024 at the Yas Marina Circuit against teams from international universities, competing at speeds exceeding 200 km/h. To achieve this, motion prediction, the prediction of the time-dependent vehicle positions within a time horizon, plays an important role in this software stack.

The aim of this thesis is to integrate an existing time-optimal sampling planner into the motion prediction module used in autonomous racing. This planner will generate optimal trajectories for opponents based on their predicted movements. The focus will be on analyzing how this integration affects racing interaction behavior, specifically in scenarios where both the ego vehicle and opponents continuously adjust their trajectories to avoid collisions.

Work packages:

- Integrate the existing time-optimal sampling planner algorithm into the motion prediction module
- Analyze the interaction behavior between the ego vehicle and opponents using the integrated prediction module.
- Identify specific scenarios where the time-optimal planning approach does not work effectively and propose modifications or alternative strategies to address identified issue

Requirements:

- independently familiarize yourself with the topic
- creativity
- a structured way of working
- knowledge of ROS2
- programming experience in C++ and python

Contact:
If you are interested in this project, send your CV, transcript and a short motivation to:

Daniel Esser, M.Sc. | daniel.esser@tum.de
Lehrstuhl für Fahrzeugtechnik | Prof. Dr. Markus Lienkamp