Interdisciplinary Project

Simulation Environment for Autonomous Racing

Situation:
In the context of the Indy Autonomous Challenge, software for an autonomous racing vehicle is developed at the Chair of Automotive Technology. This software manages the whole process of autonomous driving: Starting at the data acquisition, perception, planning and finally controlling the vehicle safely under racing conditions with multiple opponent vehicles.

Autonomous vehicles use a wide range of environment perception sensors such as cameras, lidar and radar. The detection of objects is performed with machine learning techniques that require vast amounts of data. To facilitate the learning process, we generate training data from simulation.

Project:
In this project, the current simulation in Unity shall be enhanced with further scenarios and sensor models to retrain a detection algorithm on the newly generated data.

In the first step of this project, environment and sensor modelling for autonomous vehicle simulation are reviewed. Based on the research, the current simulation suite is expanded by adding additional sensor models. The sensor models and overall integrity of the simulation is verified by the simulation of the full software stack on the simulator.

The following work packages comprise the student research project:

- Literature research about sensor models and environment modelling in Unity
- Expanding of the lidar model or creation of the radar sensor model
- Extension of the simulation for racing scenarios
- Evaluation of the sensor data quality by running the full software stack on recorded data

Lecture recommendation:
- Autonomous Driving Software Engineering, MW2472, summer and winter term, available online

Prerequisites:
- Ideally experience in working with C#, Unity or another game engine
- Involved working attitude

Should you be interested in this project or in another project in the context of the Indy Autonomous Challenge, send a short motivation letter, transcript and CV to:

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