

IDP or Guided Research Project | Master's Thesis

Exploiting Strong Priors to Improve Vehicle Motion Prediction Accuracy for Autonomous Racing



The TUM Autonomous Motorsport team is at the forefront of developing advanced software for autonomous racing vehicles, participating in and winning cutting-edge racing series such as the Indy Autonomous Challenge (IAC) and the Abu Dhabi Autonomous Racing League (A2RL). Pushing the limits of autonomy, performing precise overtaking maneuvers at speeds exceeding 270 km/h - where milliseconds count - requires highly efficient software.

Motion prediction networks typically rely on past trajectories and map information, while autonomous racing can supply additional priors that stabilize the prediction. Race control flags, the current race phase, and opponent-specific quantities such as estimated velocity profiles are all viable inputs. Such priors constrain the prediction space and let the network resolve situations that trajectories and map alone leave ambiguous.

This research project investigates how such priors can be integrated into motion prediction networks, evaluating their effect on prediction accuracy and the robustness to inaccurate priors.

Work packages:

- Literature research on improving motion prediction accuracy using priors
- Implementation of mechanisms to integrate racing-specific priors into motion prediction networks
- Evaluation of the proposed method on real-world autonomous racing data
- Analysis of the results and identification of directions for future research

Requirements:

- Enthusiasm about deep learning and autonomous driving
- Good programming skills in Python/C++
- Excellent Grades in ML- / DL-related courses
- Ability to collaborate in a team and engage in interdisciplinary research

If you are interested in this project, send me (marcel.weinmann@tum.de) your CV and grade report (Application Deadline 14.09.2026).