Systematic Synthesis of NCAP Traffic Scenarios

Background

For developing safe autonomous vehicles (AVs), testing their motion planners systematically is desirable. Synthesizing traffic scenarios from formal specifications enables this systematic testing. In previous research, we developed methods to synthesize traffic scenarios from formal specifications [1, 2]. One remaining limitation is manual creation of formal specifications, depending on expert knowledge. Other researchers developed approaches to automatically generate formal specifications that ensure suitable test case coverage in compliance with SOTIF and NCAP standards [3]. Together with the authors of [3], we aim to combine our scenario synthesis with their specification creation and coverage.

Description

You will implement the integration of both approaches. Your research will therefore consist of the following tasks.

Tasks

- Review existing solutions for the problem at hand.
- Create CommonRoad lanelet networks for NCAP scenarios.
- Derive formal specification templates for NCAP test cases.
- Integrate parameters from the feature model in [3] into our specifications.
- Synthesize compliant scenarios.
- Documentation of the code and results.

References

[1] Moritz Klischat and Matthias Althoff. Synthesizing traffic scenarios from formal specifications for testing automated vehicles. In *IEEE Intelligent Vehicles Symposium*, pages 2065–2072, 2020.

[2] Florian Finkeldei and Matthias Althoff. Synthesizing traffic scenarios from formal specifications using reachability analysis. In *IEEE International Conference on Intelligent Transportation Systems*, pages 1285–1291, 2023.

[3] Lukas Birkemeyer, Julian Fuchs, Alessio Gambi, and Ina Schaefer. Sotif-compliant scenario generation using semi-concrete scenarios and parameter sampling. In *IEEE International Conference on Intelligent Transportation Systems*, pages 2139–2144, 2023.