

To all interested students



## [Bachelor Thesis] Graph-Level Anomaly Detection in Traffic Scenarios for Autonomous Driving (AD)

Traffic scenarios and situations that are especially critical and/or occur only very rarely in the real world (i.e. anomalies) are of particular interest for the development and verification of autonomous vehicles. An essential part of my research is to extract such scenarios automatically from data sets as a first step and generate them synthetically as a next step, using deep learning methods on graph-structured data. One direction towards finding edge case scenarios in large-scale datasets is to apply concepts of anomaly detection. Specifically, as traffic scenarios are modeled as heterogeneous, spatio-temporal graphs in our research, the problem boils down to exploring and applying graph anomaly detection to especially large and complex scenario graphs.

### Structure

- Literature research and exploration of the current state-of-the-art in ...
  - ... graph representation learning using Graph Neural Networks (GNN)
  - ... graph-anomaly detection, specifically for dynamic and heterogeneous graphs
- Evaluation of existing methods and application to complex traffic scenario graphs
- Improvement and extension of existing methods to the specific domain of scenario-based testing in AD
- Benchmark, quantitative and qualitative evaluation of different approaches
- Composition of a scenario catalog / dataset of semantically "abnormal" traffic scenarios

### Preferable skills:

- Solid foundations in the field machine learning, specifically deep learning
- Fundamental knowledge of Graph Neural Networks
- Hands-on experience with Python and frameworks like PyTorch and / or TensorFlow
- Willingness to acquire new technical knowledge, read and understand scientific papers and work independently
- Fluent in German and / or English

### Required documents:

- Brief cover letter (3-4 sentences)
- Brief CV (max. 2 pages)
- Excerpt of latest academic achievements