

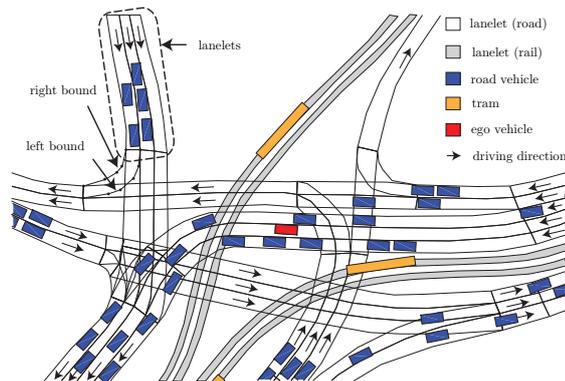
# Generation of Interactive Benchmark for Motion Planning of Autonomous Vehicles



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## Background

CommonRoad[1] is a collection of composable benchmarks for motion planning on roads, and provides researchers with a means of evaluating and comparing their motion planners for autonomous vehicles. An exemplary scenario created from the data recorded in the city center of Munich (Stachus) is shown below:



Visualization of an exemplary scenario from Stachus using CommonRoad.

However, currently CommonRoad only provides pre-recorded scenarios, i.e. the other traffic participants in the scenario are **non-interactive** and their behaviours do not change with regard to the action of the ego vehicle. This disadvantage could be overcome by integrating CommonRoad with SUMO [2] - an urban mobility simulator. An artificial traffic scenario generated by SUMO is shown below:



An example of SUMO scenario.

## Description

The aim of this thesis is to elevate the impact and influence of CommonRoad by creating a **interactive** benchmark for motion planning of autonomous vehicles. A raw idea of its working mechanism is as follows:

1. Establish correspondence between CommonRoad and SUMO by converting CommonRoad road networks to SUMO road networks using existing converter.
2. Establish connection between CommonRoad and SUMO using existing CommonRoad-SUMO interface.
3. Generate reactive behaviors of other traffic participants in SUMO based on ego vehicle's action in every time step, and update the states of corresponding traffic participants



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### Advisor:

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### Research project:

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### Type:

Bachelor/Master's thesis

### Research area:

Benchmark Creation,  
Autonomous Vehicles

### Programming language:

C++, Python

### Required skills:

Good programming skill in both C++ and Python; Optional: knowledge of Docker

### Language:

English

### Date of submission:

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in CommonRoad.

4. Generate a bunch of interactive scenarios with deterministic parameters to guarantee reproducibility, and attach necessary elements (scenario ID, planning problems, cost functions, etc.) to form the benchmark.
5. Deploy identical environment on the Chair's server to reproduce the scenario in planning phase , and evaluate uploaded solutions to scenarios.

## Tasks

- Familiarize with CommonRoad toolkit
- Familiarize with SUMO
- Familiarize with CommonRoad-SUMO interface
- Generate interactive scenarios as mentioned above, and finally produce a benchmark
- Deploy a running environment to the Chair's server
- Evaluate uploaded solutions based on given cost functions

## References

- [1] Commonroad. <https://commonroad.in.tum.de/>.
- [2] Sumo. [https://sumo.dlr.de/wiki/Simulation\\_of\\_Urban\\_MObility\\_-\\_Wiki/](https://sumo.dlr.de/wiki/Simulation_of_Urban_MObility_-_Wiki/).



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