Student Thesis

ika | **RWTH AACHEN UNIVERSITY**

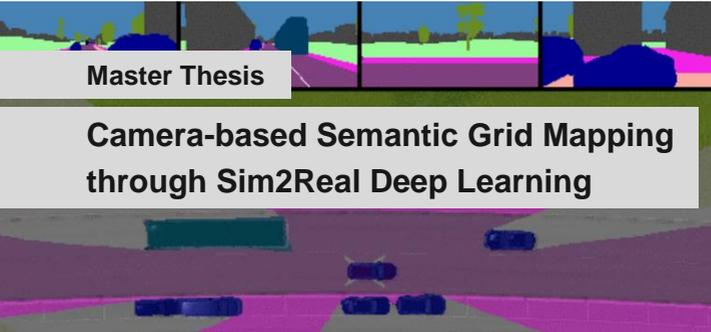**Master Thesis**

Camera-based Semantic Grid Mapping through Sim2Real Deep Learning

Background and Goal of the Thesis

Accurate environment perception is essential for automated driving. Occupancy grid maps in the world plane are a popular representation of the environment of automated vehicles, indicating the occupancy of any cell in a 2D grid of a vehicle's surroundings. Semantic grid maps also model a semantic description (e.g., "car", "bus", "road", …) of each cell's occupancy.

A 360° camera system can be an inexpensive sensor setup for estimating grid maps. Apart from geometry-based methods, deep learning and hybrid approaches exist for the transformation of camera images to bird's eye view. In order to minimize the manual labelling effort for deep learning approaches, synthetic datasets can be leveraged. This however introduces a domain shift, when applying trained models to real-world data (Sim2Real).

The goal of this thesis is to extend an existing Sim2Real deep learning approach for the transformation of images from multiple vehicle-mounted cameras to a semantically segmented image in bird's eye view (Cam2BEV). This involves identifying shortcomings of the existing approach; researching other methodologies in literature; implementing new ideas; transforming the bird's eye view image to a semantic grid map; evaluating the work; and more.

You will have access to ika's extensive hardware and software infrastructure, including research vehicles, high-performance computers, simulation environments, and deep learning-frameworks. Additionally, you can expect close supervision and collaboration with other highly motivated researchers.

Working Points

- Familiarization with ika's existing software components for deep learning and specific approach for the task at hand
- Literature research on transformation of camera images to bird's eye view, semantic grid maps, and existing datasets
- Extension of existing Sim2Real deep learning approach and/or development of new techniques for the estimation of a semantic grid map
- Generation of synthetic datasets using simulation environments
- Evaluation of the implemented methodology using synthetic and real-world datasets

Department

Vehicle Intelligence & Automated Driving

Contact

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Language

German or English

Starting Date

As soon as possible

Requirements

- Reliability, commitment, and enjoyment of working independently

- Experience with
  - Unix-Shell
  - Python
  - Deep Learning
  - Computer Vision

Application

Informal application including a short CV and an academic transcript record