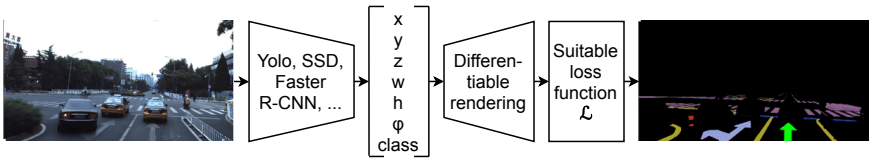
Karlsruhe Institute of Technology

Bachelor Thesis / Master Thesis



Overview of the intended approach with a camera image and pixel-wise ground truth that is supposed to be used to learn parametric instances, both taken from Apolloscapes dataset.

Learning Vectorial / Parametric Representations from Pixel-wise Labeled Data

Many datasets for deep learning (DL) for autonomous driving, such as Cityscapes, Mapillary Vistas or Apolloscapes, only contain pixel-wise labeled ground truth or at most polygon instances.

In contrast, especially elements of the static world can often be represented parametrically in a low-dimensional parametric space. For instance, dashed lane markings, traffic signs or traffic lights can be represented by a horizontally or vertically oriented bounding box that has only six parameters and a semantic class.

This low-dimensional representation can not only be directly stored in a compact high definition (HD) map or used in a simultaneous localization and mapping (SLAM) problem. It also vastly reduces the amount of output parameters, promising better performance or even real-time capability.

Recent progress in deep learning enables the training of such desirable parametric regression tasks using pixel-wise ground truth as given in the above-mentioned existing datasets.

The proposed thesis consists of the following parts:

+ Literature research about SLAM and relevant DL approaches
+ Adaptation of a state-of-the-art (oriented) bounding box / regression task approach (Yolo, Faster RCNN, ...) to output a suitable parametric representation for HD map elements such as lane markings or traffic signs / lights
+ Implementation of an additional differentiable rendering layer and/or suitable loss functions for evaluation on pixel-wise data
+ Training and evaluation including an ablation study

Conducting this thesis excellently will lead to a tier 1 computer vision or robotics conference publication.

I am happy to answer any questions you might have. Feel free to ask for an appointment or directly ask at my office!

Institute of Measurement and Control Systems (MRT)
Prof. Dr.-Ing. Christoph Stiller

Advisor:
Jan-Hendrik Pauls, M.Sc.

Programming language(s)[1]**:**
Python advanced

System, Framework(s):
Linux, PyTorch, Keras, Tensorflow

Required skills:
- Comprehensive prior knowledge of deep learning (DL)
- Hands-on experience with at least one DL framework
- Excellent grades or evidence of excellent learning ability

Language(s):
German, English

For more information please contact:

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Or directly send in your application including your current grades as well as our questionnaire!

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[1] **skill levels:**
beginner < 500 lines of code (LOC)
advanced 500 – 5000 LOC
proficient > 5000 LOC