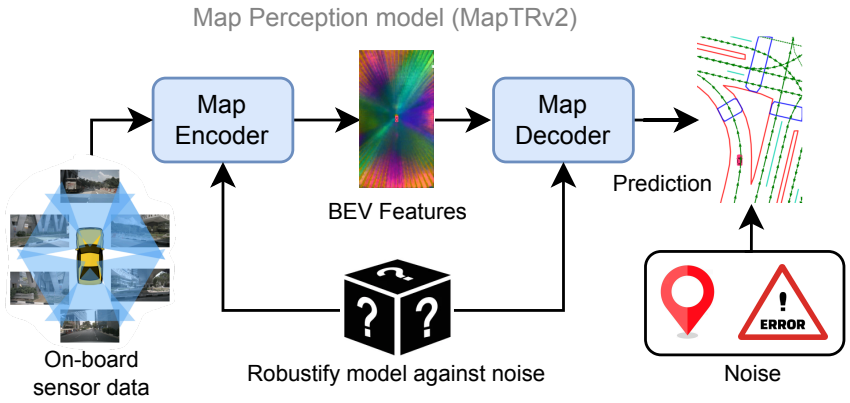
Karlsruhe Institute of Technology

Bachelor Thesis / Master Thesis



Deep Learning: Robustifying HD Map Perception against Localization and Map Label Noise

Current state-of-the-art map construction methods such as MapTRv2 use sensor data (360° surround view camera setup and LiDAR) to construct high definition (HD) maps. These methods consists of two components the map encoder and the map decoder. The map encoder extracts features from the sensor data and transform them into a Bird's Eye View (BEV) representation, whereas the map decoder derives a map in polyline representation using transformer-based architectures from those BEV features. Prior work has demonstrated that the performance of these models is significantly degraded by localization noise (arising from inaccurate ego-poses) and noisy HD map labels (caused by temporal degradation or inaccurate annotations). While numerous methods for label noise robustness have been developed in the field of Computer Vision (e.g., MentorNet, Co-Teaching, or robust loss functions), their application and rigorous evaluation within the geometrically sensitive domain of HD Map Perception remain largely unexplored.
The goal of this thesis is to adapt and implement various robustification methods to an HD map perception framework (e.g., MapTRv2) to successfully overcome performance degradation caused by localization noise and noisy labels. The work will be conducted using the Argoverse 2 [1] dataset.

The proposed thesis consists of the following parts:

+ Literature research about Robustification against noise in Deep Learning
+ Familiarization with the MapTRv2 framework and the Argoverse 2 dataset
+ Implementation of various robustification methods against localization noise and noisy labels

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

Literature

1. Bencheng Liao et al., MapTRv2: An End-to-End Framework for Online Vectorized HD Map Construction, https://arxiv.org/abs/2308.05736
2. Han et al., Co-teaching: Robust Training of Deep Neural Networks with Extremely Noisy Labels, https://arxiv.org/pdf/1804.06872

[1] Argoverse 2: https://www.argoverse.org/av2.html

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

Advisor:
Jonas Merkert, M.Sc.

Programming language(s)[1]:
Python advanced

System, Framework(s):
Linux, PyTorch

Required skills:
- Expericence with Neural Networks in Deep Learning context
- Experience with PyTorch, NumPy and Matplotlib
- Motivation and independent work style with the interest learning new things

What we offer:
- Work with state-of-the-art methods and cutting-edge research
- Access to large GPU servers and HPC clusters
- Supervision by experienced researchers in Deep Learning

Language(s):
German, English

A (partially) successful thesis may lead to a joint **international conference publication** of the scientific work

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For more information please contact:

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