KIT
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mrt

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

Bachelor Thesis / Master Thesis

On-board sensor data

Map Encoder · BEV Features

2D Backbone · PV to BEV · Transformer Decoder

Map Perception model (MapTRv2)

"deprecated map" priors

Prior Encoder · Mapshift Predictor · $\Delta x, \Delta y, \Delta \phi$
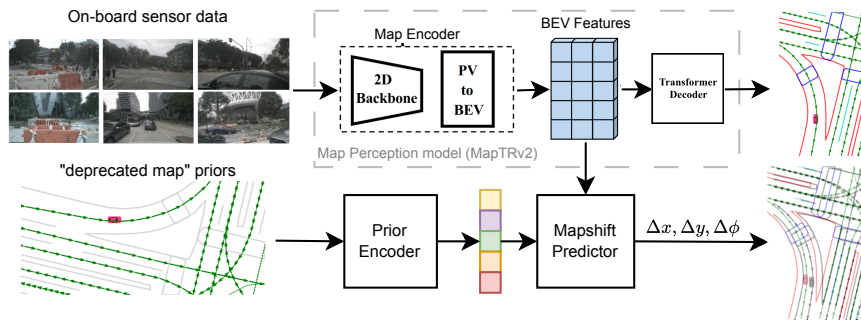
Deep Learning: Mapshift-Prediction based on (deprecated) map priors for online map perception

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 extract features from the sensor data and transform them into a Bird's Eye View (BEV) representation and derive maps in polyline representation using transformer-based architectures. However, the quality of the predicted HD map depends on precise sensor data with correct calibration and an accurate vehicle localization. In real-world scenarios there is always some noise in the localization and sensor data so that a systematic correction is beneficial.

The goal of this thesis is to investigate the possibilities of a learned mapshift predictor. Therefore, the map construction model MapTRv2 should be extended by a second prediction head, which estimates the shift with respect to the x- and y-axis and a possible rotation ϕ of the predicted map compared to the ground truth map. For a reliable mapshift estimate also prior knowledge is needed. For that reason using different types of prior knowlegde such as information from deprecated maps or other information should be evaluated. The dataset that will be used in this thesis is Argoverse 2[1].

The proposed thesis consists of the following parts:

+ Literature research about Error estimation and Map perception
+ Implementation of a second prediction head predicting the shift and rotation of the predicted map
+ Training and Evaluation of the implemented network regarding different prior knowledge and also mapshift prediction methods

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. Samuel M. Bateman et al., Exploring Real World Map Change Generalization of Prior-Informed HD Map Prediction Models, `https://arxiv.org/abs/2406.01961`

Advisor:
Jonas Merkert, M.Sc.

Programming language(s)[1]:
Python   advanced

System, Framework(s):
Linux, PyTorch

Required skills:
- Experience 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

For more information please contact:

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

[QR code]

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