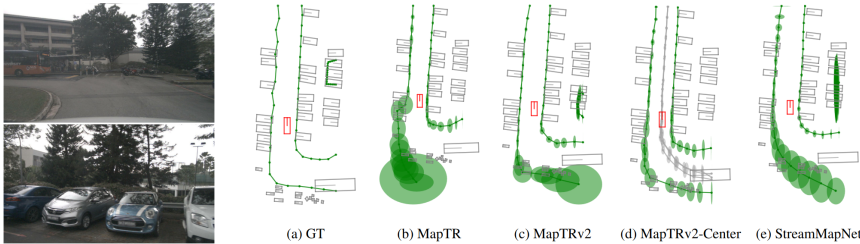


Bachelor Thesis / Master Thesis



Road border Detection Uncertainty for a Variety of Architectures in a Parking Lot

Modeling Uncertainty for Birds-Eye-View Map Perception with Detection Transformers

The field of map perception, meaning the detection of road features like road borders, lane dividers and lane centerlines, has made remarkable advances in recent years with improvements in deep learning architectures and new large scale datasets. Applied at scale, map perception could massively boost the applicable domains of automated driving. These models take in data from multiple cameras arranged in a ring together with other optional sensors and directly predict road borders, lane dividers, lane centerlines etc. as polylines.

A gap in research currently exists regarding the consideration of uncertainty in the resulting detections, on a point and instance level as well as one-shot or aggregated. Properly calibrated uncertainty is highly essential for many downstream tasks and determination of safe operating domains. The aim of this thesis is to design proper probabilistic uncertainty outputs and apply them to state-of-the-art map perception deep learning architectures.

The proposed thesis consists of the following parts:

- + Literature research about Birds-Eye-View Road Feature Perception
- + Design of Probabilistic Uncertainty Outputs
- + Adaption of a dataset for the learning task, e.g. [3]
- + Implementation and training of a network
- + Evaluation of the resulting performance

References

- [1] Bencheng Liao et al. (2023). MapTRv2: An End-to-End Framework for Online Vectorized HD Map Construction.
- [2] Xunjiang Gu et al. (2024). Producing and Leveraging Online Map Uncertainty in Trajectory Prediction.
- [3] Wilson, B., Qi, W., Agarwal, T., Lambert, J., Singh, J., Khandelwal, S., ... & Hays, J. (2023) Argoverse 2: Next generation datasets for self-driving perception and forecasting.

Additional Information

- + Students of other faculties than Mechanical Engineering are also welcome!
- + 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:
Fabian Immel, M.Sc.

Programming language(s)¹:
Python proficient

System, Framework(s):
Pytorch/Numpy, Linux

Required skills:

- Prior knowledge of deep learning / neural networks
- Experience with numerical libraries in Python like Numpy or Pytorch
- Work on your own

What we offer:

- Technical guidance by experienced deep learning practitioners
- Work on state of the art research
- Access to large scale GPU resources for model training

Language(s):
German, English

For more information please contact:

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Or directly send in your application including your current grades and a brief description of your prior coding experience!

¹ skill levels:

beginner < 500 lines of code (LOC)
advanced 500 – 5000 LOC
proficient > 5000 LOC