Lehrstuhl für Fahrzeugtechnik
Fakultät für Maschinenwesen
Technische Universität München

MA

Context-Aware Motion Prediction with Vision-Language Models for Urban Autonomous Driving

Accurate motion prediction of surrounding agents is a key requirement for autonomous driving in urban environments. Current state-of-the-art algorithms typically rely on past trajectories and map data to forecast future movements of vehicles, cyclists, and pedestrians. While this setup provides strong priors, it often neglects critical contextual cues from the scene — such as traffic lights, turning signals, or dynamic interactions — which human drivers naturally incorporate into their decision-making. As a result, prediction models may fail in complex urban scenarios where context plays a decisive role.

This thesis explores how vision-language models (VLMs) can be leveraged to embed rich visual context from onboard cameras into motion prediction systems. The idea is to extract embeddings from VLMs that capture both static (e.g., road layout, traffic signs) and dynamic (e.g., signaling vehicles, crossing pedestrians) information, and integrate these embeddings as additional input features to a prediction model. By grounding motion prediction in richer contextual information, we aim to improve the robustness and accuracy of trajectory forecasting in real-world driving scenarios.

+ Possibility of a publication in case of excellent work.
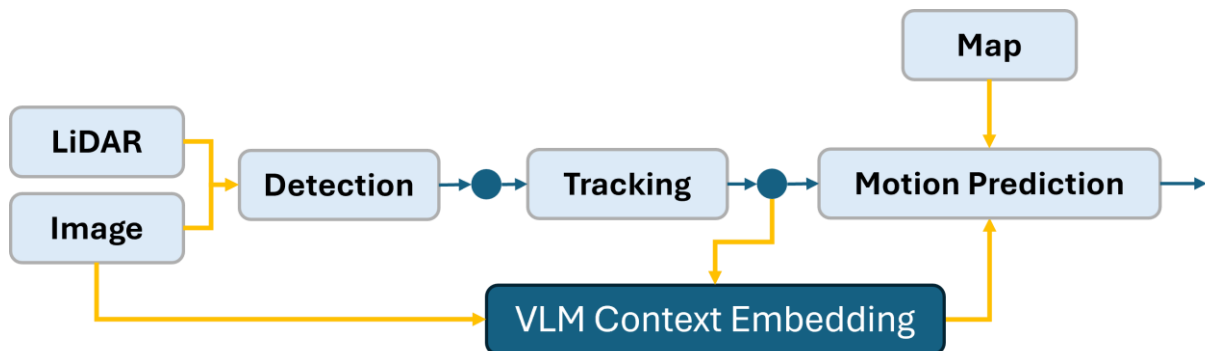
Work packages:

- Literature review: Context-aware motion prediction, VLMs
- Design and implementation of the context-aware motion prediction model.
- In-depth evaluation and comparison.
- Iterative improvement.

Requirements:

- Very good programming skills in Python.
- High personal motivation and independent working style.
- Very good language proficiency in German, English or French.

The thesis should clearly document the individual work steps. The candidate undertakes to complete the term paper independently and to indicate all scientific aids used.

The submitted work remains the property of the chair as an examination document.

Prof. Dr.-Ing. M. Lienkamp   Betreuer: Loïc Stratil, M. Sc.

Ausgabe:_____   Abgabe: _____