

Semester-/Master-Thesis/IDP

Vision-Based Extraction of Vehicle and Pedestrian Trajectories for Behavioral Analysis of Street Interventions

As part of MCube MOSAIQ (Mobility and Urban Climate in Future Neighborhoods), TUM together with the City of Munich and partners is temporarily redesigning street sections and public spaces in Schwabing-West and Moosach, adding gathering spaces, greenery, safer crossings, and cyclist amenities, and scientifically evaluating how these interventions change everyday mobility behavior.

A central question is whether people actually change their behavior after an intervention, in particular where they choose to stop, linger, and spend time in the redesigned space. Cameras have been installed at multiple intervention locations to record street-level footage.

This thesis focuses on building a machine-vision pipeline that detects and tracks vehicles and pedestrians across the recorded footage and turns it into a clean, structured trajectory database, which will form the basis for downstream behavioral analyses.

Work Packages

- Literature review on vision-based multi-object detection and tracking for traffic/pedestrian scenes
- Set up a detection and tracking pipeline (e.g. YOLO-based detector + multi-object tracker) for vehicles and pedestrians on the multi-camera footage
- Handle practical challenges: per-location calibration/homography, occlusion, varying lighting and weather
- Post-process raw tracks into a clean trajectory database with quality checks
- Derive first indicators of stopping/dwelling behavior from the trajectory database
- If enough interaction data between road users is captured, calibrate a social force model as a behavioral surrogate against the extracted trajectories
- Evaluate pipeline accuracy against manually counted ground truth data

Prerequisites

- Programming skills in Python
- Interest in computer vision / deep learning (e.g. object detection, tracking)
- Independent and structured working style

Variations of the topic and additional research questions proposed on your own initiative are always welcome. If interested, please send your CV, transcript, and a short motivation.

The write-up should document the work steps clearly. The candidate commits to working independently and citing all resources used properly.

Prof. Dr.-Ing. M. Lienkamp

Supervisor: Till Zacher, M.Sc.

Issued: _____

Due: _____