

Master's Thesis

Where Should Traffic Sensors Go? Sensor Placement for Urban Flow Estimation

- Traffic sensors observe only a small part of an urban road network. Their locations determine how much these measurements reveal about traffic on unobserved roads.
- This thesis investigates **where a limited number of sensors should be placed** to improve network-wide traffic-flow estimation, especially when historical measurements are unavailable.
- Available resources include OpenStreetMap road graphs, synthetic traffic flows, and an existing pretrained graph neural network—a model that learns relationships between connected road segments.
- The core study uses synthetic demand scenarios with known flows on every road segment. It compares placement strategies with a fixed estimator and equal sensor budgets; real-data evaluation is an optional extension.

Work Packages

- Review sensor-placement methods and reproduce random and graph-based baselines
- Develop a placement strategy using synthetic flows or information from the existing model
- Compare strategies across sensor budgets and road networks on held-out demand scenarios; keep test flows hidden during sensor selection
- Analyse estimation errors on unobserved roads, robustness, and computational cost; document reproducible results and limitations

Prerequisites

- Programming skills in Python and basic knowledge of machine learning
- Interest in transport networks, graph methods, or optimisation
- Independent, structured work and critical interpretation of results

Interested? Contact Joshua Mutter with your CV, transcript, and a short statement of motivation. Experience with PyTorch or geospatial data is welcome. The precise scope will be agreed together.

Prof. Dr.-Ing. M. Lienkamp

Supervisor: Joshua Mutter, M.Sc.

Issued: _____

Due: _____

