Institute of Automative Technology
TUM School of Engineering and Design
Technical Univercity of Munich

Bachelor-/Semester-/Master-Thesis

Pattern Recognition in Dynamic Graphs for Shared Mobility Systems

Background

Shared mobility systems such as e-scooters, bikes, and car sharing can be represented as dynamic graphs, where nodes correspond to locations (districts, stations, hexagons) and edges reflect trip flows. Anomalies in these systems are not only visible in individual time series, but also in the structure and evolution of the mobility network. For example, sudden demand spikes in one district, disrupted flows between areas, or structural breaks caused by large events may manifest as unusual graph patterns. Identifying, classifying, and linking these anomalous graph patterns to real-world causes is a promising approach to improve operational planning, anticipate disruptions, and support decision-making in urban mobility.

Your Role

- Literature research: Review pattern recognition and anomaly detection methods for dynamic graphs (graph signal processing, temporal motifs, graph neural networks).
- Graph modeling: Represent shared mobility trips as a dynamic graph with nodes, edges, and temporal features.
- Pattern discovery: Detect recurring “normal” mobility patterns and identify anomalous deviations in graph structure or signals.
- Anomaly reasoning: Relate detected graph anomalies to possible external causes (e.g., weather, events, strikes, policy changes).
- Evaluation & visualization: Benchmark selected methods and present results using intuitive visualizations (dynamic network plots, heatmaps, map overlays).

What should you bring along?

- Strong interest and motivation in mobility data science
- Initiative & independent way of working
- Basic programming skills (Python)

Language

English/German

The thesis should document the individual work steps in a clear form. The candidate undertakes to complete the term paper independently and to indicate the scientific aids used.

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

Prof. Dr.-Ing. M. Lienkamp

Supervisor: Svetlana Zubareva, M. Sc.

Ausgabe:_____

Abgabe: _____