Chair of Transportation Systems Engineering
TUM School of Engineering and Design
Technical University of Munich

AI Models for Predicting Transport Disruptions

Master's Thesis

M.Sc. Hamza Begic

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Description

Transport disruptions are defined as any planned or unplanned event that significantly impedes the normal functioning of a transportation network. They are a major source of economic loss, safety risk, and environmental impact worldwide. One of the most effective ways to mitigate these consequences, and move toward truly resilient transport systems, is the ability to accurately predict traffic states **before, during, and after** disruptive events. However, disruption-focused prediction is considerably more challenging and far less developed compared to traditional traffic forecasting under normal conditions.

To better understand these events, disruptions can be grouped into two main categories:

- **Predictable disruptions**: road work zones (Liu et al., 2024), public events (Lei et al., 2025), adverse weather (Zhang et al., 2024)
- **Unpredictable disruptions**: traffic crashes and accidents (Park et al., 2025), black swan events (Lin et al., 2026)

In this Master's thesis, the student will focus on **one** of these disruption types and develop a state-of-the-art AI model tailored to its specific challenges.

Tasks

Depending on the chosen disruption type, the student will:

- Examine relevant state-of-the-art AI approaches for predicting the selected disruption and its impact on traffic.
- Collect and preprocess required datasets (traffic flow, weather data, event data, roadwork logs, incident data, etc.)
- Design and implement the selected AI model suited for the disruption's characteristics
- Address disruption-specific challenges, such as:
    1. data imbalance and scarcity (traffic crashes and accidents)
    2. granularity mismatch between data sources (adverse weather)
    3. web scraping data (public events)
    4. changing road networks (road work zones)
    5. data scarcity and sensor unreliability (black swan events, focus on floodings)
- Evaluate model performance and compare it to suitable baselines

Requirements

- Background in Data Engineering, Computer Science, Mathematics or another similar field
- Experience with Python and common ML libraries
- Familiarity with graph neural networks or other deep learning architectures
- (Bonus) Experience working with geospatial data (osm, lanelet2, commonroad, etc.)

Starting Date

As soon as possible

How to Apply

If interested, please email your resume, academic transcripts, and preferred start date to Hamza Begic (hamza.begic@tum.de). A brief cover letter explaining your interest in the topic and relevant experiences is encouraged.

References

Lei, T., Ding, Y., Wen, J., Yin, X., Gong, L., Luo, Q., 2025. A multi-timescale dynamic graph attention network (mtdgat) for short-term traffic prediction under special events. Expert Systems with Applications 282, 127649. URL: https://www.sciencedirect.com/science/article/pii/S0957417425012710, doi:doi: https://doi.org/10.1016/j.eswa.2025.127649.

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Zhang, W., Yao, R., Yuan, Y., Du, X., Wang, L., Sun, F., 2024. A traffic-weather generative adversarial network for traffic flow prediction for road networks under bad weather. Engineering Applications of Artificial Intelligence 137, 109125. URL: https://www.sciencedirect.com/science/article/pii/S0952197624012831, doi:doi: https://doi.org/10.1016/j.engappai.2024.109125.