Technische Universität München
Chair of Transportation Systems Engineering

Master Thesis Topic

Agent-based transport simulation with mobility hubs in Munich

Background

Car-reducing measures are aiming to bring down the use of private cars in Munich and to encourage alternative ways of transport for people in the city. In aqt, the team of MCube is testing a spatial and transport concept for Munich with the goal to increase the acceptance and use of multimodal transport options and to improve the use of public space. In particular, one of the measures being considered is to **increase the number of mobility hubs** (or stations), as well as the **supply of shared vehicles** with regards to car-sharing and micromobility.

The goal of this master thesis is to explore the transportation mode choices of travellers in cases of increased supply of shared mobility, which requires the development of targeted discrete choice models. Furthermore, the master's thesis student will develop **agent-based simulation scenarios**, in order to estimate the expected demand for car-sharing and micromobility. The objective of this master's thesis can be summarised in the research question: "Do measures that encourage the use of shared mobility result in a modal shift from private vehicles to car-sharing and micromobility?"

Methodology

The mode choice preferences of individuals in Munich have already been surveyed in a survey, which was conducted by the Chair of Transportation Systems Engineering (TSE). The prospective student is expected to:

1. Analyse the available data and develop suitable mode choice model(s) that can be implemented in agent-based simulations. Suitable frameworks can be found in Moeckel et al. (2020), Hörl & Balac (2021) and Briem, Mallig & Vortisch (2019).
2. Develop agent-based simulation scenarios in MATSim by making diverse assumptions and using available open data, especially considering the siting of mobility hubs.
3. Perform sensitivity analyses of the simulation parameters and present the results.
4. Estimate the expected modal shift from a citywide implementation of the mobility hubs strategy.

The agent-based model of Munich from the TUM Professorship of Travel Behaviour will be utilised in this thesis. Deviations from the project description and new ideas are welcome.

Results

This master thesis will result in a complete agent-based simulation framework of car-sharing and shared micromobility in Munich. The main objective is to estimate the modal shift towards those modes stemming from the expansion of the mobility hubs network.

Key skills

- Completed the course “Applied Transport Modelling with MATSim” at TUM or similar **(necessary).** Experience in agent-based modelling is very important in this master thesis project.
- Completed the course “Discrete Choice Methods for Transportation Systems Analysis” at TUM or previous experience with discrete choice modelling tools such as Biogeme, Apollo R or similar will help (nice to have).
- Able to analyse data in Excel, Python, R or using other tools.
- Fluency in English and good scientific skills will be highly appreciated.

References

Hörl, S., & Balac, M. (2021). Introducing the eqasim pipeline: From raw data to agent-based transport simulation. *Procedia Computer Science, 184,* 712-719.

Moeckel, R., Kuehnel, N., Llorca, C., Moreno, A. T., & Rayaprolu, H. (2020). Agent-Based Simulation to Improve Policy Sensitivity of Trip-Based Models. *Journal of Advanced Transportation, 2020*.

Briem, L., Mallig, N., & Vortisch, P. (2019). Creating an integrated agent-based travel demand model by combining mobiTopp and MATSim. *Procedia Computer Science, 151,* 776-781.

For more information about MCube aqt, please check:
https://www.mcube-cluster.de/en/projects/aqt/

Starting date

As soon as possible starting April 2023.

How to apply:

Interested applicants should contact Filippos Adamidis (filippos.adamidis@tum.de) by email. Please include (1) a short explanation (max. 100 words) of why you are interested in this project, (2) a recent transcript of records and (3) any relevant work (e.g. report, in particular related to MATSim).