Open-source based methodology for creating small-scale commercial traffic for MATSim simulations

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Abstract

In the presentation will be introduced a workflow of creating a small-scale commercial traffic for agent-based transport simulations by using only open data. The objective of adding commercial traffic is to extend existing personnel transport models to get complete models.

Keywords agent-based simulation, freight traffic, vehicle routing problem, open data, synthetic demand generation

1 Motivation and research objectives

Microsimulation frameworks, such as MATSim (Multi-Agent Transport Simulation) [1], provide a valuable tool for analyzing and optimizing transportation systems by simulating the behavior of individual agents within a dynamic environment. However, one of the challenges faced by MATSim practitioners is the creation of small-scale commercial traffic to achieve complete and realistic traffic models. This presentation introduces a model that uses open data sources to generate small-scale commercial traffic to enable the development of comprehensive MATSim models.

2 Methodology

The proposed model follows a three-step approach: data acquisition, data processing, and generation of the resulting MATSim plans. Open data sources, such as government datasets, and available OpenStreetMap data[2], are used to identify relevant business locations. The data processing phase involves creating building based activity locations, assigning realistic time schedules for commercial activities, and determining appropriate vehicle types based on the available data. Another important input are structure data of the labour market in the study area. This data is required in high

resolution for the best possible generation. Therefore, the labour market data, e.g. for a district, is divided into smaller areas, e.g. traffic cells, using the pre-processed data from the previous steps.

The methodology for generating the volume of start and stop potentials of commercial traffic is based on generation factors calculated by IVV [3] in 2005. These factors are differentiated for the traffic types business traffic, e.g. care services, and small-scale freight traffic, e.g. parcel delivery. A distinction is also made between the different purposes of the traffic. This allows plausible assumptions to be made about the location of stops for each purpose. For freight transport, the demand for different types of vehicles is also differentiated. Using the structural data of the labour market for all traffic cells, the demand for each variant can be generated.

After combining start and stop demand by using a gravity model a vehicle routing problem (VRP) is created. This VRP contains the start location for the trips and an number of different services. Using Jsprit [4] this VRP is been solved. The final step is to integrate the small-scale commercial traffic into the MATSim simulations. The generated commercial agents will be integrated into the simulation framework, interacting with other agents and contributing to the overall traffic dynamics.

3 Outlook

During the presentation, the implementation and first results of the model will be presented through a case study in the urban area Berlin. Therefore our department is working on a new version of the MATSim Open Berlin Scenario [5] with the integration of long-distance freight traffic [6] and the small-scale commercial traffic, presented in this work. The results will demonstrate the effectiveness of the approach in generating small-scale commercial traffic and its impact on the overall traffic patterns within the MATSim simulation.

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References

1. Horni A, Nagel K, and Axhausen KW, eds. The Multi-Agent Transport Simulation MATSim. Ubiquity, London, 2016. DOI: 10.5334/baw.
2. OpenStreetMap. http://www.openstreetmap.org. accessed 2023.
3. IVV. Kleinräumige Wirtschaftsverkehrsmodelle. Tech. rep. FE-Nr. 70.0689/2002/. 2005.
4. jsprit. https://github.com/graphhopper/jsprit. Accessed on 02-dez-2018. 2018.
5. Ziemke D, Kaddoura I, and Nagel K. The MATSim Open Berlin Scenario: A multimodal agent-based transport simulation scenario based on synthetic demand modeling and open data. Procedia Computer Science 2019;151:870–7.
6. Lu C, Martins-Turner K, and Nagel K. Creating an agent-based long-haul freight transport model for Germany. Procedia Computer Science 2022;201:614–20.