Modelling Innovative Mobility Systems in Agent-Based-Simulation

Michael Heilig, Jörn-Ole Schröder
Karlsruhe Institute of Technology (KIT), Institute for Transport Studies

Different studies assume that mobility behaviour of individuals will change within the next years. The changing mobility behaviour of people in combination with information and communication technology results in changing use patterns: multimodal as well as intermodal use of transport modes are getting more and more important [1]. Public transport services, used in combination with innovative concepts of eMobility and flexible vehicle sharing services gain importance, the possession of an own car becomes however less important.

To model changes in mobility behaviour, the Institute for Transport Studies at the Karlsruhe Institute of Technology (KIT) develops the agent-based-simulation software “mobiTopp” over the last few years [2]. For a given planning area, the software simulates the trips of all persons within one week. Recently, the model has been applied for two large example areas in Germany: The Stuttgart area with more than 2.7 million inhabitants and the metropolitan area of Rhine-Neckar with 2.4 million inhabitants. For the travel demand simulations “mobiTopp” generates consistent household data with persons representing the characteristics of the real population in the planning area. The collected input data results from regional household surveys as well as information from the German Mobility Panel, which is an annual survey in Germany, designed and scientifically supervised by the Institute of Transport Studies at KIT [3].

“mobiTopp” contains trip generation, trip distribution and mode choice. In the first step, the software builds a synthetic population for each cell based on census data and the classified households. Households are classified by the number of persons, the number of cars available in the household, its income and the availability of season tickets. Further, activity patterns gained in the survey are assigned to the households based on their classification. Trip distribution is realised by a modified gravity model. The location of fixed destinations of persons like home and workplace, which were assigned for every person, affect the choice of flexible destinations. The discrete choice model for the mode choice is affected by many factors such as day of the week, car availability, trip time and trip cost. Each trip is represented by a main mode. Due to the simulation of one week, the model is able to show changes in travel demand and travel behaviour, for example the multimodal travel behaviour within one week.

Our current work on two research projects allows for further extensions and improvements of the existing software. There are two important developments which have to be integrated into the model. On the one hand the implementation of intermodal trips and on the other hand the implementation of eMobility and other new innovative mobility systems.

The project “I-eMM – Intermodal eMobility Management” aims to model intermodal trips. In contrast to multimodal behaviour that is described as the usage of different modes in different trips by the same person an intermodal trip is understood as the usage of several transport modes during one single trip. The modeling of intermodal trips is needed in order to integrate electric vehicles (e.g. bikes, cars, segways) into the sequence of stages of persons between their public transport station.
and their origins and destinations. In addition the implementation of intermodal trips allows more accurate representation of individual mobility behaviour in agent-based simulation models.

The project “eVerkehrsraum Stuttgart” contains the implementation of eMobility as well as new and innovative mobility systems like car-sharing into the existing model of the Stuttgart area. To show the use patterns of electric vehicles used for car-sharing, for example, we have to add car agents and recharging infrastructure to the model as well as intermodal trips.

Especially the modelling of intermodal trips and car-sharing in a multi-agent traffic-simulation is still an open field. So, for modelling intermodal trips and car-sharing systems in a urban region, there are many problems to solve. We would like to attend the Summer School on ‘Mobility modeling an big data sources’ at the Transportation Research Institute (IMOB) of Hasselt University to improve our knowledge on the topics mentioned above and to learn about new approaches in multi-agent simulation tools and in modelling intermodal trips.

Literature

