Analyzing and Modeling a City’s Spatiotemporal Taxi Supply and Demand: A Case Study for Munich

This paper presents a method for studying supply and demand in a taxi network in time and space by using the example of Munich. First, we introduce the necessary data collection that is linked to a fleet management system (FMS) operated by a local taxi agency and create a statistically sound database, which represents the mobility behavior on a trip level. Second, we derive key figures describing the city’s taxi characteristics. Here both the temporal taxi supply and demand of 420 taxis over a period of 19 weeks is considered. As the taxi demand differs according to the city district, the investigated area has to be divided into various zones. We analyze their specific characteristics and describe key factors influencing taxi requests, such as weekdays, public holidays and number of point of interests within an area. Next, a model to predict a time-variant demand for individual districts is introduced. We classify the problem and choose an appropriate algorithm to forecast spatiotemporal taxi requests. As booking actions differ over time, a nonhomogeneous Poisson distribution is suitable for counting those events. In a final step, we validate the proposed model on a local and global scale. Our model helps to provide a better understanding of taxi fleet operations on a city scale. We use the suggested demand prediction as one input parameter for an agent-based fleet simulation that represents individual taxi movements.

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