Modeling Mobility Demands for Bike Sharing Systems

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Abstract

Due to increasing urban mobility demands, (station-based) bike sharing systems (BSS) have become an essential part of urban passenger transportation. In the last years, significant amount of work on controlling, especially on balancing BSS has been carried out. Until now, instances for computational studies are derived from historical data of trips, i.e., observations of spatio-temporal rental and return realizations for a particular real-world BSS. Thus, results of different approaches for similar problems are generally not comparable and not generalizable respectively. Further, customer detours and "lost sales", i.e., unsuccessful rentals and returns are usually not considered sufficiently. To allow a comparison and to consider lost sales, artificial BSS instances are required representing typical spatio-temporal mobility demand of BSS. In this contribution, we present models of parameterizable artificial BSS instances. To this end, we do not draw on data analysis of real-world BSS but analyze BSS business models, city structures, mobility demand patterns, and behavior of cyclists to model spatio-temporal demands for bike rentals and returns and the resulting trips respectively. To prove the rigor of the models, we compare the artificial BSS instances to trip observations of the according real-world BSS. Comparisons show that artificial and real-world BSS comprise the same spatio-temporal mobility demands.

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