Choice-based Availability Controls for Urban Carsharing Revenue Management

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Abstract

Urban carsharing services provide flexible, affordable and green mobility options where customers can pick up a car from one station and return it to the same station (round trip) or any other station in the car-sharing network (one-way). While one-way car-sharing offers a higher degree of mobility flexibility to customers, it may cause operational challenges such as fleet unbalance between multiple rental stations. Carsharing operators have employed various vehicle relocation techniques to ensure the availability of sufficient vehicles across rental stations. In this study, we adopt the user-based relocation strategy where customers are offered incentives such as fare discounts to drop off the vehicles in proposed alternative destinations.

We estimate a Multinomial logit choice model based on collated responses from a discrete choice experiment implemented in a survey. We formulate a dynamic program model based on this choice model to determine the optimal destination-fare discount combinations offered to each arriving customer, which maximizes the total expected revenue over a finite time horizon. To address the computational complexity of the dynamic program, we approximate it with a choice-based deterministic linear program. The effectiveness of the proposed vehicle relocation strategy and the performance of the models are tested in a numerical study.