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Enhancing carsharing pricing and operations through integrated choice models

Balancing supply and demand in free-floating one-way carsharing systems is a critical operational challenge. We propose a novel approach integrating a logit model into a mixed integer linear programming framework to optimize short-term pricing and fleet relocation. Based on a binary logit model, demand modelling aggregates different trips under a unified utility model and improves estimation by incorporating information from similar trips. A categorizing approach is used to speed up the estimation process, where variables such as location and time are classified into a few categories based on shared attributes. The modelling framework adopts a dynamic structure where the binary logit model estimates demand using accumulated observations from past iterations at each decision point. This continuous learning environment allows for dynamic improvement in estimation and decision-making. At the core of the framework is a mathematical program that prescribes optimal levels of promotion and relocation. The framework then includes simulated market responses to the decisions, allowing real-time adjustments to balance supply and demand effectively. Computational experiments demonstrate the effectiveness of the proposed approach and highlight its potential for real-world applications. The continuous learning environment, combining demand modelling and operational decisions, opens avenues for future research in transportation systems.

Author: BRITO OLIVEIRA, Beatriz (up.pt)

Co-author: AHIPASAOGLU, Selin (CORMSIS, School of Mathematical Sciences, University of Southampton)

Presenter: BRITO OLIVEIRA, Beatriz (up.pt)

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