Integrating Dial-a-Ride with Mode Choice

Xiaotong Dong*†[1], David Rey[1], and S.travis Waller[1]

[1]University of New South Wales [Sydney] (UNSW) – High StKensington, Sydney, NSW 2052, Australia

Abstract

The classical Dial-A-Ride Problem (DARP) aims at designing the minimum-cost routing that accommodates all requests under a set of constraints. The current trend of research on the DARP is to incorporate additional real-life characteristics to extend the scope of its applications. In this work, we propose to incorporate travellers' mode choice decisions within the original DARP formulation. Specifically, we consider that two travel modes are available: a shared mobility service (dial-a-ride) and a private travel option. We assume that travellers' utility for the shared mobility service depends on the collective choice of travellers whereas travellers' utility of private travel is fixed. We integrate these utility functions in a rich DARP formulation. Assuming that travellers are rational and seek to maximize their trip utility, we introduce variables and constraints to track users' mode choice and optimize the route and the schedule of the shared mobility service accordingly. Specifically, the shared mobility service must accommodate the requests of all travellers which have a higher utility for this mode compared to their private travel alternative. We explore the behaviour of the proposed integrated DARP with mode choice constraints formulation by conducting sensitivity analyses on the parameters of the utility functions and present a new solution algorithm for this rich DARP. Computational experiments are conducted on traditional DARP benchmark instances and numerical results are presented to show the effectiveness of the algorithm.

Keywords: Dial, a, Ride Problem, mode choice, shared mobility services

*Speaker

†Corresponding author: xiaotong.dong@unsw.edu.au