

Fusing Multiple Biased Datasets to Recover Missing Trips:

A Behaviorally-informed Likelihood-based Approach

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Abstract: The prevalence of mobile sensors has made big mobile sensor data with time and location information a promising data source for transportation applications. Since users self-select into using different mobile services, selection bias exists in the mobile sensor data, and the kinds of trips excluded or included differ systematically among data sources. To our best knowledge, solutions to the selection bias are lacking in the current literature. This study develops a behaviorally-informed likelihood-based approach to address selection bias. The key idea is that since biases reflected in different data sources are likely different, the integration of multiple biased data sources will mitigate biases. The model is evaluated through both simulation data and the 2017 National Household Travel Survey data. Our results demonstrate the robustness of the model in recovering missing trips: more specifically, it recovers 89 to 106 percent of the missing trips, when the behavioral factors in data generation process are captured by the model. When the model is mis-specified with factors in play ignored, the model is still able to recover nearly half of the missing trips.

Bio: Cynthia Chen is a professor in the Department of Civil & Environmental Engineering at the University of Washington (Seattle). She is an internationally renowned scholar in transportation science and directs the THINK (Transportation-Human Interaction and Network Knowledge) lab at the UW. Cynthia has published over 60 peer-reviewed publications in leading journals in transportation and systems engineering including Transportation Research Part A-F and PNAS. Her research has been supported by many federal and state agencies. She is an associate director of TOMNET (Center for Teaching Old Models New Tricks), a USDOT-funded Tier 1 University Transportation Center led by ASU, as well as a co-investigator of the new Center of Understanding Future Travel Behavior and Demand, a USDOT-funded national center led by UT Austin. Currently, Cynthia serves as an associate editor for Transportation Science and Service Science (both are INFORMS journal), and is on the editorial board of Sustainability Analytics and Modeling.

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