**Publications using data from WholeTraveler:**

1. Department of Energy, *SMART Mobility: Mobility Decision Science Capstone Report*. Department of Energy Office of Energy Efficiency and Renewable Energy (2020). <https://www.energy.gov/sites/prod/files/2020/08/f77/SMART-MDS_Capstone_08.05.20.pdf>

Description: comprehensive Capstone Report from the Mobility Decision Science Pillar of the first round of SMART Mobility. This report contains a description of the WholeTraveler Study, the data collection, and an overview of results from a variety of analyses conducted using data from the WholeTraveler Study.

1. Kwasnik, Ted, Scott Carmichael, and Steven Isley. *An Overview of Technologies for Individual Trip History Collection: Mobility Decision Science Pillar SMART Mobility Consortium*. NREL/TP-6A20-70331. National Renewable Energy Laboratory (2018). <https://www.nrel.gov/docs/fy19osti/70331.pdf>

Description: Fine-grained location data (FGLD), which for the purpose of this study is a record of an individual’s location collected at a resolution sufficient to determine both the unique destinations a traveler visits each day and the modes used to travel between them, are a component of the WholeTraveler study. The methods for collecting FGLD and the means by which it is associated with a traveler’s personal attributes have significant implications for the burden on research participants, the cost and complexity of the study, as well as the confidence with which hypotheses can be validated. This paper provides a broad overview of existing technologies for FGLD collection, categorizing them as either network or onboard approaches. An onboard system, such as smartphone or Global Positioning System (GPS) device sends signals to external networks to capture its own location. Conversely, network systems, such as cell towers, are comprised of sensing nodes with known locations that record when individually identifiable assets come within their range of detection. This study assesses the applicability of each potential approach, documenting the considerations for choosing the appropriate approach for a study such as WholeTraveler.

1. Lazar, Alina, Alexandra Ballow, Ling Jin, C. Anna Spurlock, Alex Sim, and Kesheng Wu. “Machine Learning for Prediction of Mid to Long-Term Habitual Transportation Mode Use.” 2019 IEEE International Conference on Big Data (2019). <https://doi.org/10.1109/BigData47090.2019.9006411>

Abstract: Prediction of daily transportation mode use (car, public transit, or active travel) is an important task in transportation research. Unlike statistical models that impose a predetermined model structure, machine learning models are learned from the data, making them more flexible with higher prediction accuracy. Despite an increasing number of applications of machine learning methods to mode choice analysis, the research has so far been limited to short-term trip data, while understanding of the mid-to long-term habitual modes still largely rely on traditional statistical analysis using small samples of cross-sectional data. Low interpretability of “black-box” machine learning models limits their usefulness for generating behavior insights needed for designing appropriate interventions. This paper, leveraging a unique life course data set, is the first use case to demonstrate machine learning methods applied for both predicting and interpreting regularly used travel modes. We combine sequence clustering and tree- based machine learning methods coupled with TreeExplainer to predict and interpret habitual travel modes using mid- to long-term predictors. Five life course clusters are derived to provide evaluation and interpretation contexts. This allows us to improve upon recently developed TreeExplainer methods to better distinguish predictor importance locally and globally; and predictor interactions across subpopulations within distinctive life history contexts. Our results demonstrate a promising step toward interpretable machine learning applications to mid- to long-term prediction of travel modes for transportation planning.

1. Spurlock, C. Anna, James Sears, Gabrielle Wong-Parodi, Victor Walker, Ling Jin, Margaret Taylor, Andrew Duvall, Anand Gopal, and Annika Todd. "Describing the users: Understanding adoption of and interest in shared, electrified, and automated transportation in the San Francisco Bay Area." *Transportation Research Part D: Transport and Environment* 71 (2019): 283-301. <https://doi.org/10.1016/j.trd.2019.01.014> also accessible at: <https://eta.lbl.gov/publications/describing-users-understanding>

Abstract: Emerging technologies and services stand poised to transform the transportation system, with large implications for energy use and mobility. The degree and speed of these impacts depend largely on who adopts these innovations and how quickly. Leveraging data from a novel survey of San Francisco Bay Area residents, we analyze adoption patterns for shared mobility, electrified vehicle technologies, and vehicle automation. We find that ride-hailing and adaptive cruise control have penetrated the market more extensively than have electrified vehicles or car- sharing services. Over half of respondents have adopted or expressed interest in adopting all levels of vehicle automation. Overall, there is substantial potential for market growth for the technologies and services we analyzed. Using a county fixed effects regressions, we investigate which individual and location-level factors correlate to adoption and interest. We find that, although higher-income people are disproportionately represented among current adopters of most new technologies and services, low- to middle-income people are just as likely to have adopted pooled ride-hailing. Younger generations have high interest in automated and electrified vehicles relative to their current adoption of these technologies, suggesting that young people could contribute substantially to future market growth—as they are doing for ride-hailing. We find no evidence that longer commutes present a barrier to plug-in electric vehicle adoption. Finally, women are less likely than men to adopt and/or be interested in adopting most new transportation technologies, with the exception of ride-hailing; designing or marketing technologies with women’s preferences in mind could contribute to future market expansion.

1. Spurlock, C. Anna, Annika Todd-Blick, Gabrielle Wong-Parodi, and Victor Walker. "Children, Income, and the Impact of Home Delivery on Household Shopping Trips." *Transportation Research Record* (2020): 0361198120935113. [https://doi.org/10.1177/0361198120935113](https://doi.org/10.1177%2F0361198120935113)

Abstract: Expanding e-commerce and delivery benefit consumers with increased flexibility and convenience. However, there is a potential impact on vehicle miles traveled (VMT) by delivery and personal vehicles, and the resulting energy consumption, air quality, and congestion. Delivery trips could replace personal vehicle trips, but if not could add to (or supplement) shopping-related VMT for a given household. We examine the benefits of e-commerce to consumers and the impact on personal shopping trips, and how these differ across item types and household child status and income. We find that high-income households and households with children care relatively more about time saving from deliveries. We find that on average, deliveries substitute for 12% of vehicle shopping trips, but for 9% of purchases deliveries supplement personal shopping trips. Underlying these averages are two main types of households: those for whom all deliveries substitute for trips (between 55% and 70% of households) and those for whom all deliveries supplement trips (between 20% and 35% of households). There is significant heterogeneity across households with and without children and with high or low income with respect to the use of delivery. While time savings was more likely to motivate higher-income households and households with children to use delivery, this did not translate through to these households substituting for more of their trips; deliveries of prepared meals for both these categories of households are relatively more likely (15% for households with children, and 12% for higher-income households) to supplement, and not substitute for, personal trips.