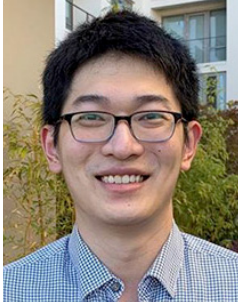




# Demand Inference for Free-Floating Micro-Mobility: Accessibility and Availability

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## Background

The city of Seattle, Portland, and other major US cities have been seeing an increasing amount of deployment and usage of micro-mobility fleets such as electric bikes and scooters. These services quickly gain popularity by providing convenient, cost-effective, and emission-free mobility options

to riders. The form of these micro-mobility services has evolved from the traditional dock-based systems where vehicles must be picked up and returned to a station, to the more recent dock-less systems where fleets can be picked up and returned at almost anywhere (subject to parking requirement) within the service area (e.g., Jump and Lime in Seattle), and most recently a hybrid system which combines both forms (e.g., Biketown in Portland).

One critical and challenging aspect of monitoring and operating free-floating mobility services is to understand the rider demand and how accessible the current service is to different communities including underrepresented ones. The city of Seattle has been actively monitoring the usage and accessibility of these services through the open data project using trip data. However, trip data are censored and biased observations of the underlying true demand as riders will not use the service if there is no available vehicle nearby, which is endogenous to the vehicle availability. Moreover, riders choose where to get the vehicle based on the location of the available vehicle, thus the actual pickup location observed in the data might not be consistent with the actual demand location --- the ideal location the rider wants the vehicle to be at. These challenges are further complicated by the time-varying nature of the rider demand, and the uncertain and dynamic aspects of vehicle locations.

## Research Project

In response to such challenges, the proposed project develops novel statistical methods aiming to construct accurate demand estimates. To be specific, given historical

trip data and vehicle availability and location data, the proposed methods consistently recover underlying true demand --- the time-varying spatial distribution and intensity of potential riders who want to use the service if there were always vehicles available nearby. This resulting spatial distribution can be used to further infer service quality --- the distance between the demand location and the closest available vehicle. As we mentioned, this problem is non-trivial and challenging as trip data is censored, demand can arrive, and vehicles can be anywhere in the service region. An accurate estimate of underlying demand is practically important in many ways. First, it helps agencies and operators to understand the true need for such service across different areas. In addition, within each area, it measures how well riders are served in terms of demand fulfillment rate and average walking distance to get a vehicle. These data-driven insights can complement the existing monitoring tools which often only report statistics based on past trip data. Most importantly, it informs agencies and fleet operators to allocate and deploy a fleet that satisfies the mobility needs of various communities more equitably and efficiently. For example, areas with low service quality might warrant more fleet allocation, and areas with high potential demand but no fleet allocation might be worth a service area expansion.

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## ABOUT THE AUTHORS

The research team consisted of Chiwei Yan of the University of Washington.

## ABOUT THE FUNDERS

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## EXPECTED DATE OF COMPLETION

March 2023

## FOR MORE INFORMATION

<https://depts.washington.edu/pactrans/research/projects/demand-inference-for-free-floating-micro-mobility-accessibility-and-availability/>