**Data Science Clinic Spring 2024 - Perpetual**

Perpetual is a non-profit organization that aims to reduce plastic waste by implementing city-scaled reusable foodware distribution systems. Perpetual collaborates with local cities, reuse service providers, and various stakeholders to revolutionize the way we think about food containers, drinkware, and utensils.

For the past two years, the Data Science Clinic team has worked towards optimizing and automating Perpetual's outdoor bin placement for foodware collection. Perpetual must install bins close to expected consumer footpaths to maximize participation rates and reduce overall plastic waste. To that end, the Clinic team has helped Perpetual implement a rule-based algorithm for identifying likely consumer locations (i.e., "demand sites") where bins can be co-located. The algorithm is generalizable to any U.S. city, but results were produced for Hilo, Hawaii, as a case study.
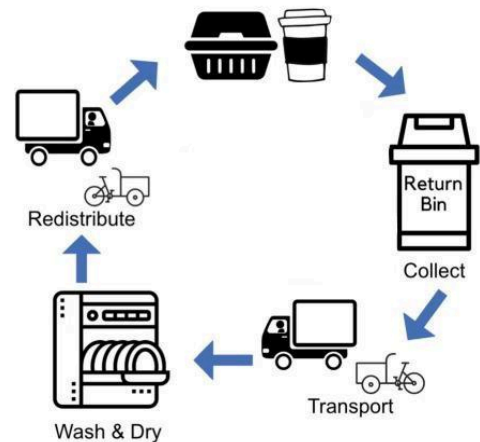


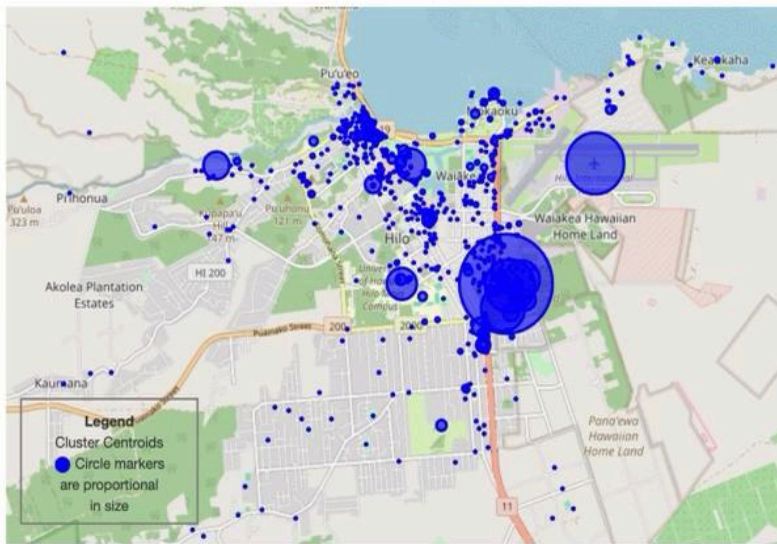Figure 1. Perpetual's foodware reuse model



Figure 2. Foot traffic cluster centroids in Hilo

Building off the work of previous students, this quarter's Clinic team completed a data pipeline to implement the rule-based algorithm. Last quarter's team implemented part of this algorithm by writing scripts to collect points of interest like popular restaurants, big box grocery stores, and parks from providers like Google and Yelp. This quarter's team successfully created scripts to easily identify large hotels (90+ rooms), large apartments (40+ units), and areas of high foot traffic.

Now, all bin locations are fully categorized using algorithms created from rules provided by Perpetual. The completed pipeline features scripts to easily identify optimal bin locations. To account for Perpetual's budget constraints, the Clinic team uses a geospatial algorithm that determines the number of most optimal bin sites by weighting demand and considering travel costs along the network of roads and sidewalks. Ultimately, Perpetual will use this pipeline to streamline the identification of the optimal locations and quantity of outdoor bins for any city within its budget.