

Improvements to Worker Assignment in Bike Sharing Systems

Trent Johnson

Department of Mathematics
Georgia Institute of Technology

Jie Wu

Department of Computer and Information Sciences
Temple University

Abstract—Bike-sharing systems (BSSs) are widely used in cities worldwide as they offer an affordable, eco-friendly method of transport. However, the rate of renting and returning bikes from stations is not always equal. The stations with imbalanced demand can become out of service by having all docks filled or emptied. These out-of-service stations can lead to a worse user experience and fewer people using BSSs. Researchers are trying to solve the rebalancing problem by developing algorithms that incentivize workers to pick up and drop off bicycles from different stations to balance the rent and return rates. Many of these algorithms focus on creating incentive and pricing models to encourage workers to go to imbalanced stations. Since they do not consider all of the placements of workers, this strategy may lead to inefficiencies where workers travel farther than they need. We can treat rebalancing as a *Worker Assignment Problem* by assigning worker stations to minimize the total distance traveled. We propose an algorithm that can approximate the optimal assignment significantly faster than other techniques with very high performance. The rapid speed allows for real-time use in experimenting pricing models and as a standalone method for



Fig. 1: Bikes at a bike sharing dock in New York City

usage, potential profits, and benefits of a BSS. Furthermore, for dock-less BSSs, there can be areas with too many or not enough bicycles, resulting in a similar issue. Thus, BSSs must rebalance stations and zones to reduce the number of OSSs.