

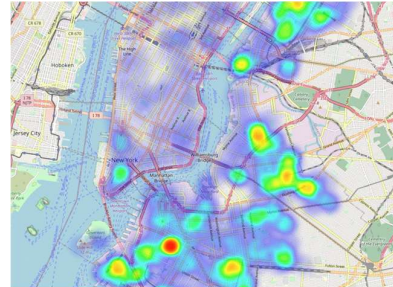
Our goal

The goal is to help Citibike find the best way of bike relocation to achieve the highest profit. In order to achieve that, I gathered distance, demand, inventory and replenishment data, built optimization models and have the following key insights.

Key finding 1: West Brooklyn can potentially supply the high demand in Manhattan



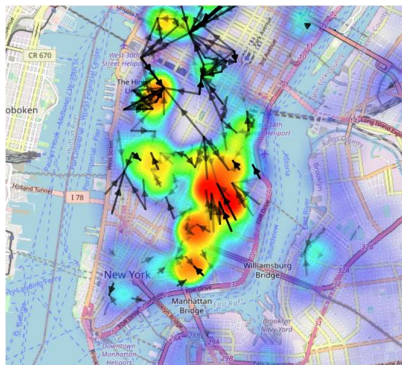
Inventory deficit



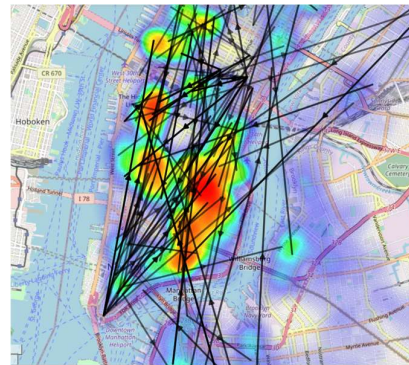
Inventory excess

Based on the heat maps above, we can see that West Brooklyn has high inventory excess, while Manhattan has a high inventory deficit. This indicates a potential operation strategy of relocating bikes from West Brooklyn to Manhattan. However, is this strategy economically optimal? How many bike inflows and outflows should be there from one area to another? These questions are answered by optimization models below.

Key finding 2: Procuring vehicles from external provider generates max optimal profit of \$75,890



Operate Vehicles



Procure Vehicle

Strategy	Optimal profit
No rebalancing	62468.0
Rebalancing	71314.1
Condition A: Rebalancing + Replenishment	75662.9
Condition A + Operate Vehicles	75881.9
Condition A + Procure Vehicle	75890.0

By comparing the result of optimal profit of operating own vehicles, against procuring vehicles from external providers, we see that it is more beneficial for Citibike to procure vehicles from external providers. However, from the graph we learn that the relocation routes (arrows) required are more complicated. Therefore, managing the service levels of the external provider can be a challenge for Citibike because of the dynamics on the road (e.g., traffic jams).

Key finding 3: The optimal profit estimations has limitations and should be further improved

Although the optimization model is capable of deciding what volume of inflow and outflow for each pair of stations, it fails to capture several factors to make it work efficiently in reality. The most pressing factor is the under-estimation of demand. Further improvement is to be made by incorporating a more realistic demand dataset into the model. To get a more realistic representation of actual demand, potential approach can be conducting a field study to 1) group stations into categories (e.g., one category can be Midtown under-supplied area); 2) count the actual number of people in need in these categories; and 3) get the ratio of this number against the historical number; 4) apply the category-wise ratio to stations within the category.