Towards Robust Bike Sharing Systems

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Bike-sharing systems are getting wide-spread use. For example in Aalborg, we have "Donkey Republic".[1] In these systems, there are a number of predefined stations, where users may pick-up and/or drop the bikes. In order for the system to be reliable, we need to ensure that any time a user wants to go from station A to station B, there is an available bike at A, and there is room to leave the bike at B. Otherwise, the user won't be able to use the system and they will be a disatisfied client.
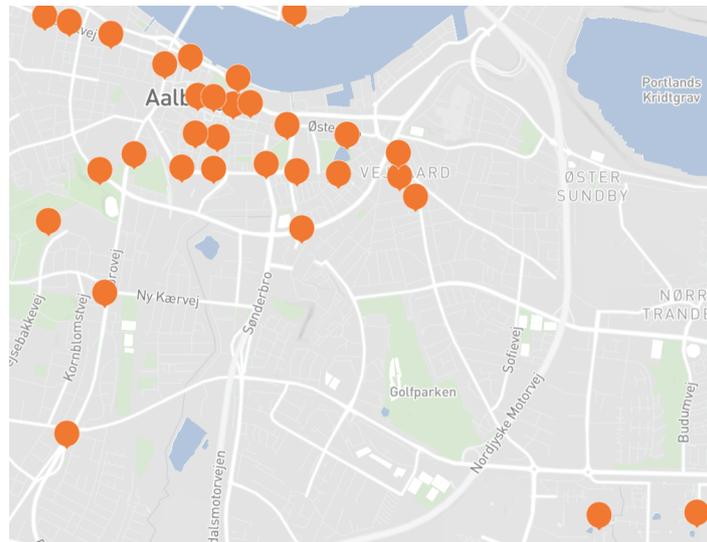
Figure 1: Stations of Donkey Republic system in Aalborg.

This project aims at analyzing and improving the robustness of a bike-sharing system. We will make use of a simple probability model that predicts the expected number of travels every hour between any pair of stations. This model can be populated using data from existing datasets.[2] Our tool should specify what is the expected number of disatisfied clients, and other related questions, such as:

- Given a fixed number of bikes, how can they be distributed to minimize the expected number of disatisfied clients?

- We can quantify the amount of disatisfaction, depending on the distance between the user and the closest available station. Use this to predict the total expected disatisfaction of users.

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[1] https://www.donkey.bike

[2] For example, https://archive.ics.uci.edu/ml/datasets/bike+sharing+dataset

To perform the robustness analysis you will build upon mathematical probability models and simulation-based approaches. You will perform experiments to analyze how your methods converge towards a solution, and how the runtime is affected by different parameters like the network size.