FairVizARD: A Visualization System for Assessing Fairness of Ride-Sharing Matching Algorithms

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What?

Helping people analyze the fairness of ride-sharing algorithms offline using visualizations.

Why?

As AI algorithms are deployed to decide which passengers to pick in a ridesharing environment, concerns about the relative fairness of these assignments need to be recognized and addressed.

How?

Using a combination of maps and aggregated graphs to display the spatio-temporal distribution of the assignments, we allow users to interact with data and compare multiple algorithms based on their subjective idea of fairness.

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What does a ride-share matching algorithm do?
Given locations of taxis and incoming passenger requests, the algorithm decides whether to accept the request or not, in addition to matching it with a taxi driver to maximize some quantity like profit.

Stakeholders

Ride-sharing ecosystems have a variety of stakeholders, and "fair" is different for each of them:

- Taxi drivers
- Passengers
- Ride-sharing companies (Uber, Lyft, etc.)
- City authorities

Input

For visualizing ridesharing data for a given city, the following information is required:

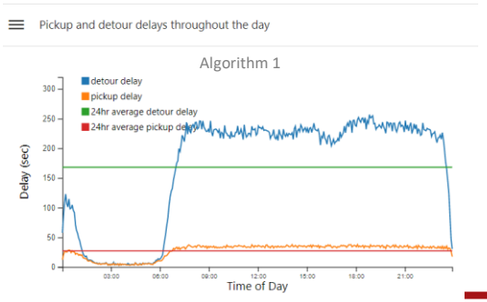
1. **Geographic Information**
   - Road network
   - Zone definitions
2. **Matching algorithm output, sampled every 60 seconds**
   Requests:
   - Pickup/dropoff locations
   - Time of request
   - Assigned driver

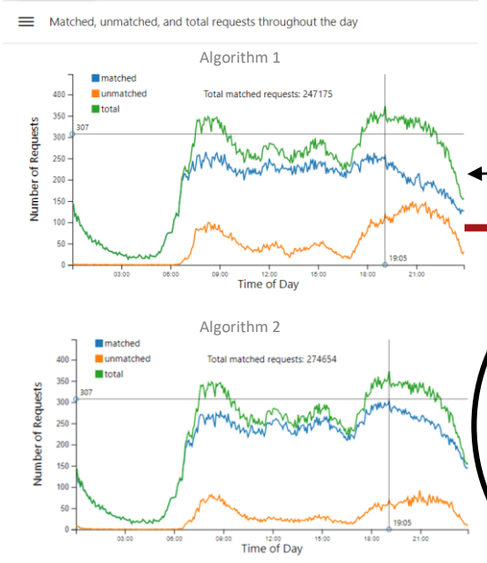
   Taxi drivers:
   - Location
   - Trajectory

Output

FairVizARD can visualize the following information:

1. **Map View**
   - Locations of all taxis
   - Pickup and dropoff locations
   - Pickup delay
   - Service rate across zones
2. **Graph View**
   - Requests served
   - Pickup and detour delay
   - Variance in driver earning



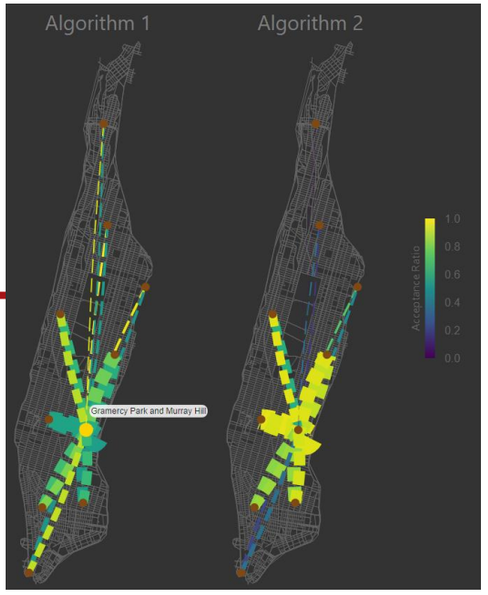


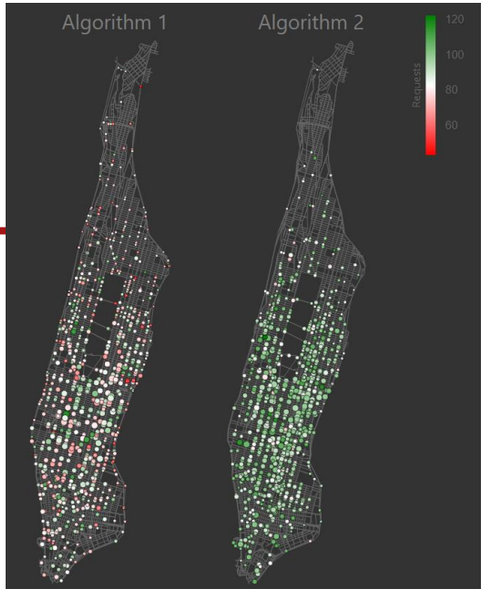
Use Case

Consider the following example comparing the pros and cons of two algorithms, and think about their fairness in terms of different stakeholders in ride-sharing.

Algorithm 1 has **better acceptance for longer trips** and **lower average delay** than Algorithm 2.

Algorithm 2 has **higher trips per driver** and **higher total passengers served** than Algorithm 1.





Which is fairer?

Tell us here

https://youtu.be/0-G-o4E0gKM