

Using Fixed Route Transit to Improve Paratransit Service Quality

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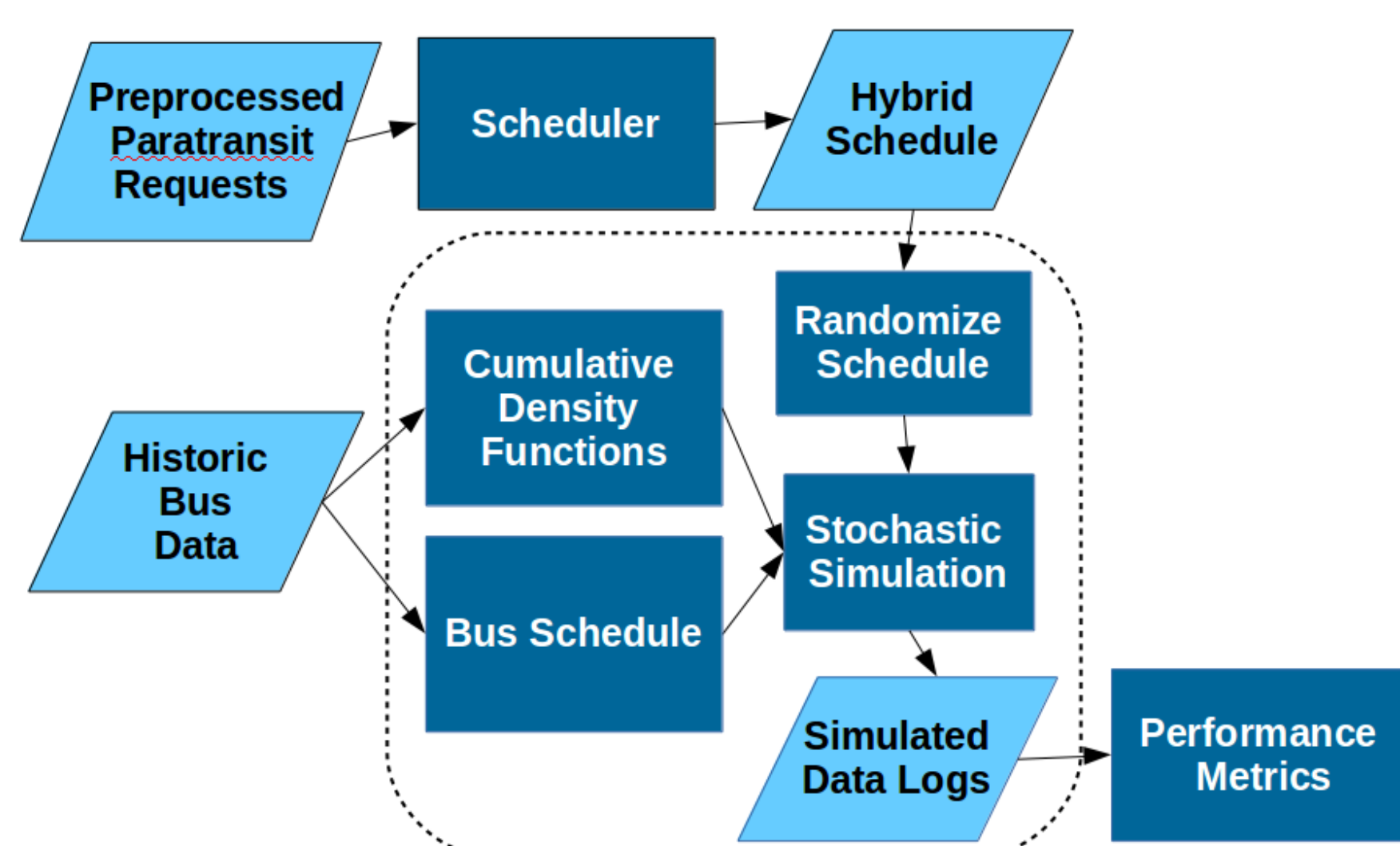
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Introduction

- Paratransit is a flexible route public transit system for the elderly and handicapped
- Paratransit systems follow a shared-ride model, leading to long wait times
- Coordinating Paratransit with bus schedules could reduce overall service time

Methods

- Ride requests were scheduled using greedy scheduling algorithm with local search algorithm Generalized Task Swap in addition[1]
- Generated schedule was tested using statistical simulator, written in Python
- Bus schedules randomized using CDFs of Port Authority historical data
- Total Ride Duration was used as the main performance metric

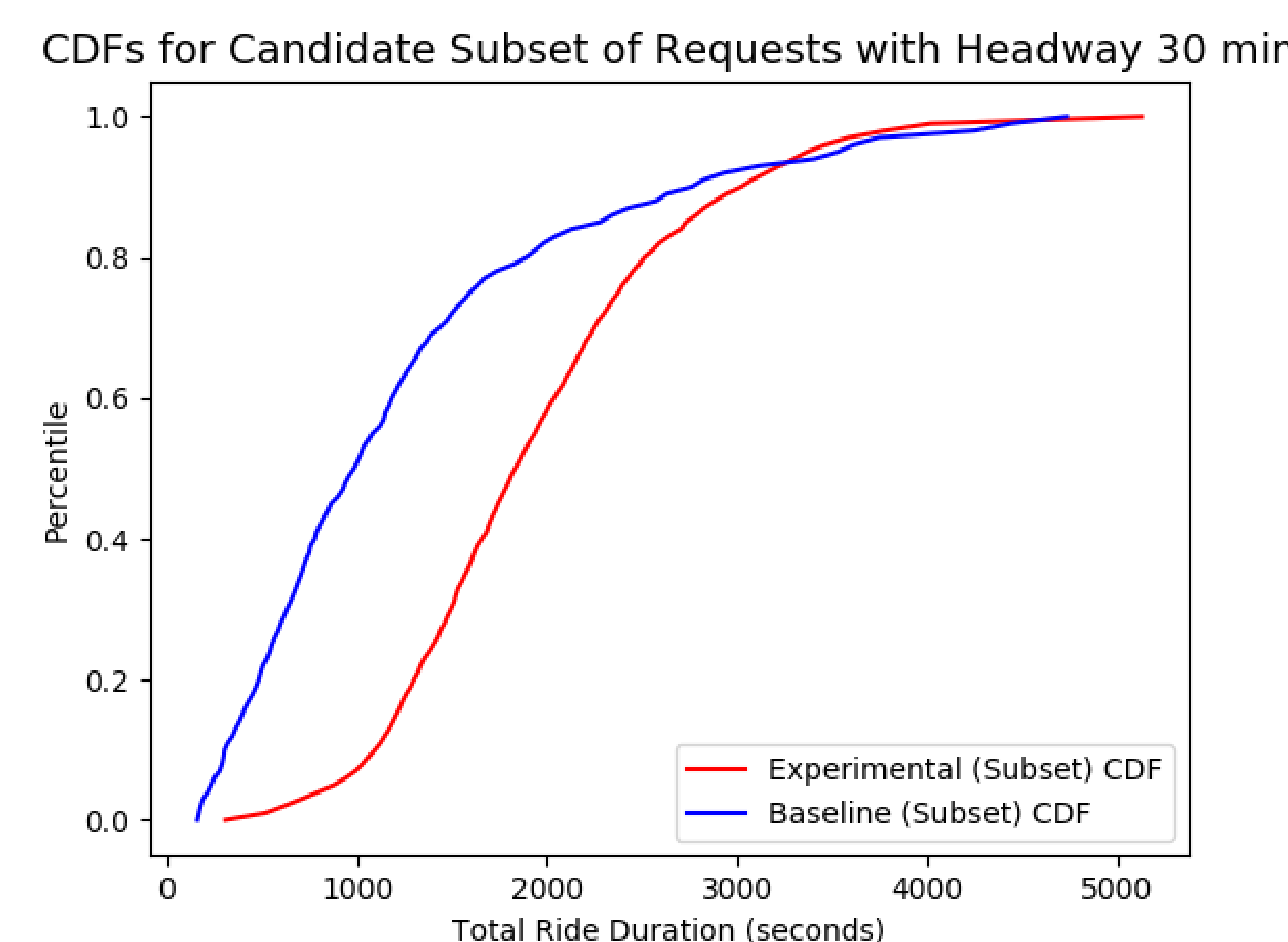
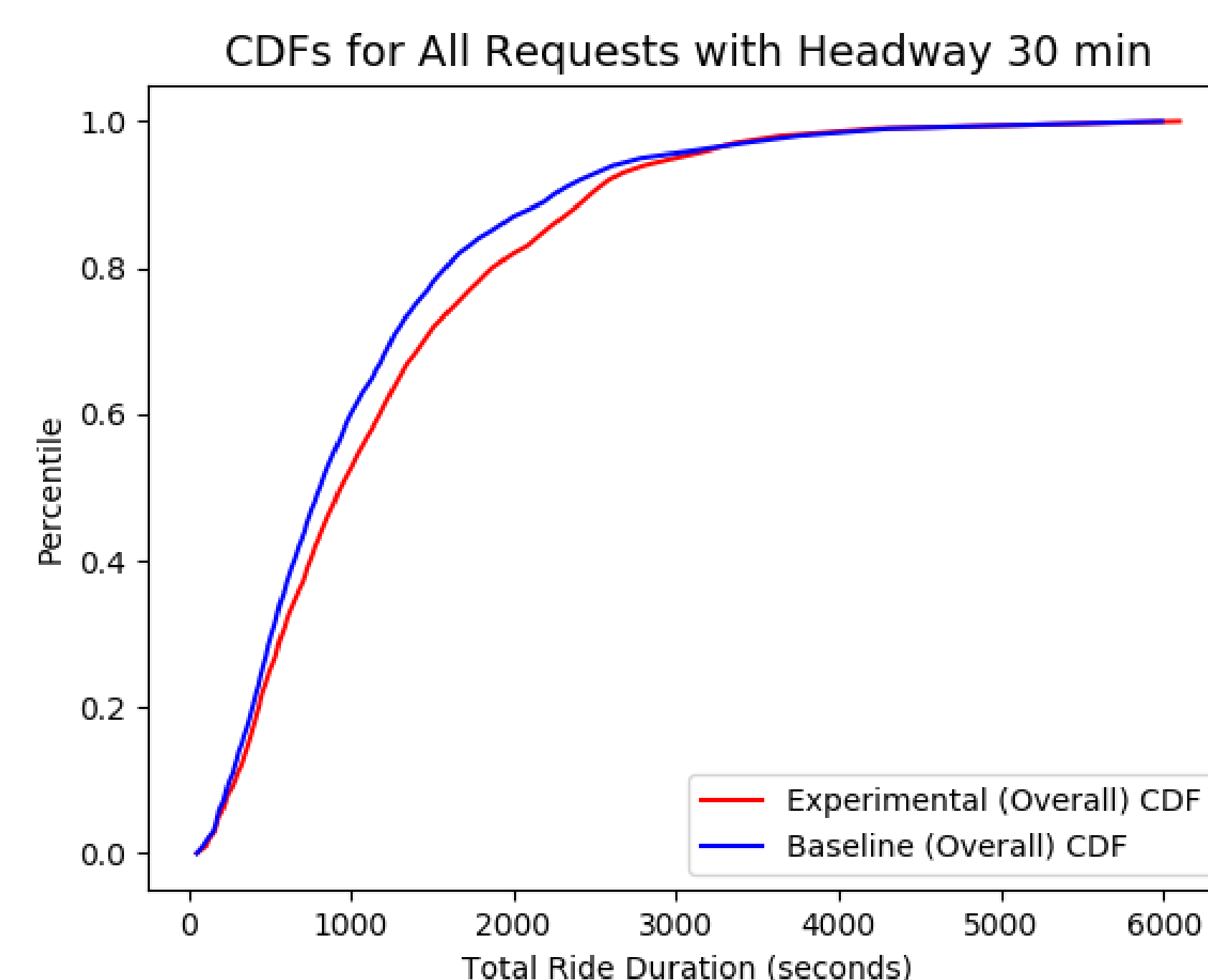
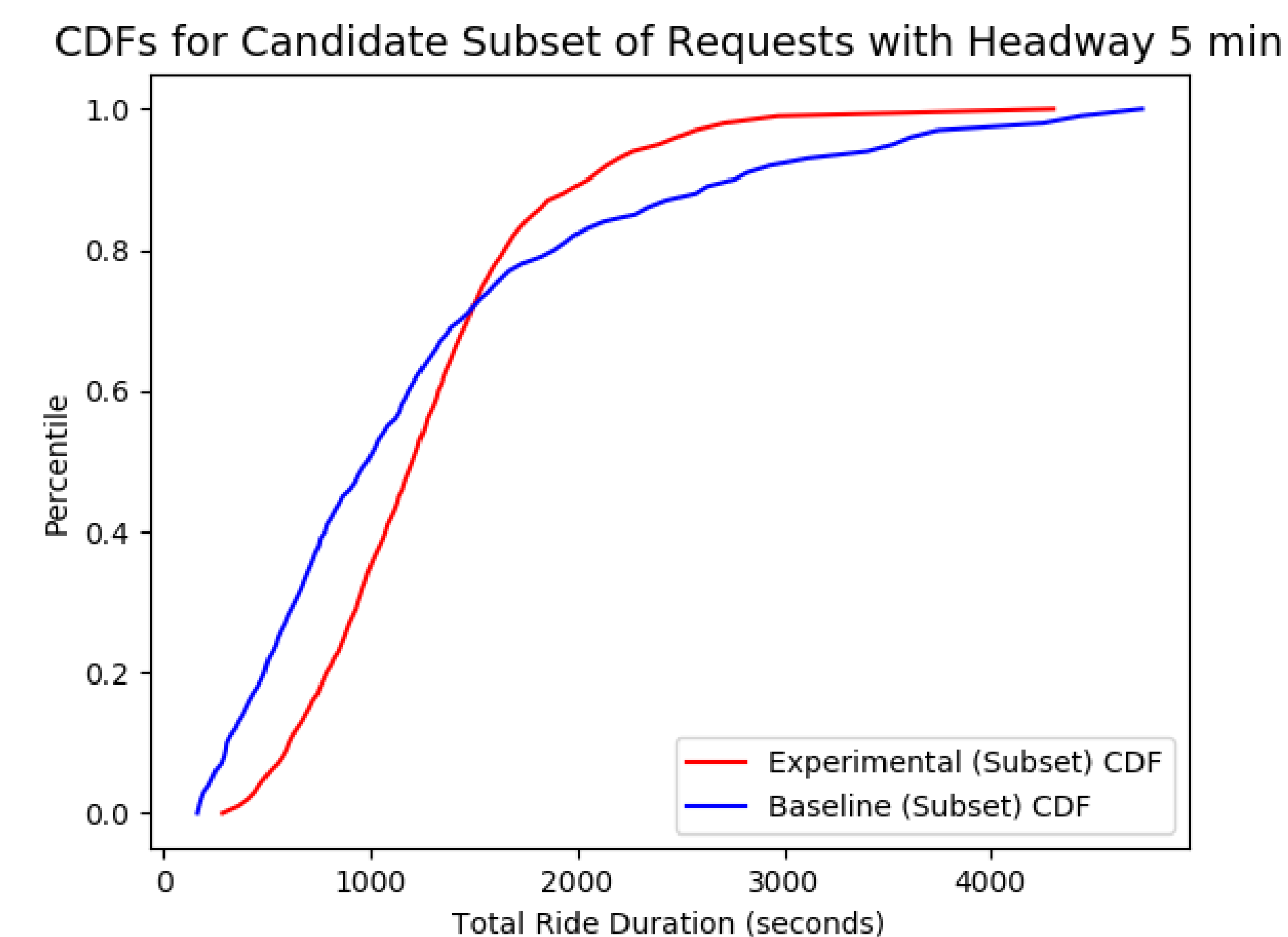
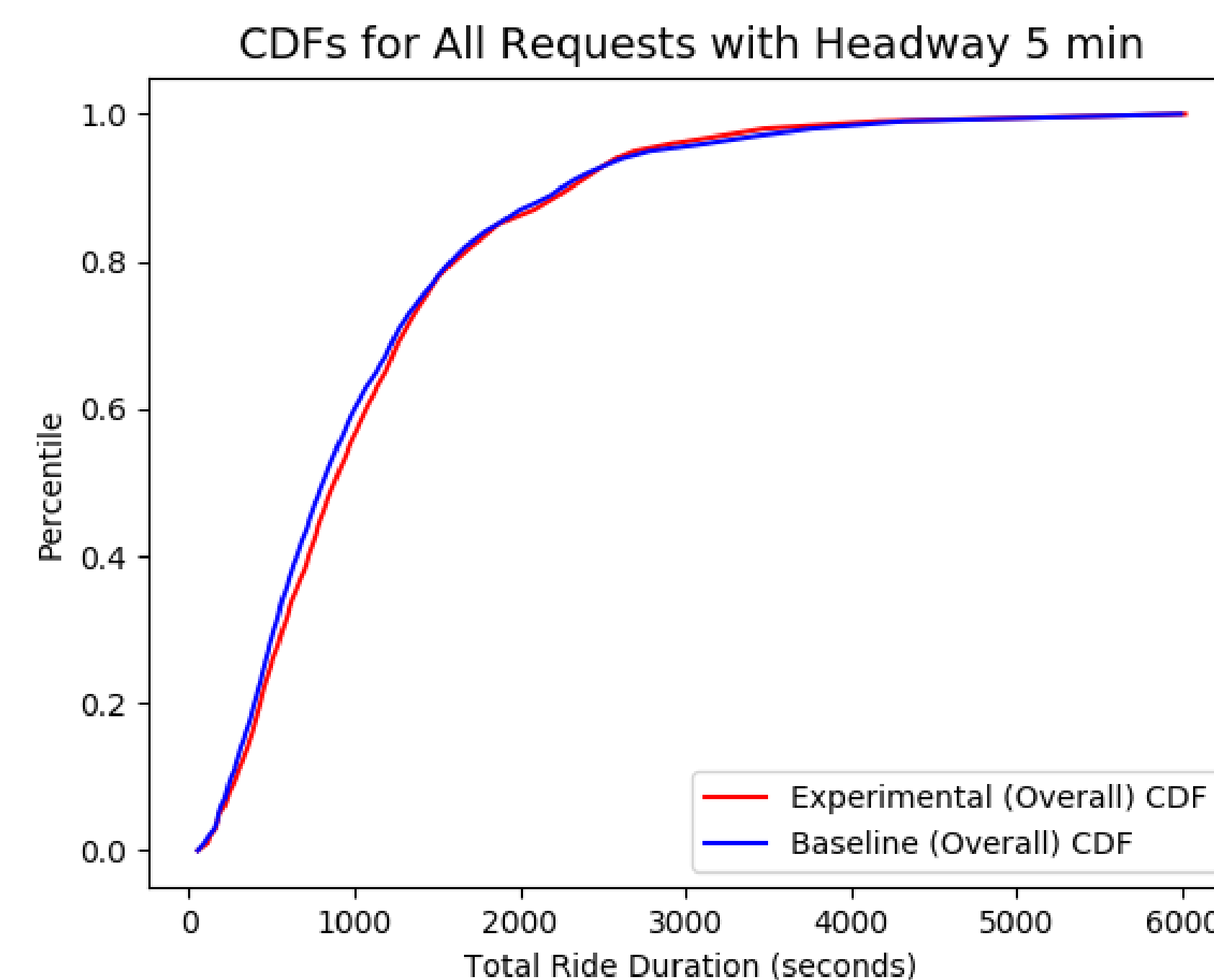


Results

- 15 simulations were run per headway parameter
- 14% of the requests for one day were identified as candidates for using the bus based on the distance from pickup location

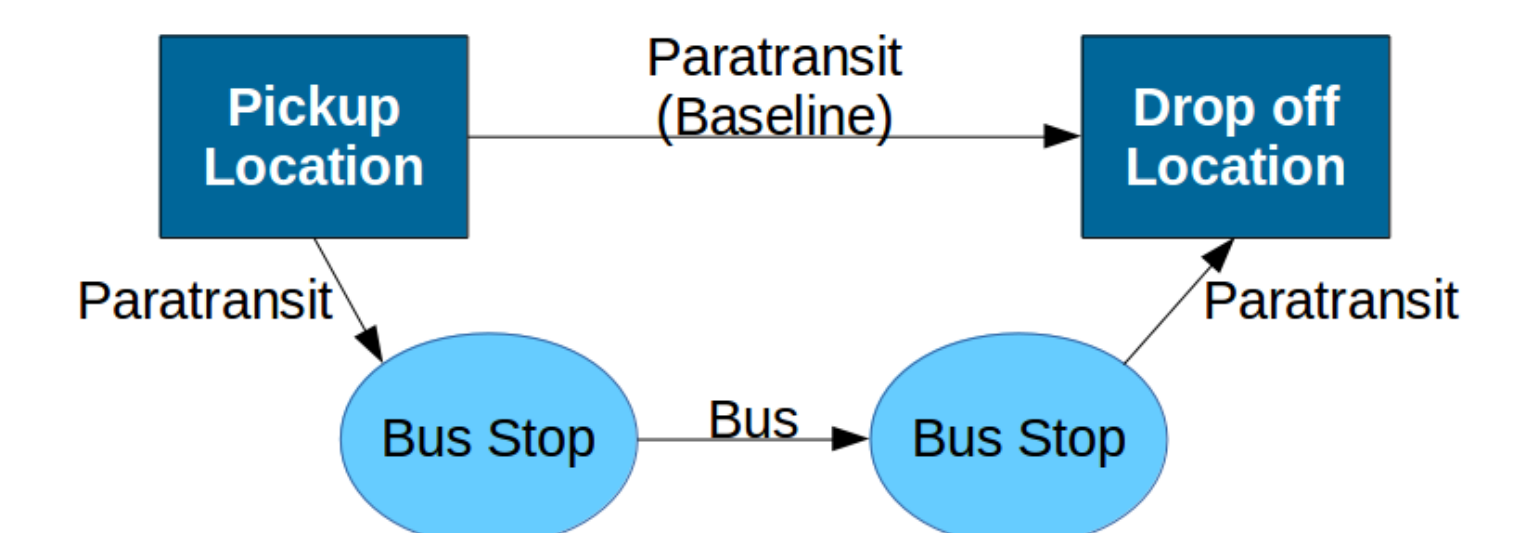
Results from Entire set of requests vs Candidate subset

Headway	Min	Max	Average	Median	Headway	Min	Max	Average	Median
Baseline	00:00:56	01:37:22	00:17:49	00:13:31	Baseline	00:02:48	01:17:31	00:21:00	00:16:26
5 min	00:00:57	01:36:47	00:18:23	00:14:40	5 min	00:05:40	00:54:37	00:21:10	00:20:02
10 min	00:00:57	01:36:46	00:18:45	00:15:04	10 min	00:06:04	00:58:27	00:23:56	00:22:40
15 min	00:00:59	01:36:59	00:19:04	00:15:22	15 min	00:06:20	00:59:36	00:25:58	00:24:11
30 min	00:00:57	01:37:15	00:19:57	00:15:38	30 min	00:06:44	01:13:10	00:32:24	00:30:32



Conclusion

- Adding fixed route transit decreases ride duration for long trips, but increases duration for short trips

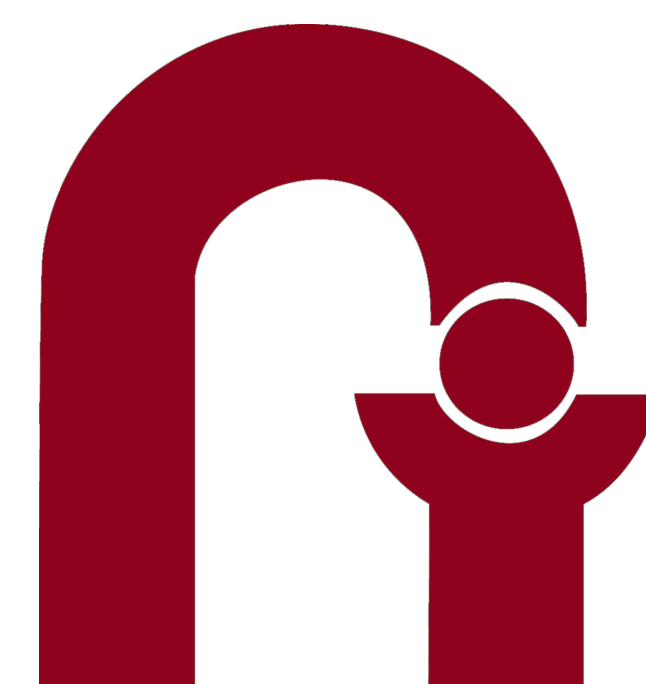


Future Work

- Add minimum distance covered on bus as candidacy constraint
- Analyze system using other performance metrics such as cost or capacity
- Increase standard deviation of paratransit travel time distribution to more realistically simulate traffic conditions
- Test simulation using dynamic paratransit scheduling
- Schedule paratransit rides to a particular bus time, instead of waiting for next bus
- Test feasibility of holding the bus based on scheduled paratransit arrival at stop

[1] Z. Rubinstein, S. Smith, and L. Barbulescu, "Incremental Management of Oversubscribed Vehicle Schedules in Dynamic Dial-A-Ride Problems", Twenty-Sixth AAAI Conference on Artificial Intelligence, 2012.

Acknowledgements



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