



TaxiHailer: A Situation-Specific Taxi Pick-up Points Recommendation System

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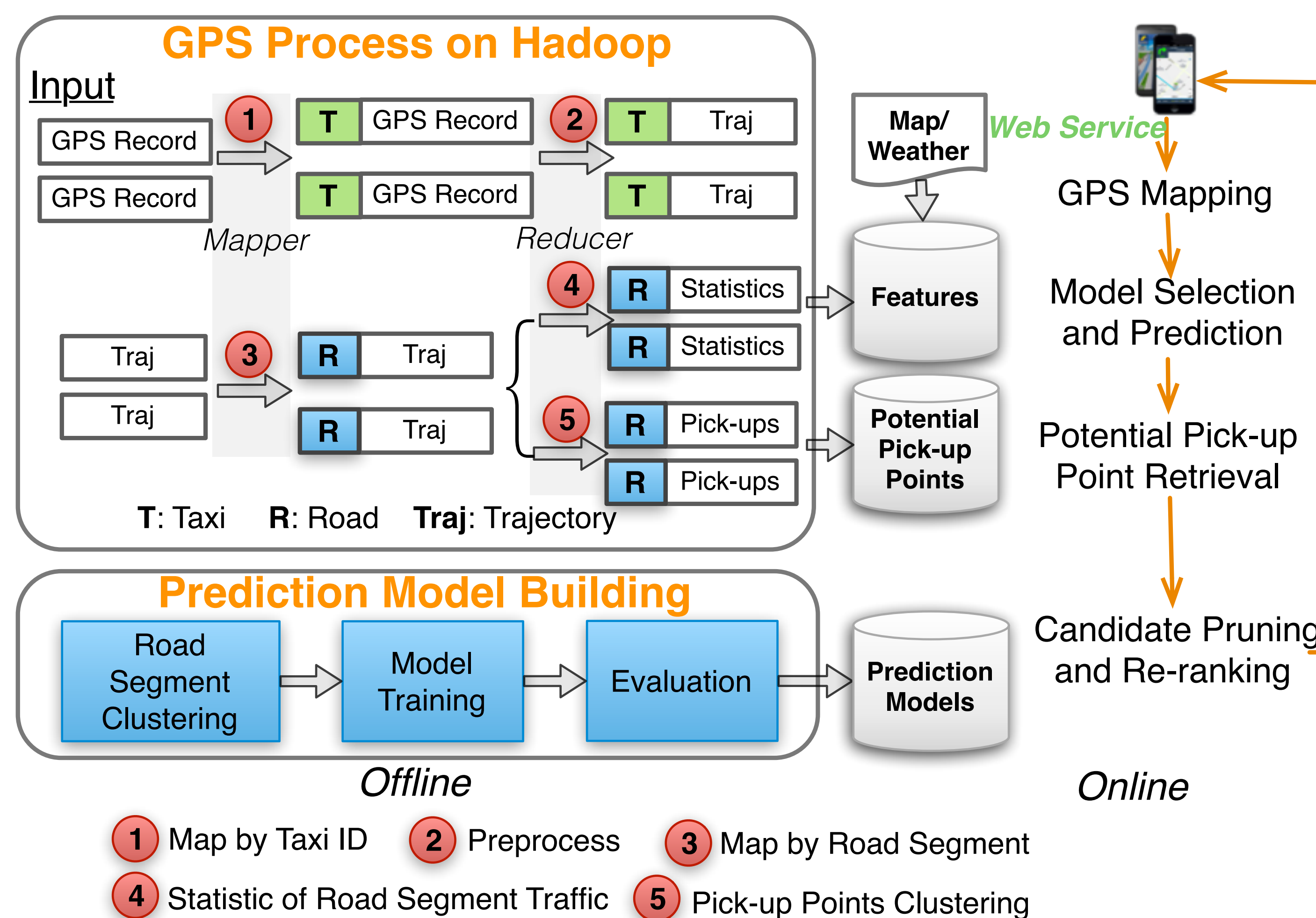
Motivation

- GPS devices in taxis are like millions of sensors on the road, collecting huge amount of GPS data.
- It is valuable to make pick-up points recommendation for passengers, especially for people who are eager to find a vacant taxi in an unfamiliar place.
- Many factors should be considered in the prediction of waiting time for vacant taxis in different situations, as well as the passenger's destination.

Introduction

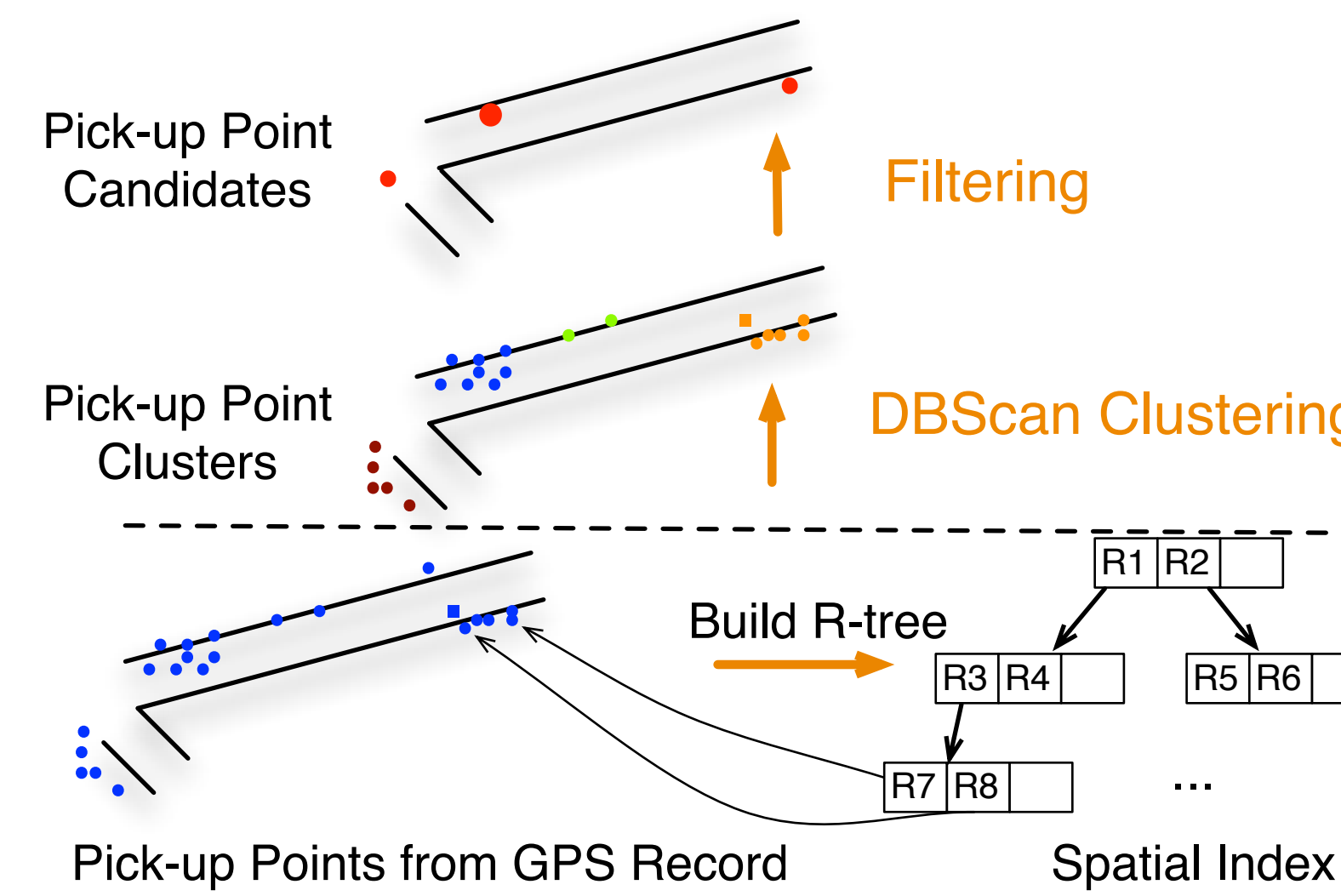
This demonstration presents TaxiHailer, a situation-specific pick-up points recommendation system for passengers. For example, a traveler who stays on East China Normal University campus in Shanghai wants to visit some places elsewhere, like the Bund, in the next morning. TaxiHailer will provide him/her with a list of pick-up points within a specified distance to his position ranked by waiting time plus walking penalty. The situation is determined by the time interval, weekday/weekend/holiday, cluster of road segment, weather and so on according to the query context. The waiting time for each point is predicted using the specific model corresponding to the situation.

System Architecture



Candidate Points Generation

- Build spatial index on pick-up points in GPS data to accelerate region queries
- Perform clustering on pick-up points
- Filter out "sparse" clusters by frequency and distance rules
- Generate potential pick-up points for recommendation



Waiting Time Prediction Model

- Road Division** cluster road segments into groups by traffic patterns
 - Time Division** divide into hours and weekdays/weekends/holidays
 - Features** 1) trajectory-related features, which reflect the traffic state, 2) road features and 3) weather features
 - Models** linear regression, tree-based regression and Poisson process
- The most proper prediction models for each situations are selected by periodical evaluation. In this way, TaxiHailer can yield different recommendations in different situations to achieve higher accuracy.

Pick-up Points Recommendation

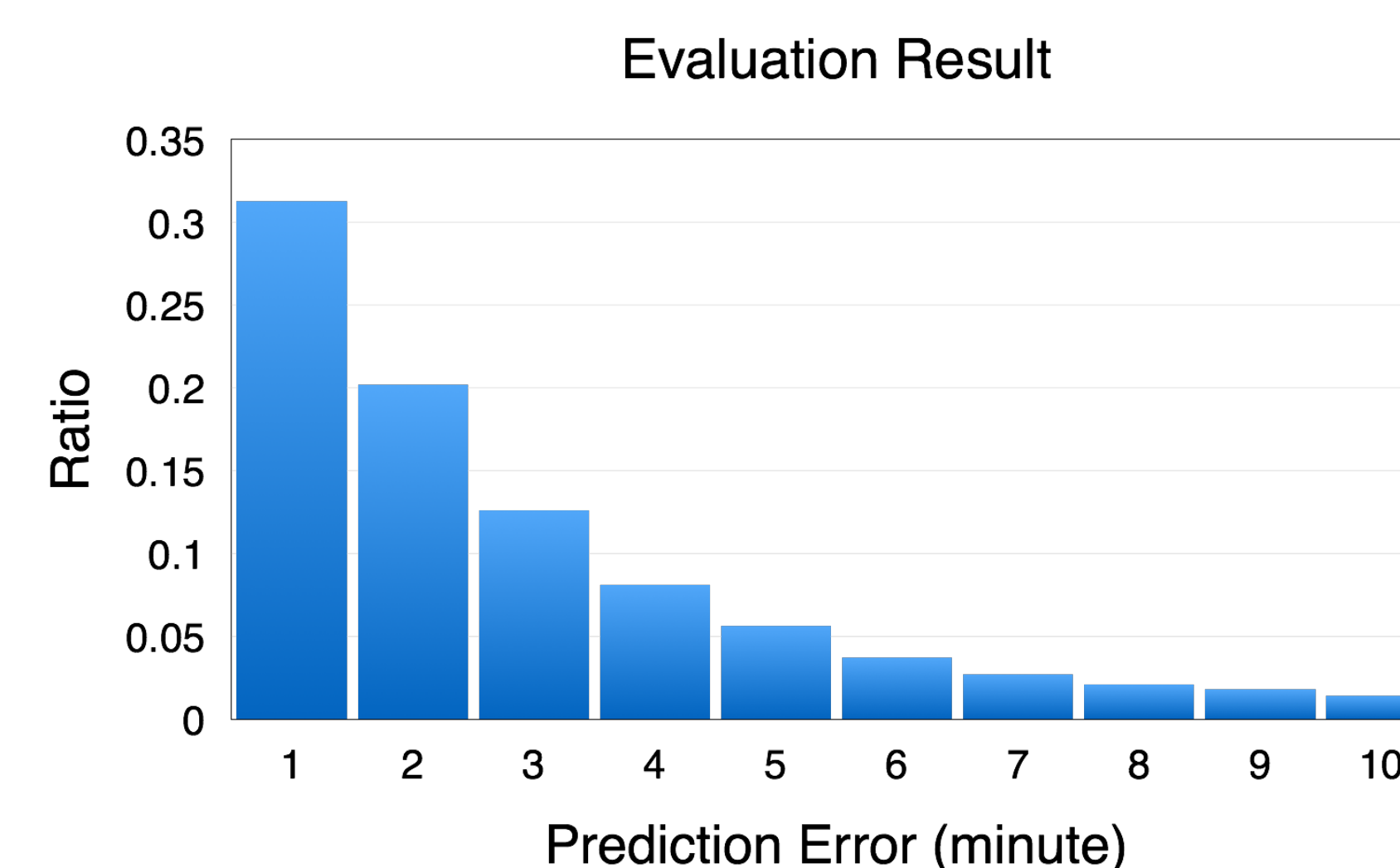
TaxiHailer provides a RESTful web service to process recommendation requests online as below:

- Query road segments nearby and prune them by the route, if the destination is provided.
- Use corresponding model to predict the waiting time for each segment.
- Retrieve pick-up points and rank them.
- Prune and re-rank candidates by direction.

Dataset & Evaluation

Dataset Description

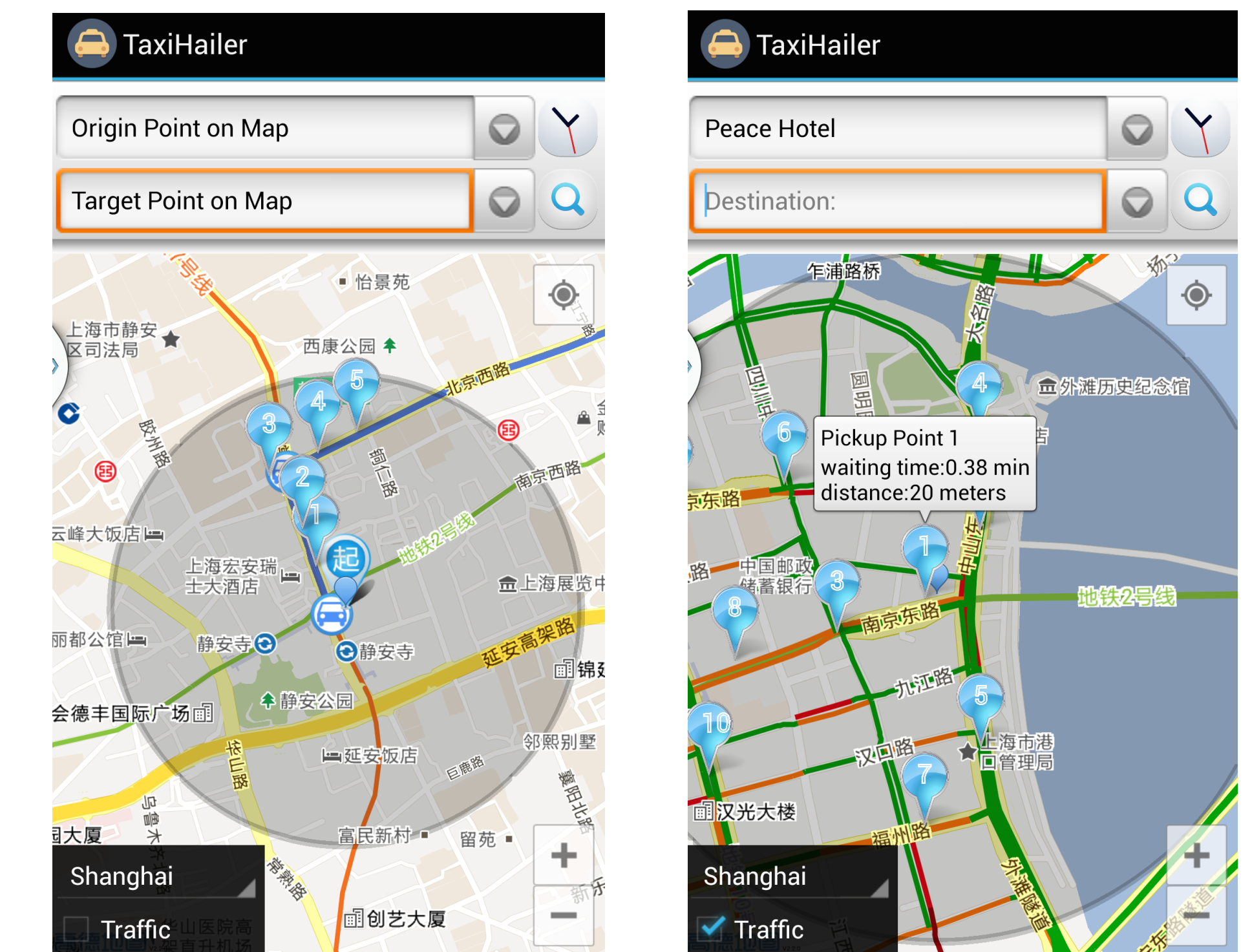
- GPS data of taxis in China (real and synthetic)
- Shanghai: 29,000 taxis
- Beijing: 12,000 taxis
- Time span: 4 weeks
- Evaluation: 65,000 queries



Challenges

- Error and noise filtering
- Efficient offline trajectory processing
- Situation-specific model building
- Destination-aware pick-up points recommendation

TaxiHailer Application



Related Work

Our approach is complementary to the previous work

- Energy-efficient mobile recommender system (KDD 2011)
- Non-homogeneous Poisson process (UrbComp 2012)
- T-Finder (TKDE 2013)

Future Work

- Recommend drivers locations to pick up passengers with real-time prediction functionality
- Crowd sourcing platform for both drivers and passengers

Demonstration Website

<http://database.ecnu.edu.cn/taxihailer/index.html>

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