Human mobility


C. Roth et al., PLOS ONE 6, e15923 (2011)

Urban taxi systems

7 days in 20 sec
Urban taxi systems

7 days in 20 sec

Pickups
Dropoffs
Large GPS data sets on taxi

NYC
13,500 cabs

Singapore
26,000 cabs

Shanghai, San Francisco, Vienna, ...
Zoom into the data

Pickups
Dropoffs
The system is inefficient

High emissions & cost
Attempts at improvement

- Ride sharing
- Smart hailing
We need a new system

- More efficient
- Less emissions
- Affordable alternative
Step 1: Analyze data
NY 170,000,000 trips / year
Step 1: Analyze data

Destinations

Origins

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Trips can be combined
Step 2: A new dispatch algorithm

- Combine trips
- Satisfaction criteria
- Minimize cost of service
Step 2: A new dispatch algorithm

Combine 2 trips
Step 2: A new dispatch algorithm

Combine $k$ trips  “Taxi Limousine”
Step 2: A new dispatch algorithm

Trip hypergraph
Step 2: A new dispatch algorithm

Trip hypergraph

Maximum matching for optimal solution
Online tool for interactive

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Taxi Pickup
1st Avenue
Total Pickups: 1674
Avg Trip Duration In: 10.1 min
Avg Trip Distance Out: 0.35 mi

Taxi Dropoff

hubcab

About

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Online tool for interactive

Fronten

OpenStreetMap

MapBox

Backend

using GeoIndex
Impact on urban planning and

- Use sensed data to better design cities
- Less congestion and cost
- Environmental improvement
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Urban Code
2012–11

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