PublicTransitSnapper:

Map Matching Mobile Phones to Public Transit Vehicles

Bachelor’s Thesis by Gerrit Freiwald
Introduction: Live Demo
General Transit Feed Specification (GTFS)

- Each trip is described by:
  - Shape
  - Route
  - Service
    - Active weekdays
    - Exception dates
  - Stops
    - Location
    - Stop times
Public Transit Vehicle Matching

- Geographical Component
- Time Component
PTV Matching – The Geographical Component

GPS Points

Choosing the closest street parts

Map Matching
PTV Matching – Shapes in Freiburg
PTV Matching – The Time Component

Stop 1
16:22h
16:32h

GPS point

Bus 1

Bus 2

Stop 2
16:45h
16:55h
Anti Over-Matching

PublicTransitSnapper: Map Matching Mobile Phones to Public Transit Vehicles
Anti Over-Matching
User Study
User Study – General Inquiry

- Were there any bugs?
- Were there unclear elements within the app?
- Were there matches when you were not in a Public Transport Vehicle?
- Usability rating from 1 to 5 stars
- Other remarks?
User Study – Freiburg

- Matching not precise on the highly frequented tracks
- No Matching at some stations
- Matching precise on lesser frequented tracks
User Study – Hamburg

- Correct matching on most tracks
User Study – Munich

- One correctly matched trip in a tunnel
- No wrong matching on busses
- No non-matching at stops

<table>
<thead>
<tr>
<th>Munich</th>
<th>Route Name</th>
<th>Vehicle Type</th>
<th>Time &amp; Date</th>
<th>Boarding Station</th>
<th>Exit Station</th>
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<tbody>
<tr>
<td>Trip 1</td>
<td>192</td>
<td>Bus</td>
<td>08:39h 18.10.2022</td>
<td>Am Hochacker</td>
<td>Quiddestrasse</td>
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<td>Trip 2</td>
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<td>Stachus</td>
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<td>U6</td>
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<td>08:01h 20.10.2022</td>
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<td>Trip 4</td>
<td>68</td>
<td>Bus</td>
<td>11:56h 20.10.2022</td>
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<td>Königsplatz</td>
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<td>Trip 5</td>
<td>58</td>
<td>Bus</td>
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<td>Bus</td>
<td>09:57h 21.10.2022</td>
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<td>Odeonsplatz</td>
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</tbody>
</table>
User Study – Zurich

- Some stops and curves lead to a non-matching
- Always matched correctly
- Tester walked next to a road and got matched
User Study – Conclusion

- 18 recorded trips
  - 8x bus
  - 3x tram
  - 6x subway
  - 1x ferry
- Bus matchings very accurate
- Subway matchings rather inconsistent
- Anti Over-Matching too strict
- Next stop always shown correctly
- Transfer options page risky without real time data
GTFS in Germany
Or: Prospects of publicly available GTFS data sets in Germany
GTFS in Germany - The Current State

PublicTransitSnapper: Dynamic Map-Matching To Public Transit Vehicles
**GTFS in Germany - Prospects**

- **DELFI**: Verein zur Förderung einer Durchgängigen Elektronischen Fahrgastinformation e.V. (Association for `continuous electronic schedule information support´)

- **DEEZ**: `Deutschlandweite Echtzeitdaten´ (real time data throughout Germany)
Image Sources
