A Map-Matching Algorithm for Applications in Multimodal Transportation Network Modeling (15-5081)

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Objectives

Mapping georeferenced data to an underlying map
- e.g. GTFS shapes → Node-link road representation

- Integrate DTA traffic model w/ transit planning model
- Validate DTA traffic model w/ GPS tracks
- Share data sources that vary by resolution & accuracy

Background

- Geometric vs. Topological
- Global vs. Local
- Trackpoint density
- Heuristics (overpasses, turns, speed, etc.)
- Challenge: A wrong routing decision leads to more wrong decisions. WE NEED MULTIPLE HYPOTHESES!

Example

Trackpoint sets:
- CapMetro GTFS: 84 routes · 170 shapes · 45,476 points · 1,383 miles · 2 in - 3472 ft apart, avg. 161 ft
- GPS 1-sec.: 22 routes · 44 journeys · 44,298 points · 283 miles · 0 to 14 ft apart, avg. 34 ft

Maps of Austin, TX area:
- NMC CAMPO DTA: 11,393 nodes · 13,353 links
- OpenStreetMap: 123,046 nodes · 300,199 links

Experiments

<table>
<thead>
<tr>
<th>Trackpoint Set</th>
<th>Underlying Map</th>
<th>Discontinuities</th>
<th>Routing Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 CapMetro GTFS</td>
<td>NMC CAMPO</td>
<td>0</td>
<td>35.9% *</td>
</tr>
<tr>
<td>#2 GPS 1-sec.</td>
<td>NMC CAMPO</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>#3 CapMetro GTFS</td>
<td>OpenStreetMap</td>
<td>0</td>
<td>99.8% *</td>
</tr>
</tbody>
</table>

* In hand-checked cases, 3068 of 45,476 GTFS points

Conclusions

- No heuristics, multiple hypotheses, quasi-global algorithm
- High routing accuracy at regional scale
- Future work:
  - Observe link curvature
  - Computational speedups
  - Fixing underlying topology

Acknowledgements

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Check It Out!

Source code (GPL license, Python): http://ctr.utexas.edu/nmc/nmc-map-matcher

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