DECENTRALIZED PUBLICATION AND CONSUMPTION OF TRANSFER FOOTPATHS

Harm Delva, Julián Andrés Rojas Meléndez, Pieter Colpaert, and Ruben Verborgh

IDLab, Ghent University – imec
OPEN DATA PUBLISHING

What data should be published?
How should data be published?
How do we enable data reuse?
MOBILITY AS A SERVICE

“provide a traveler with the service needed for a door-to-door travel under a single payment whilst integrating disparate modes of mobility under one travel experience”
MOBILITY AS A SERVICE

“provide a traveler with the service needed for a door-to-door travel under a single payment whilst integrating disparate modes of mobility under one travel experience”

What about walking between public transit stops?
FOOTPATHS

Terminology used in RAPTOR, CSA, ...

A footpath connects two stops

\[\leftrightarrow\]

You can walk between those stops
DISCONNECTED BUT COMPLETE GRAPHS
“Even with all accelerations, the exact algorithms proposed are not fast enough for interactive applications.”

“...limits walking transfers between stops to \( x \) minutes; in this case we precompute these transfers.... Note that existing solutions often use such restrictions.”

UNRESTRICTED WALKING IS IMPORTANT

OUR GOALS

- Time and space efficient
- No walking restrictions
- Open-world assumption
Delaunay Triangulation

\( O(n) \) edges

Easy to compute

Contains nearest-neighbors subgraph

Good approximation of complete graph
PATH ALONG TRIANGLE EDGES
PATH ALONG TRIANGLE EDGES

Everything is still reachable
TRIANGULATING PUBLIC TRANSIT STOPS
MERGING NETWORKS
# Overlapping Service Areas

<table>
<thead>
<tr>
<th></th>
<th>Paths in ♠</th>
<th>Paths in ♦</th>
<th>Missing paths</th>
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<tr>
<td>♠ ← Flanders</td>
<td>107,171</td>
<td>7,969</td>
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<td>♦ ← Brussels</td>
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<td>♦ ← Wallonia</td>
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PUBLISHING THE RESULTS

https://hdelva.be/stops/distances/12/2090/1370

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{
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    },
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            "prov:generatedAtTime": "2019-08-14T14:01:09"
        }
    ]
}
```
Delaunay triangulations require a metric space $d(x, y) = d(y, x)$
Delaunay triangulations require a metric space

\[ d(x, y) = d(y, x) \]

Euclidean distance is by far the most convenient
APPROXIMATING WALKING DISTANCE

Can a bus network be used to approximate the distance between train stations?
NEXT STEPS

How reasonable are our overestimations?

Do you trust data that says two train stations are 200m apart?
CONCLUSION

Practical solutions use heuristics
Delaunay graphs seem promising

hdelva.be/slides/sem4tra2019/
hdelva.be/articles/decentralized-footpaths/