

# Effective Map-matching on the Most Simplified Road Network

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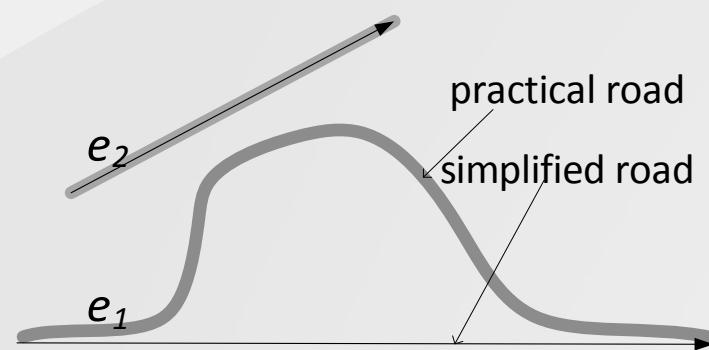


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## Map-matching on the Simplified Road Network: Why?

### Motivation

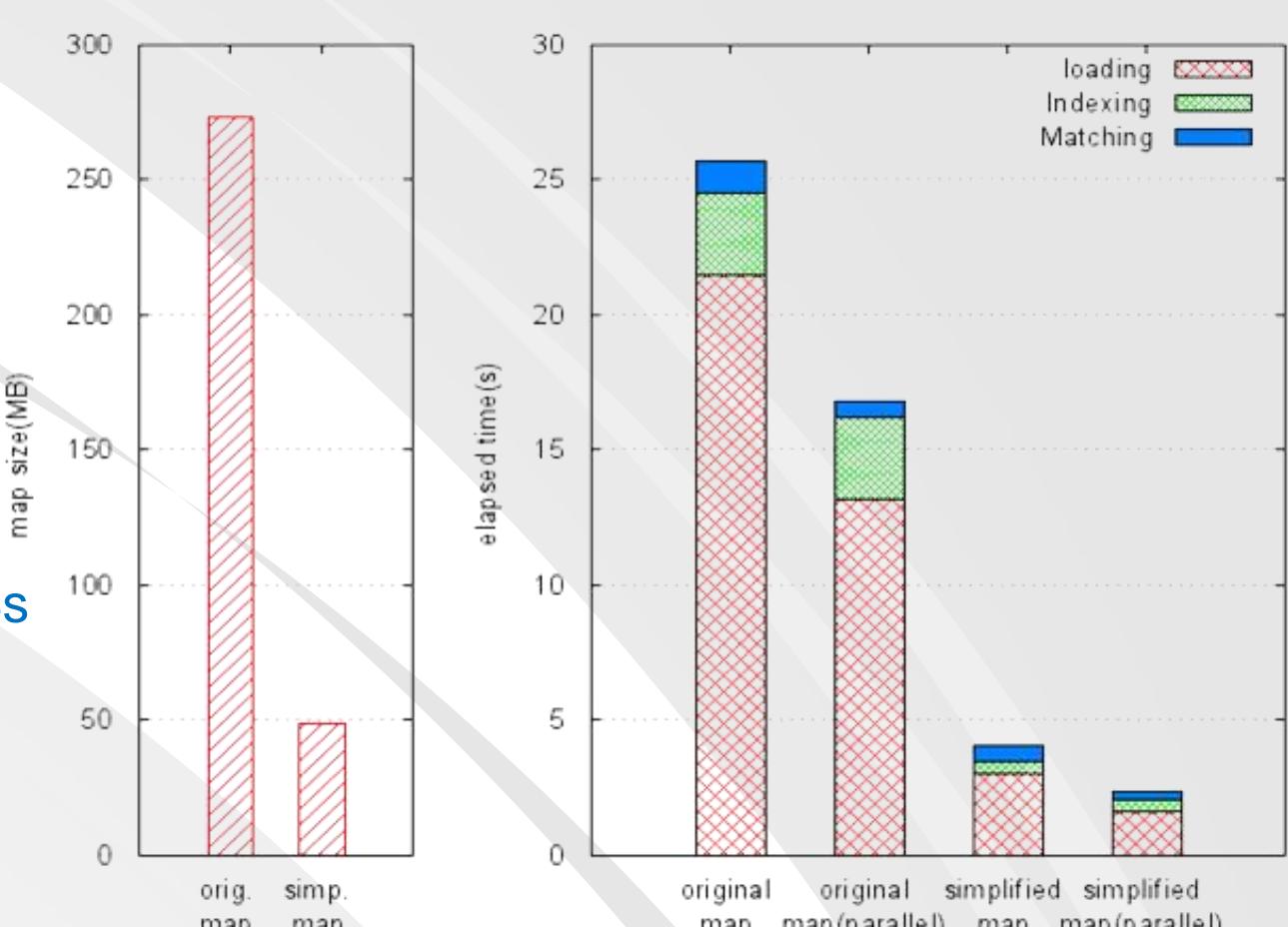
- Some maps are simplified naturally.
- Some terminals have limited memory.



Type	Attributes
Original	<code>id, name, type, length, speed limit, width, start, p1, p2, ..., pn, end, etc.</code>
Simplified	<code>id, start, end</code>

### Result

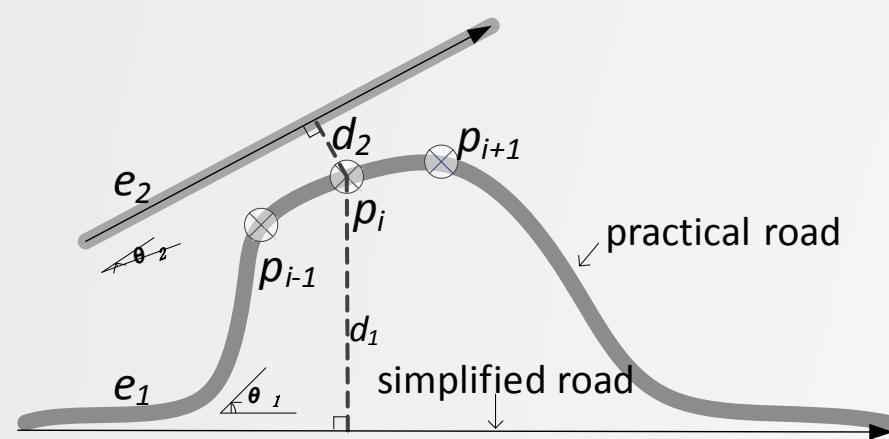
- Map size:
  - 273.5MB → 48.6MB.
- Speed up
  - Indexing: 3s → 0.48s
  - Matching: 1.2s → 0.58s
- Accuracy
  - 1Hz GPS: 95.63%



## Proposed Method: Passby

### Example

- An object  $o$  moving on road  $e_1$ , with sampled positions  $P_{i-1}, P_i, P_{i+1}, \dots$
- Should  $P_i$  be matched to road  $e_1$  or road  $e_2$ ?

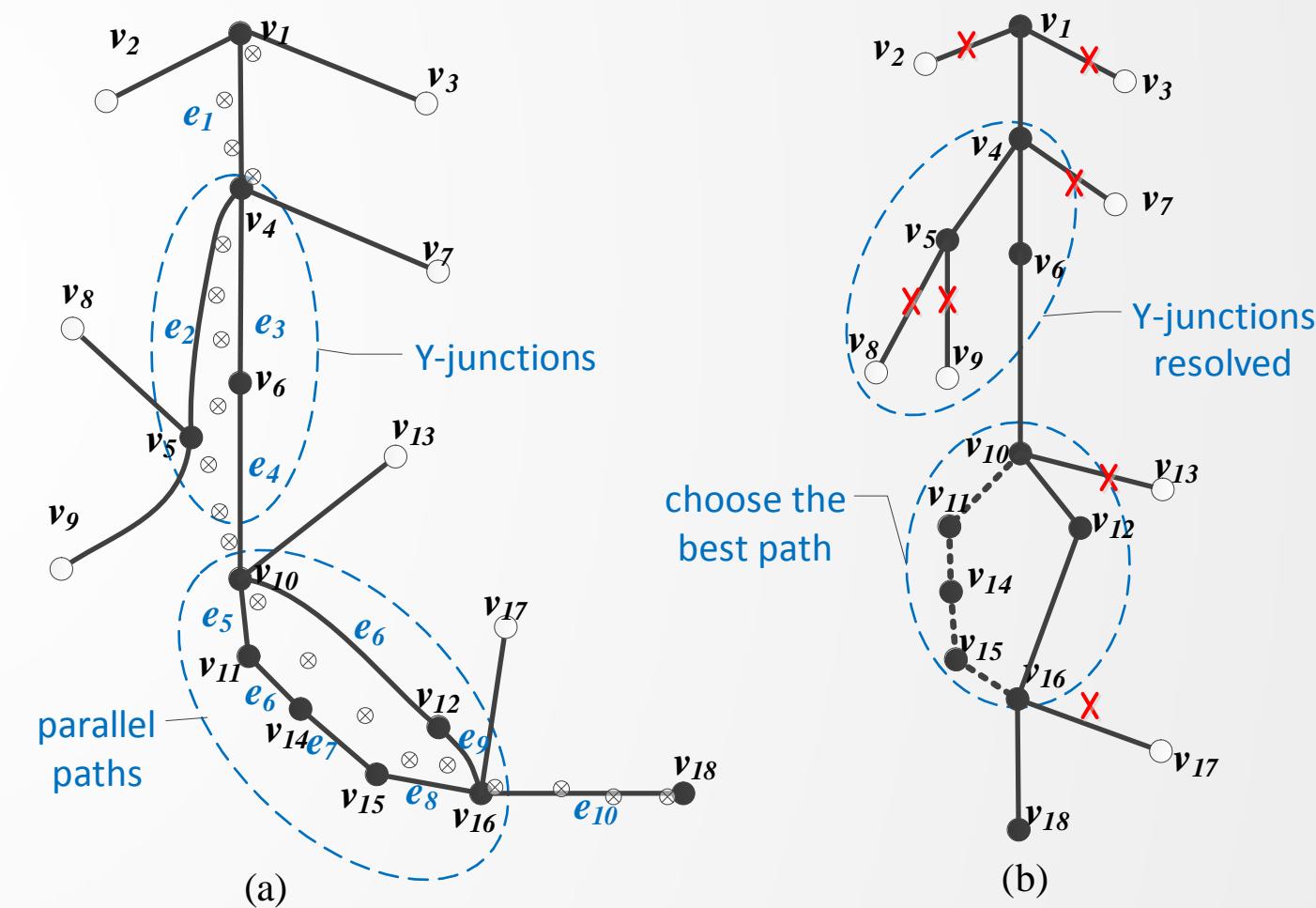


### Challenges

- Low sampling rate trajectories
- Other problems, e.g., Y-junction, Parallel pathways, tunnel

### Improved approach

- Search Space
  - 1. Topological constraints
  - 2. Spatial constraints
  - 3. Temporal constraints
- Ranking with weighted sum strategies



### Basic idea

- We can reduce the uncertainty of map-matching by considering both intersections which object  $o$  has passed and will pass by next.



Unfortunately, it applies to high-sampling-rate trajectories only.

Passby shoots more than 60%(15s). Now, much better!

## Some supplementary mechanisms & tools

### Fast Angle Calculation

- Hash tables:  $\arctan$ ,  $\cos$  and  $\sin$

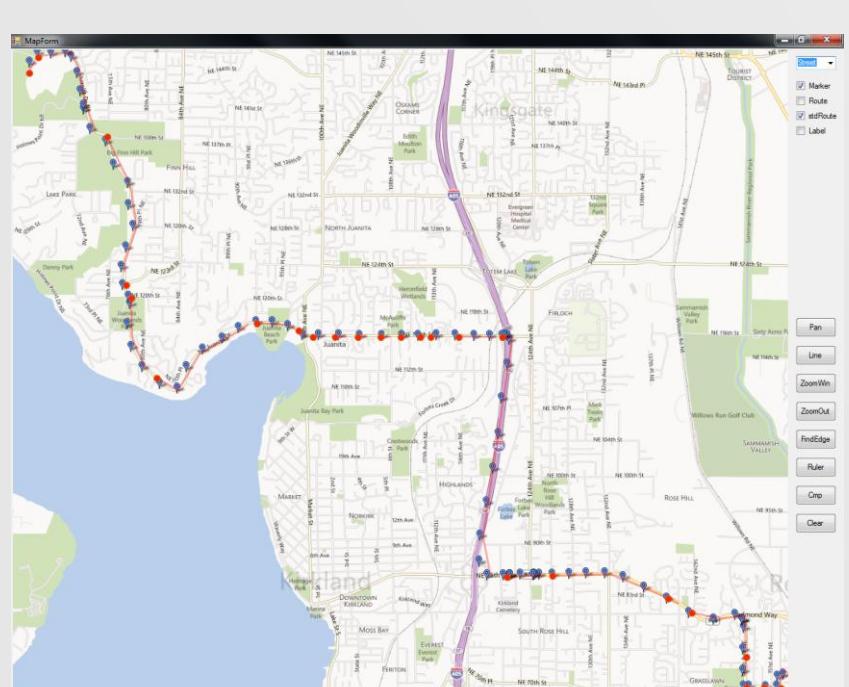
### Parallelized Matching Process

- Matching(1hz) with OpenMP: 0.58s → 0.3s

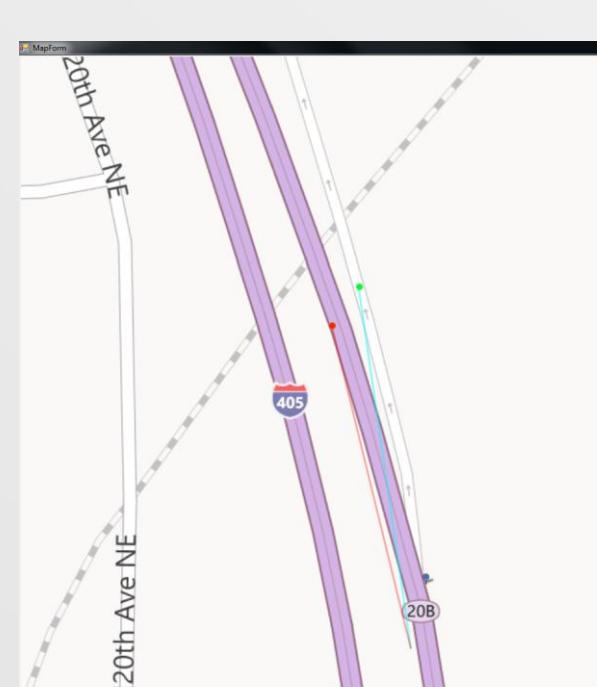
### Outlier Identification

- Topology connectivity and path reversibility

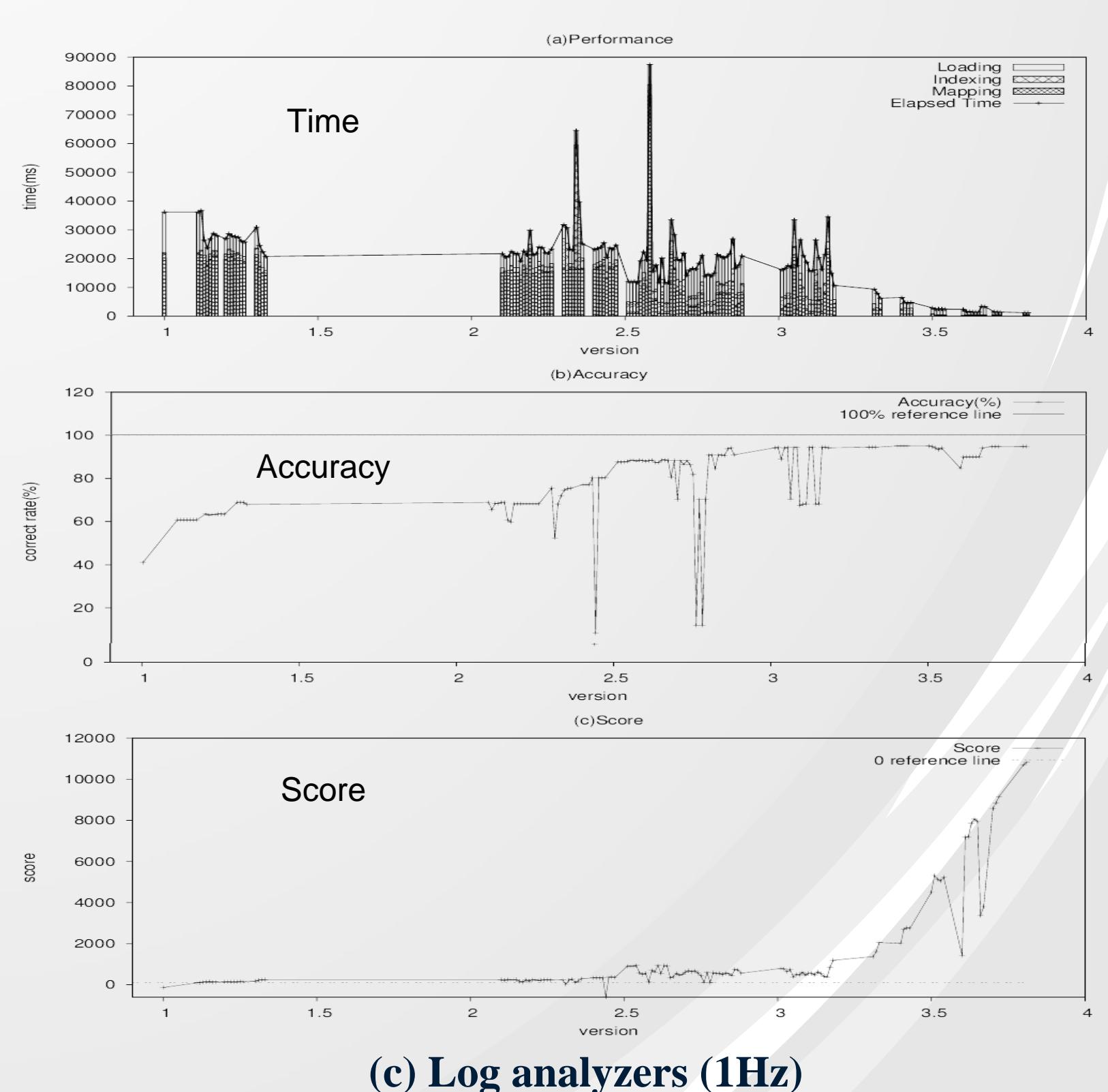
### Visualization Tools



(a) Matching result



(b) Error debugging



(c) Log analyzers (1Hz)

Authors:

