tmc

Informatics ac ALGORITHMS AND COMPLEXITY GROUP

Open Master Thesis topic

Geometry-based railway track extraction from OpenStreetMap data

Our company partner tmc (detailed information below) develops a service (tmTrackDB) that acts as a common source of railway track geometries and associated metadata for all tmc products. This service is dependent on some source of geometry data. If no other geometry data source is available, the import process is designed to fall back to OpenStreetMap (OSM) information, which is very detailed, but may also contain incomplete or imprecise data.

A first goal of the thesis project is to come up with a solution that allows an automatic import process to deduce correct track geometries in a deterministic way from the raw geometry data source available, but with the aim to find a solution that is able to merge data from different sources, like different geometry providers, and consolidate/integrate them into a consistent geometry data base with more details/accuracy/precision when more data is available.

Base Problem Description

The tracks are provided by OSM as a set of unordered line segments or short polylines (Figure 1), each of which has two endpoints in a 2D space coordinate system. The goal of the thesis is to design and implement algorithms to connect and order those segments in a way that the output represents the true rail geometry in a railway system map.

- Develop and analyze suitable algorithms for segment connectivity, minimizing possible errors and distortions (the result should be as close to topographic reality as possible).
- Make the algorithms robust against editing errors in the data source such as non-touching line segments or improper tagging.
- Consider real-world edge cases, such as self-intersecting tracks. The two red and the two black segments in Figure 1 should be connected, but Figure 2 shows an edge case in which this connection information is not easily identifiable.
- Compare the suggested solution in terms of quality and performance to an existing greedy approach by tmc.
- Desired: Extend the algorithm to allow merging geometry datasets of different quality and resolution.

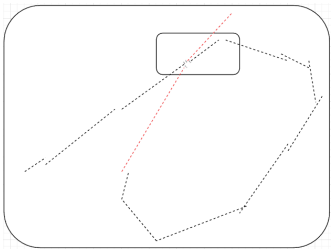

Figure 1 Common case of a loop on a track

Figure 1 Overlapping loop Gotthard, Switzerland

Technology & Skills

- Java
- Java Technology Suit (JTS)
- OpenStreetMap (OSM)

Contact

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Recommended Lectures

- 186.122/192.133 VU Algorithmic Geometry

Track Machines Connected GmbH (tmc) is a railway digitalization leader that applies multi-disciplinary science to create unique software and hardware solutions that capture, measure and optimize the status and condition of railway infrastructure, track machines and entire track maintenance fleets. The Austrian niche player is headquartered in Linz with a subsidiary in Vienna and employs the brightest 90 scientists, developers, project managers and digitalization enthusiasts worldwide.

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