Our data sets do not provide the geometry of the actual tracks and use straight-line edges between the geographic locations of stations. One edge represents a bundle of one or more metro lines. We describe an algorithm that produces metro maps with circular arcs based on this input. We steer the geometric similarity of the resulting lines by controlling the number of circular arcs in the schematic map.

To deal with interchanges, we partition the deformed input into disjoint polylines called strokes. We first group edges that represent the same bundle of metro lines to obtain better continuity of metro lines. Then we further group these bundles depending on the continuation angle at the interchanges.

Our algorithm repeatedly replaces two circular arcs by a single arc. It always picks the replacement with lowest Fréchet distance to the original geometry. Our main innovation lies in the algorithm’s ability to replace two arcs meeting at an interchange. For degree-3 interchanges, the third arc is extended; for higher degrees, the replacement is constrained to stay close to the interchange.

If multiple lines connect two stations, an offset of the computed arc is used for each metro line. This results in concentric circular arcs. The order of metro lines is optimized to be consistent between edges. During the schematization step, some stations may have been removed; these are reinserted at equidistant positions along the correct arc.

The geographic input typically has a dense city center, with a high number of stations and interchanges. We apply the method of Van Dijk and Haunert (2014) to locally enlarge these arcs, minimizing the distortion. The enlargement factor for each station depends linearly on the number of nearby stations.

During the schematization step, some stations may have been removed; these are reinserted at equidistant positions along the correct arc.

Geographic locations of stations
Straight edges
Bundle of metro lines per edge

Deformation
Make space in dense areas
Local enlargement
Factor: number of nearby stations

Strokes
Partition into disjoint polylines
Group bundles of same lines
Continuation at interchanges

Schematization
Replace 2 arcs by single arc
Do not introduce intersections
Maintain interchanges

Rendering
Offset arcs for multiple lines
Ordering
Reinsert stations

Results
Input 90 edges
Input 132 edges
Input 339 edges

Vienna
24 arcs
15 arcs

Karlsruhe
27 arcs
19 arcs

London
81 arcs

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