Using the Straight Skeleton for Generalisation in a Multiple Representation Environment

Jan-Henrik Haunert, Institute of Cartography and Geoinformation, University of Hannover
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Outline

- Motivation
- Algorithm for Straight Skeleton
- Application to Generalisation
- Insertion of a new Feature
- Future Work & Conclusion
Motivation

- Comprehensive administration of different data sets
  - Better support of complex analysis
  - More efficient updating process

- MRDB approach:
  - Correspondences are explicitly expressed as links and stored in a database
  - Example: German cadastral and topographical datasets

- Aim: Propagation of updates

Different representations of features!
Motivation

Approach for updating in MRDB:

- Insert feature to base level
- Generate appropriate representation for target level

1. Generalisation task:
   
   Need for algorithms that generate the proper representation.

- Insert new representation to target level

2. Integration task:

   Conflation of new features with features in target dataset.
Skeleton Algorithm

One possibility to gain a linear feature from an areal one:
- Straight Skeleton - Raising roof on ground plan of a house

Construction by shrinking process:
- Construct bisectors in vertices of polygon
- Parallel offset of polygon edges along bisectors until event happens

Two types of events:
- Edge Event
- Split Event
Skeletons

- Straight Skeleton
- Constrained Delaunay Triangulation
- Medial Axis
Skeleton Algorithm

Faster Algorithm: (Eppstein & Erickson 1999)

- Generate ordered list of events
- Perform next event and maintain changes in list.

- Perform next event:
  - Delete adjacent events
  - Add new events
  - Insert skeleton edges
- Perform next event...
Application to Generalisation

- Using the Skeleton for Generalisation:
  - Geometry type change from area to line
  - Partial geometry type change
  - Collapse of an area
Reconfiguration of junction areas

Construction of incircles in junctions of skeleton

Two incircles, each containing the centerpoint of the other circle:

→ Merge to one junction.

Create new junctions by extrapolation of road axes and intersection.
Application to Generalisation

Example:
Extracted road axes from parcels
(after rule based reconfiguration of skeleton)

Derived from cadastral data
Reference from topographic dataset
Application to Generalisation

► Modification of Algorithm:
  - Setting different inclinations to roof planes
  - To preserve topological relationship with adjacent features: Vertical plane
  - Example: Area collapse without change of outer borderline
Insertion of a new Feature

▶ Integrating a new feature to the target dataset
  - Generalisation of new feature and other features that need to be considered. Here: Enclosing Region
  - Approach to Map Conflation problem: When preserving links within generalisation, then counterpart features are known.
  - Rubber-Sheeting Transformation via counterpart features
  - Transforming new features
Conclusion & Future Work

► Approach for Propagation of Updates:
  ▪ Generalisation and Integration as two different processes
  ▪ Straight skeleton is used for Geometry type change and Collapse

► Future Work:
  ▪ Which feature needs to be collapsed?
  ▪ The geometry type of which feature needs to be changed?
  ▪ With which settings does the algorithm need to be applied?
  ▪ Which impact does this have on other features?
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Thank you for your attention!