Automatization of Cartographic Generalisation of Contour Lines

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Model vs. Cartographic Generalisation

- Model/data generalisation - obtaining a less detailed database from a more detailed one
- **Cartographic generalisation** - deriving a map in a smaller scale from a database or map in a larger scale
  - map scale
  - minimal dimensions
  - properties of geographic features
  - map purpose
  - ...

Motivation – Automatic Vectorisation of Lines

“conformal” generalisation, i.e. shape (length, areas) of lines is unchanged

equidistant, equiareal or other type of line generalisation
a) original object
b) enlargement by generalisation
c) reduction by generalisation
d) preserving area (Frančula 2003)
Four to Three Consecutive Points = Simplification

Three to Four Consecutive Points $= \text{Smoothing}$

**Triangle -> Isosceles trapezoid**

Combined Effect of These Two Operators
Example

102343 vertices

481 vertices

654 vertices

1:25 000 000

1:50 000 000
Usability
Analysis of manually generalised lines on „old” topographic maps.

Length is shortened in smaller scales.

Length of middle segment is the key parameter of simplification operator.

Iteratively find a middle segment length to get line lengths as on maps.

Linear function = 0.04 mm in map scale (for thin lines).

Test dataset – coastlines of all Croatian islands.
User Can Fine Tune the Result...

- Map scale – the only parameter for the algorithm
- Line weight – if thicker line, think of it as smaller scale
- Map purpose – wall, thematic, topographic (adjust map scale)
- Medium – paper, screen resolution (adjust maps scale)
- ...

... but automated system (on thy fly map generalisation) can use it for map scale is always known in advance.
• GRASS GIS module (v.cartographic.line. generalisation) binded over

• Web Processing Service (OGC) – algorithm is available to anyone who has WPS-client
  (http://wps.kartografija.hr/pywps/cgi-bin/pywps.cgi)

• QGIS Plugin – planned this year
Real Life Examples – New Topographic Maps
To Improve... Feedback from Professionals
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Orienteering Maps – Importance of Contours
Conclusion – Advantages

- Filtering small objects by area (before or after generalisation)
- Thematic mapping (attribute over an area, e.g. drainage basins)
- Simulates manual generalisation
- Good visual and geometrical properties
- Polygons never collapse to lines or points
- Convex areas are intact (e.g. circles)
- ...

• Topological issues (self intersections, features intersections)
• Global quality of the algorithm (as Douglas-Peucker)
• Improvement of point position selection
• Orthogonal version (building generalisation)
• Availability in different cartographic softwares (GRASS, QGIS, web-mapping (Leaflet, OpenLayers ...))
• ...

Conclusion – Future Challenges
Thank you for your attention!

- Questions, ideas, collaboration, critics ... are welcome