A Methodology on Natural Occurring Lines Segmentation and Generalisation

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the aim of the project

description of methodology

segmentation

line generalisation tools

examples

future outlook
aim:

to develop a model that generalise natural occurring lines (lines that represent physical features, like rivers, coastlines, etc)

concept:

based on the “philosophy“:

    segmentation - analysis - generalisation


condition:

to preserve the legibility of the outcome
Remark:

Parts of the cartographic line that are more complex in shape (ε-non-convex) have:

- significant legibility problems in the target scale under generalisation
\[ \varepsilon = W + D + T \]

\( \varepsilon \): is associated with line width and visual discrimination limit at target scale

- **W**: Line width
- **D**: Visual discrimination limit
- **T**: Tolerance
Type A:
Left or right sided $\varepsilon$-non-convex parts

Type B:
Both sided $\varepsilon$-non-convex parts

Type C:
Line coalescence between separated parts

Type D:
$\varepsilon$-convex parts
Type A
Left or right sided $\varepsilon$-non-convex parts
Type B
Both sided $\varepsilon$-non-convex parts
Type C
Line coalescence between separated parts
Type D
\(\varepsilon\)-convex parts
segmentation

Implementation environment:

ArcGIS (© ESRI)

Model Builder
segmentation model (overall view)
segmentation model (part 1)
segmentation model (part 2)
segmentation model (part 3)
segmentation model (part 4)
generalisation tools

**Gauss filtering** (smoothing algorithm)  
Fritsch 1997

**Balloon** (exaggeration algorithm)  
Lecordix et al. 1997

**Bend Analysis** (detection of inflection points & peeks)  
Wang & Müller 1998

**Affine transformation** (geometric transformation)

**Depress** (displacement algorithm)

Implementation environment: MATLAB (© MathWorks)
Type A

\[ \sigma = 9 \]
\( \sigma = 40 \)

Type B
Type C
Type D
examples

Peristera Island

generalisation scenarios:

1:100K
1:250K
1:500K
1:1M

from scale 1:50K to
example of segmentation

1:100K

One-Sided $\epsilon$-non-convex parts
$\epsilon$-convex parts
example of segmentation

1:250K

One-Sided $\epsilon$-non-convex parts
Two-Sided $\epsilon$-non-convex parts
$\epsilon$-convex parts
example of segmentation

1:500K

One-Sided $\varepsilon$-non-convex parts
Two-Sided $\varepsilon$-non-convex parts
$\varepsilon$-convex parts
example of segmentation

1:1M

One-Sided $\varepsilon$-non-convex parts
Two-Sided $\varepsilon$-non-convex parts
Parts of Convergence
$\varepsilon$-convex parts
generalisation example (1:50K to 1:100K)
generalisation example (1:50K to 1:100K)

analogue map

proposed
generalisation example (1:50K to 1:250K)
generalisation example (1:50K to 1:250K)

analogue map

proposed
generalisation example (1:50K to 1:500K)
generalisation example (1:50K to 1:500K)

analogue map

proposed
generalisation example (1:50K to 1:1M)

initial line

proposed
generalisation example (1:50K to 1:1M)

analogue map

proposed
future outlook

**Depress** algorithm with more than two interacting parts

incorporate generalisation tools (**MATLAB**) into Model Builder (with Python)
Thank you