Generalisation Process for Top100:
Research in Generalisation brought to Fruition

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Carto2001 PROJECT
IGN
Generalisation process for Top100

- Carto2001 project: Context and objectives
- Carto2001’s needs in generalisation
- The automatic generalisation process
- The guided interactive part
- Conclusion and outlooks
The Top100 product

- Source DB
- BDCarto®
- 10-meter resolution
- Several themes: roads, hydrography, etc.

Top100 Map
- Scale 1:100,000
- 76 sheets with overlapping
- Topographic and touristic map

Context

Needs Carto2001 generalisation process

Conclusion
Generalisation context

- Previous project aborted: 95-98
  - Too expensive: 60 000 € / 18 months by map

- Maturity of research in automated generalisation
  - COGIT experience
  - AGENT project

- New Platform: LAMPS2
  - 1 DB covering the whole French Territory

- Cooperation between IGN and LSL
Carto2001’s needs

- No buildings

- Tools for network generalisation
  - Rivers, roads, railway
  - «Independent» generalisation for roads
  - Network displacement

- Tools to maintain data consistency
  - Connectivity of network
  - Geometry sharing
  - Relative positions of objects
  - Displacement has to be contained
Production constraints

- High degree of automation
- Automated process
  - Robustness
  - No data alteration
- Interactive process
  - Guided: conflicts detection tools
  - Ergonomics
  - Smart tools: semi-automatic tools
Automated generalisation

- **3 main steps**
  - Displacement of rivers
  - Bending generalisation of roads
  - Network displacement of roads and railway

- **2 techniques**
  - AGENT for bending generalisation
  - BEAMS for network displacement

- **Data consistency mechanism**
  - Diffusion
  - Frozen objects
Context

Needs

Carto2001 generalisation process

Conclusion

Bending generalisation

- Solving conflicts due to coalescence and noise on the object itself
- Remove tiny details (noise)
- Stretch bends
- Remove some bends in bend series

Use AGENT technique on each object separately

Results:

<1% objects unsolved

Risk: creation of intersections between objects
Contextual generalisation

- Solve conflicts due to symbol overlapping with other objects
- Enforce readability of junctions

- "Elastic Beams" technique used

- M. Bader PHDThesis (University of Zürich)
- Presented in ICA Workshop in Beijing
- Available in LAMPS2 since March 2002
- Principle: optimisation approach
  - Internal and external forces on each vertex of the line ~ conflicts
  - Definition for each object of an ability to be distorted, compressed or extended
Context Needs

Carto2001 generalisation process

Conclusion

Contextual generalisation

• How to use beams on thousands of objects?
  • Data partitioning • which logic?
  • Definition of « flexibility graphs »
    – 1 – conflicts detection
    – 2 – evaluation for each conflict of the objects which could be displaced to solve it : graph
    – 3 – graph merging
    – 4 – Beams is applied on each merged graph

process

Conclusion
• Some specific tools have been interfaced with all the generalisation tools

• Diffusion tool
  • Propagate displacements on connected objects and objects sharing the same geometry
  • Used for isolated point: creation of fictive line to connect isolated point (church, hospital) to the road network

• Objects freezing
  • Possibility to stop the diffusion on specific objects
  • Possibility in Beams to not move specific objects (simulation of coastline)
Carto2001 automated generalisation process

• 1 – river displacement
  • BEAMS
  • Roads are frozen

• 2 – Generalisation of bending roads
  • AGENT

• 3 – Roads and railway networks contextual generalisation
  • BEAMS
Context Needs

Carto2001 generalisation process

Conclusion

The guided interactive part

• Conflicts detection

• To not check all the map

• Correction tools

• Use of diffusion to maintain data consistency

• Beams and AGENT can be launched on specific objects

• « Smart » displacement tools
Results and outlooks

• Automated generalisation : 50 h / map
• Interactive part ~100 h / map
  • previous project : 1000 h / map
• Adaptability of research work to production
• Future work :
  – interface generalisation tools with updating process
  – integration of generalisation tools in other similar production line : departmental maps
  – extension to buildings : 1:50000
Carto2001 project’s challenge

Derivation

Updates retrieval

Evolution data

Updating

t0 → t0

BDCarto DB

Time

t1 → t1

BDCarto DB

Top100 DB

Evolution data

Updating

Top100 DB