QGIS plugin for vector conflation

Geoinformatics FCE CTU 2013

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Introduction

Background:

- my bachelor thesis

The aim of thesis:

- design of QGIS plugin for vector conflation
- design and creation of C++ library with selected algorithms
- list of existing tools in this field
Conflation

Definition

In GIS, conflation is defined as the process of combining geographic information from overlapping sources so as to retain accurate data, minimize redundancy, and reconcile data conflicts.

(Shekhar, Xiong: Encyclopedia of GIS)

Brief definition

Conflation is the action of unifying two distinct datasets into a new dataset.

(Blasby et al.: GIS Conflation Using Open Source Tools)
Classification

**Type of input layers:**
- raster to raster
- vector to raster
- vector to vector

**Area occupied by input layers:**
- horizontal
  - neighbouring areas - aligning boundaries
- vertical
  - overlapping areas - feature matching and aligning
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Conflation Workflow

Vector conflation steps:

1. Pre-processing
2. Control of data quality
3. Find matching features
4. Geometry alignment and/or transfer of attributes
5. Post-processing
Proprietary Tools

- ESRI ArcGIS - Spatial Adjustment, Integrate
  - sub-tools for some conflation steps
- Intergraph Geomedia - Fusion
  - maintenance of data in geographic database, data integration
- ESEA MapMerger
  - attribute transfer, map combination and update
- ConflleX
  - use of artificial intelligence
## Open Source Tools

- **JCS - Java Conflation Suite**
  - the most interesting open source in this field
  - library using JTS (Java Topology Suite)
  - collection of OpenJUMP plugins

- **OpenStreetMap**
  - JOSM conflation, Potlatch2merging tool
  - small tools, conflation subtasks, manual conflation
name - just temporary

- vector to vector conflation algorithms
- independent on QGIS plugin (later)
- GEOS (Geometry Engine, Open Source)
  - C++ port of the Java Topology Suite (JTS)
  - geometry representation
  - spatial predicates and operation
Vertex Snapper
Snap close vertices

1. tolerance distance
2. find close features
3. compute distance between vertices of close features
4. snap two close vertices
**Coverage Alignment**
Align two overlapping layers

1. find matching features
2. select TIN vertices
3. Delaunay triangulation
4. local affine transformation
5. more iterations
Coverage Alignment

Matching features criteria

Buffer test

Boundary buffer test
Line Matcher
Matching line segments

1. find close lines
2. test pair of segments from close lines
3. find matching segment (length, angle, proximity)
4. mean from two matching segments
Conflate

- Quantum GIS
- written in C++
- using GEOC algorithms

![Diagram showing the relationship between QgsConflatePlugin, Dialog, and QgsConflateProvider]

- QgsConflatePlugin: loading plugin
- Dialog: graphical interface
- QgsConflateProvider: functionality
Graphical User Interface

**Reference Layer**: railways_JTSK

**Subject Layer**: ZELEZ

**Select conflation method**
- **Snap Vertices**
- **Coverage Alignment**
- **Match Lines**

**Distance tolerance**: 55,000

**Matching criterion [%]**: 70

**Try to repair invalid geometries**

**Output shapefile**:
/home/teresa/CVUT-FSv/output.shp

**Coverage Alignment**

This method changes the position and shape of features in the subject layer according to matching features in the reference layer. It deforms and moves features with no equivalents in the other layer. Delaunay triangulation and affine transformation is used for alignment.

**Match Lines**
Graphical User Interface

Conflation dialog

- Reference Layer: forest_JTSKpart
- Subject Layer: LESY
- Select conflation method:
  - Snap Vertices
  - Coverage Alignment
  - Match Lines
- Distance tolerance: 150,000
- Matching criterion [%]: 75

Protocol

- Conflation protocol
- reference layer: forest_JTSKpart
- subject layer: LESY
- new layer: LESY(1)
- distance tolerance: 150
- conflation method: Snap Vertices
- number of processed features: 5741
- number of invalid features: 2
- ids of invalid features (needs to be repaired manually):
  - 3180
  - 4250
- end of protocol

Text of protocol
Conflation Example - Coverage Alignment

Before

After
Conflation Example - Line Matcher
Conclusion

Practical use

- Vertex Snaper - align map boundaries
- Coverage Alignment - improving geometry precision of detailed maps
- Line Matcher - road map matching

Further development

- provide plugin to QGIS users
- new algorithms
Thank you for your attention