Collaboration on an ontology for generalization

Nicholas Gould - Manchester Metropolitan University
William Mackaness - University of Edinburgh
Guillaume Touya - IGN
Glen Hart - University of Nottingham

17th ICA Workshop on generalization and Multiple Representation
Vienna, Austria, 23 Sept. 2014
Searching for an algorithm...

Analysis of Urban Road Networks to Support Cartographic Generalization

A Road Network Selection Process Based on Data Enrichment and Structure Detection

The ‘Good Continuation’ Principle of Perceptual Organization applied to the Generalization of Road Networks

A Structural Approach to the Model Generalization of an Urban Street Network

Selection of Streets from a Network Using Self-Organizing Maps

Road Network Selection for Small-Scale Maps Using an Improved Centrality Approach

Thin Road Network

Selective omission of road features based on mesh density for automatic map generalization

Road network selection using an extended stroke-mesh combination algorithm

Integration of linear and areal hierarchies for continuous multi-scale representation of road networks

Generalization of Geographical Networks

Generating hierarchical strokes from urban street networks based on spatial pattern recognition
Representing cartographic knowledge

- Generalization Software Knowledge
- Cartographers’ Knowledge
- Ontologies
- Operator Taxonomies

Formal

Implicit

Explicit

Informal
An ontology is a “formal, explicit specification of a shared conceptualization” (Studer et al. 1998)

Requires collaboration

Ensure acceptance
Capturing the semantics of generalization

• Should avoid encapsulating rules

• Goal: capture the semantics of generalization
  – Modelling relationships
    • Spatial but also geographic
    • An ontology can (theoretically) model any relationship
      – hierarchical, topological, partonomic

• Support reasoning about generalization
Size of the task
Benefits

• Better sharing of algorithms
  – what are the characteristics of generalization algorithms?
• Support for on-demand mapping
• Support for web services - WEBGEN
Core skills


- Clarifying the **purpose** of a given ontology, understanding potential deployment, performing **requirements analysis**.
- Managing ontologies across their **life cycle** (requirements analysis and planning, managing a systematic update process, versioning, documentation).
- Identifying, evaluating and using **software tools** that support ontology development.
- Choosing the appropriate **level of detail**.
- Conducting **ontological analysis**, that is identifying entities and relationships; formulating definitions and axioms.
Core knowledge

- The basic **terminology** of ontology (relation of ontology to knowledge representation, conceptual modeling, data modeling, . . . ).
- Theoretical foundations: Set theory, **description logic**
- Ontology **evaluation strategies** and theories (e.g. Ontoclean).
- Representation languages: Resource Description Framework (RDF), **Web Ontology Language** (OWL)
- **Reasoning** with ontology content;
- improving **search** and retrieval;
- **decision support**, situational awareness, information fusion, anomaly detection.
Ontology design methodology

• Methodology will provide structure
• Number of different ontology design methodologies
  – UPON, DILIGENT, NeOn, GEONTO-MET, Ontology 101
• Different approaches
  – Software design life cycle
  – Collaborative approach
• Reviews
• Hybrid methodology
• Use case
Select a use case

• Defines the scope and purpose
• For example:
  – Create an ontology that represents sufficient knowledge to allow for the automatic selection of **line simplification** algorithms *or*
  – **line simplification and smoothing** algorithms *or*
  – **building amalgamation** algorithms or
  – **road selection** algorithms
Ontological engineering

• How do we model a generalization algorithm?
  – What is an algorithm?
    • What are the common characteristics?
  – Is Douglas-Peucker a sub-class of “algorithm” or a label?
  – Is it an individual(instance) of an operator?
  – What of the variations of DP?

• What are the other concepts?
  – How do we model scale? Or the consequences of scale change?
Tools

• webProtégé
  – allows for collaboration
How do we animate this?

• Identify partners
• Define scope of the ontology
• Define ontology design methodology
• Define outcomes
  – Ontology (OWL2) for the use case(s)
  – Report back to next commission workshop
• Identify tools (e.g. webProtégé)
• Define project roles
  – Conceptual
  – Methodological
  – Technical
  – Evaluation
• **Project plan**
• Cartographers lack the means to systematically document the knowledge required for generalization (Nyerges, 1991)
• Now have...
  – the model - ontologies
  – the language - OWL
  – the tools - Protégé and webProtégé