TECHNISCHE UNIVERSITÄT DRESDEN

ICA-generalisation workshops (1995-2010)

From past generalisation workshops
to future works on the field

Dirk Burghardt

Outline

- "Session topics" of the ICA generalisation workshops
- idea for the future

ICA generalisation workshops

- provide a good overview of current and past research in automated generalisation (http://aci.ign.fr/)
- papers and presentations are grouped together in sessions → reflects main research interest in the past
- six main categories can be distinguished
  1. Production issues and vendor perspective
  2. Quality assessment, knowledge formalisation and acquisition
  3. Modelling of relations and semantics
  4. Generalisation operators
  5. MRDB and incremental update
  6. Generalisation process orchestration

I – production issues and vendor perspective

- contains paper describing both requirements as well as solutions from NMA map production
- this session are carried out at nearly all ICA-workshops
- good motivation for the workshop → trigger of research work
- possible extension involve other groups which use/develop generalisation tools
  - communities around free software developers, OSM
  - initiatives around INSPIRE with cartographic-technical oriented focus
  - contact to big industry player besides GIS vendors might be useful, e.g.
    - navigation industry (TomTom, Navtec, Tele Atlas, ...),
    - web mapping (Google, Microsoft, ...),
    - mobile applications (Apple, Sony Ericsson, Nokia, ...)

II - Quality assessment, knowledge formalisation and acquisition

- the start of the generalisation workshop series (1995) reflects the growing interest on automated generalisation at that time
  → start with research on conflict detection and knowledge formalisation
- knowledge formalisation
  - quite popular in the middle of the 90ties with the attempt to replace batch processing by expert systems (later also by constraint-based approaches)
- constraint modelling
  - became important during the AGENT-project (1997-2000)
  - during the EuroSDR-project (2007-2010) definition of harmonised constraints for map production

III – modelling of relations and semantics

- focus on modelling spatial and hierarchical relations for generalisation purposes
  - preservation of topological relations by the generalisation algorithms
  - auxiliary data structures (Delaunay, Voronoi, constraint delaunay, networks, ...)
  - hierarchical data structures (BLG-tree, GAP-tree, quadtree, dendrogram, ...)
- relation modelling for the description of patterns such as alignments, neighbourhood relations, partitions, etc.
  → data base enrichment vs. ad hoc computation
- semantic modelling and linked data
  → Dagstuhl seminar (2009) with semantic web people

IV – generalisation operators and algorithms

- many investigations made on line simplification and smoothing
- but also research on more elaborate generalisation operations such as displacement, aggregation or typification
- in recent times interesting approaches proposed on generalisation of networks and mosaics
- improvements required for the generalisation of group of objects → depends strongly on the research of the third category (modelling of relations)

V – MRDB and incremental update generalisation operators

- this category contains research on Multi-Representation Databases with integrated or connected feature representations at different scales
- model generalisation on the basis of rule-based generalisation systems
- incremental update
- data integration and matching
  - matching to establish links between feature representation
  - distinction between schema matching and instance matching
  - GDI 2010 symposium (see presentation from Babs)

VI – generalisation process orchestration

- combines work on the overall generalisation process with orchestration and combination of generalisation operators
  - optimisation methods with the simultaneous application of different generalisation operations
  - constraint-based methods (including agents), which search for suitable operator sequences
- workflow management systems for the semi-automatic control of the generalisation processes
- situation dependent parameterisation of generalisation operator

Session topics

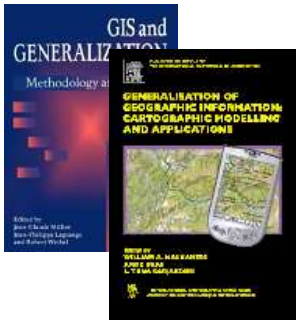
	Session topics	95	97	99	01	02	03	04	05	06	07	08	09	10
I	production issues, NMA and vendor perspectives		X	X	X		X	X	X	X	X	X	X	X
II	quality assessment, measures and constraints	X	X	X	X	X	X					X	X	X
	knowledge acquisition and encoding	X	X				X				X			
	feature conflict detection, shape analysis	X	X			X	X		X					
III	modelling spatial and hierarchical structures		X	X		X					X	X	X	X
	modelling semantics and non-spatial structures		X	X						X			X	X
	data base enrichment						X	X	X		X	X	X	X
IV	generalisation operators	X	X	X	X	X	X	X	X		X	X	X	
V	MRDB, database updating			X	X	X		X			X	X		
	model generalisation			X			X							
	matching								X					
VI	optimisation methods			X	X		X						X	X
	gen. process orchestration, agents, machine learning						X		X			X	X	

Journals

- Weibel, R. (1995). Map Generalization. Special Issue of Cartography and Geographic Information Systems, Vol. 22, No.4.
- Weibel, R. and Jones, C. B. (1998). Issue on Map Generalization. Special Issue of Geoinformatica, Vol. 2, No.4.
- Richardson, D.E., and Mackaness, W. (1999). Computational Methods for Map Generalization. Special Issue of Cartography and Geographic Information Science, Vol. 26, No. 1.
- Jones, C. B. and Mark, J. W. (2005). Special Issue: Generalisation. International Journal of Geographical Information Science, Vol. 19, No. 8-9.
- Oosterom, van P. (2009). Special Issue: Generalisation. Computers, Environment and Urban Systems, Vol. 33, No. 5.

Books

- Müller, J.-C., Weibel, R. and Lagrange, J.-P. (1995). GIS and generalization - Methodology and Practice. Taylor & Francis, GISDATA 1.
- Ruas, A., Mackaness, W.A. and Kilpeläinen, T. (2007). Challenges in the Portrayal of Geographic Information: Issues of Generalisation and Multi Scale Representation. Elsevier Science.



TECHNISCHE UNIVERSITÄT DRESDEN

How to proceed?

Generalisation of web and mobile maps

- besides production of different paper map series our research should also consider the web and mobile use of geoinformation
  - research in this community was/is driven by map production scheme of NMA, e.g. EuroSDR project → state of the art in ad-hoc web based generalisation (which maybe will also help the NMA in some years)
- user-centered design to support user interaction, e.g. information selection (interactive generalisation)
  → tools for user to influence the generalisation degree of maps
- fixed scale levels get extended up to 20 level of detail in a web mapping environment → continuous generalisation
- real-time generalisation
  - with distinction of foreground and background information
  - usage of hierarchical and vario-scale data structures

Change from general to individual maps

- William at Dagstuhl: "abstraction of space in reaction to tasks"
- formalization of user needs
- focus on fitness-for-use – maps which are maybe less beautiful from a cartographic point of view but pragmatic
- balance between automation and quality – in the context of data integration: how much mismatched data become unacceptable?

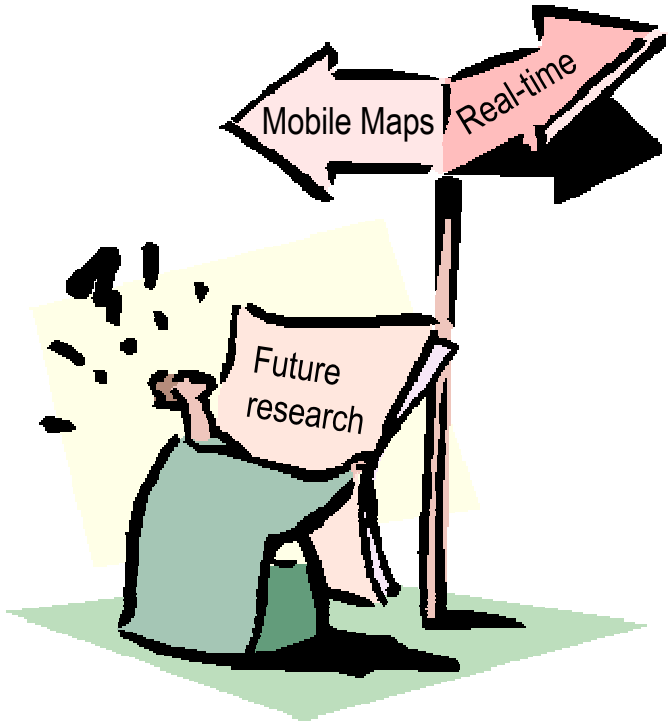
Future research

- formalisation of semantics of the spatial information
  - semantic web / linked geodata (see presentation of Stefan Hahmann)
  - focus also on higher order concepts as combination of individual objects
    → implicit structure and pattern of geographic phenomena
- consider different characteristics of data
  - new dimensions: 3D/perspective views, temporal data
  - user generated content (consistency, completeness, uncertainty)
  - huge masses of data (sensors, web2.0, ...)
- common test beds, shared operations via web services
  - syntactic and semantic interoperability
  - machine understandable description of service functionalities
  - web processing services as combination of generalisation operators

Upcoming topics

- only a few contributions on real-time generalisation, but seems to be important for user specific maps
- 3D-generalisation required for navigation solutions and web applications, already research on 3D-building generalisation;
- development of generalisation services triggered research on syntactic/semantic interoperability – interest from GDI
- generalisation for mobile applications

	Session topics	95	97	99	01	02	03	04	05	06	07	08	09	10
	real-time generalisation				X									
	3D-generalisation						X	X					X	
	web based services and generalisation on demand								X	X	X		X	
	generalisation for mobile applications							X					X	X



Discussion