Vario-scale geo-information

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1.1 Abstract

Today, current practice is to store digital geographic data sets at multiple scales with multiple representations, i.e. data is stored multiple times at a fixed number of resolution (or scale) intervals in so-called MRDB's. In these data structures links between corresponding objects of the different resolution levels are stored, to offer consistency during the use of the data. Drawbacks of those structures are that redundant data is stored and that these structures are not suitable for progressive data transfer, because each resolution level requires its own graphic representation to be transferred.

Raster images can accomodate progressive transfer nicely with techniques like wavelet compression and data pyramids. Due to the data structures, first a coarse representation can be send and later on refined with more details. It's more difficult to obtain those effects with vector data, as these require more advanced data structures.

In earlier research both the theoretical and practical (implementation) aspects of an example of such a more advanced data structure, the tGAP structure (topological Generalized Area Partitioning) have been described [Van Oosterom, 2005], [Van Oosterom et al., 2006]. Purpose of this tGAP structure is to store the data only once, with no redundancy of the geometry, and derive different representations of this same data on the fly according to the level of detail needed.

In this research extensions to the original tGAP vario-scale data structures are to be found, to get to a continuous representation of the real world with respect to resolution, instead of a discretised representation in multiple layers, each only representing one resolution level. This includes storage methods, semantics, progressive transfer of data over networks and smooth zoom and pan (e.g. geo-morphing) at the client side.

Benefits of such an approach, but not limited to those mentioned here, are:

- data consistency between different resolutions
- possibility of progressive transfer
- smooth zooming / panning

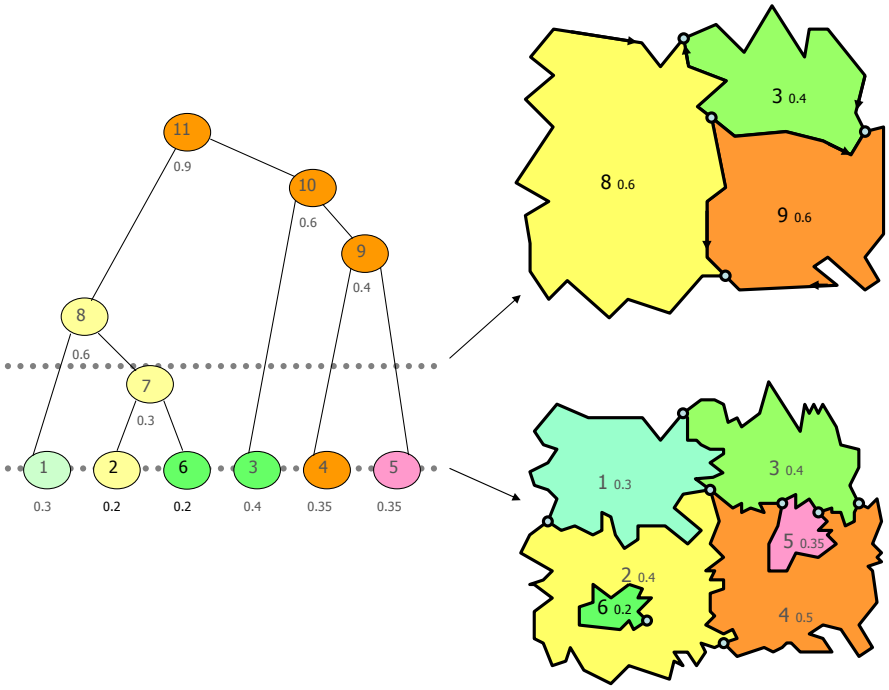

Figure 1: tGAP structure in action

- variable scale in one map (fish eye effect)

Methods that will be adopted to reach this objective will be (amongst others):

- Literature review
- Development of data structures in geo-DBMSes, network interfaces, interactive client
- Generalization experiments with real world data at different scales, for example:
  - Topographic data
  - Height data
  - Soil data

This research may contribute to the long standing issues in generalization research: it tries to find one integrated model of the world, suitable for visualization and querying, in which non-predefined resolutions can be accomodated and from which multiple representations can be derived.

1.2 References

References

[Van Oosterom, 2005] Van Oosterom, P. (2005). Scaleless topological data structures suitable for progressive transfer: the gap-face tree and gap-edge forest. In *Proceedings Auto-carto 2005*, Las Vegas, Nevada. Cartography and Geographic Information Society (CaGIS).

[Van Oosterom et al., 2006] Van Oosterom, P., de Vries, M., and Meijers, B. (2006). Vario-scale data server in a web service context. In *Proceedings of 9th ICA Workshop of the ICA Commission for Map Generalisation and Multiple Representation*, Portland. ICA.