LANDMARKS FOR ROUTING – AUTOMATIC IDENTIFICATION, EXTRACTION AND VISUALIZATION

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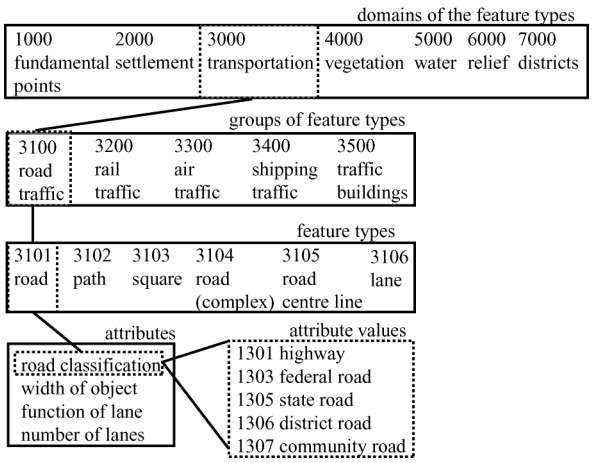
ABSTRACT

Location Based Services (LBS) are often called killer-application for mobile devices. The user find it very helpful to get the spatial data of the environment for wayfinding tasks. Current methods to communicate the routing information to the user often provide sequences of instructions for these routes. But this kind of procedure do not pay attention to the human wayfinding behavior: research in spatial cognition has shown that people do not only reference to sequences but frequently use landmarks during spatial reasoning and communication of routes [Raubal, M. & Winter, S., 2002].

Experiments have shown that people react to the absence of landmarks. The reason is that landmarks are essentially used as sub-goals along the route: people progress along a route by orientating themselves towards a landmark [Michon, P.-E. & Denis, M., 2001]. In a further experiment [Lovelace, K., Hegarty M. & Montello, D., 1999] landmarks were classified in four different types: landmarks at a choice point, potential (but not used) landmarks at choice points, on route (along the path) landmarks and off-route landmarks (not neighbored to the followed path, but with some orientation value). The research indicates that the appearance of landmarks correlates significantly with quality of route directions. Especially for unfamiliar route directions landmarks at turning points and just on-route points are quite frequently used. Landmarks may have particular visual characteristics, a unique purpose or meaning or may be in a central or prominent location that makes them effective as a landmark [Sorrows, M. & Hirtle S., 1999].
The aim of this research is to set up a model (ontology) of how a person involved in a navigation situation experiences his/her environment and needs navigational aids. Based on this model it is possible to automatically extract navigation relevant information from given data sets.

In this approach a route corridor consisting of information about start- and endpoint and sequence instructions (turning points and relevant streets) is enhanced with important landmarks along and crossing the route. The automatic generation of such a presentation involves firstly the identification of important landmarks. These features may be bridges, prominent buildings, statues, vegetation like a big tree or a park. For a description of the route, only a "topological structure" in the sense of important landmarks and connecting roads is necessary. To solve this task the ATKIS database is investigated about the semantic content and its use for the extraction of useful landmarks.

The Authoritative Topographic Cartographic Information System called ATKIS is a joint project of all German national mapping agencies and can be described as a geobase information system. It consists of several products, here the relevant database is the digital terrain model, an object orientated vector database of scale 1:25.000.



The feature types and attributes in the feature catalogue will be filled in continuously each (periodic) maintenance of the data, at the moment in the federal state Lower Saxony the database contains 121 different feature types with 35 attributes. A complete description of the concept is given in the object catalogue [ATKIS-OK, 2001].

Additionally the digital cadastral map (in Germany called ALK) is investigated, especially the building content, to support the enriching of route corridors with useful landmarks.

At the workshop an exemplary presentation of an route corridor enriched with landmarks extracted from ATKIS and ALK will be shown.

Even when relevance and/or importance have been defined, it is not guaranteed that this leads to a unique and unambiguous route description, as several neighbored objects can fulfill the requested criteria. Thus, there is the necessity to design mechanisms for an automatic selection of one object among a group of similar ones – e.g. select one buildings out of several similar buildings in a row as a landmark for orientation.

Here, techniques from information theory will be investigated in order to define the degree of surprise of a piece of information.

Another option for distinguishing target objects from their surrounding is to us a visual distinction based on graphical variables and generalization operations. Obviously, the graphical variable "color" is a very adequate means to highlight objects. In the paper, however, the use of geometric properties to enhance an object will be presented. As such, geometric generalization methods will be used: simplification, generalization, exaggeration, as well as displacement. These operations can be executed automatically using algorithms based on adjustment theory.

REFERENCES

ATKIS 2002. ATKIS – Feature Catalogue, Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany (AdV), Germany, http://www.atkis.de and http://www.adv-online.de/english/products/atkis.htm (accessed: 20. Feb. 2002)

Elias, B. & Sester, M., 2002. Landmarks für Routenbeschreibungen, GI-Tage Münster, Germany, June 2002

Lovelace, K., Hegarty M. & Montello, D., 1999. Elements of Good Route Directions in Familiar and Unfamiliar Environments, In: Freksa, C. & Mark, D., Eds., *Spatial Information Theory: Cognitive and Computational Foundations of Geographic Information Science*, International Conference COSIT `99, Proceedings, Springer Verlag, Germany, pp. 65-82.

Michon, P.-E. & Denis, M., 2001. When and Why Are Visual Landmarks Used in Giving Directions, In: Montello, D., Ed., *Spatial Information Theory,* International Conference COSIT 2001, Proceedings, Springer Verlag, Germany, pp. 292-205.

Raubal, M. & Winter, S., 2002. Enriching Wayfinding Instructions with Local Landmarks. Technical Report, Institute for Geoinformation, Technical University Vienna, Austria.

Sorrows, M. & Hirtle S., 1999. The Nature of Landmarks for Real and Electronic Spaces, In: Freksa, C. & Mark, D., Eds., *Spatial Information Theory,* International Conference COSIT `99, Proceedings, Springer Verlag, Germany, pp. 37-50.

Sester, M., 2000. *Generalization based on Least Squares Adjustment*, in: 'International Archives of Photogrammetry and Remote Sensing', Vol. 33, ISPRS, Amsterdam, 2000.

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