Computational Model for Spatial Knowledge Discovery in Topographic Map Database

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Abstract. Knowledge discovery in very large databases (VLDB) is a booming field in information analysis. GIS researchers have introduced this ideas and techniques to automatically extracting hidden and useful patterns in spatial databases, which is voluminous and ever increasing. A new research opportunity, namely spatial data mining or spatial knowledge discovery, has emerged. Each kind of cartographic feature in a map can not commnuicate spatial information separately, they depend on other features. Data update in the topographic map databases, especially in the process of cartographic generalization and in map revision through various maps at different map scales, needs the spatial association knowledge's support. In addition, the system should maintain the spatial knowledge consistently. Automatic operations can only work well by means of a knowledge base. The spatial association knowledge (rules) is an important part of the spatial knowledge discovery in topographic map database. Based on our empirical work, in this paper a computational model for the spatial associated knowledge discovery in the database of National General Map Series at map scale 1:50000 is discussed. The main contents are as follows. l. Automatic cluster of settlement. The clustering rules and methods in its application are given. One is based on distance criteria, and another employs irregular triangulation. This work benefits the amalgamation and symbolization of area objects when a map is generalized to a new map at smaller map scales. 2 Proximal relationships between area objects. This kind of spatial knowledge is not easy to be inputted manually. Voronoi Diagram is used as an efficient tool for this purpose. In order to get Voronoi Diagram, the constrained Delaunay triangulation is constructed after the cluster. Based on a variation of Voronoi Diagram, the proximal spatial relationships between areas can be got. 3 Association spatial knowledge. The spatial association knowledge is acquired by means of a kind of technique, which is similar with buffer operation. In this test, only the spatial association knowledge of the linear features and the settlement is considered. Conventional topological relationships have paid little attention on this kind of spatial relationships. However, the geographical visualization and data integrity can be improved with these spatial knowledge. The spatial knowledge is represented by means of the relational tables. Efficient access methods and applying strategies are designed in our work. The application of the discovered knowledge is examined in a test of cartographic generalization.