

Chapter 3

Recent Trends in Spatial Data Mining and Its Challenges

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ABSTRACT

With tremendous development in the field of science and technology, there is vast amount of data which are used in analytics for decision making. Considering its spatial characteristics for mining will enhance the accuracy of decision. So, obtaining knowledge from spatial data becomes very essential and meaningful. The spatial database contains very numerous amounts of spatial and non-spatial data of different forms. Interpretation and analyzing of vast data is far beyond human ability. In order to acquire knowledge on such scenario we need spatial data mining. The challenges involved in spatial mining are to deal with different objects that represent the spatial characteristics. This makes spatial data mining a dominant research field. This chapter briefs about the characteristics of spatial data mining and the methods of spatial data mining in recent years.

INTRODUCTION

Spatial data mining refers to discovering hidden and interesting patterns or rules from large amount of spatial database. Large amount of space related data is stored in spatial database which has relational database with different characteristics that contains information about distance and geology.

Data are organized in multi-structural spatial index dimension and often needs mathematical calculations and geographic reasoning and complicated operations. Spatial characteristic involves mining of information that faces many challenging issues. Because spatial data is different from other data such

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as numbers, points, polygons, classification and symbols which is traditionally treated by data mining techniques.

Data mining is about pattern extraction from larger database, there is strong spatial component which exists in that larger database, for example, satellite observing earth which maps the entire earth surface systematically collects about terabyte of spatial data every day. A Larger database includes weather, climate and U.S Census. The mining classical relational database is different from those of mining spatial database. Compare to common dataset, spatial data mining is more complex, different and larger. Spatial extent refers to each data item that has a spatial reference where occurrence of each entity will take on a continuous surface or where the two nearby entities have a spatial-relationship existing between them.

Spatial data does not only include location data and attribute data but also the spatial entities relationship. Moreover, data structure is complex in spatial database than the table's in common relational database. In spatial database there are vector and raster graphical data along with numerical data. Storing the features of graphical data is not clear and at the same time, only basic analytical functionalities are given by contemporary GIS. Raster data model in spatial data mining is represented by Single Square of for the land cover and corresponding to land cover each cell has its value as shown in *Figure 1*.

Raster data is better for representing:

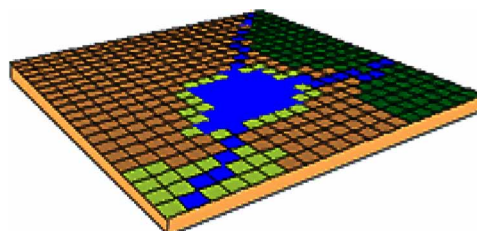
- Data are continuous (e.g. slope, elevation etc.).
- Data with multiple feature types (e.g. lines, polygons) and also has single feature types(cell)
- Data with rapid calculation ("map algebra") in which mathematical expression of raster layers are treated as elements.
- Data with multi-variant analysis (e.g. satellite image processing)
- Disk space hogging.

Vector data model in spatial data mining is represented by points, lines, polygons and the TIN's (Triangulated irregular networks) is shown in *Figure 2*. Vectors data are good at:

- Accurately representing true shape and size.
- Representing non-continuous data (e.g., rivers, political boundaries, road lines, mountain peaks).
- Creating aesthetically pleasing maps.
- Conserving disk space.

Spatial mining has its application in the field of Geographic Information System (GIS), remote sensing, medical imaging, exploration of image database and other areas where spatial data is used. Knowledge

Figure 1. Raster image



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