Extending GIS to the common man through image-based vector GIS

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Even though a map is better understood by all, the Geographic Information System (GIS) has not penetrated reasonably into usage of the common man. In traditional GIS, features are depicted on the map as point, line and polygon of various symbols and colours. It passes query to vector layer and highlights the result on the vector. To carry out the query and display the result, the vector layer should be loaded/visible on the display.

A new approach called image-based vector GIS is proposed, whereby the common man can easily understand information from the GIS with the help of images. Image-based vector GIS is referred here as a GIS system in which an image is used essentially for display and vector layer for analysis. According to the approach, a high-resolution image is always visible on the display. The vector layers are not visible on the display, preferably vectorized from a high-resolution image, and may be composed of polygons wherever possible. The query is passed onto the vector layer and the result highlighted on the image using graphics of user-defined colour and transparency. Thus the common man is not interfaced with depiction of features, but with easily understandable image with query result highlighted on it.

To demonstrate the approach, image-based vector GIS software has been developed, the snapshots of which are shown in this article.

Keywords: Geographic information system, image, map, query, vector.

GEOGRAPHIC Information System (GIS) is a computer-assisted system for acquisition, storage, analysis and display of spatial information and related attributes. Spatial data are those having location with respect to the earth, generally represented in terms of latitude and longitude. In traditional GIS, the spatial features are depicted on the map as point, line and polygon of various symbols and colours. Compared to the well-known MIS (Management Information System), the GIS has a map interface additionally. Traditionally, there are two types of GIS software. The first is raster-based GIS, wherein the display and analysis are carried out essentially through a raster data format. In raster data, the spatial features are represented using digital numbers. The second is vector-based GIS, where the analysis and display are carried out through a vector data format. In vector data, the spatial features are represented using coordinates of point, line and polygon. Currently, most of the GIS software available in the industry have both raster and vector capabilities – a hybrid GIS.

Conventionally, GIS queries are being carried out using vector data format, which can hold attribute data. The GIS passes the query to the vector layer and highlights the result on it. To carry out the query and display the result, the vector layer should be loaded/visible on the display.

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The present finding relates generally to query and graphical display and more particularly to a method and system for retrieving and displaying spatial data in GIS.

Traditional GIS query

The query in traditional GIS software has the following steps: (a) raster data may be displayed; (b) vector layer is essentially displayed; (c) query is passed onto the vector layer, and (d) the entities in the vector layer satisfying the query condition are highlighted.

If the vector layer is not visible on the display, the result of the query is also not visible on the map. The attribute data of the vector entities are displayed in a table and the rows of the data related to each entity satisfying the query are highlighted in the table.

Examples of traditional GIS software are ArcGIS (www.esri.com), MapInfo (www.mapinfo.com) and image processing/remote sensing software are ERDAS (gis.leica-geosystems.com) and Geomatica (www.pcigeomatics.com).

Image-based vector GIS and query

The present findings make it easy to query and display through an approach termed here as image-based vector

Figure 1. Result of a query (seven buildings) is highlighted on the image in green colour. All roads (red colour) and railways (yellow colour) are also visible.

Figure 2. Image-based vector GIS where a high-resolution image is loaded.

GIS. This is a GIS system in which an image is used essentially for display purpose and vector layer for analysis. The finding helps not only to utilize the amply available high-resolution satellite data, but also avoids overloading the system with all the vector layers.

The image-based vector GIS, applied to a conventional GIS software, will have the following steps for a query: (a) image of an area is essentially displayed; (b) vector layer of the area is available, but not displayed; (c) user queries on the invisible vector layer, and (d) the result of

Figure 3. Result of a query (two buildings) is highlighted on the image in green colour by image-based vector GIS.

the query is displayed on the image as a graphic of selected colour and transparency.

The entities in vector layers should preferably be composed of polygons, even for roads, buildings, etc. This will have better appreciation of features on the image, rather than using points and lines to depict area features. Once the query is passed, the features satisfying the query are converted into a graphic layer and displayed on the image. If the user request is to display all the features in a vector layer, graphics of all the features of the layer, visible on the display, may be created and displayed (Figure 1; all features available in roads and railways are highlighted). User-defined transparency and colour may be set to the graphic layer, so that the features highlighted are also visible.

Image-based vector GIS need not have symbols for vector entities, as a high-resolution image is always displayed wherein the features are clearly visible. Thus, it saves memory for symbols and colours for the vector entities.

An image-based vector GIS software has been developed to demonstrate the approach. Figure 2 shows the display of an image-based vector GIS where a high-resolution image is loaded. The list of vector layers available (now road, railway, building and vegetation) is displayed on the left side (layer tree). The vector layers are digitized from the satellite data as the developed software has an option to vectorize features. The vector layers could have also been imported from a reliable source. The file paths of the vector layers are set through the software so that the layers appear in the layer tree.

Any type of query can be passed onto the vector layer, be it spatial or attribute-based. When a query is passed onto a vector layer (building), the result (two buildings) is highlighted on the image in green colour (Figure 3). The transparency is set in the colour highlighted, so that features under the highlight are visible. The attribute data of the query result may be visualized in the same way as in the case of conventional GIS software.

Figure 1 shows the result of another query passed onto the vector layer (building). The result of the query (seven buildings) is highlighted on the image in green colour. All roads (red colour) and railways (yellow colour) are also visible over the image.

Conclusion

In traditional GIS, features on a map are depicted using various symbols and colours, which makes it difficult for the common man to appreciate various information. Traditional GIS software passes the query to the vector layer and highlights the result on it. The image-based vector GIS approach enables the common man to query and obtain the result highlighted on the image using graphics of user-defined colour and transparency. Thus the common man need not worry about the depiction of features through vector layers in conventional GIS.

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