GEOGRAPHICAL SCIENCES

SPATIAL DATA MODELS

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Introduction. The basic principles, approaches, methods and techniques for spatial data models are presented.

Aim. The paper considers the issues classification of models, non-topological TP topological data models, transport network model, raster data model, triangulation surface model, georelational data model and geobase.

Materials and methods. The geographic information system is based on data models. Data models reflect real entities on the ground, the relationship between it and other knowledge with spatial binding. Each data model includes different spatial objects, interconnected by additional topological relationships.

A spatial object or digital model of a terrain object is a digital representation of a specific reality object with coordinate reference (description of geometry) and a set of attributes (textual and numerical characteristics).

Basic types of spatial objects: vector - simple shapes (points, multipoints, lines, polygons) and complex shapes (rectangles, ellipses, arcs, splines, rasters, OLE-objects, meta files, labels, pointers, dimension lines, scale rulers, arrows to the north, map legends, map fragments, composite objects), as well as cellular ones (pixels, cells, triangles).

The data model is a way of describing the same type of spatial objects, including the description of individual objects, topological relationships between them, as well as additional knowledge about the whole set of objects in the model.

Spatial data models are divided into vector and cellular.

Vector models of spatial data are divided into non-topological (shape model, CAD models) and topological (coverage, transport network).

Cellular spatial data models are divided into regular (raster, regular network) and irregular (triangulation) models.

Logical (thematic) groups of data organization (layer) is a logical (thematic) group of data. All data in geographic information systems are grouped into layers. Layers are grouped into a map.

Map layer (theme) - a set of the same type of spatial objects defined in one data model in the common area and in the general coordinate system. A GIS map is a collection of different layers defined in a common area and in a common coordinate system. Digital terrain model - a mathematical model of the terrain, consisting of sets of spatial data that describe different types of entities and knowledge about the Earth. Digital map - a mathematical model of graphic representation of paper maps, common in cartography. Digital terrain model - part of a digital terrain model that describes the shape of the earth's surface

The non-topological data model includes objects that are arbitrarily and independently located in space. Within the data set, objects are not interconnected and do not affect each other.

The main subspecies of vector non-topological models are the shape model and the CAD model.

The shape model contains 4 valid types of data - point, multipoint, line, polygon. Only one type of object is allowed within one map layer. Map layers are named according to the type of object. Additional numeric or text parameters (attributes) can be stored for each figure.

CAD model is typical for computer-aided design systems, used in geographic information systems, usually for graphic design of maps and the creation of complex drawings. Objects of different types are allowed within one layer. Used to create complex graphic images on a cartographic basis

The topological data model contains 3 main types of objects - node, arc, region. Each object has a unique ID, which is used to establish relationships between objects. A layer of a map represented as a topological data model is called a coating.

The model of transport (geometric) network describes in the form of a connected graph the scheme of transport communications (automobile, railway, aviation, water) for the purpose of network analysis. The transport network contains two main types of objects - nodes and arcs - and one additional - route

The raster data model is historically the first data model for geographic information systems. Uses simple algorithms for processing and spatial analysis. It is not basic and is used in cases when the vector model does not give an adequate result. Data vectorization and rasterization operations are relevant.

The triangulation data model (irregular triangulation lattice) is designed to describe the surface - the relief of the Earth's surface or the distribution of some parameters on it. The initial data for construction are elevations, isolines, structural lines. Triangulation is a planar graph built on a set of given nodes, which divides the entire plane into triangles and one external infinite figure. Contains 3 main types of data - nodes, edges, triangles.

Georelational data model - a set of additional attributes with numerical or symbolic values is specified for any spatial object. For GIS, the most common is the relational database model. Georelational approach - the geometry of the spatial object is stored in a separate place in a special format, and the attributes of the object - in a specific database table. The relationship between geometry and attributes is done with a key.

In GIS, the geometry and attributes of spatial objects are stored in different files, not in databases, due to performance and limitations on integrity, locking, and transaction. GIS uses extensions and add-ons over conventional databases - spatial databases. Geometry, attributes and behavior of objects are tightly integrated in modern spatial databases. They allow you to create networks, define spatial relationships between objects and introduce new object-oriented entities.

Results and discussion. The basic principles, approaches, methods and techniques for spatial data models are presented.

Conclusions. The paper considers the issue classification of models, non-topological TP topological data models, transport network model, raster data model, triangulation surface model, georelational data model and geobase.

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