FEATURES OF METHODS USED IN DIGITAL MAPPING

Khozhalyev D.[1], Sukhanov D.[2], Ovezov E.[3], Ishanov M.[4]

[1]Khozhalyev Dovlet -student,
[2]Sukhanov Dayanch - student,
[3]Ovezov Emirkhan - student,
[4]Ishanov Maksat - senior lecturer,
TURKMEN STATE ARCHITECTURE AND CONSTRUCTION INSTITUTE
ASHGABAT, TURKMENISTAN

Abstract: *the features of the main methods used in digital mapping are shown. The positive aspects of raster systems are indicated. We come to the conclusion that vector structures very well represent the positions of objects in space on individual layers of a digital map.*
Keywords: *digital mapping, digital map layer, raster method, vector structures*.

There are two main methods used in digital mapping. The first method uses quantization, or the division of space into many elements, each of which represents a small but well-defined part of the earth's surface. This raster method can use elements of any geometric shape, provided that they can be connected to form a continuous surface representing the entire space of the study area. Although many raster element shapes are possible, such as triangular or hexagonal, it is usually easier to use rectangles, or even better, squares called cells.

Consider models in which all cells are the same size and represent the same amount of geographic space as any other. Raster data structures do not provide precise location information because geographic space is divided into discrete cells of a finite size. Instead of exact coordinates of points, there are individual raster cells in which these points are located. This is another form of changing spatial dimensionality. Lines, that is, one-dimensional objects, are depicted as chains of connected cells. Each line point is represented by a raster cell, and each line point must be somewhere inside one of the raster cells. In raster systems, there are two ways to include attribute information about features [1, 2].

The simplest is to assign an attribute value to each raster cell. When distributing these values, the positions of the attribute values play the role of the locations of the objects. For example, if the number 10 represents the water surface, which is recorded in the upper left cell of the raster, then by default this cell is also the area of the earth's surface that represents water. Thus, each cell on a given map is assigned only one attribute value. An alternative approach, actually an extension of what was just described, is to associate each raster cell with a database. This approach is becoming increasingly prevalent as it reduces the amount of data stored and can provide connectivity to other data structures.

Raster data structures lack precise location information. However, raster structures also have many advantages over others. In particular, they are relatively easy to understand as a method of representing space. For example, television uses the same raster representation of images as a set of dots (pixels). Another great characteristic of raster systems is that many functions, especially those related to surface operations and overlays, can easily be built on this type of data structure. Among the main disadvantages of the raster data structure is the problem of low spatial accuracy, which reduces the reliability of measuring areas and distances, and the need for a large amount of memory due to the fact that each raster cell is stored as a separate numerical value [3, 4].

The second method used in digital mapping, called vector, allows you to explicitly specify precise spatial coordinates. The implication here is that geographic space is continuous rather than divided into discrete cells. This is achieved by assigning to points a pair of coordinates (X and Y) of the coordinate space, to lines - a connected sequence of pairs of coordinates of their vertices, to areas - a closed sequence of connected lines, the starting and ending points of which coincide. The vector data structure shows only the geometry of map objects. To give it the usefulness of a map, we associate geometric data with corresponding attribute data stored in a separate file or database. In a raster structure, the attribute value is specified in each cell. In vector data structures, a line consists of two or more pairs of coordinates; for one segment, two pairs of coordinates are sufficient, giving the position and orientation in space.

More complex lines consist of a number of segments, each of which begins and ends with a pair of coordinates. This shows that although vector data structures are better at representing the positions of objects in space, they are not completely accurate. They are still an approximate representation of geographic space. Although some lines exist independently and have certain attribute information, other, more complex sets of lines, called networks, also contain additional information about the spatial relationships of these lines. For example, a road network not only contains information about the type of road and the like, it also shows the possible direction of travel. Other codes linking these segments may include information about the nodes that connect them. All of these additional attributes must be defined throughout the network in order for the computer to know the inherent relationships that the network is modeling. This information about connectivity and spatial relationships is called topology.

Before we can use data structures, models, and systems, we need to transform our reality into a computer-understandable form. The methods by which this is done will depend on the equipment available and the specific system. First, the input subsystem is designed to transfer graphical and attribute data to the computer. Secondly, it must comply with at least one of the two fundamental methods of representing graphic objects - raster or vector. Third, it must be linked to a storage and editing system to ensure that what is entered is stored and retrievable and to allow errors to be corrected and changes to be made as needed. It is first necessary to determine what type of GIS, vector or raster, will be used, and whether the GIS will be capable of converting these data types into one another [5].

Area objects can be represented in a vector data structure similar to linear ones. By connecting line segments into a closed loop, in which the first pair of coordinates of the first segment is simultaneously the last pair of coordinates of the last segment, an area or polygon is created. Both points and lines and polygons are associated with a file containing the attributes of these objects. While raster and vector data structures provide a means of displaying individual spatial phenomena on individual maps, there is still a need to develop more complex approaches, called data models, to incorporate feature relationships into the database, link features and their attributes, and enable collaborative analysis several map layers.

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