

Geographical information systems (gis)

Technology, Information Technology



1. Spatial data are what drive a GIS. Spatial features or entities and their attributes are stored in computers using a number of spatial data models. It is vital to understand the characteristics of them since the data model employed has considerable influence on the functionality of the GIS. Spatial data can represent real world features with discrete boundaries (such as roads, buildings, lakes, rivers, administrative boundaries) as well as real world phenomena with non-discrete boundaries (such as precipitation and nutrient levels, terrain).

The basic approaches are: raster data model and vector data model. Depending on the type of problem that needs to be solved, the type of maps that need to be made, and the data source, either raster or vector, or a combination of the two can be used. Each data model has strengths and weaknesses in terms of functionality and representation. | Raster Data Model| Vector Data Model| Descriptions| The raster data model is the simpler model and is based on the division of reality into a regular grid of identically shaped cells.

Raster data represent the landscape as a rectangular matrix of square cells. In raster data model, attributes are limited to the numeric values of the cells themselves, and while it is possible to link additional attributes to the groups of cells having same values, which is rarely done in practice because of the low utilizing value and cumbersome data management. | In vector data model, an object's shape is represented by dots which are located where the shape of the object changes.

The dots which are known as vertices are joined by straight lines. Vector data represent features as discrete points, lines, and polygons. In vector
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model, as a point of difference, vector objects are additionally described by one or more characteristics, in GIS called attributes. Vector files attributes are stored in tables which consists of records (rows) representing individual features, fields (columns) representing a particular theme describing the feature, and attributes that refers to an intersection between a record and a field.

Advantages

- * The geographical location of each cell is implied by its position in the cell matrix. Accordingly, no geographical coordinates are stored other than an origin point.
- * Due to the nature of the data storage technique data analysis is usually easy to program and quick to perform.
- * The inherent nature of raster maps that is one attribute maps, is ideally suited for mathematical modeling and quantitative analysis.
- * Grid-cell systems are very compatible with raster-based output devices. As reconnaissance satellites and aerial surveys use raster-based scanners, the information can be directly incorporated into GIS.
- * Data can be represented at its original resolution and form without generalization.
- * Graphic output is usually more aesthetically pleasing (traditional cartographic representation).
- * Allows precise representation of points, boundaries, and linear features.
- * Accurate geographical location of data is maintained.
- * Since most data, e. g. hard copy maps, is in vector form no data conversion is required. Allows for efficient encoding of topology and operations that require topological information.

Disadvantages

- * The cell size determines the resolution at which the data is represented.
- * It is especially difficult to adequately represent linear features depending on the cell resolution. Accordingly, network linkages are difficult to establish.
- * Processing of associated attribute data may be cumbersome if large

amounts of data exist. Raster maps inherently reflect only one attribute or characteristic for an area. Since most input data is in vector form, data must undergo vector-to-raster conversion. Besides increased processing requirements this may introduce data integrity concerns due to generalization and choice of inappropriate cell size. * Most output maps from grid-cell systems do not conform to high-quality cartographic needs. | * The boundaries of the resulting map polygons are discrete whereas in reality the map polygons may represent continuous gradation or gradual change, as in soil maps. * The location of each vertex needs to be stored explicitly. Vector data must be converted into a topological structure to achieve effective analysis, which is often processing intensive and requires extensive data cleaning. * Continuous data is not effectively represented in vector form that usually requires substantial data generalization or interpolation for these data layers. * Spatial analysis and filtering within polygons is impossible. |

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U. (n. d.). The GIS Spatial Data Model. Retrieved November 16, 2012, from Introduction to Geographic Information Systems in Forest Resources: http://courses.washington.edu/gis250/lessons/introduction_gis/spatial_data_model.html

Buckey, D. J. (n. d.). VECTOR AND RASTER - ADVANTAGES AND DISADVANTAGES. Retrieved November 16, 2012, from Biodiversity GIS: http://bgis.sanbi.org/gis-primer/page_19.htm 2. Basic concept of GIS As the name implies,

geographic information systems (GIS) are systems designed to be input, store, edit, retrieve, analyze, and output geographic data and information.

It is composed of an orchestrated set of parts, which includes computer hardware and software, space and organizations within which these reside, personnel who use the system in numerous levels and capacities, data and information upon which the system operates, clients who obtain and use the products, vendors who supply the hardware and software, and other systems within which the GIS functions. These parts allow it to perform its many interrelated tasks well. The main task of a GIS is to analyze spatially referenced data and information.

There are various ways of classifying the analytical and modeling capabilities of GIS as many of these capabilities interact. Ultimately, the software most certainly contains algorithms and computer code specifically designed to: (i) Organize geographic data within appropriate referencing systems, (ii) Selectively query those data and aggregate them for easy understanding, (iii) Count and measure both individual objects and collections of objects, (iv) Classify and reclassify objects based on user specified properties, (v) Overlay related thematic map data, (vi) And be able to combine these individual techniques into ordered sequences of operations designed to simulate some natural or anthropogenic activities for decision making. One of the purposes of using GIS is to take observations of the real world and simplify and scale the data into graphical elements to which are related descriptive features termed attributes. Database management system (DBMS) is used to maintain the attributes while the graphical elements are described in any

one of two general types of spatial structure which are vector and tessellation.

Vector structures which refer to discrete elements, points, lines, and polygons, are represented digitally by a series of 2-D coordinates (x and y) that imply magnitude and direction. Whereas tessellation refers to representation of spatial data with a network of elements such as rectangles, squares, hexagons, equilateral triangles, and irregular rectangles. In general, vector methods are more suitable for mapping and performing spatial queries, while tessellation is more suitable to represent continuous surfaces such as topography.

The history of development of GIS parallels the history of developments in digital computers and database management systems as well as those in cartography and automation of map production. The development of GIS has also relied upon innovations made in other sectors including geography, photogrammetry, remote sensing, civil engineering, and statistics. Generally, GIS can be very beneficial in various fields that some organizations are utilizing it, such as retail, utilities, environment, local government, healthcare, transportation and financial services.

However, it could go wrong if the organization was not really sure how it could use it. It should be determined that how an organization uses spatial data and whether the current practices can be automated, and also identify any new processes which would be useful to help decision making. Some people believe that there is no difference between computer-assisted cartography (CAC), computer aided drafting (CAD), and GIS. Because the

graphic display from these three systems can look identical to both casual and trained observers.

Nonetheless, CAC computer systems that designed to create maps from geographical objects combined with descriptive attributes are excellent for display but lack of the analytical capabilities of a GIS. Also, for pure mapping purposes, CAC is highly desirable for the input, design, and output of mappable data rather than working through the myriad analytics of GIS to produce a simple map. Whereas CAD is developed to produce graphic images that is excellent for architects, but it is not capable of analyzing maps that it is the primary task assigned to the GIS.

A successful GIS may not be an off-the-shelf solution to your problems, while it will require considerable thought for a successful implementation. Applications Nowadays, GIS technologies have been applied to diverse sectors to assist experts and professionals in analyzing various types of geospatial data and dealing with complex situations. GIS plays a vital role to help people collect and analyze related spatial data as well as to display data in different formats in business, education, transportation, public safety, natural resources, mapping and charting, geospatial intelligence, government, tourism, and health service.

In agriculture, GIS can be very beneficial too as the ability of GIS to analyze and visualize agricultural environments and workflows has contributed much in the farming industry. Balancing the inputs and outputs on a farm as a fundamental to agriculture success and profitability can be determined easily through GIS. Pest/ disease tracking, farm management, crop monitoring, yield prediction and soil analysis can easily be done through GIS.

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From mobile GIS in the field to the scientific analysis of production data at the farm manager's office, GIS is playing an increasing role in agriculture production by helping farmers increase production, reduce costs, and manage their land more effectively. In natural resource management, GIS has also played important role in various applications. For example, groundwater recharge potential evaluation platform, soil database query system, biodiversity geographic information system, climate rainfall map system, private forest land management system, water body quality and pollutant management system, as well as rainfall analysis system.

In planning and economic development, GIS helps economic developers in effective decision-making that it conducts analysis, displays and disseminates results and makes informed decisions about where to locate new businesses or grow existing ones. GIS technology is really powerful and efficient in helping economic developers sustain economic recovery and growth. The necessary platform for visualization, modeling, analysis, and collaboration can be provided by GIS tools and help the economic developers to achieve their goals.

Next, for public safety, GIS contributes a lot especially in disaster management. There are some systems introduced to detect and prevent disasters such as GIS-based campus emergency system, disaster prevention area planning, urban disaster prevention spatial system, and emergency response digital map platform. However, remote sensing can be combined with GIS to produce a better tool in disaster management. For example, the Wellington Regional Council (WRC) in New Zealand has developed a comprehensive library of earthquake hazard maps.

The data have been digitized and forms part of the WRC GIS. Black and white copies of the maps are faxed to media outlets, police and emergency services while GIS/GPS were utilized to monitor the daily spread of the fire, measure fire suppression actions and assess damage to structures and to natural and cultural sources. Bibliography Basic Concepts. (n. d.). Retrieved November 13, 2012, from <http://www.ce.utexas.edu/prof/maidment/gishydro/docs/reports/smith/sect3.pdf> Buckey, D. J. (n. d.). VECTOR AND RASTER - ADVANTAGES AND DISADVANTAGES.

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http://courses.washington.edu/gis250/lessons/introduction_gis/spatial_data_model.html 3. Future of GIS Geographical Information System (GIS) is a technological tool designed to store, analyze and display geographical data so that a person reading a map can select data necessary for a specific project or task. The demand for GIS tools is constantly growing.

Comparing to the early years of GIS one would dream up a new spatial widget, code it, and then attempt to explain to others how and why they ought to use it, nowadays GIS has been applied into various fields whether in data management, economic planning and development, agriculture, and public safety, whereas in future GIS application should be better than this and make jobs to be done more easily. Why is future of GIS valuable? One of the reasons is geographic information science as a new science that is used to design future information systems.

Also, it is valuable as it generates expansion into new fields and application areas, discovering new uses and solving problems. In future, the scientific visualization and computer graphics will be increasingly integrated with GIS capabilities, especially animated and interactive maps. The potential of future of GIS is far beyond the other sciences for the tools. In today's world, acquiring data for a new GIS is no longer a major problem. GPS has become a main source of new GIS data and comes increasingly from integrated GPS/GIS systems.

Nevertheless, this GIS domain has always been the outdoors where GPS signals are strong and reliable. Thus this matter should be looked into that moving GIS indoors. We need techniques for the rapid, cheap, and accurate <https://assignbuster.com/geographical-information-systems-gis/>

capture of 3D geometries and attributes, as well as efficient methods of determining indoor position. The market for solutions to the problem of moving GIS indoors and integrating the indoors and outdoors really holds an enormous potential. By developing GIS trends, knowing where everything is can be very possible.

Take consideration during emergencies but not invading privacy of ones, tracking individuals using the technologies of GIS would be very useful. For instant, it would be much easier to search for the possible victims if every inhabitant of the Wenchuan area of China had been tracked prior to the May 2008 earthquake. Furthermore, shifting GIS from the relatively leisurely process of analyzing static data to a far more dynamic process of real-time monitoring and decision making can be possible in future also.

A GPS navigation system, fed by sensors, might show the state of congestion of the road system in real time; an emergency manager might view the real-time situation of a disaster response; and a public health researcher might monitor the real-time state of a disease outbreak. Nonetheless, as the progress of future of GIS is developing, we should also take the major influencing factors on it either positive or negative into consideration.

There are several positive influences of future of GIS that we can see, such as continuing hardware cost reductions and improved performance, improvements in storage capacities and performance, the improved capability and functional range of most software, the adoption of standards for GIS in many countries, the availability of a greater range of digital data sets, the greater recognition of GIS as valuable management tool, and also the perceived success of GIS in a number of varied fields.

For the negative sides, the lack of government funding for basic research initiatives, too many systems are stand-alone applications having little incentive to progress, the necessary implementation procedures are very complex, data costs can be prohibitive, too frequently data is difficult to integrate because of structure, accuracy, scale, level of aggregation, as well as the legal concerns over the copyright of data. In conclusion, GIS can be very useful if researches of innovation and evolution can be made more.

Of course, advantages and disadvantages of applications of GIS in future have to be concerned much so that it can be fully utilized and the consequence of GIS development can be minimized. Last but not least, there is one fact that is inescapable: the world of GIS has always been full of surprises, and there is every reason to believe the future will be just exciting! Bibliography Basic Concepts. (n. d.). Retrieved November 13, 2012, from <http://www.ce.utexas.edu/prof/maidment/gishydro/docs/reports/smith/sect3.pdf> Berry, J. K. (2007). Topic 27: GIS Evolution and Future Trends. Retrieved