

Spatial Database

A **SPATIAL DATABASE** IS A **DATABASE** THAT IS OPTIMIZED FOR STORING AND QUERYING **DATA** THAT REPRESENTS OBJECTS DEFINED IN A GEOMETRIC SPACE. MOST **SPATIAL DATABASES** ALLOW THE REPRESENTATION OF SIMPLE GEOMETRIC OBJECTS SUCH AS POINTS, LINES AND POLYGONS.

Characteristics of Spatial Database

- ▶ A spatial database system has the following characteristics
 - It is a database system
 - It offers spatial data types (SDTs) in its data model and query language.
 - It supports spatial data types in its implementation, providing at least spatial indexing and efficient algorithms for spatial join.

Example

- ▶ A road map is a visualization of geographic information. A road map is a 2-dimensional object which contains points, lines, and polygons that can represent cities, roads, and political boundaries such as states or provinces.
- ▶ In general, spatial data can be of two types –
 - Vector data: This data is represented as discrete points, lines and polygons
 - Raster data: This data is represented as a matrix of square cells.

Vector

- ▶ Vector data is best described as graphical representations of the real world. There are three main types of vector data: points, lines, and polygons. Connecting points create lines, and connecting lines that create an enclosed area create polygons. Vectors are best used to present generalizations of objects or features on the Earth's surface.



Raster

- ▶ Raster data is data that is presented in a grid of pixels. Each pixel within a raster has a value, whether it be a colour or unit of measurement, to communicate information about the element in question. Rasters typically refer to imagery. However, in the spatial world, this may specifically refer to orthoimagery which are photos taken from satellites or other aerial devices. Raster data quality varies depending on resolution and your task at hand.



Attributes

- ▶ Spatial data contains more information than just a location on the surface of the Earth.
- ▶ Spatial data can have any amount of additional attributes accompanying information about the location.
- ▶ For example, you might have a map displaying buildings within a city's downtown region.
- ▶ Each of the buildings, in addition to their location, may have additional attributes such as the type of use (housing, business, government, etc.), the year it was built, and how many stories it has.

Geographic Coordinate System

- ▶ To identify exact locations on the surface of the Earth, a geographic coordinate system is used.
- ▶ Normally, an x and y-axis are used in mathematical systems, but in geography, the axes are referred to as lines of latitude (horizontal lines that run east-west) and longitude (vertical lines that run north-south).

Georeferencing and Geocoding

- ▶ Georeferencing and geocoding are different but similar processes since both involve fitting data to the appropriate coordinates of the real world.
- ▶ Georeferencing is the process of assigning coordinates to vectors or rasters so they can be oriented accurately on a model of the Earth's surface.
- ▶ The data used in geocoding are addresses and location descriptors (city, country, etc.). Each of these locations is given the exact coordinates of reference for that location on the surface of the Earth.

What is a GIS?

- ▶ These are programs or a combination of programs that work together to help users make sense of their spatial data.
- ▶ This includes management, manipulation and customization, analysis, and creating visual displays.
- ▶ If you were using GIS for a municipality project, you might have vector data like street data (lines), neighbourhood boundary data (polygons), and high school locations (points).
- ▶ Placement of layers is important for visual purposes as it will help you understand the various types of data and present your findings in an easily understandable way.

- ▶ The field and study of GIS extends much further than digital mapping and cartography.
- ▶ It consists of a variety of categories including spatial analysis, remote sensing, and geovisualization.
- ▶ In these GIS fields, the spatial data becomes much more complex and difficult to use.

Additional Types of Spatial Data

- ▶ While spatial data has long been used for analyzing and presenting the Earth's surface, it is not limited to the outdoor environment.
- ▶ There are many architectural, engineering, and construction (AEC) companies that use CAD (computer-aided design) and BIM (building information model) data in their day-to-day activities.
- ▶ While CAD and BIM may not necessarily be thought of as traditional spatial data, they and other AEC formats also need to consider many spatial elements to understand their work.