Databases and GIS

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Databases: Chapter 2

Encyclopedia Articles:

• PostGIS, C. Strobl, pp. 891-898.
• Oracle Spatial, Geometries, R. Kothuri and S. Ravada, page 821-826.
• GRASS, M. Halbey-Martin, pp. 413-418.
• Oracle Spatial, Raster Data, Q. Xie, page 826-832.
Relevance to Course

- Primary means of storage for GIS
  - Structured Query Language (SQL)
  - Extensions based on DBMS

- Strong discussion on Computer Science principles
  - Database storage structures
  - Database types: Relational vs Object-Orientation
Related Material in Textbook

- Foundation for GIS
  - Primary storage method of GIS data

- Database properties
  - Defined level of availability
  - Defined levels of performance
  - Data integrity
  - Data independence
  - Self describing data

- Types
  - Relational
  - Object-Oriented
Novelty in Encyclopedia Articles

- Covered the history and current development of several spatial DBMS
  - Oracle
    - Spatial
    - GeoRaster
  - PostGIS
    - Extension for PostgreSQL
  - Geographic Resources Analysis Support Software (GRASS)
Societal Motivation

- How are these ideas used in society?
  - Databases are ubiquitous
  - Primary storage method for Big Data

- How did they transform society?
  - Consolidation of information
  - Means to extract information to obtain knowledge
  - Pattern recognition and trends
Computer Science Motivation

- **Efficiency**
  - Fast and efficient way to store and retrieve large amounts of data
  - Necessary for Big Data in the 21\textsuperscript{st} Century

- **Application in GIS**
  - Allows for GIS to handle large amounts of data
  - Increases the productivity of GIS operations and analysis tools
  - Provides data management for large amounts of complex data
Geometries in Oracle Spatial are split into two data types:

1. **SDO_GEOMETRY**
   - Stores the geometry as is.
   - Requires a larger storage space due to redundancy.
   - Useful for queries that retrieve the entire geometry of a feature.

2. **SDO_TOPO_GEOMETRY**
   - Stores geometry using topological elements.
   - Allows for topology management over multiple features.
   - Decreased redundancy and thus decreased storage space.
   - Supports topological queries and processing

Oracle Spatial is an open format and is compliant on a large number of platforms. Geometry data types are restricted to two dimensions.
GeoRaster in Oracle Spatial is used to handle raster data.

- Uses its own “GeoRaster” data type to standardize the rasters stored in the database instead of storing the variety of raster file types that exist.
- Employs the SDO_GEORASTER data type for the storage of the raster data.
- Also uses the SDO_GEOMETRY data type to store the spatial extent of the raster data for ease of indexing.
- This is a logically layered multidimensional data model that stores each raster band as a layer.
- Further development needed in geoprocessing and modeling capabilities.