GEOGRAPHIC INFORMATION SYSTEM (GIS)

Ankara Bilim University

Departmen of Management Information System

Dr. Murat BAŞEĞMEZ

Functions of GIS

- Geographic Information Systems (GIS) perform several critical functions that enable the efficient management, analysis, and visualization of spatial and non-spatial data. These functions are essential in various fields, including urban planning, environmental management, transportation, and disaster response.

- The key functions of GIS include:

Functions of GIS

❑ Data Collection

- Computers Acquisition of spatial and non-spatial data from multiple sources such as satellite imagery, GPS, remote sensing, and field surveys.
- Integration of data from different formats, including raster and vector datasets.
- Continuous updating and validation of data to ensure accuracy and reliability.

Functions of GIS

- Data Processing

- Data management and manipulation to refine raw geospatial information.
- Georeferencing and transformation of spatial datasets to align with standardized coordinate systems.
- Data cleaning, error detection, and correction to enhance data integrity.

Functions of GIS

- Data Analysis

- Spatial analysis, including overlay, buffer, and proximity analysis, to extract meaningful insights.
- Statistical analysis for decision-making, pattern recognition, and predictive modeling.
- Geostatistical methods to analyze spatial relationships and trends over time.

Functions of GIS

- Data Storage

- Efficient data archiving and retrieval using spatial databases and cloud-based GIS platforms.
- Organization of large geospatial datasets in relational databases for quick access and processing.
- Implementation of metadata standards to improve data discoverability and usability.

Functions of GIS

- Data Production

- Generation of high-quality maps, 3D models, and thematic visualizations.
- Development of tabular reports, charts, and graphical representations to support decision-making.
- Integration with Geographic Information Visualization (GIV) techniques to enhance user engagement and interaction.

Types of Data in GIS

- GIS data is categorized into two primary types:

  - spatial data
  - non-spatial data.

- These data types form the backbone of GIS applications and enable comprehensive geospatial analysis.

Types of Data in GIS

❑ Spatial Data

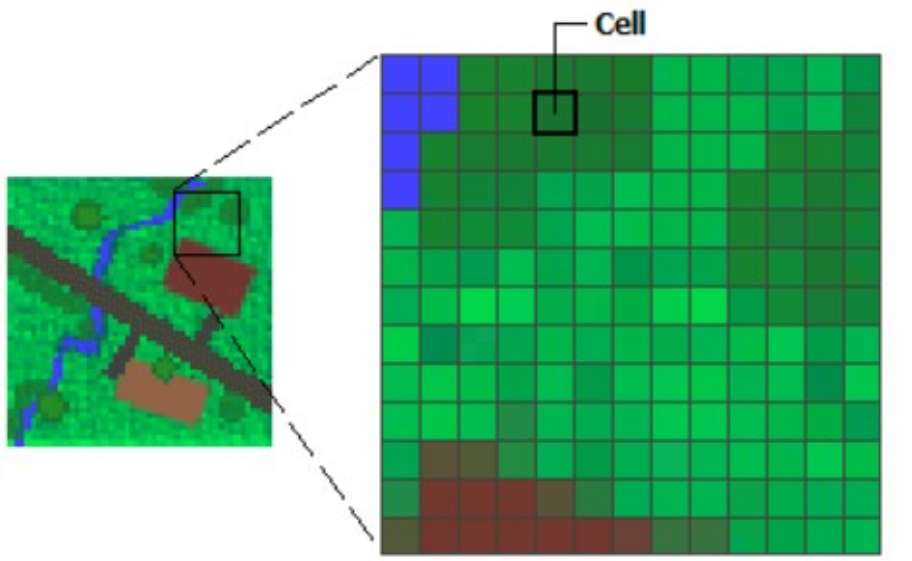
Spatial data represents the geographic location, shape, and relationships of features on the Earth's surface. It is further classified into:

- Raster Data
- Vector Data

Types of Data in GIS

❑ Raster Data

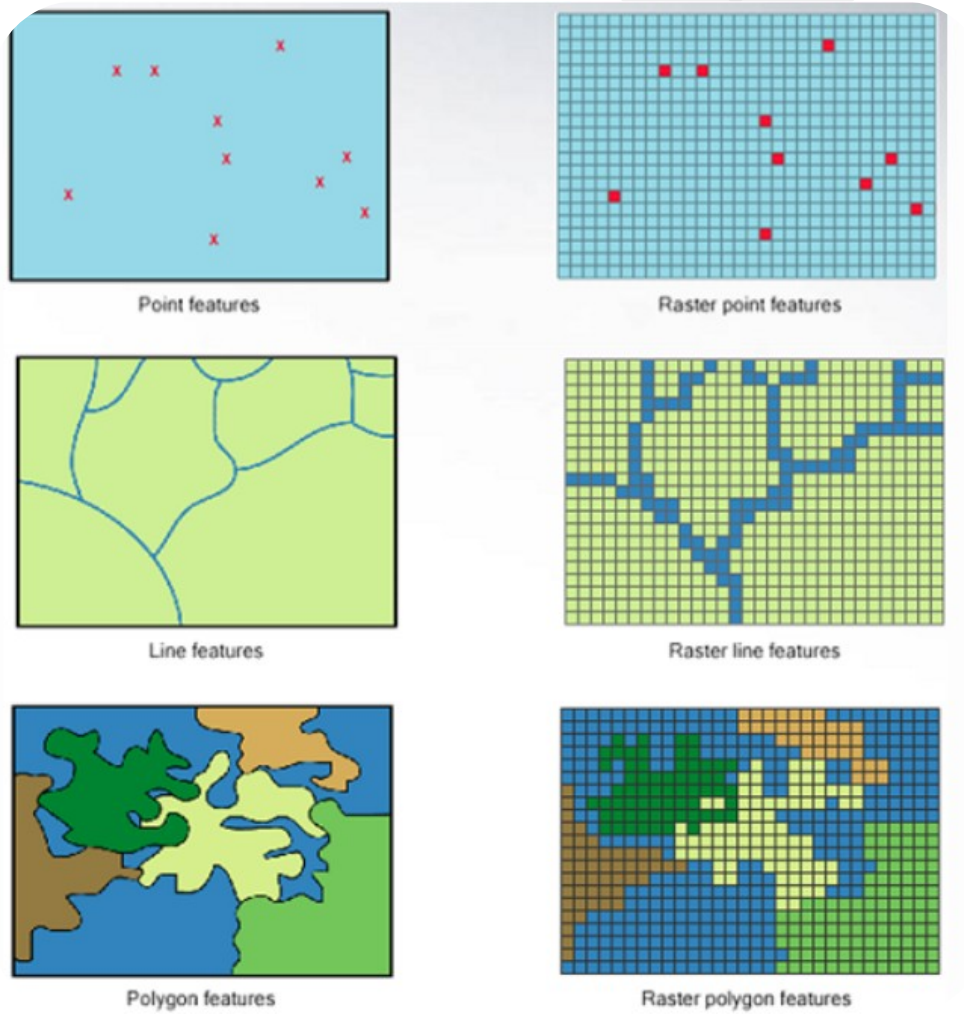
- Consists of grid-based pixel structures where each cell represents a specific geographic feature.
- Examples include satellite imagery, aerial photographs, and scanned maps.
- Common applications involve land-use classification, climate modeling, and remote sensing analysis.



Types of Data in GIS

❑ Vector Data

- Represents spatial features using geometric shapes, including points, lines, and polygons.
- Vector data is widely used in urban planning, transportation networks, and natural resource management.



Types of Data in GIS

❑ Point Data

- Represents specific locations of discrete features, such as buildings, trees, and infrastructure points.
- Examples: GPS coordinates of landmarks, utility poles, and crime incident locations.

Types of Data in GIS

❑ Line Data

- Represents linear features such as roads, rivers, pipelines, and electrical grids.
- Used in network analysis, transportation planning, and hydrological modeling.

Types of Data in GIS

❑ Polygon Data

- Represents area-based features such as land parcels, administrative boundaries, and land cover classifications.
- Used in zoning regulations, land-use planning, and cadastral mapping.

Types of Data in GIS

- Non-Spatial Data

Non-spatial data (also known as attribute data) provides descriptive characteristics of geographic features without representing their physical location.

It includes:

Types of Data in GIS

❑ Attribute Data

- Descriptive information linked to spatial features, enhancing the depth of GIS analysis.
- Stored in attribute tables associated with spatial datasets.
- Examples: land ownership records, demographic statistics, environmental quality indices, and infrastructure attributes.

Types of Data Representation in GIS

❑ Spatial Information

Spatial information in GIS refers to data that describes the location, shape, size, and topology of geographic features.

GIS primarily employs two data models for spatial representation:

Types of Data Representation in GIS

❑ Vector Data Model

- Uses geometric primitives (points, lines, polygons) to depict real-world features.
- Enables precise representation and topological analysis of spatial relationships.

Types of Data Representation in GIS

❑ Raster Data Model

- Composed of grid cells where each pixel holds a specific value representing spatial characteristics.
- Ideal for continuous data such as elevation, temperature, and land cover classification.

Types of Data Representation in GIS

- Non-Spatial Information

Non-spatial information complements spatial data by providing additional attributes about geographic entities.

These attributes help in classification, categorization, and in-depth analysis.

Types of Data Representation in GIS

❑ Forms of Non-Spatial Information

- Descriptive Data: Provides qualitative details about spatial features (e.g., road names, soil types, zoning classifications).
- Textual Data: Contains alphanumeric descriptions such as addresses, labels, and street names.
- Verbal Information: Includes annotations, narratives, or supplementary data related to geospatial entities.

Types of Data Representation in GIS

- Examples of Non-Spatial Data in GIS

- Demographic Data: Age distribution, gender ratios, employment statistics.
- Environmental Data: Rainfall levels, air pollution indices, biodiversity records.
- Ownership Details: Land tenure status, property boundaries, legal documentation.
- Infrastructure Information: Number of public facilities, road classifications, service availability.

Types of Data Representation in GIS

- Vector Data in GIS

Vector data models provide an efficient way to represent and analyze geographic features using discrete geometric shapes.

The three primary vector data structures include:

Types of Data Representation in GIS

❑ Points

- Represent precise locations of features, such as landmarks, water wells, and communication towers.
- Utilized in geocoding, spatial pattern analysis, and facility location optimization.

Types of Data Representation in GIS

❑ Lines

- Depict linear features, such as roads, pipelines, rivers, and electrical transmission networks.
- Essential for routing analysis, transportation planning, and hydrology studies.

Types of Data Representation in GIS

❑ Polygons

- Define area-based features, such as lakes, administrative zones, and protected regions.
- Frequently used in land-use planning, resource management, and ecological assessments.

Types of Data Representation in GIS

❑ Raster Data in GIS

Raster data provides a grid-based representation of spatial features, capturing continuous phenomena with high precision.

Key characteristics of raster data include:

Types of Data Representation in GIS

❑ Pixel-Based Structure

- Raster datasets consist of an array of pixels, each assigned a specific attribute value (e.g., elevation, temperature, vegetation index).

Types of Data Representation in GIS

- Color and Attribute Differentiation

- Features are distinguished based on pixel values, facilitating spectral analysis in remote sensing applications.

Types of Data Representation in GIS

❑ Applications of Raster Data

- Land cover classification using satellite imagery.
- Climate change modeling through spatial interpolation techniques.
- Environmental impact assessment by analyzing vegetation indices and pollution distribution.

Types of Data Representation in GIS

❑ Applications of Raster Data

- Land cover classification using satellite imagery.
- Climate change modeling through spatial interpolation techniques.
- Environmental impact assessment by analyzing vegetation indices and pollution distribution.

Types of Data Representation in GIS

GIS integrates diverse datasets, methodologies, and analytical techniques to enable informed decision-making in spatial sciences. By leveraging both spatial and non-spatial data representations, GIS supports various applications, ranging from urban planning and environmental management to disaster mitigation and public policy development.

Thank you…