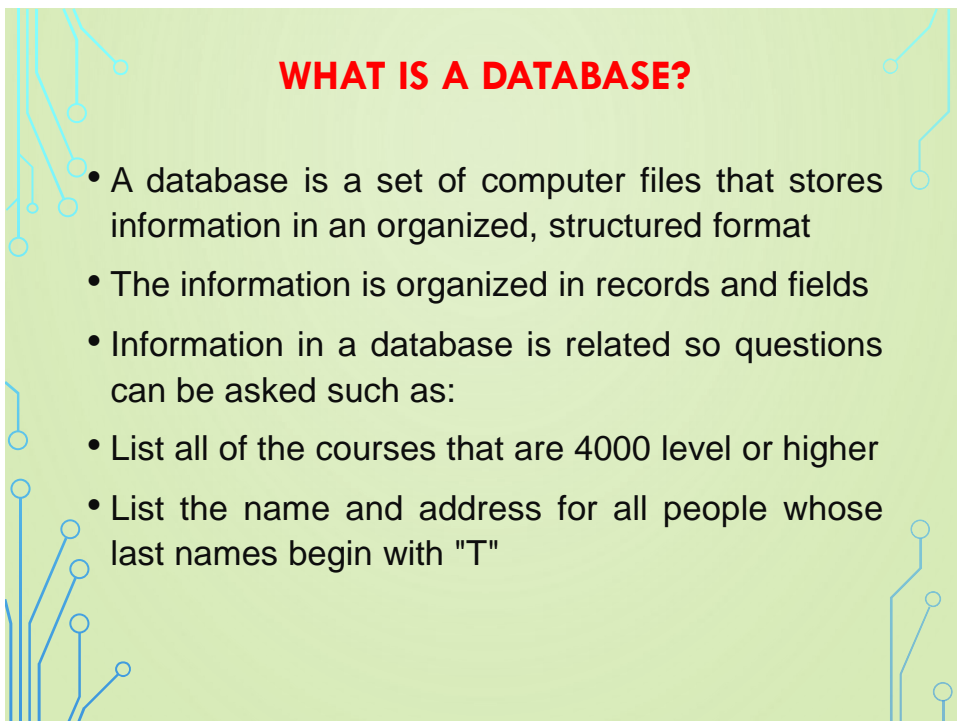


1



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GEODATABASE

- A **geodatabase** is an alternate way to store GIS information in one large file, which can contain multiple point, polygon, and/or polyline layers. ESRI is pushing the **geodatabase** idea, because it is a less “messy” way of organizing data than having multiple shapefiles. in multiple folders
- The geodatabase is a "container" used to hold a collection of datasets.
- It is a collection of geographic datasets of various types.
- An ArcGIS geodatabase is a collection of geographic datasets of various types held in a common file system folder, a Microsoft Access database, or a multiuser relational database (such as Oracle, Microsoft SQL Server, PostgreSQL, Informix, or IBM DB2).
- A key geodatabase concept is the dataset. It is the primary mechanism used to organize and use geographic information in ArcGIS. The geodatabase contains three primary dataset types:

- Feature classes
- Raster datasets
- Tables

OBJECTID	SHAPE	AREA	PERIMETER	HEVC_LINK_UTM
1941	Polygon	1417540.1	11941.867	2
1942	Polygon	321332.03	3148.0269	3
1943	Polygon	10489729	109932.23	4
1944	Polygon	274196.16	3101.4026	5
1945	Polygon	381471.69	3409.4033	6
1946	Polygon	136979.41	1542.3068	7
1947	Polygon	88315.867	1170.6542	8
1948	Polygon	58569.234	1059.4961	9
1949	Polygon	12626.43	1630.2614	10
1950	Polygon	2177387.83	11357.415	11
1951	Polygon	126587.38	1486.1949	12
1952	Polygon	131079.53	1655.1431	13
1953	Polygon	28951224	116835.71	14
1954	Polygon	851989.69	4640.5933	15
1955	Polygon	189941.86	1732.4766	16
1956	Polygon	196032.53	1994.9439	17
1957	Polygon	50374.468	996.4891	18

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TYPES OF GEODATABASE

- There are three types:
- **File Geodatabases**—Stored as folders in a file system. Each dataset is held as a file that can scale up to 1 TB in size. The file geodatabase is recommended over personal geodatabases.
- **Personal Geodatabases**—All datasets are stored within a Microsoft Access data file, which is limited in size to 2 GB.
- **ArcSDE Geodatabases**—Stored in a relational database using Oracle, Microsoft SQL Server, IBM DB2, IBM Informix, or PostgreSQL. These multiuser geodatabases require the use of ArcSDE and can be unlimited in size and numbers of users. When you need a large multiuser geodatabase that can be edited and used simultaneously by many users, the ArcSDE geodatabase provides a good solution. It adds the ability to manage a shared, multiuser geodatabase as well as support for a number of critical version-based GIS workflows. The ability to leverage your organization's enterprise relational databases is a key advantage of the ArcSDE geodatabase.

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CONTD.

- File and personal geodatabases, which are freely available to all users of ArcView, ArcEditor, and ArcInfo, are designed to support the full information model of the geodatabase. This includes topologies, raster catalogs, network datasets, terrain datasets, address locators, and so on. File and personal geodatabases are designed to be edited by a single user and do not support geodatabase versioning.

Geodatabase storage in tables and files

Geodatabase storage includes both the schema and rule base for each geographic dataset plus simple, tabular storage of the spatial and attribute data. All three primary datasets in the geodatabase (feature classes, attribute tables, and raster datasets) as well as other geodatabase elements are stored using tables. The spatial representations in geographic datasets are stored as either vector features or as rasters. These geometries are stored and managed in attribute columns along with traditional tabular attribute fields.

A feature class is stored as a table. Each row represents one feature. In the polygon feature class table below, the Shape column holds the polygon geometry for each feature. The value Polygon is used to specify that the field contains the coordinates and geometry that defines one polygon in each row.

- **Pls. Check this link for details:**

http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Types_of_geodatabases

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GEOMETRIC ERROR

- Two-step procedure
 - Systematic (predictable)
 - e.g. eastward rotation of the earth → skew distortion
 - Deskewing → offset each successive scan line slightly to the west → parallelogram image
 - Random (unpredictable)
 - e.g. random distortions and residual unknown systematic distortions

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RANDOM (UNPREDICTABLE): EXTERNAL GEOMETRIC ERROR

- External geometric errors are usually introduced by phenomena that vary in nature through space and time.
- The most important external variables that can cause geometric error in remote sensor data are random movements by the aircraft (or spacecraft) at the exact time of data collection, which usually involve:
 - altitude changes, *and/or*
 - attitude changes (roll, pitch, and yaw).

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Definitions

Rectification : The process by which the geometry of an image is made planimetric. A map coordinate system is involved.

Registration : The process of making an image conform to another image. A map coordinate system is not necessarily involved.

Georeferencing : It refers to process of assigning map coordinates to image data. It involves changing only the map coordinates information in an image file. The grid does not change.

Geocoding : Geographical referencing of image data. Geocoded images are rectified to a particular map projection and pixel size, and usually radiometric corrections are applied.

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TYPES OF GEOMETRIC CORRECTION

- Two common geometric correction procedures are often used by scientists to make the digital remote sensor data of value:
 - **image-to-map rectification:** Find Ground Control Points (GCPs) on the image and on maps (or from the field).
 - **image-to-image registration:** Create links between two images or between the image and a digital map.
- The general rule of thumb is to rectify remotely sensed data to a standard map projection whereby it may be used in conjunction with other spatial information in a GIS to solve problems.

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Image Rectification and Registration

- Raw, remotely sensed image data gathered by a satellite or an aircraft are representation of irregular surface of earth, or
- Geometry of an image is distorted with respect to north south orientation of map.
- This is a process of geometrically correcting an image so that it can be represented on planar surface, conform to other images or conform to a map.
- It is necessary when accurate area, distance and direction measurements are required to be made from the imagery.
- It is achieved by transforming the data from one grid system into another grid system using a geometric transformation.
- In other word by establishing mathematical relationship between the addresses of pixels in an image with corresponding coordinates of those pixels on another image or map or ground.

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GEOMETRIC CORRECTION

Four Basic Steps of Rectification

- Collect **ground control points (GCPs)**
- “Tie” points on the image to GCPs.
- Transform all image pixel coordinates using mathematical functions that allow “tied” points to stay correctly mapped to GCPs.
- Resample the pixel values (BVs) from the input image to put values in the newly georeferenced image

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GROUND CONTROL POINTS (GCP)

- ▶ Features with known locations on a map (X,Y coordinates). These are the “ground control points”
- ▶ The same features can be accurately located on the images as well (column, row numbers)
- ▶ The features must be well distributed on the map and the image
- ▶ Highway intersections are commonly used ground control points

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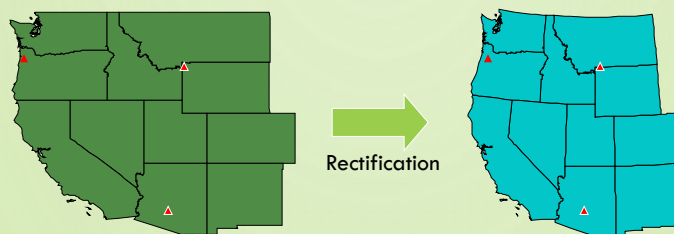
GROUND CONTROL POINT (GCP)

Several alternatives to obtaining accurate **ground control point** (GCP) map coordinate information for image-to-map rectification include:

- *hard-copy planimetric maps*
- *digital planimetric maps*
- *digital orthophoto*
- *global positioning system (GPS) instruments*

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GEO-RECTIFICATION



▲ Ground Control Points

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Polynomial Transformation

- Polynomial equations are used to convert the source file coordinates to rectified map coordinates.
- Depending upon the distortions in the imagery, the number of GCPs used, their location relative to one other, complex polynomial equations are used.
- The degree of complexity of the polynomial is expressed as ORDER of the polynomial.
- The order is simply the highest exponent used in the polynomial.

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MINIMUM NUMBER OF REQUIRED GCP'S

Higher orders of transformation can be used to correct more complicated types of distortion. However, to use a higher order of transformation, more GCP's are needed. The minimum number of GCP's required to perform a transformation of order t equals:

$$\frac{((t + 1)(t + 2))}{2}$$

Polynomial Order (t)	Min. no. of GCP's
1	3
2	6
3	10
4	15

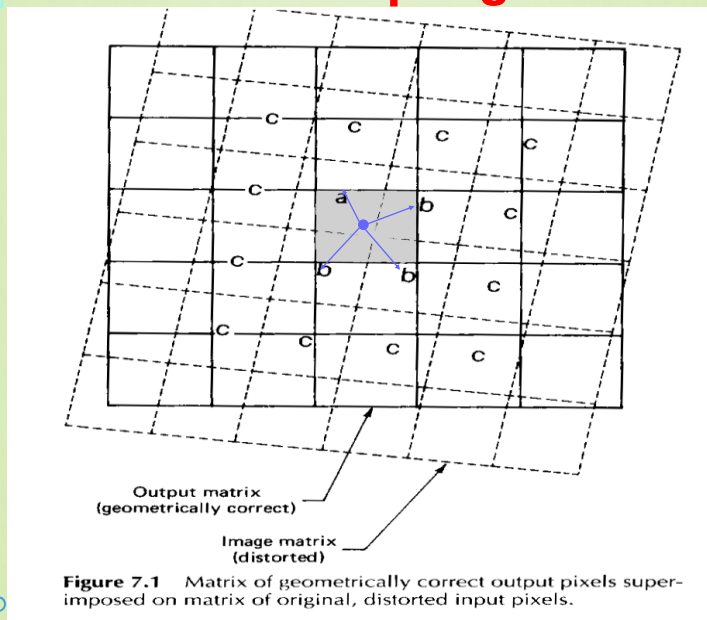
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RESAMPLING

- The purpose is to assign pixel values to the empty pixels in the rectified matrix output
- Superimpose the rectified output matrix to the distorted image
- The digital number (DN) of a pixel in the output matrix is assigned based on the DN of its surrounding pixels in the distorted image

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Resampling

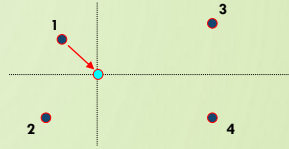


18

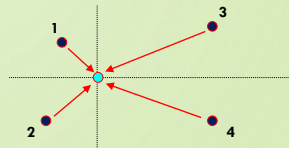
Types of Resampling

- Three Types of Resampling

- **Nearest Neighbor** - assign the new BV from the closest input pixel. This method does not change any values.



- **Bilinear Interpolation** - distance-weighted average of the BVs from the 4 closest input pixels



- **Cubic Convolution** - fits a polynomial equation to interpolate a "surface" based on the nearest 16 input pixels; new BV taken from surface

