Spatial Analyst Tools

GIS III: GIS Analysis
Overview

- Spatial Analyst Toolbox
  - Density Tools
  - Interpolation Tools
  - Statistics Tools
What is GIS Analysis?

- Mapped data shows you where objects are located but cannot explain why

  - GIS analysis searches for patterns and meaning in mapped data using GIS software

  - Allows you to link, query, collect and display your spatial data
Elements of Spatial Analysis

Spatial Analysis

- statistics
- modeling
- spatial statistics
- gis analysis
- cartographic display
- geographic information systems
Geoprocessing

- Geographic analysis and data management
- Performs an operation on an input dataset, resulting in a new output dataset
Storing Abstracted Objects

- Two primary methods for digital storage
  - Vector formats discretely identify shape coordinates
  - Raster formats assign square cells to real world entities
Spatial Analyst Tools Toolbox

- Specialized tools for analysis
- Raster based
Density Tools

- Population per square mile
- Number of features per acre
- Uses
  - Produce a continuous surface from a point layer
  - Visualize overlapping points
  - Identify “hot spots”
Density Tools

- Three density tools in Spatial Analyst
  - **Line density**: Calculates a magnitude per unit area from polyline features that fall within a radius around each cell
  - **Point density**
  - **Kernel density**
- All density tools produce new raster datasets
Density Tools

Point Density
Calculates a magnitude per unit area from point features that fall within a neighborhood around each cell.
Kernel Density
Calculates a magnitude per unit area from point or polyline features using a kernel function to fit a smoothly tapered surface to each point or polyline.
Point vs. Kernel Density

Point Density

Kernel Density

Search radius

Grid cell

Search radius

Grid cell
Density Tools

Point Density

Kernel Density
• Interpolation creates a continuous surface from individual point values

• Examples:
  - Elevation data
  - Temperature

• In ArcMap interpolation creates a new raster dataset
Interpolation Tools

• There are many different interpolation techniques

• Different methods produce different results

• Method parameters will also affect results

• Three common interpolation models
  - Inverse Distance Weighted
  - Spline
  - Kriging
• IDW determines values by weighting sample points
• Weight determines the influence of sampled points
• Use IDW for simple interpolation or in cases where closer points are thought to be similar

Examples:
- Temperature
- Precipitation
Inverse Distance Weighted

Example:

Point 1 has less influence than point 2
The Spline method estimates values using a mathematical function that minimizes overall surface curvature, resulting in a smooth surface that passes exactly through the input points.

The amount of smoothing can be adjusted through the tension.
Kriging

- Based on the idea that closer points are more similar
- Kriging uses a statistical model to weight sample points
- Models based on the spatial autocorrelation between points
- The model produces an error surface
Comparison

IDW

Spline

Krig
Why Use Interpolation?

- To estimate values where there is no data
- Visualization of complex point data
- Analysis of trends over space and time
- Creation of discrete boundaries between values
Zonal Statistics

Can calculate:
- Majority
- Maximum
- Mean
- Median
- Minimum
- Minority
- Range
- Standard Deviation
- Sum
- Variety
Other Useful Spatial Analyst Tools

• Extraction – Subset raster datasets by values or locations

• Map Algebra – Run any algebraic operation on two rasters

• Overlay – Combine multiple rasters into one layer, applying weights to the input datasets

• Reclass – Change the values of rasters