

A Short Course on GIS

Introduction: What is GIS? What can we do with GIS?

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What is Geographical Information Systems (GIS)?

- **GIS** is a information system that captures, stores, manages, presents, and analyzes data that is linked to location.
 - **Capturing geographical data**
 - GPS (lon/lat), Remote sensing (satellite images)
 - **Storing and managing geographical data**
 - Databases (e.g., .dbf /.mdb formatted)
 - **Presenting and analyzing geographical data**
 - Mapping software and its extensions
- **First GIS:** Canadian GIS by Roger Tomlinson (British) of the Department of Energy, Mines, and Resources.

What can GIS do?

- Can create a fancy map (“spatial data visualization”)
 - by overlaying multiple features
 - by mapping lon/lat (x/y) or addresses (“geocoding”)
 - by showing a trend over time and create a movie
 - by showing 3D view with rotation
- Can be used to develop policies involving spatial issues (infectious disease, location decisions, transportation, etc.) based on the results of spatial data analysis

Leading GIS Software

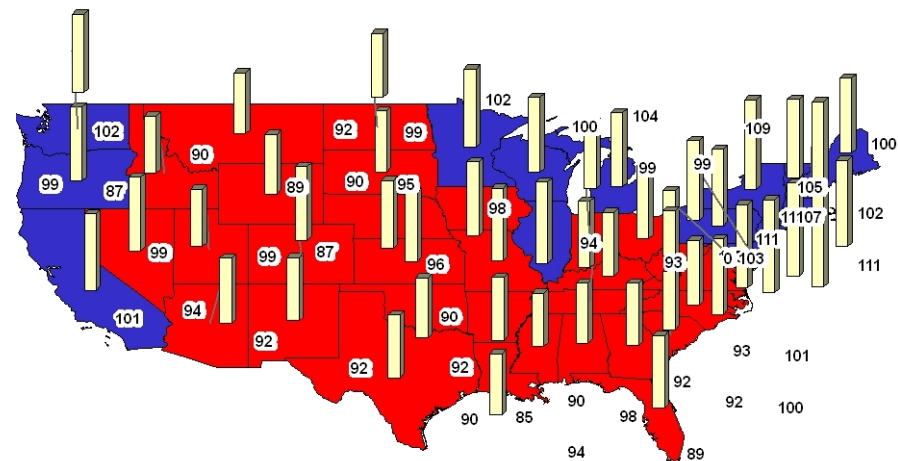
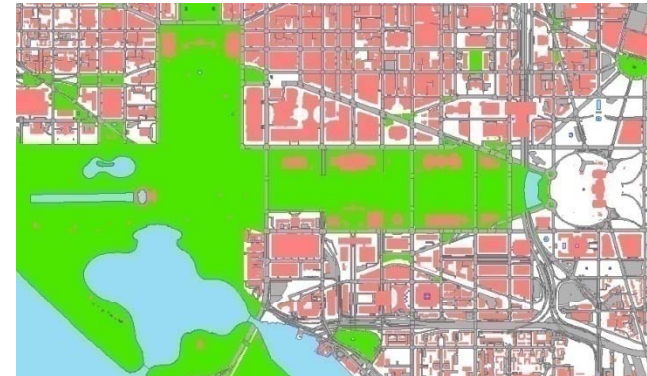
- **ArcGIS** (by ESRI - Environmental Systems Research Institute)
- **GRASS** (some gov and defense ministries; more programming oriented)
- **MapInfo** (similar to ArcGIS)
- **ERDAS** (raster analysis)
- **GEODA** (spatial statistics)
<https://www.geoda.uiuc.edu/> (free)
- **Crimestat** (specific to crime analysis)

Spatial Data Visualization

- **Thematic Map:** A map with multiple features
 - **Choropleth Map:** A map with different features (e.g., pop density, pollution level, etc.) that are colored or patterned in proportion to their sizes.
 - Use of US census file

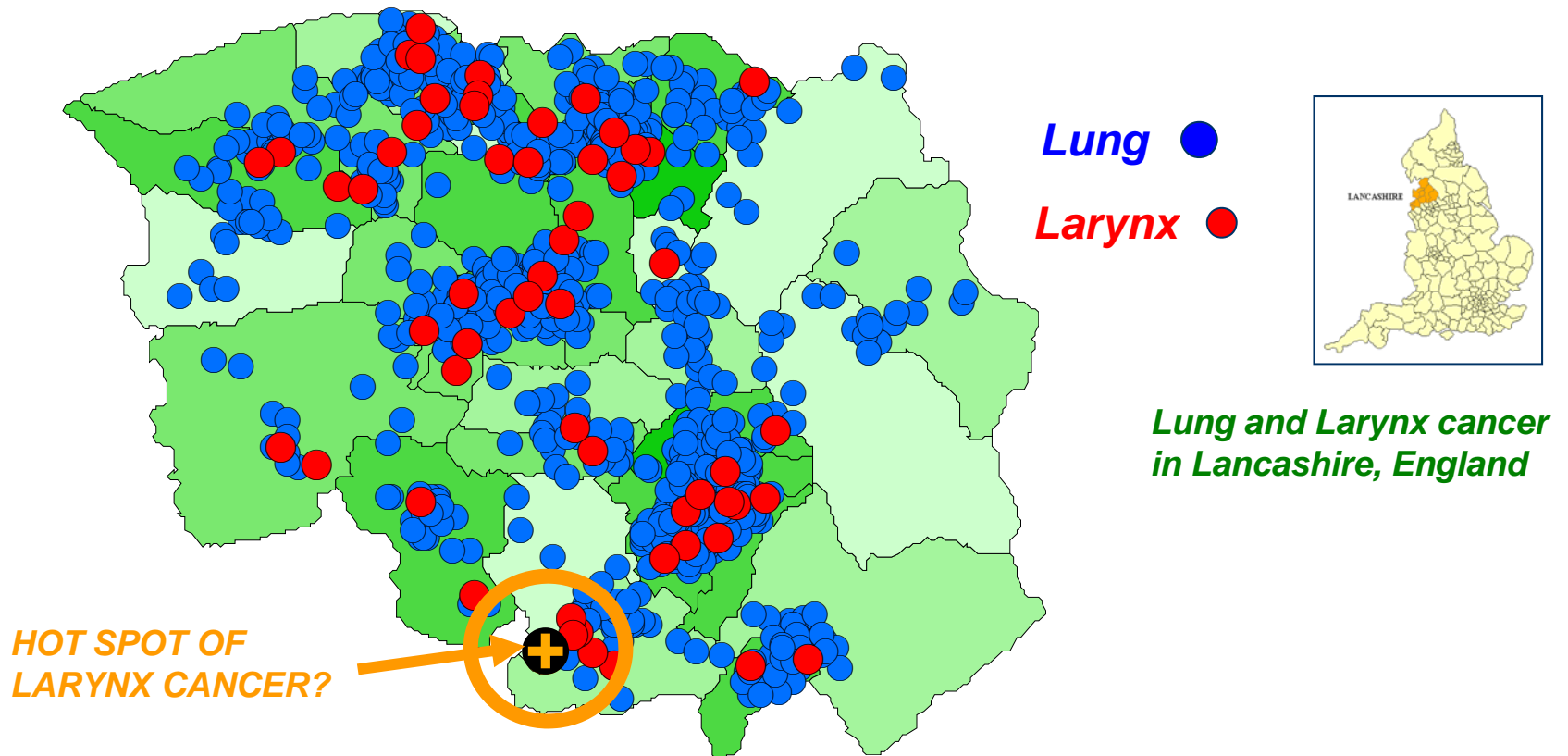
Legend

-  Water
-  Bldg
-  Park
-  Road



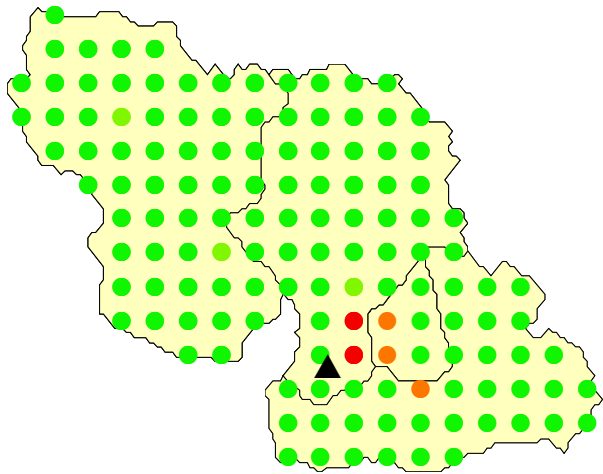
Analysis of Point Data

Identifying Clustering: K-function Analysis

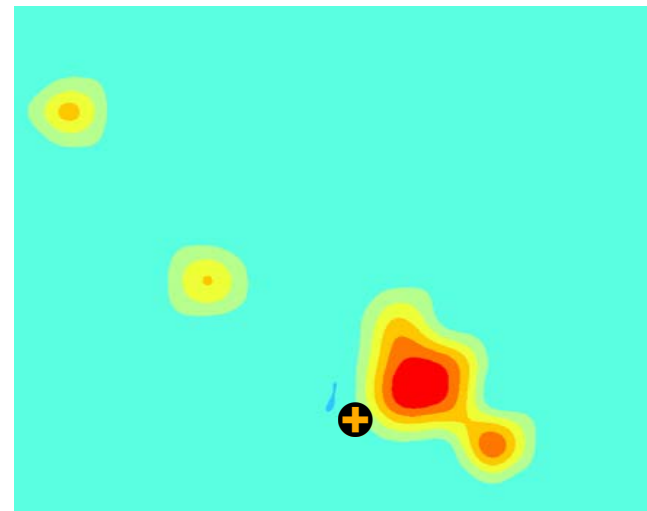


Analysis of Point Data

Identifying Clustering: K-function Analysis



Where do we see unusual clustering of Larynx cancer events?

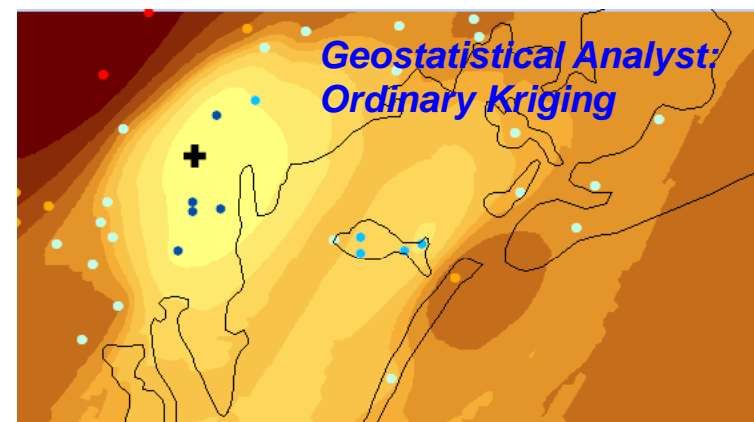
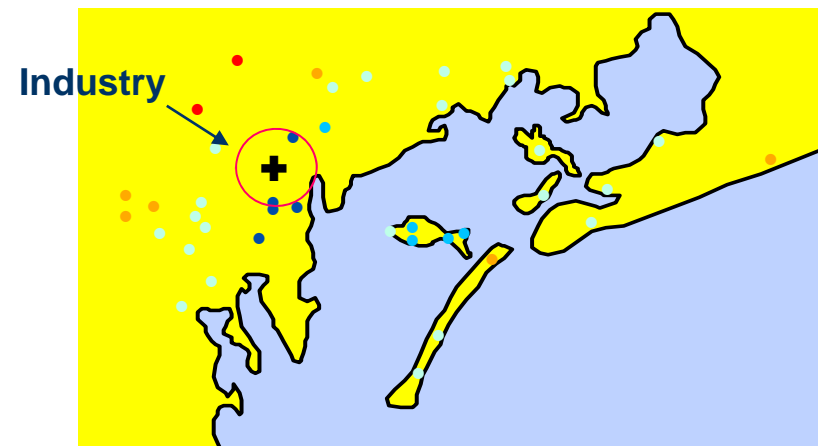


Smoothing (Spatial Analyst Tool => Spatial Interpolation using the p-values

Analysis of Continuous Data

Venice Study by Gambolati and Volpi (1979): Kriging

- **Data:** 40 borehole measurements of the water table level (relative to sea level) around Venice area in 1973.
- **Hypothesis:** There was a suspicion that overuse of groundwater by industry is causing water table to go down (and sinking Venice)



Other GIS Projects

- California redwood SOD (sudden oak death) control
- California weed control
- Hot spot analysis of pneumonia patients in the Philadelphia area
- Optimal locations for mental health care clinics in Philadelphia
- Geographical disparity in access to liver transplantation



SOC syndrome

