Course Outlines

Spatial Point Pattern

Regional Data (Areal Data)

Continuous Spatial Data (Geostatistical Data)

Representation and Operations of Spatial Data

What is Special about Spatial?
Characteristics of Spatial Data and Map Projection
Basic Probability and Statistics

Statistical tools

- histogram
- mean, median, variance
- covariance, correlation coefficient
- p-value
- QQ-plot, box-plot

Pitfalls of spatial data

- MAUP
  - zone effect
  - scale effect
- Ecological fallacy
Spatial Point Pattern Analysis

Geographic distribution

- mean center, median center
- standard distance, standard ellipsoid distance

Point pattern analysis methods

- 1st order
  - Quadrat methods
  - Density estimation
- 2nd order
  - nearest neighbour distance
  - distance functions K,G
Hypothesis testing of CSR

- CSR: complete spatial randomness
- Hypothesis testing

Lab

- Lab 7: Point Pattern Analysis
- Homework assignment
Areal data and spatial autocorrelation

Basics

• Spatial neighbourhood
• Spatial weight matrix

Measuring spatial autocorrelation

• Joint count
• Moran’s I and Moran’s scatter plot
• Hypothesis testing
  • permutation test

Consequences of ignoring spatial autocorrelation

Lab

• Lab 8-a: Getting started with GeoDa
• Lab 8-b: Exploratory analysis using GeoDa
Spatial Fields

Representation of spatial fields

- Contours
- Lattice
- TIN
Spatial Interpolation

Spatial interpolation

- Deterministic interpolator
  - Nearest neighbour
  - Natural neighbours
  - Trend surface
  - Inverse distance weighting
  - Spatial splines
  - Triangulation

- Stochastic interpolator
  - Kriging family of methods

How to make choices of different spatial interpolation methods?
Geostatistics

Kriging

- Semivariogram, covariogram
  - Range, nugget, sill
  - Empirical semivariogram and theoretical semivariogram models
- Kriging
- Advantages of Kriging over deterministic methods, such as IDW

Lab

- Lab 9: Spatial interpolation and Kriging
Labs and software

Lab topics

- Map projection
- Find what’s inside
- Find what’s nearby
- Raster spatial analysis
- Model builder
- Geocoding
- Point pattern analysis
- Exploratory analysis (Moran’s I)
- Spatial interpolation
- Kriging
Software

- ArcMap
  - Arctoolbox: 3D analyst, spatial analysis, spatial statistics, geostatistics
- GeoDa (open-source)
- OpenStreetMap (mapathon)
Summary

Spatial autocorrelation

• First law of geography
• These terms often used interchangeably: spatial autocorrelation, spatial patterns, spatial dependence, spatial context

Methods and tools to explore and measure spatial autocorrelation

• Point pattern → K and G functions, kernel density estimation
• Areal data → Moran’s I
• Geostatistical data → Semi-variogram (i.e., covariogram)
Summary

Read and use maps/geospatial data critically!

- Map projection
- Scale and zone of the geospatial data (remember MAUP?)
- In the spatial methods we covered, parameters can be ‘manipulated’ to show different results
  - Look at these parameters when reading maps
  - Include these parameters when showing resultant maps
Project presentation and report

Project presentation

- Next week during lab times, Wednesday lab moves to next Friday afternoon 1:30pm (May 10th).
- PechaKucha style (20x20), about 7 minutes each group

Project report due: COB Sunday, May 12th

- Put your report on your folder on Techshare
- Upload your project materials, including presentation, datasets and results to your folder on Techshare

Format of 2nd exam

- May 7th, 12:30-1:30, Science 234 (classroom)
- Open books and open notes, but access to any digital devices (e.g., phones, tables, computers) are not allowed
- Multiple choices (with possible multiple correct answers) plus writing questions
Graduate level class and links

Graduate class available

- Geog 5330: Applied Spatial and Spatiotemporal Data Analysis
- Graduate level class
- Counted toward the GIS certificate

Map links

- [http://www.gis.ttu.edu/gist4302/links.html](http://www.gis.ttu.edu/gist4302/links.html)
- @ttugis, @guofengcao
Course evaluation

- Online evaluation now, you should have received the link.

Thank you, any questions/comments