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
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

- Moran’s I and Moran’s I 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?
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
Spatial Uncertainty

Characteristics of uncertainty

- Unavoidable
- Uncertainty in points, networks, area-class and DEM
- Assessment of impact of uncertainty and the propagation
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
Labs and software

Software

- ArcMap
  - Arctoolbox: 3D analyst, spatial analysis, spatial statistics, geostatistics
- GeoDa (open-source)
- OpenStreetMap (mapathon)
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 $\rightarrow$ K and G functions, kernel density estimation
- Areal data $\rightarrow$ Moran’s I
- Geostatistical data $\rightarrow$ Semi-variogram (i.e., covariogram)
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
Final and Project presentation

Format of 2nd exam

- At-home exam, available on BlackBoard on May 5th (next Tuesday), due in the midnight of the same day (May 5th)
- Open books and open notes
- Multiple choices (with possible multiple correct answers) plus short answers questions
- A study guide will be sent

Project presentation

- Recorded Power Point (see here for an instruction)
- PechaKucha style (20x20), about 7 minutes each group
- Due on COB of May 8th (next Friday)
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
- @ttugis, @guofengcao
Thanks

Course evaluation

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

Thank you, any questions/comments