GIST 4302/5302: Spatial Analysis and Modeling

Review

Guofeng Cao

www.gis.ttu.edu/starlab

Department of Geosciences
Texas Tech University

guofeng.cao@ttu.edu

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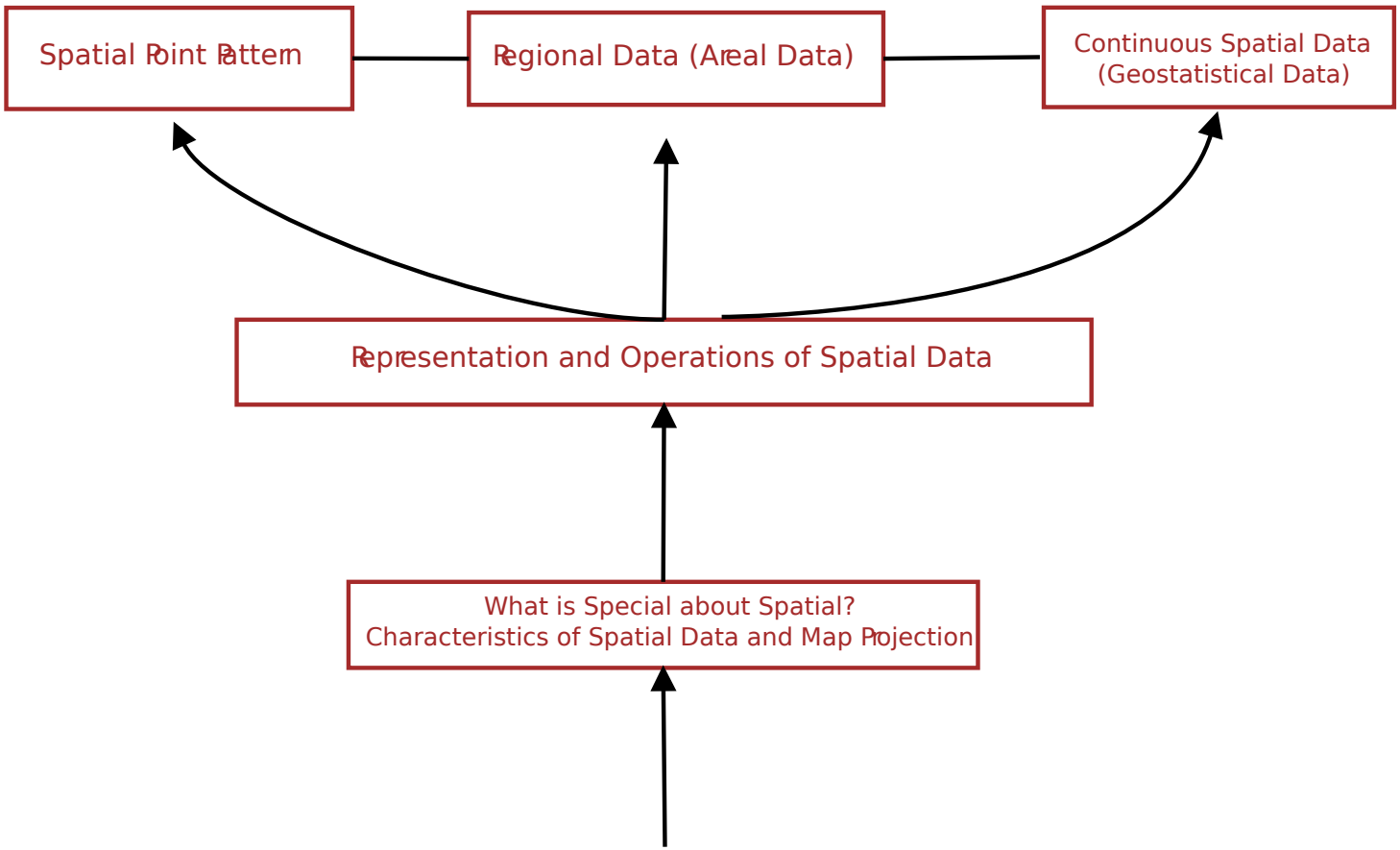
Course Outlines



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

Spatial Point Pattern Analysis

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

- Deterministic interpolator
  - Nearest neighour
  - Natural neighours
  - 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 determistic 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 analytst, 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 $\rightarrow$ K and G functions, kernel density estimation
- Areal data $\rightarrow$ Moran's I
- Geostatistical data $\rightarrow$ Semi-variogram (i.e., covariogram)

Summary

Read and use maps/geospatial data critically!

- Map projection
- Scale and zone of the geospaital 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