Geography 407/507: Spatial Analysis

Instructor: Raymond J. Dezzani Ph.D.

Meeting: TuTh 11:00-12:20 PM in McClure 206

Office Hours: TBA

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Course Description.

The purpose of this course is to provide a broad presentation of spatial data analysis with sufficient theory and methods to permit the acquisition through self-study of any additional analytical methods that may be needed for research or projects. We will cover basic classical statistics based on the frequentist (Fisher) perspective that makes use of independence assumptions for hypothesis testing and parameter estimation. We will also examine more modern and logically consistent approaches to model and hypothesis testing using Neyman-Pearson and Bayesian approaches. As we incorporate more spatial effects, we will relax the independence and eventually fully incorporate dependence (covariance) effects more appropriate for spatial data into our methods. Along the way, we will explore how the principles of nature govern probability (stochastic) processes and the role of field influences in estimating statistical models.

Fall 2010

The motivation for this course is the necessity of spatial data analysis for solving explicitly spatial problems. You might think of this course as "critical quantitative reasoning for geography". In particular and generally speaking, GIS is only a glorified mapping and data management instrument without the incorporation or use of spatial analytical methods to solve real problems that explicitly use the available spatial data.

Course Requirements.

Assignments/exercises 25%

Quizzes 15%

Midterm exam 30%

Final exam 30%

The midterm and final exams will both be of the "take home" variety. One week will be allocated for their completion. For those enrolled in Geog 507, we will meet at an additional time preferably on Wednesday morning or afternoon to cover certain topics in greater depth as per necessity for a graduate course. The 507 students will also have additional exercises to complete as well as different exams and more readings.

Required Textbooks:

- 1) Elementary Statistics for Geographers. Third Edition. By James E. Burt, Gerald M. Barber and David L. Rigby. Guilford Press (2009), New York.
- 2) Fotheringham, S., C. Brunsdon and M. Charlton. 2000, 2004. *Quantitative Geography: Perspectives on Data Analysis*. Sage.

Additional materials will be provided on the course BlackBoard website and as lecture handouts.

Calendar of topics and Course Outline (approximate)

- 1.) Introduction: Geography and Statistical Methods (week 1)
- 2.) Basic Descriptive Statistics (weeks 2-3: we will cover this material quickly)
 - i) Displaying Data
 - ii) Interpreting spatial data
 - iii) Using statistics to describe spatial data and relationships
 - iv) Spatial dependence: graphs, covariance, correlation, basic spatial pattern analysis: points and area approaches. Simple autocorrelation (Moran's I and Geary c). Review of linear regression, linear probability models.
- 3) Inference (weeks 4-8)
 - i) Random variables and basic probability/distributions
 - ii) Sampling (including spatial sampling schemes)
 - iii) Point and interval estimation
 - iv) Basic time series approaches: linear models and temporal autocorrelation.
 - v) One and two sample hypothesis testing
 - vi) Basic Discrete analysis: contingency tables (necessary for land use change assessment) basic Markov models.
 - vii) Basic nonparametric methods (optional)
 - viii)Intro to Analysis of Variance (ANOVA) (optional)
 - ix) Inference in linear regression
 - x) Stochastic time series: AR processes, MA processes.
 - xi) Logistic probability modeling
 - xii) More sophisticated multiple regression approaches (evaluation of assumptions) and trend surface.
- 4) Patterns in Space and Time (weeks 9-16)
 - i) Spatial autocorrelation:, non-stationarity, LISA, kernel estimators.
 - ii) Spatial Interpolation
 - iii) Basic regression with spatial effects: SAR approaches
 - iv) Geographically weighted regression.