Spatial Analysis - Syllabus

Full Class Information: ERE596 – Section 08 SPATIAL ANALYSIS
Registration: You will need to obtain permission from instructor, along with a password to register.

Instructor:
Giorgos Mountrakis
419 Baker
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Lectures:	Tuesday and Thursday	11:00 - 11:55	Baker 437
Lab:	Thursday	12:30 - 3:20	Baker 314

Office Hours: The instructor will be available after lectures or email him for an appointment.

Course Description:
Topics covered in this course include elements of spatial statistics and modeling as applied to various data formats: single point data, continuous data and area data. The triangle visualize-explore-model will be employed with emphasis in the modeling section. Examples of taught methods include: first/second order effects, complete spatial randomness, tessellation, kernel, covariograms and variograms, kriging, distance measures, correlation/correlogram and spatial regression models. Also multivariate analysis methods such as principal components, clustering and grid analysis will be discussed if time permits.

General programming experience and quantitative background are required. Assignments will use Matlab software package, though <u>no prior knowledge of Matlab is required</u>.

Course Objectives:
The course aims to provide:
- Understanding of the basic principles and concepts in spatial statistics.
- The application of spatial analysis methods to hands-on geographic problems.
- Customization of taught methods as applied to student-chosen problems.

Course Outcomes:
Upon successful completion of the course students will be able to:
- Formulate their own hypotheses on a variety of geographic problems and establish a spatial analysis plan to test multiple hypotheses for each problem.
- Synthesize various statistical methods (e.g. on point data, continuous data, area data) to analyze their hypotheses, critique results from various methods and refine hypotheses as appropriate.
- Apply the two aforementioned goals to geographic problems beyond their strict area of expertise (e.g. a biologist working on a transportation problem).

Note: Becoming an expert in Matlab or any other software is <u>NOT</u> an expected outcome.

Grading:
Homeworks (35%), Midterm (25%), Project (30%), Paper Presentation (10%)

Textbook:
Interactive Spatial Data Analysis (2nd Edition) by Trevor Bailey and Tony Gatrell
Publisher: Prentice Hall, ISBN: 0582244935. Available from Follett's Orange Bookstore

Course Delivery: Class will use BlackBoard for all homeworks, lectures and class updates.

Detailed Course Content:
Students need to start by identifying a spatial problem. They should examine available spatial analysis techniques taught in lectures and establish a plan of action. They should follow the triangle visualize-explore-model. Combinations of methods can be used leading to a variety of results. Students need to evaluate these results and possibly identify a new approach to test.

Sequence of topics and concepts:
**** Introductory material**
- Spatial data formats
- GIS and Spatial Analysis
- Visualization

**** Single point data**
- Visualize (Dot maps and labeling)
- Explore (First/second order effects, Quadrat, kernel, nearest neighbor, k-function)
- Model (Complete Spatial Randomness)
- Expand VEM concepts to multivariate datasets.

**** Continuous data**
- Visualize (Symbol maps)
- Explore (Moving average, tessellation, kernel, covariograms and variograms)
- Model (Trend surfaces, least squares, kriging (simple, ordinary and universal, block, co-kriging)
- Multivariate (principal components, clustering)

**** Area Data (if time permits)**
- Visualize (Cloropleth and density maps)
- Explore (Distance measures, moving average, median, kernel, correlation and correlogram)
- Model (Spatial regression models)
- Expand to multivariate data (PCA, image analysis)

**** Combine the above in your project**