Spatial Analysis – Fall 2016 Syllabus

Full Class Information: ERE621 - SPATIAL ANALYSIS

Instructor: Giorgos Mountrakis , **Teaching Assistant:** Tim Pede
Office Location: 419 Baker
E-mail: gmountrakis@esf.edu
Website: http://www.esf.edu/ere/faculty/mountrakis.asp

Class time: Tuesday/Thursday 9:30 - 10:50 Baker 434

Instructor and TA Office Hours: To be determined

Course Description:
Topics covered in this course include elements of spatial statistics and modeling as applied to single point and continuous 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, and several types of kriging.

Note: General programming experience and quantitative background are required. Assignments will use Matlab software package, though **no prior knowledge of Matlab is required.**

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) 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 NOT an expected outcome.

Grading:
Homeworks (35%), Midterm (30%), Project (30%), Paper Presentation (5%)

Textbook:
Interactive Spatial Data Analysis (2nd Edition) by Trevor Bailey and Tony Gatrell
Publisher: Prentice Hall, ISBN: 0582244935. Available at several online stores (e.g. Amazon).

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**

**** Discrete 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 bivariate 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)

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

Course Schedule

Week starting on	Lecture #	Homework
Tuesday, August 30, 2016	Syllabus + L1. Introduction	#1. Getting Started with Matlab + Visualization
Tuesday, September 6, 2016		#1. Getting Started with Matlab + Visualization
Tuesday, September 13, 2016	L2. Visualization-Quadrat-Kernel	#2. Kernel
Tuesday, September 20, 2016	L3. Nearest Neighbor	#3. Nearest Neighbor
Tuesday, September 27, 2016	L4. K-Function + L5. Modeling CSR	#4. K-Function + Confidence (CSR)
Tuesday, October 4, 2016	L6. Bivariate K-Function	#5. Bivariate K-function (Repulsion/Attraction)
Tuesday, October 11, 2016	Lecture Bonus	Paper Presentations
Tuesday, October 18, 2016	**Review + Midterm**	
Tuesday, October 25, 2016	L7. Cont.data: Visualization + Kernel	#6. Continuous Kernel/Delaunay
Tuesday, November 1, 2016	L8. Variograms	#7. Variogram + Variogram cloud
Tuesday, November 8, 2016	L9. Variograms2 + L10. Trends	#8. Trends Surface Analysis
Tuesday, November 15, 2016	L11. Variogram fit + L12. Simple Kriging	#9. Simple Kriging - Project Proposals
Tuesday, November 22, 2016	**No Class - Thanksgiving Break**	
Tuesday, November 29, 2016	L13. Ordinary Kriging	#10. Ordinary Kriging
Tuesday, December 6, 2016	L14. Var. Effects on K + L15. Cross Val.	Projects

Important Deadlines:

Paper selection for presentation is due October 2nd.
Project proposal is due November 7th , preferably earlier

COMPUTER USE

E-mail will be used as a common means of communicating outside class times. All students have access to an e-mail account through the Syracuse University system. The internet will be used for providing information throughout the course. Computer clusters at ESF and at SU provide access for those who do not have home access.

It is the students responsibility to check daily their email *syr* accounts.

The class will also use BlackBoard software. Make sure you can log-in using this web address:
blackboard.syr.edu

SOURCES OF SUPPORT AND CLASS ABSENCE

If you experience academic or personal difficulties that affect your studies or life, there are people and resources who will help you. In particular, the ESF Office of Student Life, 110 Bray Hall (470-6660) will provide academic support, career guidance, personal counseling, or direct you to the proper source of help. If you encounter a situation beyond your control in which you will be missing 3 or more days of classes, you can contact the Office of Student Life and they will contact all your instructors for you. If you have an identified disability and will need accommodations, contact Tom Slocum in the Office of Student Life in 110 Bray Hall.

ACADEMIC INTEGRITY

Academic dishonesty is unacceptable and every incident will be reported according to ESF's policy found here: http://www.esf.edu/facgov/integrity.pdf.

Students are NOT allowed to:

- **share their own code**
- **use a current or former student's code**
- **check other student's code and provide coding help.**