SIE 512 SPATIAL ANALYSIS
Fall Semester 2014

Instructor: Kate Beard
Tues and Thurs: 2:00 - 3:15 Boardman Room 336
Course webpage: http://www.spatial.maine.edu/~beard/sie_512_spatial_analysis.htm
3 credits

Course objective:
This course introduces techniques for the statistical analysis of spatial data. Topics include characterization of spatial data, and techniques for visualizing, exploring and modeling spatial data distributed as point patterns, continuous data, and area data, and methods and problems in spatial data sampling. Students will become familiar with methods for identifying, describing, modeling and testing patterns in observed data.

Students will be responsible for completing several lab exercises, one paper, a midterm exam and a final project. Prerequisites: an introductory statistics course.

Course outline
Issues in analyzing spatial data
General concepts in spatial data analysis
Methods for point pattern analysis
Methods for spatially continuous data analysis
Methods for area data analysis
Sampling spatial populations

Text:
Bailey, T. C. and A. C. Gatrell. 1995. Interactive Spatial Data Analysis. Longmans Scientific and Technical

Supplementary Readings:
Haining, R. 1990. Spatial Data Analysis in the Social and Environmental Sciences. Cambridge: Cambridge University Press.

Stephenson, D.B. 2003. Notes on Statistical Concepts in Environmental Science**.**

Additional references:
Cressie, N. 1993. Statistics for Spatial Data. Revised ed. John Wiley & Sons, New York.

Diggle, P. Statistical Analysis of Spatial Point Patterns. London: Academic Press.

Fotheringham, S. Brunsdon, C. Charlton, M. 2000. Quantitative Geography: Perspectives on Spatial Data Analysis. Sage Publications: London.

Goovaerts, P. Geostatistics for Natural Resource Evaluation. Oxford University Press.

Isaaks, E., and R. Srivastava. 1989. An Introduction to Applied Geostatistics. Oxford University Press, New York.

Lab exercises:
Lab exercises will be done using R an open source statistical software. This software is freely available for download on your computers or you may use the versions installed in the SIE Lab – 138 Boardman Hall. We will also use GeoDa, open source software from the Spatial Analysis Lab, University of Arizona. Lab assignments are due weekly and must be turned in on the day they are due.

Papers: One short paper is required. For this paper assignment students will review a journal article that describes a spatial analysis method from one of the topic areas covered by the course (e.g point patterns, continuous data, area data, or sampling). Papers should be approximately 3 pages in length. They are due **Dec 1.**

Midterm:
There will be a take home midterm exam distributed on October 27 and due November 1.

Final Projects:
Students must complete a final project using analysis techniques learned in the course of the class. There are two options for the final project: 1) implement a spatial analysis technique, or 2) carry out spatial analysis on a data set of your choice. For the first option, any programming or scripting language can be used to code an analysis method. For the second option, the objective will be to select a data set of your choice, use exploratory techniques to examine the data, and develop a hypothesis or set of hypotheses concerning the data and test these using techniques discussed in class. Any software of your choice can be used to perform the analysis. Many spatial data sets are now available on the web but they take some work to prepare for analysis. You should not leave planning for this project until the eleventh hour. A one-page project description of what you propose to do will be presented in class on **November 3**. Final presentations of projects will be scheduled during final exam week.

Grading

Lab Assignments	20%
Midterm Exam	20%
Journal Article review paper	15%
Final project and presentation	35%
Class Participation	10%

If you wish to request an accommodation for a disability, please contact either your instructor or Ann Smith, Coordinator of Services for Students with Disabilities (Onward Building, 1-2319) as early as possible in the semester. SIE

Approximate Schedule of Lectures and Assignments

Wk	Day	Date	Topic	Book Reading Assignments*	Lab Assignments	Data Sets
1	T	Sept 2	Class OverView [SlidesLecture1]	-	Lab 1 Intro to R	DataSet for Lab 1
	TH	Sept 4	Overview of Statistical Concepts [SlidesLecture2]	Text Chap 1 p 3-24. Stephenson 2,3		
2	T	Sept 9	Overview of Statistical Concepts [SlidesLecture3]	Text Chap1, Stephenson 4-6	Lab 2 Regression with R	DataSet for Lab2
	TH	Sept 11	Overview of Statistical Concepts [SlidesLecture4]	Stephenson 7		
3	T	Sept 16	Issues in Spatial Analysis [SlidesLecture5]	Text Chap 1 p 27-35	Lab 3 First/Second order effects	DataSet for Lab 3
	TH	Sept 18	General Concepts in Spatial Analysis [SlidesLecture6]	Haining: Chap 2 pp. 12-32Fotheringham, "The Problem of Spatial Autocorrelation and local Spatial Statistics		
4	T	Sept 23	Introductory Methods in Point Processes[SlidesLecture7]	Text: Chapter 3	Lab 4 Exploratory point process methods	
	TH	Sept 25	Introductory Methods in Point Processes			
5	T	Sept 30	Introductory Methods in Point Processes [SlidesLecture8]	Text: Chapter 3	Lab 5 Modeling point patterns	
	TH	Oct 2	Modeling Point Processes[SlidesLecture9]	Text: Chapter 3		
6	T	Oct 7	Modeling Point Processes[SlidesLecture10]	Text: Chapter 3		
	TH	Oct 9	Multivariate Point Processes[SlidesLecture11]	Text: Chapter 4	Lab 6 Multivariate point patterns and space time	
7	T	Oct 14	Fall Break			
	TH	Oct	No Class			

		16				
8	T	Oct 21	Local cluster detection [SlidesLecture 12]	Text chapter 4 and Kulldorf Waller	Lab 7 Continuous Data Methods	Lab 7 Data
	TH	Oct 23	Continuous Data Analysis [SlidesLecture 13]	Text: Chapter 5		
9	T	Oct 28	Continuous Data Analysis[SlideLecture14]	Text: Chapter 5		
	TH	Oct 30	Continuous Data Analysis[SlidesLecture15]	Text: Chapter 5	Lab 8 Continuous Data Methods	Lab 8 Data
10	T	Nov 4	Continuous Data Analysis [SlidesLecture16]	Text: Chapter 6		
	TH	Nov 6	Continuous Data Analysis [SlideLecture17]	Text: Chapter 6	Lab 9 Area Data Analysis	Lab 9 Data
11	T	Nov 11	Area Data Analysis [SlideLecture18]	Text: Chapter 7		
	TH	Nov 13	Area Data Analysis [SlideLecture19]	Text: Chapter 7	Lab 10	Lab 10 data
12	T	Nov 18	Area Data Analysis [SlideLecture20]	Text: Chapter 7		
	TH	Nov 20	Area Data Analysis [SlideLecture21]	Text: Chapter 7	Project Development	
13	T	Nov 25	Modeling Proportion and Count Data [Slides]	Text: Chap 8		
	TH	Nov 27	Thanksgiving Break			
14	T	Dec 2	Geographically weighted regression [Slides]	GWR- Charlton and Fotheringham	Project Development	
	TH	Dec 4	Sampling Design [Slides]	Haining: Chap 5		
15	T	Dec 9	Sampling Design [Slides]	Haining: Chap 5		
	TH	Dec 11	Work on Projects			
16	T	Dec 16	Final Presentations 12-2			Final presentation and report outline
-	W	Dec 17	Final Presentations 12-2			