

SIE 512 SPATIAL ANALYSIS

Fall Semester 2009

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, area data, and spatial interaction data, and methods and problems in spatial data sampling. Students will become familiar with methods for identifying, describing 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

Methods for spatial interaction data

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:

Most lab exercises will be done using SPLUS which is installed in the SIE Lab – Boardman 138. We will also use R, an open source statistical software similar to SPlus, and GeoDa, open source software from Spatial Analysis Lab, University of Arizona. We will use ArcGIS for general mapping and display tasks. 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 find and 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 3**.

Examples of some relevant Journals:

- Journal of American Statistics
- Geographical Analysis
- Mathematical Geology
- International Journal of GIS
- Environment and Planning B
- Landscape Ecology

Midterm:

There will be a take home midterm exam distributed on October 22 and due October 27.

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 one of the spatial analysis techniques, 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 5**. 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.

Fall 2009 Class outline

	Topics	Readings
1 Sept	Course Overview	
3 Sept	Overview of Statistical Concepts	Text Chap 1, Stephenson 2,3
8 Sept	Overview of Statistical Concepts	Text Chap1, Stephenson 4-6
10 Sept	Overview of Statistical Concepts	Stephenson 7
Lab1	Introductory Concepts	
15 Sept	No Class	
17 Sept	Issues in Spatial Analysis	Haining: Chap 2 pp. 12-32
Lab 2	First and second order effects	
22 Sept	General Concepts in Spatial Analysis	Haining: Chap 2 pp. 32-61
24 Sept	Introductory Methods in Point Processes	Text: Chapter 3
Lab 3	Exploratory point process methods	
29 Sept	Introductory Methods in Point Processes	Text: Chapter 3
1 Oct	Introductory Methods in Point Processes	Text: Chapter 3
Lab 4	Modeling point patterns	
6 Oct	Multivariate Point Processes	Text: Chapter 4
8 Oct	Multivariate Point Processes	Text: Chapter 4
13 Oct	Fall Break	
16 Oct	Continuous Data Analysis	Text: Chapter 5
Lab 5	Continuous data methods	
20 Oct	Continuous Data Analysis	Text Chapter 5
22 Oct	Continuous Data Analysis	Midterm Exam
Lab 6	Continuous Data Methods	
27 Oct	Continuous Data Analysis	Text: Chapter 6
29 Oct	Continuous Data Analysis	Text: Chapter 6
Lab 7	Continuous Data Methods	
3 Nov	Area Data Analysis	Text: Chapter 7 Project Proposals
5 Nov	Area Data Analysis	Text: Chapter 7
Lab 8	Area data exploratory methods	
10 Nov	Area Data Analysis	Text: Chapter 7
12 Nov	Area Data Analysis	Text: Chapter 7
Lab 9	Area Data Modeling	
17 Nov	Area Data Analysis	Text Chapter 8
19 Nov	Sampling Design	Haining: Chap 5
Lab	Final Projects	
24 Nov	Sampling Design	Haining: Chap 5
26 Nov	Thanksgiving Break	

1 Dec	Sampling Design	Haining: Chap 5
3 Dec	Analysis of Interaction Data	Text: Chapter 9
Lab	Final Projects	
8 Dec	Analysis of Interaction Data	Text: Chapter 9
10 Dec	Analysis of Interaction Data	Text: Chapter 9
Lab	Final Projects	