GPH 483/598
Geographic Information Analysis
Spring 2009

Sergio J. Rey
Arizona State University

Meetings:	Tu-Tr 1:30-2:45, SCOB 316
Office:	Coor Hall 5612
E-mail:	srey@asu.edu
Office Hours:	Tues 10-11, Thurs 3-4
Credit:	3 units

1 Objectives

The purpose of this course is to introduce you to advanced methods of exploratory spatial data analysis (ESDA). The focus is on both conceptual and applied aspects of ESDA methods. We will place particular emphasis on the computational aspects of ESDA methods for three different types of spatial data: point processes, geostatistical and lattice. Throughout the course you will gain valuable hands-on experience with several specialized software packages for ESDA. The overriding goal of the course is for you to acquire familiarity with the fundamental methodological and operational issues in ESDA and the ability to extend these methods in your own research.

2 Prerequisites

All participants are expected to have working knowledge of spatial analysis concepts and to be familiar with multivariate statistics. No extensive GIS background beyond ArcGIS basics is needed.

3 Course Organization

The course will meet in the GIS Laboratory in 316 Schwada for both lectures and labs. The class time will be complemented with a virtual classroom supported by the *moodle* software. This is a continued experiment but I hope you will appreciate the added opportunity for virtual office hours and easy access to materials. As this is an evolving project, any feedback on the design and features of the site is welcome. The course site will be announced in class.

4 Grade

The course grade will be based on graded assignments and a final project. The final project will consist of a data analysis, writeup and class presentation for 50% of the grade. You will have to select a spatial data set and carry out an in-depth analysis of spatial pattern. Your selection will need to be approved before you can proceed with the project. Graduate students must find their own data, while undergraduate students have the option of finding their own data or provided by me. Graduate students will also be required to give a short presentation on readings related to a topic from the course. In addition, graded class assignments will be given for each of the three major topics (point patterns, geostatistics, spatial autocorrelation) which focus on the mechanics of carrying out an analysis. Your grade on the two best ones will make up the remaining 50% of the class grade. The objective is for everyone to complete the best possible work so assignments can be revised to improve your grade (within 2 weeks after the original due date).

5 Computational Resources

While this course does not have a formal lab unit, in the sense that you would get an additional credit unit, the course material lends itself rather nicely to computationally based instruction. We will utilize a set of freely available software packages[1] that you can put on your own (or a friend's) computer to work on the examples and exercises in support of the course material. We will set aside part of the lectures to demonstrate various capabilities of these software packages to support spatial analysis. You will have additional opportunity to apply these methods both in the individual exercises as well as in your project. We will primarily rely

[1]The majority of the packages recommended can be classified as open source software. This means, among other things, you are free to use this software without having to pay any licensing fee, so long as you respect the copyright of the author who wrote the package. For more details on the concept of open source see http://www.opensource.org .

on the package R for which is freely available and runs on a number of platforms, including Linux, Unix, Mac OS X, and Windows (all flavors). It is a very powerful mathematical programming language with many data analysis, graphical and computational functions.

6 Readings

There is no required textbook for the course. Supplementary readings will be taken from journals and the following two textbooks:

- O'Sullivan, D.O. and D.J. Unwin (2003) *Geographic Information Analysis*. John Wiley: New York.
- de Smith, M.J., M.F. Goodchild and P.A. Longley (2008) *Geospatial Analysis*. Available at http://www.spatialanalysisonline.com/.

Reading lists for each topic will be given out in class and made available on the moodle class web site.

7 Course Schedule

The proposed topics and their sequence are listed in Table 2.

Table 1: Course Schedule

DATE			TOPIC
Jan	20	T	Introduction
	22	R	Spatial Analysis
	27	T	Spatial Data
	29	R	Lab: Introduction to *GeoDa*
Feb	3	T	Point Pattern Analysis Basics
	5	R	Lab: Descriptive Point Pattern Analysis
	10	T	Point Pattern Processes
	12	R	Lab: Point Pattern Analysis in *R*
	17	T	Clustering and Clusters
	19	R	Lab: Scan Statistics in StatScan
	24	T	Second Order Analysis and Point Pattern Process Modeling
	26	R	Lab: Second Order Analysis and Point Processes in *R*
Mar	3	T	Geostatistics Basics
	5	R	Lab:Variography in *ArcGIS Geostatistical Analyst* and *R*
	10	T	Spring Break
	12	R	Spring Break
	17	T	Kriging
	19	R	Lab: Kriging Prediction in *R* and *Geostatistical Analyst*
	24	T	AAG
	26	R	AAG
	31	T	Spatial Autocorrelation Basics
Apr	2	R	Spatial Weights
	7	T	Advanced Spatial Weights
	9	R	Lab: Spatial Weights
	14	T	Global Autocorrelation
	16	R	Lab: Global Autocorrelation
	21	T	Local Spatial Autocorrelation
	23	R	Lab: Local Spatial Autocorrelation
	28	T	Exploratory Space-Time Analysis
	30	R	Lab: *STARS*
May	5	T	Presentations
	12	T	Presentations (12:10-2:00PM)

Table 2: Course Schedule (Planned)

Month	Date	Topic	Out	Due
Jan	20	Intro, Spatial Data		
	27	Representation of Spatial Structure	Exercise 1	
Feb	3	Point Pattern Basics		
	10	Centrography	Exercise 2	Exercise 1
	17	Advanced Point Patterns		Exercise 2
	24			
Mar	3	Lattice Data Basics	Exercise 3	
	10	Spatial Weights		
	17	Spring Break		
	24	Global Autocorrelation	Exercise 4	Exercise 3
	31	Local Autocorrelation		
Apr	7	Space-Time Autocorrelation		Exercise 4
	14	Geostatistics Basics	Exercise 5	
	21	Variography		
	28	Kriging		Exercise 5
May	5			Projects
	12			Presentations