USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences
Spatial Sciences Institute

SSCI 583, Spatial Analysis

Syllabus

Units: 4

Term — Day — Time: Fall, 2018, Lectures: Mondays and Wednesdays 3:00-4:50 p.m.

Location: Allan Hancock Foundation, AHF 145D

Instructor: Su Jin Lee, PhD, GISP
Office: AHF B55K
Office Hours: Mondays 11:00 a.m.-12:00 p.m. and Tuesdays 2:00-3:00 p.m. Also available most days and times by appointment via email.
Contact Info: sujinlee@usc.edu, 213-740-2845 (office)

Library Help: Andy Rutkowski
Office: VKC B36B
Office Hours: Tuesdays 10:00 a.m.-12:00 p.m. and Thursdays 4:30-5:30 p.m.
Contact Info: arutkows@usc.edu, 213-740-6390 (office), http://bit.ly/andyhangout

IT Help: Richard Tsung
Office: AHF B57E
Office Hours: By appointment
Contact Info: ctsung@usc.edu, 213-821-4415 (office)

Course Scope and Purpose

Spatial analysis is key to the successful application of GIS to today's difficult and critical environmental and social challenges. While digital mapping technologies such as Google Maps, Google Earth, and Microsoft's Bing Maps are now in widespread general use, GIS only reaches its full potential when the power of spatial analysis is engaged. While the consumer oriented mapping tools are simple and intuitive for most people to use, spatial analysis requires a much deeper awareness of the underlying assumptions and methods. In fact, the easy access to very advanced spatial analytical tools in today's GIS is deceptive as it is fairly simple to walk through wizards and push buttons to perform an analysis, but much more difficult to produce a valid, defensible analytical result. Helping you become an informed spatial analyst is the goal of this course.

This course aims to provide students with the knowledge and skills necessary to investigate the spatial patterns which result from social and physical processes operating on or near the Earth's surface. Essential theoretical concepts of quantitative geography are examined, including measures of geographical distribution (including point and areal pattern analysis) and spatial autocorrelation, interpolation, and network connectivity. The focus is on understanding the theories and context of spatial analysis so that you are equipped to find and apply the best analytical tool for your problem and to correctly and appropriately interpret and present your results. Since proficient spatial analysis requires imaginative application of a myriad of available tools, there are far more tools and techniques available than we can possibly cover in a single course. Therefore, practical assignments in this course are not intended to provide comprehensive training in any of the wide range of available tools, but rather to develop skills that will help you find, understand and use the multitude of tools and, importantly, the related learning resources when you need them in the future.

By both necessity and design, this course serves several different audiences. It is a required course for students in the GeoHealth track in Master of Public Health program and in the Spatial Informatics M.S. program, as well as an elective for students in the GIST M.S. program and in the GIST, the Geospatial Intelligence and the Geospatial Leadership Graduate Certificate programs. To address this diverse range of student interests, this course focuses on common principles and tools. Most assignments direct students to apply these to specific applications or problem areas according to individual requirements.

Learning Outcomes

On completion of this course, students should be able to:

- Plan, design, and implement a spatial analysis project demonstrating the ability to select, apply, and critically interpret appropriate methods for the analysis of geographical information.
- List several different approaches to spatial analysis and differentiate between them.
- Outline the geographic concepts of distance, adjacency, interaction, and neighborhood, and discuss how these are fundamental in performing spatial analysis.

- Explain how point patterns, including clustering, can be identified and understood as realizations of spatial processes.
- Apply appropriate spatial references (datum and projection) to spatial data before undertaking analysis.
- Outline the central role that spatial autocorrelation plays in spatial analysis and explain how it helps and hinders the use of current tools.
- Demonstrate how different concepts about nearness and neighborhoods result in a variety of interpolation methods that produce different results.
- Outline the various ways that overlay is implemented in GIS.
- List several emerging geographical analysis techniques using temporal and 3D analysis.

Prerequisite(s): SSCI 581 or permission of the instructor
Co-Requisite(s): None

Course Structure

The main theoretical concepts are provided through a directed reading of the text *Geographic Information Analysis.* A collection of reading notes provide the basis for an informed review of most chapters. Additional readings will be assigned to expand on the text when needed. The course will generally unfold on a biweekly basis. When possible, assignments will be given in advance, but usually they will be posted on or before Mondays. Practical exercises utilize published tutorial materials using ArcGIS and a final project allows students to demonstrate their ability to apply spatial analytical tools in an appropriate, informed manner.

Workload – This is a four credit, one semester course. Students should expect to spend 10-15 hours per week completing the work in this course.

Technological and Communication Requirements

ArcGIS is provided online via the SSI Server; hence, you do not need to install it on your own computer. Instead, every student must meet the following technology requirements:

- A computer with a fast Internet connection.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the SSI Server

SSI Server and Tech Support – This course utilizes the SSI Server which is a virtual desktop giving access to many different professional software packages. If you are unable to connect to the server or experience any type of technical issue, send an email using your USC account to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) me on the email.

Communications – This is a distance learning course, so most of our interactions will be asynchronous (not at the same time). All materials to be handed in will be submitted via Blackboard. It is each student's responsibility to stay informed about what is going on in our

course. In addition to email about time-sensitive topics, any important announcements will be posted on the Announcement page in Blackboard. Be sure to check these each time you log onto Blackboard.

I will send via email through Blackboard any notices that are time sensitive. Please be sure that you read as soon as possible all email sent from Blackboard or from me. Do not ignore course email until the day before assignments are due. Also double check to be sure that email sent from the USC Blackboard account does not go into your junk mail!

While I am usually on-line all day and will probably respond to emails from students very quickly, I will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours delay. In the rare case when I expect to be off-line for more than 72 hours, I will post an announcement on the Blackboard site.

Discussion forums – On the Blackboard site, I will post a series of discussion threads relevant to various sections of the course. Discussions provide a key means for student-to-student discussion and collaboration that can replicate the face-to-face contact you may have experienced in traditional classrooms. Here students can provide support to each other while working on your assignments, sharing hints and helpful tips, as you would in a classroom laboratory. Please post your questions about assignments there, as you would ask them publically in the classroom. I monitor the discussion threads and offer comments when necessary, but more importantly, consider the discussion board a key way to connect with your classmates and share your discoveries.

Required Readings and Supplementary Materials

The required textbooks for this course are:

- O'Sullivan, David, and David J. Unwin. 2010. *Geographic Information Analysis*, 2nd Edition. New York: John Wiley & Sons. While you may purchase this book if you wish to own a bound copy, it is available online through the USC Libraries. Sign on to the USC Libraries and search for this title.
- Mitchell, Andy. 1999. *The Esri Guide to GIS Analysis. Volume 1: Geographic Patterns and Relationships*. Redlands, CA: Esri Press.
- (Optional) Mitchell, Andy. 2005. *The Esri Guide to GIS Analysis*. *Volume 2: Spatial Measurements and Statistics.* Redlands, CA: Esri Press.
- (Optional) Mitchell, Andy. 2012. *The Esri Guide to GIS Analysis*. *Volume 3: Modeling Suitability, Movement, and Interaction.* Redlands, CA: Esri Press.

The practical Mitchell books are useful in association with the theoretical text as a means of bringing theory into a working context. Used copies of these books are widely available online, so there is no need to pay the full retail price.

Supplementary readings will be assigned from various sources including:

- de Smith, Michael J., Michael F. Goodchild and Paul A. Longley. 2013. *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques and Software Tools*, 3rd

Edition. Winchelsea, UK: The Winchelsea Press. Available in both print and a (free!) web version at www.spatialanalysisonline.com.

- Fisher, Peter F., and Nicholas J. Tate. 2006. Causes and consequences of error in digital elevation models. *Progress in Physical Geography* 30: 467-489.
- Kemp, Karen K., ed. 2008. *Encyclopedia of Geographic Information Science.* Thousand Oaks, CA: Sage Publications. Available online from the USC Libraries.

As well, for several of the assignments in this course, you will conduct online library research to find articles that apply specific techniques in an application area of your choice.

Description and Assessment of Assignments

Weekly Assignments

There are several different kinds of assignments with at least one due weekly. These are described in the Weekly Folders on Blackboard. Due dates are shown in the summary that follows.

Resume Assignment – 1 worth 2 points. We require all current students to post and maintain a public resume, short biography and recent photo on our shared SSI Student Community Blackboard site. Please prepare your resume in the SSI template which will be provided to you. Unless you opt out, your resume will be included in the Spatial Sciences Institute Graduate Programs Resume Book. This resume book is compiled annually and, along with our web presence, is used to promote our programs, and more importantly, your skills, experience and professional aspirations.

Tutorials 1, 3, 4, 5, 6, 7, and 8 – 7 worth a total of 14 points. Due in the weeks between Reading Assignments, hands-on Tutorials from the Esri tutorial collection will be used to practice the techniques explored in theory in the text. At the completion of each tutorial, you will prepare a brief written report to demonstrate that you have completed it.

Tutorial 2 – 1 worth 4 points. Tutorial 2 is more substantial than the other tutorials, requiring more thought and effort.

Reading Assignments – 4 worth a total of 24 points. These will focus on the text and other assigned readings. One will be due every other week. Their objective is to help you evaluate and integrate the information you have acquired from the course readings. Some of these will involve discussions and collaborative works, most will be individual efforts.

Analysis Reports – 5 worth a total of 20 points. Written reports will be assigned regularly to document steps in the analysis and/or to reflect upon assigned readings.

Final Project

To integrate your learning of all the material covered in the course, in the final project you will design, undertake, and report on an individually-chosen project that will be the context of discussion in several of the assignments. The three project components will be due at different times during the term to build gradually on the material presented in the course. All points for

project components will be assigned using a grading rubric provided at the time the project assignment is posted. The three components of the project are:

Proposal - 2 points. A description of the spatial question(s) you would like to ask or the spatial problem you want to solve and how you plan to solve it.

Data Report - 9 points. A draft of the section of your final report that discusses the data you will use and the exploration of that data that you have already completed.

Presentation - 10 points. A presentation in the classroom

Project Report - 20 points. A written report on your project methodology and outcomes.

Grading Breakdown

Assessment	Number	Points Each	Total Points
Weekly Assignments			
Resume Assignment	1	2	2
Tutorials 1,3,4,5,6,7,8	7	2	14
Tutorial 2	1	4	4
Reading Assignments	6	4	24
Analysis Reports	3	5	15
Final Project Components			
Proposal	1	2	2
Data Report	1	9	9
Presentation	1	10	10
Final Report	1	20	20
Total	22	-	100 points

Assignment Submission Policy

Unless otherwise noted, assignments must be submitted via Blackboard by the due dates specified in the Course Schedule on the next page and on the assignment instructions.

Unless otherwise noted, all Reading Assignments and Tutorials are *due by 11:59 pm Pacific Time (PT) on Mondays*. Project components have different due dates as indicated on the Course Schedule below. Your attention to on-time assignment submission is essential if I am to meet my goal to return comments on your submitted assignments before the next one is due. Sometimes this is impossible, so I will post a notice on anticipated delays if needed.

Strict penalties apply for late assignments as follows:

- All assignments will be penalized 2 points up to FOUR days late. No points will be given for submissions more than FOUR days late. Note that all assignments worth 2 points will receive 0 points if submitted late.
- Additionally, no written work will be accepted for grading after 5 pm PT on the last day of classes, with the exception of the final Summative Assignment.

Course Schedule

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 1 8/20	Introduction to Course	SSCI 583 Syllabus Course Notes Resume Assignment	No deliverables
8/22		Tutorial 1 Introduction	
Week 2 8/27	Introduction to GI Analysis and Spatial Data	Course Notes O'Sullivan & Unwin: Preface, Ch 1&2 Mitchell, Vol. 1: Ch 1&2 Reading Assignment 1	Resume Assignment: Monday, 8/27
8/29		Mitchell, Vol. 1: Ch 3 ArcGIS documentation Tutorial 2 MAUP	Tutorial 1: Wednesday, 8/29
Week 3 9/3 *Monday, 9/3 is a university holiday	No class		Reading Assignment 1: Tuesday, 9/4
9/5	Maps for Spatial Analysis and Spatial Processes	Course Notes	Tutorial 2 MAUP: Wednesday, 9/5
Week 4 9/10		O'Sullivan & Unwin: Ch 3&4	
9/12		Reading Assignment 2	Reading Assignment 2: Wednesday, 9/12
Week 5 9/17		ArcGIS documentation	Tutorial 3: Monday, 9/17
9/19		Tutorial 3 Projections and ModelBuilder	
Week 6 9/24	Point Pattern Analysis	Course Notes O'Sullivan & Unwin: Ch 5&6 de Smith et al.: various	Reading Assignment 3: Monday, 9/24
9/26		Reading Assignment 3 Analysis Report 1	
Week 7 10/1		Mitchell, Vol. 1: Ch 4 ArcGIS documentation	Analysis Report 1: Monday,10/1
10/3		Tutorial 4 Point Patterns	
Week 8 10/8	Spatial Interpolation	Course Notes O'Sullivan & Unwin: Ch 9&10 Fisher and Tate 2006 ArcGIS Help readings	Tutorial 4: Monday,10/8
10/10		Reading Assignment 4 Analysis Report 2	

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 9 10/15		ArcGIS documentation	Reading Assignment 4: Monday, 10/15 Analysis Report 2: Monday, 10/15
10/17		Tutorial 5 Surface Modeling	
Week 10 10/22	Overlay and Networks	Course Notes O'Sullivan & Unwin: Ch 11	Tutorial 5: Monday, 10/22
10/24		Reading Assignment 5	Proposal: Wednesday,10/24
Week 11 10/29		ArcGIS documentation Tutorial 6 Rasters and Overlay	Reading Assignment 5: Monday, 10/29
10/31		de Smith et al. 2013: various ArcGIS documentation	
Week 12 11/5		Tutorial 7 Network Analysis	Tutorial 6: Monday, 11/5 Project Data Report: Monday, 11/5
11/7	Spatial Autocorrelation	Course Notes O'Sullivan & Unwin: Ch 7&8 Kemp, 2006: various sections	
Week 13 11/12		Reading Assignment 6 Analysis Report 3	Tutorial 7: Monday, 11/12
11/14		ArcGIS documentation Tutorial 8 Regression	
Week 14 11/19* 11/21-11/25 is a university holiday	Final Project	Final Project Presentation Final Project Report	Reading Assignment 6 Part One: Monday, 11/19 Analysis Report 3: Monday, 11/19
Week 15 11/26			Tutorial 8: Monday, 11/26 Reading Assignment 6 Part Two: Monday, 11/26
11/28			Final Project Presentation Slides: No later than 5:00 pm PT on Friday, 11/30 Project Report: No later than 5:00 pm PT on Friday, 11/30
Exam Week 12/5-12/12	Final Project Presentation		Final Project Presentation Wednesday, 12/5

Statement on Academic Conduct and Support Systems

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.
Provides overall safety to USC community. dps.usc.edu