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, 2019, Lectures: Mondays and Wednesdays 3:00-4:50 p.m.

Location: Allan Hancock Foundation, AHF 145D

Instructor: Su Jin Lee, Ph.D., GISP
Office: AHF B55K
Office Hours: Mondays 2:00-3:00 p.m. and Wednesdays 1:00-2:00 p.m. Also available most days and times by appointment via email.
Contact Info: sujinlee@usc.edu, 213-740-2845 (office)

Instructor: Elisabeth J. Sedano, J.D., Ph.D
Office: AHF B57C
Office Hours: Mondays 12:00-1:00 p.m. and Wednesdays 12:00-1:00 p.m. Also available most days and times by appointment via email.
Contact Info: sedano@usc.edu, 213-740-9582 (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 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 an elective for students in the M.S. Geographic Information Science and Technology program and the M.S. Homeland Security and Geospatial Intelligence program, and in the Graduate Certificates in GIST, the Geospatial Intelligence and the Geospatial Leadership. 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

When you have completed this course, you should be able to:

- 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/or hinders the use of current tools.
- Demonstrate how different conceptions of nearness and neighborhoods underlie a variety of interpolation methods that can produce different results.
- Outline the various ways that overlay is implemented in GIS.
- List several emerging geographical analysis techniques that employ temporal and 3D analysis.
- Select, apply, and critically interpret appropriate methods for the analysis of geographical information in a spatial analysis project of your own plan and design.

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

Course Structure

This is a graduate level course, so you should expect this class to be intellectually challenging. As a graduate student, you are expected to engage with the information you are learning and to explore the heady cauldron of ideas, opinion, and analysis that describe our collective effort to thoroughly interrogate the subject at hand. Learning arises from active engagement with the knowledge found in our reading materials and with one another. As in any graduate class, the instructor's role is that of a guide who keeps you on this path of discovery.

The course will generally unfold on a biweekly basis. All course materials will be organized through Blackboard. 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.

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.

SSI Server and Tech Support – This course utilizes the SSI Server which is a virtual desktop giving access to many different professional software. 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!

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 course Blackboard site, I will post a series of discussion threads relevant to various sections of the course. These 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 publicly 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, NY: 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 main theoretical concepts are provided through a directed reading of the text *Geographic Information Analysis.* Additional readings will be assigned to expand on the text when needed. The practical Mitchell books are useful in association with the theoretical text as a means of bringing theory into a working context.

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.

For several of the assignments in this course, you will conduct research to find scholarly articles that apply specific techniques in an application area of your choice. As a USC student, you have access to a vast collection of academic journals, books, and other texts via USC's online library website.

Description and Assessment of Assignments

Your grade in this course will be determined on the basis of several different assessments:

Weekly Assignments

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.

Reading Assignments – 4 worth a total of 24 points. These will focus on the text and other assigned readings. 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 work, most will be individual efforts. One will be due every other week.

Tutorials 1, 3, 4, 5, 6, 7, and 8 – 2 worth a total of 14 points. Due in the weeks between Reading Assignments, these hands-on assignments require students to work with the theoretical techniques explored 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.

Review Presentations – 4 worth a total of 12 points. Students will critically review various case studies and discuss the data and the methodologies in the classroom.

reflect on the course learning outcomes and explain how the assigned work completed during the semester address these.

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 spatial analysis project that will be the context of discussion in several of the assignments. The four 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 four components of the Project are:

Proposal - 4 points. A brief 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 - 10 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 will be held during the final examination period 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
Review Presentations	3	4	12
Project Components			
Proposal	1	4	4
Data Report	1	10	10
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 below and on the assignment instructions.

Unless otherwise noted, all submissions are due by 11:59 pm PT on the due date listed.

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.

Schedule

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 1 8/26	Introduction to Course	SSCI 583 Syllabus Course Notes Resume Assignment	No deliverables
8/28		Tutorial 1 Introduction	
Week 2* 9/2 *Monday, 9/2 is university holiday		No Class	Resume Assignment: Tuesday, 9/3
9/4	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	Tutorial 1: Wednesday, 9/4
Week 3 9/9		Mitchell, Vol. 1: Ch 3 ArcGIS documentation	
9/11		Tutorial 2 MAUP	Reading Assignment 1: Wednesday, 9/11
Week 4 9/16	Maps for Spatial Analysis and Spatial Processes	Course Notes O'Sullivan & Unwin: Ch 3&4	
9/18		Reading Assignment 2	Tutorial 2 MAUP: Wednesday, 9/18
Week 5 9/23		ArcGIS documentation	
9/25		Tutorial 3 Projections and ModelBuilder	Reading Assignment 2: Wednesday, 9/25
Week 6 9/30	Point Pattern Analysis	Course Notes O'Sullivan & Unwin: Ch 5&6 de Smith et al.: various	
10/2		Reading Assignment 3 Review Presentation 1	Tutorial 3: Wednesday, 10/2

	Topic	Readings and Assignments	Deliverables/Due Dates
Week 7 10/7		Mitchell, Vol. 1: Ch 4 ArcGIS documentation	
10/9		Tutorial 4 Point Patterns	Reading Assignment 3: Wednesday, 10/9 Review Presentation 1: Wednesday, 10/9
Week 8 10/14	Spatial Interpolation	Course Notes O'Sullivan & Unwin: Ch 9&10 Fisher and Tate 2006 ArcGIS Help readings	
10/16		Reading Assignment 4	Tutorial 4: Wednesday, 10/16
Week 9 10/21		ArcGIS documentation Review Presentation 2	
10/23		Tutorial 5 Surface Modeling	Reading Assignment 4: Wednesday, 10/23
Week 10 10/28	Overlay and Networks	Course Notes O'Sullivan & Unwin: Ch 11	Proposal: Monday, 10/28 Review Presentation 2: Monday, 10/28
10/30		Reading Assignment 5	Tutorial 5: Monday, 10/30
Week 11 11/4		ArcGIS documentation Tutorial 6 Rasters and Overlay	
11/6		de Smith et al. 2013: various ArcGIS documentation	Reading Assignment 5: Wednesday, 11/6
Week 12 11/11		Tutorial 7 Network Analysis	Tutorial 6: Monday, 11/11 Project Data Report: Monday, 11/11
11/13	Spatial Autocorrelation	Course Notes O'Sullivan & Unwin: Ch 7&8 Kemp, 2006: various sections	
Week 13 11/18		Tutorial 8 Regression	Tutorial 7: Monday, 11/18
11/20		Reading Assignment 6	
Week 14* 11/25 *11/27-12/1 is a university holiday		Review Presentation 3	Tutorial 8: Monday, 11/25
11/27	Final Project	Project slides Project Report	Reading Assignment 6: Wednesday, 11/27
Week 15 12/2			Review Presentation 3: Monday, 12/2

	Topic	Readings and Assignments	Deliverables/Due Dates
12/4 *Friday, 12/6 is last day of class			Final Project Report: Friday, 12/6, 5pm
Final Exam Week 12/11-12/18		Final Project Presentation	Final Project Presentation: Wednesday, 12/11

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
engemannshc.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

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

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

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
equity.usc.edu, titleix.usc.edu
Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical

condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support – (213) 740-2421
studentaffairs.usc.edu/bias-assessment-response-support
Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs – (213) 740-0776
dsp.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

Student Support and Advocacy – (213) 821-4710
studentaffairs.usc.edu/ssa
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC – (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, http://emergency.usc.edu/
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety – UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Resources for Online Students

The Course Blackboard page and the GIST Community Blackboard page have many resources available for distance students enrolled in our graduate programs. In addition, all registered students can access electronic library resources through the link https://libraries.usc.edu/. Also, the USC Libraries have many important resources available for distance students through the link: https://libraries.usc.edu/faculty-students/distance-learners. These include instructional videos, remote access to university resources, and other key contact information for distance students.