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

SSCI 583 (Section 35700), Spatial Analysis

Syllabus (Subject to change)

Units: 4

Term- Day-Time: Fall, 2016, Mondays and Wednesdays, 2:00 p.m. - 3:50 p.m.

Location: Allan Hancock Foundation, AHF 145D

Instructor: Dr. Su Jin Lee
Office: AHF B55K
Office Hours: Mondays, 10-11 a.m. PT, and Wednesdays, 1-2 p.m. PT, and by appointment
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Office: AHF 146
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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.

This particular course is a required course in the SPIF M.S. Program, and the GeoHealth track in the Keck School of Medicine's Master of Public Health Program. This course is also an elective in the GIST M.S. and Graduate Certificate Programs and the Geospatial Leadership Graduate Certificate Program.

Learning Objectives

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): None
Co-Requisite (s): None
Concurrent Enrollment: None
Recommended Preparation: None

Course Formats
This is a graduate level course, so you should expect this class to be both academically robust and intellectually challenging. As graduate students 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-level class, the instructor's role is that of a guide who keeps you on this path of discovery and you will find that you will learn much from your fellow classmates.

We have several technologies that will facilitate our course work and our interactions, despite our dispersed locations. These include:

Blackboard: All course materials and correspondence will be posted on the course Blackboard site. As a registered student, you will find this course will show up in your available courses no later than 12:00 p.m. PT on the first day of classes. It is here that the day-to-day flow of the course will be recorded.

Discussion forums: On the Blackboard site, we will post a number of discussion threads relevant to various sections of the course. These threads are very important in terms of providing support to each other while working on class exercises to share hints and helpful tips, as you would in a classroom setting. I will check the discussion threads periodically and offer occasional comments. Please send me an email directly if you have a question or concern that requires my immediate attention.

GIST server and tech support: This course will utilize the GIST Server which is a virtual desktop. You can access the GIST Server at https://gistonline.usc.edu. If you are unable to connect to the server or experience any type of technical issues, send an email to GIST

Tech Support at gistsupport@dornsife.usc.edu and make sure to copy (cc) me on the email.

Technological and Communication Requirements
The geospatial software and data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute.
ArcGIS is provided online via the GIST Server; hence, you do not need to install it on your own computer. Instead, every student must have the following technology requirements:

- Every student MUST have a computer with a fast Internet connection.
- Every student MUST have a functional webcam and a microphone for use whenever a presentation or meeting is scheduled.

Communications
This is a residential course. All materials to be handed in will be submitted via the Blackboard Assessment link. We can discuss issues and comments on the course assignments, exercises, and projects in the classroom. However, I will also create Blackboard discussion forums throughout the semester for asynchronous discussion. Please be sure that you read as soon as possible all e-mail sent from Blackboard or from me. Check now to make sure that mail sent from both the USC Blackboard accounts and my private domain (sujinlee@usc.edu) does not go into your junk mail.
While I am usually online and will probably respond to emails from students relatively 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 offline for more than 72 hours, I will post an announcement on the Blackboard site.
That said, 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.

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

Required Readings and Supplementary Materials
Textbooks – There are three required textbooks and one optional textbook for this course. They are available from the USC Bookstore or online outlets such as Amazon. We encourage you to purchase these books immediately since you will need these materials from the opening day of class. The O'Sullivan and Unwin book is available through USC Libraries as an e-Book.

- O'Sullivan, David, and David J. Unwin. 2010. *Geographic Information Analysis*, 2nd Edition. New York: John Wiley & Sons.
- Mitchell, Andy. 1999. *The Esri Guide to GIS Analysis. Volume 1: Geographic Patterns and Relationships*. Redlands, CA: Esri Press.

- 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 on-line, 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 library.

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

Your grade in this class will be determined on the basis of several different assessment tools:

Resume Assignment (2%): We require all current students to post and maintain a public resume, short biography and recent photo on our shared GIST 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 and 7 (12%): 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 (6%): Tutorial 2 is more substantial than the other tutorials, requiring more thought and effort.

Reading Assignments (36%): 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 work, most will be individual efforts.

Final Discussion (2%): To make sure you take a moment to reflect on all that you have learned in the course, before the last day of the course, you will share your observations in the class room on what you feel are the most important things you have learned in this course.

Final Project (42%): 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 (proposal, data report, presentation, and project report) 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 (2%): A brief description of the spatial question(s) you would like to ask or the spatial problem you want to solve and briefly how you plan to solve it.
- Data Report (10%): 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%): A presentation made on-line via Adobe Connect, open to all students in the course.
- Project Report (20%): A written report on your project methodology and outcomes.

Careful planning and a serious, consistent commitment will be required for you to successfully navigate the various deliverables in this and other GIST courses. The table on the next page summarizes the SSCI 583 course assignments and their point distribution:

Assignments	**Number**	**Points Per Assignment**	**% of Grade**
Resume Assignment	1	2	2
Reading Assignments	6	6	36
Tutorial 2	1	6	6
Tutorials 1,3,4,5,6,7	6	2	12
Final Discussion	1	2	2
Project Components			
Proposal	1	2	2
Data Report	1	10	10
Presentation	1	10	10
Final Report	1	20	20
Totals	**19**	**-**	**100**

Assignment Submission Policy
Assignments will be submitted for grading via Blackboard using the due dates specified in the Course Schedule below.

Additional Policies
Students are expected to attend and participate in every class session and to complete and upload all assignments before the deadlines detailed in the Course Schedule. Late work will be assessed a penalty of 10% per day and zero grades will be assigned for work that is more than four days late.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Assignments	Deliverables/Due Dates
Week 1 8/22* *Class starts on Monday, 8/22	**Introduction to Class**	SSCI 583 Syllabus Course Notes About the Student Community Resume Assignment Tutorial 1: Introduction	No deliverables.
Week 2 8/29	**Introduction to GI Analysis and Spatial Data**	Reading Assignment 1: Course Notes O'Sullivan & Unwin: Preface, Chs. 1&2 Mitchell, Vol. 1: Chs. 1&2	Resume Assignment: Monday, 8/29 Tutorial 1: Monday, 8/29
Week 3 9/6* *Monday, 9 /5 is a university holiday		Tutorial 2: MAUP Mitchell, Vol. 1: Chapter 3 ArcGIS documentation	Reading Assignment 1: Tuesday, 9/6
Week 4 9/12	**Maps for Spatial Analysis and Spatial Processes**	Reading Assignment 2: Course Notes O'Sullivan & Unwin: Chs. 3&4	Tutorial 2: Monday, 9/12
Week 5 9/19		Tutorial 3: Projections and ModelBuilder ArcGIS documentation	Reading Assignment 2: Monday, 9/19
Week 6 9/26	**Point Pattern Analysis**	Reading Assignment 3: Course Notes O'Sullivan & Unwin: Chs. 5&6 De Smith et al.: various Project Discussions	Tutorial 3: Monday, 9/26 Project Discussions: Wednesday, 9/28 in the class room
Week 7 10/3* *Due to SSCI 587 Catalina Field Excursion, no class on 10/4 and 10/6.		Tutorial 4: Point Pattern Mitchell, Vol. 1 Chs. 4,5,6 Mitchell, Vol. 2 Ch. 1&2	Reading Assignment 3: Monday, 10/3

Week 8 10/10	**Spatial Interpolation**	Reading Assignment 4: Course Notes O'Sullivan & Unwin: Chs. 9&10 Fisher and Tate 2006 ArcGIS Help readings	Tutorial 4: Monday, 10/10 Esri Web Course: Monday, 10/10
Week 9 10/17		Tutorial 5: Surface Modeling ArcGIS documentation	Reading Assignment 4: Monday, 10/17
Week 10 10/24	**Overlay and Networks**	Reading Assignment 5: Course Notes O'Sullivan & Unwin: Ch. 11 De Smith et al.: various	Tutorial 5: Monday, 10/24 Project Proposal: Monday, 10/24
Week 11 10/31		Tutorial 6: Rasters and Overlay ArcGIS documentation	Reading Assignment 5: Monday, 10/31
Week 12 11/7	**Overlay**	Reading Assignment 6: Course Notes O'Sullivan & Unwin: Chs. 7&8 Mitchell, Vol. 2 Ch. 5 Kemp: various	Tutorial 6: Monday, 11/7 Project Data Report: Monday, 11/7
Week 13 11/14		Tutorial 7: Regression or Networks ArcGIS documentation	Reading Assignment 6 (Q1&Q2): Monday, 11/14
Week 14 11/21* *Thanksgiving break (11/23-25)	**Final Project**	Project Presentation Slides Project Presentation Project Report	Reading Assignment 6 (Q3&Q4): Monday, 11/21 Tutorial 7: Monday, 11/21
Week 15 11/28* *Friday, 12/2 is the last day of classes		Final Discussion	Project Presentation Slides: Monday, 11/28 Presentation: Tuesday 11/29 & Thursday, 12/1 Final Discussion: Thursday, 12/1 Project Report: No later than 05:00 p.m. PT on Friday, 12/2

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 Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions. 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.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://adminopsnet.usc.edu/department/department-public-safety. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

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 http://libguides.usc.edu/distancelearning. This includes instructional videos, remote access to university resources, and other key contact information for distance students.