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

SSCI 583 (Section 35700), Spatial Analysis

Syllabus

Units: 4

Term — Day — Time: Spring, 2017, Wednesday and Fridays, 2:00 p.m. - 3:50 p.m.

Location: Allan Hancock Foundation, AHF 145D

Instructor: Su Jin Lee, PhD, GISP
Office: AHF B55K
Office Hours: Wed. 12-1 p.m. PT, and Fri. 1-2 p.m. PT, and by appointment

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GIS Library Help: Katharin Peter
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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.

By both necessity and design, this course serves several different audiences. It is a required course for the GeoHealth track in the Keck School of Medicine's Master of Public Health Program and the M.S. in Spatial Informatics program. As well, it is an elective for the GIST M.S. and Graduate Certificate, the Geospatial Intelligence Graduate Certificate and the Geospatial Leadership Certificate programs. To address the interests of this diverse range of students, the instructional materials in this course focus on common principles and tools and most assignments direct students to apply these to specific application or problem areas according individual requirements.

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.
- Discuss key issues related to the use of spatial analysis in one or more specific application areas as determined by each student's professional interests.

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.* The course reader will emerge as a collection of reading notes that provide the basis for an informed review of most chapters. Additional readings will be assigned to expand on the text when needed and in many cases students will be directed to discover relevant research literature specific to their individual areas of interest. 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.

All course materials will be organized through Blackboard. The main theoretical concepts will be provided through course notes and assigned readings. Presenting the course notes and assigned readings again in class would simply consume your precious time. Instead, you are required to read the texts and course notes before you come to the classroom and discuss what concepts you thought the most challenging to understand. This allows you to engage in internalizing and applying the concepts and theory learned from readings for a deeper understanding of our course materials. In addition, you will work with your classmates together and actively interact by sharing experiences through collaborative learning.

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 GIST Server; hence, you do not need to install it on your own computer. Instead, every student must have the following technology requirements:

- A computer with a fast Internet connection.
- 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. If you are unable to connect to the server or experience any type of technical issues, 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 – All materials to be handed in will be submitted via the Blackboard Assessment link in advance of the classroom session during which they will be discussed. This allows you to engage in reading and class preparation assignments individually before you come to the classroom.

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 and collaborative work – In the classroom, you will discuss the concepts and theory you have already learned with your classmates and you will work with them to complete course assignments, tutorials, and projects as the need arises. Through discussion and collaborative work, students can provide support to each other while working on your individual assignments, sharing hints and helpful tips.

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 and 7 – 6 worth a total of 12 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 6 points. Tutorial 2 is more substantial than the other tutorials, requiring more thought and effort.

Reading Assignments – 6 worth a total of 36 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 work, most will be individual efforts.

Summative Assignment – 1 worth 4 points. A final summative written assignment to be completed during the final examination period is required. In this assignment you will 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 - 2 points. 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 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 - 8 points. A presentation made on-line via Blue Jeans, open to all students in the course

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	6	2	12
Tutorial 2	1	6	6
Reading Assignments	6	6	36
Summative Assignment	1	4	4
Project Components			
Proposal	1	2	2
Data Report	1	10	10
Presentation	1	8	8
Final Report	1	20	20
Total	19	-	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 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.

Schedule

	Topics	Reading and Assignments	Deliverables/Due Dates
Week 1 1/9	Introduction to Class	Resume Assignment Tutorial 1: Introduction SSCI 583 Syllabus Course Notes	No deliverables.
Week 2 1/17* *Monday, 1/16 is university holiday	Introduction to GI Analysis and Spatial Data	Reading Assignment 1 Course Notes O'Sullivan & Unwin: Preface, Ch. 1&2 Mitchell, Vol. 1: Ch. 1&2	Resume Assignment: Tuesday, 1/17 Tutorial 1: Tuesday, 1/17
Week 3 1/23		Tutorial 2: MAUP Mitchell, Vol. 1: Chapter 3 ArcGIS documentation	Reading Assignment 1: Monday, 1/23
Week 4 1/30	Maps for Spatial Analysis and Spatial Processes	Reading Assignment 2: Course Notes O'Sullivan & Unwin: Ch. 3&4	Tutorial 2: Monday, 1/30
Week 5 2/6		Tutorial 3: Projections and ModelBuilder ArcGIS documentation	Reading Assignment 2: Monday, 2/6
Week 6 2/13 Online learning due to I will be in the USC WMSC Institute	Point Pattern Analysis	Reading Assignment 3: Course Notes O'Sullivan & Unwin: Ch. 5&6 De Smith et al.: various	Tutorial 3: Monday, 2/13
Week 7 2/21* *Monday, 2/20 is university holiday		Tutorial 4: Point Pattern Mitchell, Vol. 1 Ch. 4 ArcGIS Documentation	Reading Assignment 3: Tuesday, 2/21
Week 8 2/27 Online learning due to Dr. Lee will be in the USC Wrigley Institute	Spatial Interpolation	Reading Assignment 4: Course Notes O'Sullivan & Unwin: Ch. 9&10 Fisher and Tate 2006 ArcGIS Help readings	Tutorial 4: Monday, 2/27
Week 9 3/6		Tutorial 5: Surface Modeling ArcGIS documentation Project Discussions	Reading Assignment 4: Monday, 3/6 Project Discussions: Wednesday, 3/8 in the class room
3/13* *3/13-3/17 is Spring Recess	*Spring Recess*		
Week 10 3/20	Overlay and Networks	Reading Assignment 5: Course Notes O'Sullivan & Unwin: Ch. 11 De Smith et al.: various	Tutorial 5: Monday, 3/20 Project Proposal: Monday, 3/20

Week 11 3/27		Tutorial 6: Rasters and Overlay ArcGIS documentation	Reading Assignment 5: Monday, 3/27
Week 12 4/3	Overlay	Reading Assignment 6: Course Notes O'Sullivan & Unwin: Ch. 7&8 Mitchell, Vol. 2 Ch. 5 Kemp: various	Tutorial 6: Monday, 4/3 Project Data Report: Monday, 4/3
Week 13 4/10		Tutorial 7: Regression or Networks ArcGIS documentation	Reading Assignment 6 (Q1&Q2): Monday, 4/10
Week 14 4/17	Final Project	Complete project work	Reading Assignment 6 (Q3&Q4): Monday, 4/17 Tutorial 7: Monday, 4/17
Week 15 4/24* *Friday, 4/28 is last day of class		Prepare project presentation and final report	Project Presentation Slides: Monday, 4/24 Presentation: Wednesday 4/26 & Friday, 4/28 Project Report: No later than 05:00 p.m. PT on Friday, 4/28
Study Days 4/29-5/2			
Exam Week 5/3-5/10	Summative Assignment	Summative Assignment	Summative Assignment: 5/5

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 Section 11, *Behavior Violating University Standards* https://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.
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 Relationship and*

Sexual Violence Prevention Services http://engemannshc.usc.edu/rsvp/ 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: https://libraries.usc.edu/faculty-students/distance-learners. This includes instructional videos, remote access to university resources, and other key contact information for distance students.