## SSCI 583 – Spatial Analysis
## Course Syllabus – Spring 2014

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**Office Hours:** Via Skype - Mondays, 1-2 p.m. and Wednesdays, 5-6 p.m., PT
I am always available via email. Also, available for chats via phone or Skype, audio or video, most days and times *by prior arrangement* via email. Or we can meet in my Adobe Connect room. Just get in touch!

### 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.

### 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.
- Discuss how linear feature concepts of length, direction and connection are represented and analyzed in networks.
- 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.

### *Textbook and other readings*

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 on-line through the USC library. Sign on to the USC library and search for this title.

Mitchel, Andy. *The Esri Guide to GIS Analysis* (three volumes). Redlands, CA, Esri Press.
1999. Volume 1: Geographic Patterns and Relationships
2005. Volume 2: Spatial Measurements and Statistics
2012. Volume 3: Modeling Suitability, Movement, and Interaction

Since the O'Sullivan and Unwin text is available free on-line, you are asked also to purchase an additional three Esri publications about spatial analysis. The more practical Miller 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's no need to pay the full retail price.

Supplementary readings will be assigned from:

de Smith, Michael J., Michael F. Goodchild and Paul A. Longley, 2006-2011. *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.

Kemp, Karen K., ed. 2008. *Encyclopedia of Geographic Information Science*. Thousand Oaks, CA, Sage Publications. Available online from USC library.

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

### *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. 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.

## Assessment

*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.

- *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.
- *Tutorial 2 – 1 worth 6 points.* Tutorial 2 is more substantial than the other tutorials, requiring more thought and effort.
- *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.
- *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 GIST Student Community Blackboard site. With your permission, your resume will be included in the GIST Resume Book. The latter is compiled annually and along with our web presence used to promote our programs and more importantly, your skills, experience, and professional aspirations.
- *Final Discussion – 1 worth 2 points.* 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 through a discussion board posting your observations on what you feel are the most important things you have learned in this course.

*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 -10 points.* A presentation made on-line via Adobe Connect, open to all students in the course
- *Project Report - 20 points.* A written report on your project methodology and outcomes.

*Assessment Due Dates*

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 docked 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 5:00 p.m. PT on the last day of classes.

*Summary of Assessments*

| Assessment | Number | Points Each | Total Points |
|---|---|---|---|
| Weekly Assignments | | | |
|    Reading Assignments | 6 | 6 | 36 |
|    Tutorial 2 | 1 | 6 | 6 |
|    Tutorials 1,3,4,5,6,7 | 6 | 2 | 12 |
|    Resume Assignment | 1 | 2 | 2 |
|    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 |
| | | | |
| Total | 19 | - | 100 points |

The grade breaks across the 100 possible points for this course will be as follows. Note that for graduate work, C- is a failing grade. Values indicate the lower end of each letter range to the left.

| Break | 93 | 90 | 85 | 75 | 65 | 55 | 45 | 0 |
|---|---|---|---|---|---|---|---|---|
| Grade | A | A- | B+ | B | B- | C+ | C | C- |

## Requirements

*Technology* – 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.

- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- A current web browser, Firefox recommended, to access the GIST Server

*GIST Server and Tech Support* – This course will utilize the SSI GIST Server which is a virtual desktop. You 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 *using your USC account* to GIST Tech Support at gistsupport@dornsife.usc.edu, making sure to copy (cc) me on the email. GIST Tech Support is available Monday through Friday, 9:00am-5:00pm PT.

*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 36 hours delay. In the rare case when I expect to be off-line for more than 24 hours, I will post an announcement on the Blackboard site.

*Discussion boards* – 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.

*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.

## Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to an instructor as early in the semester as possible. DSP is located in STU 301 and is open from 8:30 a.m. to 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

## Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's

own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: http://scampus.usc.edu/files/2013/05/appendix_a.pdf. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: http://www.usc.edu/student-affairs/SJACS/.

*Important Administrative Dates*

| | |
|---|---|
| 1/13: | Spring semester classes begin |
| 1/20: | Martin Luther King Day, university holiday |
| 1/31: | Last day to register and add classes, change enrollment option to Pass/No Pass or Audit, purchase or waive tuition refund insurance or drop a class without a mark of "W," and receive a 100% refund |
| 2/17: | Presidents' Day, university holiday |
| 3/17-22: | Spring recess |
| 4/11: | Last day to drop a class with a mark of W |
| 5/2: | Spring semester classes end, final date for submission of all course work |
| 5/16: | Commencement |

## *Course Schedule*

| Week | Starts | USC calendar | Ass'nt due Monday, 11:59 pm PT | Project components due | Theme | Readings O'Sullivan & Unwin | Miller | Hands-on topic |
|---|---|---|---|---|---|---|---|---|
| 1 | 13-Jan | | | | Introduction | Various | | T1- Introduction |
| 2 | 20-Jan | | T1 and Resume | | Intro to GI analysis Spatial data | Ch 1+2 | I Ch 1-3 | T2 - MAUP |
| 3 | 27-Jan | 1/31 Drop | R1 | | | | | |
| 4 | 3-Feb | | T2 | | Maps for spatial analysis | Ch 3+4 | | T3 - ModelBuilder, Coordinate Systems |
| 5 | 10-Feb | | R2 | | Spatial processes | | | |
| 6 | 17-Feb | | T3 | | Point pattern analysis | Ch 5, 6 | I Ch 4 II Ch 1-4 | T4 - Point pattern |
| 7 | 24-Feb | | R3 | | | | | |
| 8 | 3-Mar | | T4 | | Spatial autocorrelation | Ch 7,8,9 | II Ch 5 | T5 - Regression |
| 9 | 10-Mar | | R4 | Topic discuss 3/11-12 | | | | |
| | 17-Mar | Spring Recess | | | | | | |
| 10 | 24-Mar | | T5 | Proposal 3/24 | Spatial interpolation | Ch 10 and Readings | | T6 - Interpolation |
| 11 | 31-Mar | | R5 | | | | | |
| 12 | 7-Apr | 4/11 Drop | T6 | Data Report 4/7 | Overlay | Ch 11 | I Ch 5-6 | T7 - Rasters and Site Selection |
| 13 | 14-Apr | | R6 | | | | | |
| 14 | 21-Apr | | T7 | | | | | Project |
| 15 | 28-Apr | 5/2 Last class | Final Disc (due 5/2) | Presentation 4/27-28    Report 5/2 | | | | |
| | | | T = Tutorial | | | | | |
| | | | R = Reading | | | | | |