SSCI 583 – Spatial Analysis and Modeling
Course Syllabus Fall 2012

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Office Hours: 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 and (spatial) modeling are keystones for 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 and modeling 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 and spatial statistics are examined, including measures of geographical distribution (including point and areal pattern analysis) and spatial autocorrelation, network connectivity, interpolation and geostatistics. The focus is on understanding the theories and context of spatial analysis and modeling 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 and/or modeling 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.
• 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.
• Discuss the value and constraints in the use of simple linear regression in the context of GIS and describe some alternative approaches.
• Describe interpolation by the method known as kriging with reference to the semivariogram.
• Outline various ways that overlay is implemented in GIS.
• Describe in general terms multi-dimensional scaling and spatialization.
• List several emerging geographical analysis techniques.

Textbook and other readings

The required textbook for this course is:

O'Sullivan, D, and DJ Unwin, 2010. Geographic Information Analysis, 2nd Edition. John Wiley & Sons. While you may purchase this book if you wish to own a bound copy, it is now available on-line through the USC library. Sign on to the USC library and search for this title.

Additional readings will be assigned from many sources, including:


Finally, a great little book that we won’t use directly in this course, but which contains lots of very simple explanations of concepts also covered in the textbook is The Esri Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics, by Andy Mitchell, 2005, Esri Press. You may find it is handy to have this at hand to review course concepts from a different angle.

Course Structure

The main theoretical concepts will be provided through a complete, directed reading of the course text Geographic Information Analysis. The course reader will emerge as a collection of reading notes that will provide the basis for an informed review of each chapter. Additional readings will be assigned to expand on the text contents 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 will utilize published tutorial materials using ArcGIS and a final project will allow students to demonstrate their ability to apply spatial analytical tools in an appropriate, informed manner.

**Assessment**

Assessment is by coursework. There will be three kinds of assessments which unless otherwise noted are due by 8am Pacific Time on TUESDAYS.

Readings Homework – 7 making up 30% of course grade. These will focus on the text and other readings assigned in the course with one due approximately 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, some will be individual efforts, one early in the term will involve a one-on-one presentation to the instructor. These are graded on an A/B/C scale - A is excellent, B is good, C is not acceptable. _Late submissions will be docked one grade. No grade will be given for assignments turned in over one week late._

Tutorials (Credit) – 5 making up 20% of course grade. Due almost every other week, a hands-on tutorial from the Esri tutorial collection will be used to practice the techniques covered in the text. A brief written report will be assigned to demonstrate that you have completed each tutorial. These are graded on a credit/no credit basis, _with no credit given for late submissions_. The following final grade calculation will be used:

- All assignments completed, on time, with credit = A
- All assignments but 1 completed, on time, with credit = B
- All but 2 completed, on time, with credit = C
- More than 2 not completed = no grade for the hands-on exercises component

Tutorials (Graded) – 2 making up 10% of course grade. Two of the hands-on exercises are more substantial, requiring more thought and effort. These will be graded, like Readings Homework, on the A/B/C scale as described above. _Late submissions will be docked one grade. No grade will be given for assignments turned in over one week late._

Final Project – several components making up 40% of course grade. To integrate learning of all the material covered in the course, for the final project, students will design, undertake and report on an individually chosen spatial analysis project that will be the context of discussion in several of the assignments. In addition to submitting a fully annotated and illustrated project report, students will present a public presentation. The Final Project will have several components including a proposal, background research, data assessment, analysis, report and a public presentation (made on-line via Adobe Connect). More details on the project will be provided soon.
Requirements

Technology – There are several technology requirements:

- ArcGIS is provided on-line via the GIST Server, you do not need to install it on your own computer.
- Every student must have a computer with a fast Internet connection (DSL at a minimum). Since we now serve the key software from the Server, you can use either a Mac or a PC.
- Every student MUST have a functional webcam for use whenever a presentation or meeting is scheduled.

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. We will have at least one assigned on-line bulletin board discussion and I will create and monitor BB forums through which we can discuss issues and comments on the course assignments, exercises and project as the need arises.

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. Also double check to be sure that mail sent from both the USC blackboard accounts and my private domain (karenkemp@geokemp.net) 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.

Your responsibility: 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 course. Students should expect to spend 10-12 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

**Important Administrative Dates**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>8/27</td>
<td>Fall semester classes begin</td>
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<tr>
<td>9/3</td>
<td>Labor Day, university holiday</td>
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<tr>
<td>9/14</td>
<td>Last day to add classes and to drop without “W” and get 100% refund</td>
</tr>
<tr>
<td>11/16</td>
<td>Last day to drop class with a mark of W</td>
</tr>
<tr>
<td>11/21-24</td>
<td>Thanksgiving recess, university holiday</td>
</tr>
<tr>
<td>12/7</td>
<td>Fall semester classes end</td>
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</tbody>
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**Course Schedule (TENTATIVE)**

<table>
<thead>
<tr>
<th>Week</th>
<th>Starts</th>
<th>Ass'n due Tues, 23:59 PT</th>
<th>USC calendar</th>
<th>Theme</th>
<th>Reading</th>
<th>Hands-on</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>27-Aug</td>
<td></td>
<td>Introduction</td>
<td>Various</td>
<td>Introduction (CR)</td>
<td></td>
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<tr>
<td>2</td>
<td>3-Sep</td>
<td>T1</td>
<td>Intro to GI analysis</td>
<td>Ch 1</td>
<td>MAUP (G)</td>
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<tr>
<td>3</td>
<td>10-Sep</td>
<td>9/14 drop</td>
<td>Spatial data</td>
<td>Ch 2</td>
<td></td>
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<tr>
<td>4</td>
<td>17-Sep</td>
<td>R1, T2</td>
<td>Maps for spatial analysis</td>
<td>Ch 3</td>
<td>ModelBuilder, Spatial Analyst (CR)</td>
<td></td>
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<tr>
<td>5</td>
<td>24-Sep</td>
<td>Spatial processes</td>
<td>Ch 4</td>
<td></td>
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<tr>
<td>6</td>
<td>1-Oct</td>
<td>R2, T3</td>
<td>Point pattern analysis</td>
<td>Ch 5</td>
<td>Point pattern (CR)</td>
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<tr>
<td>7</td>
<td>8-Oct</td>
<td>Practical point pattern</td>
<td>Ch 6</td>
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<tr>
<td>8</td>
<td>15-Oct</td>
<td>R3, T4</td>
<td>Spatial autocorrelation</td>
<td>Ch 7</td>
<td>Regression (G)</td>
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<td>9</td>
<td>22-Oct</td>
<td>Local statistics</td>
<td>Ch 8</td>
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<td>10</td>
<td>29-Oct</td>
<td>R4, T5</td>
<td>Spatial interpolation</td>
<td>Ch 9</td>
<td>Surface Modeling (CR)</td>
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<tr>
<td>11</td>
<td>5-Nov</td>
<td>11/16 withdraw</td>
<td>Trend surface and kriging</td>
<td>Ch 10</td>
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<tr>
<td>12</td>
<td>12-Nov</td>
<td>R5, T6</td>
<td>Overlay</td>
<td>Ch 11</td>
<td>Network Analyst and/or others (CR)</td>
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<tr>
<td>13</td>
<td>19-Nov</td>
<td>Thanksgiving</td>
<td>Reading</td>
<td></td>
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<tr>
<td>14</td>
<td>26-Nov</td>
<td>R6, T7</td>
<td>Analytical models</td>
<td>Reading</td>
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<tr>
<td>15</td>
<td>3-Dec</td>
<td>New approaches</td>
<td>Ch 12</td>
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<tr>
<td>10-Dec</td>
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<td>R7</td>
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In addition to the usual Tuesday due dates as indicated in this table, the following special due dates have been set:

- Final Project Written Report and Slides – due Thurs, Dec 6, 11:59pm Pacific Time
- Final Project Presentations – Fri, Dec 7 and Sat Dec 8 (times TBD)
- Revised Final Reports (if needed) – due 2nd day after presentation, 11:59pm Pacific Time