SSCI 683: Principles of Spatial Data Analysis

Units: 4

Term—Day—Time: Spring, 2018, Thursdays, 2-4:50 pm

Location: Spatial Sciences Institute, AHF 145D

Instructor: An-Min Wu, Ph.D.
Office: AHF B55B
Office Hours: Tuesdays 3 pm – 4 pm and Thursdays 12 noon – 1 pm, or by appointment.
Contact Info: anminwu@usc.edu, 213-740-2876 (office)

Library Help: Andrzej Rutkowski
Office: USC VKC Library 36B
Office Hours: Tuesdays 10am – 12 noon & Thursdays 4:30 pm – 5:30 pm
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 Description
This course explores the theoretical foundations, methods, techniques, and software systems for spatial analysis. The course aims to provide students with the knowledge and skills necessary to investigate spatial health problems. Essential concepts of quantitative geographic information are presented, including the fundamental spatial concepts, the core components of geospatial analysis techniques, exploratory spatial data analysis and spatial statistics, surface analysis, and network and locational analysis. The latest research in a variety of topics related to population, health, and place that are central to spatial analysis are also examined. Students will also gain a deep understanding and hands-on experience in the ways to explore a variety of health-related applications through a combination of homework and projects. Students will learn about the wide variety of geospatial data and analytical tools available, including how to find relevant data and transform it as needed so that it can be used for solving specific health-related challenges and problems.

Learning Objectives
On completion of this course, students will be able to:

- Describe key theoretical foundations of geospatial analysis.
- Identify and investigate spatial and non-spatial data to understand the importance of place and its role in shaping or moderating environmental exposures, health-related impacts and outcomes, and the efficacy of health care delivery systems.
- Evaluate spatial analysis approaches and techniques for working with health-related geospatial data.
- Apply relevant spatial analysis techniques to solve spatial health problems.

Prerequisite(s): None
Co-Requisite(s): None
Concurrent Enrollment: None
Recommended Preparation: Students must be enrolled in an existing USC PhD program

Course Structure
The course will be delivered using both lectures and class discussion formats. During each class, the instructor will present the core topics and the students will participate and give presentations on some of the subtopics in the first hour and a half. For the remaining of the time in the class, students will lead and participate in group discussions about the readings. The class will encourage student participation with ample discussion time for reviewing readings, homework assignments, and other course material. Throughout the semester there will be homework assignments to give students first-hand experience in spatial analysis as well as weekly briefings to ensure students keep up with the readings. Students design and conduct individual final projects to learn in more depth in one or
more topics of interest and demonstrate their ability to apply spatial analysis tools in resolving spatial health problems.

**Technological Requirements**

The analysis software and geospatial data required for course assignments will be accessed using computing resources provided by the Spatial Sciences Institute. The course will be focused on using ArcGIS and R.

**Required Readings and Supplementary Materials**

The required textbooks for this course are:


Supplementary readings will be assigned from various sources and will be accessed via the USC Library’s electronic collections and/or provided by the instructors via Blackboard, including:


• James, Peter, Mariana C. Arcaya, Devin M. Parker, Reginald D. Tucker-Seeley, and S. V. Subramanian. "Do minority and poor neighborhoods have higher access to fast-food restaurants in the United States?" *Health and Place* 29 (2014): 10-17.


• Jia, Tao, Hongbing Tao, Kun Qin, Yulong Wang, Chengkun Liu, and Qili Gao. "Selecting the optimal healthcare centers with a modified P-median model: a


- Messina, Joseph P., Nathan J. Moore, Mark H. DeVisser, Paul F. McCord, and Edward D. Walker. "Climate change and risk projection: dynamic spatial models of


**Description and Assessment of Assignments**

Students must prepare two small lecture-style presentations, participate in class discussion, submit weekly briefings, and turn in homework assignments.

**Weekly Briefings** (14, worth a total of 14%): Each week students select one or more of the assigned readings and share a commentary with other students in the online Discussion Forum before the class session.

**Class Participation** (14, worth a total of 14%): A class participation grade for the semester will be assigned based upon how actively students engage in the class sessions. Students will be required to read all material outlined for each week of the course, and be prepared to lead and participate in group discussions about the readings in class. Failure
to attend or to be adequately prepared to discuss the readings will lead to the assignment of a lower grade for that week.

**Homework Assignments** (6, worth a total of 30%): Students will be assigned a total of 6 homework assignments in this course. These hands-on assignments are to practice spatial analysis techniques explored in theory in the texts. You will analyze the data of your own choice using ArcGIS and/or R scripts, and write a short report to answer the questions assigned in each assignment.

**Class Presentations** (2, worth a total of 10%): Students will conduct two presentations based on topics determined in consultation with the instructor. Students will work alone and will be expected to become an expert on that topic and present a short lecture of 30-45 minutes on the topic.

**Final Project**
Each student will design, conduct and report on a research project related to spatial analysis topics covered in class. The students will propose their own project ideas and determine the topics to be included after consultation with the instructor. The project might take one of two forms: (1) You may have a specific problem in mind and some data you want to analyze; or (2) You may be interested in exploring a spatial analysis method more deeply. The three components of the project will be due at different times during the semester. The grading rubric for each project component will be provided at the time the assignment is released. The three final project components include:

**Proposal** (2%): A brief description of the spatial questions and/or spatial analysis method you would like to investigate, how you plan to solve them and the data to be used for analysis.

**Presentation** (10%): A final presentation during the final week of the class session.

**Report** (20%): A written report in the format of a research paper on your final project methodology and outcomes.

**Grading Breakdown**

<table>
<thead>
<tr>
<th>Assessments</th>
<th>Number</th>
<th>% Each</th>
<th>Total % of Grade</th>
</tr>
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<tbody>
<tr>
<td>Weekly Briefings</td>
<td>14</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Class Participation</td>
<td>14</td>
<td>1</td>
<td>14</td>
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<tr>
<td>Homework Assignments</td>
<td>6</td>
<td>5</td>
<td>30</td>
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<tr>
<td>Class Presentations</td>
<td>2</td>
<td>5</td>
<td>10</td>
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<tr>
<td>Final Project Proposal</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Final Project Presentation</td>
<td>1</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Final Project Report</td>
<td>1</td>
<td>20</td>
<td>20</td>
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<tr>
<td>Total</td>
<td>39</td>
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<td>100</td>
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**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 one week late.

**Course Schedule: A Weekly Breakdown**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics/Daily Activities</th>
<th>Readings and Assignments</th>
<th>Deliverables/Due Dates</th>
</tr>
</thead>
</table>
| Week 9 | 3/8 | Spatial Regression | De Smith et al. (2015). §5.6
Conley (2011)
O’Campo et al. (2015)
Barakat-Haddad et al. (2012)
Kassteene et al. (2017)
Homework Assignment #5 | Weekly briefing:
Wednesday, 3/7
Final project proposal
due: Friday, 3/9 |
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<tbody>
<tr>
<td>3/11-3/18</td>
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</table>
| Week 10 | 3/22 | Surface & Field Analysis | De Smith et al. (2015). Ch. 6-§6.1
Macintyre et al. (2018)
Messina et al. (2012)
McCann et al. (2014)
Homework Assignment #6 | Weekly briefing:
Wednesday, 3/21
Homework Assignment
#5: Friday, 3/23 |
| Week 11 | 3/29 | Deterministic Interpolation Methods | De Smith et al. (2015), §6.5-§6.6
Tatalovich et al. (2006a)
Tatalovich et al. (2006b)
Xia et al. (2015) | Weekly briefing:
Wednesday, 3/28
Homework Assignment
#6: Friday, 3/30 |
| Week 12 | 4/5 | Geostatistical Interpolation Methods | De Smith et al. (2015). §6.7
Louis et al. (2014).
Hampton et al. (2011)
Jerrett et al. (2017) | Weekly briefing:
Wednesday, 4/4 |
| Week 13 | 4/12 | Network Analysis, Location and Service Area Problems | De Smith et al. (2015). Ch. 7
Palisson et al. (2017)
Bian et al. (2012)
Shi et al. (2012)
Wan et al. (2012)
Jia et al. (2014) | Weekly briefing:
Wednesday, 4/11 |
| Week 14 | 4/19 | Emerging Spatial Analysis Methods | De Smith et al. (2015). Ch. 8 - §8.3.
O’Sullivan & Unwin Ch.12
Auchincloss & Diez Roux (2008)
Auchincloss et al. (2011)
Luna et al. (2014)
Pijanowski et al. (2014) | Weekly briefing:
Wednesday, 4/18 |
| Week 15 | 4/26* | *4/27 is the last day of class | Final Presentations | Final presentation slides
due by Thursday, 4/26 8 AM |
| FINAL | 5/5 |  | Final Presentations & Final Discussions | Final report submission
during the scheduled final examination:
12:30 - 3pm on Saturday, May 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 Part B, 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].

Support Systems

Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. [https://engemannshc.usc.edu/counseling/]

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [http://www.suicidepreventionlifeline.org]

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

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: [http://sarc.usc.edu/]

Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. [https://equity.usc.edu/]

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. [https://studentaffairs.usc.edu/bias-assessment-response-support/]

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

Diversity at USC – [https://diversity.usc.edu/]
Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students