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

SSCI 681 (35623D), Advanced Quantitative Methods for Population, Health, and Place

Syllabus

Units: 4

Term – Day – Time: Fall 2024 – Friday 9:00-11:50am

Location: 145D

Instructor: Siqin (Sisi) Wang, PhD
Office: AHF B57C
Office Hours: Tue and Thu 2:00am-3:00pm PT in-person or via zoom – please contact me via email in advance to ensure I will be available in the format you'd wish to meet.
Contact Info: siqinwan@usc.edu; (213) 821-1466

Library Help: Andy Rutkowski
Office: LIPA B40-A
Office Hours: By appointment
Contact Info: arutkows@usc.edu

IT Help: Myron Medalla
Office: AHF B56B
Office Hours: By appointment via email
Contact Info: spatial_support@usc.edu, 213-740-4415

Course Scope and Purpose

This course is an advanced course in statistical methods and spatiotemporal dataanalysis, tailored for the PhD student in the Population, Health and Place program. It covers techniques widely used in quantitative geography and Cartography/GIS. The primary emphasis is on spatial data-driven statistics, including exploratory spatial data analysis, spatial access modelling, model builder, geographic relationship modelling, spatiotemporal statistical models, time series analysis, geo-visualization and geo-computation, and computation-intensive analysis methods. This course utilizes combined ArcGIS Pro, GeoDa, R studio and JASP as a R-based statistical tool to solve statistics and spatiotemporal analysis problems.

Learning Outcomes

On completion of this course, students should be able to:

- Understand statistical concepts, methods, and techniques
- Identify the principles and approaches that might be used to solve various problems in GIS
- Be able to conduct various statistical analyses on geographic data
- Be familiar with software skills for (spatiotemporal) statistical analysis
- Be able to solve practical problems using statistics and spatiotemporal analysis methods

Students may vary in their competency levels on these abilities. You can expect to acquire these abilities only if you honor all course policies, attend classes regularly, complete all assigned work in good faith and on time, and meet all other course expectations of you as a student.

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

Class Conduct

Harassment, sexual misconduct, interpersonal violence, and stalking are not tolerated by the university. All faculty and most staff are considered Responsible Employees by the university and must forward all information they receive about these types of situations to the Title IX Coordinator. The Title IX Coordinator is responsible for assisting students with supportive accommodations, including academic accommodations, as well as investigating these incidents if the reporting student wants an investigation. The Title IX office is also responsible for coordinating supportive measures for transgender and nonbinary students such as faculty notifications, and more. If you need supportive accommodation, you may

contact the Title IX Coordinator directly (titleix@usc.edu or 213-821-8298) without sharing any personal information with me. If you would like to speak with a confidential counselor, Relationship and Sexual Violence Prevention Services (RSVP) provides 24/7 confidential support for students (213-740-9355 (WELL); press 0 after hours).

Diversity and Inclusion – It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful to everyone, and you are also expected to respect of others regardless of their race, ethnicity, gender identity and expressions, cultural beliefs, religion, sexual orientation, national origin, age, abilities, ideas and perspectives, or socioeconomic status. Your suggestions are encouraged and appreciated. Feel free to let me know ways to improve the effectiveness of the course for you personally or for other students.

Generative AI tools – All work should be original and created specifically for the given assignment. You are responsible for the accuracy and originality of any material submitted. You should be the authors of all text submitted. In assignments that are collaborative in nature, that group of students will be the co-authors and have all associated responsibilities. Academic integrity policies regarding the use of generative AI tools will apply to every assignment. The extent to which using a generative AI tool is appropriate will be identified for specific assignments. Please note that such use may differ for each assignment. Any generative AI text should be treated as source material and should be appropriately cited. In other words, if someone else (or something else) wrote the text, a citation is necessary. You will be asked to further cite not just the source, but how you used these tools. This extra step is reflective of future professional standards and responsibilities. Any generative AI image or graphic should be appropriately cited.

Course Structure

This course consists of five modules; within each module, lectures will provide basic concepts related to a particular topic and labs will help students to consolidate those concepts in real world projects.

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.

Course Content Distribution and Synchronous Session Recordings Policies

USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus

infringe on the academic freedom of other students as well as the instructor (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposed other than individual or group study is prohibited. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which has been distributed to students or in any way has been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media (Living our Unifying Values: The USC Student Handbook, page 13).

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.
- A functional webcam and a microphone for use whenever a presentation or meeting is scheduled.
- An up-to-date web browser to access the Server

If a student does not have access to any of these, please speak with the instructor at the start of the semester. Also, see the USC ITS Student Toolkit here: https://keepteaching.usc.edu/students/student-toolkit/

Brightspace – This course will utilize the Desire2Learn (D2L) learning management system which allows students to access course content, upload assignments, and participate in discussion forms, among other learning experiences. The D2L platform provides flexibility in the learning experience where students can participate in the course residentially or remotely, synchronously (meeting together at the same time) or asynchronously (accessing videos and course content outside of class).

GeoDa – GeoDa is a free and open source software tool (https://geodacenter.github.io/download.html) that serves as an introduction to spatial data science. It is designed to facilitate new insights from data analysis by exploring and modeling spatial patterns. GeoDa was developed by Dr. Luc Anselin and his team. The program provides a user-friendly and graphical interface to methods of exploratory spatial data analysis (ESDA).

R and RStudio – R and RStudio are free, and it is available for macOS, Windows, and Linux. Thus, it is highly accessible. Please first install R language for the latest version (www.r-project.org) and then install RStudio (www.rstudio.com); alternatively, *JASP* (https://jasp-stats.org/) as a free R-based statistical software is also welcomed to use given to its friendly user interface.

SSI Server and Tech Support – This course utilizes the SSI Server, which is a virtual desktop that allows access to different types of professional software. If students are unable to connect to the server or experience technical issues, they should send an email (via their USC account) to SSI Tech Support at spatial_support@usc.edu, making sure to copy (cc) the instructor on the email. Assignment specific questions should be directed to the instructor.

Communications – All assignments disseminated and all materials to be handed in will be submitted via D2L. The instructor will also create and monitor discussion forums through which students can discuss issues and assignments as needed. Students should read all email sent from D2L or from course instructor as soon as possible. Also, students who do not regularly use their USC email accounts should double-check to be sure that mail sent from both the D2L accounts and the instructor's account (noted above) to your USC account is forwarded to an address used regularly and does not go into junk mail. The instructor will endeavor to respond to all email within 24 hours of receipt, aiming for no more than 72 hours

delay. In the rare case that an instructor is off-line for an extended periodof time, an announcement will be posted to the class D2L site. Due to the synchronous and asynchronous nature of this course, it is each student's responsibility to stay informed and connected with others in our course. In addition to email, students are expectedto login to D2L regularly to check for announcements.

Required Readings and Supplementary Materials

The recommended textbooks for this course are:

- James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013). *An Introduction to Statistical Learning with Applications in R.* Springer (Free PDF copy available at http://www-bcf.usc.edu/~gareth/ISL/ISLR%20Sixth%20Printing.pdf)
- Bivand, R. S., Pebesma, E. J., and Gomez-Rubio, V. (2013). *Applied Spatial Data Analysis with R* (2nd ed). Springer.
- Wikle, C. K., Zammit-Mangion, A., and Cressie, N. (2019). *Spatiotemporal Statistics with R.* CRC Press.

Supplementary readings will be assigned from various sources including as below; additional reading materials will be posted on BB:

- Burt, J. E., Barber, G. M., and Rigby, D. L. (2009). *Elementary Statistics for Geographers*. Guilford Press.
- Cressie, N., & Wikle, C. K. (2015). *Statistics for Spatio-Temporal Data*. John Wiley & Sons.
- Everitt, B., Hothorn, T. (2011). *An Introduction to Applied Multivariate Analysis with R.* Springer Science & Business Media.

Description and Assessment of Assignments

There are two graded assignments and one group project (progressively from the very beginning of the semester) due dates are shown in the summary that follows.

Lab Assignments – 7 worth a total of 56 points. Each week students will be given a lab assignment to apply spatial or spatiotemporal analysis to real world data. The labs will use ArcGIS Pro, City Engine, and GeoDa, RStudio, or JASP (a R-based statistical software package).

Group Project – 1 worth a total of 44 points. To integrate your learning of all the material covered in the course, from the first week, you will start to prepare a progressive project - you will design, undertake and report on an individual or group statistical analysis project by comprehensively using some of the skills and methods you learn from the course. There are five components:

- *Project proposal – 6 points.* A well-developed real-world example problem with a 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.

- *Research design – 8 points.* Provide a methodological workflow, based on the what you learn from the course, to guide through data analysis at the later stage.
- *Data analysis – 10 points.* Conduct analysis following your proposed research design workflow.
- *Project paper writing – 10 points.* Complete the writing of the entire project report which can be formatted in the way of peer-reviewed journal article.
- *Class Presentation – 10 points.* A Story Map that you will present in the last week of class.

You may choose one or more group projects in this class. The decision is yours but if you choose the group project option, you will need to prepare a workflow diagram that indicates who will do what tasks and you will need to indicate each author's contribution in the final report. Each member needs to contribute equally to each step: the literature review, data collection, data analysis, paper drafting, etc., rather than each group member taking charge of only one section.

Grading Breakdown

Careful planning and a serious, consistent commitment will be required for students to successfully navigate the deliverables in this and other SSCI courses. The table below summarizes the SSCI 681 course assignments and their point distribution:

Assessment	Number	Points Each	Total Points
Lab assignments	7	8	56
Final Project			
Proposal	1	6	6
Research design	1	8	8
Data analysis	1	10	10
Report writing	1	10	10
Story map presentation	1	10	10
Total	12	--	100

Grading Scale

Assignments in this and other SSCI courses, are graded on the letter grade scale where A is exemplary, B is very good, C is satisfactory, D is unsatisfactory, and F needs improvement. Final grades use the same letter grade scale with C being the minimum passing grade for credit at the graduate level. The grading scale follows:

A	> 93 points		B-	80-82 points		D+	67-69 points
A-	90-92 points		C+	77-79 points		D	63-66 points
B+	87-89 points		C	73-76 points		D-	60-62 points
B	83-86 points		C-	70-72 points		F	<60 points

Assignment Submission Policy

Unless otherwise noted, assignments must be submitted via D2L and *due by 11:59 pm Pacific Time (PT) on the specified date.* Strict penalties apply for late assignments: it will be penalized 50% off up to FOUR days late. No points will be given for submissions more than FOUR days late.

<table>
<tr><th>Lectures</th><th>Labs</th><th>Project</th></tr>
<tr><td colspan="2">Module 1: Review</td><td rowspan="6">Proposal due on Sep 30</td></tr>
<tr><td>Lesson 1 (Aug 30): Course introduction and review on basic statistics</td><td rowspan="2">No labs</td></tr>
<tr><td>Lesson 2 (Sep 6): Hypothesis testing and confidence intervals</td></tr>
<tr><td colspan="2">Module 2: Exploratory and regression analysis</td></tr>
<tr><td>Lesson 3 (Sep 13): Exploratory spatial data analysis</td><td>Lab 1: Exploratory spatial data analysis</td></tr>
<tr><td>Lesson 4 (Sep 20): Modelling relationship (non-spatial regression models)</td><td>Lab 2: Principal component analysis, linear regression and logistic regression modelling</td></tr>
<tr><td>Lesson 5 (Sep 27): Modelling geographic relationship (spatial regression models)</td><td>Lab 3: Spatial regression modelling
Assignment 1 (combined Labs 1-3) due on Sep 27</td></tr>
<tr><td colspan="2">Module 3: Advanced modelling and simulation in health and place</td><td rowspan="5">Research design and data analysis due on Oct 31</td></tr>
<tr><td>Lesson 6 (Oct 4): Data processing and workflow modelling</td><td>Lab 4: Geoprocessing and repeatable modelling analysis</td></tr>
<tr><td>Lesson 7 (Oct 11): Change analysis and geo-simulation</td><td>Lab 5: Change analysis</td></tr>
<tr><td>Lesson 8 (Oct 18): Raster-based analysis and remote sensing</td><td>No Lab</td></tr>
<tr><td>Lesson 9 (Oct 25): POI access modelling</td><td>Lab 6-1: Measuring healthcare access</td></tr>
<tr><td colspan="2">Module 4: Spatiotemporal big data analysis and 3D modelling</td><td rowspan="4">Project report writing due on Nov 30</td></tr>
<tr><td>Lesson 10 (Nov 1): Spatiotemporal (time-series) analysis</td><td>Lab 6-2: Measuring healthcare access via Model Builder</td></tr>
<tr><td>Lesson 11 (Nov 8): 3D modelling and digital twin</td><td>Lab 7: City Engine to build 3D city</td></tr>
<tr><td>Lesson 12 (Nov 15): Big data analytics and GeoAI</td><td>Assignment 2 (combined Labs 4-7) due on Nov 15</td></tr>
<tr><td colspan="2">Module 5: Place-based communication and project presentation</td><td rowspan="3">Presentation due on Dec 6</td></tr>
<tr><td>Lesson 13 (Nov 22): Place based communication</td><td>No lab</td></tr>
<tr><td>Lesson 14 (Dec 6): Final project presentation</td><td>No lab</td></tr>
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Statement on Academic Conduct and Support Systems

Academic Integrity

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas.

Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, comprises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu.

You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.