

Introduction to Spatial Data Science

GEOG 215

Summer 2023, Session II

Course Information

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| Meeting Pattern | M-F 9:45am-11:15am |
| Instructional Format | Options: in-person, remote synchronous |
| Classroom or Location | Carolina Hall 204 or https://unc.zoom.us/j/95268987182 |

Instructor Information

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| Instructor | Name: Julia Cardwell ■ Office Location: Coates Building 201-B or Zoom ■ Office Hours: M-W 11:30-12:30pm, Th-F by appointment ✉ Contact Email: jmcard@email.unc.edu 📺 Zoom Room ID: https://unc.zoom.us/j/2724389665 (office hours) |
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Course Content

Course Description

This course will introduce students to data science with a focus on spatial (geographic) data, data that are referenced to a location on Earth's surface. Students will learn concepts and techniques to apply various facets of data science practice, including data collection, management, and integration, descriptive modeling, exploratory spatial data analysis, and communication via visualization and mapping. Real world examples and datasets spanning physical, social, and health sciences will be used throughout the course.

Course Texts

There are no required texts for this course. There will be several short readings per week, which will be available on the course Canvas site.

Course Goals and Learning Outcomes

After taking this course, students will be familiar with using the programming language R for exploring spatial data. By the end of the semester, students will be able to:

1. Develop spatially oriented research questions.
2. Identify different types of publicly available spatial data and upload these data into R.
3. Clean and organize spatial data for analysis.
4. Perform and interpret exploratory spatial data analysis techniques.

IDEAs in Action General Education Curriculum

Each requirement in the IDEAs in Action curriculum has a set of standard Student Learning Outcomes (SLOs). This course is approved for the Focus Capacity- Quantitative Reasoning requirement. The SLOs for this requirement are the following:

1. Summarize, interpret, and present quantitative data in mathematical forms, such as graphs, diagrams, tables, or mathematical text.

2. Develop or compute representations of data using mathematical forms or equations as models, and use statistical methods to assess their validity.
3. Make and evaluate important assumptions in the estimation, modeling, and analysis of data, and recognize the limitations of the results.
4. Apply mathematical concepts, data, procedures, and solutions to make judgments and draw conclusions.
5. Synthesize and present quantitative data to others to explain findings or to provide quantitative evidence in support of a position.

Expected Time Dedicated to the Class

This is an accelerated summer course. Therefore, students should be prepared to spend significantly more time on a daily and weekly basis on this course than a typical semester course. Summer courses are approximately 1/3 the length of a typical semester course (5 weeks as opposed to 15 weeks) and the workload per week will reflect this difference. Learning a programming language often has a relatively steep learning curve, and because this is an accelerated course, it may be easier for students to fall behind. Student success is my number one priority for this course. If you find yourself confused, frustrated, in danger of falling behind or already behind, **please** reach out to me sooner rather than later. I am here to support students and I will work with you to make a plan.

Note on Instructional Format

This course is designed for maximum student flexibility. The remote synchronous component allows students who are not in Chapel Hill during the summer, or have some sort of other restriction, to take this course. That being said, students taking the course remotely will be held to the same expectations as in-person students. Remote students are expected to be engaged during class time, participate regularly, and complete all in-class activities. It may be challenging for me to troubleshoot code issues or software/technology issues over Zoom, especially during class time. Therefore, remote students especially should be prepared to visit my office hours if you are experiencing problems.

Class Recordings

It can be helpful, especially in a hybrid setting, for students to be able to access course lectures outside of class. Therefore, I plan to record lectures and have them accessible on the course Canvas site. These recordings will be shared only with students enrolled in the course for the purposes of academic instruction only. If you feel uncomfortable with course recordings, please reach out to me as soon as possible.

Course Assignments & Assessments

Assignment Descriptions

Class Participation: 15% of final grade

The participation component of the course grade will be made up of in-class participation, as well as effort on in-class exercises.

Assignments (6): 40% of final grade

There will be 6 assignments that will be completed throughout the course and will be graded on accuracy. These assignments are designed to have students independently implement skills learned through course material and in-class exercises.

Tests (2): 20% of final grade

There will be two closed-book tests on course concepts during the semester.

Project Tasks (3): 10% of final grade

Project tasks will allow students to iteratively develop their final projects throughout the course of the semester. Each task will allow students to complete a portion of their final project and allow the instructor to give feedback throughout the semester.

Final Project: 10% of final grade

The final project will be a polished version of the completed project tasks that also implement any instructor feedback given on individual project tasks.

Final Presentation: 5% of final grade

Students will give a 6–8-minute presentation on their final project during the course exam period.

Grade Scale

| Undergraduate Scale |
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| 93.5 or above: A |
| 89.5 to 93.4: A- |
| 86.5 to 89.4: B+ |
| 82.5 to 86.4: B |
| 79.5 to 82.4: B- |
| 76.5 to 79.4: C+ |
| 72.5 to 76.4: C |
| 69.5 to 72.4: C- |
| 66.5 to 69.4: D+ |
| 59.5 to 66.4: D |
| Below 59.4: F |

Course Schedule

Note: See Canvas for the most up to date course schedule and for reading schedule

| Class Session | | Topic | Assignments Due |
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| # | Date | | |
| 1 | 6/26/2023 | Introduction to course | |
| 2 | 6/27/2023 | Introduction to R | |
| 3 | 6/28/2023 | In Class Activity | |
| 4 | 6/29/2023 | Measurement Basics, Location and Coordinate Systems | |
| 5 | 6/30/2023 | Spatial Data Basics | Assignment 1 (5pm) |
| 6 | 7/3/2023 | Data Introduction, Acquiring Spatial Data, Usable Spatial Data | |
| 7 | 7/5/2023 | APIs, Importing Data into R | |
| 8 | 7/6/2023 | Data Wrangling | |
| 9 | 7/7/2023 | Exam 1 , Introduction to Project | Exam 1 (in class), Assignment 2 (5pm) |
| 10 | 7/10/2023 | Introduction to Data Visualization and Mapping I | |
| 11 | 7/11/2023 | Introduction to Data Visualization and Mapping II | Project Task 1 (5pm) |
| 12 | 7/12/2023 | Filter and Aggregate | Assignment 3 (5pm) |
| 13 | 7/13/2023 | Joining Data, Geocoding | |
| 14 | 7/14/2023 | Computational Thinking | Project Task 2 (5pm) |
| 15 | 7/17/2023 | Control Structures | Assignment 4 (5pm) |

| Class Session | | Topic | Assignments Due |
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| # | Date | | |
| 16 | 7/18/2023 | Project Organization Workflows, Reproducible Research | |
| 17 | 7/19/2023 | Exam 2 , Asking Spatial Questions | Exam 2 (in class), Assignment 5 (5pm) |
| 18 | 7/20/2023 | Exploratory Spatial Data Analysis | |
| 19 | 7/21/2023 | Geographic Fundamentals | |
| 20 | 7/24/2023 | Exploratory Spatial Data Analysis II | Project Task 3 (5pm) |
| 21 | 7/25/2023 | Calculating Distance Spatial Neighbors | |
| 22 | 7/26/2023 | Spatial Clustering | Assignment 6 (5pm) |
| 23 | 7/27/2023 | Bivariate Relationships | |
| 24 | 7/28/2023 | Catch-up/ Project workday | |
| 25 | 7/31/2023 | Exam Period 8:00am-11:00am | Final Presentations |

Academic and Course Policies

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| Attendance Policy | <p>University Policy: No right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:</p> <ol style="list-style-type: none"> 1. Authorized University activities 2. Disability/religious observance/pregnancy, as required by law and approved by Accessibility Resources and Service and/or the Equal Opportunity and Compliance Office (EOC) 3. Significant health condition and/or personal/family emergency as approved by the Office of the Dean of Students, Gender Violence Service Coordinators, and/or the Equal Opportunity and Compliance Office (EOC). <p>Class Policy: I am willing to work with students who might be absent from class due to a non-University approved absence (e.g., a job interview or club activity). However, please communicate with me as early as possible about potential absences. Since this is an accelerated course, the impact of absences is greater than in a typical semester course.</p> |
| Honor Code Statement | Students are bound by the Honor Code in taking exams and in written work. The Honor Code of the University is in effect at all times, and the submission of work signifies understanding and acceptance of those requirements. Plagiarism will not be tolerated. Please consult with me if you have any questions about the Honor Code. |
| Acceptable Use Policy | By enrolling as a student in this course, you agree to abide by the University of North Carolina at Chapel Hill policies related to the acceptable use of IT systems and services. You may be asked to participate in online discussions or other online activities that may include personal information about you or other students in the course. The rights and protection of other participants are protected under the UNC-Chapel Hill Information Technology Acceptable Use Policy , which covers topics related to using digital resources, such as privacy, confidentiality, and intellectual property. Consult the University website " Safe Computing at UNC " for information about the data security policies, updates, and tips on keeping your identity, information, and devices safe. |
| Late Submissions | Our due dates in this class are not arbitrary. The course's pacing is designed to help you make steady and productive progress toward the learning objectives, so all work |

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| | should ideally be submitted by the specified due dates. If you do not believe that you will be able to complete an assignment on time, be in contact with me as soon as possible to discuss an extension. Students who do not contact me regarding an extension before the due date will have 10% deducted from the assignment grade for each day that it is late. |
| Optional Mask Use | UNC-Chapel Hill is committed to the well-being of our community – not just physically, but emotionally. The indoor mask requirement was lifted for most of campus on March 7, 2022. If you feel more comfortable wearing a mask, you are free to do so. There are many reasons why a person may decide to continue to wear a mask, and we respect that choice. |
| Grade Appeal Process | If you feel you have been awarded an incorrect grade, please discuss with me. If we cannot resolve the issue, you may talk to our departmental director of undergraduate studies or appeal the grade through a formal university process based on arithmetic/clerical error, arbitrariness, discrimination, harassment, or personal malice. To learn more, go to the Academic Advising Program website. |
| Technology Use | Computers should be brought to class charged and ready for use to complete in-class activities and assignments. |
| Syllabus Changes | The instructor reserves the right to make changes to the syllabus, including project due dates and test dates. These changes will be announced as early as possible. |

Services and Student Support

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| Accessibility Resources and Services | <p>The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.</p> <p>Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.</p> |
| Counseling and Psychological Services | <p>CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.</p> |
| Title IX Resources | <p>Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Reports can be made online to the EOC at https://eoc.unc.edu/report-an-incident/. Please contact the University's Title IX Coordinator (Elizabeth Hall, interim – titleixcoordinator@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvsc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.</p> |
| Policy on Non-Discrimination | <p>The University is committed to providing an inclusive and welcoming environment for all members of our community and to ensuring that educational and employment decisions are based on individuals' abilities and qualifications. Consistent with this principle and applicable laws, the University's Policy Statement</p> |

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| | <p>on Non-Discrimination offers access to its educational programs and activities as well as employment terms and conditions without respect to race, color, gender, national origin, age, religion, creed, genetic information, disability, veteran’s status, sexual orientation, gender identity or gender expression. Such a policy ensures that only relevant factors are considered and that equitable and consistent standards of conduct and performance are applied.</p> <p>If you are experiencing harassment or discrimination, you can seek assistance and file a report through the Report and Response Coordinators (see contact info at safe.unc.edu) or the Equal Opportunity and Compliance Office, or online to the EOC at https://eoc.unc.edu/report-an-incident/.</p> |
| <p>Diversity Statement</p> | <p>I value the perspectives of individuals from all backgrounds reflecting the diversity of our students. I broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. I strive to make this classroom an inclusive space for all students. Please let me know if there is anything I can do to improve, I appreciate suggestions.</p> |
| <p>Undergraduate Testing Center</p> | <p>The College of Arts and Sciences provides a secure, proctored environment in which exams can be taken. The center works with instructors to proctor exams for their undergraduate students who are not registered with ARS and who do not need testing accommodations as provided by ARS. In other words, the Center provides a proctored testing environment for students who are unable to take an exam at the normally scheduled time (with pre-arrangement by your instructor). For more information, visit http://testingcenter.web.unc.edu/. (source: http://testingcenter.web.unc.edu/)</p> |
| <p>Learning Center</p> | <p>The UNC Learning Center is a great resource both for students who are struggling in their courses and for those who want to be proactive and develop sound study practices to prevent falling behind. They offer individual consultations, peer tutoring, academic coaching, test prep programming, study skills workshops, and peer study groups. If you think you might benefit from their services, please visit them in SASB North or visit their website to set up an appointment: http://learningcenter.unc.edu.</p> |
| <p>Writing Center</p> | <p>The Writing Center is located in the Student and Academic Services Building and offers personalized writing consultations as well as a variety of other resources. This could be a wonderful resource to help with your writing assignments in this course (and any assignments in your other courses). You do not need a complete draft of your assignment to visit; they can help you at any stage! You can chat with someone in the writing center or set up as appointment on their website: http://writingcenter.unc.edu.</p> |