Special Topics: Spatial Analysis in R (GEOG 491/891)
University of Nebraska-Lincoln
College of Arts and Sciences
School of Global Integrative Studies
Fall 2021

Class meetings

Room: 126 Burnett Hall (GIS Lab)
Meetings: MWF 2:30pm – 3:20pm

Instructor

Dr. Patrick Bitterman
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Department Chair

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Course description

This is a special topics course focused on spatial analysis using open source tools grounded in the R programming language. This is a project-based, student-led course that explores how to implement GIScience concepts, theories, and methods using R and R-based tools. Students will develop algorithms and programs to edit, query, manipulate, visualize and analyze spatial data. Students will also generate graphical output (maps and other plots) and create reproducible workflows. Students will develop a public-facing portfolio documenting their learning and course outputs to communicate their skills to potential mentors, employers, and the public.

Learning objectives

By the end of the term, students will be able to successfully:

- Demonstrate a familiarity with the R programming language in the context of geospatial analysis
- Write self-contained functions to automate geospatial tasks
- Analyze model workflows and describe computer code and algorithms in plain language
- Create small-scale programs that interface with web-based tools
- Practice good programming practices
- Plan, develop, and execute a programmatic analysis of a dataset

Prerequisites

Students are expected to have completed GEOG 217: Principles of GIS or similar course
Though not required, previous programming experience is recommended.

Required materials

Brundson, C., Comber, L. 2019. An Introduction to R for Spatial Analysis and Mapping (Spatial Analytics and GIS). SAGE.

Suggested materials

Wickham, H. 2017. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. O'Reilly Media. (if you are unfamiliar with R or other programming language)

Course policies

Class format

Primary instruction will take place in a hybrid lecture-lab format. Lab assignments will provide students with the opportunity to demonstrate their work in a practical setting.

Late work

Unless otherwise noted:

- all assignments are due on the specified due date
- late items will be accepted, but will be penalized 20% of the potential points for each day that they are late.

Changes to the syllabus

Any changes to the syllabus will be communicated via email and posted on the Canvas course page.

Working in the Lab

You are free to work in the lab whenever it is open and there is not another class using the lab. Be respectful of other classes. Students enrolled as of xx/xx/2021 have access to the Lab using their NCard. If you need access, please let me know immediately. Students have access to the room when the building is open, and no classes are meeting. Students working in the room may stay past the closing of the building but should remain aware and alert.

Room availability outside of classes scheduled (subject to change):

Monday	TBD
Tuesday	TBD
Wednesday	TBD
Thursday	TBD
Friday	TBD

Digital file storage on lab computers should always be considered temporary. Students are encouraged to save each lab in a separate directory and sync their data with GitHub. ***YOU ARE ALWAYS RESPONSIBLE FOR YOUR DATA!*** Make backups as necessary.

Collaboration
In this class, students are not allowed to collaborate with others on any exam. Do not share your work with others or ask others to see their work.

While you may choose to interact with other students on laboratory assignments and the final project, all submitted work is expected to be your own. All write-ups, discussion statements, and other work should be your own, individual thoughts. Your maps and project should also reflect work that is independent and unique to you.

Students who do not follow these policies will be reported to the College for academic dishonesty. If you have questions regarding this policy, it is your responsibility to ask them.

Your Responsibilities
You have a responsibility to help create a classroom environment where all may learn. At the most basic level, this means you will respect the other members of the class and the instructor and you will treat them with the courtesy you expect to receive in return. This policy applies to all forms of communication in this course. Any email correspondence will be conducted via your UNL email address.

Miscellany
Be honest and have integrity in your work. For example, do not increase the perceived length of a lab report by increasing the size of punctuation or manipulating spacing. Be kind and be polite. Finally, you will get out of this class what you put into it – be prepared, participate, and be attentive, and you will be successful.

Preparing for lab and lecture

Using the GIS Lab and Software
We will use RStudio to write and organize our work. RStudio is cross-platform and is available free of charge on the web.

Other tips
- Read relevant materials before the lecture.
- If there are topics you would like to hear more about, please bring share your ideas to make the class more relatable and interesting.
- Read the entire lab document *before* you attempt the lab assignment.
- Take advantage of office hours.
- Post questions to the appropriate Canvas forum.
- Take breaks.
- Do not leave assignments until the last minute.

Assessment

Lab assignments (50%)

There are 5 required lab assignments. Labs will become more complicated and include less guided instruction as the semester progresses. Each lab assignment will have a corresponding Canvas Discussion Board where you can post (and respond) to questions. ***Please use the discussion board to attempt and answer your questions about lab assignments prior to emailing your instructor.*** Using the discussion board will ensure that all students will benefit from the questions and their responses. You may work on labs at any time. A weekly schedule for the lab will be posted on Canvas. Feel free to work on labs elsewhere if you have access to the necessary software and are comfortable working independently. Lab assignments are to be completed at your own pace, but they must be submitted prior to the due date. The due date for each assignment is included in the instructions.

All completed lab assignments must be submitted to the course Canvas site. No other submissions will be accepted.

Final Project (40%)

The final project is a chance for you to apply your programming, scripting, and automation skills to an area of your interest. The final project is a required component of the course. You must submit this assignment to pass the course regardless of your other assignments such as exams and labs. Additional documents explicitly defining the guidelines and milestones of the project, and example projects will be shared. Final project has four milestones: 1) a project proposal that includes preliminary data, 2) an in-class presentation that will update the class on your progress and serve as opportunity to receive feedback, 3) a final in-class presentation on your term project, and 4) a term paper, relevant code, and ay relevant analysis. There will be a series of final project workshops throughout the semester to provide you the rubric and expectation for the final project proposal, data, and final project deliverables.

Participation (10%)

You are expected to engage in in-class discussion with your peers and instructor.

All assignments should be submitted to the corresponding Canvas assignment before the due date.

Evaluation scale

Grade	% of Points	Grade	% of Points	Grade	% of Points	Grade	% of Points
A	94-100	B+	87-89	C+	77-79	D+	67-69
A-	90-93	B	84-86	C	74-76	D	64-66
		B-	80-83	C-	70-73	D-	60-63
						F	Below 60

Grades will be based on the following:

Assessment	**Total points**
Lab assignments (5 x 100 points/each)	500
Participation	100
Final project	*400 total*
Proposal	50
In-class update	25
Final presentation	75
Final paper	250
Total	**1000**

Extra credit
Extra credit assignments and opportunities will not be offered.

Enrollees of 891 (Graduate Students)
For those students enrolled in GEOG 891, the requirements of the final project will be expanded to include: 1) an additional 3-4 pages in your report, 2) code documentation, and 3) an additional 5 minutes in your final presentation to the class. You are also required to produce a cover page for your GitHub page/portfolio

Tentative Course Schedule

Week	Date	Topic
1	8/23	Introduction, introduction to R and RStudio, GIScience refresher
2	8/30	Data structures and plots, the Tidyverse
3	9/6	Basics of spatial data handling in R, VCS **Lab 01**
4	9/13	Writing functions and writing reproducible code
5	9/20	Point pattern analysis
6	9/27	Spatial attribute analysis **Lab 02**
7	10/4	Spatial data operations
8	10/11	Geometry operations **Lab 03**
9	10/18	Localized spatial analyses **Fall break**
10	10/25	Rasters **Lab 04**
11	11/1	Making maps with R
12	11/8	Interactive mapping **Lab 05**
13	11/15	Applications: topics TBD (based on student interests)
14	11/22	**Thanksgiving week**
15	11/29	Applications: topics TBD (based on student interests)
16	12/6	Final project presentations
Finals	12/13	**Paper due**

University policies

Accommodations
Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Academic honesty
Academic honesty is essential to the existence of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. The University's Student Code of Conduct addresses academic dishonesty. Students who commit acts of academic dishonesty are subject to disciplinary action and are granted due process and the right to appeal any decision. In this course, unintentional plagiarism is still considered plagiarism. It is essential that you properly cite your sources.

Academic Support Services
You can schedule free appointments for individual academic coaching with First-Year Experience and Transition Program staff through MyPLAN. You can also take advantage of study stops--which provide individual and group study with learning consultants in a variety of disciplines--and free group workshops on topics such as time management, goal setting, test preparation, and reading strategies. See success.unl.edu for schedules and more information.

Counseling and Psychological Services
UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS); is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red Resilience & Well-Being (BRRWB) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

Diversity and Inclusion
The University of Nebraska-Lincoln does not discriminate on the basis of race, ethnicity, color, national origin, sex (including pregnancy), religion, age, disability, sexual orientation, gender identity, genetic information, veteran status, marital status, and/or political affiliation.

Recording of class-related activity
I invite all of you to join me in actively creating and contributing to a positive, productive, and respectful classroom culture. Each student contributes to an environment that shapes the learning process. Any work and/or communication that you are privy to as a member of this course should be treated as the intellectual property of the speaker/creator, and is not to be shared outside the context of this course.

Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from me or an approved accommodation from Services for Students with Disabilities. If you have (or think you may have) a disability such that you need to record or tape class-related activities, you should contact Services for Students with Disabilities. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Failure to follow this policy on recording or distributing class-related activities may subject you to discipline under the Student Code of Conduct.

COVID-19 related policies

Attendance
Students who are sick or who are engaging in self-quarantine in accordance with guidance from the Lincoln-Lancaster County Health Department or their health care professional should not physically attend in-person classes. They must notify the instructor of their absence and must still meet the stated engagement expectations of the course, and they must adhere to the usual codes of conduct and rules of academic integrity that remain in place.

Flexibility with instruction methods
This course is designated as an "in person" course for Spring 2021. However, we recognize that the current situation is fluid and we may need to adapt to changing conditions.

Revisions