



# SYLLABUS

## GEOG 5229: Emerging Topics in GIS

### Spatial data analytics in R

Autumn 2024

3 credit hours

3:55-5:15 TR, Derby 140

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## COURSE OVERVIEW

### Instructors

Instructor: Dr. Huyen Le

Email: [le.253@osu.edu](mailto:le.253@osu.edu)

Office hours: 2-3 Monday, 2:30-3:30 Thu, and by appointment (request via email)

### Prerequisites

GEOG 5210 or equivalent (with basic knowledge of spatial data), or as approved by the instructor.

### Course description

This course introduces you to R, one of the most popular programming languages, and spatial analysis in R. We will start with the basics of R programming, and transition to R spatial data processing, analysis, and mapping. The lab examples in this class cover various applications of spatial data analytics in the real world, such as urban studies, transportation, environmental sciences, and public health.

### Course learning outcomes

Upon successful completion of this course, students should be able to:

1. Demonstrate familiarity with common R libraries for spatial data analysis and visualization
2. Identify various approaches to load, read, and write spatial data
3. Writing R scripts process and analyze non-spatial and spatial data
4. Visualize spatial data in R
5. Apply various data analysis techniques to make sense of spatial data in real-world applications

## HOW THIS COURSE WORKS

**Mode of delivery:** This class is in-person. All learning materials will be uploaded on Carmen Canvas. There will be additional components:

- General lectures on R functions, workflow, and applications
- In-class quizzes and group exercise/discussion
- Labs
- In-person office hours.

**Credit hours and work expectations:** This is a **3-credit-hour course**. According to Ohio State policy ([go.osu.edu/credithours](http://go.osu.edu/credithours)), students should expect around 3 hours per week of time spent on direct instruction (instructor content, group and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

**Communications with instructor:** Questions related to class materials should be posted on Carmen Canvas discussion forum. Make sure you include a detailed description of the problem and attach a screenshot if applicable. You are encouraged to help your classmates out if you know the answers, but make sure you are not violating the code of student conduct (e.g., do not upload your assignment or show them the exact answer to complete their assignments). **Email me if you have questions related to personal issues and/or when you want to send me the code. Make sure that you put "GEOG 5229" in the subject line.**

## COURSE MATERIALS AND TECHNOLOGIES

### Textbooks

Geocomputation with R, Robin Lovelace, Jakub Nowosad, & Jannes Muenchow, CRC Press.  
This book is freely available online at <https://geocompr.robinlovelace.net/index.html>.

#### **Recommended texts:**

An introduction to R for spatial analysis and mapping, Chris Brunsdon and Lex Comber, Sage 2<sup>nd</sup> edition.

### Course technology

#### Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at [ocio.osu.edu/help/hours](https://ocio.osu.edu/help/hours), and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** [ocio.osu.edu/help](https://ocio.osu.edu/help)
- **Phone:** 614-688-4357(HELP)
- **Email:** [servicedesk@osu.edu](mailto:servicedesk@osu.edu)
- **TDD:** 614-688-8743

#### Technology skills needed for this course

- Newest R and RStudio version
- Familiarity with spatial analysis in ArcGIS or QGIS
- Basic computer and web-browsing skills
- Navigating Carmen ([go.osu.edu/canvasstudent](https://go.osu.edu/canvasstudent))
- CarmenZoom virtual meetings ([go.osu.edu/zoom-meetings](https://go.osu.edu/zoom-meetings))
- Recording a slide presentation with audio narration ([go.osu.edu/video-assignment-guide](https://go.osu.edu/video-assignment-guide))
- Recording, editing, and uploading video ([go.osu.edu/video-assignment-guide](https://go.osu.edu/video-assignment-guide))

#### Required equipment

- Computer: current Mac (Mac OS) or PC (Windows 10 or higher) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone

- Other: a mobile device (smartphone or tablet) to use for BuckeyePass authentication

### Required software

- Most recent (or 2<sup>nd</sup> most recent) version of R, which is a free and open source program for statistical computing and graphics (<https://www.r-project.org/>). Its privacy policy can be found at <https://www.r-statistics.com/privacy-policy/>.
- RStudio version 1.2.1335 or newer (<https://rstudio.com/products/rstudio/>), which is a shell for enhanced visualization and programming. Its privacy policy can be found at <https://www.rstudio.com/about/privacy-policy/>.
- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Full instructions for downloading and installation can be found at [go.osu.edu/office365help](http://go.osu.edu/office365help).

### Carmen access

You will need to use BuckeyePass ([buckeyepass.osu.edu](http://buckeyepass.osu.edu)) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions ([go.osu.edu/add-device](http://go.osu.edu/add-device)).
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application ([go.osu.edu/install-duo](http://go.osu.edu/install-duo)) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

## GRADING AND FEEDBACK

### How your grade is calculated

All submissions must be made via Carmen Canvas on the due date to be considered on time. All lab assignments are due on Monday 11:59 PM except for holidays.

CATEGORY	POINTS	OCCURRENCE	DUE DATES
Participation (including discussion, quizzes, short lab outputs)	15%	Multiple	N/A
Lab assignments	60%	Multiple	Monday (check Canvas for specific dates)
Final project	25%	Once, with 3 milestones	TBD

CATEGORY	POINTS	OCCURRENCE	DUE DATES
Total	100%		

### Participation (15%)

Class participation is required and accounts for 15% of the total grade. Attendance will be taken through online Carmen quizzes and/or real-time in-class quizzes, as well as in-class discussions based on the readings.

If you have excuses, please notify me before class. Excuses after class, except for certain emergencies, will not be accepted.

### Lab assignments (60%)

You will have multiple lab assignments throughout the semester. The lab assignments are designed to help you apply the R functions introduced in class to real-world mini-projects such as traffic crashes, air quality modeling, and assessing equity issues. Instructions will be provided to guide you through the steps in the lab. Discussion forums and office hours will be available to help you troubleshoot the coding problems that you encounter in the lab.

You will submit the HTML outputs from your R markdown code for grading, along with a short memo to summarize the results. Detailed guidelines and rubrics are available on Carmen Canvas.

### Final project (25%)

You are expected to consult with me during the semester about the topic, data gathering, and analysis. You will turn in a short proposal, half-time progress, and final paper for grading on Carmen Canvas.

### Extra credit (up to 2%)

There may be potential for extra credit when you volunteer for local planning agencies (e.g., MORPC, Franklin County Public Health) on certain activities, such as deploying and maintaining air quality sensors (no prior knowledge required) or performing simple analyses. Please note that these activities are only available contingent on these agencies' need, and the number of slots might be limited. I will post any opportunities on Carmen Canvas when they become available.

*Details about each assignment, including guidelines and rubric, will be made available on Carmen Canvas.*

## Late submissions

By default, late submissions of assignments and final project (or paper) are subject to 5% grade reduction for each late day. **I will NOT accept submissions that are more than 10 late days, unless you have permission from me before or on the due date.** Late submission is always better than no submission.

You have one opportunity to extend your deadline for one day during the semester (indicate it in your submission to get full credit). This extension will be applied to an assignment of your choice (including the final paper). No permission is required; you will indicate in your submission that you are using the one-day extension. We suggest that you use this opportunity wisely and reserve it for the end of the semester when the workload is unusually high.

In case of personal and family emergencies, please notify me as soon as possible so that we can work out a new submission time. Such extensions will be granted on a case-by-case basis. If you fail to notify the instructor by 5 days after the deadline, your excuses will not be accepted and all blanket policies in this class will apply.

## Grading scale

A	A-	B+	B	B-	C+	C	C-	D+	D	E
≥93%	90-92%	87-89%	83-86%	80-82%	77-79%	73-76%	70-72%	67-69%	60-66%	<60%

## Feedback and response time

We are providing the following list to give you an idea of our intended availability throughout the course. (Remember that you can call **614-688-4357(HELP)** at any time if you have a technical problem).

- **Grading and feedback:** For large assignments, you can generally expect feedback within **20 school days**, unless emergencies occur to the instructor.
- **Email:** I will reply to emails within **48 hours on school days when class is in session at the university**.

## OTHER COURSE POLICIES

### Health and safety requirements

Although there is no in-person components in this class, all students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>). Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses.

### Religious accommodation

Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, **students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course**. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or

flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the Office of Institutional Equity. (Policy: Religious Holidays, Holy Days and Observances)

## Weather or other short-term closing

Should in-person classes be canceled, we will meet virtually via CarmenZoom during our regularly scheduled time. I will share any updates via Carmen Canvas announcement. By default, you will receive an email notification when I post a Canvas announcement; make sure you did not turn off this notification function.

## Academic integrity policy

See **Descriptions of major course assignments**, above, for my specific guidelines about collaboration and academic integrity in the context of this online class.

### Ohio State's academic integrity policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct* ([studentconduct.osu.edu](http://studentconduct.osu.edu)), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so we recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

**Although it is permitted to use AI to support troubleshooting, you may NOT use direct outputs from AI for your paper and codes in this class.**

**If I suspect that a student has committed academic misconduct in this course, we are obligated by university rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct web page ([go.osu.edu/coam](http://go.osu.edu/coam))
- Ten Suggestions for Preserving Academic Integrity ([go.osu.edu/ten-suggestions](http://go.osu.edu/ten-suggestions))
- Eight Cardinal Rules of Academic Integrity ([go.osu.edu/cardinal-rules](http://go.osu.edu/cardinal-rules))

## Copyright for instructional materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

## Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at [titleix.osu.edu](http://titleix.osu.edu) or by contacting the Ohio State Title IX Coordinator at [titleix@osu.edu](mailto:titleix@osu.edu). Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit [equity.osu.edu](http://equity.osu.edu) or email [equity@osu.edu](mailto:equity@osu.edu).

## Commitment to a diverse and inclusive learning environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

## Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental



health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting [ccs.osu.edu](https://ccs.osu.edu) or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

## **ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES**

### **Requesting accommodations**

The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; or [slds.osu.edu](https://slds.osu.edu).

### **Accessibility of course technology**

This online course requires use of Carmen Canvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- Canvas accessibility ([go.osu.edu/canvas-accessibility](https://go.osu.edu/canvas-accessibility))
- Streaming audio and video
- Collaborative course tools

## **COURSE SCHEDULE**

Please refer to this link for an updated schedule: <https://docs.google.com/document/d/11PL3XgTirBM7jvRixnCh-uWoi75wjlTbusOBq5BcRQs/edit?usp=sharing>