

GEOG 4195/5195 Geospatial Data Analytics and Visualization

Fall 2026

Mondays and Wednesdays 2:20-3:40 p.m., Env 336

This syllabus describes the requirements and procedures for **Geospatial Data Analytics and Visualization/Advanced Geospatial Data Analytics (GEOG 4195/5195)**. You are responsible for knowing this material, so please read it carefully. Any changes will be announced via email and Canvas announcement. You will be responsible for any changes.

About the Instructor & Contact Information

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Office Hours: Monday 3:40-4:40 pm, Wednesday 3:40-4:40 pm, or by appointment via email

Dr. Jung is an Assistant Professor in the Department of Geography and the Environment. Dr. Jung completed a Ph.D. at Florida State University and an MA at Ohio State University in Geography. Then, he did his postdoctoral research in the Department of Environmental and Occupational Health Sciences at the University of Washington and the Department of City and Regional Planning at the University of North Carolina at Chapel Hill. He is a Health and Medical Geographer, with a specialization in environmental health, environmental disparity, and natural disasters using GIS, remote sensing, quantitative methods, and big data. His research investigates how the biophysical and socioeconomic environments influence and interact with human health in quantitative and geo-spatial contexts.

Prerequisites

There are no formal prerequisites for this course. However, in order to complete the assignments, students are expected to have basic computer skills and working knowledge of the Windows operating system.

Textbook

No textbook is required, but there are a few resources you might want to check.

- Free books on R: <https://bookdown.org/>
- R Graphics Cookbook, 2nd edition: <https://r-graphics.org/>
- Text Mining with R: <https://www.tidytextmining.com/>
- Data Visualization - A Practical Introduction: <https://socviz.co/>

- R for Data Science - great reference for all parts of the statistical workflow, from data cleaning to creating graphics for publication: <https://r4ds.had.co.nz/>

Class Resources

There is one Canvas site for both lecture and lab. Students are expected to check the site regularly for announcements, lecture slides, lab materials, grades, and other postings.

Essential Resources

1. Computer: A PC or Mac with the latest version of R installed, available for download at: <http://cran.us.r-project.org>
2. RStudio: Latest version available for download at <http://www.rstudio.com> for both PC and Mac.
3. Laptop Rental: Laptops are available for rent from the library. For more information, visit <https://library.unt.edu/services/laptop-checkout/>.

Course Overview

This course introduces students to the fundamental concepts and practical techniques used to analyze and visualize geospatial data using R. The course is designed to provide students with hands-on experience working with a variety of datasets and developing effective data visualization skills. The first third of the course focuses on the fundamentals of the R programming language, including data types, data structures, indexing, and basic data manipulation. The remaining two-thirds focus on exploratory data analysis and visualization, introducing a variety of graphical techniques such as scatter plots, line plots, box plots, violin plots, bubble plots, time-series plots, heatmaps, bar plots, and choropleth maps. The course also introduces a range of geospatial visualization techniques for exploring and communicating spatial patterns using geographic datasets. Through practical exercises and examples, students will learn how to explore data, create effective visualizations, and communicate analytical findings using both traditional and geospatial graphics.

Learning Outcomes

By the end of this course, students will be able to know:

- Understand the fundamentals of the R programming language for data analysis
- Work with various types and formats of geographic datasets.
- Import, organize, and manipulate geographic data using R.
- Create and interpret basic graphs and maps of geographic data.
- Develop effective and informative visualizations for communicating geospatial information.

I will provide you with a **hands-on learning experience** focused on working with geospatial data and creating effective visualizations. The course will teach you how to work with various types and formats of geographic datasets, explore and analyze data, and communicate spatial patterns through graphs and maps. You are expected to have a basic understanding of descriptive statistics, such as means, standard deviations, and correlation. Some course time will be devoted to independent, hands-on work where you will apply the concepts and techniques introduced in class to real-world datasets. All course work will be completed using **R/RStudio**.

Grading

Your final grade will be based on the following:

Item	Total
In class activities (Assignments)	600
Final project	
Research topic selection	50
Data collection	100
Final maps	150
Presentation	100
Grand Total	1000

Grading scale:

Grade	Score	Standard
A	900.0-1000.0	Outstanding; few if any errors/omissions
B	800.0-899.9	Good; only minor errors/omissions
C	700.0-799.9	Satisfactory; minor and a few major errors
D	600.0-699.9	Poor; many major errors and omissions
F	Below 600	Fail

In Class Activities (Assignments)

There will be **12 assignments** throughout the semester. Most assignments will be introduced and completed as **in-class activities**. Students who complete an assignment during class may submit it through **Canvas** during or after class. Each assignment will have a specific due date, typically **11:59 p.m.** on the assigned date (see below).

The **first assignment** will have a different point value (100). Assignments 2–12 will be worth **50 points each**, for a total of **650 points** across all assignments. I understand that students may occasionally forget to submit an assignment. To provide some flexibility, **the lowest assignment score will be dropped** when calculating your final assignment grade.

Week		Due date	Points
1	Assignment 1: Introduction to R, installing R, and the R Environment	August 21	100
2	Assignment 2: R Basics and data types	August 28	50
3	Assignment 3: Basic concepts on GIS and cartography	September 4	50
4	No assignment		
5	Assignment 4: Reading and writing data with R	September 18	50
6	Assignment 5: Creating basic plots	September 25	50
7	Assignment 6: Creating choropleth maps	October 2	50
8	Assignment 7: Creating weather/land use maps	October 9	50
9	Assignment 8: Creating vegetation/population maps	October 16	50
10	Assignment 9: Creating crime/sociodemographic maps	October 23	50
11	No assignment		
12	Assignment 10: Vulnerability analysis	November 6	50
13	Assignment 11: Social media data analysis	November 13	50
14	Assignment 12: Remote sensing data analysis	November 20	50
Total (the lowest score will be dropped)			650

Final Project – Research Topic Selection

For the first eight weeks, you will have time to think about a potential research topic for this class. Your topic can be flexible - it could focus on a specific geographic area, environmental issue, population, or spatial phenomenon that interests you. The goal is to identify a topic that can be explored using the spatial data and analytical methods introduced in this course. For example, you could examine spatial and temporal trends in crime within a specific area and explore whether the number of crimes is associated with factors such as temperature or vegetation indices. Another example would be to use Twitter (X) data to examine people's sentiments about a specific topic, such as extreme heat. If you have difficulty selecting a research topic, please reach out to me with a few **specific topics or keywords** that interest you. I can help you refine your ideas and identify a suitable research question. Once you have selected your research topic, you will develop a research question based on that topic.

Please upload a Word document containing your research question to Canvas. This should consist of at least two sentences. The deadline for research topic selection is **October 9**. Late submissions will incur a penalty of 20% of the maximum score for each day (24 hours) past the deadline, including weekends. Submissions more than five days late will receive a score of zero.

Final Project – Data Collection

At this stage, you should have identified your research area. The next step is to search for datasets relevant to your research interests. Please ensure that the datasets you select are **publicly available** and available at the **county level**, as you will be required to create maps illustrating the spatial patterns of your research topic.

Please upload the dataset you plan to use for your final project by **November 6**. Late submissions will incur a penalty of 20% of the maximum score for each day (24 hours) past the deadline, including weekends. Submissions more than five days late will receive a score of zero.

Final Project – Final Maps

You are expected to create at least **three maps related to your research topic**, using different datasets that are relevant to your topic. You may use datasets introduced in this class, as well as other datasets that you find or obtain independently.

Along with your maps and plots, please provide a brief explanation of your work, including the datasets you used, the methods you applied, and the key patterns or findings you observed.

Please upload a Word document containing your final maps by **December 4**. Late submissions will incur a penalty of 20% of the maximum score for each day (24 hours) past the deadline, including weekends. Submissions more than five days late will receive a score of zero.

Final Project – Presentation

During the last week of the semester, you will have approximately 5–10 minutes to present your final project. Your presentation should briefly introduce your code and the R packages you used, your maps, and the most interesting findings or patterns you discovered.

At the end of the presentations, we will hold a map competition. Each student will have the opportunity to vote for three maps they think are the best. The map receiving the most votes will be selected as the winner. The winner of the map competition will receive a final course grade of A, regardless of their other scores in the class.

Class Schedule

Week	Day	Date	Topic	Due dates
1	Monday	August 17	R and R Studio	
1	Wednesday	August 19	Data types	Assignment 1 (August 21)
2	Monday	August 24	Data structures, index	
2	Wednesday	August 26	Data structures, index	Assignment 2 (August 28)
3	Monday	August 31	Reading/writing aspatial data	
3	Wednesday	September 2	Reading/writing spatial data	Assignment 3 (September 4)
4	Monday	September 7	Labor data (No class)	
4	Wednesday	September 9	Basic statistical functions in R	
5	Monday	September 14	Data Models: vector vs. raster	
5	Wednesday	September 16	Basic cartography	Assignment 4 (September 18)
6	Monday	September 21	Basic GIS functions	
6	Wednesday	September 23	Scatter, line, box, time series plot	Assignment 5 (September 25)
7	Monday	September 28	Violin plot, bar plot, ...	
7	Wednesday	September 30	Choropleth map, interactive maps	Assignment 6 (October 2)
8	Monday	October 5	Climate/weather	
8	Wednesday	October 7	Land use/land cover	Assignment 7 Final project – research topic selection (October 9)
9	Monday	October 12	Vegetation, digital elevation model	
9	Wednesday	October 14	Population	Assignment 8 (October 16)
10	Monday	October 19	Crime	
10	Wednesday	October 21	American Community Survey	Assignment 9 (October 23)
11	Monday	October 26	Grocery store	
11	Wednesday	October 28	Combining multiple spatial data sets 1	
12	Monday	November 2	Combining multiple spatial data sets 2	
12	Wednesday	November 4	Vulnerability analysis	Assignment 10 Final project – Data collection (November 6)
13	Monday	November 9	Social media data analysis	
13	Wednesday	November 11	Shapefile data analysis	Assignment 11 (November 13)
14	Monday	November 16	Remote sensing data analysis	
14	Wednesday	November 18	Google Earth Engine (GEE)	Assignment 12 (November 20)
	Monday	November 23	Thanksgiving Break (No classes)	
	Wednesday	November 25	Thanksgiving Break (No classes)	
15	Monday	November 30	Final project presentation	
15	Wednesday	December 2	Final project presentation	Final project – Final maps (December 4)

Syllabus Change Policy: This syllabus is a guide for the course and is subject to change.

Artificial Intelligence (AI) Policy

This class strongly encourages the use of Artificial Intelligence (AI) tools to enhance your work, particularly when creating and improving maps, graphs, and visualizations. However, AI should be used as a tool to support your learning, not as a replacement for your own analysis and decision-making.

To use AI effectively, you first need to develop a fundamental understanding of R and its basic structure. Once you understand how R works, you can use AI to help you write and improve code, troubleshoot errors, explore different visualization techniques, and create more effective maps and graphs. Without a basic understanding of R, it can be difficult to evaluate, modify, and appropriately use AI-generated code.

Attendance and Participation

Research has shown that students who attend class are more likely to be successful. You should attend every class unless you have a university excused absence such as active military service, a religious holy day, or an official university function as stated in the [Student Attendance and Authorized Absences Policy](#). If you cannot attend a class due to an emergency, please let me know. Your safety and well-being are important to me.

In that light, students are expected to complete each week's material for the course on time. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

Deadline Extensions

If you need a deadline extension due to an extenuating circumstance, you must email the instructor as soon as possible with documentation. Extenuating circumstances include documented illness, deaths in the family, and other documented crises.

Extra Credit

The Department of Geography and the Environment does not allow extra credit assignments.

Email Etiquette

Your emails to your instructor must be professional, otherwise, you are unlikely to receive a response. You can expect email responses during normal business hours (i.e., Monday to Friday, 9:00 a.m. to 5:00 p.m.), but not outside of these hours. In your email, include a meaningful subject line, a professional greeting, and a professional signature.

Academic dishonesty

We hold each student to a high level of academic integrity using the University policy for academic honesty and integrity, [Academic Integrity Policy \(PDF\)](https://policy.unt.edu/sites/default/files/06.049_Standard%20Syllabus%20Policy%20Statements_supplement.pdf) (https://policy.unt.edu/sites/default/files/06.049_Standard%20Syllabus%20Policy%20Statements_supplement.pdf). Students caught cheating or plagiarizing will receive a "0" for that particular assignment or exam. Additionally, the incident will be reported to the Office of Student Rights and Responsibilities for further penalty. According to the UNT catalog, the term "cheating" includes, but is not limited to:

- Use of any unauthorized assistance in taking quizzes, tests, or examinations;
- Dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments;
- The acquisition, without permission, of tests or other academic material belonging to a faculty or staff member of the university;
- Dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor(s); or
- Any other act designed to give a student an unfair advantage.

The term "plagiarism" includes, but is not limited to:

- The knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgment; and
- The knowing or negligent unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

Academic Support and Student Services

Mental Health

UNT provides mental health resources to students to help ensure there are numerous outlets to turn to that wholeheartedly care for and are there for students in need, regardless of the nature of an issue or its severity. Listed below are several resources on campus that can support your academic success and mental well-being:

- [Student Health and Wellness Center](https://studentaffairs.unt.edu/student-health-andwellness-center) (<https://studentaffairs.unt.edu/student-health-andwellness-center>)
- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testingservices) (<https://studentaffairs.unt.edu/counseling-and-testingservices>)
- [UNT Care Team](https://studentaffairs.unt.edu/care) (<https://studentaffairs.unt.edu/care>)
- [UNT Psychiatric Services](https://studentaffairs.unt.edu/student-health-and-wellnesscenter/services/psychiatry) (<https://studentaffairs.unt.edu/student-health-and-wellnesscenter/services/psychiatry>)
- [Individual Counseling](https://studentaffairs.unt.edu/counseling-and-testingservices/services/individual-counseling) (<https://studentaffairs.unt.edu/counseling-and-testingservices/services/individual-counseling>)

Chosen Names

A chosen name is a name that a person goes by that may or may not match their legal name. If you have a chosen name that is different from your legal name and would like that to be used in class, please let the instructor know. Below is a list of resources for updating your chosen name at UNT.

- [UNT Records](#)
- [UNT ID Card](#)
- [UNT Email Address](#)
- [Legal Name](#)

**UNT EUIDs cannot be changed at this time. The collaborating offices are working on a process to make this option accessible to UNT community members.*

Pronouns

Pronouns (she/her, they/them, he/him, etc.) are a public way for people to address you, much like your name, and can be shared with a name when making an introduction, both virtually and in person. Just as we ask and don't assume someone's name, we should also ask and not assume someone's pronouns.

You can [add your pronouns to your Canvas account](#) so that they follow your name when posting to discussion boards, submitting assignments, etc.

Below is a list of additional resources regarding pronouns and their usage:

- [What are pronouns and why are they important?](#)
- [How do I use pronouns?](#)
- [How do I share my pronouns?](#)
- [How do I ask for another person's pronouns?](#)
- [How do I correct myself or others when the wrong pronoun is used?](#)

Additional Student Support Services

- [Registrar](https://registrar.unt.edu/registration) (<https://registrar.unt.edu/registration>)
- [Financial Aid](https://financialaid.unt.edu/) (<https://financialaid.unt.edu/>)
- [Student Legal Services](https://studentaffairs.unt.edu/student-legal-services) (<https://studentaffairs.unt.edu/student-legal-services>)
- [Career Center](https://studentaffairs.unt.edu/career-center) (<https://studentaffairs.unt.edu/career-center>)
- [Multicultural Center](https://edo.unt.edu/multicultural-center) (<https://edo.unt.edu/multicultural-center>)
- [Counseling and Testing Services](https://studentaffairs.unt.edu/counseling-and-testingservices) (<https://studentaffairs.unt.edu/counseling-and-testingservices>)
- [Pride Alliance](https://edo.unt.edu/pridealliance) (<https://edo.unt.edu/pridealliance>)
- [UNT Food Pantry](https://studentaffairs.unt.edu/food-pantry) (<https://studentaffairs.unt.edu/food-pantry>)

Academic Support Services

- [Academic Resource Center](https://clear.unt.edu/canvas/student-resources) (<https://clear.unt.edu/canvas/student-resources>)
- [Academic Success Center](https://success.unt.edu/asc) (<https://success.unt.edu/asc>)
- [UNT Libraries](https://library.unt.edu/) (<https://library.unt.edu/>)

- [Writing Lab \(http://writingcenter.unt.edu/\)](http://writingcenter.unt.edu/)