GIS 6125C: Geocomputation using R Programming

Dr. David Keellings **M 12:50-3:50pm** **3006 Turlington Hall** **Fall 2025**

Office Hours
W/F 10:30-11:30am, other times **BY APPOINTMENT ONLY**
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Note: For best results – utilize office hours. If you are having trouble with the course, come and see me sooner rather than later so that I can help you.

Course Description
This course is an introduction to geodata analysis using R. The course will be taught from the perspective of geographical and climate data analysis but serves as a broad introduction to the high-level programming language, R, as well as applied spatial data analysis. Students will load and manipulate data of different types, perform a variety of statistical analyses, generate graphical output, and create productive workflows using R alone. The primary outcome will be to facilitate students' use of R to analyze data of their own choosing on a final project. Students will present these methods to the class for others to critique, analyze and learn from. Code sharing and re-use is highly emphasized, as is collaboration. The course is designed as a 1-hour lecture plus 2-hour lab each week. *3 Credit Hours*

Student Learning Objectives
After completing the course, students should have developed a foundation of basic ability to program in R, be capable of performing statistical analyses using R, and generate meaningful graphical output of results. Specific learning objectives include:

- Identify common logic, flow control, and syntactic features within R code segments.
- Develop the technical ability to work with varied large and small datasets within R.
- Perform a variety of statistical analyses of geospatial data using R.
- Design informative visualizations of results that are of publishable quality.
- Apply technical skills to automate large workflows.
- Propose, execute, and defend a research project.
- Develop technical skills within R as a stand-alone software for data pre-processing, data analysis, and data visualization.
- Design detailed code segments and present these to others.

NOTE: This course is co-listed with GIS 4124 which is an undergraduate course. While the two will meet together and complete similar assignments, undergraduates and graduates will be evaluated on a different basis. Graduate students are required to present a code share to the class and lead a discussion of the code. Graduate students are also required to propose and execute a more rigorous independent data analysis project, complete a longer project report, and present their project to the class.

Course Resources

There is no required text for this course. However, you might find the following resources useful:

- Roger S. Bivand, Edzer Pebesma, Virgilio Gomez-Rubio, 2013. Applied spatial data analysis with R, Second edition. Springer, NY.
- Robin Lovelace, Jakub Nowosad, Jannes Muenchow, 2020. Geocomputation with R, 1st edition. CRC Press. https://geocompr.robinlovelace.net/index.html
- An Introduction to R manual is freely available here: https://cran.r-project.org/manuals.html

Furthermore, throughout the semester readings will be distributed and discussed. All of these readings will be free, online books or articles and will be posted on the class website.

Computer/Software Requirements

- R (http://cran.us.r-project.org) is a free command-line based statistical language.
- RStudio is a free IDE for R (http://www.rstudio.com/)

We will install these programs together at the first lab meeting. You will need to bring a laptop with these programs installed to regular class meetings. All of these programs are free and multi-platform compatible (Windows, Mac, Linux). Install R first and then RStudio. Use the latest versions of each.

Grades and Grading Scale

Labs (11 labs, lowest grade dropped): 40% (10 labs @ 4% each)
Code Share: 10%
Project Proposal: 10%
Project Presentation: 20%
Project Report: 20%

- **Labs:** Learning to program is challenging and weekly labs are reserved for in-class work and one-on-one instruction. For this reason, attendance in weekly labs is required. Labs missed without permission from the instructor will result in a zero for that week's lab assignment. Lab assignments are due by the end of the next lab period (one week after initial assignment). Late assignments will have 10 percent deducted from the possible total score for each day they are late (E.g. if you earn an 80% on the lab but are one day late you receive a 70%). The lowest lab grade will be dropped.

- **Code Share:** Students are expected to share a brief code snippet with the class. The code will perform a short task that has not been previously presented in lectures or labs. The student will lead the class through an exploration of the code and respond to questions/comments. Students will sign up for times to present their code snippets throughout the semester. Code sharing will facilitate enhanced learning of R programming by introducing students to code/concepts not otherwise covered in the class.

- **Project:** Working individually you will propose and execute an analysis of data in R. This analysis may be related to your graduate thesis/dissertation. You will be graded on the viability of your proposal i.e., is the proposed study suitable for an R workload and can the work be reasonably completed during the course of a single semester. You will present your project to the class at the end of the semester and also hand in a project report written in the form of a short paper not to exceed 10 pages, excluding references.

>=91.0% = A	90.0-90.9%= A-	87.0-89.9%= B+	81.0-86.9%= B
80.0-80.9%= B-	77.0-79.9%= C+	71.0-76.9%= C	70.0-70.9%= C-
67.0-69.9% = D+	64.0-66.9%= D	60.0-63.9%= D-	<60.0% = E

A grade threshold must be crossed in order to receive the letter grade indicated (no rounding). It is your responsibility to know your current grade. Grades will be posted to the course website. Information on current UF grading policies for assigning grade points may be found at https://catalog.ufl.edu/graduate/regulations/.

Make-Up Assignments
Students must notify the instructor as soon as possible in case of absence and provide documentation as to the reason for the absence. If deemed an excused absence, the student will be permitted one week from their return to classes in order to make up the missed work with no grade penalty. Requirements for make-up assignments and other work in this course are consistent with university policies that can be found at https://catalog.ufl.edu/graduate/regulations/

Late Work
Late assignments will have 10 percent deducted from the possible total score for each day they are late (E.g. if you earn an 80% on the work but are one day late you receive a 70%).

Canvas Course Website Information
This syllabus, announcements concerning exams, some lecture content, grades, and other course information will be posted on Canvas course management system. Access this page at https://elearning.ufl.edu/. If you miss a class, it is your responsibility to learn the material covered during your absence. Come see me if you have any questions. Students must activate their UF GatorLink account in order to use Canvas. If you need help learning how to perform various tasks related to this course or other courses that utilize Canvas, please consult the above webpage. You may also contact the UF Computing Help Desk at (352) 392- HELP(4357) or helpdesk@ufl.edu

Attendance and Proper Conduct
There will be no exams and lecture attendance is not required. However, failure to attend during student presentations will result in a 10-percentage point deduction from your final presentation score per each day's absence.

This course complies with all UF academic policies. For information on those polices and for resources for students, please see this link. *(The direct link is https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/.)*

Course Schedule (Subject to Change)

Week	Topics	Labs
1 Aug. 25	Introduction to R	NO LAB
2 Sep. 1	**NO CLASS**	NO LAB
3 Sep. 8	Intro to Geostatistics – Local Spatial Autocorrelation	Lab 1: Exploring Data Using R, Basic Graphing
4 Sep. 15	Preprocessing & Basic Analysis	Lab 2: Importing Data, Graphing, and Basic Analysis
5 Sep. 22	Mapping in R – Static & Interactive Maps	Lab 3: Programming Structures and Batch Processing
6 Sep. 29	Problem Solving	Lab 4: Controlling Program Flow and Problem Solving
7 Oct. 6	Fun with Functions	Lab 5: Functions and Modularizing
8 Oct. 13	Time Series Analysis & Forecasting	Lab 6: Time Series Analysis
9 Oct. 20	Intro to Machine Learning – Random Forest for Classification & Regression	Individual Project Work – **Proposal Due**
10 Oct. 27	Geostatistical Interpolation – IDW & Kriging	Lab 7: Spatial data objects and spatial data analysis
11 Nov. 3	Analysis of Spatial Networks – Sustainable Transport Planning	Lab 8: Analysis of Spatial Networks
12 Nov. 10	Spatial Regression	Lab 9: Advanced analysis - spatial regression
13 Nov. 17	Extreme Value Analysis	Lab 10: Advanced analysis – extreme value analysis
14 Nov. 24	NO CLASS	NO LAB
15 Dec. 1	Project Presentations – **Paper Due**	NO LAB