

ANG6930

ADVANCED R FOR ARCHAEOLOGY

Course Information

Spring 2024
Th 12:50p - 3:25p
TUR 1208H

Instructors: Dr. Daniel Contreras | Dr. Nicolas Gauthier

Offices: B346 Turlington | 376 Dickinson Hall

Phone: 352-294-6880 | 352-273-1946

Email: daniel.contreras@ufl.edu | nicolas.gauthier@ufl.edu

Office Hours: Dr. Contreras W 1-3p and by appointment, B346 Turlington | Dr. Gauthier holds office hours by appointment only. Please reach out via email Mon-Fri to schedule a time to meet in his office (Dickinson 376) or via Zoom

Course Description

This course provides an in-depth exploration of use of the R programming language for archaeological data analysis and visualization. It emphasizes independent implementation of advanced statistical methods, grounded in collaborative and reproducible research practices. The curriculum covers exploratory data analysis and visualization, regression analysis, time series, spatial data analysis, and deep learning applications, blending theory with hands-on application and emphasizing the importance of open science. This approach ensures students are well-equipped to tackle complex archaeological data and contribute to scholarly research.

Course Objectives

After completing this course, students will be able to:

1. Analyze and interpret archaeological data using advanced statistical techniques such as regression analysis, time series analysis, and spatial data analysis.
2. Independently learn and apply new statistical methods and tools in R, utilizing available documentation and resources.
3. Understand and implement the principles of collaborative and reproducible research, including the use of version control systems and literate programming.
4. Effectively communicate the results of data analysis, both in written form and orally, using appropriate visualization and reporting techniques.
5. Critically evaluate and discuss scholarly research, demonstrating an ability to integrate statistical analysis into broader archaeological discussions.

Course structure

The course is structured to provide a comprehensive and interactive learning experience in the application of advanced R methods in archaeology. Each week, students are required to engage with assigned readings, including a methodological vignette or tutorial and relevant application papers, focusing on understanding and potentially replicating the showcased methods. Classes meet once a week for approximately three hours. The first half of each session focuses on introducing the week's topic, covering method fundamentals, and discussing papers and R packages. The second half is reserved for open discussion and hands-on coding work. There are three major homework assignments spread throughout the course that require synthesizing the previous weeks' topics in a small group through a novel analysis. The culmination of the course is a final project, where each student produces a reproducible research report in book chapter form. This chapter should demonstrate the use of a specific method, approach, or package in archaeology, backed by a publicly available dataset, and include a review of its applications in archaeology and other fields.

Course Requirements

- *Seminar Facilitation* 10% - Each student will be responsible for facilitating one week's topic by preparing a reproducible analysis vignette on the given topic and leading the in-class discussion. This will be prepared in consultation with the instructors *no later than the previous Tuesday*.
- *Development* 5% Contribute **5** issues / comments / pull requests to presented teaching vignettes
- *Participation* 10%
- *Homework Exercises* 15% (5% each) - completed by lab groups
- *Annotated bibliography* 10% - contribute to shared/collaborative annotated bibliography of R packages for archaeology
- *Term Project* 50%
 - *Topic* 5% - Written description of paper topic, identifying dataset(s), question(s), and potential analyses and methods, uploaded to Canvas no later than **1 Mar**.
 - *Bookdown chapter draft* 10% (due **29 Mar**).
 - *Peer Review* 10% – Review and contribute to someone else's bookdown chapter (due **5 Apr**)
 - *Presentation* 5% – Each student will give a five-minute presentation of their term paper topic, findings, and conclusions. These will take place at our final meeting during the course exam time [**3 May @ 10:00 AM - 12:00 PM**].
 - *Paper* 20% - due **1 May**.

Attendance Policy, Class Expectations, and Late Assignments

Attendance

Since attendance is fundamental to the learning goals of this course, it is required. Of course, life may sometimes intervene, in which case you are expected to notify the instructor ahead of time or as soon as practical afterwards. More than two absences will already constitute >10% of the course, and you should consult with the instructor about appropriate make-up activity.

Excused absences must be consistent with university policies in the [Graduate Catalog](#) and require appropriate documentation. Additional information can be found in [Attendance Policies](#).

Late Assignments

Because each week in this course builds on the previous, no late assignments will be accepted outside of [UF Attendance Policies](#) accompanied by appropriate documentation.

ChatGPT and Generative AI Policy

ChatGPT and other large language models are powerful tools for generating content and assisting with tasks such as coding assignments, especially for those with little to no coding experience. However, it's essential to understand that while these models often provide valuable information, they just as often produce inaccurate or misleading outputs. **Always** cross-check and critically assess the answers you receive. For writing and coding assignments, if you use ChatGPT to help, **always** acknowledge the portions of your text or code that were influenced by or directly taken from it in your written reports and code comments. You are solely responsible for the quality of the work you turn in.

We recommend posing clear and concise questions to ChatGPT or asking it to explain, comment on, and review existing code, or even explain bugs and error messages, rather than asking it to create complex models or procedures from scratch. You can also use ChatGPT to brainstorm or workshop new ideas, enhancing your creativity without outsourcing the actual content creation. As with any tool, it's there to help you do your best work rather than to do it for you. *-Written with the help of ChatGPT*

Recommended Texts

Due to the nature of the material, this course has no required text, but will rely on several articles and book excerpts available on Canvas.

We recommend referring regularly to several freely available texts on data analysis and modeling in R:

- R for Data Science: <https://r4ds.hadley.nz/>
- Tidy Modeling with R: <https://www.tmwr.org/>
- R Graphics Cookbook: <https://r-graphics.org/>
- Geocomputation with R: <https://r.geocompx.org/>
- R Markdown: The Definitive Guide: <https://bookdown.org/yihui/rmarkdown/>
- Advanced R: <https://adv-r.hadley.nz/>
- Statistical Inference via Data Science: <https://moderndive.com/>

- Notes on Quantitative Archaeology and R:
https://www.researchgate.net/publication/277931925_Notes_on_Quantitative_Archaeology_and_R

Students are expected to download and install the free and open-source software packages [R](#) and [R Studio](#), and several R packages throughout the course of the semester. Use of version control software such as Git/[GitHub](#) is optional but strongly suggested.

Course Schedule

Week	Date	Topic	Assignments	Readings	Student Led?	
1	1/11	Introduction, Open-Source Tools, and Data Wrangling	Download and install R, RStudio, and other required packages	Baxter 2015 Ch.1 Kansa & Witcher Kansa 2021 Data Analysis and Visualization in R for Archaeologists	No	R refresher; dplyr + ggplot; Intro to GitHub; Digital data
2	1/18	Exploratory Data Analysis and Unsupervised learning	—	Baxter 2015:Ch.6, 7, 9 dimensio package & vignette	Yes	More dplyr and ggplot; PCA and dimensionality reduction
3	1/25	Regression and Classification Models Pt1	—	broom package	Yes	linear models + checks; GLMs; GAMs
4	2/1	Time Series and Chronology in Archaeology Pt 1	HW1 Due Friday (2/2) - Exploratory data analysis	coffee , BChron , and rcarbon packages Bevan & Crema 2021	Yes	Building chronologies; working with periods and ¹⁴ C data
5	2/8	Time Series and Chronology in Archaeology Pt 2	—	hockeystick package Crema & Bevan 2021	Yes	SPDs; paleoclimate data
6	2/15	Spatial Data Analysis Pt 1	HW2 Due Friday (2/16) - Chronological Modeling	sf package, Rmapview Hijmans & Elith 2017: Part I	Yes	spatial data in R; point data; getting/manipulating spatial data

7	2/22	Spatial Data Analysis Pt 2	—	terra package, Geodata Hewitt et al. 2020	Yes	raster data
8	2/29	Regression and Classification Models Pt 2	Project proposals due Friday (3/1)	tidymodels and tidySDM packages Leonardi et al. 2023	No	Random forest; cross validation
9	3/7	Deep Learning Applications in Archaeology	HW3 Due Friday (3/8) - Niche Modeling	keras and tensorflow packages	Yes	Image analysis; natural language
-	3/14	Spring break, no class	—	—	—	—
10	3/21	Network Analysis in Archaeology	—	tidygraph and ggraph packages Golitko 2019 Peeples et al. 2016	Yes	Analysis and visualization of relational data
11	3/28	Mechanistic modeling and simulation	Final project code draft due Friday (3/29)	nlrx package	Yes	Creating mechanistic models and fitting to data
12	4/4	Open science and reproducible research	Final project peer reviews due Friday (4/5)	bookdown , blogdown , shiny , and quarto packages Marwick 2017	No	Making public-facing interfaces for analyses
13	4/11	TBD	—	—	—	What do the people want?
14	4/18	No class (SAA)	—	—	—	—
15	TBD	Present final projects	Final paper due 5/1	—	—	—

Readings

Weekly readings will be determined as needed by the instructors and student discussion leaders and distributed no later than the Tuesday prior to class.

Baxter, Mike J

2015 Notes on Quantitative Archaeology and R.

Bevan, Andrew, and Enrico R Crema

2021 Modifiable reporting unit problems and time series of long-term human activity. *Philos Trans R Soc Lond B Biol Sci* 376: 20190726. [including code:

<https://github.com/ercrema/repunitprobs>]

Crema, Enrico R, and Andrew Bevan

2021 Inference from large sets of radiocarbon dates: software and methods. *Radiocarbon* 63: 23–39.

Golitzko, Mark

2019 The Potential of Obsidian “Big Data”. *The Journal of the International Union for Prehistoric and Protohistoric Sciences* 2: 83–98.

Hewitt, Richard J., Francis F. Wenban-Smith, and Martin R. Bates.

2020. "Detecting Associations between Archaeological Site Distributions and Landscape Features: A Monte Carlo Simulation Approach for the R Environment" *Geosciences* 10, no. 9: 326. <https://doi.org/10.3390/geosciences10090326>

Hijmans, R J, and Jane Elith

2017 Species distribution modeling with R.

Kansa, Eric, and Sarah Witcher Kansa

2021 Digital Data and Data Literacy in Archaeology Now and in the New Decade. *Advances in Archaeological Practice* 9: 81–85.

Leonardi, Michela, Margherita Colucci, and Andrea Manica

2023 tidysdm: leveraging the flexibility of tidymodels for Species Distribution Modelling in R. *bioRxiv : the preprint server for biology*. DOI:[10.1101/2023.07.24.550358](https://doi.org/10.1101/2023.07.24.550358).

Marwick, Benjamin

2017 Computational Reproducibility in Archaeological Research: Basic Principles and a Case Study of Their Implementation. *Journal of Archaeological Method and Theory* 24: 424–450.

Peeples, Matthew A, Mills, Barbara J, Randall Haas, W, Clark, Jeffery J, and Roberts, JM

2016 Analytical challenges for the application of social network analysis in archaeology. In *The Connected Past: Challenges to Network Studies in Archaeology and History*, pp. 59–84. Oxford University Press, Oxford.

University Policies

Grading

Grading scale:

- 92.5-100% A
- 90-92.5% A-
- 87.5-90% B+
- 82.5-87.5% B

- 80-82.5% B-
- 77.5-80% C+
- 72.5-77.5% C
- 70-72.5% C-

- 67.5-70% D+
- 62.5-67.5% D
- 60-62.5% D-
- < 60% E

Information on UF grading policy may be found at: [UF Graduate Catalog](#) and [Grades and Grading Policies](#).

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see the [Notification to Students of FERPA Rights](#).

Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing [online evaluations](#). Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students on the [Gator Evals page](#).

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/> specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: counseling.ufl.edu/cwc/, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services SARS

Student Health Care Center, 392-1161.

University Police Department at 392-1111 or 9-1-1 for emergencies, or police.ufl.edu.

Academic Resources

E-learning technical support, 352-392-4357 select option 2 or e-mail to Learning-support@ufl.edu.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.

Library Support, Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

Student Complaints Campus

On-Line Students Complaints