THE OHIO STATE UNIVERSITY

SYLLABUS
HCS 7100

Data Visualization in R
Autumn 2024 (full term)
2 credit hours
Tuesday 4:10-5:55pm and hybrid synchronous delivery

You can join class in person: Howlett 116 (Columbus) or Williams 123 (Wooster) or via Zoom (but I would recommend you come in person)

Zoom link for class: https://go.osu.edu/dataviz-zoom (Links to an external site.)
Full Zoom details: Meeting ID: 937 4016 0297 Password: dataviz
https://osu.zoom.us/j/93740160297?pwd=2wPNkuaKbb2uaKFQ3jC8txf6tJlUHj.1

Course website: https://www.rdataviz.com/ used in conjunction with Carmen Canvas

COURSE OVERVIEW

Instructor

Instructor: Jessica Cooperstone

Email address: cooperstone.1@osu.edu (preferred contact method)

Phone number: 614-292-2843 (non-preferred contact method)

Office hours: I will hold 2, 1 hour-long virtual office hour sessions during the semester

Prerequisites

You do not need to be an R expert for this class, but I will assume working-level knowledge of R programming. If you have no experience with R, but would still like to take this class, you can. I ask then you get yourself up to speed by taking this free online class https://www.edx.org/course/data-science-r-basics (audit only) before the start of the 3rd week of class. Tips and tricks in R will be scattered throughout the course material.

Course description

This course aims to introduce students to the principles and practice of data visualization. Students will learn fundamental principles of data visualization and create figures that appropriately and ethically represent their data. Data visualizations will be created in the R programming environment, using tools including the grammar of graphics implemented in ggplot2. In the process of creating visualizations, students will also become familiar with data handling and wrangling in R.

Course learning outcomes

By the end of this course, students should successfully be able to:

- Recall and describe the fundamental goals and principles of data visualization.
- Distinguish between good and bad visualizations, and understand how to make those are ineffective more effective.
- Learn to use R, R Markdown, and ggplot to make clear, descriptive, and aesthetic visualization.
- Apply principles learned in class, both theoretical and technical, to create effective visualizations.

HOW THIS COURSE WORKS

Mode of delivery: This course is a hybrid-delivered course where I provide ~ 50 min of lecture material, followed by ~1 hour of recitation activities to do in-class (with assistance from the instructor and the TA). You can attend class in person or virtually via Zoom. You are also welcome to come to class with questions about the weekly videos, or problems you are currently encountering in creating your visualizations.

Attendance and participation requirements: This is a hybrid course, but is taught synchronously, meaning it is expected that you attend class, either in person or virtually (via Zoom) during its meeting time. I will not take attendance. If circumstances require you to miss class, it will be expected you watch the recorded sessions, and catch up on material on your own. I have found that students who attend classes more quickly and completely master course content.

Class recordings: To help you master material, and to better accommodate students, classes will be recorded, and recordings uploaded directly after class to Carmen.

Credit hours and work expectations: This is a **2-credit-hour course**. According to Ohio State policy (go.osu.edu/credithours), students should expect around 2 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 4 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

Required

- There are no required textbooks for this course, though you will find many of the recommend texts and resources very useful.

Recommended/optional books/online resources (all are free)

- R for Data Science by Hadley Wickham and Garrett Grolemund

- Introduction to Data Science by Rafael Irizarry

- Data Visualization with R by Rob Kabacoff

- Data Visualization, A practical introduction by Kieran Healy

- Hands-On Data Visualization by Jack Dougherty and Ilya Ilyankou

- Fundamentals of Data Visualization by Claus O. Wilke

- ggplot2, Elegant Graphics for Data Analysis by Hadley Wickham, Danielle Navarro, and Thomas Lin Pedersen

- Modern Data Science with R by Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton

- R Markdown Cookbook by Yihui Xie, Christophe Dervieux, Emily Riederer

- The tidyverse style guide

- A ggplot2 tutorial for beautiful plotting in R by Cédric Scherer

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, and support for urgent issues is available 24/7.
- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu

- **TDD:** 614-688-8743

Technology skills needed for this course

- Beginner understanding of R (https://www.r-project.org/) and RStudio (https://www.rstudio.com/)
- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)

Required equipment

- Computer: functional computer that enables the download of R and RStudio, has an internet browser, 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

- R: We will use the R programming environment for this class https://www.r-project.org/ (free)
- RStudio Desktop: This IDE (integrated development environment) allows a user-friendly interface with the R programming environment, which we will use in class as well. You must have R before you download RStudio https://www.rstudio.com/products/rstudio/download/ (free)
- 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.

Carmen access

You will need to use BuckeyePass (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).
- 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) 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 FACULTY RESPONSE

How your grade is calculated

ASSIGNMENT CATEGORY	POINTS
Module assignments (4)	40 (10 points per assignment)
Class reflections	20
Capstone assignment	40
Total	**100**

See course schedule below for due dates.

Descriptions of major course assignments

Module assignments

Description: During each module, there will be an assignment to provide practice for the techniques learned in class. Assignments will be posted at least one week prior to their due date, and due dates can be found on Carmen.

Grading: Each part of the assignment will have a certain number of points associated with it, provided along with the assignment. Knit such that code is visible.

Academic Integrity: Students may use class notes and class resource materials. Students are not permitted to collaborate on assignments. Students must complete work on their own.

Class reflections

Description: After each week, you will write a 1 paragraph reflection on the material that was presented in class. This can include your thoughts on how you will use these lessons in your own research and data visualizations, ways in which you have investigated this topic (or expect to) on your own, or what else you'd like to learn in this area. The purpose of this assignment is not to be burdensome, but to keep you engaged in the course material, and providing feedback to me on what parts you've found useful, what you've struggled with, and what you'd like to see more of in the future.

Grading: Reflections will be graded as follows:
- *Full credit*: Reflections thoughtfully engage with course content, demonstrate the student thought about material and how it would (or wouldn't) be relevant to their work and development. This is the level of engagement I expect for this course.

- *Half credit*: Reflections are superficial and demonstrate minimal engagement with the course content. A half credit grade indicates better engagement is required for the next reflection. I do not expect to assign these grades often.

Academic Integrity: Students may use class notes and class resource materials. Students are not permitted to collaborate on assignments. Students must complete work on their own.

Due Date: Reflections are due 1 week after each class. For example, if class is on Tuesday September 1, the reflection for that class is due on Tuesday September 8 by 11:59pm.

Capstone assignment

Description: At the end of the semester, you will complete a capstone assignment where you create a series of visualizations based on your research data, data coming from your lab, or other data that is publicly available. I expect this assignment to be completed in R Markdown, annotated, and knitted into an easy-to-read .html file. I also expect your code to be fully commented such that I can understand what you are doing with each step, and why. You will be required to submit a capstone assignment "plan" by the beginning of November.

Grading: Guidance will be provided for the grading of the capstone assignment. Assignments completed outside R Markdown, or not knitted to a .html are not acceptable. Knit such that code is visible.

Academic Integrity: Students may use class notes and class resource materials. Students are not permitted to collaborate on assignments. Students must complete work on their own.

Late assignments

I expect you will turn assignments in on time. Late assignments are not accepted. If there are extenuating circumstances that prevent you from turning in an assignment on time, please connect with me as soon as possible after such a situation arises for discussion about a possible deadline extension.

Please refer to Carmen for assignment due dates.

Grading scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B

80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

Instructor feedback and response time

I am providing the following list to give you an idea of my 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 assignments, you can generally expect feedback within **7 days**.

- **Email:** I will reply to emails within **48 hours on days when class is in session at the university**.

COURSE SCHEDULE

Refer to the Carmen course for up-to-date assignment due dates.

Module	Topic
1: Principles	Principles of data visualization
1: Principles	Good and bad visualizations
2: Coding fundamentals	R Markdown for reproducible research
2: Coding fundamentals	Wrangling, the basics
2: Coding fundamentals	ggplot 101
2: Coding fundamentals	Themes, labels, facets (ggplot 102)
3: Data exploration	Data distributions
3: Data exploration	Correlations
Capstone prep	Open session, capstone prep
3: Data exploration	Annotating statistics
4: Putting it together	Principal components analysis
4: Putting it together	Manhattan plots, making lots of plots at once
4: Putting it together	Interactive plots
No class, Thanksgiving	Relaxing and eating

4: Putting it together	ggplot extension packages and complexheatmap
4: Putting it together	Capstone assignment open session

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style**: While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility**: Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources**: When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work**: Store your files in a cloud-based system like OneDrive to prevent unintentional data loss. Consider composing your reflections in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic Misconduct/Academic Integrity

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

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, 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 I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If I suspect that a student has committed academic misconduct in this course, I am 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)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (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.

Creating an environment free from harassment, discrimination, and sexual misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.

- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Diversity

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit:

- https://odi.osu.edu/
- https://odi.osu.edu/racial-justice-resources
- https://odi.osu.edu/focus-on-racial-justice
- http://mcc.osu.edu/

In addition, this course adheres to **The Principles of Community** adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at https://go.osu.edu/principlesofcommunity. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (https://equityandinclusion.cfaes.ohio-state.edu/). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at https://equity.osu.edu/.

Counseling and Consultation Services/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 Counseling and Consultation Services (CCS) by visiting 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 through the 24/7 National Suicide Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org

David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor in Columbus. He is available for new consultations and to establish routine care. To schedule with David, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Dr. Schaad, schaad.15@osu.edu, is the CFAES embedded mental health counselor in Wooster. She is available for new consultations and to establish routine care. To schedule with Dr. Schaad, please call 614-292-5766. Students should mention their affiliation with CFAES when setting up a phone screening.

Land Acknowledgement Statement (adapted from Michael V. Drake Institute for Teaching and Learning, https://drakeinstitute.osu.edu/about/mission-vision-values-and-goals)

We would like to acknowledge the land that The Ohio State University occupies is the ancestral and contemporary lands of the Shawnee, Potawatomi, Delaware, Miami, Peoria, Seneca, Wyandotte, Ojibwe and Cherokee peoples. The university resides on land ceded in the 1795 Treaty of Greeneville and the forced removal of tribes through the Indian Removal Act of 1830. We honor the resiliency of these tribal nations and recognize the historical contexts that have and continue to affect the Indigenous peoples of this land.

Safe and Healthy Buckeyes

Health and safety requirements: 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 result in a warning first, and disciplinary actions will be taken for repeated offenses.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. 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. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of our course website (www.datavisualizing.netlify.app) and CarmenCanvas (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)
- Streaming audio and video

- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)
- Collaborative course tools