Data Visualization & Dashboards in Agriculture
ABE 6933 – Special Topics in Agricultural and Biological Engineering
Class Periods: Tuesdays 1:55 pm to 2:45 pm and Thursdays 1:55 pm to 3:50 pm
Location: Frazier Rogers Hall 282
Academic Term: Fall 2024
Three (3) credit hours

Instructor:
Willingthon Pavan
wpavan@ufl.edu
352-294-6736
Office Hours: Wednesday, 9:00 am to 11:00 am, Frazier Rogers Hall – 243 or Zoom (contact to schedule office hours)

Course Description

This course aims to provide students with an understanding of the key principles of data visualization. They will learn to make insightful and persuasive visualizations using various tools and programming languages.
In this course, students will cultivate both creative and technical proficiencies needed to convert raw data into compelling visual reports to foster mutual understanding. Students will be trained in data ingestion, organization, and the art of visual depiction. A particular emphasis will be placed on applying design principles to create straightforward and aesthetically pleasing graphs and dashboards, encapsulating essential findings, messages, or recommendations derived from data analyses. The course will introduce learners to exploratory and explanatory data visualization techniques, equipping the students with the skills for compelling data storytelling.

Course Pre-Requisites / Co-Requisites

1. Basic computer literacy: Students should be comfortable using computers and familiar with basic software applications.
2. Comfort with computers. Basic understanding of Excel functions and the fundamentals of R.
3. Research methods: Some familiarity with research methods could be beneficial, especially for the research data visualization topic.

Course Objectives

By the end of the course, students will be able to:
1. Understand the principles behind effective data visualization.
2. Learn to use visualization tools such as Excel, Tableau, and Power BI.
3. Gain experience in using programming languages like R for data visualization.
4. Analyze and interpret complex data sets.
5. Create visual narratives to convey findings effectively.
6. Employ Git and GitHub for version control and collaborative coding projects.
7. Integrate coding tools with data management systems to streamline data handling processes.

Educational Goals
1. Students can not only assimilate theory but also master its application in practical, everyday situations, thus aiding them in their careers and equipping them to make enlightened social decisions.
2. Develop a passion for learning and a commitment to continuous self-learning and self-improvement.

Required Software and Textbooks

Software:
- Git/GitHub/GitLab
- Sourcetree
- R
- Power Bi
- Microsoft Excel

Textbooks: N/A

Recommended Materials

Various academic articles, books, and resources will be provided along with the recommended sources available at the UF libraries and online:

- Mittal, Mamta, and Nidhi Grover Raheja. *Data Visualization and Storytelling with Tableau.* 1st ed. Milton: Taylor & Francis Group, 2024. Print. https://ufl-flvc.primo.exlibrisgroup.com/permalink/01FALSC_UFL/6ad6fc/alma99384245325306597
- Alby, Tom. *Data Science in Practice*. 1st ed. Boca Raton, FL: CRC Press, 2024. Print. https://ufl-flvc.primo.exlibrisgroup.com/permalink/01FALSC_UFL/6ad6fc/alma99384163526606597
- Po, Laura et al. *Linked Data Visualization : Techniques, Tools, and Big Data*. 1st ed. 2020. Cham: Springer International Publishing, 2020. Web. https://ufl-flvc.primo.exlibrisgroup.com/permalink/01FALSC_UFL/6ad6fc/alma99383943735106597
- Döbler, Mario, and Tim Grössmann. *The Data Visualization Workshop : An Interactive Approach to Learning Data Visualization*. Second edition. Birmingham, UK: Packt Publishing Ltd, 2020. Print. https://ufl-flvc.primo.exlibrisgroup.com/permalink/01FALSC_UFL/6ad6fc/alma990379640980306597
- Kabacoff R. Modern Data Visualization with R. CRC Press; 2024 Mar 29. https://rkabacoff.github.io/datavis/index.html
- Healy K. Data visualization: a practical introduction. Princeton University Press; 2018 Dec 18. https://socviz.co
- VanderPlas J. Python data science handbook: Essential tools for working with data. " O'Reilly Media, Inc."; 2016 Nov 21. https://jakevdp.github.io/PythonDataScienceHandbook
- Wilke CO. Fundamentals of data visualization: a primer on making informative and compelling figures. O'Reilly Media; 2019 Mar 18. https://clauswilke.com/dataviz
- Baruffa O. Big Book of R; 2024 May 11. https://www.bigbookofr.com
- Various academic articles and online resources (to be provided).

Course Schedule

Module	Lecture	Day	Topics	Assignments
	1	22-Aug	Introductions & Ice breaking	Meet & greet
Introduction to Data Visualization	2	27-Aug	What is data visualization and why is it important?	
	3	29-Aug	Types of visualizations: charts, graphs, maps, etc. Overview of tools and technologies. Hands-on.	HW1
Design Principles	4	3-Sep	Color, typography, layout and spacing	
	5	5-Sep	Examples & Exercises.	Quiz1
Version Control	6	10-Sep	Introduction to version control (GIT, GitHub).	
	7	12-Sep	Hands-on activity: Managing projects and data with Git.	HW2
Exploratory data analysis	8	17-Sep	Introduction to Exploratory data analysis (EDA)	
	9	19-Sep	Hands-on activities.	Quiz2
ChatGPT for Data Analysis & Visualization	10	24-Sep	Introduction to ChatGPT, its applications in data analysis, and data visualization.	
	11	26-Sep	Data Analysis and Visualization: Importing datasets, performing basic statistics, data cleaning, and creating	HW3

			simple visualizations (e.g., bar charts, line charts) with practical examples and hands-on exercises.	
Excel for Data Visualization	12	1-Oct	Basic charting features. PivotTables and PivotCharts. Dashboards.	
	13	3-Oct	Examples & Exercises.	Quiz3
Power BI Introduction	14	8-Oct	Getting started with Power BI. Importing data. Visualizations in Power BI.	
	15	10-Oct	Hands-on & Exercises.	HW4
Flexible Week	16	15-Oct	Flexible content/activity.	
	17	17-Oct	Flexible content/activity.	Quiz4
R for Data Visualization	18	22-Oct	Introduction to R and RStudio.	
	19	24-Oct	Basic Plotting with ggplot2. Hands-On Exercise.	HW5
	20	29-Oct	Customizing Visualizations in R.	
	21	31-Oct	Working with Spatial Data. Hands-On Exercise.	Quiz5
RMarkdown & Shiny R (Dashboards)	22	5-Nov	Introduction to RMarkdown (reproducible reports and documents)	
	23	7-Nov	Hands-On Exercise.	HW6
	24	12-Nov	Dynamic Visualizations with shiny.	
	25	14-Nov	Creating Shiny Apps. Building and Deploying Shiny Dashboards. Exercises.	Quiz7
Final Project and Presentation	26	19-Nov	Final Project Presentations	
	27	21-Nov		
	28	3-Dec	Special topic lecture. Project Report Due.	

Attendance Policy, Class Expectations, and Make-Up Policy

Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation. Additional information can be found here: https://gradcatalog.ufl.edu/graduate/regulations/

Please carefully read the following 8 topics pertaining to class expectations and make-up policies:

1. Communications

    General information:
    a. The primary means to get help with a problem, other than office hours, will be the Canvas discussion boards. I will check the board daily to answer inquiries. Other students should feel free to post responses to these questions within the guidelines discussed in the collaboration and course etiquette sections.
    b. Questions about grades or personal issues may be emailed to me at wpavan@ufl.edu or within Canvas. You are welcome to talk with me during office hours or schedule an appointment.
    Expectations: if you have an issue or need help, do not wait to ask about it! Problems are generally easier to solve sooner rather than later. You are expected to contribute to the ongoing constructive feedback that is essential to the learning process.

2. Attendance Policy:

    General information: attendance is not required though summative and cumulative assessments, such as practice quizzes, collaborative teamwork, graded exercises, and participation, will happen during synchronous class meetings (including in an online setting, if any).

Expectations: I will prepare course materials with the expectation that students will attend class synchronously and bring a computer to follow along with any practical implementations.

3. Grading Policy:

   General information: All assignments will have a grading rubric and submissions will be graded based on the assignment's rubric. Students must submit correct and elaborated answers that follow instructions for maximum credit. For assignments that require code, clean, easy-to-read, easy-to-run, and well-commented code is required.
   Expectations: I expect that students will complete all assignments with care, ensure that submissions are complete, and illustrate an understanding of the concepts being assessed.

4. Late Work:

   General information: All submissions are accepted until the assignment solutions are posted but will lose the "on-time" points listed in the rubric.
   Expectations: I will expect students to follow all deadlines. In case of conflict, I expect students to communicate with me and inform me well in advance about any conflicting issues to avoid losing the "on-time" points.

5. Make-Up Policy

   General information:
   a. If you feel that any graded assignment needs to be re-graded, you must discuss this with the instructor within one week of posting grades. If approved, the entire assignment will be subject to complete evaluation.
   b. If you have an academic conflict with any assignment or exam date/time, please let me know well in advance so the necessary changes can be made and make the appropriate accommodations available.
   Expectations: I expect students to communicate with me and inform me well about any conflicts or time/date change requests.
   Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

6. Collaboration

   General information: healthy discussion and collaboration amongst classmates are encouraged to solve individual assignments. The healthy collaboration includes:
   a. discussing and explaining general course material.
   b. discussing assignments for better understanding.
   c. aiding in general programming and debugging issues.
   Expectations: if another student contributes substantially to your understanding of a problem, you should cite this student to let me know your similar interpretations of a problem. You will not be negatively judged for citing another student.

7. Cheating and Plagiarism

   General information: while collaboration is encouraged, you are expected to submit your own work and follow the student honor code. Submitting work completed by another student is considered plagiarism and will be dealt according to university policy. In general, if you do not understand your solution, the work is not your own. Examples of plagiarism include:
   a. copying (or allowing someone to copy), even partially, an assignment solution or program from the course.

     b. submitting material, particularly code, using material taken from another source without proper citation.

     c. obtaining solutions to assignments or exams through inappropriate means.

Expectations: all students should be bound to the honor pledge as indicated in the <u>student honor code</u>. If you are suspected of dishonest academic activity, I will invite you to discuss it further in private. Academic dishonesty will likely result in grade reduction, with severity depending on the nature of the dishonest activity. I must report on academic misconduct with a letter to the department, college, and/or university leadership. Repeat offenses will be treated with significantly greater severity.

8. Course Etiquette

- Be present. This will allow you to get the most out of class time as well as for your classmates to get the most out of their collaborations with you.
- Put your cell phone away unless you are actively using it to further the class activities.
- Be prepared. The readings and videos are carefully chosen to support the in-class activities.
- Listen carefully, and do not interrupt others.
- Give quality feedback. What constitutes "quality" will be discussed in class.
- Respect the opinions of others, even when you disagree.
- Keep an open mind and embrace the opportunity to learn something new.
- Avoid monopolizing the discussion. Give others a chance to contribute and be heard.
- Do not be afraid to revise your ideas as you gather more information.
- Try to look at issues from more than one perspective.
- Respect others by learning and using the name and pronoun they prefer.
- Do not use offensive language.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Quizzes	100 each	30%
Homeworks	100 each	30%
Project Presentation	100	20%
Project Report	100	20%
		100%

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
<u>UF Graduate Catalog</u>
<u>Grades and Grading Policies</u>

Students Requiring Accommodations

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session. Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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://sccr.dso.ufl.edu/process/student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
• Your academic advisor or Graduate Program Coordinator

- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

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: https://registrar.ufl.edu/ferpa.html

Student Complaints
At the University of Florida, we are committed to maintaining a respectful, fair, and academically enriching environment for all students. Under the Student Honor Code and Student Conduct Code (Regulation 4.040 - https://policy.ufl.edu/wp-content/uploads/2021/12/4-040_2021-12-06.pdf), we recognize that issues and disagreements may arise, necessitating a structured and fair process for lodging and addressing complaints.

We encourage students to voice their concerns or grievances in a constructive manner. This can include, but is not limited to, issues related to academic integrity, student conduct, interpersonal conflicts, and other aspects of university life that may impact a student's experience.

To file a complaint, students should follow the prescribed procedures outlined in the Student Honor Code and Student Conduct Code. These procedures are designed to ensure that all complaints are heard, investigated, and resolved in a manner that is just and consistent with the university's values and policies.

The University of Florida values open communication and the well-being of its student community. We are dedicated to addressing concerns promptly and effectively, ensuring that our campus remains a conducive environment for learning, growth, and academic excellence.

Teaching Philosophy: A Lifelong Dream Realized in the Classroom
Embarking on a teaching career has been the realization of my earliest dreams, deeply influenced by my father's commitment to education and the transformative journey it entails. My philosophy is centered around the concept that learning is not simply the acquisition of knowledge; it is a transformative journey that, when successful, imparts knowledge and instills a genuine passion for lifelong learning and problem-solving skills with tangible real-world applications.

Being a professor involves fostering mastery, competency, and transformational learning. I ardently believe in creating an interactive, practical, and energizing teaching environment achieved through a blend of meticulously designed lectures, illustrative case studies, and immersive hands-on activities. My goal is to ensure that students not only assimilate theory but also master its application in practical, everyday situations, thus aiding them in their careers and equipping them to make enlightened social decisions.

My teaching methods are interactive and diverse, encompassing lectures integrated with my research findings to provoke thought and reflection, practical case studies illustrating real-world applications, and collaborative group projects to cultivate teamwork and interpersonal skills.

Openness and accessibility are part of my educational approach. My open-door policy, coupled with the accessibility through various communication platforms, ensures that I am readily available for academic or personal guidance. The essence of my teaching approach is to foster a community-based learning environment that facilitates the most enriching and meaningful learning experiences.

In my dedication to professional growth, I continually seek development opportunities, including completing pedagogy courses, actively participating in interdisciplinary conferences, and rigorously reviewing student

evaluations. This commitment allows me to adapt and refine my teaching strategies to meet the evolving needs of my students, enhance the quality of their education, and remain up to date on developments in my diverse fields of expertise.

Assessing learning in my classes transcends the confines of traditional testing. It delves into project-based assessments, portfolios, and presentations, with a criterion-referenced grading system, spotlighting individual improvement and mastery of material over relative performance.

In my tireless commitment to teaching, I embrace it as a dynamic, ever-evolving journey. I've learned and evolved with each cohort of students over the past 27 years, continually refining my teaching approach to resonate with changing educational landscapes and feedback. Having a multi-disciplinary background, I consider myself well-positioned to adapt and thrive in the ever-changing educational environment, bringing many perspectives and innovative teaching methodologies to the classroom.

I am committed to contributing to the future, inspiring each student to embrace lifelong learning, and fostering an environment that helps intellectual and personal development, thus shaping the future one student at a time.

Campus Resources:
Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

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

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. 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. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/; https://care.dso.ufl.edu.

On-Line Students Complaints*: https://distance.ufl.edu/getting-help/; https://distance.ufl.edu/state-authorization-status/#student-complaint.*