CONTACT INFORMATION

Instructor: Fadel M. Megahed
E-mail: fmegahed@auburn.edu
Office Hours: TR from 1:00 pm – 2:00 pm in 3301L Shelby Center, or by appointment

I am available to answer your questions by email and will usually respond within one working day. Please note it is often difficult to explain your questions using email and therefore, I highly encourage you to take advantage of my availability to answer questions face-to-face during office hours.

COURSE OVERVIEW

As our information infrastructure evolves, our ability to store, extract, and analyze data is rapidly changing. Large, diverse, complex and/or longitudinal datasets are continuously generated from a variety of instruments, sensors and/or computer-based transactions. As the volume, variety, and velocity of data increase, our existing analytical methodologies are stretched to new limits. These changes pose new opportunities for engineering practitioners and researchers. In this course, we will explore how to approach datasets using graphical methods. The focus will be on how to discover new information and/or new questions based on visual techniques. This will include a discussion of the following: a) basics of effective visualization and human cognition, b) good practices and the differences between effective and creative presentations, c) basic plots for continuous, spatial, spatiotemporal and text-heavy datasets, and d) use of software to develop interactive visualizations. Once these basics are covered, participants will approach real-world problems, of their choice, and create new visualizations that provide new insights about the problems and allow for better decision-making or necessitate further confirmatory analysis.

COURSE OBJECTIVES

You can expect to be re-introduced to how data should be explored. You will experience how visualization methods can be used to answer existing questions, thereby corroborating or invalidating preconceptions. In addition to directed exploration, participants will experience first-hand the power of data exploration and visualization to reveal unexpected patterns, trends and exceptions as well as stimulate new perspectives and insights. Even though software will be used, this is not a software training course. Instead, the focus is on understanding the underlying methodology and mindset of how data should be approached, handled, explored, and incorporated back into the domain of interest. At the end of the course, you are expected to:

- Have confidence to explore new data using the exploration/visualization approach;
- Be able to approach and deploy interactive visualization;
- Understand how to identify practically meaningful discoveries;
- Experience the use of state-of-the-art visualization software, and
- Think creatively about data and insights.
TEXTBOOKS

Title: Visual Display of Quantitative Information
ISBN: 9780961392147
Edition: Second Edition
Author: Edward R. Tufte
Publication Date: 2001

Title: Visual and Statistical Thinking
ISBN: 9780961392130
Edition: First Edition
Author: Edward R. Tufte
Publication Date: 1997

Title: Cognitive Style Of Power Point
ISBN: 9780961392161
Edition: First
Author: Edward R. Tufte
Publication Date: 2006

SPECIAL ACCOMMODATIONS

Students who need accommodations are asked to electronically submit their approved accommodations through AU Access and to arrange a meeting during office hours the first week of classes, or as soon as possible if accommodations are needed immediately. If you have a conflict with my office hours, an alternate time can be arranged. To set up this meeting, please contact me by e-mail. If you have not established accommodations through the Office of Accessibility, but need accommodations, make an appointment with the Office of Accessibility, 1228 Haley Center, 844-2096 (V/TT).

If you desire special accommodations for religious and cultural holidays, please contact me during the first two week of classes so that we can work together towards rescheduling any assignments that are affected by these holidays. I am also willing to arrange for extra office-hours to explain any of the course material missed during these holidays (as long as you inform me in the first two weeks of classes).

HONOR CODE

The faculty and students of Auburn University will not tolerate any form of academic dishonesty. We must adhere to the Auburn University student academic honesty code (Title XII), which can be found by clicking here. Anything less than complete adherence to its rules and intent is unacceptable and will be met with the processes defined therein. Honesty in your academic work will develop into professional integrity.

CREDITS

The first two stages of the course are heavily based on Prof. Hanspeter Pfister’s CS 171 Class at Harvard. Other material is based on the classes taught by Miriah Meyer at the University of Utah, Tamara Munzner at the University of British Columbia, Canada, Prof. Pat Hanrahan and Prof.
COURSE COMPONENTS

Lectures: The class meets twice a week for lectures and joint class activities. The class activities are designed to help you master the relevant materials, to work on your homework in groups, and to get you started on your project. The weekly schedule of lectures is provided at the end of this document. Students are expected to bring their laptops (or school laptops from the library) for every class session.

Projects: The best way to learn how to create effective visualizations is by creating them. At the core of the course are three month-long visualization projects. The goal of the projects is to design interactive visualizations that allow you to answer questions you have about some topic of your own choosing. You will acquire the data, design your visualization method, implement the tool, and analyze the results. At the beginning of each project, you will receive a handout that describes the learning goals and evaluation criteria for that project. Graduate students are also required to submit a journal (or conference) style paper that demonstrates the scientific contribution behind their work. Accordingly, your three mini-projects are expected to tackle one large problem of your choice. This is a sample paper highlighting the work of a student team involving a graduate student and an undergraduate student who collaborated for one summer in VT, so it is doable 😊 Note that it would be greatly appreciated if you include a table similar to Table 1 to highlight the contribution of your work.

Homework: The path to a good visualization design in your projects is likely to involve mistakes and wrong turns. It is therefore important to recognize that mistakes are valuable in finding the path to a solution, to broadly explore the design space, and to iterate designs to improve possible solutions. Weekly homework (with the exception of weeks where projects are due) is going to provide an opportunity to learn these design skills and to test your understanding of the material. The homework is designed to support you in the projects.

Reading Assignments: The course schedule includes required weekly readings – you are free to study ahead, but the schedule ensures that you are prepared for the activities in class and the homework. The goal of the reading assignments is to prepare for class, to familiarize yourself with new terminology and definitions, and to determine which part of the subject needs more attention. The homework assignments will contain questions about the mandatory readings. When answering those please be brief and to the point!

ASSESSMENT

- **Projects:** 60%, assessed on meeting the project criteria as described in the project handouts. Individual student grades may be adjusted up or down based on peer assessment.
- **Homework:** 30%, assessed on your individual and on your group reflection submission, as stated above.
- **Participation:** 10% assessed on participation and lecture and lab attendance.
- **Best Project:** The best project submission will be sponsored to present their work in a national conference—provided that the abstract submission is accepted and the work is accepted to a scholarly journal.

**Students have to obtain at least 85% in their project grade to pass the class.** The standard Auburn University grading scale will be followed: A (90% and above), B (80-89%), etc.
| Stage 1: 
Foundations of 
Data 
Visualization | Wk | Date | Topic | Deadlines |
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<td>1-9</td>
<td>Introduction: What is visualization? Why is it important? Course overview</td>
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<td>Visualization Process. Design Iterations. Data Types. Visual Variables</td>
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<td>Maps and Visualizing Spatial Data</td>
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<td>High-Dimensional Data. Filtering. Parallel Coordinates. Glyphs. Aggregation. PCA</td>
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<td>No Class – Spring Break</td>
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