CS 416 Data Visualization

Course Description

Welcome to CS 416: Data Visualization! In this course, you will be introduced to and learn to effectively use tools like Tableau, Excel, and the D3.js library to connect to data sources and effectively display data.

During the first half of the course, you will learn how to make more effective visualizations of data. Not only will you gain deeper insight into the data, but you will also learn how to better communicate that insight to others. You will learn new ways to display data, applying some fundamental principles of design and human cognition to choose the most effective way to display different kinds of data. The programming will be fairly simple during the first half of the course, when you will learn how to use popular applications like Tableau and Excel to connect to data warehouses, how to extract and visualize relevant data, and how sophisticated visualization systems like Tableau work.

In the second half of the course, we'll shift our focus to interactive storytelling. You'll set up interactive web pages similar to those featured on the New York Times website, create visualizations that allow viewers from all backgrounds to interact with data, and gain insight into data through the data's presentation. **The second half of this course will require web programming using JavaScript and the D3.js library**. You will learn about interactive web graphics programming in the Scalable Vector Graphics (SVG) format, as well as some fundamentals of 2-D and some 3-D graphics. In addition to this, you'll learn about human visual perception and how user interface design makes for more effective visualization, manipulation, and understanding. You will also learn some advanced methods for interacting with data through immersive virtual reality interfaces.

Course Goals and Objectives

Upon successful completion of this course, you will be able to:

- Make more effective visualizations for data.
- Understand how fundamental principles of design and human cognition inform effective visualizations.
- Utilize popular visualization applications such as Tableau and Excel.
- Develop web pages that allow others to interact with data.
- Create visualizations using interactive web graphics programming in SVG format, javascript, and D3.js.
- Describe the fundamentals of 2-D and 3-D graphics.
- Summarize advanced methods for interacting with data through immersive virtual reality interfaces.

Textbook and Readings

There is no textbook required for this course. All necessary content will be available in the lectures.

Course Outline

This 4-credit hour course is 12 weeks long. You should invest 10-12 hours every week in this course.

Week	Topics
1	Orientation, overview of visualization, graphics, drawing, photorealism, human perception
2	Data, mapping, charts, glyphs, parallel coordinates, stacked graphs, Tufte's design rules, using color
3	Graphs, networks, tree maps, Principle Component Analysis, multidimensional scaling, packing
4	Visualization systems, Information Visualization Mantra, database visualization, visualization system design
5	Midterm Project submission
6	Midterm Exam
7	Overview and intro to web programming, intro to D3 and selections, D3 chart help
8	Interactive computing, MVC, browsers, event callbacks, interaction design, D3 events, Tooltips, D3 Graphs, D3 transitions, interactive dynamics
9	Narrative structure, narrative layouts, narrative spectrum, Ellipsis
10	Declarative programming, reactive programming, course conclusion
11	Final Project submission
12	Final Exam

MOOC Version and CS 416: Data Visualization Content Mapping

If you have taken the MOOC version of the course, namely *Data Visualization*, below is how the content in that MOOC maps to this course.

MOOC	CS 498: Data Visualization
Data Visualization	Weeks 1-4
Content Original to CS 498: Data Visualization	Weeks 5-12

Assignment Deadlines

For all assignment deadlines, please refer to the **Course Assignment Deadlines, Late Policy, and Academic Calendar** page.

Elements of This Course

The course is comprised of the following elements:

- **Lecture Videos.** In each week, the concepts you need to know will be presented through a collection of short video lectures. You may stream these videos for playback within the browser by clicking on their titles or you may download the videos. You may also download the slides that go along with the videos. **The videos usually total 1.5 to 2 hours each week.** You generally should spend at least the same amount of time digesting the content in the videos. The actual amount of time needed to digest the content will vary based on your background.

- **Orientation Quiz.** The purpose of the Orientation Quiz is to ensure that you have gone through the orientation module and acquired the necessary information about the course before you start it. The Orientation Quiz is a required activity, but it's not part of the course grading. You have unlimited attempts and you need to answer all questions correctly in order to pass it.
- **Graded Quizzes**. Almost every week conclude with a graded quiz. You will be allowed unlimited attempts for each graded quiz with your highest attempt score used toward your final grade. You'll want to be sure you get a **70% or higher** on each quiz. There is no time limit on how long you take to complete each attempt at the quiz. Graded quizzes will be used when calculating your final score in the class.
- **Programming Assignments.** There are 2 total programming assignments in this course. You may invest about 2 hours on the programming assignments. You have unlimited attempts on the programming assignments. For more information about the programming assignments, please read the instructions in respective weeks.
- **Peer Review Assignment.** There is 1 peer review assignment in this course. You may invest about 3 hours on the peer review assignment, and you will be required to grade at least 5 of your classmates' submissions. You have unlimited attempts to submit your peer review assignment before the deadline. For more information about the peer review assignment, please read the instructions on the assignment in its respective week.
- **Projects.** There are 2 projects to complete in this course: the Midterm Project and Final Project. Both will be graded using peer review. For more information about the course projects, please read the instructions in the **Course Projects Information** page, or in Week 5 for the Midterm Project and Week 11 for the Final Project.
- **Proctored Exams**. There are **2** proctored exams in this class. The exams will be proctored via a proctoring service called ProctorU. For more information about ProctorU and the proctor exams, read the **Proctored Exam** page.

Grading Distribution and Scale

Grading Distribution

Assignment	Percent of the Final Grade
Quizzes	8% (1% each)
Assignments (Peer Review and auto-graded)	12% (4% each)
Midterm Project	20%
Final Project	20%
Midterm Exam	20%
Final Exam	20%

Grading Scale

95% A+ 90% A 88% A-

85% B+ 80% B 78% B-

75% C+ 70% C 68% C-

65% D+ 60% D 58% D-

<58% F

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the University of Illinois Student Code for more information.

Academic Integrity

All students are expected to abide by the campus regulations on academic integrity found in the Student Code of Conduct. These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will be actively looking for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on this assignment up to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb: *Keep every typed word and piece of code your own*. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please contact the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.

Late Policy

Late assignments are not accepted unless given approval by the instructor at least 3 days beforehand. Arrangements for submitting late (e.g., sending via Piazza, email, etc...) must be made at the time you request approval for late submission. Submissions submitted late without prior permission will be docked 10% per day late. **You must submit all requests for assignment extensions through the student support email.**