Course Information

Course Name: Data Visualization

Course ID: CIS 568 – Course is fully online

Semester: Spring 2026

Location: Canvas LMS

Time: Week starts on Monday 12PM

Instructor Information

Name: Amir Akhavan Masoumi

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Office Hours: See https://calendly.com/masoumi

Course Description

The growing availability of new data sources, ease of access to big data and improvements in data storage has led to increased demand and reliance on data visualizations across all areas of science and technology. Data visualization is the principal tool for communication of data-driven findings. The goal of this course is to introduce students to data visualization including principles and techniques. Students will learn the value of visualization, specific techniques in data visualization, scientific visualization, and understand how to best take advantage of visual communication methods. The course will cover basic underlying related theoretical concepts, introduction to applications of each visualization method, and development of data visualizations.

Prerequisite: a course in algorithms and data structures

Course Credits: 3

Textbooks:

- Visualization Analysis and Design, Tamara Munzner, AK Peters Visualization Series, CRC Press, Nov. 2014 (**Required**)
  https://www.taylorfrancis.com/books/9780429088902
- Information Visualization: Perception for Design, Colin Ware, Interactive Technologies (4th Edition), 2020 **(Good to have)**
  Chapter 1 of the book is available for online access
- D3 and JS sources (link in Canvas)

AI Usage Policy

In general, the use of artificial intelligence tools, including AI engines, software, or artwork-generating programs, is not permitted for assignments in this course <u>unless explicitly authorized by the course instructor</u>. If such tools, like ChatGPT or similar, are permitted, you must clearly acknowledge their use by citing the AI tool as an external source and providing the specific prompts used to generate the results.

Course Objectives

By the end of the course, students will be able to:

- Explain the importance of data visualization in data analysis, problem-solving, and decision making
- Critique and optimize data visualizations
- Design visualizations <u>with different requirements</u>
- Use web technologies to create visualizations

Communication Plan

Expectations for Electronic Communication

I check my email regularly during the workweek, and you can expect a reply from me within 24 hours. You *may* get an email reply during the weekend, but that would be an exception, not the rule.

I will also communicate through discussions. If the question you ask is of a nature that any other student in the course could benefit from the answer, post the question in the appropriate discussion board forum. I will check the discussion forums daily during the workweek and respond to any questions you may have.

All course-related material including announcements, lecture notes, lecture and lab assignments, grades, etc. can be found on Canvas website.

Check your email and Canvas website frequently on a daily basis for important updates and information.

Assignments and Activities

The assignments and activities of the course will be in 3 different types. Weekly class activities in the form of code completion projects. Concept Map of research papers discussed during the course in addition to textbook material. Visualization Design assignments.

1. Weekly short assignment
2. Readings assessments
3. 4 Major Visualization Assignments
    a. Quick Visualization Methods
    b. HTML, CSS and SVG
    c. Interactive Visualization (D3js)
    d. Interactive Geospatial Visualization (D3js)

Projects

There will be <u>1 semester long project.</u>

Goals: The project help the students develop and improve web-based visualization design from data acquisition to interactive web-based visualization. Almost all real-world visualization projects rely on teamwork, therefore team project aims to help students develop a mindset in the application of their visualization design skills. Each team can have between 1 and 3 members.

Visualization Project: The main goal of this project is to experience data visualization as a developing process. In three milestones, progress should be presented.

Project details:

The semester long project consists of three major phases and presentation recording.
Phase 1 Topic selection and realization of the data in the form of a project.
Phase 2 Prototype design: The static prototype should contain all the views and structure of the final design
Phase 3 Final project implementation as a web application. The final design should be a robust interactive implementation of the design presented in phase 2.

Minimum requirements:

1. All visualizations should be related to the topic and in 1 web page (hosted on GitHub, Render or any other web server)
2. There are 2 options for the design
    Option 1: Three different conventional visualizations which are interconnected (Example: 1 Line chart with sliders, Bar Chart and Geospatial visualization) with data filtration and interaction.
    Option 2: One fully integrated multivariate visualization with data filtration and interaction.
3. Color Brewer must be used for color coding of visualizations. Colors should be consistent and meaningful.
4. The Visualizations should be meaningful (presenting Correlation, Comparison, Trend, Causality or Dynamics)

I will be available for virtual meetings to provide consultation on design and implementation.

Late Policy

For assignments, you have three late days (72 hours) to use as you wish. The assignments/Assessments will be hidden after day **four** and will not be available for submission anymore.

Project milestones are due on the specified deadlines; submitting them late may result in decrease of the score.

The main goal for having strict deadlines and milestones is to keep up with the schedule and make grading fair for all students, so complying with the milestones and deadlines is appreciated.

Grading

- 20% Weekly short Assessments and Reading activities
- 40% Assignments (4 Major assignments)
- 30% Project (Phase 1: 5%, Phase 2: 5%, Phase 3: 5%, Phase 4: 15%)
- 10% Final Exam

Bonus marks will be awarded based on activities and exceptional outputs (details will be described later)

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Students may not elect the P/NC option for a course in Fall 2021. All courses will be evaluated using the UMass Dartmouth grading system as defined here: https://catalog.umassd.edu/content.php?catoid=62&navoid=5015#Grades_and_Grading_System

Course Technologies

The course is based on three types of technologies:

Python-Based libraries: Matplotlib, Seaborn and Altair (Vega)

Web-Based programming: JavaScript libraries (D3 and eCharts), SVG and HTML/CSS (flask/bootstrap)

Visualization Software: DeckGL, KeplerGL, QGIS and Gephi

Academic Integrity

All UMass Dartmouth students are expected to maintain high standards of academic integrity and scholarly practice. A high standard of academic integrity promotes the pursuit of truth and learning and respect for the intellectual accomplishments of others. These are values that are fundamental to the mission of this University. Such values are undermined by academic dishonesty.

The University does not tolerate academic dishonesty of any variety, whether as a result of a failure to understand required academic and scholarly procedure or as an act of intentional dishonesty. All students should read and understand the University's Academic Integrity Policy, which can also be found in the Undergraduate Catalog.

Students must complete their own work. They must not submit work from another source (e.g. another student, a book or other published document, or a website). This includes your own work; if you wrote a document for another course that you are using in this course, you must acknowledge that. You must explicitly acknowledge anything that you did not write yourself for this course. Consequences range from a zero on the assignment to dismissal from the university. In this course, the instructor reserves the right to use the plagiarism detection software including but not limited to SafeAssign.

A student found responsible for academic dishonesty is subject to severe disciplinary action, which may include dismissal from the University.

Syllabus Change Policy

Except for changes that substantially affect the evaluation (grading) of the course, this syllabus is a guide for the course and is subject to change.

Students Behavior

Students are expected to follow the Student Code of Conduct within the classroom settings. Faculty may ask students to leave if the faculty member(s) determines that the code of conduct has been violated and a student is creating an environment that is unsafe or not conducive to learning.

You may not record lectures without the instructor's permission. Please do not cause distractions that detract your fellow students' learning. Cell phones and other electronic devices should be silent.

Attendance Policy

The course will be online (recorded content).

Student Support Service & Campus Resources

Our Student Support Services and Campus Resources are designed to help you succeed academically and personally. Whether you need tutoring, counseling, or assistance with accessibility services, we have resources available to support you. For an extensive and complete list of services, visit our Student Resources Page.

University Academic Policies

These policies are also available in the student handbook on the University website - umassd.edu

- Information on Incompletes

- Student Behavior

- Student Academic Integrity

- Definition of Credit Hour

- Course Withdrawal

- Grade Appeal

- Attendance Policy

- Academic Calendar

- Title IX and Sexual Assault/Harassment

Academic and Technical Support

Tutoring

If you have difficulty and need help with the coursework, please reach out to me. You may also contact the Academic Resource Center.

Technical Help

- 24/7 email, live chat, and phone support for Canvas is available at the CITS Canvas portal.

- Do you need help with other UMass Dartmouth technologies? Please contact CITS.

Add/Drop Dates and Withdrawal Policy

For updated Add/Drop dates refer to UMassD Academic Calendar https://www.umassd.edu/academiccalendar/

For updated withdrawal policy refer to https://www.umassd.edu/bursar/refunds/withdrawal-refund-policy/

Course Schedule

Week	Topics	Readings	Activity/Assignment
1	Introduction	Chapter 1	Data Visualization Story Design
2	Visual Perception and Python based Data Exploration I	Chapter 2	Project Proposal

3	Data abstraction and Python based Data Exploration II	Chapter 3 (3.1-3.5) and Chapter 5 (5.1-5.4)	Assignment 1 (Due: Monday of week 5)
4	HTML, CSS, SVG, JavaScript coding	Online resources	CSS, HTML and SVG Assessment
5	Marks and Channels and Web Applications using D3	Chapter 5 Online resources	Assignment 2 (Due: Monday of week 7)
6	D3 and Geospatial visualization and other Geospatial visualization tools	Chapter 6	Assessment on Chapters 3 to 5
7	Networks, tools, and applications	Chapter 9	Assignment 3 (Due: Monday of week 9) Mid Semester Review Assessment
8	Spring break	N/A	N/A
9	Trees and eCharts	Chapter 9	Project Draft Design Review: Phase 2 (Due: Monday of week 11)
10	Manipulable-view and Multi-view	Chapter 11 and 12	Assessment on Chapters 11 and 12
11	Aggregation and Filtering and Using AI for Aggregation	Chapter 13	Project Development Review (Phase 3)
12	Spatial Data, Cartograms and QGIS	Online resources	Assignment 4
13	Field Data and Paraview, ThreeJS for 3D visualization and Animation	Chapter 8.5	Final Project Submission (Due: Monday of week 14)
14	Focus + Context and Evaluation of Visualizations (D3 scan path design)	Chapter 14 Online resources	Assessment on Chapter 14
15	Explain the Final Exam	No readings	Online Final Exam