Project Overview

This is a group assignment

The goal of the final project for this course is to expose students to the real-world process of researching, designing, and implementing a novel visualization tool. As part of the project, groups of 3 students will work with real datasets, complete a task analysis, design and implement an interactive web-based visualization, solicit and incorporate feedback, and communicate the final project and results through a webpage, research paper, demo video, and in-class presentation.

This project is designed to give students an opportunity to build a visualization tool that relates directly to an area of interest to them. Because of this, it is up to each student to identify and propose a project topic. Students should start thinking about potential topics of interest at the beginning of the semester. Keep in mind that your project should result in a visualization tool that is of use to people in the real world.

Students should think about who they know that could benefit from an interactive, web-based data visualization. You may choose to work directly with a potential end user for their visualization tool—for example, a student group on campus, a PhD student researcher, a professor, a government researcher, or a non-profit—but you do not have to.

We will work on the final project throughout the semester. To keep work on track, the project will be broken into a series of mid-semester deliverables called project milestones (notated pm-##). Additional information and requirements for each project milestone will be released throughout the semester. Final project grades will be an average of the grades received on each project milestone. A grading rubric will be provided for each project milestone rather than for the project as a whole. Details on final project deliverables are below.

Project Requirements

The final deliverables for students' projects include (1) a visualization tool, (2) a demonstration video, (3) a webpage, (4) an in-class presentation, and (5) a final report. Each is described below.

Note: Don't worry if you do not understand all of the terms used below; they will be covered during the course. If you have any questions, please ask!

1. Visualization Tool Requirements
Students will create a custom visualization tool that meets the following criteria.

- **Technology Requirements**
  The final visualization tool must:
    - Be created using D3. Final submissions built using out of the box tools such as Tableau, R Shiny, or Plotly Dash will not be accepted.
    - Be stored in a GitHub Classroom generated repository and hosted using GitHub Pages.
    - Render and run without errors in Firefox or Chrome.
    - Be usable with the latest versions of Firefox and Chrome.
    - Update within 1 second of any user interaction (even if to only display partial results) and remain responsive to user inputs during any calculations. Two considerations will help achieve this goal:
        - Using a dataset of a manageable size (recommended option).
        - Using advanced implementation techniques such as parallelization and advanced rendering (not recommended, but possible).

- **Data Requirements**
  The final visualization tool must visualize data that:
  - Does not contain any private or secure information.
  - Has substance and depth. Very small datasets with only a few attributes (<10) or rows (<10 - 100, depending on number of attributes) will not suffice.
  - Is publicly available (or that you can make publicly available). A user should be able to access the raw data that your visualization shows.
  - Is transparent:
    - Collection method of the data should be available to the user.
    - Any biases in the data should be clearly disclosed by the visualization tool or corrected in pre-processing.

- **Programming Requirements**
  The project code must:
  - Be a collaboration between all team members. Each team member must make meaningful commits to the GitHub repository. Every member can contribute differently, but all must contribute to the code in some way.
  - Use the basic webpage template provided without serious modification. (This template will be provided as part of a project milestone assignment).
  - Be clear and well-structured.
  - Include concise but informative comments which provide information not present in the code itself and that help organize the code.
  - Have proper and consistent indentation (ex. code inside a block should be indented more than code outside a block).
  - Have function and variable names that are descriptive and in camel-case or another consistent scheme.
  - Use let, and const appropriately (var should not be used to declare variables).
  - Terminate expressions with semicolons when applicable.
  - Be modular. This means it is organized into short, reusable functions and there is little to no code duplication.
  - Not include console.log statements, entirely commented out functions or variables, or any other debugging code.

- **Design Requirements**
  The final visualization tool must:
  - Include a minimum of two different views with different visual encodings. Ultimately, how many views and visual encodings are employed will depend on the data and tasks.
  - The two views must be linked/coordinated. A tooltip does not count as a linked view.
  - Be custom designed. The design should not be from an off-the-shelf library and it must not be copied from an existing visualization. Individual visualization components may be copied from elsewhere (with attribution).
  - Represent data through a thoughtful combination of useful existing techniques or a new original technique.
  - Demonstrate appropriate and effective use of basic visual encodings: spatial layout, color, size, shape, etc..
  - Include tooltips.
  - Be interactive, and have no usability issues.
  - Show evidence of iterative improvement.
  - Include appropriate legends and explanatory text.
  - Provide a fair representation of the underlying data.
  - Be aesthetically pleasing and clear.

2. Demonstration Video Requirements

Students will prepare a demonstration video of their visualization tool in action. The video must meet the following requirements.

- **Specification**
  The video must:
  - Be 1–2 minutes long.
  - Include a title slide listing (in this order): 1. Name of the project, 2. Full names of group members, and 3. DS 4200 Fall 2022 — Prof. Ab Mosca, Northeastern University.
  - Be encoded with the H.264/MPEG-4 AVC codec. If necessary, you can use Handbrake (or another tool of your choosing) to convert between formats.
  - Be at least 1920x1080 — 1080p resolution and have a 16x9 aspect ratio. There should be few to no compression artifacts (e.g., text and thin lines should be clearly readable). Letterboxed or upscaled video does not meet these requirements.
  - Be embedded on your web page using the HTML5 <video> tag.
  - Include captions. This resource explains how to include captions in an embedded video, and more details are provided in the Content section below.

- **Content**
  The video must:
  - Include a video screengrab of the final visualization in-action.
  - Clearly step the viewer through how to use the final visualization. This should include enough detail for the viewer to understand the data visualized, what tasks the visualization tool supports, and the visualization tool's visual idioms (encodings, interactions, etc.).
  - Include a clear and audible audio narration.
  - Include subtitles, which you can generate via YouTube, but will need to proofread and edit yourself. (Note: finalized subtitles should be downloaded as a .vtt file).
  - Optionally: include annotations to highlight areas of interest.

3. Webpage Requirements

Students will house their visualization tool on a GitHub Pages webpage. A template for this webpage will be provided in one of the project milestone assignments. The webpage must include the following sections:

- **Title and Authors**
  - Title followed by a list of group members and class information per the provided template.
- **Abstract**
  - Summary of the motivation for the visualization tool and intended use.
- **Visualization**
  - The visualization tool, embedded in the webpage.
- **Demo Video**
  - A demonstration of the visualization tool (specific requirements described above).
- **Visualization Explanation**
  - A high-level explanation of the visualization tool (purpose, data visualized, tasks supported, visual encodings, interactions, etc..).
- **Research Paper**
  - A locally hosted PDF of the final project paper (paper requirements described below).
- **Acknowledgements**
  - A list of where any code, packages/libraries, text, images, designs, slides, etc. that the visualization tool leverages came from. Please see the Academic Integrity Policy for details.

4. In-class Presentation Requirements

Students will prepare an in-class presentation to share their work. The presentation must:
- Be ~10 minutes in duration.
- Include an additional ~2 minutes to answer questions from the audience.
- Include either a live demo of the final visualization, or a pre-recorded video demonstration of the visualization. You may use your webpage demo video, or you can record a new video specifically for your presentation. A demo video is recommended over a live demo. Your demo should not be repetitive of other parts of your presentation.
- Be created using Google Slides and not require any local files. We will use the classroom PC for presentations, so your presentation cannot rely on any files not on the classroom PC.
- Content-wise, the presentation should:
  - Provide an explanation of the domain problem the visualization tool addresses, what tasks the visualization tool supports, of the visual encodings and interactions, etc..
  - Explain the design process at a high-level (Did you make any significant design changes throughout the project? If so, why?)
  - Showoff the hard work you put into your tool and what it can do!

5. Written Report

Students will prepare a written research paper to accompany their visualization tool.
This type of paper is called a design study. The following are some high-level overviews of this type of paper that students may use for reference.
- Syeda et al. (2020)
- Sedlmair et al. (2012)
- Lam et al. (2017)

Like the visualization tool itself, written reports will be iterated on over the course of the semester as parts of project milestone assignments.

The report will be composed utilizing the template for VGTC conferences. The LaTeX template is available on Overleaf — our recommended approach for collaborative paper writing —and both LaTeX or Word are available from IEEE.

Example Projects

For reference, here are some recent examples of final projects from PhD and undergraduate (UG) courses:

CS 7250 Spring 2020 (PhD)
- Loch Prospector: webpage, short paper published at IEEE VIS 2020
- TYPEical for R: webpage, short paper published at IEEE VIS 2020

DS 4200 Fall 2019 (UG)
(This year students were required to make web pages with prose rather than research papers.)
- Bus Delays 2
- Bus Delays 3
- Pedestrian Crossings
- Bike Crashes
- Parking Survey

CS 7250 Spring 2019 (PhD)
- Data Comets: webpage, full paper presented at EuroVis 2020

CS 7260 Fall 2017 (PhD)
- CerebroVis: best poster IEEE VIS 2018, full paper presented at IEEE VIS 2019
- WWOVis: webpage, paper at VIS4DH 2018

Other Example Course Projects
- Student project from 2014 at WPI on MBTA ridership

Other Example Design Studies
- Short papers
  - DebateVis: webpage, short paper presented at IEEE VIS 2020
  - GalStamps: short paper presented at IEEE VIS 2019
- Full papers
  - IDMVis: webpage, full paper presented at IEEE VIS 2018
  - Lineage: webpage, full paper presented at IEEE VIS 2018
  - Overview: full paper presented at IEEE VIS 2014