IN4089 - Data Visualization - Project 1: Information Visualization

Summary

Introduction: In this project, you will carry out a Visualization Design Study. That is *a project in which visualization researchers analyze a specific real-world problem faced by domain experts, design a visualization system that supports solving this problem, validate the design, and reflect about lessons learned in order to refine visualization design guidelines* [1].

Learning Objectives: The goal of this project is to assess to what degree you have mastered LO4: Design suitable visualization systems for a given practical data analysis problem and LO5: Implement visualization systems for a given practical data analysis problem.

Purpose: The project is designed to practice the practical aspects of data visualization. You will use what you have learned in the course to design and implement a information visualization tool. Given the practical direction of the course, the project will contribute 35% of your final grade.

Resources: Look at D3 Intro in the Content tab on Brightspace for some resources on D3 and links to example data repositories. You can refer to Sedlmair et al. [1] for a set of guidelines for good Design Studies. Another helpful read to get started, with many code examples is *Making data visual : a practical guide to using visualization for insight* by Fisher and Meyer, which is also available as ebook in the library[1].

Submission

You will work on your project in **groups of three**. Submit your deliverables to Brightspace through the 'InfoVis Project' assignment. The deadline for the final project and all corresponding deliverables is **Dec. 17th, 2021**.

Deliverables

1. **Software** [group] complete code and networks needed to run your solution in a zip file.
2. **Report** [group] single pdf file (2 pages plus references)
3. **Individual reflection** [individual] single pdf file per group member (max 200 words)
4. **Video presentation** [group] single mp4 video file (max 5 minutes)

Note: all limits are hard limits, everything above the limits will not be graded. E.g., if your video is 10 minutes we will ignore the last 5 minutes.

Assesment Criteria

1. **Software** (40%)
   - Effectiveness (20%): How well does the solution actually work?
   - Technical ingenuity (10%): How far did you go from of-the-shelf examples?
   - Code quality (10%): How well is your code structured? How well documented is it?
2. **Report** (50%)
   - Problem Analysis (10%): How clearly is the problem described in terms of visualization?
   - Justification (10%): How well are the proposed solutions justified?
   - Evaluation (10%): How well is the solution evaluated?
   - Discussion (10%): How well do you asses your solution? What improvements do you identify?
   - Structure and presentation (10%)
3. **Video presentation** (10%)
   - Demo (10%): How well does your software work, how do you link this to your problem description?

[1] https://tudelft.on.worldcat.org/oclc/1018480478

Instructions

In groups of three, perform a Visualization Design Study following Munzners 4-level analysis framework and implement it with D3. In particular, your tasks are

- **Domain situation**. Choose a dataset and related domain problem of your choice. **You define the domain!** The dataset should be complex enough to perform some form of multi-faceted exploration. **Define at least two non-trivial questions that you want to ask the data in the domain language.** Justify why they make sense for a visualization process. Note: you can also work with actual domain experts but it is not expected.
- **Data/task abstraction**
  - Abstract your data (**What**).
  - Abstract your questions to visualization tasks (**Why**).
- **Visual encoding/interaction idioms**/**Algorithm** Design and implement (with D3) a solution (**How**). Justify why your solution makes sense. Evaluate the results and discuss their weaknesses and possible improvements.

Remember, this is an iterative process. Sketch and discuss different ideas before you implement. You can use these in your report. The process of how you design and how you reflect on this is at least as important as the final result.
Use this framework when you discuss with the TAs during the labs.

Implementation [Group]

Implement your solution with D3/HTML/javascript. You can start with typical examples but add some custom aspect for a good grade. Build a system that allows for some multifaceted exploration. A good result **combines** at least a couple of charts and **links** them through interaction. If you can solve your questions with a single chart with no interaction it is very unlikely that you have defined a suitable problem.

Report [Group]

Write a **concise report** describing the project, following a typical research paper format, **no longer than 2 pages** (plus references). Use the provided **EuroGraphics format**. A LaTeX(you can for example use Overleaf as a collaborative writing environment) template is provided alongside this assignment on Brightspace. Look at the assessment criteria to structure your report. Include at least sections on problem analysis/introduction, the proposed and justified solution, evaluation, and discussion/conclusion. Present the result itself only in brief, use the video for full detail. Start the writing early, it will take considerable time and the report accounts for a good amount of your grade.

Individual reflection [Individual]

Submit a brief (max 200 words) individual reflection on the project to indicate what your contribution was.

Video presentation [Group]

Create a short **video/screencast** of no more than **5 minutes** in which you present your project and what you have achieved. Very Briefly introduce the **problem analysis**. Add a **demonstration** of your final visualization in form of a screencast. Make your project shine! Narrate your presentation and explain your work such that an audience that has not seen your project or the project details before-hand can follow along.

Get Started

- Choose a dataset and problem that excites you. Think about your interests and make it personal. This will not only make for a fun and unique project it will also increase your motivation. In any case, your data set should
  - be complex enough to justify the visualization you propose and the methods that you use for the visualization,
  - and have a certain level of complexity. Use multi-faceted data or enrich with data from multiple sources, present the data on multiple levels of detail, e.g. through aggregation/clustering, etc.
  - Preprocessing will probably be unavoidable, so be prepared to do data cleansing, curation, filtering, etc. Remember that this is a visualization course, though. The focus should be on the visualization, not on the preprocessing alone.
- Derive and document important aspects of the data that could be of interest to an analyst. Formulate a set of tasks that an analyst might want to perform with the data, and some specific questions where visualization can play a major role. For example, develop the analysis based on T. Munzner's method shown in class. Make sure that at least some of the tasks and questions require interaction and/or multiple linked views in order to be performed or solved.
- Consider/design various interactive visualization techniques and combinations thereof (e.g. using linked views) that support these tasks, and that are suitable to analyze this data. Justify your choices and discuss marks and visual-channel encodings (as seen in class). Use the lecture material and other sources if needed to justify your choices. Discuss pros and cons of your design choices.Consider showing alternatives you discussed in the design process in the report (e.g., if you made design scribbles).
- Results/evaluation: Go back to the tasks and questions you formulated and use the application you build to make interesting observations about the data. We would expect some none-trivial goals. Document how you came to these observations and how your design or visualization technique was beneficial to your discoveries (or not). Be open and critical here, if you find out at the end that your solution was not optimal stating that and pointing to possibly better solutions is a useful result and will score higher than uncritically stating that you achieved all your goals.

Report guidelines

Note, these guidelines are not exhaustive.

- Do not underestimate the difficulty of technical writing, so reserve enough time for writing the report.
- The paper/report is **not** a manual. The justification of what you did is very important. Do not forget to document it.
- Be precise. It is not sufficient if only you understand what you mean. If the reader cannot understand it, it is usually your fault and not the reader's.
- Use illustrations and screenshots to clarify methods and results.
- Each figure and table should be numbered and accompanied by a caption explaining what the reader sees in the figure or table.
- Refer to figures and tables in the text by using their numbers, for example, "Figure 1 shows...", do NOT use text like " The figure below shows..." . Furthermore, each figure and table must be referenced in the text somewhere.
- Use proper expressions, for example, "don't" should be written as "do not", "it's" as "it is", and so on. The pronoun that goes with "it" is "its" without an apostrophe.
- Spell check, grammar check, and proof read the document before handing it in. Most readers, in particular examiners, will be irritated by poor spelling and poor grammar.
- Do not use material that you did not write yourself. Copy-and-paste without citation, quotation, or reference, is considered plagiarism. Copied material will not be considered as valuable as self-developed content.

References

[1] M. Sedlmair, M. Meyer, and T. Munzner, "Design study methodology: Reflections from the trenches and the stacks," *IEEE Transactions on Visualization and Computer Graphics*, vol. 18, no. 12, pp. 2431–2440, 2012.