

Course Code
COMP 4462

Course Title
Data Visualization

Course Description

This course will introduce visualization techniques for data from everyday life, social media, business, scientific computing, medical imaging, etc. The topics include human visual system and perception, visual design principles, open- source visualization tools and systems, visualization techniques for CT/MRI data, computational fluid dynamics, graphs and networks, time-series data, text and documents, Twitter data, and spatio-temporal data. The labs and the course project will give students hands-on experience to turn their data into beautiful visualizations. Previous Course Code(s): COMP4901F; Prerequisite(s): COMP 2011.

List of Topics

Lecture Notes:

Topic
Introduction
Color and Perception
Visual Design Principles
Visual Design Tasks and Rules
Visual Analytics of Trajectories
Visual Analytics of Multi-Dimensional Data
Text Data Visualization
Graph Visualization

Evaluations

Lab Schedule:

Topic
Introduction to visualization tools and warm-up with MS Excel visualization
Visualization with Tableau and data processing pipeline
Where to find visualizations and interesting datasets?
Data scientist toolbox 1: Python, Jupyter Notebook and Pandas
Data scientist toolbox 2: Pandas and Python visualization
Visualization with Javascript 1: Javascript basics and Observable
Visualization with Javascript 2: Vega-lite and data processing libraries
Visualization with D3.js
Visualization and interaction with D3.js

Textbooks

N/A

Reference books

- Visualization Analysis and Design by Tamara Munzner: [Visualization Analysis and Design \(Links to an external site.\)](#)
- Interactive Data Visualization: Foundations, Techniques, and Applications by Matthew Ward, Georges Grinstein, and Daniel Keim: [Interactive Data Visualization \(Links to an external site.\)](#)
- The visualization handbook
- Information visualization: perception for design
- The visual display of quantitative information
- Envisioning information
- Visual explanations: images and quantities, evidence and narrative

Grading Scheme

Midterm Exams	40%
Top Vis Competition and Essay	10%
Class Activities and Participation	10%
In-Class Exercise and Lab	10%
Final project	30%
Total	100%

Course Intended Learning Outcomes

CLO-1 : Understand human visual system, color, design principles, and core techniques of data visualization.

CLO-2 : Learn to understand domain problems and needs of end users.

CLO-3 : Learn to design, implement and evaluate a visualization system.

CLO-4 : Communicate effectively with domain experts, general public, and different stakeholders in government, academia and industry.

CLO-5 : Analyze social impact and responsibilities as well as possible ethical, legal, security and privacy issues.

Knowledge/Content Related:

Course ILO #1: Understanding the basic concepts and methods in visualization research

Course ILO #2: Understanding the foundations and trends of visualization applications

Academic Skills/Competencies:

Course ILO #3: Design data visualization using various methods through different design activities.

Course ILO #4: Prototype a visualization (visual analytics) system with assorted tools

Course ILO #5: Evaluate data visualization through user studies.

Other Learning Outcomes:

Course ILO #6: Communicate effectively with target users and different stakeholders in academia and industry

Assessment Rubrics

Course Learning Outcome	Exemplary	Competent	Needs Work	Unsatisfactory
Understanding the basic concepts and	Define and clarify the basic visualization	Define and clarify the basic visualization	Define the basic terminologies	Have difficulty in explaining the

methods in visualization research	concepts and methodologies, and provide proper examples for demonstration	concepts and methodologies.	and methodologies in visualization research, have difficulty in clarifying the details, conditions, and contexts.	basic concepts and processes of common design / prototyping / evaluation methods in visualization research
Understanding the foundations and trends of visualization applications	Elicit the history of visualization applications, the key changes, and driving forces, clarify the major challenges and future directions	Elicit the history of visualization applications, and explain the key changes and driving forces	Elicit the history of visualization applications, have difficulty in explaining the key changes and driving forces	Have difficulty in identifying the core values, scopes, challenges, and trends in visualization applications
Design an interactive system using various methods through different design activities	Conduct common design activities, make good use of design tools, and generate clear design insights	Conduct common design activities and make good use of design tools	Conduct common design activities, have difficulty in using design tools	Have difficulty in conducting common activities in design process to generate design ideas
Prototype an interactive system with assorted digital and physical tools	Conduct common prototyping activities, make good use of various prototyping tools, and generate prototypes at different fidelities	Conduct common prototyping activities and make good use of various prototyping tools	Conduct common prototyping activities, have difficulty in using various prototyping tools	Have difficulty in conducting common prototyping activities and using various prototyping tools
Evaluate an interactive system	Design and conduct user studies and data	Design and conduct user studies and data	Design and conduct user study and data	Have difficulty in designing user

through user studies	analysis, make good use of various prototyping tools, and generate good design implications	analysis, and make good use of various prototyping tools	analysis, have difficulty in using various evaluation tools	studies and conducting data analysis
An ability to communicate effectively with target users and different stakeholders in academia and industry	Explain visualization designs / applications to a general audience and handle questions, and make good use of multimedia	Explain visualization designs / applications to a general audience and handle questions	Explain visualization designs / applications to a general audience, have difficulty in handling questions	Have difficulty in explaining visualization designs / applications to a general audience