New York University Tandon School of Engineering
Computer Science and Engineering
Course Outline CS-UY 6313 Information Visualization
FALL 2018
Professor Enrico Bertini
Wed 3:20-5:50pm
2MT, Rm 09.009

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Course Prerequisites

The coursework includes projects that requires some programming using JavaScript and web technologies. While previous knowledge of JavaScript and web technologies is not required, being proficient and comfortable with extensive programming is a fundamental prerequisite for this course. Previous experience with data manipulation and analysis can also help but it is not required.

Course Description

Being able to analyze and present data visually has become one of the most important skills for students who want to work in data science and related fields. Information Visualization teaches you how to design effective interactive visualizations of complex data for data understanding discovery, and presentation.

The course is a blend of theoretical knowledge and practical work aimed at developing a well-rounded set of skills to ideate, design, implement, and evaluate sophisticated data visualization projects. The theoretical part aims at providing a mental model to think about the visualization design space in a principled manner. This includes the theory of *visual encoding*, *human perception* and *visualization techniques*.

The practical part aims at teaching the skills needed to develop effective interactive data visualizations for analysis and presentation. This includes teaching the D3 javascript library and practical labs on *exploratory data analysis*, *sketching*, *design* and *critique*.

The course also includes a series of small practical projects which enable students to gain experience with the development of fully-working interactive visualizations to solve an assigned problem. The work is organized in a way to simulate conditions happening in real-world data analysis and communication projects and includes activities to gain feedback from the instructor and the teaching assistants.

Course Objectives

- Identify what kind of problems visualization can solve
- Explain why and when visualization works
- Develop analytical questions for a data analysis problem and develop appropriate data manipulations and graphs to answer them
- Describe how to evaluate a visualization project: identify the elements of a project that need to be evaluated and strategies to carry out effective evaluations
- Identify the right type of graph for a data analysis and presentation problem based on tabular data
- Identify the appropriate graph for a given problem
- Describe what the limitations of a visualization method are and how they can be overcome
- Recall the set of marks and channels visualization methods can use and describe their advantages and disadvantages
- Describe a visualization in terms of its encoding strategy (marks and channels used) and identify its potential limitations
- Describe the concepts of channel *effectiveness* and *expressiveness* and demonstrate how to apply them in the design and evaluation of data visualizations
- Use appropriate visual representations for problem with geographical, time-oriented and network data

- Develop simple interactive visualizations with D3.js and be able to argue for their effectiveness

Course Structure

The course includes recorded lectures, practical work in class, readings, exercises, and visualization design and development projects.

Textbooks

There is no required texts. However the following books are those that contain most of the information taught in the course:

- Visualization Analysis and Design, Tamara Munzner, CRC Press 2014 (for the theoretical part).
- Interactive Data Visualization for the Web, 2nd Ed., Scott Murray, O'Reilly Media 2017 (for the D3.js tutorials). A digital version of the D3 book is freely available online at: http://shop.oreilly.com/product/0636920037316.do?cmp=af-strata-books-video-product_cj_0636920037316_6754088

Other recommended texts are:

- Design for Information, Isabel Meirelles, Rockport, 2013.
- Readings in Information Visualization, Stuart K. Card, Jock Mackinlay, Ben Shneiderman, Morgan Kaufmann, 1999.
- The Visual Display of Quantitative Information, Edward Tufte, Graphics Press, 2001.
- Information Visualization: Perception for Design, Colin Ware, Morgan Kaufmann, 2012.

You can find the books on Amazon, at the NYU bookstore, and at the Dibner Library.

Course requirements

The course requires:

- Attendance: full attendance of weekly classes;
- Homework: submission of all homework (readings, quizzes, etc.) (see details below);
- Mini-Projects: development and submission of assigned projects;
- Midterm: graded test for midterm.

Grading breakdown:
- Attendance: 10%
- Homework: 30%
- Mini-Projects: 30%
- Midterm: 30%

Attendance

The course requires full attendance of classes for the face to face section of the course and virtual meetings for the online section. Attendance counts as 10% of the final grade (10 points out of 100). Missed meetings result in reduction of attendance points as follows:

Missed Classes	Pt. reduction
1, 2	0
3, 4, 5	3, 4, 5
6 or more	10

For special situations such as sickness, religious festivities, problems with transport, no attendance points will be removed as long as you send your instructor a note via email **before** the class starts. Attendance will be recorded at the beginning or end of each meeting every week.

Weekly Virtual Meetings for Online Section

Students enrolled in the online section of the course must attend weekly meetings. The meetings take place through conference call using Zoom. A link to access the conference call will be shared shortly. Students must attend the weekly meetings and are encouraged to participate actively. Attendance will be taken.

Homework

The course includes three different types of homework:

- **Readings.** To solidify, expand, and deepen the knowledge acquired in class.
- **Quizzes.** To understand what you have have learned and what needs additional explanations from the instructor.
- **Exercises on data visualization practice.** To develop data analysis and visualization design skills.
- **Programming assignments.** To train your programming skills on relevant data visualization problems.

Grading policy

Each assigned homework is evaluated using the following scale:

- **Not satisfactory:** Your grade is decreased of 0.25 points and you need to re-submit the assignment within one week (after getting feedback).
- **Satisfactory:** All good.
- **Excellent:** You get 1 extra point for each excellent submission (for a maximum of 5)!

Late and no submission policy:

Late	Pt. deducted
1 day	0.5
2-7 days	1
Above 7 days	2
No submission	10

Important note on "due dates": it is your responsibility to check that you understand when a given assignment is due. It is never a good justification to say: "*I made a mistake and thought the submission was due ...*". Keep in mind that 12pm is actually noon in the afternoon, not midnight!

Mini Projects

A project consists of an assigned data set and a problem the visualization is supposed to solve. The solution requires designing a solution and implementing it in D3/javascript.

The students will have to submit for each assigned project the following material:

- Design sketches (developed before coding)
- Short description of the design and its rationale
- Working code showing the visualization implemented

(More details will be provided at the time the projects are assigned.)

All students are assigned the same projects so that we will be able to compare and discuss the solutions.

The projects will be easier at the beginning and will gradually increase in complexity as the course progresses.

Peer-Review

As part of the assignment each student will have to review two submissions from other students. The peer-review will be graded with the same criteria used for the rest of the homework.

Midterm Tests

The course includes one graded test administered halfway throughout the course. The test aims at evaluating the knowledge and skills acquired in the course and it will include only questions and exercises on material that has been presented and tested in the weeks before the test.

Schedule

This is the tentative schedule for the course. Note that the schedule may change to adapt to specific needs of the class.

1	Sep 5, 2018	Intro to VIS
2	Sep 12, 2018	Questions, Tasks and Evaluation
3	Sep 19, 2018	Data Abstraction and Transformation
4	Sep 26, 2018	Fundamental Graphs
5	Oct 3, 2018	Marks and Channels
6	Oct 10, 2018	Color
7	Oct 17, 2018	Visualizing Network Data
8	Oct 24, 2018	Visualizing Geolocated Data
9	Oct 31, 2018	Visualizing Temporal Data
10	Nov 7, 2018	Interaction
11	Nov 14, 2018	Mini Projects
12	Nov 21, 2018	Mini Projects
13	Nov 28, 2018	NO CLASS
14	Dec 5, 2018	Mini Projects
15	Dec 12, 2018	Mini Projects

A detailed schedule for this class can be found here: https://docs.google.com/spreadsheets/d/1DviNRKVATa1Phgwq06KXjqavTD6cFaKmWVlg1fWY3EQ/edit?usp=sharing. Note that the schedule may slightly vary during the semester. Make sure to check frequently for possible changes!

Quoting Policy and Collaboration

The work students submit for individual assignments and class projects must be their own original work. When ideas are borrowed from existing work it is necessary to provide citations and a clear statement that describes which part has been adopted and which is original. For homework students are NOT allowed to collaborate with their peers. The submitted homework must be produced and submitted individually.

Academic Dishonesty

It's always annoying having to explain that copying work or cheating is not allowed. I like to totally trust each and everyone of you. But bad things happen and I have to warn you that academic dishonesty is a very serious thing and you might get in very serious trouble if caught cheating. Students caught in dishonest behavior get an F score for the course and are reported to the school.

Moses Center Statement of Disability

If you are student with a disability who is requesting accommodations, please contact New York University's Moses Center for Students with Disabilities at 212-998-4980 or mosescsd@nyu.edu. You must be registered with CSD to receive accommodations. Information about the Moses Center can be found at www.nyu.edu/csd. The Moses Center is located at 726 Broadway on the 2nd floor.