Stevens Institute of Technology
School of Systems and Enterprises: Financial Engineering
FE 550 Data Visualization Applications

Course Description
Effective visualization of complex data allows for useful insights, more effective communication, and making decisions. This course investigates methods for visualizing financial datasets from a variety of perspectives in order to best identify the right tool for a given task. Students will use a number of tools to refine their data and create visualizations, including: R and associated visualization libraries, Ruby on Rails visualization tools, ManyEyes, HTML5 & CSS 3, D3.js and related javascript libraries, Google Chart Tools, Google Refine, and image-editing programs.

Course Outcomes
1. Develop knowledge of tools for visualizing datasets with emphasis on financial datasets.
2. Develop a programmatic understanding of translating data into useful visual forms
3. Develop a critical vocabulary to engage and discuss information visualization
4. Develop an understanding of data visualization theory.
5. Understanding of ethical considerations for data visualization

Required Textbooks
1) Maclean, Malcolm. *D3 Tips and Tricks,* **Available online at: https://leanpub.com/D3-Tips-and-Tricks**
Over 580 pages of tips and tricks for using d3.js, one of the leading data visualization tools for the web. It's aimed at helping you get started and move forward. Includes over 50 downloadable code examples. You can download for free or donate to encourage further development if you wish :-).

2) Yau, Nathan. *Visualize This: The Flowing Data Guide to Design, Visualization, and Statistics.*
Wiley Publishing, 2011. ISBN: 978-0470944882

See your data in new ways

Our world is awash in data. To mean anything, it must be presented in a way that enables us to interpret, analyze, and apply the information. One of the best ways to do that is visually. Nathan Yau is a pioneer of this innovative approach. In this book, he offers you dozens of ideas for telling your story with data presented in creative, visual ways. Open the book, open your mind, and discover an almost endless variety of ways to give your data new dimensions.

● Learn to present data with visual representations that allow your audience to see the unexpected
● Find the stories your data can tell
● Explore different data sources and determine effective formats for presentation
● Experiment with and compare different visualization tools
● Look for trends and patterns in your data and select appropriate ways to chart them
● Establish clear goals to guide your visualizations

Visit the companion web site at www.wiley.com/go/visualizethis for code samples, data files you can download, and interactive examples to show you how visualization works

About the Author
Nathan Yau is a PhD candidate in Statistics at UCLA and a lifelong data junkie. His goal is to make data available and useful to those who aren't necessarily data experts, and he focuses on data visualization and personal data collection. You can follow his visualization experiments at http://flowingdata.com.

3) Tufte, Edward. *The Visual Display of Quantitative Information.* **Cheshire, CT: Graphics Press, 2001. Print. ISBN: 978-0961392147**

The classic book on statistical graphics, charts, tables. Theory and practice in the design of data graphics, 250 illustrations of the best (and a few of the worst) statistical graphics, with detailed analysis of how to display data for precise, effective, quick analysis. Design of the high-resolution displays, small multiples. Editing and improving graphics. The data-ink ratio. Time-series, relational graphics, data maps, multivariate designs. Detection of graphical deception: design variation vs. data variation. Sources of deception. Aesthetics and data graphical displays. This is the second edition of The Visual Display of Quantitative Information. Recently published, this new edition provides excellent color reproductions of the many graphics of William Playfair, adds color to other images, and includes all the changes and corrections accumulated during 17 printings of the first edition.

Optional, but recommended, texts

1) Navarro, Pablo. *Mastering d3.js.* **Packt Publishing, 2014. Print. ISBN: 978-1783286270**
2) Ellis, Byron. *Real Time Analytics.* **Wiley Publishing, 2014. Print. ISBN: 978-1118837917**
Data Sets:
Through the Hanlon Financial Systems Lab, each student enrolled in this course has free access to various historical data sets. See the HFSL Wiki: http://web.stevens.edu/hfslwiki/index.php?title=Main_Page for more details.
Other data sets may be found from various locations across the web, though you may find that the data will need to be "cleaned" before usage in visualization projects and assignments.
These sources include, but are not limited to:

www.nytimes.com
http://lib.stat.cmu.edu/DASL/
http://www.freebase.com/
http://aws.amazon.com/public-data-sets/
http://aggdata.com/free-data

Topically Relevant Websites:
http://visual.ly/
http://flowingdata.com/
http://ilovecharts.tumblr.com/
http://www.visualizing.org/
http://www.informationisbeautiful.net/
http://fivethirtyeight.com/

Grading Policy:
Course grades are calculated precisely based on the following components:
Participation (Discussion and Weekly Exercises): 35%
Assignments: 25% (5% per assignment)
Final Project (broken down by submission component): 40% (5% proposal, 10% prototype,
25% final presentation)
Participation grade will be assigned based on *active participation* in weekly activities and discussions based on readings, exercises, and additional contributions. You will serve yourself well by competing course readings and/or finding alternative readings and relevant contributions to share with class.

Changes in the syllabus:
The instructor may modify or alter the syllabus to make up for lost classes due to weather conditions, health, or other reasons or when he/she feels it would help to attain course objectives, or for any other such reasons.

Notes:
This course uses material in part from the MIT Open Courseware course title *User Interface Design and Implementation.* Miller, Robert. *6.831 User Interface Design and Implementation, Spring 2011*. (MIT OpenCourseWare: Massachusetts Institute of Technology), http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-831-user-interface-design-and-implementation-spring-2011 (Accessed 14 Aug, 2014). License: Creative Commons BY-NC-SA

Week One
In class Exercise(s) each week:
1) User Experience (UX)/User Interface (UI)
2) Visualization

Week Two
-Readings Due:
1) Ch.1, The Visual Display of Quantitative Information: Graphical Excellence
2) Introduction + Ch. 1, Visualize This
3) Segal, Heer: Narrative Visualizations: Telling Stories with Data
-Assignments Due: Biographical Infographic
-In class Exercises

Week Three
-Readings Due: Ch. 2, 3 Visualize This
-In class Exercises

Week Four
-Readings Due:
1) Liu, Cui, Wu, Lu: A Survey on Information Visualization: Recent Advances and Challenges
2) Lin, Fortuna, Kulkarni, Stone, Heer: Selecting Semantically-Resonant Colors for Data Visualization
-Assignments Due: Basic Visualization Design; User Stories
-In class Exercises

Week Five
-Readings Due:
Ch. 4, The Visual Display of Quantitative Information: Data-Ink and Graphical Redesign
Ch. 4 Visualize This
-In class Exercises

Week Six
-Readings Due:
1) Nagel, Maitan, Duval, Moere, Klerkx: Touching Transport - A Case Study on Visualizing Metropolitan Public Transit on Interactive Tabletops
2) Ch. 5 Visualize This
-Assignments Due: Working with Data
-In class Exercises

Week Seven
-Readings Due:
1) Ch. 5, The Visual Display of Quantitative Information: Chartjunk
2) Stephen Few: Effectively Communicating Numbers
-In class Exercises

Week Eight
-Readings Due:
1) Ch. 6, 7 Visualize This
2) Satyanarayan, Wongsuphasawat, Heer: [Declarative Interaction Design for Data Visualization](#)
-Assignments Due: Developing Interactive Visualizations
-In class Exercises

Week Nine
-Readings Due:
1) 6, The Visual Display of Quantitative Information: Data-Ink Maximization and Graphical Design
2) Carpendale: Evaluating Information Visualizations
3) Ch. 8 Visualize This
-In class Exercises

Week Ten
-Readings Due:
1) Ch. 7, The Visual Display of Quantitative Information: Multifunctioning Graphical Elements
2) Ch. 9 Visualize This
-Assignments Due: Networks and Maps
-In class Exercise

Week Eleven
-Readings Due: Ch. 8 The Visual Display of Quantitative Information: Data Density and Small Multiples
-Assignments Due: Final Project Proposal
-In class Exercises

Week Twelve: Project Proposal Design Review
-Assignments Due: Final Project User Interface and Experience refinement
-In class Exercises

Week Thirteen
-Readings Due: Ch. 2, The Visual Display of Quantitative Information: Graphical Integrity
-Assignments Due: Final Project Prototype

Week Fourteen: Finals Period: Final Project Presentations