Department of Technology Management and Innovation
MG-GY 9753 Data Visualization for Business Intelligence
Fall 2018

<u>**Professor**</u>:	Dr. George Lapiotis
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<u>**Office/Hours:**</u>	Thursday 5:00-6:00 [depends on class time] Metrotech Center, Rogers Hall 614
<u>**Class Schedule:**</u>	Thursday 6:00 – 8:30

<u>**Course Pre-requisites:**</u>

(i) Graduate Standing; (ii) familiarity with college statistics and computer programming concepts will be helpful but not mandatory.

<u>**Course Description:**</u>

Huge volumes of data are generated, stored and analyzed to drive complex technical and business decisions by providing actionable insights. To achieve this end-users across the industry, need to visualize the data in diverse representations and perform explanatory and exploratory analysis. The course will provide a graduate-level introduction to Data Visualization, as a human perception-friendly approach to convey concepts and analysis based on appropriately presented field data. It will systematically introduce building blocks, including types of data, visual elements and design approaches with many examples; provide a basic introduction to the latest visualization software tools as well as programming technologies, such as R and D3; and review several case studies of their application in producing business intelligence.

(Please note that this is **not** a programming language course. Students will only be expected to learn how to apply the visualization design principles taught in class using at least one off-the-shelf visualization package. Students with a coding background will be given the chance to work on visualization projects that involve coding only if they choose so.)

<u>**Course Objectives:**</u>

- Explain and motivate the usage of data visualization as a business intelligence tool
- Introduce a systematic background for students to create their own visualization design projects
- Expose to available popular visualization software and provide hands-on experience
- Provide insightful case studies of using Data Visualization in industrial settings

Course Structure:

The course will include lectures, in-class supervised group training exercises, case studies, and will promote interaction between students and between students and instructor. Time permitting, a few selected industry guest speakers will be hosted to present industry use cases from their respective field.

Readings:

Required Text:

- Visualization Analysis & Design, by Tamara Munzner, CRC Press, ISBN: 978-1-4665-0891-0

Optional Reading:

- Edward R. Tufte, The Visual Display of Quantitative Information, 2nd Edition, Graphics Press, ISBN: 978-0961392147

Course Assignments and Grading:

- Class preparation and participation: 10%
- Assignments   20% (create specific visualizations using course-provided data)
- Midterm Project (individual)   20% (design/create your individual visualizations with 1-2 page report, using course-provided data)
- Final Project (individual or groups of 3 max) 50% (design/create individual/group visualizations with a 3-5 page report and presentation, using data from specified public sources)

(Visualization assignments and projects can be created using software tools such as Tableau or other)

Course Topic Outline

Class Date and Topic	Readings, Assignments, & Exams
[Week 1] **Introduction to Visualization – Motivation, Examples, Tools**	• Munzner, VAD Ch. 1, *What's Viz and Why do it?* • Tufte, TVDQI, 2nd Ed., Ch. 1, *Graphical Excellence* • Tufte, TVDQI, 2nd Ed., Ch. 2, *Graphical Integrity* • Statistics Refresher - *Notes*
[Week 2] **Visualization Design I: Data, Perception and Visual Elements**	• Munzner, VAD Ch. 2, *Data Abstraction* • Munzner, VAD Ch. 4, *Analysis & Validation* • Munzner, VAD Ch. 5, *Marks & Channels* • Tufte, TVDQI 2nd Ed., Ch. 6, *Data-Ink Maximization and Graphical Design* • Tufte, TVDQI 2nd Ed., Ch. 7, *Multifunctioning Graphical Elements*
[Week 3] **Visualization Design II: Principles and Empirical Rules**	• Munzner, VAD Ch. 3, *Tasks* • Munzner, VAD Ch. 6, *Rules of Thumb* • Tufte, TVDQI 2nd Ed., Ch. 4, *Data-Ink and Graphical Redesign* • Tufte, TVDQI 2nd Ed., Ch. 8, *Data Density* • Tufte, TVDQI 2nd Ed., Ch. 9, *Aesthetics and Technique in Graphical Data Design*

[Week 4] **Tools for Data Visualization Design and Engineering**		• Notes from training material from Tableau Microsoft BI, Qlik, TIBCO Spotfire, R, Excel • *D3: Data-Driven Documents*, Michael Bostock, Vadim Ogievetsky and Jeffrey Heer
[Week 5] **Visuals for Table Data & High Dimensional Data**		• Munzner, VAD Ch. 7, *Arrange Tables* • Data Analytics Made Accessible, Ch. 5: *Data Visualization* • Notes on *Statistical Correlation*
[Week 6] **Visualizing Spatial, Graphs and Text Data**		• Munzner, VAD Ch. 8, *Spatial Data* • Munzner, VAD Chap. 9, *Arrange Networks and Trees*
[Week 7] **Midterm Project Presentations**		
[Week 8] **Multiple Views & Interactivity**		• Munzner, VAD Ch. 11, *Manipulate View*, • Munzner, VAD Chap. 12, *Facet in Multiple Views* • Tufte TVDQI 2nd Ed., Chap. 8, *Small Multiples*
[Week 9] **Visual Data Reduction and Embedding**		• Munzner, VAD Ch. 13, *Reduce Items & Attributes* • Munzner, VAD Ch.14. *Embed: Focus+Context*
[Week 10] **Color and Time**		• Munzner, VAD Chap. 10, *Map Color and other Channels*

		• Tufte, Envisioning Information, Ch. 5, *Color and Information* • Tufte, Envisioning Information, Ch. 6, *Narratives of Space and Time*
[Week 11] **Visualization for Business Intelligence**		• *Good Charts*, Harvard Business Review • *Storytelling with Data*, by CNK
[Week 12] **Business Intelligence Case Studies I**		• Munzner, VAD Chap. 15, *Analysis Cases Studies* • Industry Case Study: Finance (tentative guest speaker)
[Week 13] **Business Intelligence Case Studies II**		• Storytelling with Data, Ch. 9, *Case Studies* • Industry Case Study: TBD (Telecoms, Digital Advertisement and/or Transportation, based on guest speaker availability)
[Date] **Final Project Presentations**		

Academic Integrity:

All students are responsible for understanding and complying with the NYU Statement on Academic Integrity.

Academic Integrity for Students at NYU

This policy sets forth core principles and standards with respect to academic integrity for students at New York University. Each school at New York University may establish its own detailed supplemental guidelines for academic integrity, consistent with its own culture, and consistent with the University-wide general guidelines described in this document.

At NYU, a commitment to excellence, fairness, honesty, and respect within and outside the classroom is essential to maintaining the integrity of our community. By accepting membership in this community, students take responsibility for demonstrating these values in their own conduct and for recognizing and supporting these values in others. In turn, these values will create a campus

climate that encourages the free exchange of ideas, promotes scholarly excellence through active and creative thought, and allows community members to achieve and be recognized for achieving their highest potential.

In pursuing these goals, NYU expects and requires its students to adhere to the highest standards of scholarship, research and academic conduct. Essential to the process of teaching and learning is the periodic assessment of students' academic progress through measures such as papers, examinations, presentations, and other projects. Academic dishonesty compromises the validity of these assessments as well as the relationship of trust within the community. Students who engage in such behavior will be subject to review and the possible imposition of penalties in accordance with the standards, practices, and procedures of NYU and its colleges and schools. Violations may result in failure on a particular assignment, failure in a course, suspension or expulsion from the University, or other penalties.

Faculty are expected to guide students in understanding other people's ideas, in developing and clarifying their own thinking, and in using and conscientiously acknowledging resources - an increasingly complex endeavor given the current environment of widely available and continually emerging electronic resources. In addition, students come to NYU from diverse educational contexts and may have understandings regarding academic expectations that differ from those at NYU. NYU values and respects all academic traditions; however, while at NYU, students are expected to adhere to the norms and standards of academic integrity espoused by the NYU community and will be assessed in accordance with these standards. Students should ask their professors for guidance regarding these standards as well as style guide preferences for citation of sources for assignments in their courses.

Following are examples of behaviors that compromise the academic and intellectual community of NYU. The list is not exhaustive. Students should consult the websites and guidelines of their individual schools for an extended list of examples and for further clarification.

1. Plagiarism: presenting others' work without adequate acknowledgement of its source, as though it were one's own. Plagiarism is a form of fraud. We all stand on the shoulders of others, and we must give credit to the creators of the works that we incorporate into products that we call our own. Some examples of plagiarism:
- a sequence of words incorporated without quotation marks
- an unacknowledged passage paraphrased from another's work
- the use of ideas, sound recordings, computer data or images created by others as though it were one's own

2. Cheating: deceiving a faculty member or other individual who assess student performance into believing that one's mastery of a subject or discipline is greater than it is by a range of dishonest methods, including but not limited to:
- bringing or accessing unauthorized materials during an examination (e.g., notes, books, or other information accessed via cell phones, computers, other technology or any other means)
- providing assistance to acts of academic misconduct/dishonesty (e.g., sharing copies of exams via cell phones, computers, other technology or any other means, allowing others to copy answers on an exam)

- submitting the same or substantially similar work in multiple courses, either in the same semester or in a different semester, without the express approval of all instructors
- submitting work (papers, homework assignments, computer programs, experimental results, artwork, etc.) that was created by another, substantially or in whole, as one's own
- submitting answers on an exam that were obtained from the work of another person or providing answers or assistance to others during an exam when not explicitly permitted by the instructor
- submitting evaluations of group members' work for an assigned group project which misrepresent the work that was performed by another group member
- altering or forging academic documents, including but not limited to admissions materials, academic records, grade reports, add/drop forms, course registration forms, etc.

3. Any behavior that violates the academic policies set forth by the student's NYU School, department, or division.

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.