CUNY School of Professional Studies

Data 608 – Knowledge and Visual Analytics

Instructor: Samuel Gralnick, Ph.D., PE
Class Meetup: Weekly Zoom to be scheduled
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Course Description

This course is about the creation of high quality Data Visualizations - diagrams, graphs/plots, maps/geographic, tables, etc. - that tell the story or stories hidden in the underlying data. You will learn the skills, techniques and the art of "Story Telling with Data". You will gain the knowledge and experience necessary to source data and use the tools available to you as a Data Practitioner to build high quality Data Visualizations that tell a story, conveying the information that your audience needs to know and wants to hear.

Course Learning Outcomes:

By the end of the course, as a Data Practitioner you will:

- Be able to create high quality data graphics using various libraries (Python, R and/or Java Script), Web Applications, and/or Desktop Applications.
- Understand the quality factors that distinguish high quality data graphics.
- Have developed a "Critical Eye", the ability to discern poor quality and misleading data visualizations as differentiated from those of high quality.
- Be cognizant of the data story process and your role as a data practitioner in identifying the story audience and the required story content, determining the context of the story, and the iterative process of developing high quality data visualizations and accompanying text

Students will be required to:

- Demonstrate their ability to build high quality data visualizations.
- Demonstrate their ability to recognize poor quality and/or misleading visualizations published in online and /or print sources.
- Offer constructive critiques of data graphics produced by classmates in weekly class meetings to help each other improve their data visualization development skills

- Participate actively on Class Discussion Boards both initiating threads of discussion as well as participating in threads initiated by others.

Program Learning Outcomes addressed by the course:

- *Business Understanding*. Learn when analytical and/or probabilistic techniques apply to certain categories of business problems, and be able to build data stories that guide business decisions.
- *Foundational Data Visualization Skills*. Explore and analyze data, build probabilistic and statistical models, and create meaningful data stories using the craft of data visualization.
- *Presentation.* Complete and submit assignments using techniques from the course.

How is this course relevant for Data Practitioners?

Algorithms and models using probabilistic and/or analytical techniques, machine learning and Bayes analysis are the foundation of modern business analyses. This course will ensure that students have a strong understanding of these foundations as they relate to decisions making and the ability to communicate analysis results and conclusions using high quality data visualizations.

Course Prerequisites

The following courses are the listed prerequisites for this course:

Data 602 - Advanced Programming Techniques, which in turn has as its prerequisite

Data 607 - Data Acquisition and Management

Course Outline

Discussion Topics (20%)	Week	Major Assignments (80%)
Introduction & Setup Welcome, Syllabus Review, Course Overview, Assignments & Grading	1	Story - 1 : Infrastructure & Jobs Act Funding Allocation **Due by -** End of Week 2; 10% penalty per day if submitted late
Types of Data Visualizations	2	
Data Visualization Quality Features	3	Story - 2 : Can the FED Control Inflation and Maintain Full Employment? **Due by -** End of Week 4; 10% penalty per day if submitted late
The Importance of Context & KYA (Know Your Audience)	4	
Pre-concious Vision	5	Story - 3 : Do Stricter Gun Laws Reduce Firearms Deaths? **Due by -** End of Week 6; 10% penalty per day if submitted late
Sailence	6	
Emphasis - Effective Use of Color & Fonts	7	Story - 4 : How Much Do We Get Paid? **Due by -** End of Week 8; 10% penalty per day if submitted late
Distributions & Histograms	8	
Project Score Cards & Burn-down Charts	9	Story - 5 : What Is The Effect of The Earth's Temperature On Cyclonic Storms? **Due by -** End of Week 10; 10% penalty per day if submitted late
Multiple Figures	10	
Smoothing	11	Story - 6 : What Is The State of Food Security and Nutrition in the US? **Due by -** End of Week 12; 10% penalty per day if submitted late
Visualizing Empirical Data	12	
Info-graphics	13	Story - 7 : Where Do Strategic Minerals Come From? **Due by -** End of Week 14; 10% penalty per day if submitted late
Dynamic Visualizations	14	
Wrap up.	15	

How This Course Works:

This course is entirely online. Participation in Weekly Course Zoom meet-ups and on the course Discussion Forum is essential and counts for 20% of your grade; major Assignments count for 80%.

Collaboration

Collaboration is encouraged, as it is essential in the workplace, but coding and visualization generation is the individual responsibility of each student.

The use of ChatGPT and other AI tools is encouraged when fully documented and within reasonable bounds. If any work submitted contains analysis, text, or code that is tool generated it must be documented as such.

Grading

This course will be graded using an earned value scheme.

Each Major Assignment will have a maximum numeric earned value of 100 Earned-value-points (EVP). The submission will be graded based on the following percent of earned value Rubric.

Criteria	Story Fails to Meet Expectations (0%)	Story Partially Meets Expectations (50%)	Story Meets or Exceeds Expectations (100%)
Fidelity (20 EVP)	Visualization is not a true representation of the data.	Visualization is only partially true to the data.	Visualization is a high fidelity representation of the data.
Simplicity (10 EVP)	Visualization is overly complicated and/or cluttered with chart junk.	Visualization can be simplified by eliminating unnecessary element.	Visualization is a simple as it can be.
Utility (20 EVP)	The visualization is not fit for purpose. It doesn't tell the story of the data.	The visualization only partially tells the story of the data	The visualization tells the story of the data fully.
Saliency (10 EVP)	The most important message of the story isn't told.	The most important message isn't emphasized.	The most important message is fully emphasized.
Efficacy (20 EVP)	The visualization lacks clarity and is difficult to interpret.	The visualization tells parts of the story and is difficult to interpret.	The visualization tells the story fully and and can be interpreted straight forwardly.
Uniformity (10 EVP)	The story lacks a theme.	The story visualizations violate the story theme unnecessarily.	The story has a theme and the visualizations consistently conform to it.
Amity (10 EVP)	It is impossible for the viewer/reader to understand the story.	The viewer/reader has to work hard to understand the story told by the visualizations.	The viewer/reader will understand the story told by the visualization immediately without effort.

As noted previously participation in weekly Zoom calls and on the Course Discussion Board accounts for 20% of your grade. The following Rubric will be used to value participation

Criteria	Fails to Meet Expectations (0%)	Partially Meets Expectations (50%)	Meets or Exceeds Expectations (100%)
Attends Weekly Zoom Calls (10 EVP)	Absent from calls	Attendance is spotty without justifiable reason	Attendance is consistent and absences are justified
Participates Actively in Zoom Call Discussions (30 EVP)	Attends but doesn't participate	Participates infrequently	Actively participates
Initiates Threads on Weekly Discussion Boards (30 EVP)	Fails to initiate threads	Initiate threads infrequently	Initiates threads almost every week
Comments Meaningfully on Threads Imitated by Others (30 EVP)	Fails to comment on threads initiated by others	Comments infrequently	Comments on almost every thread initiated by others.

Texts, Data Sources and Other References

Recommended Texts

Nussbaumer Naflic, Cole - *Story Telling With Data*; John Wiley & Sons ,(2115)
Available @ https://github.com/Saurav6789/Books-/blob/master/storytelling-with-data-cole-nussbaumer-knaflic.pdf

Wilke, Claus O. - *Fundamentals of Data Visualization*; O'Reilly (2019)
Available @ https://clauswilke.com/dataviz/boxplots-violins.html

Data Visualization Resources

The Data Visualization Catalogue @
https://datavizcatalogue.com/resources.html

Selected Data Sources

US Census @ https://www.census.gov/about/adrm/linkage/guidance.html

Tyler Technologies - Data Insights @ https://dev.socrata.com/

Centers for Disease Control https://data.cdc.gov/

United Nations @ https://data.un.org/

NOAA @ https://www.noaa.gov/nodd/datasets

NOAA - Global Surface Temperature Dataset @

https://www.ncei.noaa.gov/access/metadata/landing-page

/bin/iso?id=gov.noaa.ncdc:C01585

US Bureau of Labor Statistics @ https://www.bls.gov/developers/home.htm

Federal Reserve Board @ https://www.federalreserve.gov/data.htm

Pew Research Center @ https://www.pewresearch.org/download-datasets/

Human Progress Datasets Archive @

https://www.humanprogress.org/datasets/#more-info

GitHub Classroom

GitHub Classroom will be used as a repository for submission of all course assignments. If you are unfamiliar with GitHub and/or GitHub Classroom please review the following tutorials which will guide you through the process.

https://www.youtube.com/watch?v=SWYqp7iY_Tc

https://www.youtube.com/watch?v=8gbKzNlWNAk

Contact

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Online Etiquette and Anti-Harassment Policy

The University strictly prohibits the use of university online resources or facilities, including Blackboard, for the purpose of harassment of any individual or for the posting of any material that is scandalous, libelous, offensive or otherwise against the University's policies. Please see: http://media.sps.cuny.edu/filestore/8/4/9_d018dae29d76f89/849_3c7d075b32c268e.pdf

Academic Integrity

Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the educational mission of the City University of New York and the students' personal and intellectual growth. Please

see: http://media.sps.cuny.edu/filestore/8/3/9_dea303d5822ab91/839_1753cee9c9d90e9.pdf

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