

Data Visualization Course Syllabus

HIMSS in partnership with Alliant International University

Course Overview:

Instructor: Dr. Dexter Francis

Instructor Email: dexter.francis@alliant.edu

Class Location: Canvas [Online] + weekly optional Zoom hour with instructor [online]

Office Hours: Tuesday and Thursday; 5pm to 6pm PST Time

Course Length: 12 weeks [12 modules]

Course Schedule: July 17th – October 8th

Instructor Bio:

Dr. Dexter Francis has worked in the Information Technology field for the last 23 years. He started his career working with electronics, but later decided to change careers and work with computers and software. He is currently the Lead Software Engineer at CACI International, Inc. where they develop and maintain software solutions that collect maintenance data from military aircraft fighters for the Navy and Marine Corps.

For the last eight years, he has taught at several universities as full-time and/or adjunct faculty. He is a business and technology teacher who is passionate about extending educational opportunities to learners from diverse backgrounds. Additionally, he is committed to helping learners identify and develop their own passions while becoming familiar with academic concepts. Lastly, he enjoys speaking at high schools to introduce young minds to the wonderful world of information technology.

Dr. Francis earned his Ph.D. in Information Technology from Capella University. He also earned his MBA from the University of Phoenix (Jacksonville, FL Campus). Lastly, he earned his BS in Electrical Engineering from the University of Florida. As a lifelong learner, he is pursuing a Certified Information Systems Security Professional (CISSP). He is also a member of the following organizations: InfraGrad San Diego, ISC2 San Diego, and PMI California. Lastly, he truly believes that the knowledge and skills he has gained over the years will provide learners with an effective and engaging learning experience.

Course Objectives:

- Evaluate data types and identify relevant visualization methods for communicating modeling and analytic results to management.
- Evaluate alternative programming methods for the production of data and text visualizations.

- Design and program a browser-based presentation that uses open-source software components for organizing, manipulating, and displaying data.
- Design and program a browser-based presentation that employs visualization best practices for data display, color, typography, composition, and narrative.
- Demonstrate techniques associated with data visualizations that show meaningful emerging patterns based on raw text-based, time-series-based, geospatial, and network data sets.

Expected In-class (Online) and Preparation Time per Week:

Weeks	Preparation Time (Readings, Viewings)	Optional Office Hour Time (Discussions, Interactions, Live Demos, QA)
Week 1	8 hours	1 hour (2 sessions available)
Week 2	8 hours	1 hour (2 sessions available)
Week 3	8 hours	1 hour (2 sessions available)
Week 4	8 hours	1 hour (2 sessions available)
Week 5	8 hours	1 hour (2 sessions available)
Week 6	8 hours	1 hour (2 sessions available)
Week 7	8 hours	1 hour (2 sessions available)
Week 8	8 hours	1 hour (2 sessions available)
Week 9	8 hours	1 hour (2 sessions available)
Week 10	8 hours	1 hour (2 sessions available)
Week 11	8 hours	1 hour (2 sessions available)
Week 12	8 hours	1 hour (2 sessions available)
Total Time	96 Hours	12 Hours (@ 1 Session/Week)

Course Overview:

Week 1 – Module 1 – Exploring data visualization in health care.

Week 2 – Module 2 – Data visualizations: Good, Bad, and Misleading.

Week 3 – Module 3 – Types of data visualizations.

Week 4 – Module 4 – Data transformation for visualizations.

Week 5 – Module 5 – Interactive health data visuals.

Week 6 – Module 6 – Data visualizations using Visualize Free from InetSoft.

Week 7 – Module 7 – Data visualizations using Excel.

Week 8 – Module 8 – Data visualizations using Gephi.

Week 9 – Module 9 – Data visualizations using Python and Matplotlib.

Week 10 – Module 10 – Data visualizations using R and RStudio.

Week 11 – Module 11 – Data visualizations using Cytoscape.

Week 12 – Module 12 – Future trend of data visualizations.

Learning Objectives:

Module 1 – Exploring data visualization in health care.

- Learn how different stakeholders within the healthcare industry can use data visualizations to understand complex data quickly
- Develop an understanding of the main types of dashboards: Operational (displaying real-time data), Strategic (showing patterns and trends over time), and Analytical (used for more advanced analytics).
- Understand some of the data visualization tools that are used in healthcare.
- Learn the factors that organizations must consider when selecting a custom software package or a ready-made application.

Module 2 – Data visualizations: Good, Bad, and Misleading.

- Learn art of using data visualizations to tell stories for the healthcare sector.
- Identify the best practices and pitfalls to avoid when selecting or producing data visualizations for a particular audience.
- Learn the three main goals of data visualizations are to explore, monitor, and explain.
- Understand the different approaches that can be used to represent data visually.

Module 3 – Types of data visualizations.

- Learn the primary main types of data visualizations used to translate large amounts of complex information in visual form.
- Identify the primary main types of charts, graphs, and maps to help the students develop an understanding of their implementation in the healthcare sector.
- Learn how bar charts (or bar graphs) are used to reveal large changes over time, and large amounts of information are easily summarized.
- Learn how line charts (or line plot, line graph) connect plotted data points with lines to convey trends over time and compare different data points.
- Learn how heatmaps provide color-coded representations of data that help identify user behavior in the form of hot and cold spots, making it easier to identify trends.

Module 4 – Data transformation for visualizations.

- Understand the five Cs of data visualizations.
- Gain insight into scientific, information, and infographic visualizations.
- Learn how users can draw insights from abstract data that provide an overview showing relevant connections.
- Learn how infographics combine various statistics and visualizations with a narrative to illustrate data.

Module 5 – Interactive health data visuals.

- Learn the three major data visualization goals while reviewing the interactive visualizations.
- Use data visualization tools focused on exploration and fast iterations that help find patterns and insights in the data.
- Understand how tools used in exploration should have strong connections with other tools that extract, transform, and load the data.
- Learn about the various monitoring tools used in dashboards that focus on leading indicators that show information connected to direct actions.

Module 6 – Data visualizations using Visualize Free from InetSoft.

- Learn the basics of data visualization and exploratory data analysis using Visualize Free from InetSoft.
- Evaluate exploratory data to create interactive dashboards, visual analysis, charting, and reporting.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.
- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 7 – Data visualizations using Excel.

- Creating excel dashboards that help users get an insight into their data by simply glancing at the dashboard.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.
- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 8 – Data visualizations using Gephi.

- Learn Gephi an open-source software used for network visualization and analysis.
- Manipulate the structures to reveal patterns and trends intuitively, highlight outliers, and tells stories with their data.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.

- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 9 – Data visualizations using Python and Matplotlib.

- Learn Python and Matplotlib to create informative, customized plots to visually present data in simple and effective ways.
- Create line plots, bar graphs, pie charts, histograms, and many more visuals with Matplotlib.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.
- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 10 – Data visualizations using R and RStudio.

- Learn R programming and R studio to build visualizations and present data for statistical computing and graphics.
- Use ggplot2 to create graphical representations based on The Grammar of Graphics documentation.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.
- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 11 – Data visualizations using Cytoscape.

- Learn Cytoscape an open-source software platform for integrating, visualizing, and analyzing network measurement data.
- Create powerful visualizations that portray functional relationships and experimental responses simultaneously.
- Understand data visualization principles and compelling storytelling.
- Learn to present information and data visually and meaningfully using graphics, images, and dynamic interactive features.
- Use simple visualizations to moderate healthcare datasets to communicate data-driven findings and create custom charts, graphs, and maps.
- Learn a set of tools and concepts that will assist them with optimizing their visualizations and presentation styles.

Module 12 – Future trend of data visualizations.

- Learn about the trends in data visualizations as technology advances and evolves over time.

- Understand the key factors that must take place for data visualization to become more widespread in the future.
- Learn how user experience and data visualizations merge workflows with actionable insights, suggestions, predictions, and best subsequent actions.
- Learn how data democratization changes accessibility because no data boundaries exist.

Questions and Answers:

Is this course primarily theory and didactic lessons or does it include hands-on application of the data visualization principles being taught?

While these are self-paced courses, we'll have the instructor overseeing and tracking the course. The instructor will also have optional weekly scheduled 1-hour zoom office hour meetings in each module where students can follow along while the instructor shows them in brief and discusses via QA how to dive into data and optimize their usage of tooling and modeling features from other tools as determined by the instructor. These will be brief and short walk throughs with Q/A and interactive engaging dialogue with students if they choose to join the instructor in these live sessions each week. The demo session with the instructor will be recorded so that students who did not join can watch them later if they choose to do.

Additionally, each of the 12 modules will end with a Q/A format multiple choice short quiz to help reinforce materials for the students and facilitate their understanding and retention of the proper highlights of the topics in the module. This will also act as a bridge to enable students to move forward to the next module.

What programming languages and data visualizations tools will be used? (and other related tools?)

Since this is a self-paced course and self-sufficient (without a textbook purchased), students are expected to have access to free open-source programming languages and specific statistics packages. The following programming languages and visualization packages will be used: Python, R language, Excel, Cytoscape, and Gephi. Additionally, in the 12 modules of the course there are some data usage and report interpretation contents to enable students to learn skills in data analysis modeling, interpretation, reporting, recommendations, and decision-making within the healthcare context. This data will likely come from sources determined by the instructor. Further, the instructor will be including short weekly demos of all open-source programming languages and data visualizations tools (all free to students) in optional office hours