# CUS 625 Course Project

## Introduction

This project entails an exploration of visualization design requirements as well as construction of an information visualization that supports practical needs.  Information visualization has the potential to improve understanding and decision-making in many fields and disciplines.  Subject to instructor approval, each student is to pick a project context to frame the application of the concepts and skills learned in this course. Students are encouraged to consider this effort as a means to augment the capstone project necessary for completion of the Masters degree in Data Mining and Predictive Analytics.

This project will be comprised of milestones that have deadlines throughout the semester.  The milestones are listed in this document.  The deliverable dates will be communicated during class and will be on Blackboard.

Visualization can be facilitated by a number of tools.  Students are not restricted in using any particular software application or development toolkit.  Tableau Desktop has been procured for you use, but you are welcome to locate and use alternatives that support the interactive visualization and navigation principles discussed in this course.

The project will culminate in a final report and presentation.  There are no other assignments for this course, and this project contributes significantly to the student's final grade.  The expectation is that this project will yield professional quality results. Students should consider including project work products into their professional portfolio.

## Milestones

### Milestone 1 - Establishing the Visualization Context
Identify a topic within a domain/discipline/practice to be the focus of an interactive visualization.  Identify five understanding and/or decision challenges relevant to the chosen topic to be facilitated by using an interactive visualization.

### Milestone 2 – Research and Preparation
Locate and evaluate five topic related and influential visualization research articles written in IEEE, ACM or other peer-reviewed conference proceedings, magazines or journals.  The goal is to become familiar with related current visualization, human

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factors and/or usability efforts, and use these articles to inform personal understanding and advance the design of the student's visualization project.   Locate or generate relevant datasets for this visualization effort.  Make note of any conceptual, accuracy, completeness, or bias issues present in the datasets.  Select and acquire visualization software or a visualization development tool kit.

Using credible knowledge sources beyond the specified five articles that address domain knowledge of the chosen topic, interactive visualization, usability and other design considerations is strongly encouraged.  However, the scope of the research deliverable related to this milestone is limited to the five research articles.  Look at the second and third sections of Milestone 4 for more information on what should be written for the Milestone 2 deliverable.  The deliverable will be a draft of what will appear in the report. It is understood that writing about the incorporation of research ideas into visualization development cannot be done until after Milestone 3 is completed.

## Milestone 3 – Interactive Visualization Design and Development

Develop a functional visualization using the datasets identified in Milestone 2. Document the five understanding and/or decision challenges the visualization enabled. Make note of any specific principles and guidance being incorporated in the design. These notes will be helpful for Milestone 4.  Make note of any dataset corrections, augmentations or compensations implemented in the visualization or through data pre-processing.  Consider how dataset limitations will be conveyed to the user.  If possible, implement a means to convey these limitations within the user interface, or document dataset issues in a style accessible to a professional in the domain/discipline/practice of focus.

The milestone deliverable will consist of a functional visualization and relevant datasets the instructor can experience as well as the documentation of the design notes specified.

## Milestone 4 – Documentation

Write a report that has the sections listed below.  This document should be 25 – 40 pages in length.  Pages should use default MS Word margins, 12 point typeface, 1.5 line spacing within paragraphs, section header style similar to style used in this document, images should take no more than 1/3 of the functional area of a page.  Larger images are permitted, but the expected page count must grow accordingly.  Page estimates for each section can be found in the outline below.

1. Introduction (1.5 pages)
   a. Introduce the chosen domain/discipline/practice.
   b. Describe the five understanding and/or decision challenges chosen and enabled by the visualization.
2. Literature Analysis (4.5 pages)
   a. Identify the scholarly articles located for this project.

      b.  Summarize the ideas they introduce.

      c.  Evaluate the significance of these articles to the developed visualization.

3. Data and Visualization Resources (3 pages)
   a. Data
      i. Discuss the data sources.
      ii. Discuss the nature of the data (e.g. original purpose, significant fields, age of the data, update frequency).
      iii. Discuss the limitations and challenges with the datasets chosen.
   b. Visualization resources
      i. Describe the visualization software or toolkit used.
      ii. Describe the platform(s) used to manage the data and preform the visualization. The platform consists of hardware (CPU and memory), operating system, database (if any) and visualization tools/services/applications.
      iii. Describe the structure of the data view as seen by the visualization software.

4. Visualization Design (6 pages)
   a. Describe the role of users targeted in the visualization design process.
   b. Describe the use environment (i.e. user platform, location (ex. Office, data center, trading floor, on the move), necessary connectivity, and interaction methods.
   c. Describe the prioritized visual perception constraints considered in the design.
   d. Describe the prioritized analytical interactions considered in the design.
   e. Describe the rationale behind the visual analysis techniques chosen for this design.
   f. Describe the analytical value behind any interactive linkages (e.g. filters, highlighting) between displays in any designed dashboard.

5. Walkthrough – A User Introduction (15 pages)
   a. For each understanding or decision challenge provide the following:
      i. Identify the understanding or decision challenge.
      ii. Describe the data necessary to address the understanding or decision challenge.
      iii. Describe the user's objectives while using the visualization.
      iv. Describe a few of the potential visual patterns and their significance to the understanding or decision challenge.
      v. Outline the user's typical interaction sequence followed for this understanding or decision challenge.

6. Discussion (3 pages)
   a. Provide a reflection on what was learned from class and readings.
   b. Discuss the lessons learned from the visualization development experience. Answer the question "Next time… What would I do differently if I could design this iteration over again?"
   c. Discuss what work needs to be done to enhance this visualization.

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7. Bibliography (1.5 pages)
   a. Document the knowledge sources used in the creation of this visualization.
      i. Use a consistent bibliographic style. If uncertain which bibliographic style to pick, use the "Communications of the ACM" style.

## Milestone 5 – Presentation

Provide a presentation to the class that does the following:

1. Introduces the visualization context.
2. Demonstrates the visualization enabling the chosen understandings and/or decisions.
3. Assesses the visualization's effectiveness in terms of enabling the chosen understandings and/or decisions, and discusses future work.

# Starting List of Possible Resources

## Relevant Literature

ACM Transactions on Applied Perception
ACM Transactions on Knowledge Discovery and Data
ACM Transactions on Spatial Algorithms and Systems
IEEE Transactions on Visualization and Computer Graphics
IEEE Computer Graphics and Applications Magazine

## Conferences

IEEE Viz
ACM Applied Perception in Graphics & Visualization
ACM Geographical Information Systems
ACM Interactive Surfaces and Spaces
ACM Conference on Human Factors in Computing Systems

## Data Sources

US Census sites
factfinder.census.gov
quickfacts.census.gov
censtats.census.gov
www.census.gov/geography.html

SEC – Public company filings - www.sec.gov/edgard.shtml
US Department of Justice statistics - www.bjs.gov
US Tax statistics  - www.irs.gov/uac/Tax-Stats-2
Bureau of Economic Analysis - www.bea.gov
Bureau of Labor Statistics - www.bls.gov
US Department of Education Statistics - www.ed.gov/rschstat

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US Department of Transportation Statistics  - www.rita.dot.gov/bts
Generic US Government data portal - fedstats.sites.usa.gov
CIA World Factbook  - www.cia.gov/library/publications/the-world-factbook
United Nations managed statistics  - data.un.org
Statistics related to the European Union - ec.europa.eu/eurostat
Organisation for Economic Co-operation and Development  - data.oecd.org

## Software and Toolkits

Tableau Desktop
D3 – Java script library
D3Plus – Java script library
ggplot2 – Extension of R.

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