COLLEGE OF INFORMATION STUDIES

INST 462 (0103) - Introduction to Data Visualization - Spring 2019

Syllabus

- **Term:** Spring 2019
- Online section
- **Instructor:** Sriram **Karthik** Badam, Ph.D. Candidate in Computer Science
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  - **Office:** HBK 2117 (second floor of the Hornbake building, South Wing)
- **Teaching Assistant:** Parv Rastogi (parv@terpmail.umd.edu)
  - **Office hours:** Please contact Parv. He will make sure to meet when it works for you and him.
- **Lecture Slides:**
  - https://drive.google.com/drive/folders/1a_FbqTJ-UW0yF8e7h1Ca3hfuaMOLNBXN
- **Textbook:**
  - Tamara Munzner, *Visualization Analysis and Design*, CRC Press, 2014. (http://www.cs.ubc.ca/~tmm/vadbook/)
    - Free eBook available online at UMD libraries (link)

Introduction

Data visualization is the graphical representation of data to aid understanding, and is the key to analyzing big data for fields such as science, engineering, medicine, and the humanities. This undergraduate course is an introduction to data visualization, where you will learn how to design, build, and evaluate visualizations for different types of data, disciplines, and domains.

The course has a strong emphasis on design and practical applications of data visualization. The format for the course will be lectures by the instructor and weekly activities determining class participation for this online section as well as a set of practical assignments throughout the course.

Overview and Course Goals

Upon successful completion of the course, students will be able to:

1. Articulate human, visual, and interactive design issues for creating effective visualizations.
2. Use existing visualization tools and techniques to analyze basic datasets.
3. Apply existing techniques from scalar, volume, multidimensional, textual, graph-based, tree-based, and temporal visualization to actual problems and data.
4. Evaluate a visualization solution based on quantitative metrics such as time and error, as well as more complex and qualitative metrics.

5. Articulate issues and techniques for applying visualization to domains such as medicine, finance, science, engineering, the humanities, policy, and government.

Grading

The course outcomes will be assessed through the following mechanisms:

- **Visualization assignments** (80%) - practical assignments on data visualization, including visual and interactive design, cognition, and data transformation.
- **Weekly activities** (20%) - activities following the online lecture such as sketching exercises, readings, discussions on ELMS, etc.

Rubric

Final grades will be assigned using the following categories:

A+ : More than 97.0	A : 93.0 - 96.9	A- : 90.0 - 92.9
B+ : 87.0 - 89.9	B : 83.0 - 86.9	B- : 80.0 - 82.9
C+ : 77.0 - 79.9	C : 73.0 - 76.9	C- : 70.0 - 72.9
D+ : 67.0 - 69.9	D : 63.0 - 66.9	D- : 60.0 - 62.9
F : Less than 60		

Assignments

Biweekly assignments where students work on practical visualization problems will be a major part of the course. These assignments are worth 10% of the final grade each, and are designed to be relatively lightweight. The goal is to expose the student to as many practical visualization techniques and problems as possible. Here is an overview:

- Assignment 1: Infographics - create a simple infographic about your own life and career. (10%)
- Assignment 2: Basic Visualization Design - designing a new visualization technique. (10%)
- Assignment 3: Tableau - use Tableau to analyze multidimensional data. (10%)
- Assignment 4: Gephi - use Gephi to analyze network data. (10%)
- Assignment 5: R and Jupyter Notebooks - use R and/or Python in Jupyter Notebooks. (10%)
- Assignment 6: Data Illustrator - use the Adobe Data Illustrator tool. (10%)
- Assignment 7: Storytelling - create a data-driven story using visualization about a dataset. (20%)

Class Schedule

Week	Topic	Readings & Assignments
1	**Introduction** Course organization Introduction to visualization The visualization pipeline **The Value of Visualization** What's Vis, and Why Do It?	Chapter 1 (VAD)

2	**Data** Why Do Data Semantics and Types Matter? Data Types Dataset Types Attribute Types **Tools I - Tableau**	Chapter 2 (VAD)
3	**Tasks** Why Analyze Tasks Abstractly? Who: Designer or User Actions Targets How: A Preview	Chapter 3 (VAD)
4	**Marks and Channels** Why Marks and Channels? Defining Marks and Channels Using Marks and Channels Channel Effectiveness Relative vs. Absolute Judgments **Validation** Why Validate? Four Levels of Design	Chapter 5 (VAD)
5	**Validation** Angles of Attack Threats and Validation Approaches Validation Examples **Tools 2: Excel (will be provided by Eric Newburger)**	Chapter 4 (VAD)
6	**Design Guidelines** Why and When to Follow Rules of Thumb? No Unjustified 3D No Unjustified 2D Eyes Beat Memory Resolution over Immersion Overview First, Zoom and Filter, Details on Demand Responsiveness Is Required Get It Right in Black and White Function First, Form Next **Tools 3: D3**	Chapter 6 (VAD)
7	**Tables** Why Arrange? Classifying Arrangements by Keys and Values Express: Quantitative Values Separate, Order, and Align: Categorical Regions Spatial Axis Orientation	Chapter 7 (VAD)

	Spatial Layout Density	
8	**Networks and Trees** Connection: Link Marks Matrix Views Costs and Benefits: Connection vs. Matrix Containment: Hierarchy **Tools 4 - Gephi**	Chapter 8 (VAD)
9	**Spatial Data** Why Use Given? Geometry Scalar Fields: 1 Value Vector Fields: Multiple Values Tensor Fields: Many Values **Color** Color Theory Colormaps Other Channels	Chapter 10 (VAD)
10	**Facets and Views** Why Facet? Juxtapose and Coordinate Views Partition into Views Superimpose Layers **Interaction and Navigation** Why Change? Change View over Time Select Elements Navigate: Changing Viewpoint Navigate: Reducing Attributes	Chapter 11, 12 (VAD)
11	**Data Reduction** Why Reduce? Filter Aggregate **Tools 5 - R and Jupyter Notebooks**	Chapter 13 (VAD)
12	**Case Studies** Case studies from VAD and elsewhere. **Tools 6 - Adobe Data Illustrator / Charticulator**	Chapter 15 (VAD)
13	**Textual Data** Words and text visualization Document visualization **Temporal Data** Continuous time-series visualization Discrete event visualization	
14	**Storytelling** Data-driven storytelling Storytelling media	

	Examples of data-driven storytelling **Tools 7 - Idyll**	
15	**Beyond the Desktop** Novel input and output platforms **Collaboration** Collaborative visualization Co-located collaboration Distributed collaboration	
16	Advanced Topics	

Syllabus Change Policy

This syllabus is a guide for the course and is subject to change with advance notice.

Academic Integrity

Academic dishonesty is a corrosive force in the academic life of a university. It jeopardizes the quality of education and depreciates the genuine achievements of others. Apathy or acquiescence in the presence of academic dishonesty is not a neutral act. All members of the University Community - students, faculty, and staff - share the responsibility to challenge and make known acts of apparent academic dishonesty.

Students have a responsibility to familiarize themselves with violations of the Code of Academic Integrity. Among these include:

- Cheating: "Intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise."
- Fabrication: "Intentional and unauthorized falsification or invention of any information or citation in an academic exercise."
- Facilitating Academic Dishonesty: "Intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty."
- Plagiarism: "Intentionally or knowingly representing the words or ideas of another as one's own in an academic exercise."

For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.

Students with Disabilities

The University is legally obligated to provide appropriate accommodations for students with disabilities. The campus' Disability Support Services Office (DSS) works with students and faculty to address a variety of issues ranging from test anxiety to physical and psychological disabilities. If a student or instructor believes that the student may have a disability, they should consult with DSS (4-7682, email dissup@umd.edu). Note that to receive accommodations, students must first have their disabilities documented by DSS. The office then prepares an Accommodation Letter for course instructors regarding needed accommodations. Students are responsible for presenting this letter to their instructors.

Extensions

If you have to miss a deadline, you should inform the instructor as soon as possible, indicating when you will submit your work. The instructor will try to accommodate your needs. You should use this clause only for extraordinary personal reasons (e.g., personal illness, death in the family, etc.). The general policy is that late work will be deducted 20% of its total grade per calendar day, starting on the same day it is due. It is at the instructor's discretion to accept late work and assign late penalties.

Emergency Preparedness

See the following URL: http://www.umd.edu/emergencypreparedness/

Course Evaluation

Course evaluations are a part of the process by which the University of Maryland seeks to improve teaching and learning. The University Senate approved the implementation of a standard, online, University-wide course evaluation instrument. Each course evaluation contains a set of universal questions, and some are supplemented by questions from specific colleges. Students who leave no "Pending" evaluations in their Evaluation Dashboard each semester can view the aggregate results of a sub-set of universal items online. Across the University, course evaluations are being administered through a web-based system dubbed CourseEvalUM. All information submitted to the Evaluation System is confidential. Instructors and academic administrators can only view summarized evaluation results after final grades have been submitted. Instructors and academic administrators cannot identify which submissions belong to which students. This standardized set of evaluation results provides the University with useful information on teaching and student learning across the campus.

For additional info see Student Fast Facts at
https://www.irpa.umd.edu/Assessment/CourseEval/stdt_faq.shtml