

## Scientific Data Visualization CSCI 497N-597N

### Course outcome:

1. Basic understanding of principles of human perception and cognition as related to data visualization.
2. Thorough understanding of structured design process to create effective visualizations.
3. Basic understanding of conceptualization of ideas and interaction techniques using sketching.
4. Ability to evaluate visualization quality, identify and correct problems.
5. Ability to apply visualization techniques such as small multiples and Heat Map to enable visual analytics.
6. Ability to create interactive visualization framework using D3.

### Recommended Textbook:

1. Edward Tufte, *The Visual Display of Quantitative Information*, 2001.
2. Edward Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative*, 1997.
3. Tamara Munzner, *Visualization Analysis and Design*, 2014.
4. Mike Dewar, *Getting Started with D3: Creating Data-Driven Documents*, 2012.

### Proposed Topics:

1. Introduction to Data Visualization
2. Graphical Integrity - Perception, Cognition, Color
3. Design Principles – Navigation, Zooming, Abstraction
4. Data Collection, Processing, and Analysis
5. High dimensional Data Visualization
6. Quantitative Data Visualization
7. Qualitative Data Visualization
8. Data Visualization in R
9. Building Blocks of Data Visualization Framework
10. Visualization for Mobile Devices

### Labs:

Labs will be designed to give students hands-on experience in using state-of-the-art visualization tools that are used in the industry. Following is a list of tentative labs that are proposed:

**Lab1:** Tableau (the most commonly used data analysis and visualization software). This software is free to use for active students and instructors.

**Lab2:** Basics of using R for data visualization.

**Lab3:** Basics of using D3 to create interactive visualizations.

**Lab4:** Time-Series Data Visualization.

**Lab5:** Mobile Data Visualization.

**Lab6:** High-Dimensional Data Visualization.

**Lab7:** Biological Data Visualization.

**Lab8:** Health Data Visualization.

**Assignments:**

**Assignment1:** Computation Biology - Data exploration through visualization in R: Students will design and develop visualizations in R to identify pattern in large biological datasets.

**Assignment2:** Human-Computer Interaction - User Data visualization in D3: Students will design and develop visualizations in D3 to support exploration, analysis, and comparison based on time series and health datasets.

**Assignment3:** High Performance Computing - Web-based visualization in D3: Students will design and develop visualizations in D3 to identify performance anomalies based on datasets collected on large-scale high performance computing clusters.