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**DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING  
NORTHEASTERN UNIVERSITY**

**EECE 5642 Data Visualization  
Fall 2019**

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**Instructor:** This class will be taught by Mr. Zhiqiang Tao

Office: 427 Richards Hall

Email: [zqtao@ece.neu.edu](mailto:zqtao@ece.neu.edu)

Electronic communication: We will use [Blackboard](#) for posting assignments, notes, any on-line discussions, and other forms of electronic communication. It will be assumed that you check your email regularly, and it is your responsibility to make sure that the instructor has a good email address for you. In particular you should make sure that the email address that Blackboard has for you is one you check regularly---you can change it if you wish on Blackboard.

**Prereq.** Basic programming skills, knowledge of fundamental data structures and algorithms

**Teaching Assistant:** Ms. Huixian Zhang, SMILE Lab, Room 427, Richards Hall, Email: [zhang.hu@husky.neu.edu](mailto:zhang.hu@husky.neu.edu)

**Class and Office Hours:**

Class Hours : Tuesday and Friday 03:25 pm - 05:05 pm in Snell Library 035

Office Hours: **TBD**

**Textbook**

Class lecture slides will be provided by the instructor, either printout or electronic file. Students will be asked to find more self-learning content from Internet resources. Recommended textbooks are:

1. The Visual Display of Quantitative Information (2nd edition), Edward Tufte, Graphics Press, ISBN 0961392142.
2. Visualizing Data, Ben Fry, O'Reilly (2007), ISBN: 0596514557.
3. Show Me the Numbers, by Stephen Few, Analytics Press, ISBN: 0970601999.
4. Data Visualization (principles and practice), Alexandru C. Telea., A K Peters, Ltd.
5. Information Visualization (perception for design) (2nd Edition), Colin Ware, Elsevier Press.

**Catalog Course Description:** Introduction to relevant topics and concepts in visualization, including computer graphics, visual data representation, physical and human vision models, numerical representation of knowledge and concept, animation techniques, pattern analysis, and computational methods. Tools and techniques for practical visualization. Elements of related fields including computer graphics, human perception, computer vision, imaging science, multimedia, human-computer interaction, computational science, and information theory. Covers examples from a variety of scientific, medical, interactive multimedia, and artistic applications. Hands-on exercises and projects.

## Grading

Students will be graded on class participation, three assignments, a midterm examination, a midterm project and a final project and presentation. The final grade will be composed as follows:

Class Participation..... 10% Homework..... 30%  
 Midterm Exam..... 10% Midterm Project..... 20% Final Project..... 30%

## Course Topics and Schedules

Week	Date	Tuesday	Friday	HW	Exam
1	Sep 3 & 6	<b>No class</b>	Introduction		
2	Sep 10 & 13	Data Representation	Image Model and Human Vision System	HW 1	
3	Sep 17 & 20	Midterm Project Introduction	Visual Cognition		
4	Sep 24 & 27	Visualization Design 1 & 2	Table and Graph		
5	Oct 1 & 4	Color and Visualization Tools	Dimensionality Reduction	HW 2	
6	Oct 8 & 11	<b>Midterm Project Progress Review</b>	Perception, HW1 Recitation [ <a href="#">Huixian</a> ]		
7	Oct 15 & 18	<b>Proposal Presentations</b>	<b>Exam</b>		Midterm
8	Oct 22 & 25	Interactive Visualization [ <a href="#">Guest</a> ]	Human and Face Visualization [ <a href="#">Guest</a> ]		
9	Oct 29 & Nov 1	Trees & Networks, HW2 Recitation [ <a href="#">Huixian</a> ]	Maps and Geolocation [ <a href="#">Huixian</a> ]		
10	Nov 5 & 8	Midterm Recitation [ <a href="#">Huixian</a> ]	Paper Discussion	HW 3	
11	Nov 12 & 15	Paper Discussion	Paper Discussion		
12	Nov 19 & 22	Image-based Rendering and Beyond [ <a href="#">Guest</a> ]	<b>No lecture (prelim preparation)</b>		
13	Nov 26 & 29	<b>Project Presentations</b>	<b>Project Presentations</b>		
14	Dec 3 & 6	<b>Project Presentations</b>	<b>No class</b>		
15	Dec 10 & 13	<b>Final Report Due at 5pm</b>			Final

\* Guest lecturers will be invited to present some topics if funding is available for honoraria or expenses.

\* Courtesy of Prof. Hanspeter Pfister, Harvard University.

## Midterm Project

The mid-term project is designed for training the basic programming skills for data visualization. The topic of this project will be specifically given and highly related to a machine learning task. Students will learn some basic knowledge about natural language processing and deep learning, and also have a chance to build an entire visualization project from the scratch. Students are required to provide a demo to show their visualization results and a two-page technical report to analyze their experiments. Team work is highly recommended for this project.

## Final Project

The final project has two options: visualization demo design or software tool design. The basic idea of the two directions is the same which is to collect some scientific data and visualize them. The demo design mainly focuses on the visual animations, 2D/3D graphics, video making, and computer vision based visualization techniques. The tool design is mainly to design and implement a visualization tool that can analyze the data with any kind of visualization concepts or formats, summarize some useful results/conclusions, answer questions, and provide suggestions or comments. The data should be real data, which can be either collected by individual or borrowed from somewhere (with permission and acknowledgement). Students can use any API or programming language they like. Students can work on the project by themselves or team up with other students in the class. The team members cannot be more than two.

To grade the final project, three aspects will be considered. 1) proposal presentation (20%); 2) final project presentation (30%); 3) final project report and software package (50%). Late submission without instructor permission may not be considered. Typically, we do not anticipate that the grades for each team member will be different. However, we reserve the right to assign different grades to each team member if the efforts or contributions they make are apparently different and unbalanced. Bonus points may be earned if the project shows significant novelty and large potentials for real-world applications. Those projects may get our guidance for further paper publications.

## Proposals and Reports

Please consider following contents when you prepare for your proposals and final reports:

- Project title
- Team members names, affiliations and emails (one or two members)
- The project option you choose (demo or tool)
- Motivations of the project
- Real-world applications
- Data source and background (in detail)
- Tools and programming languages used in the project
- Contributions of the work (the work by the authors)
- Novelty of the work (optional)
- Visualization techniques (need to present details)
- Division of work for each team member
- Challenges and solutions
- Future work, extensions, improvements
- Additional comments
- References (including all papers, links, source codes, etc.)

## Project Presentations

PPT or PDF slides and demos can be used for final project presentations.

Schedule: TBA

## Submission

The presentation slides, the final report and software package should be submitted to Blackboard on time, **5pm on Dec. 10.**

**Policy**: If submitting latter than 5pm without permission, we will reduce the score with a penalty of 20%. If submitting after midnight of today without permission, we do not count it as a successful submission.