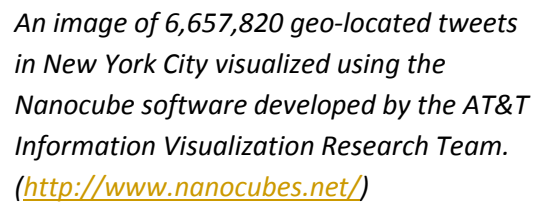


Information Visualization
Fall Semester 2015 – Syllabus

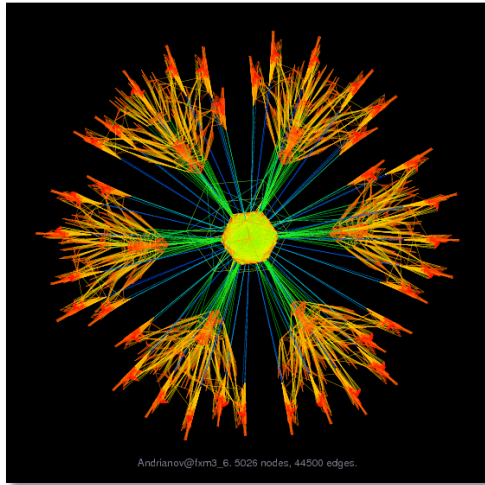
Class: Monday, Wednesday, and Friday 12:00-12:50
Class Room: Fulton Hall 107A

Instructor: Prof. Michael G. Hilgers Ph.D. CQF
Email: hilgers@mst.edu
Phone: 341-6484(office)
Office: Fulton Hall 106D
Office Hours: Monday, Wednesday, & Friday (10:00-12:00) or by appointment
(I can answer many questions by email: hilgers@mst.edu)



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COURSE INFORMATION:



This course is an upper-level exploration of the emerging field of information visualization¹.

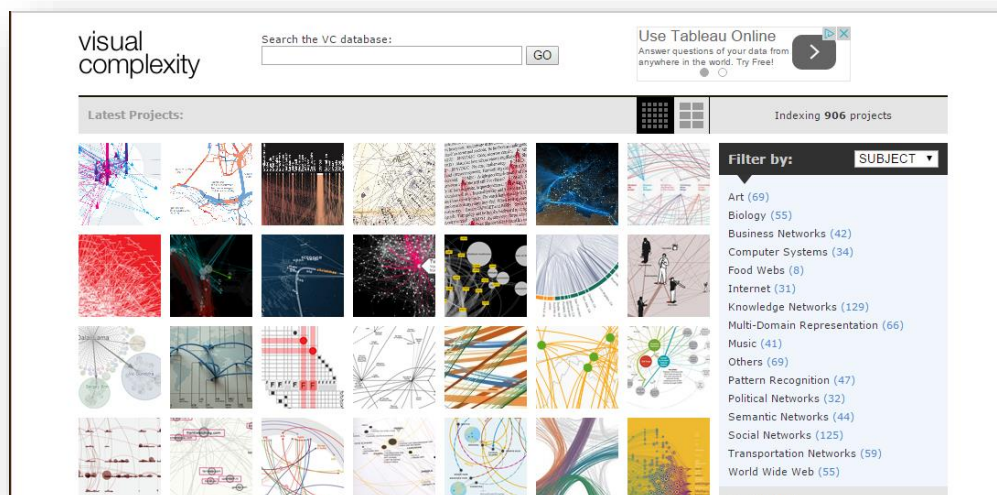
“The goal of data visualization is to provide the viewer an aggregated representation of available data by taking into account human’s visual system and its influence to comprehension. Spotting trends, seeing patterns and identifying outliers are some of the human’s visual system processes that are being manipulated in order to make data more accessible and appealing.”

University of Florida Sparse Matrix Collection

Exploiting the power of human perception is taking us into realms far beyond pie charts and bar graphs. To extend beyond simple representations of data requires a broad spectrum of skills and understanding. Hence, this course will be composed several pedagogical components. We will begin with foundational concepts (such as color space) and specific design approaches. Then we will pursue successful visualizations topologies by example. We will explore case studies of successful visualizations that are representative of modern approaches. Ultimately, we will combine these elements in applications.

Text Book:

We will not use a specific textbook as the internet is full of wonderful free material. You will be given specific reading assignments of selected material drawn from experts in the field.



¹ M. Michalos, P. Tselenti, S. L. Nalmpantix, “Visualization techniques s for Large Datasets”, *Journal of Engineering Science and Technology Review*, 5(1) (2012) 72-76

Tools:

This is not a programming class. This course does not teach how to use a specific software tool. In fact, the more challenging problems will involve prototyping a visualization, which can be done by hand with colored pencils.

The problem is that the 15 to 20 “basic” charts (bar charts, scatterplots, etc.) can be drawn by using numerous programs. A high school student is capable of using these tools to make simple graphs. Our focus is to learn how to create the “non-standard” information visualizations of tomorrow.

For prototyping a visualization, I often use Microsoft PowerPoint. It has a great set of capabilities. I may use some Adobe products.

For programmatic generation of a visualization using data:

- Microsoft Excel
- R is a powerful, widely used suite and it is free. It can be downloaded in its most simple form from: <http://cran.r-project.org/>. This web site has a vast array of supporting material and well worth exploring. RStudio is a great integrated development environment and has been my primary platform. R comes with it if you download it: <http://www.rstudio.com/>.
- Tableau (<http://www.tableau.com/partners>) has some benefits and has an academic license.

COURSE OUTLINE

The course will likely proceed as follows. (Note: Sticking to a precise timeline is difficult.)

Weeks	Topic
1 to 4	Foundational Concepts: color, shape, perception
5 to 8	Specific design considerations
9 to 12	Basic Visualization Topologies plus extensions
13 to 16	Case Studies of Developing Topologies

COURSE ELEMENTS

The course is composed of several elements:

- Basic visualization concepts
- Foundational theory
- Applications

Daily lectures will have a corresponding reading assignment drawn from textbooks, research papers, software documents, or other notes I have supplied.

To supplement this material, we will have papers and visualization prototype projects. In addition, graduate students will perform a literature review and a case study. Elaborating slightly, here are some of the deliverables:

1. Paper: A constructive critique of a published visualization. You will use the principles taught to identify weakness and suggest changes.
2. Prototype Visualization Drawings: Hand-drawn (or tool drawn) image(s) representing the suggested improvements from the first paper. You will not need “real” data to generate the visualization. Rather you will fashion by hand, making in a suggestive prototype.
3. Given a larger project, you will wrangle data and supply me with the refined data set.
4. Visualization: You will combine all you have learned to produce a significant interactive visualization
5. Paper: Literature of review of a topic relevant to class supplied by me.
6. Case Study: An investigation of an emerging topology in big data visualization.

COURSE GRADING

Important Comment: It is very likely that this may change. In the case of a significant change, we will discuss options and vote for approval as a class.

Activity	Worth
Critique Paper	15%
Improved Visualization	15%
Literature Review	15%
Data Wrangling	15%
Interactive Visualization	15%
Case Study	15%
As needed	10%

Grades:

A: 100% - 90%
B: 89% - 80%
C: 79% - 70%
D: 69% - 60%
F: Below 59%

Learning Objectives

Course Objectives	Program Learning Objectives			
	Communication Skills	Critical Thinking	Information Technology	Teamwork & Leadership
To learn and apply the basic methods of information visualization	X	X	X	
To develop an appreciation of information aesthetics				
To use R software to prepare data for visualization		X	X	
To use R software to produce a variety of visualizations		X	X	
To use R to process text and hypertext documents for visualization		X	X	
To learn the basic definitions and theorems of graph theory		X	X	
To become knowledgeable users of graph layout algorithms		X	X	
To be able to recognize and analyze clustering in networks	X	X	X	
To be able to create a wordle visualization	X	X	X	
To be able to create a social network visualization	X	X	X	
To explore other types of large graph techniques		X	X	

COURSE POLICIES

Attendance:

Attendance is required.

Why attend?

- Assignments will be based on the important definitions and concepts presented in the lectures.
- You will likely want to ask questions.
- The class moves quickly and it is easy to fall behind and not get caught up.
- The more you miss class, the more material that will be foreign to you.
- If a student has missed an extended or excessive amount of classes or has failed to turn in multiple assignments, I will send that student an Academic Alert.
- The alert will be emailed to the student and student's advisor.
- The student must meet with the instructor within three days or the instructor will send out another alert.
- If the student has not met with the instructor after the second alert, the instructor reserves the right to drop the student.
- If emergency circumstances arise, please contact the instructor soon to avoid penalties, and to try to catch up to the rest of the class.

Academic Integrity Statement

(<http://registrar.mst.edu/academicregs/>):

Violations of the University's academic code include, but are not limited to, possession of or use of unauthorized materials during quizzes or tests; providing unauthorized information to another student; or copying the work of another person. Violations may result in academic penalties in addition to receiving an "F" on the assignment in question. (See page 30 of S&T's "Student Academic Regulations" handbook for further details about student standards of conduct relative to the system's Collected Rules and Regulations section 200.010.)

Academic Alert System

(<http://academicalert.mst.edu/>):

S&T is committed to the success of its students by providing an environment conducive to teaching and learning. To ensure that every student takes full advantage of the educational opportunities and support programs on campus, the University has implemented an Academic Alert System, a web-based application. The purpose of the System is to improve the overall academic success of students by:

- Improving communication between students, instructors, and advisors;
- Reducing the time required for students to be informed of their academic status;
- Informing students of actions they need to perform in order to meet the academic requirements in the courses they are taking.

To assist you, I will initiate an academic alert for students who are not meeting academic course requirements through poor performance on assignments or poor attendance. When an alert is initiated, an email is immediately sent to the instructor, student, and advisor. You are encouraged to respond quickly to all academic alerts. If you fail to open the alert within one week, email notification is sent to your advisor.

Disability Support Services

(<http://counsel.mst.edu/>):

If you have a documented disability and anticipate needing accommodations in this course, you are strongly encouraged to meet with me early in the semester. You will need to request that the Disability Services staff send a letter to me verifying your disability and specifying the accommodation you will need before I can arrange your accommodation. If you have a disability that might require academic accommodations, please visit Disability Support Services in 204 Norwood Hall (341-4211; dss@mst.edu) very early in the semester.

Classroom Egress Maps

(<http://registrar.mst.edu/links/egress/>):

Please familiarize yourself with the classroom egress maps posted on line so you will know where emergency exits are located.

LEAD Learning Assistance

(<http://lead.mst.edu/>):

The Learning Enhancement across Disciplines Program (LEAD) sponsors free learning assistance in a wide range of courses for students who wish to increase their understanding, improve their skills, and validate their mastery of concepts and content in order to achieve their full potential. LEAD assistance starts no later than the third week of classes. Check out the online schedule at <http://lead.mst.edu/assist>, using zoom buttons to enlarge the view. Look to see what courses you are taking have collaborative LEAD learning centers (bottom half of schedule) and/or Individualized LEAD tutoring (top half of the schedule). For more information, contact the LEAD office at 341-7276 or email lead@mst.edu.

Cell Phones

Students are asked to set phones and pagers to vibrate or silent while in the laboratory. Cell phone use is not permitted. This includes texting. Please remember that voices carry and that speakers using cell phones tend to speak more loudly than normal conversational tones. In general, talking and texting are disrespectful.

With that said, I have had students ask to take a picture of something I had written in class. Provided you ask my permission, I am comfortable with this. Do not take pictures of other student's work.

Title IX

(<http://titleix.mst.edu>)

Missouri University of Science and Technology is committed to the safety and well-being of all members of its community. US Federal Law Title IX states that no member of the university community shall, on the basis of sex, be excluded from participation in, or be denied benefits of, or be subjected to discrimination under any education program or activity. Furthermore, in accordance with Title IX guidelines from the US Office of Civil Rights, Missouri S&T requires that all faculty and staff members report, to the Missouri S&T Title IX Coordinator, any notice of sexual harassment, abuse, and/or violence (including personal relational abuse, relational/domestic violence, and stalking) disclosed through

communication including but not limited to direct conversation, email, social media, classroom papers and homework exercises.

Missouri S&T's Title IX Coordinator is Vice Chancellor Shenethia Manuel. Contact her directly (manuels@mst.edu; (573) 341-4920; 113 Centennial Hall) to report Title IX violations. To learn more about Title IX resources and reporting options (confidential and non-confidential) available to Missouri S&T students, staff, and faculty, please visit <http://titleix.mst.edu>.