SLIS S637 - Information Visualization

Course Information

Jan 10 - May 1, 2012
Lecture: Tuesday 9:30 - 10:45a, LI 030
Lab: Tuesday 11:00a -12:15p, LI030 or LI002

Description

The visual representation of information requires a deep understanding of human perceptual and cognitive capabilities, computer graphics, interface and interaction design, as well as creativity.

Information - such as log files reporting access of webpages or paper-citation network data - is typically non-spatial or abstract and needs to be mapped into a physical space that will represent relationships contained in the information faithfully and efficiently. If done successfully, visualizations can provide a very intuitive and efficient "interface between two powerful information processing systems - the human mind and the modern computer" (Gershom et al., 1998)

This course provides an overview about the state of the art in the emerging field of information visualization. It will highlight the process of producing effective visualizations that take the needs of users into account and illustrate practical visualization procedures. It will cover the

- perceptual basis of information visualization,
- data analysis algorithms that enable extraction of relationships in data,
- major visualization and interaction techniques,
- discussions of systems that drive research and development, and
- future trends and remaining fundamental problems in the field.

The course objective is to give you a working knowledge of how to effectively visualize abstract information and hands-on experience in the application of this knowledge to specific domains, different tasks such as browsing or organizing information for diverse and possibly non-technical users.

The course utilizes a combination of lectures, presentations and discussions, and projects. It also comprises Overview & Discussion sessions that present state of the art tools for the visualization of diverse data sets. There will be in-class presentations of software, and you will work with software packages that have been developed for this course. You will be expected to do weekly readings, to give a presentation of a topic or paper, to participate in class, and to work in teams to leverage strengths of other class members and develop skills for collaborative design.

This course was taught in Spring 2001, 2002, 2003, 2004, 2005, 2006, 2008, 2009, 2010, and 2011, resulting in numerous workshop and conference papers.

Schedule of Topics

Session	Date	Topic
1	10 Jan	**Introduction** Course description & outline, class format, grades, resources. Information Visualization - Overview, history, relation to other disciplines. *Lab:* Introduction to Oncourse. Thinking Machine, The Brain, Visual Thesaurus, Marketmap, Baby Name Wizzard, TextArc, Historical Browser Statistics, ZIPdecode, The Ebb and Flow of Movies, Wordle, Travel Time Tube Map, Travel Time and House Price Maps
	16 Jan	**Due at 12:00 p.m. (noon):**

Project 1:
Personal Profile and Insightful Information Visualizations

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2 17 Jan **Perception for Design**

Readings:

- Ware, C. (2008). Chapter 1 - Visual queries. In *Visual Thinking for Design*. Burlington, MA: Morgan Kaufmann.
- Healey, C. G., & Enns, J. T. (in press). Attention and visual memory in visualization and computer graphics. *IEEE Transactions on Visualization and Computer Graphics*.

Play:

- Psychology Tutorials and Demonstrations
- Fun Things in The Joy of Visual Perception by Pete Kaiser.
- Jim Bumgardner's Colr Pickr, Cindy Brewer's ColorBrewer, and Adobe's Kuler.

Lab:

ManyEyes

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3 24 Jan **Visual Representation and Meaning**

Reading:

- Kuhn, W. (1996). Handling data spatially: Spatializing user interfaces. In M.-J. Kraak & M. Molenaar (Eds.), *Proceedings of 7th International Symposium on Spatial Data Handling, SDH'96, Advances in GIS Research II, published by IGU, Vol. 2* (pp. 13B.1 - 13B.23).
- Ware, C. (2008). Chapter 6 - Visual objects, words, and meaning. In *Visual Thinking for Design*. Burlington, MA: Morgan Kaufmann.

Watch:

Blaise Aguera y Arcas: Jaw-dropping Photosynth demo, TED Talk.

Lab:

TinkerPlots

30 Jan **Due at 12:00 p.m. (noon):**

Project 2:
Complete the human subjects CITI test for Social/Behavioral Researchers (Stage 1)

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4 31 Jan **User Needs, Project Organization**

Reading:

- Pfitzner, D., Hobbs, V., & Powers, D. (2003). A unified taxonomic framework for information visualization. In T. Pattison & B. Thomas (Eds.), *Proceedings of the Asia-Pacific symposium on Information visualisation - Volume 24 (APVis '03)* (pp. 57-66). Darlinghurst, Australia: Australian Computer Society, Inc.
- Shneiderman, B. (1996). The eyes have it: A task by data type taxonomy for information visualizations. *Proceedings of IEEE Symposium on Visual Languages - Boulder, CO* (pp. 336-343).

Lab:

Tableau Public

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5 7 Feb **Data Processing and Analysis**

Reading:

- Keim, D. (2001). Visual exploration of large data sets. *Communications of the ACM, 44*(8), 38-44.
- Reshef, D. N., Reshef, Y. A., Finucane, H. K., Grossman, S. R., McVean, G., Turnbaugh, P. J., Lander, E. S., Mitzenmacher, M., & Sabeti, P. C. (2011). Detecting novel associations in large data sets. *Science, 334*, 1518.

Presentation: Ulrich Houzanme

Lab:

Processing

13 Feb **Due at 12:00 p.m. (noon):**

Project 3:
Visual Perception Principles in Action

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6 14 Feb **Layout and Design for Visualization**

Reading:

- Wainer, H. (2008). Improving graphic displays by controlling creativity. *Chance 21*(2), 46-53.

Presentation: Geng Zhang

Lab:

Final Project client presentations.

20 Feb **Due at 12:00 p.m. (noon):**

Final Project, Part 1:
Brief Project Description

Display Techniques

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7 21 Feb **Temporal, tabular, and multidimensional data displays.**

Reading:

- Friendly, M. (2002). A brief history of the mosaic display. *Journal of Computational and Graphical Statistics, 11*(1): 89-107.
- Chi, E.H., Riedel, J., Barry, Ph., & Konstan, J. (1998). Principles for information visualization spreadsheets. *IEEE Computer Graphics and Applications, 18*(4), 30 - 38. (Sung Pil Moon)

Watch:

Hans Rosling: Debunking third-world myths with the best stats you've ever seen, TED Talk and his 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four

Presentation: Jae Vick

Lab:

GapMinder

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8 28 Feb **Trees**

Reading:

- To Draw a Tree by Pat Hanrahan.

- Munzner, T., Guimbretiere, F., Tasiran, S., Zhang, L., & Zhou, Y. (2003). TreeJuxtaposer: Scalable tree comparison using Focus+Context with guaranteed visibility. *ACM Transactions on Graphics, 22*(3), 453-462.
- Algorithms: Hyperbolic Trees, Radial Trees, Treemaps.

Presentation: Dean Barrett

Lab:

d3/Protovis

5 Mar **Due at 12:00 p.m. (noon):**

Project 4:
Viewing Data from Multiple Perspectives

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9 6 Mar **Networks**

Reading:

- Network Analysis & Visualization, Force Directed Layout, Pathfinder Network Scaling
- Yee, K.-P., Fisher, D., Dhamija, R., & Hearst, M. (2001). Animated Exploration of Graphs with Radial Layout. In *Proceedings of the IEEE Symposium on Information Visualization 2001 (Infovis 2001)*, October 2001.

Watch:

NodeXL video

Presentation: Anand Kulanthaivel

Lab:

NodeXL

Studio time for Final Project?

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13 Mar Spring Break

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10 20 Mar **Text Data and Semantic Data Landscapes**

Reading:

- Katy Börner, Chaomei Chen, & Kevin Boyack. Visualizing Knowledge Domains. In Blaise Cronin (Ed.), *Annual Review of Information Science & Technology*, Volume 37, Medford, NJ: Information Today, Inc./American Society for Information Science and Technology, chapter 5, pp. 179-255, 2003.
- Viegas, F., & Wattenberg, W. (2008). Tag clouds and the case for vernacular visualization. *Interactions, 15*(4), 49-52.

Watch:

The Beauty of Maps - BBC Four

Presentation: Jacob Fairclough

Lab:

Sci2 Tool

26 Mar **Due at 12:00 p.m. (noon):**

Project 5:
User-Centered Design, Discussion and Evaluation of a Tree Visualization

11 27 Mar **Geographic Data Landscapes and Activity Patterns**

Reading:

- Cartwright, W. E. (2010). Addressing the value of art in cartographic communication. *ISPRS Journal of Photogrammetry and Remote Sensing, 65*(3), 294-299.
- Skupin, A. (2000). From metaphor to method: Cartographic perspectives on information visualization. In S. F. Roth & D. A. Keim (Eds.), *Proceedings IEEE Symposium on Information Visualization, Salt Lake City, Utah* (pp.91-97). Los Alamitos: IEEE Computer Society.

Play:

Election 2004 Results, Maps and cartograms of the 2004 US presidential election results, Worldprocessor.org

Play more:

CAIDA tools, WiGLE, Urban Security Project, Time Maps, Named storms, Cabspotting, UrbanMobs, Where Tourists Flock, Facebook friendships

Presentation: Justin P. Peters

Lab:

Lilly Library Tour with Rebecca Cape. We will meet her at the Lilly Library Foyer at 11am.

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12 3 Apr **User Testing and Evaluation**

Reading:

- Lam, H., Bertini, E., Isenberg, P., Plaisant, C., Carpendale, S. (in press). Empirical studies in information visualization: Seven scenarios. *IEEE Transactions on Visualization and Computer Graphics*.

Presentation: Randy Gugenheim

Lab:

Flex/Flare

Studio time for Final Project?

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13 10 Apr **Interaction Techniques and Distortion**

Reading:

- Ahlberg, C., Williamson, C., & Shneiderman, B. (1992). Dynamic queries for information exploration: An implementation and evaluation. In P. Bauersfeld, J. Bennett, & G. Lynch (Eds.), *Proceedings of the SIGCHI conference on Human factors in computing systems* (pp. 619-626). New York: ACM.
- Paley, W. B. (2002). Illuminated Diagrams: Using light and print to comparative advantage. In *Proceedings of IEEE Information Visualization 2002*.
- Leung, Y. and Apperley, M. (1994). A review and taxonomy of distortion-oriented presentation techniques, ACM ToCHI, 1(2), 126-160.

Watch:

Jeff Han: Unveiling the genius of multi-touch interface design, TED Talk.
Scott Snibbe, Snibbe Interactive.

Lab:

AVL Tour (arrive 11:15am at CIB):

- In the Cyberinfrastructure Building:
  - 50 million pixel IQ-wall (usually run in a lower resolution mode of 25 million pixels at 8160x3072)
  - 24 tiles each capable of 1920x1080 resolution for a combined canvas of 11,520x4320
- In the Innovation Center
  - Visualization and Collaboration Theater
  - Three stereoscopic capable HD screens at 1920x1200 each for a combined canvas of 5760x1200
  - full 120 Hz stereoscopic 3D display for any quad buffered OpenGL applications

Student generated test questions:

If you would like a better sense of the content and format of the final exam, you may submit one or more test questions and exemplary answers that cover main course topics. Submit questions via email to Angela by 4-16-2012, noon. Use subject header 'S637-exam'.

16 Apr **Due at 12:00 p.m. (noon):**

Final exam - student generated test questions

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14 17 Apr **Current Trends in Information Visualization and Remaining Fundamental Problems in the Field**

Taxonomies. Scalability and complexity issues.

Reading:

- TBD

Presentation: Lyla Medeiros

Lab:

Foundational programming languages

Discussion of test questions as preparation for final exam.

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15 24 Apr **Final Project Presentations**

26 Apr **Due at 11:59 p.m. (midnight, Thursday night):**

Final Project:
Written Report

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1 May **Final Exam**

10:15 a.m. - 12:15 p.m.

It will be open book - you can use all your notes etc. You will not be able to use a computer.

Assignments

Individual and group work will be evaluated according to how well the course material is understood and implemented into projects, quality of written and oral presentations. You are expected to spend about 8 hours per week outside of class for readings, presentation, and projects.

The final grade will be based on class participation (15%), extension presentation (10%), projects (55%), and a written final exam (20%). Grades are assigned according to the grading standards of SLIS and as specified below.

Class participation:
The quantity and quality of contributions made to class are crucial to mastery of course material for all. All students will be expected to study the assigned readings before each class and to participate in class by asking and answering questions. Class participation will be assessed by the proxy method of collecting brief reflections on the course material and discussion at the end of every session.

"Extension" presentation:
Each student will sign up for a particular session. During that session, the student will present material based on the student's extended research into the topic of the week. The 20 minute presentation will address some aspect of how the week's topic has evolved into current theories, methods, tools, visualizations, etc. You are expected to consult the instructor during office hours prior to the week in which you will give the presentation. Prepare your presentation as well as any specific questions you may have in advance.

Projects:
Descriptions of project assignments will be posted on Oncourse. For some, you will work in teams. Projects will be graded according to:

- The technical quality, including its reliability, ease-of-use, internal consistency, robustness, and performance, and
- The quality of the content, including the accuracy and completeness of information, the expressiveness and clarity in communication of ideas, and the appropriateness of the attribution(s) for the work of others.

Final exam:
The final exam primarily tests your knowledge of the material presented in class and the assigned readings. Toward the end of the course you will have the opportunity to submit sample test questions and answers regarding main course topics. This will give you the opportunity to evaluate course topics, reflect on what you understood, and establish what are good test items for the upcoming final exam. The resulting set of questions as well as missing material will be discussed in class as preparation for the final exam.

Grading

Indiana University School of Library and Information Science Definitions of Letter Grades

The following definitions of letter grades have been defined by student and faculty members of the Curriculum Steering Committee and have been approved by the faculty as an aid in evaluation of academic performance and to assist students by giving them an understanding of the grading standards of the School of Library and Information Science.

A (4.0; 95% and above): Outstanding achievement. Student performance demonstrates full command of the course materials and evinces a high level of originality and/or creativity that far surpasses course expectations.
A- (3.7; 90% to 94%): Excellent achievement. Student performance demonstrates thorough knowledge of the course materials and exceeds course expectations by completing all requirements in a superior manner.
B+ (3.3; 87% to 89%): Very good work. Student performance demonstrates above-average comprehension of the course materials and exceeds course expectations on all tasks as defined in the course syllabus.
B (3.0; 83% to 86%): Student performance meets designated course expectations and demonstrates understanding of the course materials at an acceptable level.
B- (2.7; 80% to 82%): Marginal work. Student performance demonstrates incomplete understanding of course materials.
C+ (2.3; 77% to 79%): Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course materials.
C (2.0; 73% to 76%): "
C- (1.7; 70% to 72%): Unacceptable work. Coursework performed at this level will not count toward the MLS or MIS degree. For the course to count toward the degree, the student must repeat the course with a passing grade.
D+ (1.3; 67% to 69%): "
D (1.0; 63% to 66%): "
D- (0.7; 60% to 62%): "
F (0.0; 59% and below): Failing. Student may continue in program only with permission of the Dean.

Please visit the following web page on the SLIS website for additional information:
http://www.slis.indiana.edu/courses/forms/grades.html.

Late assignments or incompletes are allowed only because of an unforeseen emergency that is preceded by diligent work, not for a pattern of weak performance. No individual student will be allowed to do extra work to raise the final grade or to make up missing work. All grades become final one week after the material is returned to you. If there is a medical or personal reason requiring you to miss an exam, you must present your excuse, in writing, and some physical proof.

Course work handed in past the deadline will garner deductions as follows:

- Assignments submitted after the deadline but within the first day will be reduced by a full letter grade.
- Assignments will not be accepted after a full day has passed.

Attendance

You are required to attend every class. If you are unable to attend a class, please contact me before class or as soon as possible. If you do miss a class, you will be still responsible for:

- Handing in all assignments on time, and
- Obtaining notes and handouts from other students.

Academic Dishonesty

Information on academic dishonesty can be found in the "Code of Student Rights, Responsibilities and Conduct" at http://www.iu.edu/~code/index.shtml. In this document, plagiarism is defined as follows:

> "Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered 'common knowledge' may differ from course to course."
> Retrieved January 9, 2012 from http://www.iu.edu/~code/code/responsibilities/academic/index.shtml.

Instructor

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