Welcome

Welcome to the course Website for IS247, Information Visualization and Presentation!

Instructors

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Course Objectives

The goal of information visualization is the unveiling of the underlying structure of large or abstract data sets using visual representations that utilize the powerful processing capabilities of the human visual perceptual system. Information visualization is an exciting topic, and the last decade has witnessed the development of many interesting ideas about how to visualize abstract information. However, to date, its use in every day products and applications has not yet lived up to its promise.

In 1998 when I first taught this course, the field was very young, I knew every piece of work that had been done, and the course was a survey of the field. Now the field is very active and a survey a survey or a history of all information visualization techniques would not be feasible nor particularly enlightening.

Instead, this course will take a critical stance towards the field of information visualization. Rather than survey existing approaches, we will analyze the factors contribute to success or lack thereof, as a means to determine how to devise future successful visualizations. Criteria for success in this analysis are either positive results from usability studies or wide adoption by the target user population.

There are many related topics that this class will not address. These include: scientific visualization, cartography, computer graphics, and visualization as an artistic enterprise.

Class Meetings

Class meets on Mondays and Wednesdays from 10:30am-12:00 in 202 South Hall. The format of the class will be a mix of lecturing, looking at visualizations, student presentations and in-class design.

Grading

Grading will be 50% on assignments, readings, and in-class work and 50% on a final project.

Readings and Books

Readings will consist of one required book, Stephen Few's Show Me the Numbers, as well as a number of papers that will be accessible online or handed out in class.

Computer Accounts

See Roberta (roberta@sims) in 210 South Hall.

Foundations

Monday, August 29 Introduction

No Readings

Wednesday, August 31 Visual Analysis

Assignments

Assignment 1: Visualization Critiques (due Wednesday, Sep 21)

Readings

Stuart K. Card, Jock D. Mackinlay, Ben Shneiderman. Information Visualization. Chapter 1 of Readings in Information Visualization. Morgan-Kaufmann, 1999. p. 1-34.

Stephen Few. Introduction. Chapter 1 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 3-14.

Monday, September 5 Holiday - No Class!

Readings

Jacques Bertin. Post-Mortem of an Example. Chapter 1 of Graphics and Graphic Information Processing.

Stephen Few. Numbers Worth Knowing. Chapter 2 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 15-37.

Optional Readings

William S. Cleveland, R. McGill. Graphical Perception and Graphical Methods for Analyzing Scientific Data. Science, 229:828-833. 1985.

Visual Psychology and Data Graphics

Wednesday, September 7 Visual Perception and Principles

Readings

Stephen Palmer. An Introduction to Vision Science. Chapter 1.1 of Vision Science: Photons to Phenomenology. p. 4-15.

Stephen Few. Visual Perception and Quantitative Communication. Chapter 6 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 88-112.

Optional Readings

Stephen Palmer. An Introduction to Vision Science. Chapters 1.2 & 1.3 of Vision Science: Photons to Phenomenology. p. 15-44.

Fredo Durand. Gestalt and composition. In Course #13, SIGGRAPH 2002.

Monday, September 12 Designing Tables and Graphics to Enlighten (Guest Lecturer Stephen Few)

Assignments

Complete the Show Me the Numbers Pre-Test (not to be turned in)

Readings

Stephen Few. Chapters 3-5 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 38-87.

Wednesday, September 14 Information Visualization for Discovery and Analysis (Guest Lecturer Stephen Few)

Assignments

Complete the Data Visualization for Discovery Pre-Test (not to be turned in)

Readings

Stephen Few. Chapters 7, 9-10 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 113-126, 162-212.

Monday, September 19 Color / Design Exercise

Readings

Cynthia A. Brewer. Color Use Guidelines for Data Representation, Proceedings of the Section on Statistical Graphics, American Statistical Association, Alexandria VA. pp. 55-60. 1999. (Color Schemes Page)

Optional Readings

Colin Ware. Chapters 1 & 4 of Information Visualization: Perception for Design.

Interactive Information Visualization

Wednesday, September 21 Interaction: Dynamic Queries, Brushing, and Linking

Assignments

Assignment 1: Visualization Critiques Due

Assignment 2: Applying Visualization Tools (due Monday, Oct 10)

Readings

Stephen G. Eick, Graham J. Wills. High interaction graphics. European Journal of Operational Research, 81:445-459, 1995.

Ben Shneiderman. Dynamic queries, starfield displays, and the path to Spotfire. February 4, 1999

Bongshin Lee, Mary Czerwinski, George Robertson, and Benjamin B. Bederson. Understanding Research Trends in Conferences using PaperLens. CHI 2005 Extended Abstracts.

Optional Readings

Ben Shneiderman. The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations. Proc. 1996 IEEE Visual Languages.

Monday, September 26 Multidimensional Data Analysis

Readings

Chris Stolte, Diane Tang, Pat Hanrahan. Polaris: A System for Query, Analysis and Visualization of Multi-dimensional Relational Databases. IEEE Transactions on Visualization and Computer Graphics, Vol. 8, No. 1, January 2002.

Stephen Few. Design Solutions for Multiple Variables. Chapter 11 of Show Me The Numbers: Designing Tables and Graphs to Enlighten. p. 213-226.

Al Inselberg. Multidimensional Detective. IEEE InfoVis 1997.

An Empirical Comparison of Three Commercial Information Visualization Systems, Alfred Kobsa, in Infovis 2001, IEEE Symposium on Information Visualization, San Diego, CA.

Optional Reading

VizCraft: A Problem-Solving Environment for Aircraft Configuration Design, Goe, Baker, Shaffer, Grossman, Mason, Watson, Haftka, IEEE Computing, pp. 56-66, 2001

Wednesday, September 28 Parallel Coordinates, Zoomable User Interfaces

Readings

Takeo Igarashi, Ken Hinckley. Speed-dependent Automatic Zooming for Browsing Large Documents. UIST 2000.

M. Baldonado, A. Woodruff, and A. Kuchinsky. Guidelines for Using Multiple Views in Information Visualization. Proc. Advanced Vis. Interfaces 2000, Palermo, Italy, May 2000, pp. 110-119.

Optional Readings

Ben B. Bederson, James D. Hollan. Pad++: A Zooming Graphical Interface for Exploring Alternative Interface Physics. UIST 1994.

Ben B. Bederson, Jon Meyer, Lance Good. Jazz: An Extensible Zoomable User Interface Toolkit in Java. UIST 2000.

Andy Cockburn, Joshua Savage, Andrew Wallace. Tuning and Testing Scrolling Interfaces that Automatically Zoom. ACM CHI 2005.

Monday, October 3 Focus + Context, Visual Distortion Techniques

Readings

George Furnas. Generalized Fisheye Views. ACM CHI 1986.

The Table Lens: Merging Graphical and Symbolic Representations in an Interactive Focus + Context Visualization for Tabular Information, R. Rao and S. K. Card, CHI '94.Demo

Ben B. Bederson, Mary P. Czerwinski, George R. Robertson. A Fisheye Calendar Interface for PDAs: Providing Overviews for Small Displays. University of Maryland, HCIL Tech Report #HCIL-2002-09

Optional Readings

Y. K. Leung, M. D. Apperley. A Review and Taxonomy of Distortion-Oriented Presentation Techniques. ACM Transactions of Computer-Human Interaction, 1(2), June 1994, p.126-169.

Jock D. Mackinlay, George G. Robertson, Stuart K. Card. The Perspective Wall: Detail and Context Smoothly Integrated. ACM CHI 1991.

M. S. T. Carpendale, Catherine Montagnese. A Framework for Unifying Presentation Space. UIST 2001.

Wednesday, October 5 Animation

Readings

Bay-Wei Chang, David Ungar. Animation: From Cartoons to the User Interface. UIST 1993.

Ping Yee, Danyel Fisher, Rachna Dhamija, and Marti Hearst, Animated Exploration of Graphs with Radial Layout, in IEEE Infovis Symposium, San Diego, 2001

Barbara Tversky, Julie Morrison, Mireille Betrancourt. Animation: Does It Facilitate?. International Journal of Human Computer Studies, v57, p247-262. 2002.

Monday, October 10 The 3rd Dimension

Readings

Heiser, Phan, Agawala, Tversky, Hanrahan, Identification and Validation of Cognitive Design Principles for Automated Generation of Assembly Instructions, AVI'04

Andy Cockburn, Bruce McKenzie. Evaluating the Effectiveness of Spatial Memory in 2D and 3D Physical and Virtual Environments. Proceedings of CHI 2002.

Optional Readings

Mary Czerwinski, Desney S. Tan, George G. Robertson. Women Take A Wider View. ACM CHI 2002.

Bob Leitheiser and David Munro, An Experimental Study of the Relationship Between Spatial Ability and the Learning of a Graphical User Interface In Proceedings of the Inaugural Americas Conference on Information Systems, 1995.

Wilmot Li, Maneesh Agrawala, David Salesin. Interactive image-based exploded view diagrams. In Proceedings of Graphics Interface 2004.

Wednesday, October 12 Implementing Visualizations (Guest Lecturer Martin Wattenberg, IBM Research)

Assignments

Assignment 2: Applying Visualization Tools Due on Friday Oct 14

Assignment 3: Project Proposal (due Monday, Oct 24)

Links from class

IdeaLine
HistoryWired
Color Code (WordNet viz)

Readings

Fernanda Vi&#65533;gas, Martin Wattenberg, Kushal Dave. Studying Cooperation and Conflict between Authors with History Flow Visualizations. ACM CHI 2004.

Martin Wattenberg. Arc Diagrams: Visualizing Structure in Strings. IEEE InfoVis 2002.

Monday, October 17 Software Architectures / Design Exercise

Links

Prefuse Demo source code

Processing 1.0 Demo

Readings

Jeffrey Heer, Stuart K. Card, and James A. Landay. prefuse: A Toolkit for Interactive Information Visualization. ACM CHI 2005.

Jean-Daniel Fekete. The InfoVis Toolkit. IEEE InfoVis 2004.

Optional Readings

Ben B. Bederson, Jon Meyer, Jesse Grosjean. Toolkit Design for Interactive Structured Graphics. IEEE Transactions on Software Engineering, 30(8), August 2004.

Visualizing Specific Data Types

Wednesday, October 19 Time-based Data

Readings

Harry Hochheiser, Ben Shneiderman. Dynamic Query Tools for Time Series Data Sets, Timebox Widgets for Interactive Exploration. Information Visualization, 3(1), p.1-18. March 2004.

John V. Carlis, Joseph A. Konstan. Interactive Visualization of Serial Periodic Data. UIST 1998.

Optional Readings

S Harada, M Naaman, YJ Song, QY Wang, A Paepcke, Lost in memories: interacting with photo collections on PDAs, JCDL'04.

Ed H. Chi, James Pitkow, Jock D. Mackinlay, Peter Pirolli, Rich Gossweiler, and Stuart K. Card. Visualizing the Evolution of Web Ecologies. ACM CHI 1998.

Monday, October 24 Video Visualization

Readings

Marc Davis. Media Streams: An Iconic Visual Language for Video Representation. In Readings in Human-Computer Interaction: Toward the Year 2000, eds. Ronald M. Baecker, Jonathan Grudin, William A. S. Buxton, and Saul Greenberg. 854-866. 2nd ed., San Francisco: Morgan Kaufmann Publishers, Inc., 1995.

Jon Snydal, Marti Hearst. ImproViz: Visual Explorations of Jazz Improvisations. Extended Abstracts of ACM CHI 2005. (Poster)

David F. Huynh, Steven M. Drucker, Patrick Baudisch, Curtis Wong. TimeQuilt: Scaling Up Zoomable Photo Browsers for Large, Unstructured Photo Collections. ACM CHI 2005.

Wednesday, October 26 Trees

Assignments

Assignment 3: Project proposal due Oct 27th

Readings

Ben Shneiderman. Treemaps for space-constrained visualization of hierarchies. 1998-2005.

John Lamping, Ramano Rao. Laying out and visualizing large trees using a hyperbolic space. UIST 1994.

Stuart K. Card, David Nation. Degree-of-Interest Trees: A Component of an Attention-Reactive User Interface. AVI'02.

Pat Hanrahan. To Draw A Tree. October 2001.

Optional Readings

Tamara Munzner, Francois Guimbretiere, Serdar Tasiran, Li Zhang, and Yunhong Zhou. TreeJuxtaposer: Scalable Tree Comparison using Focus+Context with Guaranteed Visibility. SIGGRAPH 2003.

Monday, October 31 Networks

Readings

Ivan Herman, Guy Melan&#65533;on, M. Scott Marshall. Graph Visualization and Navigation in Information Visualization: A Survey. IEEE Transactions on Visualization and Computer Graphics, 2000.

Jeffrey Heer, danah boyd. Vizster: Visualizing Online Social Networks. InfoVis 2005.

Wednesday, November 2 Search and Documents

Serial Periodic Data Comparison by Itai Brickner

Readings

Emile Morse, Michael Lewis, Kai A. Olsen. Testing visual information retrieval methodologies case study: comparative analysis of textual, icon, graphical, and "spring" displays. JASIST 53(1), 2002.

Allison Woodruff, Ruth Rosenholtz, Julie Morrison, Andrew Faulring, and Peter Pirolli. A comparison on the use of text summaries, plain thumbnails, and enhanced thumbnails for web search tasks. JASIST 53(2), 172-185, 2002.

Mika Kaki. Findex: Search Result Categories Help Users when Document Ranking Fails. ACM CHI 2005.

Optional Readings

Marti Hearst. TileBars: Visualization of Term Distribution Information. ACM CHI 1995.

Ping Yee, Kirsten Swearingen, Kevin Li, and Marti Hearst. Faceted Metadata for Image Search and Browsing. ACM CHI 2003.

Earl Rennison. Galaxy of News: An Approach to Visualizing and Understanding Expansive News Landscapes. UIST 1994.

Monday, November 7 Search and Documents (cont)

Also, go over EDA assignment

Wednesday, November 9 Reports on Infoviz and UIST

Guest lectures by Jeff Heer and Rowena Luk

Project Design Reviews

Monday, November 14 Project Design Reviews

Word
IRC Chat
UFO Vlz
MarketViz
GeoViz

Wednesday, November 16 Project Design Reviews

SecurityViz
Transport
Patents
GeneViz (PD-TF)

Monday, November 21 Project Design Reviews

WikiBuddy
WordTrolley
AMP
PhotoArcs
BlogViz

Wednesday, November 23 Project Design Reviews

ClusterBlog
Biblio
HomeSkim
TimeLineCompare
TheNetwork

Visual Explorations

Monday, November 28 Visualization and the Arts

Readings

Tobias Skog, Sara Ljungblad, Lars Erik Holmquist. Between Aesthetics and Utility: Designing Ambient Information Visualizations. IEEE InfoVis 2003.

The Whitney Artport.

Proce55ing Exhibitions.

Optional Readings

Fernanda Vi&#65533;gas, Ethan Perry, Ethan Howe, Judith Donath. Artifacts of the Presence Era: Using Information Visualization to Create an Evocative Souvenir. IEEE InfoVis 2004.

The works of Ben Fry, Golan Levin, Jonathan Harris, Fernanda Vi&#65533;gas, Martin Wattenberg, and others.

The Infosthetics Blog

Wednesday, November 30 Empirical Evaluation of Visualizations

Readings

Peter Pirolli, Stuart K. Card, and Mija Van Der Wege. The Effect of Information Scent on Searching Information Visualizations of Large Tree Structures. AVI 2000, Palermo, Italy.

Mohammad Ghoniem, Jean-Daniel Fekete, Philippe Castagliola. A Comparison of the Readability of Graphs Using Node-Link and Matrix-Based Representations. InfoVis 2004, Austin, TX, Oct 2004. IEEE Press. pp. 17-24

Optional Readings

Alfred Kobsa. An Empirical Comparison of Three Commercial Information Visualization Systems. Infovis 2001, IEEE Symposium on Information Visualization, San Diego, CA

Monday, December 5 Visualization on Small Devices; Course Summary

Readings

A fisheye calendar interface for PDAs: providing overviews for small displays (short version), Ben Bederson et al., CHI 2003.

Halo: A Technique for Visualizing Off-Screen Locations Baudisch, P. and Rosenholtz, R., CHI 2003.

Optional Readings

DateLens: A Fisheye Calendar Interface for PDAs (optional long version) Ben Bederson et al., ACM TOCHI, 2004.

Peephole Displays: Pen Interaction on Spatially Aware Handheld Computers Ka-Ping Yee, CHI 2003.

Wednesday, December 7 Guest Lecture: Maneesh Agrawala

Readings

Maneesh Agrawala, Doantam Phan, Julie Heiser, John Haymaker, Jeff Klingner, Pat Hanrahan, Barbara Tversky. Designing Effective Step-By-Step Assembly Instructions. SIGGRAPH 2003.

Jock D. Mackinlay. Automating the Design of Graphical Presentations of Relational Information. ACM Transactions on Graphics, 5(2), April 1986, p. 110-141.

Martin Wattenberg, Danyel Fisher. A Model of Multi-Scale Perceptual Organization in Information Graphics. Information Visualization, 3(2), June 2004.

Monday, December 12 Final Projects Due

(No class.)

Assignments

Project Final Write-Up Due