



Information Visualization Learning Modules

Katy Börner, InfoVis Lab, School of Library and Information Science
Indiana University, Bloomington



Motivation

The exponential growth of information makes it increasingly difficult to locate relevant resources, to understand emerging trends, and to manage information. Information Visualization (IV) combines aspects of scientific visualization, human-computer interaction, data mining, imaging, and graphics techniques, etc. to transform data that is not inherently spatial (e.g., document collections, network traffic logs, customer behavior, etc.) into a visual form. Well designed visualizations reduce visual search time, improve understanding of complex data sets, reveal relations otherwise not noticed, enable data sets to be seen from several perspectives simultaneously, facilitate hypothesis formulation, and are effective sources of communication [1].

Since Spring 2001, Börner has been teaching the L697 (recently renamed L579) Information Visualization course at the School of Library and Information Science at Indiana University. The course comprises lecture and lab sections as well as project work. Lectures equip students with working knowledge about visual perception principles, theoretical approaches to IV design, a variety of existing data mining and visualization techniques, algorithms, and systems. During lab, students run, discuss, and evaluate different information visualizations and gain hands-on experience with diverse IV algorithms. In project work, they constructively apply their knowledge to design novel IVs and develop skills in critiquing and evaluating visualization techniques.

There exist a number of excellent textbooks by Card et al. [1], Chen [2], Ware [3], and Spence [4] that can be used to teach IV. Several come with accompanying web sites containing screen-sized snapshots of user interfaces as well as animations and movies. However, there exists no toolkit or learning resource that facilitates the exploration, application, evaluation, and comparison of algorithms.

InfoVis CyberInfrastructure
A Data-Code-Compute Resource for Research and Education in Information Visualization

Home Learning Modules Software Data Bases Compute Resources References

This web site provides access to different software packages easing the exploration, modification, comparison, and extension of data mining and information visualization algorithms. Diverse software packages were bundled into learning modules. Links to diverse databases, compute resources, and references are provided as well. It is our hope that the community will adopt this resource to foster Information Visualization education and research. This site is work in progress. A very first version was released at IEEE InfoVis in October 2003.

Gain Access
In order to gain access, please contact Katy Börner at kab@indiana.edu. Shortly, you will be able to register and to access usage statistics.

Contribute
If you would like to contribute to the Information Visualization Software Cyberinfrastructure please contact Katy Börner at kab@indiana.edu.

Acknowledgements
The Information Visualization Software Repository was created in 2000 and has since then been used to teach the Information Visualization class at Indiana University. Katy Börner, Yuezhong Zhou, and Jason Baumgartner implemented the very first algorithms. In Summer 2003, Jason Baumgartner, Nihar Sheth, and Nathan J. Deackard lead a project to design a XML toolkit that enables the serialization and parallelization of commonly used data analysis and visualization algorithms. Contributions of software packages and implementation work are acknowledged on the respective software pages.

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HPNAP Sun SBC

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Information Visualization CyberInfrastructure

The InfoVis CyberInfrastructure provides access to data, code and computing resources in support of the analysis, modeling and visualization of diverse data sets at <http://iv.slis.indiana.edu>.

So far, a number of preprocessing, eight data mining, eight visualization, and a couple of interaction algorithms have been integrated and documented

Since Fall 2003, the IVR has been downloaded from about 50 institutions, organizations and companies in the US, 14 institutions in Europe and 16 unidentifiable units.

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Learning Modules

Most information visualizations are highly interactive. While a number of excellent textbooks exist, the two-dimensional printouts on paper often cannot convey their true visual appearance and interactive performance. Several textbooks come with accompanying web sites that contain snapshots of user interfaces as well as animations and movies. However, none of them facilitates the exploration, application, evaluation, and comparison of algorithms.

This web page will provide access to a number of learning modules. Each learning module comes with an:

- Description of the data analysis and visualization task
- Usage hints on how to run and use a particular algorithm or tool
- Learning task - a challenging scenario to use an algorithm or to analyze and/or visualize a data set
- Discussion of the results, and
- References to research papers, online demos, (commercial) applications.
- Acknowledgements

Modules

We are in the process of designing and testing the subsequently listed learning modules. They will be available in August 2004.

- Visual Perception Principles
- Time Series Analysis (CrawSearcher vs. Bural)
- Visualizing Tabular Data (ORNL, Fishye Table)
- Visualizing Tree Data (Superbolic Tree, Radial Tree, Treemap)
- Semantic Data Analysis (G2 vs. Topic)
- Network Analysis & Visualizations (Centrality Analysis Tool & Path)
- Clustering Algorithms (K-Means Algorithm vs. Similarity Search)
- Interaction and Distortion Techniques (Superbolic Tree, Fishye Table)
- Social Visualizations (GV ToolKit)

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Learning Modules

The learning module set aims to equip learners with a practical skill set by providing code and advice to quickly modify and run different algorithms, test different interaction techniques and design features, and to quickly generate and compare diverse IVs.

The modules build on one another and collectively provide an introduction to major information visualization approaches and techniques. Each module constitutes a learning unit that can be processed within a reasonable amount of time.

The modules may be used in multiple ways, such as synchronously during a class or asynchronously for professional development with or without credit. While the modules are self-contained making any-time, any-place instruction possible, their incorporation in class work with discussions and sharing of knowledge and visualizations will be most effective.

Students use the learning modules to work through exemplary data analysis and visualization scenarios and are able to compare their solutions with the provided answers and explanations. The problem-based teaching approach is intended to encourage students to engage in the exploration and design of information visualizations, to visualize self-selected data sets, and to modify the visualizations so that they fit different end user needs.

All modules are available online and free of cost ensuring that they are accessible not only to teachers, but also to time- and place-bound learners.

Validation and Significance

An initial version of the learning module set was tested in the L579 Information Visualization course at SLIS that is offered each spring. The learning modules enabled students to explore, combine, and contrast diverse data mining and information visualization algorithms and to take on projects of considerable complexity.

There is an enormous need to provide more efficient access to data. Visual data access has a so far untapped industry potential. IVs have gathered tremendous attention and are of interest to managers, users, and researchers. Students with working knowledge of the application of data mining algorithms and the design of effective information visualizations will have a significant advantage at the workplace.

References

- Card, S., Mackinlay, J. and Shneiderman, B. (eds.) (1999) Readings in Information Visualization: Using Vision to Think. Morgan Kaufmann.
- Chen, C. (1999) Information Visualisation and Virtual Environments. Springer Verlag, London.
- Ware, C. (2000) Information Visualization: Perception for Design. Morgan Kaufmann.
- Spence, B. (2000) Information Visualization. Addison-Wesley.
- Börner, K. and Zhou, Y. (2001) A Software Repository for Education and Research in Information Visualization. In Information Visualisation Conference, (London, England, 2001), IEEE Press, 257-262.
- Baumgartner, J. & Börner, K. (2002) Towards an XML Toolkit for a Software Repository Supporting Information Visualization Education. IEEE Information Visualization Conference, Boston, MA. Interactive Poster.
- Jesse M. Heines, Katy Börner, Melody Ivory & Ed Gehring (2003) The Development, Maintenance, and Use of Course Web Sites. Panel at the ACM SIGCSE 34th Technical Symposium on Computer Science Education, Reno, Nevada, Feb 19-23.
- Jason Baumgartner, Katy Börner, Nathan J. Deackard, Nihar Sheth (2003) An XML Toolkit for an Information Visualization Software Repository. Interactive poster, IEEE Information Visualization Conference.