10241 Abstracts Collection
Information Visualization
— Dagstuhl Seminar —

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Abstract. From 13.06.10 to 18.06.10, the Dagstuhl Seminar 10241 "Information Visualization" was held in Schloss Dagstuhl – Leibniz Center for Informatics. During the seminar, several participants presented their current research, and ongoing work and open problems were discussed. Abstracts of the presentations given during the seminar as well as abstracts of seminar results and ideas are put together in this paper. The first section describes the seminar topics and goals in general. Links to extended abstracts or full papers are provided, if available.

Keywords. Information Visualization, Visualization, Data Visualization, Collaboration, Display Technologies, Human-Computer Interaction

10241 Executive Summary – Information Visualization

Information Visualization (InfoVis) focuses on the use of visualization techniques to help people understand and analyze data. While related fields such as Scientific Visualization involve the presentation of data that has some physical or geometric correspondence, Information Visualization centers on abstract information without such correspondences.

The aim of this seminar was to bring together theoreticians and practitioners from the field with a special focus on the intersection of InfoVis and Human-Computer Interaction. To support discussions that are related to the visualization of real world data, researchers from selected application areas also attended and contributed. During the seminar, working groups on eight different topics were formed and have allowed a critical reflection on actual research efforts, the state of field, challenges, etc. This document summarizes the event.

Keywords: Information Visualization, Visualization, Data Visualization, Collaboration, Display Technologies, Human-Computer Interaction

Joint work of: Kerren, Andreas; Plaisant, Catherine; Stasko, John T.

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2010/2760

Multitouch-multimodal Break-out Discussion

Paolo Buono (University of Bari, IT)

The noticeable growth of the number of different technologies for human computer interaction permits today intuitive and creative interactions, which involves several senses (sight, sound, touch and kinesthetic forces, smell and taste...). One of the challenges today is about the identification of relationships among InfoVis and Multitouch/multimodal displays. This report is focused mainly to multimodal, tangible and multi-touch interfaces for InfoVis and the fusion/blending of different interaction modalities and interfaces.

Keywords: Multimodal multitouch blending metaphor

Joint work of: Buono, Paolo; Kennedy, Jessie; Reiterer, Harald; Roberts, Jonathan C.

Large Display Group: Notes

First breakout notes from the large display working group. Includes slides from talk from Stephen North, summary talk by Jean-Daniel Fekete, and discussion notes by Jessie Kennedy.

Keywords: Large displays

Joint work of: Jankun-Kelly, T. J.; Hansen, Charles; Kennedy, Jessie; Brodbeck, Dominique; Fekete, Jean-Daniel; Henry-Riche, Nathalie; Lee, Bongshin; Ebert, Achim; Zeckzer, Dirk; North, Stephen; Lam, Heidi; Roberts, Jonathan C.; Buono, Paolo; Reiterer, Harald

Text and Document Visualization Break-out Group Report

Christopher Collins (University of Ontario, CA)

Our discussion was structured around enumerating pitfalls, successes, and challenges in visualizing text and documents. In these discussions we found that text and document visualization is too often treated as a general problem, when in fact, the problem (and appropriateness of the solution) differs by the target audience of the visualization and the task support desired. Thus we also include a categorized list of text visualization user populations and tasks in this report.

Keywords: Visualization, text

Joint work of: Collins, Christopher; Friere-Moran, Manuel; Heer, Jeffrey; van Ham, Frank; Jusufi, Ilir; Keim, Daniel; Livnat, Yarden; Munzner, Tamara; Perer, Adam; Plaisant, Catherine; Strobelt, Hendrik; Ward, Matt; Weaver, Chris

Comparison in Infovis - Report

Tim Dwyer (Microsoft Research - Redmond, US)

A model for comparison in information visualization was discussed that maps the design space into three categories: (1) juxaposition, separation, small multiples, which uses the memory of a user to make visual connections; (2) overlay, superposition that allows the user to make visual connections, and (3) fusion, difference objects, which are derived representations and use algorithms to provide the correlation and differences between data. This model highlights several challenges offering multiple opportunities for further research: including depiction of context, incorporating heterogeneous data, complexity, and comparison across different forms and partiality. Orthogonal to this model is the understanding of who does comparison: whether the effort is put to the user or whether it is an analytic process of the computer.

Keywords: Comparison, Infovis

Joint work of: Beck, Fabian; Diehl, Stephan; Dwyer, Tim; Gleicher, Michael; Hansen, Charles; Jusufi, llir; Ma, Kwan-Liu; Perer, Adam; Roberts, Jonathan C.; Yang, Jing; Zeckzer, Dirk

Analysis Process Reportback

Tamara Munzner (University of British Columbia - Vancouver, CA)

The analysis process discussion group found that those who have engaged deeply with analysts now perceive that the true analysis process is often significantly different than many assumptions widespread in the information visualization literature. Stories from the trenches were told by Heidi Lam about the analysis process inside of Google, Jason Dykes about urban planning, and Jean Scholtz about intelligence analysts.

Our conclusion was that in order to find common grounds between different domains we need specific data points of observational studies. These are currently being published in external venues such as CHI and CSCW, but not in our own venues such as the InfoVis Conference. Participants noted that a big barrier to publication at our own venues is the (mis)perception of reviewers that such studies need to be generalized with design implications to be worthwhile as standalone papers. We argue that applying the standards of formal experimental studies with quantitative measures, or even qualitative measures, is not always appropriate for observation studies. Paul Dourish argues in a paper at CHI 2006 that including implications for design with an observational study is not only an unnecessary requirement, but can be actively counterproductive.

To advance this agenda, we have action items on three fronts. First, we would like to refine the current taxonomy of keywords used to match papers and reviewers to include Observational Studies as a specific methodology. Second,

we would like to write a call for arms position paper advocating observational studies in an infovis context. Third, we will try to bring the external literature to the attention of the infovis community through a Beyond Infovis Showcase at VisWeek: a small set of posters, with each highlighting a few examples of work deemed to be interesting to our community from another venue. By the end of the seminar week, we had volunteer curators for seven areas:

CHI 10, BELIV 10, AVI 10, Graph Drawing 09, UIST 10, CSCW 10, and the 2010 blogosphere.

Joint work of: Bertini, Enrico; Carpendale, Sheelagh; Collins, Christopher; Dykes, Jason; Isenberg, Petra; Lam, Heidi; Munzner, Tamara; Schlotz, Jean

Collaborative Information Visualization

Petra Isenberg (INRIA - Saclay, FR)

Reports from the working group on collaborative information visualization.

Keywords: Information Visualization, Collaboration

Joint work of: Cernea, Daniel; Elmqvist, Niklas; Hagen, Hans; Isenberg, Petra; Lam, Heidi; Ma, Kwan-Liu; Scholtz, Jean; Schreiber, Falk

Summary report of the Aesthetics in Information Visualisation Group

Helen C. Purchase (University of Glasgow, GB)

In creating visualizations of data, an aesthetic choice needs to be made, even if the choice is a minimalist one. This talk summarized the outcomes of a group discussion on Aesthetics in Information Visualization. We concluded that:

1. Aesthetics is a loaded term; perhaps we should rather talk about visual style and interaction.
2. We should take a multiple aesthetics perspective, emphasizing that aesthetic design is an explicit choice.
3. It is important that the process of aesthetic design be described and justified.
4. We should consider the truth of the data and whether the aesthetic design choice helps or hinders the representation of the truth of the data.
5. Evaluation in graphic literacy is key to the development of good visual style.

While we did not answer the broad questions of What is Aesthetics and why do we need it?, we made progress in identifying key issues in the development of Information Visualization visual styles.

Keywords: Aesethtics, visual style

Joint work of: Purchase, Helen C.; Kerren, Andreas; Vande Moere, Andrew; Bertini, Enrico; Purchase, Helen; Van Wijk, Jack; Dykes, Jason; Gleicher, Michael; Carpendale, Sheelagh; Diehl, Stephan; Dwyer, Tim

2D or not 2D? Was 3D Information Visualization just a fad?

Tim Dwyer (Microsoft Research - Redmond, US)

In the 1990's 3D representations of data were abundant in the information visualization literature. In the early 2000's the community became more aware of the difficulties abstract data representation in 3D given the limited acuity of human depth perception. The work presented in this talk is representative of a more cautious approach to 3D infovis using a 2.5D design attitude. Seven years later we rarely see 3D in our literature. In hindsight we ask whether 3D was just a fad.

Keywords: 3D graphics, graph visualization, 2.5D.

Full Paper:
http://www.it.usyd.edu.au/~dwyer/thesis_20050609.pdf

See also: Tim Dwyer (2005): "Two and a Half Dimensional Visualisation of Relational Networks", PhD Thesis, The University of Sydney.

Using Topic Models to Visualize the Evolution of Academic Departments

Jeffrey Heer (Stanford University, US)

We visualize time-varying distances between academic departments computed using topic models of Ph.D. theses. We collected 20 years of Stanford University dissertation titles and abstracts and identified topics using Latent Dirichlet Allocation (LDA). We then grouped documents by department and year to compute topical distances between departments. Initial visualizations using dimensionality reduction (PCA projection) proved highly unsatisfactory, as seemingly interesting outliers in the display were later revealed to be artifacts of the projection and not representative of true differences. Instead, we developed an interactive display in which users select a focal department of interest; the visualization then arranges other departments to depict individual distances to the selected department. Drill-down interactions further enable investigation of individual theses, their textual source, and their association strength with other departments. The application has been used to explore the evolving topical associations among departments, e.g., in response to multidisciplinary initiatives on campus.

Our experiences suggest some lessons for visual text exploration tools: (a) dimensionality reduction and other automated techniques can introduce unwanted

artifacts that may bias apprehension of the data, (b) linking abstract visuals the backing text sources greatly aids understanding, and (c) abstracting text models via navigable hierarchies provides a promising model for multi-scale exploration of document collections.

Keywords: Text, visualization, analysis, topic models, LDA

Full Paper:
http://nlp.stanford.edu/projects/dissertations/

Visualization Education: Constructive Alignment Experiment

Jason Dykes (City University - London, GB)

This short exercise on developing visualization learning outcomes involved participants writing candidate outcomes for visualization learning units and discussing them with colleagues with a view to developing more aligned teaching strategies and encouraging less content driven curriculum development.

The outcomes will be collated and shared.

Keywords: Education

New forms of Human-Computer Interaction for Visualizing Information

Harald Reiterer (Universität Konstanz, DE)

The Graphical User Interface (GUI) although developed in research laboratories in the late 1970s is still the dominant interaction paradigm in Information Visualization. We propose a new interaction paradigm called Blended Interaction. It combines ideas of Embodied Cognition, Multimodal Interaction, Reality-Based Interaction & Ubiquitous Computing. This is intended to stress that a single increase in the reality aspect of the interaction cannot go far enough. The particular challenge and from the user's standpoint, the key advantage lies in a meaningful marriage between the tested real-world options and the digital world. As a minimum this marriage must exist on the levels of the interaction, communication, of the way we solve problems with conventional tools (workflows), and of the design of the space or the architecture of buildings and places. The digital world often offers entirely new possibilities and takes the form of interactive devices of various shapes but also of intelligent everyday objects (e.g. the 'Internet of things'). In our view, interaction concepts can indeed offer a new quality of interaction, but only when the design of the interaction includes all these domains at the same time and with equal weighting.

We test the suitability of our ideas of Blended Interaction concepts by using specific application examples that are being worked on as part of current

research projects. Our experiences show that this new interaction paradigm has also great potential for interacting with visualization. For example, we have developed multi-touch scatter plots & facet maps for tangible user interfaces supporting the searching & browsing in Digital Libraries. We have embedded different visualizations into a Zoomable Object-oriented Information Landscape (ZOIL), which supports our vision of using visualizations on different displays of different size at the same time. We have developed specific kind of search tokens that supports collaborative search activities.

For example, we try to address the following research questions:

- How can future interactive InfoVis tools look like, especially in the light of the idea Blended Interaction?
- How can future interactive InfoVis tools benefit from Multi-Displays & Multimodal environments used by Multiple Users?
- What are the specific design requirements for multi-touch visualizations?
- How can we support the collaborative use visualization tools?

Keywords: Blended Interaction, Multimodal Interaction, Tangible Computing, Reality-Based Interaction, Ubiquitous Computing, Embodied Cognition

Extended Abstract: http://drops.dagstuhl.de/opus/volltexte/2010/2739

Where are we with Haptic Data Visualization?

Jonathan C. Roberts (Bangor University, GB)

There are many different uses for haptics, from training medical practitioners, teleoperation or navigation of virtual environments. In particular, haptic technologies have been used to create data representations (visualizations) that can be felt. These allow users to perceive information by feeling and manipulating data representations. The hypothesis is that, haptic devices can be used to present information and consequently the user gains quantitative, qualitative or holistic knowledge about the presented data. Not only is it useful and possible to represent data through tactile and kinesthetic sensations for users who are blind or partially sighted (who can feel line graphs, for instance), but the haptic modality can be used alongside other modalities to increase the amount of variables being presented, or to duplicate some variables to reinforce the presentation. Over the last twenty years a significant amount of research has been done in haptic data presentation. Researchers have developed force-feedback linegraphs, bar-charts and other forms of haptic representations. These are haptic designs, are similar in design to their visual counterparts, and as such they usually follow one form. Thus there are many haptic designs for data visualization. This presentation looks at the state-of-the art of Haptic Visualization, particular looking at the forms of visualizations used. We categorize the methods by their form, as Charts, Maps, Signs, Networks, Diagrams, Images and Tables.

Keywords: Haptic Data Visualization, Multimodal Visualization

Old & New Experiences of BioVis

Jessie Kennedy (Napier University - Edinburgh, GB)

This talk gives an overview of BioVis research at Edinburgh Napier University over the past 10 years focusing on the domains, some of issues and techniques. It also describes a new project we are about to commence on investigating InfoVis for cleaning pedigree/genomic data and a planned project to make use of our new Interactive collaborative Environment.

Keywords: Biological Information Visualisation, Graph Visualisation, Tree visualisation, Pedigree visualisation

The Impact of Prior Knowledge on the Design, Use and Evaluation of Visualization Tools

Jean Scholtz (Pacific Northwest National Lab., US)

In this position paper I propose what constitutes "prior knowledge" and the impact that different types of prior knowledge have on the design, use and evaluation of visualization tools.

Keywords: Visual analytics, prior knowledge, evaluation, design

Mixing Models and Data

Matthew Ward (Worcester Polytechnic Institute, US)

A common task in data analysis is to develop a computational model of the data, using tools from fields such as statistics, pattern recognition, and data mining; these models can be used for many tasks, such as concisely describing the characteristics of the data as well as predicting future behaviors of the process generating the data. The problem is that many different models can be used to describe a given dataset, including variations on the same class of models (e.g., by using different parameters) or very different types of models (e.g., clustering, linear classifiers, association rule mining, or regression models). Over the past two years we have been exploring the design of techniques for both visual exploration of model space as well as interactions between model space and data space. Initially this was focused on the visualization of the parameter space for a single type of model to identify regions of this space that fit the data particularly well. More recently our focus has shifted to visualizing collections of heterogeneous models to identify features such as robust regions in model space as well as subspaces that have yet to be explored. In this demonstration I'll give an overview of this work and demonstrate two prototype applications.

Keywords: Visual analytics, statistical models

Adding Computational Analysis to Jigsaw

John T. Stasko (Georgia Institute of Technology, US)

Jigsaw is a visual analytics system for investigative analysis on document collections. Recently, we have added improved facilities for computational analysis to the system, including document summarization, similarity, clustering, and sentiment. This presentation showed the new capabilities of Jigsaw by examining the collection of paper titles and abstracts from all the IEEE InfoVis and VAST Conferences.

Keywords: Visual analytics, information visualization, investigative analysis, Jigsaw

PIGVIS: A multidimensional visualization approach to visualizing graphs

Jing Yang (University of North Carolina at Charlotte, US)

Visualizing large graphs with long node labels and multidimensional node attributes is a challenging task. We propose a novel graph visualization approach, named PIxel-oriented Graph Visualization (PIGVis), to exploring such graphs without clutter. PIGVis projects a large graph to a multidimensional space, making use of automatic clustering results to preserve important topology information. It uses scalable pixel-oriented techniques and html boxes to visualize the neighborhood information and labels of automatically generated clusters and user-defined groups, together with multidimensional node attributes. PIGVis supports a rich set of Boolean operations among the clusters/groups neighborhood for effective node, cluster, and multidimensional node attribute analysis.

Keywords: Graph visualization, pixel-oriented techniques

Timely Information for Citizens: Place Survey Prototype

Jason Dykes (City University - London, GB)

I demonstrated the giCentre / Leicestershire Councy Council visualization interface for providing timely information to citizens. The application uses a limited set of interactions that link statistical and cartographic views that summarize responses to a questionnaire about living in Leicestershire.

Design decisions were discussed along with opportunities for analysing usage logs.

Keywords: Visualization for the masses

Exploration Using Dynamic Tag Clouds and Loosely Coordinated Multiple Views

Yarden Livnat (Univ. of Utah - Salt Lake City, US)

The demo challenge the notion that Tag Clouds have only a limited benefit. We present a dynamic tags cloud and interactions that promote exploration and facilitate situational awareness.

The second of part of the demo focus on a novel approach for working in a coordinated multiple views environment. Rather than relaying on direct linking and brushing between views our approach is to organize and coordinate decouple views via parallel and nested workspaces. The approach empowers diverge thinking in a loosely connected environment.

Keywords: Tag Cloud, Divergence Thinking, Loosely Coordinated Multiple Views

GraphDice: A System for Exploring Multivariate Social Networks

Niklas Elmqvist (Purdue University, US)

Social networks collected by historians or sociologists typically have a large number of actors and edge attributes. Applying social network analysis (SNA) algorithms to these networks produces additional attributes such as degree, centrality, and clustering coefficients. Understanding the effects of this plethora of attributes is one of the main challenges of multivariate SNA. We present the design of GraphDice, a multivariate network visualization system for exploring the attribute space of edges and actors. GraphDice builds upon the ScatterDice system for its main multidimensional navigation paradigm, and extends it with novel mechanisms to support network exploration in general and SNA tasks in particular. Novel mechanisms include visualization of attributes of interval type and projection of numerical edge attributes to node attributes. We show how these extensions to the original ScatterDice system allow to support complex visual analysis tasks on networks with hundreds of actors and up to 30 attributes, while providing a simple and consistent interface for interacting with network data.

Keywords: Graph visualization, multidimensional visualization, social networks

Joint work of: Bezerianos, Anastasia; Chevalier, Fanny; Dragicevic, Pierre; Elmqvist, Niklas; Fekete, Jean-Daniel

Full Paper:
http://www.aviz.fr/graphdice/

See also: A. Bezerianos, F. Chevalier, P. Dragicevic, N. Elmqvist, J.-D. Fekete. GraphDice: A System for Exploring Multivariate Social Networks. Computer Graphics Forum (Proc. EuroVis 2010), 29(3):863–872, 2010.