

# “Scalable Visual Analytics”

**Dagstuhl Seminar 10471, November 21-26, 2010**

## **-Executive Summary-**

Daniel A. Keim (University of Konstanz, DE)<sup>1</sup>  
Stefan Wrobel (Fraunhofer IAIS and University of Bonn, DE)

**Keywords.** Visual Analytics, Visualization, Data Analysis, Discovery Science, Information Visualization

## **1 Motivation**

In research and development as well as numerous application areas fast growing data sets develop with ever higher complexity and dynamics. A central challenge is to filter the substantial information and to communicate it to humans in an appropriate way. Interactive visual data analysis techniques extend the perceptual and cognitive abilities of humans with automatic data analysis techniques. Only by a combination of data analysis (Data Mining) and visualization techniques, an effective access to otherwise unmanageably complex data sets is possible. Visual analysis techniques make the unexpected more easily discoverable and help to gain new insights.

Effective visual analysis systems must address the following four challenges: providing suitable automatic data analysis techniques, supporting the user with expressive visualizations where the automatic algorithms alone do not suffice, addressing scalability issues (with respect to the automatic and/or the visual methods), and finally providing the right interaction mechanisms that allow the user to steer the process.

## **2 Goals and Content of the Seminar**

The goal of the seminar was to bring together the participants of the DFG strategic research initiative SPP 1335 "Scalable Visual Analytics: Interactive Visual Analysis Systems for Complex Information Spaces" and international members of the visual analytics community. Topics addressed include the analysis of bio-molecular data, spatio-temporal data, document analysis, and streaming data.

The different scenarios had in common that approaches which work either on a purely analytical or on a purely visual level do not help due to the dynamics and complexity of the underlying processes or due to intelligent opponents. During the seminar, the participants did not only present each other the status of their own work but also discussed more general issues that are common to all projects. This includes the evaluation of visual analytics approaches, building up suitable infrastructures to improve dissemination and re-usability of the results, or aspects of cognitive science that are critical for effective user-centric analysis processes. Furthermore, special interest groups were formed to encourage and foster joint projects and collaborations.

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<sup>1</sup> Unfortunately, the third organizer of the seminar, Jim Thomas, passed away on August 6, 2010.

### 3 The Participants

The seminar gathered 55 researchers from the following 7 countries:

Country	Number of participants
Austria	2
Canada	1
France	1
Germany	46
Israel	1
Sweden	1
USA	3

The German participants from the SPP “Scalable Visual Analytics” were the largest fraction of participants, since they are all heavily involved with the topic of the seminar. Due to the Thanksgiving Holiday in the U.S., it was not surprising that many U.S. invitees had to decline their participation. Most participants come from universities or state-owned research centers (53) while 2 participants were employed by industry or industrial research centers.

### 4 The Program

#### Monday (2010-11-22) – Tuesday (2010-11-23)

The first 1 ½ days of the seminar were dedicated to presentations of the participants of the SPP “Scalable Visual Analytics”. Furthermore, two keynote talks of invited international speakers helped to widen the horizon of the participants for topics that are important in the context of visual analytics research but are often disregarded. As intended, the keynote talks did stimulate discussions and influenced future research activities.

#### Keynote Talks

- Brian Fisher: **Cognitive Aspects of Visual Analytics**
- Jean-Daniel Fekete: **Infrastructure and Evaluation Aspects of Visual Analytics**

#### Project-related Talks

- Gerik Scheuermann, Gerhard Heyer: **Topology-based Visual Analysis of Information Spaces**
- Thomas Ertl, Hinrich Schütze: **Scalable Visual Patent Analysis**
- Peter Liggesmeyer, Achim Ebert: **Visualization of and interaction with complex graphs on large-scale and high-resolution displays: models, metaphors, and interaction paradigms**
- Marcus Andreas Magnor, Holger Theisel: **Exhaustive visual search for information in multi-dimensional data sets**

- Tobias Schreck: **Visual feature space analysis**
- Joachim Giesen: **Visually guided exploration of point cloud data in Euclidean space**
- Daniel Cremers, Martin Rumpf: **Variational Methods for Model-based Interactive Analysis of Flows**
- Kay Nieselt: **Visual Analytics for Large and heterogeneous Life Science data with emphasis on expression data**
- Stefan Gumhold, Michael Schröder: **Zoomable Cell**
- Hans-Peter Lenhof, Gerhard Weikum, Michael Kaufmann, Oliver Kohlbacher: **New techniques for the interactive navigation, visualization, and analysis of heterogeneous biological networks**
- Bernhard Preim, Klaus-Dietz Tönnies: **Efficient Visual Analysis of Dynamic Medical Image Data**
- Gunther Heidemann, Daniel Weiskopf: **Scalable Visual Analytics of Video Data**
- Daniel A. Keim, Stefan Wrobel: **Visual analytics methods to support the spatiotemporal analysis of movements in a physical space, in particular in a geographical space**

#### **Tuesday (2010-11-23) – Friday (2010-11-26)**

The remainder of the seminar was used for impulse talks, presentation of new research ideas and working group meetings.

#### Impulse Talks

The following position statements, talks on controversial topics for stirring discussions, or presentations on future directions of research were given:

- Richard May: **SCALABLE visual analytics ... Everything Breaks**
- Silvia Miksch: **A Matter of Time and Interactions: Interactively Exploring Time-Oriented Data**
- Margit Pohl: **Perception and Cognition in Visual Analytics: Frameworks for Analysis and Design**
- Susanne Boll: **Designing Visual Analytics Applications for Interactive Surfaces**
- Jörn Kohlhammer: **Continuation of the VisMaster Initiative - Research Topics, Funding Opportunities, Next Steps**
- **Discussion on Teaching Visual Analytics**

#### Presentations of results / research ideas

- Loretta Auvil: **Role of Mashups, Cloud Computing, and Parallelism for Visual Analytics**
- Andreas Kerren: **Visualization of Wine Tasting Notes**
- Carsten Görg: **Visual Analysis of Biomedical Documents**

- Enrico Bertini: **High-dimensional Subspace Clustering**
- Gerhard Heyer: **Modularity and Infrastructure in the eHumanities**
- Peter Liggesmeyer/Achim Ebert: **Architecture Visualization**
- Gerik Scheuerman: **Topological Analysis of Large Document Collections**
- Daniela Oelke: **State and Future Prospects of Visual Readability Analysis**
- Waqar Saleem: **Choosing the Right Model**
- Margit Pohl, Brian Fisher: **The Role of Emotions in Visual Analytics**
- Margit Pohl, Brian Fisher: **Cultural Differences between Europe and North America**

### Working Group Meetings

The purpose of the working groups was to bring together researchers from similar applications fields or with similar research challenges in order to allow a more intensive discussion on topics related to their specific research area. Each group was working on perspectives and / or plans for joint activities in their field. Each of the six working groups met twice (having always three interest groups in parallel) and the results were shared and discussed with all participants of the seminar afterwards. The following results were achieved by the different working groups:

#### *Working group 1: Visual Analytics of High-dimensional Data*

- Position Paper on Issues in High-dimensional Visual Analytics (Submission planned for EuroVA)

#### *Working group 2: Visual Document Analysis*

- Submission of a proposal for a Visual Analytics workshop at the Digital Humanities Conference 2011, <http://dh2011.stanford.edu> (if still possible)
- Overview Paper on “Visual Analytics for the Digital Humanities”
- Overview Paper for the Natural Language Processing Community

#### *Working group 3: Geo-Spatial Visual Analytics*

- Plans for submitting an EU FET Open Project on “GeoTemporal Visual Analytics for the Masses”

#### *Working group 4: Bio-Medical Visual Analytics*

- Workshop on Biomedical Visualization as a satellite of German Conference on Bioinformatics (September 2011, Munich)

#### *Working group 5: Visual Analytics of dynamic / time-dependent / streaming Data*

- Workshop in Vienna
- Position Paper

- EU FET Open Project

#### *Working group 6: Evaluation of Visual Analytics*

- Position Paper on “The Role of Novel Methods for Evaluating Visual Analytics” (for CG&A Viewpoints)
- EU FET Open Project on Novel Methods for Evaluating Visual Analytics

The social program of the event was scheduled on Wednesday afternoon. It was decided to visit the historic city of Saarburg with the possibility to participate in a wine tasting event.

## **5 Conclusions**

The Scalable Visual Analytics seminar was a fertile meeting in which researchers from diverse backgrounds met. It included industry and academia, senior and junior researchers, multi-national representation, and people coming from several disciplines. The diversity resulted in interesting and useful discussions, which will help to shape the future of the versatile research area of Visual Analytics.

The seminar included multiple presentations and discussions which helped to exchange domain knowledge and steer future research activities. Besides, several working groups during the seminar not only identified future research directions in the field of scalable visual analytics but also initiated new joint projects. In total, plans for three position papers, two overview papers to outreach to other communities, and three EU FET Open Projects were drafted. Furthermore, three workshops as satellites of conferences that cover specific application areas were planned to further disseminate the work and provide a platform for ongoing discussions and activities.

This seminar clearly illustrated the diversity, relevance, and fertility of the topics within the field of Visual Analytics. The intensity of the participants' involvement is a clear indication that the interactions fostered by the seminar will generate significant follow-up research, and eventually lead to practical use of Visual Analytics as well. All participants of the seminar were encouraged to reference Dagstuhl in future activities that were conceived during the seminar; in particular, the papers if accepted will contain acknowledgments of their inception during the Dagstuhl seminar.