Guest Editor’s Introduction

Data-Driven Discoveries: Pushing Visualization Research Further

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Data visualization is ubiquitous in today’s society. In the last decade, research in the field has increased tremendously, and the research community has pushed the state of the art in many novel directions. In 2014, the IEEE VIS Conference celebrated its 25th year and grew to incorporate new symposia on large-scale data analysis and visualization (LDAV) and biological visualizations (BioVis). It also featured an increasingly popular art program (VISAP) and an impressive array of workshops and tutorials.

The VIS 2014 workshop program, through eight extremely well attended half-day and full-day events, offers a unique peak at emerging research topics in the field of data visualization. The 2014 program showcased a range of research directions, all attracting researchers and practitioners from a variety of other domains, from machine learning experts to decision makers and medical doctors. (The full program for each workshop is accessible at http://ieeevis.org/year/2014/info/overview-and-topics/accepted-workshops.)

This special issue samples contributions made to these workshops by showcasing two research pieces that aim at pushing the state of the art to enable data-driven discoveries with visualization.

Pushing the State of the Art Across Fields

VIS 2014 workshops as a whole shed light on a variety of cutting-edge topics, fostering discussions among the scientific visualization, information visualization, and visual analytics communities.

The workshop entitled “3DVis@IEEEVIS2014: Does 3D Really Make Sense for Data Visualization?” revived the old debate on the use of 3D versus 2D in visualizations. More than 100 researchers and practitioners attended the event and participated in animated discussions about the benefits and disadvantages of 3D visualizations. The workshop attendees cast a new light on the state of the art and focused discussions on scenarios where 3D visualization can reveal important insights. Attendees concluded the day with research directions for applications domains featuring spatial data, where 3D visualizations are crucial components.

The workshop “Death of the Desktop: Envisioning Visualization without Desktop Computing” called visualization communities to look ahead and think about interaction beyond traditional desktop machines. The organizers proposed a unique workshop format, where participants sketched future usage scenarios and brainstormed on the future technologies for data visualization. To crystallize ideas and foster discussion, participants exhibited sketches onsite on a large paper timeline.

Visualization is now ubiquitous on the Web and accessible to large audiences. However, the research community does not have much insight into what these audiences know about visualization and how they learn to decode new ones. The workshop “Towards An Open Visualization Literacy Testing Platform” focused on the topic of visualization literacy. In this hands-on workshop, attendees defined visual literacy through practical activities. The outcome of the workshop is a Web platform to assess visual literacy. Questions and measures proposed during the workshop are now available online and constitute a starting point for reflecting more broadly on this topic.

The workshop program also featured “DECI-SIVE: Dealing with Cognitive Biases in Visualizations,” which fostered discussions on cognitive biases. This event showcased the multidisciplinary nature of data visualization and its tight con-
nections with cognitive psychology and decision-making research areas. Attendees discussed how people’s reliance on mental shortcuts could result in judgment errors during critical decision-making scenarios. Participants discussed the role that visualization can play to reduce these biases, contributing ideas and examples of visualizations for different scenarios.

**Advances in Visual Analytics**

Two workshops highlighted new directions in the field of visual analytics. The workshop entitled “Visualization for Predictive Analytics” raised awareness on the tremendous amount of research on predictive models that could be leveraged in visual analytics systems. Organizers called the community to reflect on the role of predictions in data science and showcased how important this direction is in a variety of application domains. Attendees presented novel research in this area, and a concluding panel of experts discussed challenges and research opportunities in this topic.

The workshop “Provenance for Sensemaking” pushed our understanding of analytic provenance and its role in the sensemaking process even further. This workshop followed up previous events that focused on defining and showcasing techniques to support analytic provenance—capturing the exploration process leading to insights and making it visible to the analyst. The goal of this workshop was to articulate challenges and build a research agenda for this area.

The outcome of this workshop is presented in the first article of this special issue. In “Analytic Provenance for Sensemaking: A Research Agenda,” Kai Xu, Simon Attfield, T.J. Jankun-Kelly, Ashley Wheat, Phong H. Nguyen, and Nallini Selvaraj first describe the role of analytic provenance in sensemaking before highlighting challenges and proposing four research directions: enhance the provenance capture, develop and validate visualizations for sensemaking, investigate privacy-aware methods to utilize collaborative provenance, and extend error propagation through provenance pipelines to wider types of uncertainty.

**The Impact of Visualization in Other Domains**

Finally, two workshops drew the attention of the community toward exciting application domains. The workshop “business|vis|14” focused on business analytics, bringing together researchers and practitioners involved in the analysis, visualization, and consumption of business data. Highlights of the workshop included keynotes by two company CEOs and extensive discussion on key scenarios for which visual analytics tools have high value.

The workshop “Visualizing Electronic Health Record Data” tackled a different application domain with high stakes as well. Organizers attracted attention to the impact that visualization of electronic health records could have on clinical research and patients. Attendees showcased an array of visualization systems that supported medical researchers and clinicians in understanding large databases of medical records.

The second article of this special issue, “A Visual-Interactive System for Prostate Cancer Cohort Analysis” by Jürgen Bernard, David Sessler, Thorsten May, Thorsten Schlomm, Dirk Pehrke, and Jörn Kohlhammer, demonstrates the value of visualization in this application area. The article presents a visual exploration system designed with six physicians and showcases insights made with the system. This piece of research is an example of the impact visualization can have on people’s lives and constitutes a call for action to continue research in this area.

**Future Directions**

The role of workshops is unique in the research community. They offer a sneak-peak of emerging research topics and enable the community to gain a more holistic point of view on a research direction. They also inspire young researchers and foster collaborations between researchers and practitioners from different disciplines. We envision that many of these workshops will grow and eventually become their own symposiums, such as the BELIV Workshop on evaluation in information visualization (http://beliv.cs.univie.ac.at/). The VIS 2015 workshops program will certainly continue to push the field further by featuring workshops in a variety of cutting-edge research topics.

Nathalie Henry Riche is a researcher at Microsoft Research. The majority of her work is aimed at enabling scientists to make data-driven discoveries via the visual exploration of complex data, and her research interests also include data-driven storytelling and how to assess and raise visual literacy at school. She is a cochair for VIS 2014 and VIS 2015 workshops, responsible for soliciting and reviewing workshop proposals and selecting a subset to be hosted during the IEEE VIS conference. Riche has a PhD in information visualization from INRIA/Université Paris-Sud, France and University of Sydney, Australia. Contact her at nath@microsoft.com.