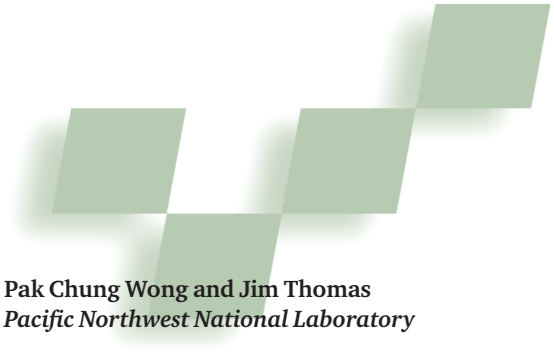

Visual Analytics

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The information revolution is upon us, and it's guaranteed to change our lives and the way we conduct our daily business. The fact that we have to deal with not just the size but also the variety and complexity of this information makes it a real challenge to survive the revolution. Enter *visual analytics*, a contemporary and proven approach to combine the art of human intuition and the science of mathematical deduction to directly perceive patterns and derive knowledge and insight from them.

Visual analytics is the formation of abstract visual metaphors in combination with a human information discourse (interaction) that enables detection of the expected and discovery of the unexpected within massive, dynamically changing information spaces. These suites of technologies apply to almost all fields but are being driven by critical needs in biology and national security.

Visual analytics is an outgrowth of the fields of scientific and information visualization but includes technologies from many other fields, including knowledge management, statistical analysis, cognitive science, decision science, and many more. The processes and goals of analysis dominate the approach, but it's enabled by the wide-band visual interface to the brain and a dynamic interaction style of communication and discourse.

A few example core technologies help to illustrate the emerging directions within visual analytics. First, the issue of multiscale information representation and visualization is fundamental for advances in genomics. Information must be analyzed between scales ranging from molecules, gene networks, signaling networks, and cells to organisms and ecosystems of different types, abstraction levels, sources, and formats. The data and visual representations are different at each scale.

Second, the analysis of masses of unstructured text reports is required for national security. We first must develop data signatures for the source data and produce high-dimensional representations both statistically and semantically within different levels of abstraction and different contexts for analysis. Then we must discover the hidden, weak, or sometimes missing relationships while considering the entire context.

Finally, the issue of temporal analytics is critical. Information structures, relationships, and meanings change over time with a context for analysis. Therefore, as information is ingested into an analytics space, we must provide visual and interaction paradigms that help us understand millions of incoming sources, comparing the new data to huge digital libraries of information to discover what might have changed and why.

These are only a few of the many examples of challenges facing visual analytics. Visual analytics will not likely become a separate field of study, but you will see its influence and growth within many existing areas, conferences, and publications. However, core to the field's success are highly interdisciplinary science teams working together that will cross from basic science to solutions. This year, the Department of Homeland Security established the National Visual Analytics Center, which the Pacific Northwest National Laboratory will lead; next year, DHS will establish regional visual analytics centers led by university teams. NVAC will lead focused workshops and conferences in this area. For more information, visit http://nvac.pnl.gov.

The future for visual analytics is that of a growing science. The challenges in both the sciences and national security are driving the needs and providing significant funding opportunities for our field. We are delighted to provide an outstanding selection of articles for the initial discussion on this topic.

About the articles

This special issue on visual analytics attracted high-quality submissions from Australia, Germany, and the US. Each submission was assigned to at least four domain experts for thorough review and evaluation. Because of conflicts of interest, the submission by Hetzler and Turner was independently managed, and later accepted, by *CG&A* associate editor-in-chief, Maureen Stone and editorial board member, Jock Mackinlay. Together, we selected six submissions that best represent the current state of the art in the studies of visual analytics.

Hetzler and Turner describe an observational study on how to successfully design a working visual analytics system that satisfies the needs and requirements of its users. While their entire discussion is on document visualization, the ideas and wisdom presented in this article go beyond text analysis and address many core issues in visual analytics.

Teoh, Ma, Wu, and Jankun-Kelly investigate the use of visualization to analyze and detect flaws and intruders in computer network systems. Their article presents results of new visual analytics techniques that are proven to outperform many others. These creative designs bring valuable contributions to an industry that is constantly seeking new and better flaw-detecting solutions.

The article by Keim, Panse, Sips, and North focuses

 Published by the IEEE Computer Society

on the use of innovative visual analytics techniques to analyze and visualize geospatial point data sets. Their elegant and highly scalable design has a wide variety of applications that explore large volumes of data from maps to GIS and demographics information.

The work by Nesbitt and Barrass is truly one of a kind. The article describes a visual- and audio-based tool that finds trading patterns in stock market data. The study results, which were collected based on realistic stock market information, show that even novices can find success in the stock market using the customized tool.

Schmidt, Chen, Bryden, Livingston, Rosenblum, and Osborn introduce multiple visual analytics techniques to analyze ocean bottom uncertainty information. Their visualization techniques are applicable in both VR and non-VR platforms. Many of these novel visualization ideas are suited to analyze uncertainty information of different types of spatial data.

Finally, Lee, Girgensohn, and Zhang examine the use of novel visual analytics techniques to study social behavior and activity patterns in Web environments that support social browsing. The ingenious design and manipulation of their visualization tools bring new discoveries and surprising results in the social interaction study between humans and computers.

Conclusion

The articles presented in this special issue represent some of the most important topics for further investigation and exploration. With continued government, academic, and industrial support, the opportunities for further advancement are practically limitless. ■

Acknowledgments

The Pacific Northwest National Laboratory is managed for the US Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RL01830.

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