Special Issue: Visualization Connections

Peter Lindstrom
Lawrence Livermore National Laboratory

Huamin Qu
Hong Kong University of Science and Technology

The visualization community hosts a number of exciting workshops each year that focus on a diverse range of topics, including the use of virtual reality (VR) in visualization applications, design, and development of data systems for interactive data exploration, consideration of cognitive biases in decision making, integration of deep learning techniques, visualization for digital humanities, strategies for teaching visualization, hands-on approach to scientific discovery, and activities to improve diversity in the visualization community. These workshops represent late-breaking work and research in cutting-edge domains that could lead to new frontiers in visualization research and application.

This special issue highlights and reports some of these exciting new areas in the visualization community, with contributions from organizers of workshops held in conjunction with the IEEE VIS 2017 conference. This issue received several excellent submissions out of which three articles appear here. These articles represent different aspects of scholarly research presented at these workshops, including a summary of challenges, success stories, and future research directions identified in the "Visualization for the Digital Humanities" workshop and an archival version of the best paper awardee from the "Visual Analytics for Deep Learning" workshop. This special issue is rounded out with a regular CG&A contribution on interactive illustration of molecular structures of cellular environments.

IN THIS ISSUE

Over the past few years, IEEE VIS has hosted a series of workshops on the role of visualization as a tool within the humanities. Digital humanities spans a very broad range of topics, including digital archiving, text mining, and visualization of historical documents, visual text analysis, geospatial data analysis, and even VR applications, for example, in archaeology. The aim of this workshop is to establish stronger ties between the two communities and to make researchers within both communities better aware of what each community has to offer and what challenges they face, with the ultimate goal of establishing effective collaborations.

Published by the IEEE Computer Society
0272-1716/19/$33.00 ©2019 IEEE

As pointed out in the first article, researchers in the two communities often employ quite different research methodologies, some of which the authors argue may be unfamiliar yet beneficial to researchers within the visualization community. The authors, which represent both of these communities as well as interests that lie near their intersection, offer perspectives from different vantage points and backgrounds. The article concludes with testimonies from the authors on how visualization has or may one day help in the humanities, as well as their experiences participating in collaborations across the two communities.

Deep learning has emerged as a powerful tool for attacking a wide range of problems in a diverse set of applications. Indeed, it is almost impossible today to find a computing application for which researchers have not contemplated the use of deep learning techniques. Although very successful examples exist in a number of domains, a common criticism of deep learning based solutions is that they serve much as black boxes that provide little insight into how, why, and when they are successful.

To gain insight into how recurrent neural networks (RNNs) learn, the authors of the second article propose RNNbow: an interactive tool for visualizing gradients that are part of the learning process in RNNs. One contribution of this paper is the realization that gradients, not activations, are indicators of how—and indeed whether—the network is learning, and that a visualization of gradient flow during training complements other visualizations to shed light on the learning process itself. RNNbow is primarily geared toward the nonexpert user for experimenting with neural networks of limited size.

The last article in this special issue presents a novel interactive painting tool called CellPAINT, which allows biological researchers and educators to build complex cellular mesocale environments with digital paint brushes and palettes. The tool incorporates a variety of mesoscale properties and supports the simulation of dynamic diffusive motion in real time. Compared with traditional methods, it is less compute intensive and relatively easy to use. The authors demonstrate the potential of the tool with an initial application that allows users to create a specific class of scenes that explore HIV structure and infection.

ABOUT THE AUTHORS

Peter Lindstrom is a computer scientist at Lawrence Livermore National Laboratory, where he leads several projects on scientific visualization and data compression. He received the Ph.D. degree in computer science from the Georgia Institute of Technology. He is a former Editor in Chief of *Graphical Models* and a senior member of IEEE. Contact him at pl@llnl.gov.

Huamin Qu is a professor with the Department of Computer Science and Engineering, Hong Kong University of Science and Technology. His main research interests are in visualization and human-computer interaction, with focuses on urban informatics, social network analysis, e-learning, text visualization, and explainable artificial intelligence. He received the Ph.D. degree in computer science from the Stony Brook University. Contact him at huamin@cse.ust.hk.