# Preface

## Message from the VIS Paper Chairs and Guest Editors

This January 2019 issue of the *IEEE Transactions on Visualization and Computer Graphics* (*TVCG*) contains the proceedings of IEEE VIS 2018, held during 21-26 October 2018 at the Estrel Hotel & Congress Center in Berlin. With IEEE VIS 2018, the conference series is in its 29th year.

IEEE VIS consists of three conferences, held concurrently: the IEEE Visual Analytics Science and Technology Conference (IEEE VAST), the IEEE Information Visualization Conference (IEEE InfoVis), and the IEEE Scientific Visualization Conference (IEEE SciVis). These three conferences are the premier venues for the visualization community to exchange the latest ideas and developments, attracting researchers and practitioners alike.

## Review Process

The timeline, general organization of the review process, and the publication process are shared by the three conferences, including identical paper submission guidelines. The conferences differ in the topics sought after in their respective call for papers, and in their paper chairs and international program committees, reflecting the different types of expertise required.

The review process consisted of two cycles to meet the quality standards of a journal publication. In the first cycle, each paper was assessed by four reviewers—inviting additional reviewers to broaden the review perspective for special cases. Two reviewers were members of the international program committee: one primary and one secondary reviewer. International program committee members were assigned by the paper chairs, taking into account the fit of expertise and information from the bidding phase, where international program committee members could select submissions of their interest based on the submitted abstracts. The primary and secondary reviewers then invited one external (tertiary) reviewer each. IEEE VIS provides optional double-blind review at the discretion of the submitting authors. In this case, the paper was anonymized for the external reviewers and only the members of the international program committee were informed about the identity of the authors.

All four reviewers wrote full reviews, providing individual scores. Based on these reviews and a discussion among the reviewers, the primary reviewer provided a summary review and recommendation. This led to a total of 1918 full reviews: 665 for IEEE VAST, 740 for IEEE InfoVis, and 513 for IEEE SciVis. The paper chairs considered the full and summary reviews, the scores, the discussion between the reviewers, and possible confidential comments by the reviewers in order to make the decisions for the first review cycle. For borderline or controversial decisions, the paper chairs had additional discussions with the primary reviewers and, where needed, also read and assessed papers themselves.

Conditionally accepted papers required revisions by the authors and were re-submitted for the second review cycle. This submission included a cover letter with a documentation of the revisions and how they took into account issues identified in the first review cycle. The primary reviewer checked the revision as to whether the required changes were addressed successfully, writing a review and giving a recommendation. Based on this second-round review, the paper chairs made the final decision about acceptance.

The success of IEEE VIS 2018 and its special issue of *TVCG* depends on the quality of the papers. Therefore, we thank all authors for submitting their work to IEEE VIS, and the 182 members of the international program committees (68 for IEEE VAST, 63 for IEEE InfoVis, and 51 for IEEE SciVis) and all external reviewers for their diligent and hard work as reviewers.

## IEEE VAST 2018

This is the 13th edition of IEEE Visual Analytics Science and Technology (IEEE VAST). Begun in 2006 as an IEEE Symposium at VIS, it is now in its 9th as an IEEE Conference. It continues to be the leading forum for Visual Analytics research, defined as the science of analytical reasoning supported by interactive visual interfaces. IEEE VAST represents research pushing the boundaries of the state of the art in theory and foundations of visual data analysis, techniques and algorithms, empirical and design studies, as well as systems and applications.

The IEEE VAST 2018 Program Committee comprised 68 senior experts from the field. 164 complete submissions entered the two-stage review cycle, from which IEEE VAST eventually accepted papers in two categories:

(a) *TVCG*-Track. Papers that exhibit the highest quality in terms of originality, rigor, and significance appear in a special issue of *IEEE Transactions on Visualization and Computer Graphics* (*TVCG*), together with the papers from the IEEE Information Visualization and Scientific Visualization Conferences. After two review cycles, 41 papers were accepted into the *TVCG* track, for an acceptance rate of 25% (compared to 37 papers and 21.4% in 2017).

(b) Conference-only Track. To increase the diversity of visual analytics applications and to better support participation of interdisciplinary researchers, the IEEE VAST conference paper track features innovative advances and applications in visual analytics that may have foci outside the scope of *TVCG*. 7 papers were accepted into the Conference-only track, adding another 4.2% to the overall acceptance rate (compared to 15 papers and 8.7% in 2017).

Papers in both tracks will be presented in the conference, be included in the IEEE VAST USB Proceedings, and submitted to the IEEE Digital Library. An exciting program of 12 sessions has been composed from the accepted papers, added to by a set of papers previously published in *TVCG* and invited for presentation at IEEE VIS. Sessions dedicated to novel visual analysis techniques by data type include spatio-temporal data, text data, graph and image data, and high-dimensional data. In addition, event and sequence data are covered. This set of technique sessions is complemented by works on evaluation and theory, security and privacy, provenance, as well as interactive analytics and design. Furthermore, IEEE VAST continues to have strong interest in application, understanding, and user steering of machine learning techniques. Three sessions are dedicated to this area, namely, explainable machine learning, deep learning, and use of ensembles. Finally, application papers continue to be an integral part of the IEEE VAST program, demonstrating the successful application of visual analysis techniques and assessing its impact in important domain analysis problems.

From the set of accepted papers, seven papers were selected by the program chairs as candidates for the IEEE VAST 2018 best paper award, based on reviewer comments and scores.

The IEEE VAST 2018 best paper committee was invited by the program chairs in consultation with the IEEE VAST steering committee. It comprised distinguished researchers Chris North (chair), Enrico Bertini, and Shixia Liu, who independently identified one best paper and three equal honorable mention awards from the candidate papers.

The IEEE VAST 2018 best paper award goes to Dongyu Liu, Panpan Xu, and Liu Ren for their paper "TPFlow: Progressive Partition and Multidimensional Pattern Extraction for Large-Scale Spatio-Temporal Data Analysis". Their paper contributes an excellent visual analytics framework for interactively steering the progressive partitioning of spatio-temporal data. It uses a novel tensor-based decomposition algorithm to extract patterns and a novel metric for optimizing the decomposition process. The process is visualized at multiple levels of detail that allow for comparisons and deviation analysis. Insightful results are demonstrated with a set of convincing use cases. This novel approach offers a fresh take on the problem, shows good potential for many different application scenarios, and will likely inspire future follow-on research.

A honorable mention is awarded to Cong Xie, Wei Xu, and Klaus Mueller for their paper "A Visual Analytics Framework for the Detection of Anomalous Call Stack Trees in High Performance Computing Applications". Their paper introduces an interactive visual system supported by machine learning to help users discover anomalous behavior in call stacks gathered from high-performance computing runs. To bring more context into the analysis of run time behavior, the authors view as their unit of analysis a function call with its chain of dependencies as a tree, and convert to vector representation using a novel feature engineering stack2vec algorithm. This is an an excellent example of visual analytics in that it truly combines visualization and analytics in an iterative, interactive feedback loop. Taking context into account by using the trees is a key takeaway for future HPC anomaly detection work.

Another honorable mention is awarded to Junpeng Wang, Liang Gou, Han-Wei Shen, and Hao Yang for their paper "DQNViz: A Visual Analytics Approach to Understand Deep Q-Networks". The work contributes a hierarchical visual analytics scheme for representing the complicated training process and performance of deep reinforcement learning models such as DQNs, with case studies on learning to play video games. An in-depth case study shows how deep learning experts can understand aspects of model performance. The paper makes use of trending deep learning visualization techniques such as guided backpropagation to ensure explainability, a key issue in deep learning applications. The paper offers novel ideas about visualizing network characteristics overlaid on the game state, and includes several interesting interactions for supporting in-depth analyses.

Furthermore, a honorable mention is awarded to Hendrik Strobelt, Sebastian Gehrmann, Michael Behrisch, Adam Perer, Hanspeter Pfister, and Alexander M. Rush for their paper "Seq2Seq-Vis: A Visual Debugging Tool for Sequence to Sequence Models". The paper contributes a visual analytics toolset for debugging of sequence to sequence models, which are often used in machine translation of human language. The strength lies in the tools modularity, as it is possible to explore potential problems and bug sources in the models at all five stages of the mapping process. The tool is aimed at ML experts, and it has been carefully designed in a close collaboration with end users. The topic is highly relevant as deep learning becomes more and more powerful and popular, yet difficult to understand and manipulate.

We congratulate the awardees, and we thank the best paper committee for their work.

To an inspiring VAST at VIS 2018!

# IEEE InfoVis 2018

Information visualization (InfoVis) covers human visual data exploration, analysis, and communication within displays that flexibly encode data in perceptually effective ways. IEEE InfoVis 2018 is the 24th annual InfoVis meeting, and remains the primary meeting in the field of information visualization. Core research issues in the field include the design of perceptually and cognitively effective visual encodings for a variety of data types, novel interaction techniques for creating and manipulating visualizations, and real-world application development and evaluation to advance this field of study.

IEEE InfoVis updates its international program committee each year, with a maximum of 3 years of consecutive service. This year the committee consisted of 63 members. Of these, 29 people returned from last year, we welcomed

back 17 members who had served in the past, and added 17 new members—well-regarded researchers who wrote strong reviews in prior years. Of the program committee members, 24 (38%) were women. IEEE InfoVis is strongly committed to diversity, and will continue to strive towards full equality in the future.

This year's IEEE InfoVis conference received 183 submissions (after 2 desk rejections). Of these, we ultimately accepted 47, following two rounds of review and revision, for an acceptance rate of 25.7%. In 2017 we received 170 submissions and accepted 39. Thus, both submissions and number of accepted papers have increased. Despite an increased acceptance rate (up from 22.9% in 2017) the average review score has actually increased slightly, an indicator that quality of accepted content remains extremely high. The decision to accept more papers is also a response to community feedback that InfoVis was becoming too restrictive.

Based on a self-categorization by the paper authors, we received the following types of papers: 64 technique/algorithm papers (35% of all submissions, 16 accepted), 54 evaluation papers (30%, 14 accepted), 28 application/design study papers (15%, 5 accepted), 23 systems papers (12%, 5 accepted), and 14 theory papers (8%, 7 accepted). Compared to 2017, we see a 4 percentage point (PP) increase in evaluation papers, a 5 PP increase in systems papers, and a 7 PP decrease in application/design study papers submitted to InfoVis.

Long-standing topics of interest in this year's proceedings include perception and cognition, trees and graphs, multidimensional data, time, uncertainty, and text. In addition, this year we have sessions on immersive analytics, interaction, design, storytelling, and devices from watches to wall displays. We feel this mixture of themes represents a balance of forward-looking exploration of emerging technologies and techniques against strong theoretical underpinnings.

Five of the finally accepted papers were nominated for the best paper award by the IEEE InfoVis papers chairs. These were among the highest rated papers as determined by the reviewers and were considered to have made a significant contribution to the discipline of information visualization. IEEE VIS policy specifies that the IEEE InfoVis papers chairs are not eligible to receive a Best Paper Award or Honorable Mention.

The Best Paper Committee consists of three members chosen by the IEEE InfoVis papers chairs in consultation with the IEEE InfoVis Steering Committee to ensure expertise whilst avoiding any conflicts of interest. This year our distinguished committee members were Melanie Tory (chair), Niklas Elmqvist, and Marc Streit. The committee read reviews and final versions of papers on the shortlist. They each ranked all the papers and met as a group to discuss and reach a consensus, in the end selecting one Best Paper and three Honorable Mentions.

For the Best Paper award, the committee selected "Formalizing Visualization Design Knowledge as Constraints: Actionable and Extensible Models in Draco" by Dominik Moritz, Chenglong Wang, Greg L. Nelson, Halden Lin, Adam M. Smith, Bill Howe, and Jeffrey Heer. Draco is a generalizable and flexible framework for representing visualization knowledge. It offers a new approach for visualization recommendation by using a constraint solver to select visualizations from an enumerated set of possibilities, and has the ability to learn rules from experimental results. As open source software, Draco offers the community a useful resource for gathering and sharing best practices, guidelines, and recommendations in visualization research as well as a stepping stone towards more approachable methods of authoring visualizations.

The committee also selected three papers for Honorable Mention (listed below in no particular order). The first was "Design Exposition with Literate Visualization" by Jo Wood, Alexander Kachkaev, and Jason Dykes. "Literate visualization" applies Donald Knuth's literate programming paradigm, where source code is interspersed with natural language and other media, to visualization design. The idea couples development with the design process itself through integrated live coding, textual narrative, and documentation. This closely intertwined process, supported by an open source development environment, will enable the externalization of design rationale and best practices in both academic and practitioner communities.

The second was "Charticulator: Interactive Construction of Bespoke Chart Layouts" by Donghao Ren, Bongshin Lee, and Matthew Brehmer. The Charticular system takes the interactive authoring of visualizations without programming to the next level by prioritizing chart-level layout as well as visual linking between graphical marks. Visualization structures can be exported as reusable templates and applied to new data, thus facilitating their use by non-programmers such as designers, journalists, and analysts.

The third was "Mapping Color to Meaning in Colormap Data Visualizations", by Karen B. Schloss, Connor C. Gramazio, Allison T. Silverman, Madeline L. Parker, Audrey S. Wang. This experimental work advances our understanding of colormap perception in relation to the background. The paper establishes evidence for dark-is-more and opaque-is-more biases in people's inferred interpretation of colormaps and identifies the conditions in which the background can interfere in these inferred mappings. Results of these studies inform the design of perceptually robust colormaps and enrich our theoretical understanding of colormap interpretation.

We congratulate all of the authors for this excellent work and thank the Best Paper Committee for their diligence.

Here's to an amazing IEEE InfoVis 2018!

# IEEE SciVis 2018

Scientific visualization (SciVis) has been a fundamental part of IEEE VIS and its predecessors since the very beginning. IEEE SciVis addresses questions related to data analysis and visualization in a large variety of application fields. Topics range from research on fundamental methods to tool development for solving real-world visualization problems. The conference is the primary venue for advances in the field and the large number of high quality submissions shows that SciVis continues to be a very active and vivid part of the visualization community.

The IEEE SciVis 2018 program represents a selection of these submissions. This year's IEEE SciVis conference received 128 submissions. Of these, we ultimately accepted 32 papers, following two rounds of reviews and revisions. The acceptance rate was 25.0%, up from 19.2% at last year's conference. We fast-tracked five more papers to the *TVCG*. The IEEE SciVis 2018 program was complemented by oral presentations of 15 regular *TVCG* papers from the previous year in the area of scientific visualization.

The program covers a blend of emerging and core topics and application domains. Topics range from volume visualization, tensors, flow features, scalable methods, topological data analysis and geometry, all the way to generative data models and new interaction paradigms. Applications cover various fields: from biology, medicine over climate and weather to physics and astronomy.

The best papers for IEEE SciVis 2018 were chosen by a committee consisting of three members picked by the papers chairs in consultation with the SciVis steering committee. This year, David Ebert (Purdue University), David Laidlaw (Brown University), and Jos Roerdink (University of Groningen) served as committee members and selected one best paper and two honorable mention awards out of a list of six candidates chosen by the papers chairs from the SciVis conference submissions (primarily based on overall scores and level of innovation).

We congratulate Andrey Krekhov and Jens Krueger on winning the best paper award with their contribution "Deadeye: A Novel Preattentive Visualization Technique Based on Dichoptic Presentation." This paper presents a novel and well executed approach to preattentive visualization. It exploits binocular vision by showing different stimuli to our two eyes. The corresponding visualization method lets visual features pop out so that they can be easily recognized, independently from the number of visual distractors. The paper is well written and provides excellent supporting evidence. Most importantly, it raises new questions on which future research can build and it is immediately useful in various applications with the potential to improve visualizations for many users.

Further, we would like to acknowledge David Kouřil, Ladislav Čmolík, Barbora Kozlikova, Hsiang-Yun Wu, Graham Johnson, David S. Goodsell, Arthur Olson, Eduard Gröller, and Ivan Viola on their honorable mention award for "Labels on Levels: Labeling of Multi-Scale, Multi-Instance, and Crowded 3D Biological Environments." The committee found that this innovative paper presents a well designed approach that addresses an important problem of interactive labeling of 3D crowded scenes of biological structures with multi-scale and multi-instance characteristics. It uses a good combination of ideas for the comprehensible labeling method that may be useful in a variety of scientific applications.

The second honorable mention award goes to Sergej Stoppel, Magnus Paulson Erga, and Stefan Bruckner for their paper "Firefly: Virtual Illumination Drones for Interactive Visualization." This paper addresses the problem of automatic light placement in three dimensional scenes by creating dynamic lights in form of illumination drones whose paths adapts to changes in the scene and camera position. The committee found their innovative approach to be well-designed and easy to deploy in a wide range of applications. The committee further commented that this method addresses an important problem that is often ignored in visualization. The paper is very well written and accompanied by a good demo.

We thank the best paper committee for their work.

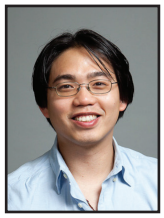
To a great IEEE SciVis 2018!

# Acknowledgments

Finally, the papers chairs would like to acknowledge everybody who contributed to making this year's program possible. These are at first all the authors who submitted their work to IEEE VIS with many valuable contributions. Equally important were the three international program committeess with their detailed reviews and discussions. Furthermore, we would like to thank the IEEE VAST, IEEE InfoVis, and IEEE SciVis steering committees, the steering committee liaisons Silvia Miksch (IEEE VAST), Melanie Tory (IEEE InfoVis), and James Ahrens (IEEE SciVis), the *TVCG* editor-in-chief Leila De Floriani, and the IEEE VIS-*TVCG* liaisons Klaus Müller (IEEE VAST), Jeffrey Heer (IEEE InfoVis), and Charles Hansen (IEEE SciVis), who were supportive whenever needed. Finally, we would like to acknowledge all the technical support from PCS by Meghan Haley and James Stewart, who were always present to support the reviewing process.

## Paper Chairs and Guest Editors

### Remco Chang, VAST



Tufts University

Remco Chang is an Associate Professor in the Computer Science Department at Tufts University where he received tenure in 2016. He received his BA from Johns Hopkins University in 1997 in Computer Science and Economics, MSc from Brown University in 2000, and PhD in Computer Science from UNC Charlotte in 2009. Prior to his PhD, he worked for Boeing developing real-time flight tracking and visualization software, followed by a position at UNC Charlotte as a research scientist. His current research interests include visual analytics, information visualization, HCI, and databases. His research has been funded by the NSF, DARPA, Navy, Army, DHS, MIT Lincoln Lab, and Draper. He has had best paper, best poster, and honorable mention awards at InfoVis, VAST, CHI, and VDA, and he is currently an associate editor for the ACM TiiS and the Human Computation journals. He received the NSF CAREER Award in 2015.

### Tim Dwyer, InfoVis

Monash University

Tim Dwyer received the PhD degree on "two and a half dimensional visualisation of relational networks" from the University of Sydney, in 2005. He is an associate professor with Monash University. He was a post-doctoral research fellow with Monash University from 2005 to 2008, then a visiting researcher with Microsoft Research, in 2008-2009. From 2009 to 2012, he worked as a senior software development engineer in the Visual Studio Product Group, Microsoft. In late 2012, he returned to Monash University as a Larkins fellow, where he co-directs the Immersive Analytics Initiative and is a founding member of the Monash Adaptive Visualisation Lab: http://marvl.infotech.monash.edu/dwyer

### Issei Fujishiro, SciVis

Keio University

Issei Fujishiro is Chief Professor of the Center for Information and Computer Science, Graduate School of Science and Technology, Keio University, Yokohama. He received his Doctor of Science in information sciences from the University of Tokyo in 1988. His research interests include graphical modeling paradigms, applied visualization design, and smart multi-modal ambient media. He has been serving on the steering committee for IEEE SciVis and IEEE PacificVis and the editorial board for *IEEE TVCG* (1999 to 2003, 2018 to date) , Elsevier Computers & Graphics (2003-2013), and Elsevier Journal of Visual Informatics (2016 to date). He was a guest editor for IEEE CG&A (Vol. 35, No. 6, 2015; Vol. 28, No. 5, 2008). He served as chair for PacificVAST 2018, CGI 2017, TopoInVis 2017, ACM VRCAI 2015, PacificVis 2014, Cyberworlds 2013, and IEEE SMI 2006 and served as a program chair for VRCAI 2014, PacificVis 2008, and Volume Graphics 2005/2003. He is a member of Science Council of Japan.

### Petra Isenberg, InfoVis

Inria

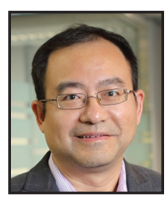
Petra Isenberg is a research scientist (CR) at Inria and member of the Aviz team. Prior to joining Inria, Petra received her PhD from the University of Calgary in 2010 and her Diplom-degree in Computational Visualistics from the University of Magdeburg in 2004. Her main research areas are information visualization and visual analytics with a focus on collaborative work scenarios, interaction, and evaluation. She is interested in exploring how people can most effectively work together when analyzing data on novel display technology such as small touch-screens, wall displays, or tabletops. Petra has held 15+ organizing committee roles (most of these at VIS), served on 40+ program committees, and co-organized 10+ workshops. Since 2012 she has, in particular, been the co-organizer for the biennial Beliv workshop.

### Steve Franconeri, InfoVis

Northwestern University

Steven Franconeri is a Professor of Psychology and Director of the Cognitive Science Program at Northwestern University. He received his B.A. from Rutgers University in Computer Science and Cognitive Science, and his Ph.D. from Harvard University in Experimental Psychology. He has received Cattell, NSF CAREER, and Psychonomic Society Early Career awards for his work on perceptual psychology. His lab conducts use-inspired research on visual thinking and communication, across science, education, and data visualization.

### Huamin Qu, VAST



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Huamin Qu is a professor in the Department of Computer Science and Engineering at the Hong Kong University of Science and Technology. His research interests include urban informatics, social network analysis, e-learning, text visualization, and explainable artificial intelligence. He has served as a papers chair of IEEE PacificVis 2011 and 2012, IEEE VIS (SciVis) 2014, IEEE VIS (SciVis) 2015, and IEEE VIS (VAST) 2018. His research has been recognized by many awards including 8 best paper/honorable mention awards, IBM Faculty Award, HKICT Best Innovation (Innovative Technology) Silver Award, and Distinguished Collaborator Award from Huawei Noah's Ark Lab. He obtained a BS in Mathematics from Xi'an Jiaotong University, an MS and a PhD in Computer Science from the Stony Brook University.

## Tobias Schreck, VAST

Graz University of Technology

Tobias Schreck is a professor with the Institute of Computer Graphics and Knowledge Visualization at Graz University of Technology. He obtained a PhD in Computer Science in 2006 from the University of Konstanz. Previously, he held positions as research group leader at Technische Universitaet Darmstadt and as assistant professor at the University of Konstanz. His research interests include visual analysis of high-dimensional, spatio-temporal, network and 3D object data. He has been a Principal Investigator in a number of research projects funded by the German Research Foundation, the European Commission's FP7 program, and state-level funding. Among others, he is currently working on a project on immersive data analytics funded by the Austrian Research Promotion Agency (FFG). Tobias is an associate editor of TVCG, and a continuing paper co-chair for IEEE VAST 2018. He previously served VIS as co-chair for Posters, Workshops, Panels and Publicity.

## Daniel Weiskopf, SciVis

University of Stuttgart

Daniel Weiskopf is a professor at the University of Stuttgart and co-director of its Visualization Research Center (VISUS). He received his Dr. rer. nat. (PhD) degree in physics from the University of Tübingen (2001), and the Habilitation degree in computer science at the University of Stuttgart (2005). His research interests include scientific and information visualization, visual analytics, eye tracking, GPU methods, computer graphics, and special and general relativity. He is spokesperson of the Collaborative Research Center SFB/Transregio 161 "Quantitative Methods for Visual Computing" (www.sfbtrr161.de) and one of the initiators of the workshop series on "Eye Tracking and Visualization" (ETVIS, www.etvis.org). He is papers chair for IEEE SciVis 2018. He previously served as a papers chair of IEEE PacificVis 2017, SIGGRAPH Asia Symposium on Visualization 2016, BioVis 2016 and 2015, EuroVis 2010, and EGPGV 2009.

## Gunther H. Weber, SciVis

Lawrence Berkeley National Laboratory & University of California, Davis

Gunther H. Weber received a Ph.D. in computer science, with a focus on computer graphics and visualization, from the University of Kaiserslautern in 2003. He is currently a Staff Scientist in the Computational Research Division at the Lawrence Berkeley National Laboratory (LBNL), where he serves as Deputy Group Lead of the Data Analysis and Visualization Group in the Data Science and Technology Department. Gunther Weber is also an Adjunct Associate Professor of Computer Science at the University of California, Davis. His research interests include computer graphics, scientific visualization, data analysis with using topological methods, parallel and distributed computing for visualization and data analysis applications, hierarchical data representation methods, and bioinformatics. He is papers chair for IEEE SciVis 2018. He previously served as reviewer for major funding agencies (DOE, NSF), conference proceedings and journals and as co-organizer, chair and program committee member of more than 40 internationally recognized conferences.