Welcome to IEEE VIS 2016!

After ten years, we are excited to be returning to Baltimore, Maryland. Known by locals as “Charm City”, Baltimore has wonderful attractions as part of the Inner Harbor district near the conference hotel. Maryland is known for its creativity and energy. The state is home to some great universities and supports some of the most advanced medical research in the world. Maryland has other personality traits: for instance, the state sport is jousting. Try the local fare: craft beer and steamed spicy blue crabs.

The conference includes programs for students, academics, artists, industry and commercial practitioners, government researchers, and anyone with interests in visualization and data analytics. VIS2016 expects to draw over 1,000 participants from dozens of countries to a week of research presentations, tutorials, workshops, panels, demonstrations, posters, and exhibitions.

This year, we have extended our mission to better serve our community, developing new approaches to helping employers meet with hopeful job-seekers, adjusting our exhibition to include a week of job fair activities along with the traditional trade show. We have become excited as new supporters have joined the conference to share in the adjusted vision.

We invite you to participate in IEEE Visual Analytics Science and Technology (VAST), IEEE Information Visualization (InfoVis), IEEE Scientific Visualization (SciVis), and our art program, along with the thought-provoking array of workshops, symposia, panels, tutorials, and other events that share our week. We hope that you brought your imagination, your data, your problems, your solutions, your research, insights, experience, and enthusiasm. We have endeavored to create a week-long celebration where you can mingle and connect with one another, helping to accelerate discovery in our field.

Terry Yoo, National Institutes of Health
VIS 2016 General Chair

Baltimore

Hilton Baltimore Hotel holds a prime place in the Inner Harbor, next door to Camden Yards and across the street from M&T Stadium. Baltimore’s Inner Harbor is a hub of activity. In just a few city blocks, you can unearth dinosaurs at the Maryland Science Center, get a history lesson at the Reginald F. Lewis Museum of Maryland African American History & Culture, pay respects to pop culture at Geppi’s Entertainment Museum, or submerge yourself in exotic sealife at the National Aquarium. Other attractions include the American Visionary Art Museum, the Babe Ruth Museum, and the Port Discovery Children’s Museum.

Baltimore’s Inner Harbor has loads of restaurants, pubs, hotels and shops, many of them at the popular Harborplace shopping and entertainment center just steps from the Hilton. The Water Taxi at the Inner Harbor can also take you to surrounding neighborhoods, and the free Charm City Circulator provides daily bus service through several downtown routes.

From family-friendly museums and restaurants to satisfy every palate, to exciting nightlife, cultural experiences and spectacular people-watching, Baltimore’s Inner Harbor offers more to see and do than you can imagine.

Table of Contents

Welcome............................................................................................................. 2
Map of Venue .................................................................................................. 3
VIS Keynote & Capstone............................................................................... 4
2016 At-A-Glance ....................................................................................... 5–7
Program Details
Sunday ............................................................................................................. 8–11
Monday........................................................................................................... 12–15
Tuesday........................................................................................................... 16–17
Wednesday ................................................................................................. 18–19
Thursday ....................................................................................................... 20–22
Friday ............................................................................................................... 23
Call for Participation: VIS 2017 ................................................................. 22
Posters & Contests ....................................................................................... 24–28
Call for Participation: Doctoral Colloquium 2017................................. 28
Committee Members ................................................................................. 29–31
Supporters & Exhibitors ............................................................................. 32

How to Order Proceedings

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IEEE Visualization and Graphics Technical Committee (VGTC)

For information on awards, national initiatives, conferences and symposia, and a comprehensive membership directory, please visit http://vgtc.org/.
1. **Conference Registration**
   Located on 2nd Fl, East Foyer
   Saturday, 6:00–8:00 PM
   Sunday & Tuesday, 7:00 AM–4:30 PM
   Monday, Wednesday, Thursday, 7:30 AM–4:30 PM
   Friday, 7:30–10:30 AM

2. **Tutorials, Workshops, Meetups**
   Located on 1st Fl, Peale, Johnson, Latrobe, Ruth
   Sunday–Monday, 8:30 AM–9:00 PM

3. **Conference Sessions**
   Located on 2nd Fl,
   Key Blrm 1–6 & Holiday Blrm 4–6
   Sunday–Thursday, 8:30 AM–5:55 PM
   Friday, 8:30 AM–12:00 PM

4. **Posters and Exhibitions**
   Located on 2nd Fl, Key Blrm 7–12
   **Posters:**
   Sunday, Wednesday, 8:30 AM–9:00 PM
   Monday, Tuesday, Thursday, 8:30 AM–5:55 PM
   **Exhibitions:**
   Tuesday, 10:00 AM–5:55 PM
   Wednesday, Thursday, 8:30 AM–5:55 PM

5. **Arts Program**
   Located on 2nd Fl, Holiday Blrm 1–3
   Sunday–Thursday, 8:30 AM–5:55 PM
   Tuesday, 8:30 AM–9:00 PM

6. **Speaker Preparation**
   Located on 2nd Fl, Armistead and Pickersgill
   Sunday–Thursday, 8:30 AM–5:55 PM
   Friday, 8:30 AM–10:30 PM

7. **Interview Rooms**
   Located on 3rd Fl, Hopkins and Tilghman
   Saturday–Friday, Schedule at Registration Desk

8. **Personal Consideration Room**
   Located on 3rd Fl, Tubman A
   Saturday–Thursday, 8:30 AM–5:55 PM
   Friday, 8:30 AM–12:00 PM
**VIS KEYNOTE**

**Visualizing know how, technological diffusion and the wealth of nations**

Ricardo Hausmann  
*Director at the Center for International Development & Professor of the Practice of Economic Development, Kennedy School of Government, Harvard University*

Tuesday, 25 October, 2016, 8:30 AM – 9:30 AM @ Key Ballroom

**Abstract**

Recent theories of the wealth and poverty of nations put the accent on the accumulation of collective know how. The fundamental difference between rich and poor countries is not in the average level of individual skills of their citizens but in the kinds of things that can be done collectively. This creates an important visualization problem: how to measure and represent the differential levels of collective know how between countries and regions? How to visualize its evolution in time? How to identify more feasible and effective paths for progress? How can visualization help orient the efforts of the public and private sectors in enhancing progress?

**Bio**

Ricardo Hausmann is Director of Harvard’s Center for International Development and Professor of the Practice of Economic Development at the Kennedy School of Government. Previously, he served as the first Chief Economist of the Inter-American Development Bank (1994-2000), where he created the Research Department.

He has served as Minister of Planning of Venezuela (1992-1993) and as a member of the Board of the Central Bank of Venezuela. He also served as Chair of the IMF-World Bank Development Committee. He was Professor of Economics at the Instituto de Estudios Superiores de Administracion (IESA) (1985-1991) in Caracas, where he founded the Center for Public Policy. His research interests include issues of growth, macroeconomic stability, international finance, and the social dimensions of development. He holds a PhD in economics from Cornell University.

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**VIS CAPSTONE**

**The three laws of communication**

Jean-luc Doumont  
*Principiae*

Friday, 28 October 2016, 10:30 AM – 11:30 AM @ Key Ballroom

**Abstract**

Useful as each of them can be, a large body of tips and tricks is impossible to remember, at least in a practical, usable way, unless it is structured into a balanced, meaningful hierarchy. This talk proposes and illustrates three simple yet solid ideas that lead to more effective communication and that underpin every other guideline: easy to remember, readily applicable, and always relevant—in short, valuable for the rest of your life.

**Bio**

An engineer (Louvain) and PhD in applied physics (Stanford), Jean-luc Doumont is acclaimed worldwide for his no-nonsense approach, his highly applicable, often life-changing recommendations on a wide range of topics, and *Trees, maps, and theorems*, his book about “effective communication for rational minds.” For additional information, visit www.principiae.be.
**SUNDAY, 23 OCTOBER**

8:30 AM
- Workshop: VAST Challenge
- Workshop: Eye Tracking and Visualization (ETVIS)
- Workshop: Visualization for the Digital Humanities
- Workshop: BELIV: BEyond time and errors: novel evaluation methods for information visualization
- Tutorial: Information Theory in Visualization
- Tutorial: Visual Analytics for High-Dimensional Data
- Tutorial: Feature-Based Flow Vis and Analysis
- Tutorial: Applying Color Theory to VIS
- Workshop: LIVVIL: Logging Interactive Visualizations & Visualizing Interaction Logs
- Tutorial: User-Centred Evaluation in Visualization

10:10 AM
- Break

12:10 PM
- Lunch

2:00 PM
- Tutorial: Visualization Analysis and Design
- Tutorial: Sketching Designs using the Five Sheets Methodology
- Tutorial: Human Vision, Cognition and Visualization Innovations in the Pedagogy of Data Vis
- Workshop: Workshop: Innovations in the Pedagogy of Data Vis

3:40 PM
- Break

4:15 PM
- Tutorial: Sketching Designs using the Five Sheets Methodology
- Tutorial: Human Vision, Cognition and Visualization Innovations in the Pedagogy of Data Vis
- Workshop: Workshop: Innovations in the Pedagogy of Data Vis

5:55 PM

**MONDAY, 24 OCTOBER**

8:30 AM
- Workshop: C4PGV: Creation, Curation, Critique & Conditioning of Principles & Guidelines in Vis
- Tutorial: Tutorial: C4PGV: Creation, Curation Critique & Conditioning of Principles & Guidelines in Vis
- Workshop: Art Program
- Workshop: Art Program
- Workshop: Workshop: Art Program
- Workshop: Workshop: Art Program

10:10 AM
- Break

12:10 PM
- Lunch

2:00 PM
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program
- Tutorial: Tutorial: Art Program

3:40 PM
- Break

4:15 PM

5:55 PM

**VIS Opening Reception**
@ Key Blrm 7-12 + South Foyer

**Recommended for Practitioners**
TUESDAY, 25 OCTOBER

8:00 AM
VIS Welcome

8:30 AM
VIS Keynote (8:30–9:30 AM)
@ Key 1+2+5 and Key 3+4+6

VIS Fast Forward (Tues) (9:30–10:10 AM)

10:10 AM
BREAK

10:30 AM
VAST Intro + Traffic and Urban Planning
Infovis Intro + Interaction
SciVis Intro + Bio, Molecular and Shape Visualization

12:10 PM
LUNCH

2:00 PM
Exploratory Analysis
Immersive Analytics
Design Studies and Evaluation
Panel: Transitioning Research

3:40 PM
BREAK

4:15 PM
Machine Learning
Geo-visualization
Topology-based Techniques
Supporters Presentations

5:00 PM

6:00 PM
Fast Forward (Wed) @ Key 3+4+6

6:30 PM

7:00 PM
VIS Arts Program Opening Event
@ Holiday 1+2+3

9:00 PM

WEDNESDAY, 26 OCTOBER

Art Program @ Key 7–12

Textual Data
Applications
Ensembles Multivariate and Comparative
VISAP Session 1

Management Visual Analytics Process
Evaluation
Panel: On the Death of Scientific Visualization
(CG&A) Visualization Systems & Applications

LUNCH

Biomedical Visualization
Graphs
SciVis Contest
Panel: How data vis and regulation meet on the modern web

BREAT

Fast Forward (Thu & Fri) (4:15–4:45 PM) @ Key 3+4+6

Break

Posters + Networking (5:00–7:00 PM) @ Key Blrm 7–12

VIS Banquet
Supported by Tableau Software @ Key Blrm 1–6
### THURSDAY, 27 OCTOBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Social Media Data and Events</th>
<th>Complementing Visual and Algorithmic Analysis</th>
<th>Visual Knowledge Discovery and Sense-Making</th>
<th>Education and Games</th>
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<td>8:30 AM</td>
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### FRIDAY, 28 OCTOBER

<table>
<thead>
<tr>
<th>Time</th>
<th>VAST Holiday 4+5</th>
<th>INFOVIS Key 3+4+6</th>
<th>SCIVIS Key 1+2+5</th>
<th>VIS Holiday 6</th>
<th>VIS Holiday 6</th>
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**Recommended for Practitioners**

- **8:30 AM**
  - Social Media Data and Events
- **10:10 AM**
  - Complementing Visual and Algorithmic Analysis
- **12:10 PM**
  - Visual Knowledge Discovery and Sense-Making
- **8:30 AM**
  - Time Series
- **10:10 AM**
  - Panel: How can we improve empirical research on understanding visual information?
- **12:10 PM**
  - VAST: Application Papers: What are they and how should they be evaluated?
SUNDAY, 23 OCTOBER

Full Day

Holiday 4+5

VAST

VAST Challenge (8:30 AM–5:55 PM)
Contributors: Kristin Cook, Georges Grinstein, Mark Whiting
VAST Challenge 2016 posed realistic tasks in streaming visual analytics. Mini-Challenge 1 participants designed streaming data analysis tools for an operations center. Mini-Challenge 2 participants characterized patterns and anomalies in static building sensor data. Mini-Challenge 3 participants built streaming visual analytics solutions for building sensor data. These solutions are intended to help users rapidly orient to emerging events and reconsider past data as circumstances change. This workshop will include presentations from award winners and a streaming visual analytics design session. http://vacommunity.org/VAST+Challenge+2016.

Workshop (8:30 AM–5:55 PM)

2nd Workshop on Eye Tracking and Visualization (ETVIS)
Contributors: Daniel Weiskopf, Michael Burch, Lewis Chuang, Andrew Duchowski
There is a growing interest in eye tracking as a research method in many communities because progress in hardware technology and the reduction of costs for eye tracking devices have made this analysis technique accessible to a large population of researchers. Nonetheless, standardized practices for technical implementations and data interpretation remain unresolved. With ETVIS, we intend to build a community of eye tracking researchers within the visualization community, covering information visualization, scientific visualization, and visual analytics. We also aim to establish connections to related fields, in particular, in human-computer interaction, cognitive science, and psychology.

Half Day

Holiday 6

Workshop (8:30 AM–12:10 PM)

Creation, Curation, Critique and Conditioning of Principles and Guidelines in Visualization (C4PGV)
Contributors: Rita Borgo, Nadia Boukhelifa, Kelly Gaither, Michael Sedlmair
C4PGV 2016 is a forum that provides an opportunity to discuss state-of-the-art and present novel contributions towards the development of a theoretical foundation for Visualization and Visual Analytics. There are three challenges that will be addressed in the workshop: (1) the lack of a centralized place for easy discovery of known or proposed principles and guidelines; (2) the lack of documentation about when and where a principle or guideline is applicable and when and where it is not, as well as examples for attesting either conditions; and (3) the lack of platforms (except formal publications) for supporting the evolution and improvement of principles and guidelines, and fostering early proposal of principles and guidelines.

Tutorial (8:30 AM–12:10 PM)

Information Theory in Visualization
Contributors: Min Chen, Mateu Sbert, Anton Bardera, Han-Wei Shen, Miquel Feixas, Ivan Viola
In this half-day tutorial (intermediate to advanced), we review a variety of applications of information theory in visualization. The holistic nature of information-theoretic reasoning has enabled many such applications, ranging from light placement to view selection, from feature highlighting to transfer function design, from data fusion to visual multiplexing, and so on. Perhaps a particularly exciting application is the potential for information theory to underpin the discipline of visualization, for example, mathematically confirming the benefit of visualization in data intelligence.

Tutorial (8:30 AM–12:10 PM)

Recent Advancements of Feature-based Flow Visualization and Analysis
Contributors: Jun Tao, Hanqi Guo, Bei Wang, Christoph Garth, Tino Weinkauf
Flow visualization has been a central topic in scientific visualization for many years with applications in scientific, engineering, medical researches. Contemporary numerical simulations produce large, time-varying and highly complex vector fields. Preserving the rich information in these and presenting concise visualizations for clarity are two desired, but often conflicting goals that need to be balanced. This requires a distinction of context and features, whose understanding and extraction is critical to obtain insight. In this tutorial, we review and discuss state-of-the-art techniques on different aspects of feature-based flow visualization and analysis: (a) interactive techniques for discovery; (b) spatio-temporal flow analysis; (c) feature extraction, tracking and simplification with robustness; d) parallel and in-situ techniques for large-scale time-varying data; and (f) theories and scalability issues in ensemble and uncertain flow.
Workshop (8:30 AM–12:10 PM)

LIVVIL: Logging Interactive Visualizations & Visualizing Interaction Logs
Contributors: Romain Vuillemot, Jeremy Boy, Aurélien Tabard, Charles Perin, Jean-Daniel Fekete

Logs recording and analysis is a very powerful mechanism to improve the usability of tools and enrich the user experience with history. This workshop aims at bringing the visualization community together to share their practice on all aspect of logging, ranging from reporting, analysis, to visualization and its underlying infrastructure. Expected benefits include raising awareness on the potentials of logging for visualization, providing shared tools and methods to instrument visualizations, show how logging can improve visualization and interaction techniques, and scale to large number of users and sessions.

Tutorial (2:00–5:55 PM)

Visualization Analysis and Design
Contributor: Tamara Munzner

This introductory tutorial will provide a broad foundation for thinking systematically about visualization systems, built around the idea that becoming familiar with analyzing existing systems is a good springboard for designing new ones. The major data types of concern in visual analytics, information visualization, and scientific visualization will all be covered: tables, networks, and sampled spatial data. This tutorial is focused on data and task abstractions, and the design choices for visual encoding and interaction; it will not cover algorithms. No background in computer science or visualization is assumed.

Workshop (2:00–5:55 PM)

Innovations in the Pedagogy of Data Visualization
Contributors: Eytan Adar, Sophie Engle, Marti Hearst, Alark Joshi, Daniel Keefe

The pedagogy of data visualization is becoming increasingly important as data visualization techniques and tools proliferate. In this workshop, we propose to create a community of practice that supports each other as they learn to be better teachers in their respective classrooms. Based on the well attended panels at IEEE Vis in 2010 and 2015, there is a strong interest in the data visualization community for exploring the pedagogy of data visualization. We propose the conduct a half-day interactive workshop that will include lightning talks followed by a discussion on strategies to further sustain the community of practice of data visualization educators.

Tutorial (2:00–5:55 PM)

Human Vision, Cognition and Visualization
Contributor: Bernice E. Rogowitz

This course builds upon the foundation set by the IEEE Vis course “Human Vision and Cognition for Emerging Technologies,” presented in 2012. The course involves a review of key principles outlined earlier, focusing on human spatial, luminance and color perception, interpreted for data visualization and visual analytics tasks, with many examples from real-world projects in a wide range of industries. The course includes many new topics, such as multisensory interactions, and provides fundamental insights into the design of experiments involving human observers.

Tutorial (2:00–5:55 PM)

Sketching Designs for Data-Visualization using the Five Design-Sheet Methodology
Contributors: Jonathan C. Roberts, Christopher Headleand, Panagiotis Ritsos

When developing visualization software, developers need to plan what they are going to build. They need to make plans of how the data can be visualized using a computer interface. Low fidelity methods, such as sketching, have been used before, however they are ad hoc. This tutorial leads the attendees through sketching designs, considering design alternatives using the Five Design-Sheet methodology.
8:30–8:35 AM
Opening
Chair: G. Elisabeta Marai

8:35–9:35 AM
Keynote
Speaker: Sheelagh Carpendale, Computer Science Professor, University of Calgary, Canada
Visualization: The power of alternate representations
To visualize data one of the first steps is to develop a visual representation. This representation is a result of a mapping by which the data can be specified. Much has been said of about the power of these visual representations. Simon (1981) said that solving a problem is simply a matter of representing so as to make the solution transparent – implying that finding the right representation solves the problem. Card et al. (1998) said that interactive visual representations can amplify our cognition – can in effect make us smarter. In spite of this, the small box in the visualization creation pipeline that signifies the development of the visual representation remains one of the least unpacked. Through examples from my own work and others’, I will discuss the power and potential of alternate visual representations.

9:35–10:10 AM
Primer Session
Chair: Eamonn Maguire
Primer: Statistical dances: why no statistical analysis is reliable and what to do about it, Pierre Dragicevic, Inria

10:10–10:30 AM
Coffee Break

10:30 AM–12:10 PM
Papers Session: Abstract Data and Pathway Visualization
Chair: Michel Westenberg
Unboxing Cluster Heatmaps, Sophie Engle, Sean Whalen, Alark Joshi, Katherine Pollard
PRODIGEN: Visualizing the Probability Landscape of Stochastic Gene Regulatory Networks in State and Time Space, Chihua Ma, Timothy Luciani, Anna Terebus, Jie Liang, G. Elisabeta Marai
Generalized Box-Plot for Root Growth Ensembles, Viktor Vad, Douglas Cedrim, Wolfgang Busch, Peter Filzmoser, Ivan Viola
A Taxonomy of Visualization Tasks for the Analysis of Biological Pathway Data, Paul Murray, Fintan McGee, Angus Forbes

12:10–2:00 PM
Lunch Break

2:00–3:40 PM
Papers Session: Protein and Microscopy Data Visualization
Chair: Carsten Görg
Comparative Visualization of Protein Secondary Structures, Lucia Kocincova, Miroslava Jaresova, Jan Byska, Julius Parulek, Helwig Hauser, Barbora Kozlikova
Virtual Reality Assisted Microscopy Data Visualization and Colocalization Analysis, Rensu Theart, Ben Loos, Thomas Niesler
Interactive Exploration of Ligand Transportation through Protein Tunnels, Katarina Furmanova, Miroslava Jaresova, Jan Byska, Adam Jurcik, Julius Parulek, Helwig Hauser, Barbora Kozlikova

3:40–4:15 PM
Coffee Break

4:15–4:45 PM
Challenges Session
Chair: Eamonn Maguire
Challenge: An Introduction to Microbiome Data Visualization, Eric Franzosa, Harvard School of Public Health

4:45–5:15 PM
Design Contest Presentations
Chair: Eamonn Maguire

5:15–5:25 PM
Poster Fast Forward
Chair: Michel Westenberg

5:25–5:35 PM
BioVis Data Contest: DREAM Challenge
Speaker: Raghu Machiraju

5:35–5:55 PM
Awards & Closing
Chair: Jan Aerts

7:00–9:00 PM
Poster Reception @ VIS Opening Reception
8:30–8:55 AM
Opening & Fast Forward

8:55–10:10 AM
Papers Session: InfoVis and Visual Analytics
Embedded Domain-Specific Language and Runtime System for Progressive Spatiotemporal Data Analysis and Visualization, Cameron Christensen, Shusen Liu, Giorgio Scorzelli, Ji-Woo Lee, Peer-Timo Bremer, Valerio Pascucci
SeekAView: An intelligent Dimensionality Reduction Strategy for Navigating High-Dim Data Spaces, Josua Krause, Aritra Dasgupta, Jean-Daniel Fekete, Enrico Bertini
Quantitative Exploration of Large Medieval Manuscripts Data for the Codicological Research, Swati Chandna, Francesca Rindone, Carsten Cachtsbacher, Rainer Stotzka

10:10–10:30 AM
Coffee Break

10:30–10:55 AM
Papers Session: Distributed and Parallel Computing
Block-Parallel Data Analysis with DIY, Dmitriy Morozov, Tom Peterka

10:55 AM–12:10 PM
Keynote
Speaker: Alex Szalay, Bloomberg Distinguished Professor, Johns Hopkins University
Exascale Numerical Laboratories
The talk will describe how science is changing as a result of the vast amounts of data we are collecting from gene sequencers to telescopes and supercomputers. This “Fourth Paradigm of Science”, predicted by Jim Gray, is moving at full speed, and is transforming one scientific area after another. The talk will present various examples on the similarities of the emerging new challenges and how this vision is realized by the scientific community. Scientists are increasingly limited by their ability to analyze the large amounts of complex data available. These data sets are generated not only by instruments but also computational experiments; the sizes of the largest numerical simulations are on par with data collected by instruments, crossing the petabyte threshold. The importance of large synthetic data sets is increasingly important, as scientists compare their experiments to reference simulations. All disciplines need a new “instrument for data” that can deal not only with large data sets but the cross product of large and diverse data sets. There are several multi-faceted challenges related to this conversion, e.g. how to move, visualize, analyze and in general interact with Petabytes of data.

12:10–2:00 PM
Lunch Break

2:00–3:40 PM
Papers Session: Rendering and Probability Distribution
Optimizing Multi-Image Sort-Last Parallel Rendering, Matthew Larsen, Kenneth Moreland, Chris Johnson, Hank Childs
Parallel Distributed, GPU-Accelerated, Advanced Lighting Calculations for Large-Scale Volume Visualization, Min Shih, Silvio Rizzi, Joseph Insley, Thomas Uram, Venkatram Vishwanath, Mark Hereld, Michael E. Papka, Kwan-Liu Ma
Interactive Visual Exploration of a Trillion Particles, Karsten Schatz, Christoph Mueller, Michael Krone, Guido Reina, Jens Schneider, Thomas Ertl
In Situ Generated Probability Distribution Functions for Interactive Post Hoc Visualization and Analysis, Yucheng Ye, Tyson Neuroth, Franz Sauer, Kwan-Liu Ma, Giulio Borghesi, Aditya Konduri, Hemanth Kolla, Jacqueline Chen

3:40–4:15 PM
Coffee Break

4:15–5:05 PM
Papers Session: Contour Trees
Parallel Peak Pruning for Scalable SMP Contour Tree Computation, Hamish Carr, Gunther Weber, Chris Sewell, James Ahrens
Contour Forests: Fast Multi-threaded Augmented Contour Trees, Charles Gueunet, Pierre Fortin, Julien Jomier, Julien Tierny

5:05–5:45 PM
Panel

5:45–5:55 PM
Awards & Closing

7:00–9:00 PM
Poster Reception @ VIS Opening Reception
Visual Analytics for High-Dimensional Data

Analyzing high-dimensional data and finding hidden patterns in them is a difficult problem and has attracted numerous research efforts in the visualization community and beyond. Gaining insight into high dimensional data is at the core of big data analysis and data science. Automated methods can be useful to some extent but bringing the data analyst into the loop via interactive visual tools can help the discovery process tremendously. All of these visual tools use some kind of projection strategy to convey the high dimensional space within the confines of the two screen dimensions. Since this projection is an inherently ill-posed problem in all but the most trivial cases, all methods will bear certain trade-offs. Knowing the strengths and weaknesses of the various paradigms existing in the field can inform the design of the most appropriate visualization strategy for the task at hand. It can help practitioners in selecting the best among the many tools available, and it can help researchers in devising new tools to advance the state of the art. This tutorial aims to serve both of these factions of the visualization community.
of temporal event sequences is an important problem to many domains. Recently, there has been an increasing amount of visualization research focusing on temporal events. The main question behind the proposed workshop is: How can we unify and advance the role of visualization in temporal event analysis? The workshop will gather visualization researchers together to discuss the interesting opportunities and challenges visualization may face with temporal events.

Ruth

Tutorial (2:00–5:55 PM)

Tensor Decomposition Methods
Contributors: Rafael Ballester-Ripoll, Renato Pajarola
Initially proposed as an extension of the concept of matrix decomposition for three and more dimensions, tensor decompositions have found numerous applications in visualization and visual computing. They constitute a powerful mathematical framework for compactly representing and manipulating dense data fields, especially in many dimensions. This course will introduce the most popular decomposition models and showcase emerging tensor methods for compression, interactive visualization, texture synthesis, denoising, and multidimensional inpainting. Multidimensional visual data types of interest include image and geometry ensembles, hyperspectral images, volumes and corresponding time-varying data.

Latrobe

Tutorial (2:00–5:55 PM)

Considering Qualitative Evaluations
Contributors: Sheelagh Carpendale, Uta Hinrichs, Trevor Hogan, Alice Thudt, Melanie Toro, Jo Vermeulen, Jagoda Walny
Evaluation is increasingly recognized as an essential component of visualization research. However, evaluation itself is a changing area of research. New methods to extend and validate our research continue to emerge. This 1/2-day tutorial is designed for beginning to intermediate audiences. We will focus on qualitative research methods using a mixture of talks and hands-on activities. After completing this tutorial, people will have a richer understanding of the benefits and challenges of qualitative empirical research.
12:10–2:00 PM  
Lunch Break

2:00–2:40 PM  
Papers Session: Evaluation in the Development Cycle  
Chair: Petra Isenberg  
On Regulatory and Organizational Constraints in Visualization Design and Evaluation, Anamaria Crisan, Jennifer Gardy, Tamara Munzner  
Action Design Research and Visualization Design, Nina McCurdy, Jason Dykes, Miriah Meyer  
Evaluation of Visualization by Critiques, Richard Brath, Ebad Banissi  
Using Concrete and Realistic Data in Evaluating Initial Visualization Designs, Soren Knudsen, Jeppe Gerner Pedersen, Thor Herdal, Jakob Eg Larsen

2:40–3:10 PM  
Papers Session: Reflections  
Chair: Petra Isenberg  
Why Evaluating Uncertainty Visualization is Error Prone, Jessica Hullman  
Design Study Contributions Come in Different Guises: Seven Guiding Scenarios, Michael Sedlmair  
An Empire Built On Sand: Reexamining What We Think We Know About Visualization, Robert Kosara

3:10–3:40 PM  
Papers Session: New Directions in Evaluation  
Chair: Petra Isenberg  
Generative Data Models for Validation and Evaluation of Visualization Techniques, Christoph Schulz, Arlind Nocaj, Mennatallah El-Assady, Steffen Frey, Marcel Hlawatsch, Michael Hund, Grzegorz Karch, Rudolf Netzel, Christin Schätzle, Miriam Butt, Daniel A. Keim, Thomas Ertl, Ulrik Brandes, Daniel Weiskopf  
Beyond Usability and Performance: A Review of User Experience-focused Evaluations in Visualization, Bahador Saket, Alex Endert, John Stasko

3:40–4:15 PM  
Coffee Break

4:15–5:30 PM  
Panel  
On the Future of Evaluation and BELIV

5:30–5:50 PM  
Closing

8:30–10:10 AM  
Opening  
Speakers: Alexander Lex, Marc Streit

Session 1  
Chair: Marc Streit  
Big Data For A Public Good, Sarah Williams  
What Shakespeare Taught Us About (Visual) Data Science, Michael Gleicher  
Explanatory Visual Analytics for Enhancing Human Interpretability of Machine Learning Models, Josua Krause

10:10–10:30 AM  
Coffee Break

10:30 AM–12:10 PM  
Session 2  
Chair: Daniel A. Keim  
Teaching Data Visualization to 4 Million Data Scientists - Lessons from Evidence Based Data Analysis, Jeff Leek  
The Role of Visualization in Prediction, Adam Perer  
Visual Analysis of Hidden State Dynamics in Recurrent Neural Networks, Hendrik Strobelt

12:10–2:00 PM  
Lunch Break

2:00–3:40 PM  
Session 3  
Chair: Hanspeter Pfister  
Teaching Data Science and Visualization: What works, what doesn't?, Jeff Leek, Patrick Lucey, Sarah Williams  
Advancing Additive Manufacturing Through Visual Data Science, Chad Steed  
Clusterix: A Visual Analytics Approach to Clustering, Eamonn Maguire

3:40–4:15 PM  
Coffee Break

4:15–5:40 PM  
Session 4  
Chair: Alexander Lex  
Interactive Sports Analytics: Going Beyond Spreadsheets, Patrick Lucey  
Coupled Interactive Visualization and Machine Learning for Accelerated Model Development: Applications to Electronic Healthcare Record Data, Charles Fisher  
Data Shading: Building Data Models from Visualizations, Joseph Cottam  
Causal Inference in Time Series Data Using Autoencoder, Kozen Umezawa

Closing  
Speakers: Alexander Lex, Marc Streit
8:30–8:40 AM
Opening

8:40–9:40 AM
Keynote
Speaker: Jay Jacobs, Sr. Data Scientist, BitSight
The State of (Viz) Security
The information security industry is changing rapidly (like always). It's worthwhile to take a moment to stop and look around to figure out if we are still on a good path. Join Jay Jacobs as he takes looks back over his career along with 12 years of VizSec and takes stock of where we are and some areas we should be moving towards.
Jay Jacobs is a Sr. Data Scientist at BitSight, before that, he spent four years as the Lead Data Analyst on the Verizon Data Breach Investigations Report (DBIR). Jacobs is the Co-Author of Data Driven Security, a book covering data analysis and visualizations for information security, and hosts the Data-Driven Security podcast. Jacobs is also a Co-Founder of the Society of Information Risk Analysts (SIRA) and serves as President on their Board of Directors.

9:40–10:10 AM
Papers Session: Methodology
Mixed Method Approach to Identify Analytic Questions to be Visualized for Military Cyber Incident Handlers, Laurin Buchanan, Anita D'Amico, Drew Kirkpatrick

10:00–10:30 AM
Coffee Break

10:30–11:00 AM
Papers Session: Code Security
Visual representation of source code vulnerabilities, Hala Assal, Sonia Chiasson, Robert Biddle Cesar

11:00 AM–12:00 PM
Papers Session: Case Studies
CyberPetri at CDX 2016: Real-time Network Situation Awareness, Dustin Arendt, Dan Best, Russ Burtner, Celeste Lynn Paul
Visualizing a Malware Distribution Network, Sebastian Peryt, Jose Andre Morales, William Casey, Aaron Volkman, Yang Cai
Visually guided Flow Tracking in Software-defined Networking, Tobias Post, Thomas Wischgoll, Adam R. Bryant, Bernd Hamann, Paul Müller, Hans Hagen

3:00–3:40 PM
Papers Session: Security Policy and Passwords
Detecting Malicious Logins in Enterprise Networks Using Visualization, Hossein Siadati, Bahador Saket, Nasir Memon
V3SPA: A Visual Analysis, Exploration, and Diffing Tool for SELinux and SEAndroid Security Policies, Robert Gove

4:15–5:35 PM
Papers Session: Visualizing Large Scale Threats
Uncovering Periodic Network Signals of Cyber Attacks, Ngoc Anh Huynh, Wee Keong Ng, Alex Ulmer, Jörn Kohlhammer
Bigfoot: A Geo-based Visualization Methodology for Detecting BGP Threats, Meenakshi Syamkumar, Ramakrishnan Durairajan, Paul Barford
Visualisation of Actionable Knowledge to Mitigate DRDoS Attacks, Michael Marie Aupetit, Yury Zhauniarovich, Giorgos Vasiliadis, Marc Dacier, Yazan Boshmaf
Understanding the Context of Network Traffic Alerts, Bram Cappers, Jarke J. van Wijk

5:35–5:55 PM
Posters Hosted Viewing

Recommended for Practitioners

Key 1+2+5
TUESDAY, 25 OCTOBER

8:00–9:30 AM
VIS Opening
VIS Keynote
Speaker: Ricardo Hausmann, Director at the Center for International Development & Professor of the Practice of Economic Development, Kennedy School of Government, Harvard University
Visualizing knowhow, technological diffusion and the wealth of nations

9:30–10:10 AM
VIS Fast Forward (Tues)

10:10–10:30 AM
Coffee Break

10:30 AM–12:10 PM
VAST Opening
VAST Papers
Traffic and Urban Planning
Chair: Tatiana von Landesberger
[J] SmartAdP: Visual Analytics of Large-scale Taxi Trajectories for Selecting Billboard Locations, Dongyu Liu, Di Weng, Yuhong Li, Jie Bao, Yu Zheng, Huamin Qu, Yingcai Wu
[J] SemanticTraj: A New Approach to Interacting with Massive Taxi Trajectories, Shamal AL-Dohuki, Farah Kamw, Ye Zhao, Chao Ma, Yingyu Wu, Jing Yang, Xinyue Ye, Fei Wang, Xin Li, Wei Chen
[T] Embedding Spatio-temporal Information into Maps by Route-Zooming, Guodao Sun, Ronghua Liang, Huamin Qu, Yingcai Wu
[T] Vis-A-Ware: Integrating Spatial and Non-Spatial Visualization for Visibility-Aware Urban Planning, Thomas Ortner, Johannes Sorger, Harald Steinlechner, Gerd Hesina, Harald Piringer, Eduard Gröller

12:10–2:00 PM
Lunch Break

2:00–3:40 PM
VAST Papers
Exploratory Analysis
Chair: Remco Chang
[J] Visualizing Dimension Coverage to Support Exploratory Analysis, Ali Sarvaghad, Melanie Tory, Narges Mahyar
[J] Supporting Visual Exploration for Multiple Users in Large Display Environments, Sriram Karthik Badam, Fereshteh Amini, Niklas Elmqvist, Pourang Irani
TUESDAY

3:40–4:15 PM
Coffee Break

4:15–5:55 PM
Supporters Presentations
IBM, T. Alan Keahey, Senior Data Visualization Scientist
NVIDIA Corporation, Thomas Fogal, Software developer
Intel Corporation, Jim Jeffers, Principal Engineer, Manager, Software-Defined Visualization Engineering
Tableau Software, Jock Mackinlay, Vice President, Research and Design

Key 3+4+6

6:00–6:30 PM
VIS Fast Forward (Wed)

7:00–9:00 PM
VIS Arts Program Opening Event

The installations, performances, and demonstrations featured in the IEEE VIS 2016 Arts Program exhibition explore the relationships between visualization research and arts and/or design practice, and present creative visual techniques that emphasize transformative aspects of scientific or cultural exploration. The featured installations include work by both established and emerging media artists from across the globe, including Gavin Baily, Maxwell Carlson, Duncan Clark, Tom Corby, Esteban Garcia Bravo, Mitch Goodwin, Benedikt Groß, Yoon Chung Han, Paul Heinicker, François-Joseph Lapointe, Dietmar Offenhuber, Raphael Reimann, Mike Richison, Weili Shi, Adam Trowbridge, Jessica Parris Westbrook, and others. Additionally, creative visualization projects will be demonstrated on the opening night of the exhibition. See http://visap.uic.edu for more details about the artists and the projects showcased in VISAP16.
WEDNESDAY, 26 OCTOBER

8:30–10:10 AM

**VISAP Papers: Track 1**
Chair: Angus Forbes

California Drought Impact: Multimodal Data Representation to Predict the Water Cycle, Yoon Chung Han, Shankar Tiwari

All Roads to Rome: Visualizing Mobility at Scale, Raphael Reimann, Benedikt Groß, Philipp Schmitt

Altering our Perception of Smartphones through Noise: Introducing the Affection Research Lab, Salvador Orara

Shan Shui in the World: A Generative Approach to Traditional Chinese Landscape Painting, Weili Shi

**Artist Talks:** Please join us in welcoming a select group of artists from around the globe!

**Holiday 4**

**VAST Papers**

**Textual Data**
Chair: Christopher Andrews

[**J**] NameClarifier: A Visual Analytics System for Author Name Disambiguation, Qiaomu Shen, Tongshuang Wu, Haiyan Yang, Yanhong Wu, Huamin Qu, Weiwei Cui

[**J**] TopicLens: Efficient Multi-Level Visual Topic Exploration of Large-Scale Document Collections, Minjeong Kim, Kyeongpil Kang, Deokgun Park, Jaegul Choo, Niklas Elmqvist

[**J**] TextTile: An Interactive Visualization Tool for Seamless Exploratory Analysis of Structured Data and Unstructured Text, Cristian Felix, Anshul Vikram Pandey, Enrico Bertini

[**C**] DocuCompass: Effective Exploration of Document Landscapes, Florian Heimerl, Markus John, Qi Han, Steffen Koch, Thomas Ertl

[**T**] Online Visual Analytics of Text Streams, Shixia Liu, Jialun Yin, Xiting Wang, Weiwei Cui, Kelei Cao, Jian Pei

**SciVis Papers**

[**J**] Ensembles, Multivariate and Comparative
Chair: Kristi Potter

[**J**] Decal-maps: Real-Time Layering of Decals on Surfaces for Multivariate Visualization, Allan Rocha, Usman Alim, Julio Daniel Silva, Mario Costa Sousa

[**J**] Time-hierarchical Clustering and Visualization of Weather Forecast Ensembles, Florian Ferschl, Mathias Kanzler, Marc Rautenhaus, Rüdiger Westermann

[**J**] Visualization of Time-Varying Weather Ensembles Across Multiple Resolutions, Ayan Biswas, Guang Lin, Xiaotong Liu, Han-Wei Shen

[**J**] A Fractional Cartesian Composition Model for Semi-spatial Comparative Visualization Design, Ivan Kolesár, Stefan Bruckner, Ivan Viola, Helwig Hauser

[**T**] Visual Analysis of Multi-run Spatio-temporal Simulations Using Isocontour Similarity for Projected Views, Alexey Fofonov, Vladimir Molchanov, Lars Linsen

**Holiday 4+5**

10:30 AM–12:10 PM

**CG&A**

**Visualization Systems & Applications**
Chair: Theresa-Marie Rhyne

Key-Node-Separated Graph Clustering and Layouts for Human Relationship Graph Visualization, Takayuki Itoh, Karsten Klein

ENTVis: A Visual Analytic Tool for Entropy-Based Network Traffic Anomaly Detection, Fangfang Zhou, Wei Huang, Ying Zhao, Yang Shi, Xing Liang, Xiaoping Fan

Visualizing Rank Time Series of Wikipedia Top Viewed Pages, Jing Xia, Yumeng Hou, Victor Chen, Cheryl Qian, David Ebert, Wei Chen

WarplV: In Situ Visualization and Analysis of Ion Accelerator Simulations, Oliver Rübel, Burlen Loring, Jean-Luc Vay, David P. Grote, Remi Lehe, Stepan Bulanov, Henri Vincenti, E. Wes Bethel

A Decision Support System for Planning Sustainable Water Distribution Systems, Alina Freund, Nazli Yonca Aydin, Dirk Zeckzer, Hans Hagen

**VIS Panel**

[**J**] On the Death of Scientific Visualization
Moderator: Bob Laramee
Panelists: Mike Kirby, David Laidlaw, Klaus Mueller, Han-Wei Shen, Anders Ynnerman

While InfoVis and VAST have been expanding for the last decade, SciVis seems to be, in general, contracting. This apparent contraction coincides roughly with Bill Lorenson’s famous paper on the Death of Visualization. This panel discusses what appears to be a trend of the SciVis track of the conference contracting. This panel addresses some very challenging, core, fundamental questions.

Coffee Break

10:10–10:30 AM

10:30 AM–12:10 PM
VAST Papers
Managing Visual Analytic Process
Chair: Brian Fisher
[J] Characterizing Guidance in Visual Analytics, Davide Ceneda, Theresia Gschwandtner, Thorsten May, Silvia Miksch, Hans-Jörg Schulz, Marc Streit, Christian Tominski
[J] Toward Theoretical Techniques for Measuring the Use of Human Effort in Visual Analytic Systems, R. Jordan Crouser, Lyndsey Franklin, Alex Endert, Kris Cook
[J] Designing Progressive and Interactive Analytics Processes for High-Dimensional Data Analysis, Cagatay Turkay, Erdem Kaya, Selim Balcişoy, Helwig Hauser
[C] What May Visualization Processes Optimize?, Min Chen, Amos Golan
[C] Approximated and User Steerable tSNE for Progressive Visual Analytics, Nicola Pezzotti, Boudewijn P.F. Lelieveldt, Laurens van der Maaten, Thomas Höllt, Elmar Eisemann, Anna Vilanova

InfoVis Papers
Evaluation
Chair: Catherine Plaisant
[J] Evaluation of Graph Sampling: A Visualization Perspective, Yanhong Wu, Nan Cao, Daniel Archambault, Qiaomu Shen, Huamin Qu, Weiwei Cui
[J] [Honorable Mention] Many-to-Many Geographically-Embedded Flow Visualisation: An Evaluation, Yalong Yang, Tim Dwyer, Sarah Goodwin, Kim Marriott
[T] The Elicitation Interview Technique: Capturing People’s Experiences of Data Representations, Trevor Hogan, Uta Hinrichs, Eva Hornecker

12:10–2:00 PM
Lunch Break
2:00–3:40 PM
Vis Panel
How data visualization and regulation meet on the modern web
Moderator: Georges Grinstein
Panelists: Robert Baker, Betsy Beaumont, Karl Groves, Mike Paciello, Joss Stubblefield
Individuals with accessibility issues are not able to access much of our work in visualization and we, as a community, have not paid a great deal of attention to that community. This panel will address the misconceptions, the law, and the steps that need to be taken to resolve this.

VIS Papers
Biomedical Visualization
Chair: David Gotz
[J] Blockwise Human Brain Network Visual Comparison Using NodeTrix Representation, Xinsong Yang, Lei Shi, Madelaine Daianu, Hanghang Tong, Qingsong Liu, Paul Thompson
[J] PhenoStacks: Cross-Sectional Cohort Phenotype Comparison Visualizations, Michael Gleave, Alina Gvozdik, Fanny Chevalier, Azam Khan, Michael Brudno, Daniel Wigdor
[C] C2A: Crowd Consensus Analytics for Virtual Colonoscopy, Ji Hwan Park, Saad Nadeem, Seykoisko Mirhosseini, Arie Kaufman
[C] The DataSpace for HIV Vaccine Studies, David McColgin, Paul Hoover, Mark Igra

InfoVis Papers
Graphs
Chair: Stephen North
[J] Probabilistic Graph Layout for Uncertain Network Visualization, Christoph Schulz, Arlind Nocaj, Jochen Goertler, Oliver Deussen, Ulrik Brandes, Daniel Weiskopf
[T] CUBu: Universal real-time bundling for large graphs, Matthew van der Zwan, Valeriu Codreanu, Alexandru Telea
[T] Visualizing Dynamic Hierarchies in Graph Sequences, Corinna Vehlow, Fabian Beck, Daniel Weiskopf

SciVis Contest
Chairs: Christoph Garth and Berk Geveci
Each year, the VisContest presents researchers from the vis community an opportunity to transfer the latest developments in visual data analysis to a challenging application scenario.

3:40–4:15 PM
Coffee Break
4:15–4:45 PM
VIS Papers Fast Forward (Thurs & Fri)
5:00–7:00 PM
Posters & Networking
7:00–9:00 PM
VIS Banquet
Supported by Tableau Software
8:30–10:10 AM

VISAP Papers - Track 2
Chair: Fanny Chevalier

Glitch style visualization of disrupted neuronal connectivity in Parkinson's disease, Tim McGraw

Glitches as a Generative Design Process, Romain Vuillemot, Samuel Huron

Staged Analysis: From Evocative to Comparative Visualizations of Urban Mobility, Till Nagel, Christopher Pietsch, Marian Dörk

Artist Talks: Please join us in welcoming a select group of artists from around the globe!

VAST Papers
Social Media Data and Events
Chair: Andreas Kerren

[C] D-Map: Visual Analysis of Ego-centric Information Diffusion Patterns in Social Media, Siming Chen, Shuai Chen, Zhenhuang Wang, Jie Liang, Xiaoyu Yuan, Nan Cao, Yadong Wu

[C] How Ideas Flow across Multiple Social Groups, Xiting Wang, Shixia Liu, Yang Chen, Tai-Quan Peng, Jing Su, Jing Yang, Baining Guo


[C] SocialBrands: Visual Analysis of Public Perceptions of Brands on Social Media, Xiaotong Liu, Anbang Xu, Liang Gou, Haibin Liu, Rama Akkiraju, Han-Wei Shen


10:10–10:30 AM

Coffee Break

10:30 AM–12:10 PM

CG&A Papers
Applied Visualization Techniques
Chair: Melanie Tory

Episogram: Visual Summarization of Egocentric Social Interactions, Nan Cao, Yuru Lin, Fan Du

VTK-m: Accelerating the Visualization Toolkit for Massively Threaded Architectures, Kenneth Moreland, Christopher Sewell, William Usher, Li-ta Lo, Jeremy Meredith, David Pugmire, James Kress, Hendrik Schrots, Kwan-Liu Ma, Hank Childs, Matthew Larsen, Chun-Ming Chen, Robert Maynard, Berk Geveci

Evaluating Shape Alignment via Ensemble Visualization, Mukund Raj, Mahsa Mirzargar, J. Samuel Preston, Robert M. Kirby, Ross T. Whitaker

Spatial Analytic Interfaces: Spatial User Interfaces for In-Situ Visual Analytics, Barret Ens, Pourang Irani

Visualizing Evaluation Structures using Layered Graph Drawings, Yosuke Onoue, Nobuyuki Kukimoto, Naohisa Sakamoto, Kazuo Misue, Koji Koyama

VIS Panel
How can we improve empirical research on understanding visual information?
Moderator: Steve Haroz
Panelists: Pierre Dragicevic, Ronald Rensink, Jessica Hullman, Matthew Kay

Empirical scientific research comprises many stages, including choosing research questions, designing experiments, analyzing data, drawing conclusions, and effectively communicating the entire process. This panel will discuss various approaches to these stages and debate how empirical research in visualization can improve.
VAST Papers

Complementing Visual and Algorithmic Analysis
Chair: Ross Maciejewski

[J] AxiSketcher: Interactive Nonlinear Axis Mapping of Visualizations through User Drawings, Bum Chul Kwon, Hannah Kim, Emily Wall, Jaegul Choo, Haesun Park, Alex Endert

[J] VisMatchmaker: Cooperation of the User and the Computer in Centralized Matching Adjustment, Po-Ming Law, Wenchao Wu, Yixian Zheng, Huamin Qu


[J] Visual Analytics for Mobile Eye Tracking, Kuno Kurzhals, Marcel Hlawatsch, Christof Seeger, Daniel Weiskopf


[V] Patterns and Sequences: Interactive Exploration of Clickstreams to Understand Common Visitor Paths, Zhicheng Liu, Yang Wang, Mira Dontcheva, Matthew Hoffman, Seth Walker, Alan Wilson

[V] Analyzing Eye-Tracking Information in Visualization and Data Space: from Where on the Screen to What on the Screen, Sayeed Safayet Alamin, Radu Jianu

SciVis Papers

Presentation, Production, and Dissemination
Chair: Daniel Keefe

[J] Vol2velle: Printable Interactive Volume Visualization, Sergej Stoppel, Stefan Bruckner

[J] Categorical Colormap Optimization with Visualization Case Studies, H. Fang, S. Walton, E. Delahaye, J. Harris, D. A. Storchak, M. Chen

[J] Hybrid Tactile/Tangible Interaction for 3D Data Exploration, Lonni Besançon, Paul Issartel, Mehdi Ammi, Tobias Isenberg

[J] GlyphLens: View-dependent Occlusion Management in the Interactive Glyph Visualization, Xin Tong, Cheng Li, Han-Wei Shen

[T] Lightness Constancy in Surface Visualization, Danielle Albers Szafrir, Alper Sarikaya, Michael Gleicher

12:10–2:00 PM

Lunch Break

2:00–3:40 PM

VIS Panel

Application Papers: What are they and how should they be evaluated?
Moderator: Gunther Weber
Panelists: Sheelagh Carpendale, David Ebert, Brian Fisher, Hans Hagen, Ben Sneiderman, Anders Ynnerman

This panel will start a discussion in the community about what goals an application paper ought to have, what its main contributions to the state of art of visualization should be, and how it ought to be evaluated by reviewers. How do we as a community generate clear evaluation criteria for this type of paper?

Holiday 4+5

VAST Papers

User Behaviors
Chair: Jonathan Roberts

[J] Visual Analytics for Mobile Eye Tracking, Kuno Kurzhals, Marcel Hlawatsch, Christof Seeger, Daniel Weiskopf


[V] Patterns and Sequences: Interactive Exploration of Clickstreams to Understand Common Visitor Paths, Zhicheng Liu, Yang Wang, Mira Dontcheva, Matthew Hoffman, Seth Walker, Alan Wilson

[V] Analyzing Eye-Tracking Information in Visualization and Data Space: from Where on the Screen to What on the Screen, Sayeed Safayet Alamin, Radu Jianu

InfoVis Papers

Time Series
Chair: Adam Perer


[J] Surprise! Bayesian Weighting for De-Biasing Thematic Maps, Michael Correll, Jeffrey Heer


[T] The Connected Scatterplot for Presenting Paired Time Series, Steve Haroz, Robert Kosara, Steven L. Franconeri

THURSDAY

Holiday 6
DOCTORAL COLLOQUIUM 2017
Call for Participation

VIS 2017 will host a Doctoral Colloquium to support the next generation of visualization researchers. Ph.D. students at any stage of their research are invited to apply to participate in the colloquium. Students who will be completing their proposal defense near the time of the colloquium are particularly encouraged to apply. It will incorporate contributions from the scientific visualization, information visualization, and visual analytics student communities.

Colloquium participation will offer students insight and support for the framing of their research and will help them create important relationships. Financial support may be available to participants to assist in traveling to the conference. The colloquium will be run as a single day invitation-only event at the beginning of IEEE VIS.

Questions? Email info@ieeevis.org
8:30–10:10 AM

Holiday 6

**VIS Panel**

**Critical Visualization**
Moderator: Angus Forbes
Panelists: Marian Dörk, Jessica Hullman, Dietmar Offenhuber, Adam Trowbridge, Jessica Westbrook

How could a critical approach to visualization promote disclosure, plurality, contingency, and empowerment? What opportunities are there for incorporating human-centered inquiry into visualization research? Does articulating value, bias, and ideology have a place in scientific discourse? The Critical Visualization panel will introduce the diverse work of the five panelists and provide a forum for discussing critical approaches to visualization.

Holiday 4+5

**VAST Papers**

**Time-Series Data**
Chair: Jessie Kennedy

[J] **Honorable Mention** ViDX: Visual Diagnostics of Assembly Line Performance in Smart Factories, Panpan Xu, Honghui Mei, Liu Ren, Wei Chen

[C] Shape Grammar Extraction for Efficient Query-by-Sketch Pattern Matching in Long Time Series, Prithvijai Muthumanickam, Katerina Vrotsou, Matthew Cooper, Jimmy Johansson


Key 3+4+6

**InfoVis Papers**

**Visualization Education**
Chair: Nathalie Riche

[J] VLAT: Development of a Visualization Literacy Assessment Test, Sukwon Lee, Sung-Hee Kim, Bum Chul Kwon

[J] VIZITCARDS: A Card-Based Toolkit for Infovis Design Education, Shiqing He, Eytan Adar


[J] Exploring the Possibilities of Embedding Heterogeneous Data Attributes in Familiar Visualizations, Mona Hosseinkhani Loorak, Charles Perin, Christopher Collins, Sheelagh Carpendale

Key 1+2+5 and Key 3+4+6

**VIS Capstone**

Speaker: Jean-luc Doumont, *Principiae*

The three laws of communication

Key 1+2+5 and Key 3+4+6

**VIS Closing**

Chair: Terry Yoo, *National Institutes of Health*

VIS 2017 General Chair: James Ahrens, *Los Alamos National Laboratory*
VIS Posters

On the Performance of Stereoscopic Versus Monoscopic 3D Parallel Coordinates, Kahin Akram Hassan, Niklas Rönnberg, Camilla Forsell, Jimmy Johansson

[InfoVis Honorable Mention] The Biasing Effect of Word Length in Font Size Encodings, Eric Alexander, Chih-Ching Chang, Mariana Shimabukuro, Steven Franconeri, Christopher Collins, Michael Gleicher

Visually-supported graph traversals for exploratory analysis, Albert Amor-Amorós, Paolo Federico, Silvia Miksch

[VAST Best Poster] Exploring Pressure in Football, Gennady Andrienko, Natalia Andrienko, Guido Budzjak, Tatiana von Landesberger, Hendrik Weber

[InfoVis Honorable Mention] Fireflies: Biomimicry-Inspired InfoVis for Exploring Public Opinion about an Infectious Disease, Bon Adriel Aseniero, Charles Perin, Marjan Eggermont, Sheelagh Carpendale

ClassSPLOM - A Scatterplot Matrix to Visualize Separation of Multiclass Multidimensional Data, Michael Auptetit, Ahmed Ali

Articulate2: Toward a Conversational Interface for Visual Data Exploration, Jillian Aurisano, Abhinav Kumar, Alberto Gonzalez, Jason Leigh, Barbara DiEugenio, Andrew Johnson

Integrating Visual Exploration into Traditional Scientific Research Methodology, Evan Barba, Yifang Wei, Janet Mann, Lisa Singh

[SciVis Best Poster] Case Study on Visualizing Gulf Stream Eddies from ROMS, Karen Bemis, Li Liu, Deborah Silver, Dujuan Kang, Enrique Curchiter

Fluid Treemap Interactions, Seth Borges, David Koop

[VAST Honorable Mention] Eliciting Strategies and Tasks in Uncertainty-Aware Data Analytics, Nadia Boukhelifa, Marc-Emmanuel Perrin, Samuel Huron, James Eagan

Immersive Analytics with WebVR and Google Cardboard, Peter Butcher, Jonathan Roberts, Panagiotis Ritsos

Guiding the Visualization of Time-Oriented Data, Davide Ceneda, Wolfgang Aigner, Markus Bögli, Theresia Gschwandtner, Silvia Miksch

Multi-Granularity Visualizations of Geographic Mobility, Bishal Chamling, Adam M. Terwilliger, Jonathan P. Leidig, Greg Wolff

A Semiotics Approach to Characterize Diffusion Tensor Imaging Visualization, Jian Chen

Adaptive Mobility Transition Graph: A Visual Exploration Approach for Citywide Crowd Mobility, Wei Chen, Minfeng Zhu, Feiran Wu, Zhaosong Huang, Wangi Hu, Tao Wang, Lingfei Zhao, Xumeng Wang, Fan Zhang, Ross Maciejewski

StreamExplorer: A Multi-Stage System for Visually Exploring Events in Social Stream, Zhutian Chen, Guodao Sun, Nan Cao, Huamin Qu, Yingcai Wu

[SciVis Honorable Mention] Extending Scatterplots to Scalar Fields, Shenghui Cheng, Pengcheng Cui, Klaus Mueller

A Data-Driven Approach for Mapping Multivariate Data to Color, Shenghui Cheng, Wei Xu, Wen Zhong, Klaus Mueller

Tile-Based Spatio-Temporal Visual Analytics via Topic Modeling on Social Media, Minsuk Choi, Jaeseong Yoo, Ashley S. Beavers, Scott Langevin, Chris Bethune, Sean McIntyre, Drake Barry, Jaegul Choo, Park Haesun

NaturalMotion: Exploring Gesture Controls for Visualizing Time-Evolving Graphs, Samuel Clarke, Nathan Dass, Duen Horng Chau

Analyzing Hillary Clinton’s Emails, Vasundhara Dehiya, Klaus Mueller

GIS and Cartographic Techniques Using Multi-Temporal Raster Datasets to Illustrate Crop Migration and Change, Lee Ebinger, Avery Sandborn

Towards an Algebra for the Visual Analytics Design Process, Ulrich Engelke, Eser Kandogan

A Hierarchical Interaction Design for Multi-dimensional Flow Datasets, Ruimin Gao, Mingran Li, Xinge Hu, Yingjie Victor Chen

Information-Theoretic Visual Exploration of Multivariate Sensor Time-series with A Time-Correlation Partitioning Tree, Fangzhou Guo, Junhua Lu, Feiran Wu, Tianye Zhang, Wei Chen, Lei Shi, Huaming Qu

SpannerFinder: Interactive Visualization of Temporal Ensemble Rankings to Explore Structural Holes in Dynamic Networks, Fengzhuo Guo, Yingcai Wu, chenyang ji, Bingzhang Dai, Tianye Zhang, Huihua Guan, Wei Chen, Tim Dywer

Supporting Sensemaking Transitions in Research Proposal Writing through Topic Modeling and Embedded Visualizations, Hua Guo, David Laidlaw

A Visualization System for Clustering Dementia Patients based on Automated Similarity Analysis, Hyoji Ha, Hyunwoo Han, Sungyoon Bae, Jihye Lee, Sunjoo Bang, Sangjoon Son, Changhyung Hong, Hyunjung Shin, Kyungwon Lee

Characterizing Visual Exploration Techniques for Temporal Data, Rafael Henkin, Aidan Slingsby, Jason Dykes

Analyzing influenza incidence and policy data at different temporal and spatial scales, Julia Hocket, Shweta Bansal, Han-Hsi Liu, Lisa Singh

Adding Semantic Information into Data Models by Learning Domain Expertise from User Interaction, Nathan Hodas, Alex Endert

Visualizing Dynamics of Complex Familial Structures, John R. Hott, Worthy N. Martin, Kathleen Flake

Visual Analysis of Rugby Matches: Pixel-oriented Visualization and Evaluation Indices, Yusuke Ishikawa, Isssei Fujishiro

SwiftTuna: Incrementally Exploring Large-scale Multidimensional Data, Jaemin Jo, Wonjae Kim, Seunghoon Yoo, Bohyoung Kim, Jinwook Seo

GPU-Assisted Visual Analysis and Categorization of Ensemble Conflict, Donald Johnson, TJ Jankun-Kelly

Investigation of Scalar Field Metrics and Respective Visualization Techniques, Christopher Paul Kappe, Michael Böttinger, Heike Leitte

TransUccess: Investigating Social Equity in Accessing Public Transportation through Visual Analytics, Shaked Kaufmann, Peter Bak, Noam Tractinsky

Multiscale Display of 1D, 2D, and 3D Genomic Information, Peter Kerpedjiev, Kasper Dinkla, Hendrik Strobelt, Hanspeter Pfister, Peter Park, Nils Gehlenborg

Supporting Graph Exploration Tasks on Display Walls Using Spatially-Aware Mobile Devices, Ulrike Kister, Konstantin Klamka, Raimund Dachselt
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Sense.me - Open Source Framework for the Exploration and Visualization of Eye Tracking Data, Nelson Silva, Lin Shao, Tobias Schreck, Eva Eggeling, Dieter Fellner
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Understanding Sensemaking Strategies in Criminal Intelligence Analysis Looking at User Interaction, Johanna Haider, Vienna University of Technology, Austria

Analyzing Creative Processes: Qualitative Methods Meets Visual Analytics, Rhema Linder, Texas A&M University, USA

Drawing Small Beautiful Diagrams, Vahan Yoghourdjian, Monash University, Australia

On the Scalability of Large Graph Visualization, Yanhong Wu, Hong Kong University of Science and Technology, Hong Kong

Visual Exploration Techniques for Urban Planning, Fabio Miranda, New York University, USA

Proofreading of Automatic Segmentations in Connectomics, Daniel Haehn, Harvard University, USA

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Scalable Visual Analytics for Advanced Manufacturing, Dominik Herr, University of Stuttgart, Germany

Effective Visualization of The Uncertainty in Hurricane Forecasts, Le Liu, Clemson University, USA

Spatial-Nonspatial Visual Integration of Dynamic, Multi-Scale, and Comparative Biological Networks, Chihua Ma, University of Illinois at Chicago, USA

Session 3
Integrating Predictive Analytics and Social Media, Yafeng Lu, Arizona State University, USA

Spatial-Temporal Historical Event Visual Exploration Through Social Media-Based Models, Vanessa Peña-Araya, University of Chile, Chile

Implementation and Evaluation of Cartogram Generation Algorithms, Sabrina Nusrat, University of Arizona, USA

Targeting Designs of Scalable Exploratory Visual Summaries, Alper Sarikaya, University of Wisconsin-Madison, USA

Compiling Differential Tensor Calculus, Charisee Chiw, University of Chicago, USA

Flow Visualization and Analysis: From Geometry to Physics, Lei Zhang, University of Houston, USA

Session 4
Visual Analytics for Temporal Event Sequence Recommendation, Fan Du, University of Maryland, USA

Using Data Visualization to Bridge the Gaps in Tuberculosis Research, Anaamaria Crisan, The University of British Columbia, Canada

Using Virtual Reality effectively: An Evaluation of Visual Fidelity Components in Immersive VR Environments, Johannes Novotny, Brown University, USA

VAST Challenge

VAST Challenge 2016: Streaming Visual Analytics, R. Jordan Crouser, Kristin Cook, John Fallon, Georges Grinstein, Kristen Liggett, Danko Nebesh, Diane Staheli, Mark A. Whiting, Kirsten Whitley


[Dini-Challenge 1 Honorable Mention Compelling Vision] Collaborative Observation and Response Environment, Jordan Riley Benson, Shaun Kurian, Karl Prewo, Rajiv Ramaraj

[Dini-Challenge 1 Honorable Mention Excellent Storyboard] Fusing Events, Tasks and Spatial Awareness in an Ambient-Enabled Work Environment, Juri Buchmüller, Manuel Stein, Alexander Jger, Sabrina Schmidt, Hansi Senaratne, Hallidör Janetzko


[VAST Challenge 2 Award: Outstanding Presentation of Patterns in Context] Visual Analytic Design for Contextualising Sensor Data, Jo Wood

[VAST Challenge 2 Honorable Mention Clear Analysis Strategy] Exploratory Analysis of Trajectory and Sensor Data, Srijam Karthik Badam, Christoph Kinkeldey, Petra Isenberg


[VAST Challenge 2 Honorable Mention: Effective Support for Building Management] Divide and Conquer Approach to the Analysis of Complex Spatio-Temporal Sensory Data, Rainer Splechtner, Michael Beham, Denis Gračanin, Alexandra Diehl, Claudio Delrieux, Krešimir Matković


[VAST Challenge 2 + VAST Challenge 3 combined Award: Outstanding Comprehensive Solution] STAD-HD: Spatial Temporal Anomaly Detection for Heterogeneous Data through Visual Analytics, Yu Zhang, Guozheng Li, Chufan Lai, Qiangqiang Liu, Shuai Chen, Lu Feng, Tangzhi Ye, Siming Chen, Ren Zuo, Zhaohan Zhang, Zhanyi Wang, Xin Huang, Fengchao Xu, Li Yu, Shunlong Zhang, Qiusheng Li, Xiaoru Yuan

Middle@GASTech, Christopher Andrews, Lily Taub, Shannon Ovitt

Analyzing Trajectory Data Using Power BI, Dawoon Choi, Pablo Martinez, Ivo Rusconi

An interactive graph-based pipeline approach to the analysis of VAST 2016 Mini-Challenge 2 dataset, Guilherme S. M. Carneiro, Victor M. de Oliveira, Aaron Quigley, Hugo A. D. do Nascimento

Visual Analytics for Proximity and HVAC Sensor Data: VAST 2016 Mini-Challenge 2, Kaarthik Madanagopal, Paul Koola, John Freeze, Kalyan Vadakkeveedu

Dynamic Employee and Sensor Visualization: VAST 2016 Mini-Challenge #2, Matthew Sindra, Ian Turk, Jun Tao, Qi Liao, Chao Li, Wang, Lei Shi

VAST 2016 Mini-Challenge 2, Pablo Andreoni, Adriana Romero, Alvaro Velez, Jonny Rodriguez, Daniel Ojeda


Pororoca: Efficient Crowd Motion Monitoring and Instant Situation Awareness, Yuankun Song, Hsin-Man Wu, Xinghe Hu, Siyan Liu, Hui Tang, Zheng Zhou, Shuang Wei, Zhenyu (Cheryl) Qian, Yingjie (Victor) Chen
SciVis Contest

Interactive Topological Exploration of Particle Ensembles, Harsh Bhatia, Pavol Klacansky, Shusen Liu, Wathsala Widanagamaachchi, Attila Gyulassy, Valerio Pascucci, Peer-Timo Bremer

Visual and Structural Analysis of Point-based Simulation Ensembles, Sebastian Grottell, Patrick Gralka, Joachim Stolb, Karsten Schatz, Grzegorz K. Karch, Manuel Hirschl, Michael Krone, Guido Reina, Stefan Gumhold, Thomas Ertl

Visualising Viscous Fingers, Martin Ender, Sebastian Weiß, Florian Ferstl, Johannes Kehrer, Rüdiger Westermann

Interactive Exploration and Tracking of Ensemble Viscous Fingers, Andrew Burks, Cassiano Sugiyama, Timothy Luciani, Jonathan Komperda, G. Elisabeta Marai

Visualizing Ensembles of Viscous Fingers, Guillaume Favelier, Charles Gueunet, Julien Tierny

VIS-In-Practice

Resonant Laboratory and Candela: Spreading Your Visualization Ideas to the Masses, Alex Bigelow, Roni Choudhury, Jeffrey Baumes

A Java alternative to open source visualisation - VisNow, Bartosz A. Borucki, Krzysztof S. Nowiński

iDotter - an interactive dot plot viewer, Daniel Gerighausen, Alrik Hausdorff, Sebastian Zänker, Dirk Zeckzer

Uncertainty-Awareness in Open Source Visualization Solutions, Christina Gillmann, Thomas Wischgoll, Hans Hagen

MegaMol---for Fun and Profit, Sebastian Grottell, Guido Reina, Michael Krone, Christoph Müller, Thomas Ertl

Lessons learned from designing and implementing Network Explorer, a real world network visual analytics tool using open source software, John Alexis Guerra-Gomez

STRAD Wheel: Web-based Library for the Visualization of Temporal Data, Carol Naranjo-Valero, Diana Fernández-Prieto, José Tiberio Hernández, Hans Hagen

OpenThinning: Fast 3D Thinning based on Local Neighborhood Lookups, Tobias Post, Christina Gillmann, Thomas Wischgoll, Hans Hagen

Application of Visual Analytics to Maritime Domain Analysis, Margaret Varga, Valérie Lavigne

On Expressiveness and Conciseness of Data Graphics Templates, Romain Vuillemot

Java Scientific Containers - an open source generic large data library for visualization applications, Piotr Wendykier, Bartosz A. Borucki, Krzysztof S. Nowiński

Keshif: Out-of-the-Box Visual and Interactive Data Exploration Environment, Mehmet Adil Yaşın, Niklas Elmqvist, Benjamin B. Bederson

TrajAnalytics: A Web-Based Visual Analytics Software of Urban Trajectory Data, Ye Zhao, Shamal Al-Dohuki, Thomas Eynon, Farah Kamw, David Sheets, Chao Ma, Yueqi Hu, Xinyue Ye, Jing Yang

BioVis Posters
Visualizing the Trajectories and Contexts of Facial Branchiomotor Neuron Pioneers, Tri Huynh, Anastasia Beiriger, Victoria Prince, Gordon Kindlmann

Co-visualisation of Close Genetic Relatedness of Mycobacterium tuberculosis Isolates with Complex Meta-data, Trien V. Do, Oriol Mazariégos Canellas, Derrick Crook, Tim Peto, David Wylie

A Story of Reanimating an Embryonic Mouse Limb, Yong Wan, A. Kelsey Lewis, Gabrielle Kardon, Charles Hansen

FluoRender: An Interactive Visualization System for 3D and 4D Confocal Microscopy Data in Neurobiology Research, Yong Wan, Hideo Otsuna, Chi-Bin Chien, Charles Hansen


Visual Analysis System for Clustering Dementia Patients Based on Similarity of Dementia Phase Changing Pattern, Mubashar Karim Raja, Youngbeom Choi, Wooseok Song, Kyungwon Lee

The JAX Synteny Browser for Mouse-Human Comparative Genomics, Mei Xiao, Keith Sheppard, Paul Hale, Govindarajan Kunde-Ramamoorthy, Joel Richardson, Carol Bult

LDV Posters
Topology-aware Image Compositing using NVLink, Cameron Christensen, Thomas Fogal, Nathan Luehr, Cliff Woolley

Scalable Rendering of Large SPH Simulations Using an RK-Enhanced Interpolation Scheme on Constrained Datasets, Kevin Griffin, Kevin Caskin

Segmented Time Series Visualization Tool for Additive Manufacturing, William Halsey, Chad Steed, Ryan Dehoff, Vincent Paquet, Sean Yoder

A Lightweight H.264-based Hardware Accelerated Image Compression Library, Jie Jiang, Thomas Fogal, Cliff Woolley, Peter Messmer, Thomas Fogal

Statistical Projections for Multi-dimensional Visual Data Exploration, Hoa Nguyen, Daiitho Stone, E. Wes Bethel

Formal Evaluation Strategies for Feature Tracking, Andrea Schnorr, Sebastian Freitag, Dirk Helmrich, Torsten W. Kuhlen, Bernd Hentschel

Correlating Sub-Phenomena in Performance Data in the Frequency Domain, Tom Vierjahn, Marc-André Hermans, Bernd Mohr, Matthias S. Müller, Torsten W. Kuhlen, Bernd Hentschel

A Study of Scientific Visualization on Heterogeneous Processors Using Legion, Lina Yu, Hongfeng Yu

VizSec Posters
Visualizing DNS Datasets for Alert-driven Threat Analysis, Rosa Romero Gomez, Yacin Nadji, Panagiotis Kintis, Manos Antonakakis

A Framework for Context-Aware Visualization in Cyber Defense, Adam Fouse, Ryan Mullins, Caroline Ziemkiewicz

DirViz: Interactively Scale Treemaps for File Permission Visualization, Jared Chandler, Lane Harrison

Network Security Visualization Using Virtual Reality, Brandon Laughlin

Applying Data Transformation to Derive Insights for Network Intrusion Detection, Dong Hyun Jeong, Soo-Youn Ji

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