IS&T International Symposium on Electronic Imaging (EI 2022)

Visualization and Data Analysis 2022

Online
17 - 26 January 2022

ISBN: 978-1-7138-9380-6

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2022) by Society for Imaging Science & Technology
All rights reserved.
Copyright for individual papers remains with the authors and are licensed under a Creative Commons 4.0 license, CC-BY. (https://creativecommons.org/licenses/by/4.0/)

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Society for Imaging Science & Technology
at the address below.

Society for Imaging Science & Technology
7003 Kilworth Lane
Springfield, Virginia 22151
USA

Phone: 703-642-9090
Fax: 703-642-9094

info@imaging.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Visualization and Data Analysis 2022

MONDAY 17 JANUARY 2022

PLENARY: Quanta Image Sensors: Counting Photons Is the New Game in Town
10:00 – 11:10

Eric R. Fossum, Dartmouth College (United States)

The Quanta Image Sensor (QIS) was conceived as a different image sensor—one that counts photoelectrons one at a time using millions or billions of specialized pixels read out at high frame rate with computation imaging used to create gray scale images. QIS devices have been implemented in a CMOS image sensor (CIS) baseline room-temperature technology without using avalanche multiplication, and also with SPAD arrays. This plenary details the QIS concept, how it has been implemented in CIS and in SPADs, and what the major differences are. Applications that can be disrupted or enabled by this technology are also discussed, including smartphone, where CIS-QIS technology could even be employed in just a few years.

Eric R. Fossum is best known for the invention of the CMOS image sensor "camera-on-a-chip" used in billions of cameras. He is a solid-state image sensor device physicist and engineer, and his career has included academic and government research, and entrepreneurial leadership. At Dartmouth he is a professor of engineering and vice provost for entrepreneurship and technology transfer. Fossum received the 2017 Queen Elizabeth Prize from HRH Prince Charles, considered by many as the Nobel Prize of Engineering "for the creation of digital imaging sensors," along with three others. He was inducted into the National Inventors Hall of Fame, and elected to the National Academy of Engineering among other honors including a recent Emmy Award. He has published more than 300 technical papers and holds more than 175 US patents. He co-founded several startups and co-founded the International Image Sensor Society (IISS), serving as its first president. He is a Fellow of IEEE and OSA.

WEDNESDAY 19 JANUARY 2022

PLENARY: In situ Mobility for Planetary Exploration: Progress and Challenges
10:00 – 11:15

Larry Matthies, Jet Propulsion Laboratory (United States)

This year saw exciting milestones in planetary exploration with the successful landing of the Perseverance Mars rover, followed by its operation and the successful technology demonstration of the Ingenuity helicopter, the first heavier-than-air aircraft ever to fly on another planetary body. This plenary highlights new technologies used in this mission, including precision landing for Perseverance, a vision coprocessor, new algorithms for faster rover traverse, and the ingredients of the helicopter. It concludes with a survey of challenges for future planetary mobility systems, particularly for Mars, Earth's moon, and Saturn's moon, Titan.

Larry Matthies received his PhD in computer science from Carnegie Mellon University (1989), before joining JPL, where he has supervised the Computer Vision Group for 21 years, the past two coordinating internal technology investments in the Mars office. His research interests include 3-D perception, state estimation, terrain classification, and dynamic scene analysis for autonomous navigation of unmanned vehicles on Earth and in space. He has been a principal investigator in many programs involving robot vision and has initiated new technology developments that impacted every US Mars surface mission since 1997, including visual navigation algorithms for rovers, map matching algorithms for precision landers, and autonomous navigation hardware and software architectures for rotorcraft. He is a Fellow of the IEEE and was a joint winner in 2008 of the IEEE's Robotics and Automation Award for his contributions to robotic space exploration.

TUESDAY 25 JANUARY 2022

PLENARY: Physics-based Image Systems Simulation
10:00 – 11:00

Joyce Farrell, Stanford Center for Image Systems Engineering, Stanford University, CEO and Co-founder, ImagEval Consulting (United States)

Three quarters of a century ago, visionaries in academia and industry saw the need for a new field called photographic engineering and formed what would become the Society for Imaging Science and Technology (IS&T). Thirty-five years ago, IS&T recognized the massive transition from analog to digital imaging and created the Symposium on Electronic Imaging (EI). IS&T and EI continue to evolve by cross-pollinating electronic imaging in the fields of computer graphics, computer vision, machine learning, and visual perception, among others. This talk describes open-source software and applications that build on this vision. The software combines quantitative computer graphics with models of optics and image sensors to generate physically accurate synthetic image data for devices that are being prototyped. These simulations can be a powerful tool in the design and evaluation of novel imaging systems, as well as for the production of synthetic data for machine learning applications.

Joyce Farrell is a senior research associate and lecturer in the Stanford School of Engineering and the executive director of the Stanford Center for Image Systems Engineering (SCIEN). Joyce received her BS from the University of California at San Diego and her PhD from Stanford University. She was a postdoctoral fellow at NASA Ames Research Center, New York University, and Xerox PARC, before joining the research staff at Hewlett Packard in 1985. In 2000 Joyce joined Shutterfly, a startup company specializing in online digital photofinishing, and in 2001 she formed ImagEval Consulting, LLC, a company specializing in the development of software and design tools for image systems simulation. In 2003, Joyce returned to Stanford University to develop the SCIEN Industry Affiliates Program.

PANEL: The Brave New World of Virtual Reality
11:00 – 12:00

Advances in electronic imaging, computer graphics, and machine learning have made it possible to create photorealistic images and videos. In the future, one can imagine that it will be possible to create a virtual reality that is indistinguishable from real-world experiences. This panel discusses the benefits of this brave new world of virtual reality and how we can mitigate the risks that it poses. The goal of the panel discussion is to showcase state-of-the art synthetic imagery, learn how this progress benefits society, and discuss how we can mitigate the risks that the technology also poses. After brief demos of the state-of-their-art, the panelists will discuss: creating photorealistic avatars, Project Shoah, and digital forensics.

Panel Moderator: Joyce Farrell, Stanford Center for Image Systems Engineering, Stanford University, CEO and Co-founder, ImagEval Consulting (United States)
Panelist: Matthias Neissner, Technical University of Munich (Germany)
Panelist: Paul Debevec, Netflix, Inc. (United States)
Panelist: Hany Farid, University of California, Berkeley (United States)

WEDNESDAY 26 JANUARY 2022

Exascale Visualization
Session Chair: Thomas Wischgoll, Wright State University (United States)
13:00 – 14:05

13:00
Conference Introduction

13:05 N/A
KEYNOTE: The big changes behind exascale visualization [Presentation-Only], *Hank Childs, University of Oregon (United States)*

Exascale computers, i.e., supercomputers that can perform one billion billion floating point operations per seconds, will arrive this year. To meet constraints in total cost and power usage, these computers have significantly different designs than the supercomputers from one decade ago. For the scientific visualization community, the two most important challenges from these new designs are the presence of accelerators with massive parallelism and the relative decrease in I/O bandwidth when compared to compute power. The

accelerators challenge has led to the usage of data-parallel primitives to achieve both performance and portability. The I/O bandwidth challenge has led to a shift towards in situ processing, i.e., visualizing data as it is computed, which in turn has required new approaches for automation, data reduction, and software delivery. In this talk, I will describe the challenges the exascale visualization community has faced and the solutions we will deploy as exascale computers come online.

Hank Childs is a professor in the department of computer and information science at the University of Oregon. He received his PhD in computer science from the University of California at Davis (2006). Childs' research focuses on scientific visualization, high performance computing, and the intersection of the two. In July of 2012, Childs received the Department of Energy's Early Career Award to research visualization with exascale computers (i.e., computers that can do 1018 floating operations per second). Childs spent more than a dozen years at Lawrence Berkeley and Lawrence Livermore National Laboratories, directing research in big data visualization. Outside of his research, Childs is best known as the architect of the VisIt project, a visualization application for very large data that is used around the world.

13:45 N/A

Visualizing and slicing topological surfaces in four dimensions (JIST-first), *Hui Zhang and Huan Liu, University of Louisville (United States)*

AR/VR Visualization

Session Chair: David Kao, NASA Ames Research Ctr. (United States)

18:00 – 19:00

18:00 VDA-407

On the suitability of current augmented reality head-mounted devices, *Sadan Suneesh Menon and Thomas Wischgoll, Wright State University (United States)*

18:20 VDA-408

AR visualization for coastal water navigation, *Randy Herritt and Stephen Brooks, Dalhousie University (Canada)*

18:40 VDA-409

Digital reconstruction of Elmina Castle for mobile virtual reality via point-based detail transfer, *Sifan Ye[1], Ting Wu[2], Michael Jarvis[3], and Yuhao Zhu[3]; [1]Stanford University, [2]eBay Inc., and [3]University of Rochester (United States)*

Information Visualization and Analytics Tools

Session Chair: Yi-Jen Chiang, New York University (United States)

19:15 – 20:15

19:15 VDA-413

CoursePathVis: Course path visualization using flexible grouping and funnel-augmented Sankey diagram, *Brendan J. O'Handley, Morgan K. Ludwig, Samantha R. Allison, Michael T. Niemier, Shreya Kumar, Ramzi Bualuan, and Chaoli Wang, University of Notre Dame (United States)*

19:35 VDA-414

Visualizing semantic 3D object clouds, *Bola Okesanjo and Stephen Brooks, Dalhousie University (Canada)*

19:55 VDA-415

Nirmaan: Dataset generation for multiclass scatterplot studies, *Allison Wong[1], Alark Joshi[2], and Sophie Engle[2]; [1]Geico and [2]University of San Francisco (United States)*