



## **Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2022**

### **Conference Chairs**

**David Akopian**, The University of Texas at San Antonio (United States)  
**Reiner Creutzburg**, Technische Hochschule Brandenburg (Germany)

This document details the conference program, held as part of the 2022 IS&T International Symposium on Electronic Imaging, online 15–26 January 2022. Manuscripts of conference papers are reproduced from PDFs as submitted and approved by authors; no editorial changes were made.

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## Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2022

### Conference overview

The goal of this conference is to provide an international forum for presenting recent research results on multimedia for mobile devices, and to bring together experts from both academia and industry for a fruitful exchange of ideas and discussion on future challenges. The authors are encouraged to submit work-in-progress papers as well as updates on previously reported systems. Outstanding papers may be recommended for the publication in the Journal Electronic Imaging or Journal of Imaging Science and Technology.

**Conference Chairs:** David Akopian, The University of Texas at San Antonio (United States); Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

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# Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 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.*

### Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2022 Posters

11:20 – 12:20

Poster interactive session for all conferences authors and attendees.

MOBMU-205

**P-20: Chatbot integrated with machine learning deployed in the cloud and performance evaluation, Ganesh Reddy**

*Gunnam, Rahul Mundlamuri, Devasena Inupakutika, Sahak Kaghyan, and David Akopian, The University of Texas at San Antonio (United States)*

**P-21: Chatbot integration with Google Dialogflow environment for conversational intervention**, *Rahul Mundlamuri, Devasena Inupakutika, David Akopian, Ganesh Reddy Gunnam, and Sahak Kaghyan, The University of Texas at San Antonio (United States)*

**P-22: Interactive books - Status report**, *Harvey R. Levenson, Cal Poly (United States)*

## 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-the-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)*

## Cybersecurity and Forensics I

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**12:15 – 13:20**

12:15

### Conference Introduction

12:20

MOBMU-350

**Evaluation and test of various tools for OSINT-based Instagram investigation,** Deepak Jamwal<sup>1</sup>, Klaus Schwarz<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>SRH Berlin University of Applied Sciences and <sup>2</sup>Technische Hochschule Brandenburg (Germany)

12:40

MOBMU-351

**Evaluation and test of various tools for OSINT-based Twitter investigation,** Arun Khajuria<sup>1</sup>, Klaus Schwarz<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>SRH Berlin University of Applied Sciences and <sup>2</sup>Technische Hochschule Brandenburg (Germany)

13:00

MOBMU-352

**Evaluation and test of various tools for OSINT-based Facebook investigation,** Chinmay Bhosale<sup>1</sup>, Klaus Schwarz<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>SRH Berlin University of Applied Sciences and <sup>2</sup>Technische Hochschule Brandenburg (Germany)

## Cybersecurity and Forensics II

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**13:45 – 14:45**

13:45

MOBMU-360

**Evaluation and test of various tools for OSINT-based Telegram investigation,** Chinonso Ashimole<sup>1</sup>, Shubham Saroha<sup>1</sup>, Klaus Schwarz<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>SRH Berlin University of Applied Sciences and <sup>2</sup>Technische Hochschule Brandenburg (Germany)

14:05

MOBMU-361

**Improving detection of manipulated passport photos - Training course for border control inspectors to detect morphed facial passport photos - Part II: Training course materials,** Franziska Schwarz<sup>1</sup>, Klaus Schwarz<sup>2</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>Technische Hochschule Brandenburg and <sup>2</sup>SRH Berlin University of Applied Sciences (Germany)

14:25

MOBMU-362

**Recognition of objects from looted excavations by smartphone app and deep learning,** Waldemar Berchtold, Huajian Liu, Martin Steinebach, Simon Bugert, and York Yannikos, Fraunhofer Institute for Secure Information Technology (Germany)

## Autonomy and Mobility

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**18:00 – 19:00**

18:00

MOBMU-371

**Autonomous self-driving vehicles - Design of professional laboratory exercises in the field of automotive mechatronics,** Franziska Schwarz<sup>1</sup>, Klaus Schwarz<sup>2</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>Technische Hochschule Brandenburg and <sup>2</sup>SRH Berlin University of Applied Sciences (Germany)

18:20

MOBMU-372

**A robust indoor localization approach exploiting multipath,** Rahul Mundlamuri, Devasena Inupakutika, and David Akopian, The University of Texas at San Antonio (United States)

## WEDNESDAY 26 JANUARY 2022

### Infrastructure Solutions I

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**10:00 – 11:00**

10:00

MOBMU-387

**Evaluation of AI-based use cases for enhancing the cyber security defense of small and medium-sized companies (SMEs),** Daniel Kant<sup>1</sup>, Andreas Johannsen<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>Technische Hochschule Brandenburg and <sup>2</sup>SRH Berlin University of Applied Sciences (Germany)

10:20

MOBMU-388

**The importance of the digital twin for the smart factory,** Reiner Creutzburg, Sören Hirsch, Robert Flassig, Sven Thamm, and Andreas Johannsen, Technische Hochschule Brandenburg (Germany)

10:40

MOBMU-389

**The role and importance of key enabling technologies as building blocks for smart factories,** Reiner Creutzburg, Sören Hirsch, Robert Flassig, Steffen Doerner, Sven Thamm, and Andreas Johannsen, Technische Hochschule Brandenburg (Germany)

### Infrastructure Solutions II

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**11:30 – 12:30**

11:30

MOBMU-397

**The hybridization of renewable energy resources,** Saiful Islam<sup>1</sup>, Michael Hartmann<sup>1</sup>, and Reiner Creutzburg<sup>1,2</sup>; <sup>1</sup>SRH Berlin University of Applied Sciences and <sup>2</sup>Technische Hochschule Brandenburg (Germany)

11:50

MOBMU-398

**Community research partnership: A case study of San Antonio Research Partnership Portal,** Mohammad Nadim and David Akopian, The University of Texas at San Antonio (United States)

### Imaging and Human-Machine Interfaces

**Session Chairs:** David Akopian, The University of Texas at San Antonio (United States) and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)

**13:00 – 14:00**

13:00

MOBMU-400

**Combination of RAW images and videos for 30K panoramic projection using ACES workflow,** Eberhard Hasche<sup>1</sup>, Reiner Creutzburg<sup>1,2</sup>, and Oliver Karaschewski<sup>1</sup>; <sup>1</sup>Technische Hochschule Brandenburg and <sup>2</sup>SRH Berlin University of Applied Sciences (Germany)

13:20

MOBMU-401

**Application scenarios and usability for modern 360 degree video projection rooms in the MICE industry,** Reiner Creutzburg<sup>1</sup>, Eberhard Hasche<sup>1,2</sup>, and Dirk Hagen<sup>2</sup>; <sup>1</sup>Technische Hochschule Brandenburg and <sup>2</sup>SRH Berlin University of Applied Sciences (Germany)

13:40

MOBMU-402

**Brain computer interface (BCI) – UX-design for visual and non-visual interaction by mental commands in the context of technical possibilities,** Julia Schnitzer, Technische Hochschule Brandenburg (Germany)