PROGRAM AND PROCEEDINGS

Media Watermarking, Security, and Forensics 2022

Conference Chairs
Adnan M. Alattar, Digimarc Corp. (United States)
Nasir D. Memon, Tandon School of Engineering, New York Univ. (United States)
Gaurav Sharma, University of Rochester (United States)

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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Media Watermarking, Security, and Forensics 2022

Conference overview

The ease of capturing, manipulating, distributing, and consuming digital media (e.g., images, audio, video, graphics, and text) has enabled new applications and brought a number of important security challenges to the forefront. These challenges have prompted significant research and development in the areas of digital watermarking, steganography, data hiding, forensics, deepfakes, media identification, biometrics, and encryption to protect owners' rights, establish provenance and veracity of content, and to preserve privacy. Research results in these areas has been translated into new paradigms and applications for monetizing media while maintaining ownership rights, and new biometric and forensic identification techniques for novel methods for ensuring privacy.

The Media Watermarking, Security, and Forensics Conference is a premier destination for disseminating high-quality, cutting-edge research in these areas. The conference provides an excellent venue for researchers and practitioners to present their innovative work as well as to keep abreast of the latest developments in watermarking, security, and forensics. Early results and fresh ideas are particularly encouraged and supported by the conference review format: only a structured abstract describing the work in progress and preliminary results is initially required and the full paper is requested just before the conference. A strong focus on how research results are applied by industry, in practice, also gives the conference its unique flavor.

Paper authors listed as of 1 January 2022; refer to manuscript for final authors. Titles that are not listed with the proceedings files were presentation-only.

Media Watermarking, Security, and Forensics 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.

Media Watermarking, Security, and Forensics 2022 Posters
11:20 – 12:20

Poster interactive session for all conferences authors and attendees.

MWSF-209

P-23: Robust face recognition: How much face is needed?, *Niklas Bunzel, Fraunhofer Institute for Secure Information Technology (Germany)*

MWSF-210

P-24: Using a GAN to generate adversarial examples to facial image recognition, *Andrew Merrigan and Alan Smeaton, Dublin City University (Ireland)*

MONDAY 24 JANUARY 2022

Video and Image Authentication

Session Chairs: Adnan Alattar, Digimarc Corporation (United States) and Nasir Memon, New York University (United States)
11:30 – 12:35

11:30
Conference Introduction

11:35 MWSF-323
A video auditing system for display-based voting machines, *Scott A. Craver and Gurinder Bal, Binghamton University (United States)*

11:55 MWSF-324
Forensic data model for artificial intelligence based media forensics - Illustrated on the example of DeepFake detection, *Dennis Siegel, Christian Krätzer, Stefan Kiltz, and Jana Dittmann, Otto-von-Guericke University Magdeburg (Germany)*

12:15 MWSF-325
Smartphone-supported integrity verification of printed documents, *Waldemar Berchtold, Dani El-Soufi, and Martin Steinebach, Fraunhofer Institute for Secure Information Technology (Germany)*

Image Forensics

Session Chair: Jennifer Newman, Iowa State University (United States)
13:00 – 14:00

13:00 MWSF-329
Enhancing PRNU-based image forensics with a non-parametric correlation predictor based on locally weighted regression, *Sujoy Chakraborty, Stockton University (United States)*

13:20 MWSF-330
Comparative study of DL-based methods performance for camera model identification with multiple databases, *Alexandre Berthet and Jean-Luc Dugelay, EURECOM (France)*

13:40 MWSF-331
NoiseSeg: An image splicing localization fusion CNN with noise extraction and error level analysis branches, *Karol Gotkowski, Huajian Liu, and Martin Steinebach, Fraunhofer Institute for Secure Information Technology (Germany)*

Watermarking and Steganography

Session Chair: Nasir Memon, New York University (United States)
18:00 – 19:00

18:00 MWSF-339
Image montage detection based on image segmentation and robust hashing techniques, *Martin Steinebach, Tiberius Berwanger, and Huajian Liu, Fraunhofer Institute for Secure Information Technology (Germany)*

18:20 MWSF-340
Image data hiding with multi-scale autoencoder network, *Chen-hsiu Huang, National Taiwan University (Taiwan)*

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)