



Computational Imaging XX

Conference Chairs

Charles A. Bouman, Purdue Univ. (United States)

Gregory T. Buzzard, Purdue Univ. (United States)

Robert Stevenson, Univ. of Notre Dame (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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Computational Imaging XX

Conference overview

Twenty years ago, when this conference first coined the term “Computational Imaging”, it was created as an interdisciplinary forum for researchers on how computation can be used to create images from data. Since then, Computational Imaging has grown enormously as an established discipline. Across diverse applications and fields, remarkably similar imaging problems appear, requiring sophisticated mathematical, statistical, and algorithmic tools. This conference focuses on imaging as a marriage of computation with physical devices. It emphasizes the interplay between mathematical theory, physical models, and computational algorithms that enable effective current and future imaging systems. Contributions to the conference are solicited on topics ranging from fundamental theoretical advances to detailed system-level implementations and case studies.

Special Sessions

This year Computational Imaging hosts six special sessions on Recent Advances in Scientific CT, Photon-limited Imaging Sensors and Algorithms, Computational Chemical Imaging, Topics in Coherent Sensing, Latent Fields in Additive Manufacturing: From Sensing to Reconstruction, and Autonomous Science, presented by researchers from academia, national laboratories, and industry.

Conference Chairs: Charles A. Bouman, Purdue University (United States); Gregory T. Buzzard, Purdue University (United States); and Robert Stevenson, University of Notre Dame (United States)

Program Committee: Clem Karl, Boston University (United States); Eric Miller, Tufts University (United States); Joseph A. O’Sullivan, Washington University in St. Louis (United States); Hector J. Santos-Villalobos, Oak Ridge National Laboratory (United States); and Ken D. Sauer, University of Notre Dame (United States)

Community Chair: Begum Gulsoy, Northwestern University (United States)

Photon-limited Imaging Sensors and Algorithms Organizing Chairs: Stanley Chan, Purdue University (United States); and Keigo Hirakawa, The University of Dayton (United States)

Recent Advances in Scientific CT Organizing Chairs: Doga Gursoy, Argonne National Laboratory (United States); K. Aditya Mohan, Lawrence Livermore National Laboratory (United States); and Singanallur V Venkatakrishnan, Oak Ridge National Laboratory (United States),

Computational Chemical Imaging Organizing Chairs: Ji-Xin Cheng, Boston University (United States); and Garth J. Simpson, Purdue University (United States),

Topics in Coherent Sensing Organizing Chair: Andre Van Rynbac, Air Force Research Laboratory, Sensors Directorate, Wright-Patterson Air Force Base (United States)

Latent Fields in Additive Manufacturing: From Sensing to Reconstruction Organizing Chairs: Jeff Simmons and Megna Shah, Air Force Research Laboratory, Wright-Patterson Air Force Base (United States); and Amir Ziabari, Oak Ridge National Laboratory (United States)

Autonomous Science Organizing Chairs: Doga Gursoy, Argonne National Laboratory (United States); and Benji Maruyama, Air Force Research Laboratory, Materials & Manufacturing Directorate, Wright-Patterson Air Force Base (United States)

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.

Computational Imaging XX

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 (IIS), serving as its first president. He is a Fellow of IEEE and OSA.

Topics in Coherent Sensing

Session Chair: Andre Van Rynbach, U.S. Air Force (United States)

11:40 – 12:45

11:40

Conference Introduction

11:45

Coherent sensing performance using photon-counting arrays (Invited) [Presentation-Only], Maureen E. Szymanski^{1,2}, Edward A. Watson^{2,3}, and David J. Rabb^{1,2}; ¹US Air Force Research Laboratory, ²University of Dayton, and ³Vista Applied Optics, LLC (United States) COIMG-102

12:00

Adaptive deep learning for coherent imaging in scattering media (Invited) [Presentation-Only], Lei Tian, Boston University (United States) COIMG-103

12:15

Quantum limits for coherent-field estimation (Invited) [Presentation-Only], Timothy J. Schulz¹ and David J. Brady²; ¹Michigan Technological University and ²The University of Arizona (United States) COIMG-104

12:30

Compressive single shot synthetic aperture imaging (Invited) [Presentation-Only], David J. Brady¹, Timothy J. Schulz², Chengyu Wang¹, and Minghao Hu¹; ¹The University of Arizona and ²Michigan Technological University (United States) COIMG-105

Topics in Coherent Sensing

Session Chair: Andre Van Rynbach, U.S. Air Force (United States)

13:10 – 14:10

13:10

3D phase and fluorescence microscopy with scattering samples (Invited) [Presentation-Only], Laura Waller, University of California, Berkeley (United States) COIMG-111

KEYNOTE: Computational imaging by phase retrieval: From astronomical speckle to x-ray coherent diffractive imaging [Presentation-Only], James R. Fienup, University of Rochester (United States)

Researchers used phase retrieval for reconstructing electron density functions of crystalline structures from scattered x-ray data (x-ray crystallography) for many decades. In the 1970's, algorithms were finally developed that worked for non-crystalline (non-periodic), general objects and were applied to astronomical imaging, overcoming the blurring effects of atmospheric turbulence, using data from Labeyrie's stellar speckle interferometry approach. In 1999, the algorithms developed for astronomy began to be used for reconstructing images of non-crystalline objects illuminated with coherent x-rays. As high-brightness, highly coherent x-ray sources were developed, the field of x-ray coherent diffractive imaging grew. The development of alternative data-collection approaches, ptychography in particular, allows for a very robust reconstruction of images of small objects on the nanometer scale. This presentation will describe the development of those phase retrieval algorithms.

James R. Fienup received an AB in physics and mathematics from Holy Cross College (Worcester, MA), and his MS and PhD (1975) in applied physics from Stanford University, where he was a National Science Foundation graduate fellow. He performed research for 27 years at the Environmental Research Institute of Michigan and Veridian Systems, where he was a senior scientist. He joined the faculty at the University of Rochester in 2002 as the Robert E. Hopkins Professor of Optics. Professor Fienup is a fellow of the Optical Society of America and of the International Society for Optical Engineering (SPIE), and is a senior member of IEEE. He was awarded the Rudolf Kingslake Medal and Prize for 1979 by the SPIE, the International Prize in Optics for 1983 by the International Commission for Optics, the Emmett N. Leith Medal by the Optical Society of America (OSA) for 2013 and became a member of the National Academy of Engineering in 2012. He was a distinguished visiting scientist at the Jet Propulsion Laboratory in 2009. He was editor-in-chief of the Journal of the Optical Society of America A, 1997-2003. He previously served as division editor of Applied Optics - Information Processing, and associate editor of Optics Letters. One of his papers [J.R. Fienup, "Phase Retrieval Algorithms: a Comparison," Appl. Opt. 21, 2758-2769 (1982)] has received more than 4,600 citations (Google Scholar) and is the most highly cited paper (out of over 50,000) in the journal Applied Optics.

Recent Advances in Scientific CT I

Session Chairs: Doga Gursoy, Argonne National Laboratory Advanced Photon Source (United States); K. Aditya Mohan, Lawrence Livermore National Laboratory (United States); and Singanallur Venkatakrishnan, Oak Ridge National Laboratory (United States)

18:00 – 19:00

18:00

COIMG-119

Weighted minimum norm algorithm for improved phase unwrapping, Tegan F. Lakshmanan¹, Kyle M. Champley², and K. Aditya Mohan²; ¹University of California, Berkeley and ²Lawrence Livermore National Lab (United States)

18:15

COIMG-120

Nondestructive characterization systems to defend the homeland, with emphasis on an x-ray CT system independent feature space (Invited) [Presentation-Only], Harry E. Martz, Steven M. Glenn, Kyle M. Champley, Isaac Seetho, Jeff Kallman, and K. Aditya Mohan, Lawrence Livermore National Laboratory (United States)

18:30

COIMG-122

Denosing advanced x-ray tomography data using deep learning without high-quality reference data (Invited) [Presentation-Only], Daniel Pelt, Leiden University (the Netherlands)

Recent Advances in Scientific CT II

Session Chairs: Doga Gursoy, Argonne National Laboratory Advanced Photon Source (United States); K. Aditya Mohan, Lawrence Livermore National Laboratory (United States); and Singanallur Venkatakrishnan, Oak Ridge National Laboratory (United States)

19:15 – 20:15

19:15

COIMG-127

Grazing-incidence diffraction tomography with synchrotron x-rays (Invited) [Presentation-Only], Esther Tsai, Masafumi Fukuto, and Ruipeng Li, Brookhaven National Laboratory (United States)

19:30

COIMG-128

Hyperspectral neutron CT with material decomposition (Invited) [Presentation-Only], Thilo Balke¹, Alexander M. Long¹, Sven C. Vogel¹, Brendt Wohlberg¹, and Charles A. Bouman²; ¹Los Alamos National Laboratory and ²Purdue University (United States)

19:45

COIMG-129

A metal artifact reduction scheme for accurate iterative dual-energy CT algorithms, Tao Ge¹, Maria Medrano¹, Rui Liao¹, Jeffrey F. Williamson¹, David Polite¹, Bruce R. Whiting², and Joseph A. O'Sullivan¹; ¹Washington University in St. Louis and ²University of Pittsburgh (United States)

20:00

COIMG-130

Non-paraxial multiple scattering model for multiplexed intensity diffraction tomography [Presentation-Only], Jiabei Zhu¹, Hao Wang¹, Alex Matlock², and Lei Tian¹; ¹Boston University and ²Massachusetts Institute of Technology (United States)

TUESDAY 18 JANUARY 2022

Photon-Limited Imaging I

Session Chairs: Stanley Chan, Purdue University (United States) and Keigo Hirakawa, University of Dayton (United States)

10:00 – 11:00

10:00

COIMG-135

Photon-starving and high-dynamic-range imaging with photon-counting quanta image sensors (Invited) [Presentation-Only], Jiaju Ma, Gigajot Technology (United States)

10:15

COIMG-136

Photon-limited object detection for CMOS cameras and quanta image sensors (Invited) [Presentation-Only], Stanley Chan¹, Chengxi Li¹, Xiangyu Qu¹, Abhiram Gnanasambandam¹, Omar Elgendy², and Jiaju Ma²; ¹Purdue University and ²Gigajot Technology (United States)

10:30

COIMG-137

High dynamic range single photon LiDAR (Invited) [Presentation-Only], Robert K. Henderson, University of Edinburgh (United Kingdom)

10:45

COIMG-138

Log-simplex denoising for color images (Invited) [Presentation-Only], Sarah Miller¹, Keigo Hirakawa¹, and Chen Zhang²; ¹University of Dayton and ²OmniVision Technologies, Inc. (United States)

Photon-Limited Imaging II

Session Chairs: Stanley Chan, Purdue University (United States) and Keigo Hirakawa, University of Dayton (United States)

11:30 – 12:30

11:30

COIMG-149

Computational imaging, one photon at a time (Invited) [Presentation-Only], Mohit Gupta, University of Wisconsin, Madison (United States)

11:45

COIMG-150

From a handful of photons (Invited) [Presentation-Only], Hamid Sheikh, Samsung Research America (United States)

12:00

COIMG-151

An improved image enhancement algorithm using a statistical model for pixel value error, Henry G. Dietz, University of Kentucky (United States)

12:15

COIMG-152

Blind estimation of noise level based on pixels values prediction, Mykola Ponomarenko¹, Oleksandr Miroshnichenko², Vladimir Lukin², and Karen Egiazarian¹; ¹Tampere University (Finland) and ²National Aerospace University (Ukraine)

Computational Chemical Imaging I

Session Chairs: Ji-Xin Cheng, Boston University (United States) and Garth Simpson, Purdue University (United States)

13:00 – 14:00

13:00

COIMG-163

Computational chemical imaging with deep UV microscopy [Presentation-Only], Francisco E. Robles, Georgia Tech and Emory University (United States)

13:15

COIMG-164

Advances in diagnostics with mid-IR photothermal spectroscopic imaging [Presentation-Only], Chalapathi Cajjela, Rupali Mankar, Ragib Ishrak, Sharmin Afrose, Xinyu Wu, Camille Artur, David Mayerich, and Rohith Reddy, University of Houston (United States)

13:30

COIMG-165

Computational label-free microscopy [Presentation-Only], Lei Tian, Boston University (United States)

Computational Chemical Imaging II

Session Chairs: Ji-Xin Cheng, Boston University (United States) and Garth Simpson, Purdue University (United States)

18:00 – 19:00

18:00 COIMG-175

Deep learning stimulated Raman scattering microscopy [Presentation-Only], Haonan Lin and Ji-Xin Cheng, Boston University (United States)

18:15 COIMG-176

Spectral super-resolution using device-informed machine learning [Presentation-Only], Yuhyun Ji, Sang Mok Park, Yunsang Kwak, and Young L. Kim, Purdue University (United States)

18:30 COIMG-177

Multi-agent consensus equilibrium (MACE) for improving chemical structure determination [Presentation-Only], Jiayue Rong, Garth Simpson, Gregory T. Buzzard, Lyudmila Slipchenko, and Charles A. Bouman, Purdue University (United States)

18:45 COIMG-178

Multi-agent consensus equilibrium (MACE) in molecular spectral analysis [Presentation-Only], Ziyi Cao, James Ulcickas, Charles A. Bouman, Lyudmila Slipchenko, Gregory T. Buzzard, and Garth Simpson, Purdue University (United States)

Methods in Computational Imaging I

Session Chairs: Charles Bouman, Purdue University (United States) and Gregory Buzzard, Purdue University (United States)

19:15 – 20:15

19:15 COIMG-179

Drone object detection using RGB/IR fusion, Lizhi Yang, Ruhang Ma, and Avideh Zakhori, University of California, Berkeley (United States)

19:30 COIMG-416

Visual vibration tomography: Estimating interior material properties from monocular video [Presentation-Only], Berthy Feng, Alexander Ogren, Chiara Darario, and Katherine L. Bouman, California Institute of Technology (United States)

19:45 COIMG-417

Deep radio interferometric imaging with POLISH: DSA-2000 and weak lensing [Presentation-Only], Liam Connor, Gregg W. Hallinan, Vikram Ravi, and Katherine L. Bouman, California Institute of Technology (United States)

20:00 COIMG-418

End-to-end sequential sampling and reconstruction for MR imaging [Presentation-Only], Zihui Wu¹, Tianwei Yin², He Sun¹, Adrian Dalca³, Yisong Yue¹, and Katherine L. Bouman¹; ¹California Institute of Technology, ²The University of Texas at Austin, and ³Harvard Medical School (United States)

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.

Computational Imaging XX Posters

11:20 – 12:20

Poster interactive session for all conferences authors and attendees.

COIMG-185

P-02: Improvement of aerial image by simulations, *Katsunari Ashimine¹, Munemitsu Abe¹, and Kazuhiro Wako²; ¹Alps Alpine Co., Ltd. and ²National Institute of Technology, Sendai College (Japan)*

Neural Networks for Computational Imaging I

Session Chairs: Charles Bouman, Purdue University (United States) and Gregory Buzzard, Purdue University (United States)

12:30 – 13:30

12:30

COIMG-217

Image denoising with control over deep network hallucination, *Qiyuan Liang, Florian Cassayre, Haley Owsianko, Majed El Helou, and Sabine Süssstrunk, École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)*

12:45

COIMG-218

FiveNet: Joint image demosaicing, denoising, deblurring, super-resolution, and clarity enhancement, *Mykola Ponomarenko¹, Vladimir Marchuk², and Karen Egiazarian¹; ¹Tampere University (Finland) and ²Don State Technical University (Russian Federation)*

13:00

COIMG-219

Transfer learning for no-reference image quality metrics using large temporary image sets, *Sheyda Ghanbaralizadeh Bahnemiri, Mykola Ponomarenko, and Karen Egiazarian, Tampere University (Finland)*

13:15

COIMG-220

Recognition aware learned image compression (Invited), *Maxime Kawawa-Beaudan, Ryan Roggenkemper, and Avidesh Zakhor, University of California, Berkeley (United States)*

Neural Networks for Computational Imaging II

Session Chairs: Charles Bouman, Purdue University (United States) and Gregory Buzzard, Purdue University (United States)

13:50 – 14:50

13:50

COIMG-226

Deep generative priors for imaging ptycho-tomography [Presentation-Only], *Selin Aslan¹, Viktor Nikitin², Zhengchun Liu², Tekin Bicer², Sven Leyffer², and Doga Gursoy²; ¹Virginia Tech and ²Argonne National Laboratory (United States)*

14:05

COIMG-227

Fully RNN for knee ligament tear classification and localization in MRI scans, *Kaiyue Zhu¹, Ying Chen¹, Xu Ouyang¹, Gregory White², and Gady Agam¹; ¹Illinois Institute of Technology and ²Rush Medical College (United States)*

14:20

COIMG-228

Correction filter for single image super-resolution: Robustifying off-the-shelf deep super-resolvers [Presentation-Only], *Shady Abu-Hussein, Tel Aviv University (Israel)*

14:35

COIMG-229

Multiresolution DECOLOR for camouflaged moving foreground detection using a redundant wavelet transform, *Zoe Fowler¹, James Fowler², and Agnieszka Miguel³; ¹Georgia Institute of Technology, ²Mississippi State University, and ³Seattle University (United States)*

Methods in Computational Imaging II

Session Chairs: Charles Bouman, Purdue University (United States) and Gregory Buzzard, Purdue University (United States)

18:00 – 19:00

18:00

COIMG-238

Structural biology by cryo-EM: From in vitro to in situ structures [Presentation-Only], *Wen Jiang, Purdue University (United States)*

18:15

COIMG-239

Chemically selective imaging by fluorescence-detected photothermal mid-infrared microscopy [Presentation-Only], *Aleksandr Razumtcev, Minghe Li, and Garth Simpson, Purdue University (United States)*

18:30 COIMG-240
A Good RAP: Converting between mismatched backprojector and modified prior model [Presentation-Only], Gregory T. Buzzard¹, Emma J. Reid², and Charles A. Bouman¹; ¹Purdue University and ²Oak Ridge National Laboratory (United States)

18:45 COIMG-241
Computational field sensor for aperture synthesis [Presentation-Only], Casey J. Pellizzari¹, Timothy Bate¹, David Strong², and Mark Spencer³; ¹United States Air Force Academy, ²Strong Inc., and ³Air Force Research Laboratory (United States)

Methods in Computational Imaging III

Session Chairs: Charles Bouman, Purdue University (United States) and Gregory Buzzard, Purdue University (United States)

19:15 – 20:15

19:15 COIMG-247
OldVSR: A model for the video super-resolution and restoration of old real-world TV series, Tony Nokap Park and Taeyoung Na, SK Telecom (Republic of Korea)

19:30 COIMG-248
Accurate measurement of charge density in nanoscale particles using an aperture optimization of Fourier based phase reconstruction, Takuma Okada, Yoshihiro Midoh, Koji Nakamae, and Noriyuki Miura, Osaka University (Japan)

19:45 COIMG-249
Jeweler: A Python module for searching binary sequences optimized for coded aperture [Presentation-Only], Daniel J. Ching, Argonne National Laboratory (United States)

20:00 COIMG-250
What is the cost of applying a constraint in least squares? [Presentation-Only], Ramakrishna Kakarala and Jun Wei, Omnivision Technologies (United States)

THURSDAY 20 JANUARY 2022

Autonomous Science

Session Chairs: Doga Gursoy, Argonne National Laboratory Advanced Photon Source (United States) and Benji Maruyama, Air Force Research Laboratory (United States)

13:00 – 14:00

13:00 COIMG-280
Physical discovery in automated scanning probe and electron microscopy (Invited) [Presentation-Only], Sergei V. Kalinin, Oak Ridge National Laboratory (United States)

13:15 COIMG-281
Domain-aware Gaussian processes and high-performance mathematical optimization for optimal autonomous data acquisition (Invited) [Presentation-Only], Marcus M. Noack, Lawrence Berkeley National Laboratory (United States)

13:30 COIMG-282
Active learning for jump regression estimation with applications to materials discovery [Presentation-Only], Chiwoo Park¹, Peihua Qiu¹, Jennifer Carpena-Nunez², Rahul Rao², Michael Susner², and Benji Maruyama²; ¹Florida State University and ²Air Force Research Laboratory (United States)

13:45 COIMG-283
Constrained matrix factorization enabling real-time insights of in situ and high-throughput experiments [Presentation-Only], Phillip M. Maffettone¹, Aidan C. Daly², and Daniel Olds¹; ¹Brookhaven National Laboratory and ²Flatiron Institute (United States)

Latent Fields in Additive Manufacturing: From Sensing to Reconstruction I

Session Chairs: Megna Shah, Air Force Research Laboratory (United States); Jeff Simmons, Air Force Research Laboratory (United States); and Amir Ziabari, Oak Ridge National Laboratory (United States)

18:00 – 19:00

18:00 COIMG-293
Opportunities and challenges in metallic additive manufacturing [Presentation-Only], Edwin J. Schwalbach, Air Force Research Laboratory (United States)

18:15

COIMG-294

Computer vision techniques for additive manufacturing quality control [Presentation-Only], Vincent Paquit, Luke Scieme, Michael Sprayberry, and James Haley, Oak Ridge National Laboratory (United States)

18:30

COIMG-295

Physics based compressive sensing for melt pool monitoring in laser powder bed fusion [Presentation-Only], Yanglong Lu and Yan Wang, Georgia Institute of Technology (United States)

18:45

COIMG-296

Challenges and progress in physical tomographic reconstruction of light doses for additive manufacturing [Presentation-Only], Vishal Bansal¹, Indrasen Bhattacharya¹, Kyle M. Champley², Erika Fong², Chi C. Li¹, Robert McLeod³, Charles Rackson³, Maxim Shusteff², Hayden Taylor¹, and Joseph Toombs¹; ¹University of California, Berkeley, ²Lawrence Livermore National Laboratory, and ³University of Colorado (United States)

Latent Fields in Additive Manufacturing: From Sensing to Reconstruction II

Session Chairs: Megna Shah, Air Force Research Laboratory (United States); Jeff Simmons, Air Force Research Laboratory (United States); and Amir Ziabari, Oak Ridge National Laboratory (United States)

19:15 – 20:15

19:15

COIMG-304

Linking processing to microstructure development under additive manufacturing conditions [Presentation-Only], Amy J. Clarke, Colorado School of Mines (United States)

19:30

COIMG-306

Inferring surface properties of oscillating fluids from video by inversion of physics models, Bob Price¹, Svyatoslav Korneev¹, Adrian Lew², Christoforos Somarakis¹, and Raja Bala³; ¹Palo Alto Research Center Incorporated, ²Stanford University, and ³Amazon (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, Imgeval 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 Imgeval 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)