IS&T International Symposium on

Electronic Imaging

SCIENCE AND TECHNOLOGY

28 January - 2 February 2018

Hyatt Regency San Francisco Airport
1333 Bayshore Highway
Burlingame, California USA

2018 Symposium Co-Chair

Joyce Farrell
Stanford University (USA)

2018 Symposium Co-Chair

Andrew Woods
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2018 Short Course Co-Chair

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2018 Short Course Co-Chair

Mohamed-Chaker Larabi
University of Poitiers (France)

2018 Short Course Co-Chair

Jonathan B. Phillips
Google, Inc. (USA)

Welcome

On behalf of IS&T—the Society for Imaging Science and Technology—we would like to welcome you to the 30th annual International Symposium on Electronic Imaging.

This week you have the opportunity to hear the latest research from the world's leading experts in image sensing, processing, display, and perception who innovate and collaborate on the design of imaging systems for consumer photography, autonomous driving, medical imaging, and the arts and entertainment.

We encourage you to create your own program for the week, using the Itinerary Planner available on the website. You can attend talks and poster presentations in any of the 18 different technical conferences, take short courses, visit the exhibits and demo sessions, and enjoy the Plenary Talks by leading researchers in Machine Learning, 3D Imaging, and Augmented Reality.

You can continue to learn more about the work presented at EI 2018 by accessing the EI Conference Proceedings, past and present, which are published open-access and available via www.electronicimaging.org and on the IS&T Digital Library (ist.publisher.ingentaconnect.com/content/ist/ei).

We hope that you will take advantage of the many special events and networking opportunities that may benefit your career and business, including the Conference Reception, Meet the Future: A Showcase of Student and Young Professional Research, the 3D Theatre, and the special Conference Banquets.

The Electronic Imaging Symposium is the premier international meeting in this exciting technological area, one that brings together academic and industry colleagues to discuss topics on the forefront of research and innovation. We look forward to seeing you and welcoming you to this unique event.

—Joyce Farrell and Andrew Woods, EI2018 Symposium Co-chairs

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January 13 – 17, 2019
Burlingame, CA

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Fengqing Maggie Zhu, Purdue Univ.

IS&T expresses its deep appreciation to the symposium chairs, conference chairs, program committee members, session chairs, and authors who generously give their time and expertise to enrich the Symposium. EI would not be possible without the dedicated contributions of our participants and members.

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Symposium Overview

Engage with advances in electronic imaging

Imaging is integral to the human experience and to exciting technology advances taking shape around us—from personal photographs taken every day with mobile devices to autonomous imaging algorithms in self-driving cars to the mixed reality technology that underlies new forms of entertainment. At EI 2018, leading researchers, developers, and entrepreneurs from around the world discuss, learn about, and share the latest imaging developments from industry and academia.

The 2018 event features 18 technical conferences covering all aspects of electronic imaging, including:

- 3D imaging and applications
- Astrophography
- Appearance rendering
- Augmented and virtual reality displays and processing
- Autonomous machine imaging algorithms
- Bioinformatics and 3D imaging
- Computational and digital photography
- Computational imaging for manufacturing
- Deep neural networks and computer vision
- Display and hardcopy
- Human vision, color, perception, and cognition
- Image and video processing and communication via the web
- Mobile imaging
- Image and video analytics
- Imaging sensors
- Image quality
- Immersive imaging
- Machine learning and machine vision
- Media security and forensics
- Spectral imaging and color
- Visualization and recognition

Research and applications of these technologies are discussed in the fields of communications, security, transportation, education, space exploration, medicine, entertainment, and more.

Technical courses taught by experts from academia and industry augment the symposium program of plenary, conference keynote, oral, and interactive (poster) presentations.

Technology demonstrations by industry and academia participants and a focused exhibition showcase the latest developments driving next generation electronic imaging products.

Symposium Event Sponsors

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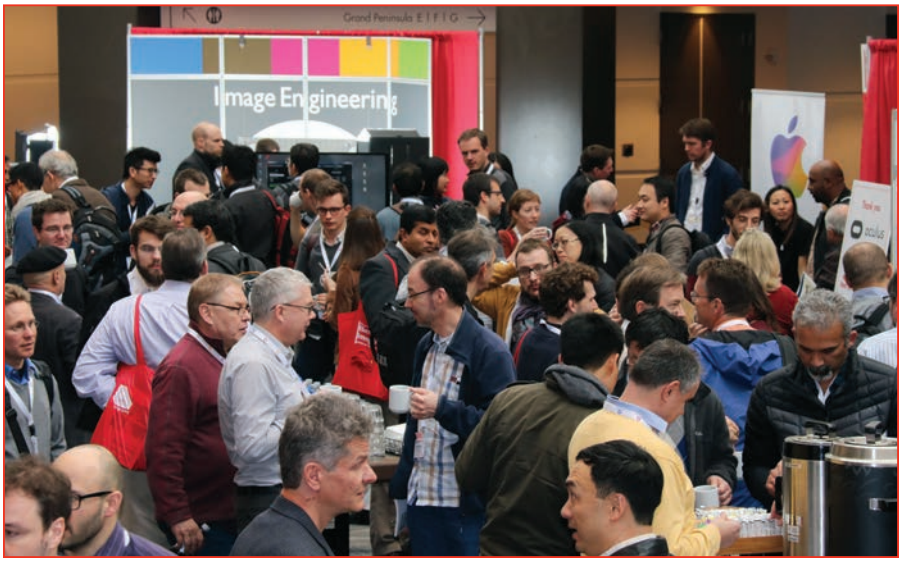

EI2018 Exhibitors

Exhibit Hours
Tuesday 10 AM – 7:30 PM
Wednesday 10 AM – 4 PM

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Plenary Speakers

Overview of Modern Machine Learning and Deep Neural Networks—Impact on Imaging and the Field of Computer Vision

Monday, January 29, 2018
2:00 — 3:00 PM
Grand Peninsula Ballroom D

Greg Corrado (Google Inc.)

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments

Tuesday, January 30, 2018
2:00 — 3:00 PM
Grand Peninsula Ballroom D

Avideh Zakhor (University of California, Berkeley)

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the Electrical Engineering and Computer Science Department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

Ubiquitous, Consumer AR Systems to Supplant Smartphones

Wednesday, January 31, 2018
2:00 —3:00 PM
Grand Peninsula Ballroom D

Ronald T. Azuma (Intel Corp.)

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

Special Events

Monday, January 29, 2018

All-Conference Welcome Reception

The Grove
5:00 – 6:00 pm

Join colleagues for a light reception featuring beer, wine, soft drinks, and hors d'oeuvres. Make plans to enjoy dinner with old and new friends at one of the many area restaurants. Conference registration badges are required for entrance.

SD&A Conference 3D Theatre

Grand Peninsula Ballroom D
6:00 – 7:30 pm
Hosted by the Stereoscopic Display and Applications (SD&A) Conference

The 3D Theatre Session of each year's Stereoscopic Displays and Applications Conference showcases the wide variety of 3D content that is being produced and exhibited around the world. All 3D footage screened in the 3D Theatre Session is shown in high-quality, polarized 3D on a large screen. The final program will be announced at the conference; 3D glasses are provided.

Tuesday, January 30, 2018

Women in Electronic Imaging Breakfast

Location provided at Registration Desk; advance registration required
7:15 – 8:45 am

Start your day meeting with female colleagues. Share stories. Make connections. This complimentary breakfast is open to EI full registrants with pre-registration. Space is limited. Visit the onsite registration desk for more information about this special event.

Industry Exhibition

Grand Peninsula Foyer
10:00 am – 7:30 pm

EI's annual industry exhibit provides a unique opportunity to meet company representatives working in areas related to electronic imaging. The exhibit highlights products and services, as well as offers the opportunity to meet prospective employers.

Symposium Demonstration Session

Grand Peninsula Ballroom E
5:30 – 7:30 pm

This symposium-wide, hands-on, interactive session – which traditionally has showcased the largest and most diverse collection of stereoscopic and electronic imaging research and products in one location – represents a unique networking opportunity. Attendees can see the latest research in action, compare commercial products, ask questions of knowledgeable demonstrators, and even make purchasing decisions about a range of electronic imaging products. The demonstration session hosts a vast collection of stereoscopic products providing a perfect opportunity to witness a wide array of stereoscopic displays with your own two eyes.

Wednesday, January 31, 2018

Industry Exhibition

Grand Peninsula Foyer
10:00 am – 4:00 pm

EI's annual industry exhibit continues on day two and provides a unique opportunity to meet company representatives working in areas related to electronic imaging. The exhibit highlights products and services, as well as offers the opportunity to meet prospective employers.

Interactive Paper (Poster) Session

The Grove
5:30 – 7:00 pm

Conference attendees are encouraged to attend the Interactive Paper (Poster) Session where Interactive Paper authors display their posters and are available to answer questions and have in-depth discussions about their work. Light refreshments are provided. Please note that conference registration badges are required for entrance.

Meet the Future: A Showcase of Student and Young Professionals Research

The Grove
5:30 – 7:00 pm

This 2nd annual event brings students and young professionals together with academic and industry representatives who may have opportunities to offer. Students and young professionals present and discuss their academic work via poster papers.

Friday, February 2, 2018

Stanford University Labs and Museums Tours

Via tour bus to Stanford University; advance registration and fee required
10:00 am – 3:00 pm

Stanford University Labs have graciously offered to open their facilities for tours to EI2018 participants. Participating labs are Stanford Computational Imaging Lab, HANA Immersive Visualization Environment (HIVE), Collaborative Haptics and Robotics in Medicine Lab, Virtual Human Interaction Lab, Stanford Center for Cognitive and Neurobiological Imaging Center. While on campus, also consider visiting Cantor Arts Center and the Anderson Collection. Sign up early, space is limited and available only to EI registrants.

EI 2018 Short Courses at a Glance (see Course Descriptions beginning on page 111)

Sunday January 28				
8:00-10:00	**EI01** Woods/Merritt - Stereoscopic Display Application Issues	**EI02** Rabbani - Advanced Image Enhancement and Deblurring	**EI03** Giduthuri/Pulli - Optimizing Computer Vision and Neural Network Applications Using OpenVX	**EI04** Agam - 3D Point Cloud Processing
10:15-12:15				
1:30-3:30		**CANCELLED** **EI08** Sharma - Introduction to Digital Color Imaging	**EI09** López-González - Using Cognitive and Behavioral Sciences and The Arts in Artificial Intelligence Research and Design	**EI10** Gray/Ptucha - Fundamentals of Deep Learning
3:45-5:45				
Monday January 29				
8:30-10:30	**EI13** Shlens/Toderici - Deep Learning for Image and Video Processing	**EI15** Marini - Digital Imaging and Astro Photography	**EI28** Matherson/Artmann - Camera Noice and its Characterization Using International Standards	
10:30-12:45				
3:15-5:15	**EI29** Hyttsteni- Introduction to Tensor Flow			
Wednesday January 31				
8:30-12:45	**EI17** Ikoma/Konrad/Molner/ Padmanaban - Build Your Own VR Display: An Introduction to VR Display Systems for Hobbyists and Educators			

Sunday January 28 continued					
8:00-10:00	**EI05** Rogowitz - Perception and Cognition for Imaging	**EI06** Ho - 3D Video Processing Techniques for Immersive Environments	**EI07** Cui - Digital Camera Image Quality Tuning	**EI19** Matherson/Artmann - Color Calibration in Mobile Imaging Devices	**EI20** Darmont - Introduction to CMOS Image Sensor Technology
10:15-12:15				**EI21** Matherson/ Artmann - Resolution in Mobile Imaging Devices: Concepts and Measurements	**EI22** Wyble - Fundamentals of Spectral Measurements for Color Science
1:30-3:30	**EI11** Hemami/Pappas - Perceptual Metrics for Image and Video Quality in a Broader Context: From Perceptual Transparency to Structural Equivalence	**EI12** Matherson/ Artmann - Optics and Hardware Calibration of Compact Camera Models	**EI23** Sampat/Viggiano - Practical Insights into Implementing a CINEMATIC VR Capture System	**EI24** Eliasson - Camera Image Quality Benchmarking	**EI25** Ferzli - Computer Vision for Autonomous Driving
3:45-5:45			**EI26** Burns/Williams - Introduction to Image Quality Testing: Targets, Software and Standards	**EI27** McCann/Rizzi - High-Dynamic-Range Theory and Technology	
Tuesday January 30					
8:30-12:45	**EI14** Agam - 3D Imaging	**EI16** Stork - Joint Design of Optics and Image Processing for Imaging Systems			
Thursday February 1					
8:30-12:45	**EI18** Sharma - Introduction to Probabilistic Models for Inference Estimation				

Conference Keynotes

Monday January 29, 2018

MWSF Keynote: Digital Watermarking from Inflated Expectation to Mainstream Adoption

Session Chair: Gaurav Sharma, University of Rochester (United States)

9:00 – 10:00 am
Cypress C

MWSF-113

Digital watermarking from inflated expectation to mainstream adoption, *Tony Rodriguez, Digimarc Corporation (United States)*

Tony Rodriguez has been an integral leader of innovation efforts at Digimarc since 1996 and currently serves as chief technology officer for Digimarc. He has 25 years' experience in computer science and image processing research and development. At Digimarc, he has held senior software engineering and research positions, focused on the development and application of digital watermarking and other content identification technologies. Before joining Digimarc, he worked at Intel Architecture Labs as a senior software engineer focused on video segmentation and streaming technologies. Rodriguez is a named inventor of numerous patents and the author of several published papers on the topic of Digital Watermarking and a chapter in the book, Multimedia Security Handbook, *published in 2005.*

MAAP Keynote: Appearance Issues in Cultural Heritage

Session Chairs: Mathieu Hebert, Université Jean Monnet de Saint Etienne (France) and Ingeborg Tastl, HP Labs, HP Inc. (United States)

10:40 – 11:20 am
Cypress A

MAAP-122

Material appearance issues: cultural heritage research, *Holly Rushmeier, Yale University (United States)*

Prof. Holly Rushmeier is a professor in the Yale Department of Computer Science. Her research interests include shape and appearance capture, applications of perception in computer graphics, modeling material appearance and developing computational tools for cultural heritage. Prof. Rushmeier received her BS, MS and PhD in Mechanical Engineering from Cornell University (1977, 1986 and 1988 respectively). Between receiving the BS and returning to graduate school in 1983 she worked as an engineer at the Boeing Commercial Airplane Company and at Washington Natural Gas Company (now a part of Puget Sound Energy). In 1988 she joined the mechanical engineering faculty at Georgia Tech. At the end of 1991, she joined the computing and mathematics staff of the National Institute of Standards and Technology, focusing on scientific data visualization. From 1996 to early 2004, Dr. Rushmeier was a research staff member at the IBM T.J. Watson Research Center. At IBM she worked on a variety of data visualization problems in applications ranging from engineering to finance. She also worked in the area of acquisition of data required for generating realistic computer graphics models, including a project to create a digital model of Michelangelo's Florence Pieta, and the development of a scanning system to capture shape and appearance data for presenting Egyptian cultural artifacts on the World Wide Web.

VIPC Keynote: Image and Video Compression

Session Chair: Zoe Liu, Google, Inc. (United States)

10:40 – 11:20 am
Sandpebble A

VIPC-123

Technical overview of AV1: An open source video codec from the Alliance for Open Media, *Yaowu Xu, Google Inc. (United States)*

Dr. Yaowu Xu is currently the tech lead manager of the video coding research team at Google. The team has been responsible for developing and defining VP9, the core video technology of the WebM project. Prior to joining Google, Dr. Xu was the vice president of codec development at On2 Technologies. He was the co-creator of On2's VPx series codecs including VP32, VP4, VP5, VP6, VP7 and VP8. These codecs were broadly adopted by the industry and have fueled the phenomenal growth of web video. Dr. Xu's education includes a BS in physics, an MS and a PhD in nuclear engineering from Tsinghua University at Beijing, China. He also holds an MS and a PhD in electrical and computer engineering from the University of Rochester. Dr. Xu has published many technical papers in the area of image processing on leading journals and international conferences. He also holds many patents and has numerous patent applications pending in the area of digital video compression. Dr. Xu's research and development experiences include digital video compression and processing, real time video encoding and decoding, mobile video, image processing, pattern recognition and machine learning. His current research focuses on advanced algorithms for digital video compression.

HVEI Keynote Session I: Human Vision Approaches to Image Quality for Images, Video and Stereo Applications

Session Chairs: Huib de Ridder, Delft University of Technology (Netherlands); Thrasyvoulos Pappas, Northwestern University (United States); and Bernice Rogowitz, Visual Perspectives (United States)

10:50 am – 12:10 pm
Grand Peninsula Ballroom A

HVEI-500

The field of view, the field of resolution, and the field of contrast sensitivity, *Andrew Watson, Apple Inc. (United States)*

Dr. Andrew Watson is a senior vision scientist at Apple, with expertise in psychophysics, neuropsychology, and applied psychology. Prior to joining Apple, Dr. Watson was the Senior Scientist for Vision Research at NASA Ames Research Center in California. He is the author of more than 100 papers and six patents on topics in vision science and imaging technology. Dr. Watson is Vice Chair for Vision Science and Human Factors of the International Committee on Display Measurement. In 2007 he received the Otto Schade Award from the Society for Information Display, and in 2008 the Special Recognition Award from the Association for Research in Vision and Ophthalmology. In 2011, he received the Presidential Rank Award from the President of the United States.

HVEI-501

Perceptual display: Apparent enhancement of scene detail and depth (Invited), *Karol Myszkowski, MPI Informatik (Germany)*

Prof. Karol Myszkowski is a senior researcher at the Max Planck Institut Informatik, Saarbruecken, Germany. In the period from 1986 till 1992 he worked for Integra, Inc. a Japan-based, company specialized in developing rendering and global illumination software. He received his PhD (1991) in computer science from Warsaw University of Technology (Poland). In 2011 he was awarded with a lifetime professor title by the President of Poland. His research interests include global illumination and rendering, perception issues in graphics, high dynamic range imaging, and stereo 3D. He co-authored the book High Dynamic Range Imaging, *and participated in various committees and editorial boards. He also co-chaired Rendering Symposium in 2001, ACM Symposium on Applied Perception in Graphics and Visualization in 2008, Spring Conference on Computer Graphics 2008, and Graphicon 2012.*

HVEI Keynote Session II: Human Behavior in Real-World Environments

Session Chairs: Huib de Ridder, Delft University of Technology (Netherlands); Thrasyvoulos Pappas, Northwestern University (United States); and Bernice Rogowitz, Visual Perspectives (United States)

3:20 – 4:40 pm
Grand Peninsula Ballroom A

HVEI-502

Lighting perceptual intelligence, *Sylvia Pont, Delft University of Technology (Netherlands)*

Prof. Sylvia Pont was appointed Antoni van Leeuwenhoek professor in 2016. She has worked at the faculty of Industrial Design Engineering at TU Delft since 2008. In the light and vision labs, within the Perceptual Intelligence Lab, her group works on studies in design, perception, optics and rendering of light and its interactions with material, shape and space. From September 1999 to 2008 she worked in the Physics of Man group of the department of physics and astronomy of Utrecht University. Her postdoctoral research into 'ecological optics' included studies into reflectance, texture, and light fields. January 2004 she got an appointment as an assistant professor and started her project entitled 'Ecological Plenoptics of Natural Scenes', for which she was granted a 'VIDI Vernieuwingsimpuls' by the Netherlands Organisation for Scientific Research (NWO). This project concerned studies into the description of the appearance of natural materials and natural light fields.

HVEI-503

Applying insights from visual perception and cognition to the development of more effective virtual reality experiences, *Victoria Interrante, University of Minnesota (United States)*

Prof. Victoria Interrante's research focuses on applying insights from visual perception and cognition to the development of more effective virtual reality experiences and the more effective communication of complex information through visual imagery. In this work, she enjoys collaborating with colleagues in a wide variety of fields, from architectural design and neuropsychology to engineering and medicine. Prof. Interrante is a recipient of the 1999 Presidential Early Career Award for Scientists and Engineers, "the highest honor bestowed by the U.S. government on outstanding scientists and engineers beginning their independent careers", and a 2001-2003 McKnight Land-Grant Professorship from the University of Minnesota. At the University of Minnesota, Prof. Interrante is currently serving as the director of the Center for Cognitive Sciences and as a member of the graduate faculty of the Program in Human Factors. In recent years, she has also served as chair of the technical track on Graphics, Animation and Gaming at the 2015 Grace Hopper Celebration of Women in Computing.

SD&A Keynote 1

3:30 – 4:30 pm
Grand Peninsula Ballroom D

SD&A-388

What use is 'time-expired' disparity and optic flow information to a moving observer?, *Andrew Glennerster, University of Reading (United Kingdom)*

Prof. Andrew Glennerster studied medicine at Cambridge before working briefly with Michael Morgan at UCL then doing a DPhil and an EU-funded postdoc with Brian Rogers on binocular stereopsis (1989 – 1994). He held an MRC Career Development Award (1994 – 1998) with Andrew Parker in Physiology at Oxford including a year with Suzanne McKee in Smith-Kettlewel, San Francisco. He continued work with Andrew Parker on a Royal Society University Research Fellowship (1999 – 2007) which allowed him to set up a virtual reality laboratory to study 3D perception in moving observer, funded for 12 years by the Wellcome Trust. He moved to Psychology in Reading in 2005, first as a Reader and now as a Professor, where the lab is now funded by EPSRC.

Tuesday January 30, 2018

MAAP Keynote: Appearance Assessment

Session Chair: Ingeborg Tastl, HP Labs, HP Inc. (United States)

8:50 – 9:30 am
Cypress A

MAAP-184

Digital appearance assessment methods and challenges, *Marc Ellens, X-Rite, Inc. (United States)*

Dr. Marc S. Ellens is a senior research scientist with X-Rite in Grand Rapids, MI. He received his PhD in computer aided geometric design from the University of Utah. Employed at X-Rite for 13 years, he has been involved in research and development efforts toward the capture and reproduction of appearance. Dr. Ellens has presented at numerous conferences including the Nvidia GPU Technology conference, Autodesk's Automotive Innovation Forums, AATCC LED Lighting Conference, and SPIE Color Image Conference and Materials Conference. He is named in three patents related to material visualization and reproduction and has been a member of ACM SIGGRAPH for more than 15 years.

MWSF Keynote: Content Protection, Beyond Conditional Access and Digital Rights

9:00 – 10:00 am
Cypress C

MWSF-197

Content protection: Beyond conditional access and digital rights management, *Mehmet Celik, NexGuard Labs (Netherlands)*

Dr. Mehmet Celik is a principle scientist and the director of research at NexGuard Labs in Kudelski Group. After receiving his PhD from University of Rochester (2004), he joined Philips Research. He was part of the Content-Identification group which spun-off as Civolution in 2008. He led the research

team at Civolution, where he helped develop renowned solutions based on watermarking and fingerprinting algorithms. Audience measurement solution based on audio watermarking was acquired by Kantar Media in 2014 and is now deployed in various countries. Broadcast monitoring and TV analytics solution based on video watermarking and audio/video fingerprinting was acquired by 4C-Insights in 2015 and is now tracking over 2100 channels in 76 countries. Forensic tracking solutions based on audio/video watermarking was acquired by Kudelski Group in 2016 and is now used by all major studios and deployed on over 100,000 movie screens. These solutions have been recognized by the National Academy of Television Arts & Sciences with Technology & Engineering Emmy® Awards in 2016 and 2018. Dr. Celik is now focusing on challenges around forensic tracking of live sports & premium content when distributed via broadcast or over-the-top.

AVM Keynote: Future with Autonomous Vehicles

Session Chair: Buyue Zhang, Intel Corporation (United States)

9:10 – 10:10 am
Grand Peninsula Ballroom B-C

AVM-198

Lyft's approach to autonomous vehicles, *Luc Vincent, Lyft, Inc. (United States)*

Dr. Luc Vincent is vice president of engineering at Lyft, where he leads the company's Marketplace & Autonomous Platform division. His responsibilities include real-time supply and demand matching, real-time pricing, mapping, and also Lyft's "Level 5" group, focused on Self-Driving Technology. Prior to Lyft, he spent 12 years at Google, most recently as Sr Director of Engineering, leading all imagery-related activities of Google's Geo group. His team of engineers, product managers, program managers, and operations experts was responsible for collecting ground-based, aerial, and satellite imagery at global scale and through computer vision, 3D modeling, and deep learning, make it universally accessible and useful to users around the world - from end-users on a mobile phone to geo scientists researching climate change. Dr. Vincent is recognized in particular for having bootstrapped Street View and turned it into an iconic Google product, available in over 80 countries around the globe. He earned his BS from Ecole Polytechnique (France), MS in computer science from University of Paris XI, and PhD in mathematical morphology from Ecole des Mines de Paris. In addition, he was a postdoctoral fellow in the Division of Applied Sciences of Harvard University.

IQSP/PMII Keynote: Imaging System Performance JOINT SESSION

Session Chair: Elaine Jin, NVIDIA Corporation (United States)

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

9:30 – 10:10 am
Regency A-B

IQSP-208

Experiencing mixed reality using the Microsoft HoloLens, *Kevin Matherson, Microsoft Corporation (United States)*

Dr. Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

AVM Keynote: Mapping and Localization

Session Chair: Buyue Zhang, Intel Corporation (United States)

10:40 – 11:40 am
Grand Peninsula Ballroom B-C

AVM-216

Scalable autonomous vehicle mapping and localization on the edge, *Sravan Puttagunta, Civil Maps (United States)*

Sravan Puttagunta is a co-founder and chief executive officer of Civil Maps, an autonomous vehicle technology company that enables cars to have Cognition through AI, 3D mapping, advanced localization, and crowdsourcing. As CEO, he is executing on a vision for safer, smarter, fully autonomous driving. With his direction, Civil Maps is on track to triple revenue from last year and is providing key technology to several major automakers. He leads the company's technology teams, who are developing innovative ways for cars to localize in six dimensions (6D) and crowdsource 3D maps at a continental scale. In his previous work, he invented video fingerprinting for linear broadcast TV to track viewing habits and developed software that runs in more than 160 million TVs. He has written substantial portions of artificial intelligence (AI) algorithms for cars which map the world in 3D. Puttagunta holds a master's degree in electrical engineering and computer science from the University of California, Berkeley.

VIPC Keynote: Image and Video Analytics

Session Chair: Grigorios Tsagkatakis, Foundation for Research and Technology (FORTH) (Greece)

10:40 – 11:20 am
Sandpebble A

VIPC-215

Perceptual optimization in video coding - a systematic approach, *Ioannis Katsavounidis, Netflix (United States)*

Dr. Ioannis Katsavounidis received the Diploma (BS/MS) from the Aristotle University of Thessaloniki, Greece, (1991) and his MS and PhD from the University of Southern California, Los Angeles, (1992 and 1998 respectively), all in electrical engineering. From 1996 to 2000, he worked in Italy as an engineer for the high-energy physics department of the California Institute of Technology. From 2000 to 2007, he worked at InterVideo, Inc., in Fremont, CA, as director of software for advanced technologies, in charge of MPEG2, MPEG4 and H.264 video codec development. Between 2007 and 2008, he served as CTO of Cidana, a mobile multimedia software company in Shanghai, China, covering all aspects of DTV standards and codecs. From 2008 to 2015 he was an associate professor with the department of electrical and computer engineering at the University of Thessaly in Volos, Greece, teaching undergraduate and graduate courses in signals, controls, image processing, video compression, and information theory. He is currently a senior research scientist at Netflix, working on video quality and video codec optimization problems. His research interests include image and video quality, compression and processing, information theory, and software-hardware optimization of multimedia applications.

MAAP Keynote: Appearance Rendering

Session Chair: Lionel Simonot, Institut Pprime (France)

10:50 – 11:30 am
Cypress A

MAAP-226

Simulating the appearance of materials, *Henrik Jensen, University of California, San Diego (United States)*

Prof. Henrik Wann Jensen is a professor at the University of California at San Diego, where he works in the computer graphics lab. His research is focused on realistic image synthesis, global illumination, rendering of natural phenomena, and appearance modeling. His contributions to computer graphics include the photon mapping algorithm for global illumination, and the first technique for efficiently simulating subsurface scattering in translucent materials. He is the author of Realistic Image Synthesis using Photon Mapping, *AK Peters 2001. He has rendered images that have appeared on the front covers of the National Geographic Magazine and the SIGGRAPH proceedings. He previously worked at Stanford University, Massachusetts Institute of Technology (MIT), Weta, Pixar, and at mental images. He received his MSc and PhD in computer science from the Technical University of Denmark. He is the recipient of an Academy Award (Technical Achievement Award) from the Academy of Motion Picture Arts and Sciences for pioneering research in rendering translucent materials. He also received a Sloan Fellowship, and was selected as one of the top 10 scientists by Popular Science magazine.*

COLOR/IQSP Keynote: Imaging and Astronomy JOINT SESSION

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Kurt Niel, University of Applied Sciences Upper Austria (Austria)

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

3:30 – 4:30 pm
Cypress B

COLOR-259

Computer vision and deep learning applied to simulations and imaging of galaxies and the evolving universe, *Joel Primack, University of California, Santa Cruz (United States)*

The keynote speaker is Dr. Joel R. Primack, Distinguished Professor of Physics Emeritus, University of California, Santa Cruz. Dr. Primack specializes in the formation and evolution of galaxies and the nature of the dark matter that makes up most of the matter in the universe. After helping to create what is now called the "Standard Model" of particle physics, Dr. Primack began working in cosmology in the late 1970s, and he became a leader in the new field of particle astrophysics. His 1982 paper proposed that a natural candidate for the dark matter is the lightest supersymmetric particle, still perhaps the leading candidate. He is one of the principal originators and developers of the theory of Cold Dark Matter, which has become the basis for the standard modern picture of structure formation in the universe. With support from NASA, NSF, and DOE, he has been using supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies under various assumptions, and comparing the predictions of these theories to the latest observational data. He organized and led the University of California systemwide Center for High-Performance AstroComputing, 2010-2015. Dr. Primack was one of the main advisors for the Smithsonian Air and Space Museum's 1996 IMAX film Cosmic Voyage, and he has worked with leading planetariums to help make the invisible universe visible.

MWSF Panel: Deep Learning, Shallow Understanding?

Panelists: Matt Cragun, Nvidia Corporation; Edward Delp, Purdue University; Jessica Fridrich, SUNY Binghamton; and Jonathon Shlens, Google Inc. (United States)

Panel Moderator: Nasir Memon, New York University (United States)

3:30 – 5:00 pm
Cypress C

Matt Cragun is a Solutions Architect at Nvidia helping customers understand and implement Deep Learning. Prior to Nvidia, he has spent time at Boeing working with robotics in manufacturing and TotalSim using HPC in automotive design. He holds a Masters in mechanical engineering and an MBA from MIT.

Edward J. Delp was born in Cincinnati, Ohio. He received the BSEE (cum laude) and MS from the University of Cincinnati, and the PhD from Purdue University. In May 2002 he received an Honorary Doctor of Technology from the Tampere University of Technology in Tampere, Finland. He is currently The Charles William Harrison Distinguished Professor of electrical and computer engineering and professor of biomedical engineering and professor of psychological sciences (Courtesy). His research interests include image and video processing, image analysis, computer vision, image and video compression, multimedia security, medical imaging, multimedia systems, communication and information theory.

Jessica Fridrich is professor of electrical and computer engineering at Binghamton University. She received her PhD in systems science from Binghamton University (1995) and MS in applied mathematics from Czech Technical University in Prague (1987). Her main interests are in steganography, steganalysis, and digital image forensics. For the past two years, she has been actively involved in applying deep learning for building detectors of information hidden in digital images and for forensic detection and classification of their processing history. Since 1995, she has received 20 research grants totaling over $11 mil that lead to more than 180 papers and 7 US patents.

Jonathon Shlens received his PhD in computational neuroscience from UC San Diego (2007) where his research focused on applying machine learning towards understanding visual processing in real biological systems. He has been at Google Research and Google Brain since 2010 and is currently a staff research scientist focused on building scalable vision systems. He was previously a research fellow at the Howard Hughes Medical Institute, a research engineer at Pixar Animation Studios, and a Miller Fellow at UC Berkeley. During his time at Google, he was an inventor and core contributor to the TensorFlow machine learning platform. His research interests have spanned the development of state-of-the-art computer vision systems, training algorithms for deep networks, generative models of images and methods in computational neuroscience.

Wednesday January 31, 2018

PMII Keynote: Mobile HDR Imaging

Session Chairs: Zhen He, Intel Corporation (United States) and Jiangtao Kuang, Qualcomm Technologies, Inc. (United States)

8:50 – 9:30 am
Regency A-B

PMII-291

Extreme imaging using cell phones, *Marc Levoy, Google Inc. (United States)*

Dr. Marc Levoy is a computer graphics researcher and Professor Emeritus of computer science and electrical engineering at Stanford University and

a principal engineer at Google. He is noted for pioneering work in volume rendering, light fields, and computational photography. Dr. Levoy first studied computer graphics as an architecture student under Donald P. Greenberg at Cornell University. He received his BArch (1976) and MS in Architecture (1978). He developed a 2D computer animation system as part of his studies, receiving the Charles Goodwin Sands Memorial Medal for this work. Greenberg and he suggested to Disney that they use computer graphics in producing animated films, but the idea was rejected by several of the Nine Old Men who were still active. Following this, they were able to convince Hanna-Barbera Productions to use their system for television animation. Despite initial opposition by animators, the system was successful in reducing labor costs and helping to save the company, and was used until 1996. Dr. Levoy worked as director of the Hanna-Barbera Animation Laboratory from 1980 to 1983. He then did graduate study in computer science under Henry Fuchs at the University of North Carolina at Chapel Hill, and received his PhD (1989). While there, he published several important papers in the field of volume rendering, developing new algorithms (such as volume ray tracing), improving efficiency, and demonstrating applications of the technique. He joined the faculty of Stanford's Computer Science Department in 1990. In 1991, he received the National Science Foundation's Presidential Young Investigator Award. In 1994, he co-created the Stanford Bunny, which has become an icon of computer graphics. He took a leave of absence from Stanford in 2011 to work at GoogleX as part of Project Glass. In 2014 he retired from Stanford to become full-time at Google, where he currently leads a team in Google Research that works broadly on cameras and photography. One of his projects is HDR+ mode for the Nexus and Google Pixel smartphones. In 2016 the French agency DxO gave the Pixel the highest rating ever given to a smartphone camera. See more https://en.wikipedia.org/wiki/Marc_Levoy .

VDA Keynote: Purpose-designed Visualization

8:50 – 9:40 am
Sandpebble A

VDA-294

Audience-targeted exploratory and explanatory visualization designs, *Kwan-Liu Ma, Institution: University of California, Davis (United States)*

Prof. Kwan-Liu Ma is a professor of computer science and the chair of the Graduate Group in Computer Science (GGCS) at the University of California-Davis, where he directs VIDI Labs and UC Davis Center of Excellence for Visualization. His research spans the fields of visualization, computer graphics, high-performance computing, and user interface design. Prof. Ma received his PhD in computer science from the University of Utah (1993). During 1993-1999, he was with ICASE/NASA Langley Research Center as a research scientist. He joined UC Davis in 1999. Prof. Ma is presently leading a team of over 25 researchers pursuing research in scientific visualization, information visualization, visual analytics, visualization for storytelling, visualization interface design, and immersive visualization. For his significant research accomplishments, Prof. Ma received the NSF Presidential Early-Career Research Award (PECASE) in 2000, was elected an IEEE Fellow in 2012, and received the 2013 IEEE VGTC Visualization Technical Achievement Award. Professor Ma actively serves the research community by playing leading roles in several professional activities including VizSec, Ultravis, EGPGV, IEEE VIS, IEEE PacificVis, and IEEE LDAV. He has served as a papers co-chair for SciVis, InfoVis, EuroVis, PacificVis, and Graph Drawing.

MWSF Keynote: DARPA MediFor Progress and Challenges

Session Chair: Adnan Alattar, Digimarc Corporation (United States)

9:00 – 10:00 am
Cypress C

MWSF-309

Scaling media forensics, *David Doermann, DARPA (United States)*

Dr. David Doermann joined DARPA in April 2014. His areas of technical interest span language and media processing and exploitation, vision and mobile technologies. He comes to DARPA with a vision of increasing capabilities through joint vision/language interaction for triage and forensics applications. Dr. Doermann holds a Doctor of Philosophy in computer science and a Master of Science in computer science from the University of Maryland, College Park. He has authored more than 250 peer-reviewed journal and conference papers and book chapters and is the co-editor of the Handbook of Document Image Processing and Recognition. *In 2014, Dr. Doermann was elected a Fellow of the IEEE for contributions to research and development of automatic analysis and processing of document page imagery.*

IMAWM Keynote: Deep Learning for Recognition and Detection I

Session Chair: Qian Lin, HP Labs, HP Inc. (United States)

9:10 – 10:10 am
Harbour A-B

IMAWM-310

How does building a low cost vision sensor teach us about deep learning?, *Tianli Yu, Morpx Inc (United States)*

Dr. Tianli Yu is the CEO and co-founder of Morpx Inc., a startup based in Hangzhou that delivers innovative computer vision hardware and software. He received his PhD in ECE from the University of Illinois at Urbana Champaign (2006). After graduation, he's been a senior computer vision researcher in Motorola Labs working on the embedded stereo depth camera for Motorola's phones. Later, Dr. Yu joined like.com and designed algorithms to assist shoppers in finding their personal styles. Like.com was eventually acquired by Google in 2010. After working for a few years in the design of large scale visual search and recognition algorithms for Google Shopping, Dr. Yu founded Morpx with his friend Frank Ran in late 2013. Morpx is the second time in his career that he is working to build an ultra-compact and super energy efficient computer vision system.

SD&A Keynote 2

Session Chair: Nicolas Holliman, University of Newcastle (United Kingdom)

9:10 – 10:10 am
Grand Peninsula Ballroom D

SD&A-474

Over fifty years of working with stereoscopic 3D systems - Anecdotes, insights, and advice illustrated by many examples of stereoscopic imagery, both good and bad, *John Merritt, The Merritt Group USA*

Senior Consulting Scientist John O. Merritt is an internationally recognized expert in the operational use of stereoscopic 3D displays and the application of research and development in sensory and perceptual science to remote-presence systems. He brings over 30 years of experience and extensive practical and theoretical knowledge of spatial perception and stereoscopic video applications to every project. Merritt's early work in overhead reconnaissance as a Naval Air Intelligence Officer, combined with his years of experience as a 3D-display

design consultant, make him uniquely qualified to assess the strengths and weaknesses of advanced 3D imaging systems. Merritt has extensive experience comparing task performance in 3D vs. 2D evaluation studies. Since completing his graduate work in sensory and perceptual psychology at Harvard University, he has provided vision research and human factors engineering consulting services to a broad range of industrial and government clients. As a senior research scientist at Perceptronics in Woodland Hills, CA, he headed a number of R&D projects related to vision and visual-simulator displays.

IMSE Keynote: Color and Spectral Imaging

Session Chair: Ralf Widenhorn, Portland State University (United States)

9:40 – 10:20 am
Cypress A

IMSE-313

Quantum efficiency and color, *Jörg Kunze, Basler AG (Germany)*

Dr. Jörg Kunze received his PhD in Physics from the University of Hamburg (2004). He joined Basler in 1998, where he started as an electronics developer and where he currently is the team leader of New Technology. Dr. Kunze serves as an expert for image sensors, camera hardware, noise, color fidelity, 3D- and computational imaging and he develops new algorithms for color image signal processing. The majority of the Basler patents name him as inventor.

ERVR/PMII/SDA Keynote: Immersive Imaging Joint Session

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

10:40 – 11:20 am
Grand Peninsula Ballroom D

PMII-320

Real-time capture of people and environments for immersive computing, *Shahram Izadi, PerceptiveIO, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

IMSE Keynote I: Technology and Design for High Performance Imaging

Session Chair: Arnaud Darmont, APHESA SPRL (Belgium)

11:50 am – 12:30 pm
Cypress A

IMSE-354

Dark current limiting mechanisms in CMOS image sensors, *Dan McGrath, BAE Systems (United States)*

Dr. Dan McGrath is Sr. Principal II Semiconductor Engineer at BAE Systems. Dr. McGrath has worked for 38 years specializing in the device physics of silicon-based pixels, CCD and CIS, and in the integration of image-sensor process enhancements in the manufacturing flow. He chose his first job because it offered that "studying defects in image sensors means doing physics" and has kept this passion front-and-center in his work. He has pursued this work at Texas Instruments, Polaroid, Atmel, Eastman Kodak, Aptina, and BAE Systems and has worked with manufacturing facilities in France, Italy, Taiwan, and the United States. His publications include the first megapixel CCD and the basis for dark current spectroscopy (DCS). He received his PhD from The Johns Hopkins University.

IMSE Keynote II: Technology and Design for High Performance Imaging

Session Chair: Arnaud Peizerat, CEA (France)

3:30 – 4:10 pm
Cypress A

IMSE-360

Sub-electron low-noise CMOS image sensors, *Angel Rodríguez-Vázquez, Universidad de Sevilla (Spain)*

Prof. Ángel Rodriguez-Vazquez (IEEE Fellow, 1999) conducts research on the design of analog and mixed-signal front-ends for sensing and communication, including smart imagers, vision chips and low-power sensory-processing microsystems. He received his Bachelor's (University of Seville, 1976) and PhD in physics-electronics (University of Seville, 1982) with several national and international awards, including the IEEE Rogelio Segovia Torres Award (1981). After research stays at UC Berkeley and Texas A&M University, he became a Full Professor of Electronics at the University of Sevilla in 1995. He co-founded the Institute of Microelectronics of Sevilla, under the umbrella of the Spanish Council Research (CSIC) and the University of Sevilla and started a research group on Analog and Mixed-Signal Circuits for Sensors and Communications. In 2001 he was the main promotor and co-founder of the start-up company AnaFocus Ltd. and served as CEO, on leave from the University, until June 2009, when the company reached maturity as a worldwide provider of smart CMOS imagers and vision systems-on-chip. He has authored 11 books, 36 additional book chapters, and some 150 journal articles in peer-review specialized publications. He was elected Fellow of the IEEE for his contributions to the design of chaos-based communication chips and neuro-fuzzy chips. His research work has received some 6,954 citations; he has an h-index of 42 and an i10-index of 143.

Thursday February 1, 2018

AVM/IMSE/PMII Keynote: Imaging Sensors and Technologies for Automotive Intelligence Joint Session

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Joyce Farrell, Stanford University (United States); and Darnell Moore, Texas Instruments (United States)

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

8:50 – 9:30 am

Grand Peninsula Ballroom B-C

PMII-415

Advances in automotive image sensors, *Boyd Fowler[1] and Johannes Solhusvik[2]; [1]OmniVision Technologies (United States) and [2]OmniVision Technologies Europe Design Center (Norway)*

Dr. Boyd Fowler joined OmniVision in December 2015 as the vice president of marketing and was appointed chief technology officer in July 2017. Dr. Fowl-

er's research interests include CMOS image sensors, low noise image sensors, noise analysis, data compression, and machine learning and vision. Prior to joining OmniVision, he was co-founder and vice president of engineering at Pixel Devices, where he focused on developing high-performance CMOS image sensors. After Pixel Devices was acquired by Agilent Technologies, Dr. Fowler was responsible for advanced development of commercial CMOS image sensor products. In 2003, Dr. Fowler joined Fairchild Imaging as the CTO and vice president of technology, where he developed SCMOS image sensors for high-performance scientific applications. After Fairchild Imaging was acquired by BAE Systems, Dr. Fowler was appointed the technology director of the CCD/CMOS image sensor business. He has authored numerous technical papers, book chapters, and patents. Dr. Fowler received his MSEE and PhD in electrical engineering from Stanford University (1990 and 1995 respectively).

ERVR Keynote: Dr. Jason Leigh

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

9:00 – 10:10 am
Cypress C

ERVR-475

Surfing the wave of virtual reality and my cybercanoe, *Jason Leigh, University of Hawaii Manoa USA*

Dr. Jason Leigh is the director at the Laboratory for Advanced Visualization and Applications (LAVA), University of Hawai'i at Mānoa; and director emeritus of the Electronic Visualization Lab, University of Illinois at Chicago. He is a Fellow of the Institute for Health Research and Policy, and he has held research appointments at Argonne National Laboratory, and the National Center for Supercomputing Applications. Prof. Leigh's research expertise includes: Big data visualization; virtual reality; high performance networking; and video game design. He is co-inventor of the CAVE2 Hybrid Reality Environment, and SAGE: Scalable Adaptive Graphics Environment software, which has been licensed to Mechdyne Corporation & Vadiza Corporation, respectively. In 2010 he initiated a new multi-disciplinary area of research called Human Augmentics - which refers to the study of technologies for expanding the capabilities and characteristics of humans. Leigh teaches classes in software design and he has been teaching video game design for over 10 years. In 2010, his video game design class enabled the University of Illinois at Chicago to be ranked among the top 50 video game programs in the US and Canada.

IMSE Keynote: Novel Vision Techniques and Applications

Session Chair: Nick Bulitka, Lumenera Corp (Canada)

10:50 – 11:30 am
Cypress A

IMSE-438

Security imaging in an unsecure world, *Anders Johannesson, Axis Communications AB (Sweden)*

Dr. Anders Johannesson is a senior expert engineer at Axis Communications AB in Lund, Sweden. He received his BS degree in physics (1987), and his PhD (1992); both from Lund University, Sweden. His thesis work involved imaging polarimetry and spectroscopy of features in the solar atmosphere. This work was continued at Caltech, (United States). He has also been involved in development within industrial and consumer imaging at a number of companies in Europe including Dialog Semiconductor. He joined Axis Communications in 2006 and is part of the core technology team for surveillance and security imaging. His focus is on the image sensor.

HVEI Keynote: Visual Representation in Art, Imaging and Visualization with Tim Jenison of Tim's Vermeer Fame

Session Chair: Claus-Christian Carbon, University of Bamberg (Germany)

2:00 – 2:40 pm
Grand Peninsula Ballroom A

HVEI-538

Capturing reality, *Tim Jenison, NewTek, Inc. (United States)*

Tim Jenison founded Texas-based computer software and hardware producer NewTek, specializing in tools for the gathering and editing of desktop video media. Following the formation of the company in Topeka, Kansas, alongside the late Paul Montgomery, NewTek went on to become renowned for the creation of the Commodore Amiga video tools DigiView and DigiPaint, which were highly popular applications at the time. Jenison later appeared as the subject of the feature documentary "Tim's Vermeer" (2014), about his efforts to digitally recreate the painting technique of the Dutch baroque painter Johannes Vermeer. In his early life, Jenison took inspiration from his electrical engineer father, and a lot of his own early work came as a result of his obsession with music; as a youth he played in rock bands, although his main love was customizing and improving their instruments and studio equipment. Among his successes with NewTek were the Video Toaster for the Amiga and later Windows, a product which won the 1993 Emmy Award for Technical Achievement, and latterly animation system LightWave 3D, live broadcast system TriCaster, and slow motion replay system 3PLAY. A casual art fan himself, Jenison was inspired by the writings of artist David Hockney and art historian Philip Steadman to see whether rumoured primitive photographic techniques in Vermeer's paintings were possible. "Tim's Vermeer," directed by magician Teller and featuring his partner, Jenison's friend Penn Jillette, documented his artistic process. The film earned an Oscar nomination for Best Documentary Feature in 2014.

Joint Sessions

Monday January 29, 2018

Automotive Camera Image Quality I JOINT SESSION

Session Chairs: Stuart Perry, University of Technology Sydney (Australia) and Buyue Zhang, Intel Corporation (United States)

8:50 – 10:20 am
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

8:50 AVM-105
Fundamental imaging system analysis for autonomous vehicles, *Robin Jenkin, Nvidia Corporation (United States)*

9:20 AVM-106
Optimizing automotive cameras for image quality, *Felix Heide and Dave Tokic, Algolux (Canada)*

9:40 IQSP-107
Color calibration of digital still cameras used on unmanned aerial vehicles, *Susan Farnand, Rochester Institute of Technology (United States)*

10:00 IQSP-108
No reference prediction of quality metrics for H.264 compressed infrared image sequences for UAV applications, *Kabir Hossain, Claire Mantel, and Soren Forchhammer, Technical University of Denmark (Denmark)*

Surveillance in Robotics, Vision, and Inspection JOINT SESSION

Session Chair: Sreenath Vantaram, Apple Inc. (United States)

10:40 am – 12:20 pm
Sandpebble C

This session is jointly sponsored by: Intelligent Robotics and Industrial Applications using Computer Vision 2018, and Surveillance Session: Applications and Algorithms.

10:40 IRIACV-125
Pose perceptual characteristics using HMD-based visual instruction; effect of front/rear view and viewpoint change methods, *Shin Kinoshita, Yoshihiko Nomura, Ryota Sakamoto, and Tokuhiro Sugiura, Mie University (Japan)*

11:00 IRIACV-126
Robust pose estimation with the stereoscopic camera in harsh environment, *Longchuan Niu, Sergey Smirnov, Jouni Mattila, and Atanas Gotchev, Tampere University of Technology (Finland)*

11:20 SRV-127
Predicting rapid fire growth (flashover) using a hybrid convolutional neural network for object recognition and segmentation, *Kyongsik Yun, Jessi Bustos, and Thomas Lu, NASA Jet Propulsion Laboratory (United States)*

11:40 SRV-128
Using shape descriptors for UAV detection, *Eren Unlu[1], Emmanuel Zenou[1], and Nicolas Riviere[2]; [1]ISAE-SUPAERO and [2]ONERA (France)*

12:00 SRV-129
About pixel densities in surveillance, *Vlado Damjanovski, ViDi Labs Pty Ltd. (Australia)*

Automotive Camera Image Quality II JOINT SESSION

Session Chairs: Luke Cui, Amazon (United States) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

10:50 AVM-145
P2020 - standard for automotive system image quality, *Patrick Denny, Valeo Vision Systems (Ireland)*

11:20 AVM-146
LED flicker: Root cause, impact and measurement for automotive imaging applications, *Brian Deegan, Valeo Vision Systems (Ireland)*

11:40 AVM-147
Visual quality evaluation of the multi-camera visualization in automotive surround view systems, *Vladimir Zlokolica[1,2], Mark Griffin[1], Aidan Casey[1], Daniela Solera[1], Brian Deegan[1], Patrick Denny[1], and Barry Dever[1]; [1]Valeo Vision Systems (Ireland) and [2]University of Novi Sad (Serbia)*

12:00 AVM-148
Detection probabilities: Performance prediction for sensors of autonomous vehicles, *Marc Geese, Ulrich Seger, and Alfredo Paolillo, Robert Bosch GmbH - Leonberg (Germany)*

12:20 AVM-149
Realistic image degradation with a measured PSF, *Christian Wittpahl, Hatem Ben Zakour, Matthias Lehmann, and Alexander Braun, Düsseldorf University of Applied Sciences (Germany)*

Simulation for Autonomous Vehicles and Machines JOINT SESSION

Session Chairs: Peter Catrysse, Stanford Univ. (United States); Patrick Denny, Valeo Vision Systems (Ireland); and Darnell Moore, Texas Instruments (United States)

3:30 – 4:50 pm
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Photography, Mobile, and Immersive Imaging 2018.

3:30 PMII-161
Image systems simulation for automotive intelligence, *Henryk Blasinski, Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

3:50 AVM-162
Large scale collaborative autonomous vehicle simulation on smartphones, *Andras Kemeny[1,2], Emmanuel Icart[3], and Florent Colombet[2]; [1]Arts et Métiers ParisTech, [2]Renault-Nissan, and [3]Scale-1 Portal (France)*

4:10 AVM-163
Assessing the correlation between human driving behaviors and fixation patterns, *Mingming Wang and Susan Farnand, Rochester Institute of Technology (United States)*

4:30 AVM-164
Virtual simulation platforms for automated driving: Key care-abouts and usage model, *Prashanth Viswanath, Mihir Mody, Soyeb Nagori, Jason Jones, and Hrushikesh Garud, Texas Instruments India Ltd. (India)*

Special Session on: Computational Imaging for Advanced Manufacturing Joint Session

Session Chairs: Vincent Paquit and Hector Santos-Villalobos, Oak Ridge National Laboratory (United States)

3:30 – 5:10 pm
Harbour A-B

This session is jointly sponsored by: Computational Imaging XVI and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

3:30 COIMG-177
Advanced manufacturing research activities in the scaling of additive, battery, carbon fiber, and composites fabrication, *William Peter, Merlin Theodore, Lonnie Love, Ryan Dehoff, Vlastimil Kunc, and Vincent Paquit, Oak Ridge National Laboratory (United States)*

3:50 COIMG-178
Automated in-situ defects detection in metal additive manufacturing parts, *Vincent Paquit, James Ferguson, Sean Yoder, Michael Kirka, and Ryan Dehoff, Oak Ridge National Laboratory (United States)*

4:10 COIMG-179
Spectral neutron tomography for crystalline materials, *Singanallur Venkatakrishnan[1], Luc Dessieux[2], and Philip Bingham[1]; [1]Oak Ridge National Laboratory and [2]University of Tennessee Knoxville (United States)*

4:30 COIMG-180
Application of characterization, modeling and analytics towards understanding process-structure-property relationships in metallic 3D printing, *Michael Groeber, Edwin Schwalbach, Sean Donegan, Kevin Chaput, Todd Butler, and Jonathan Miller, Wright-Patterson AFB (United States)*

4:50 COIMG-181
Separable models for cone-beam MBIR reconstruction, *Thilo Balke[1], Michael Groeber[2], Gregery Buzzard[1], and Charles Bouman[1]; [1]Purdue University and [2]Wright-Patterson AFB (United States)*

Surface Appearance Modeling and Reproduction Joint Session

Session Chairs: Reiner Eschbach, Norwegian University of Science and Technology (Norway) and Monroe Community College (United States) and Mathieu Hebert, Université Jean Monnet de Saint Etienne (France)

3:30 – 4:50 pm
Cypress A

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Material Appearance 2018.

3:30 MAAP-165
Color prediction based on individual characterizations of the ink layers and print support, *Théo Phan Van Song[1,2], Christine Andraud[2], Luis Sapaico[1], and Maria Ortiz Segovia[1]; [1]Océ Print Logic Technologies — Canon Group and [2]Museum National d'Histoire Naturelle (France)*

3:50 MAAP-166
Light interreflections and shadowing effects in a Lambertian V-cavity under diffuse illumination, *Dorian Saint-Pierre[1], Rada Deeb[1], Damien Muselet[1], Lionel Simonot[1,2], and Mathieu Hebert[1]; [1]Université Jean Monnet de Saint Etienne and [2]Institut Pprime (France)*

4:10 MAAP-167
Interactive RGB transparency: A color rendering tool for superimposed translucent layers in digital images, *Lionel Simonot[1,2] and Mathieu Hebert[3]; [1]Institut Pprime, [2]Laboratoire Hubert Curien, and [3]Université Jean Monnet de Saint Etienne (France)*

4:30 MAAP-168
General method for estimating fluorescent Donaldson matrices, *Shoji Tominaga, Keita Hirai, and Takahiko Horiuchi, Chiba University (Japan)*

Tuesday January 30, 2018

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 1 Joint Session

Session Chair: Björn Sommer, University of Konstanz (Germany)

8:50 – 10:10 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

8:50 SD&A-189
Mesoscopic rigid body modeling of the ExtraCellular Matrix's self assembly, *Hua Wong, Nicolas Belloy, and Manuel Dauchez, University of Reims Champagne-Ardenne (France)*

9:10 SD&A-190
Semantics for an integrative and immersive pipeline combining visualisation and analysis of molecular data, *Mikael Trellet[1], Nicolas Ferey[1], Patrick Bourdot[1], and Marc Baaden[2]; [1]LIMSI and [2]IBPC (France)*

9:30 SD&A-191
3D-stereoscopic modeling and visualization of a Chlamydomonas reinhardtii cell, *Niklas Biere[1], Mehmood Ghaffar[1], Daniel Jäger[1], Anja Doebbe[1], Nils Rothe[1], Karsten Klein[2,3], Ralf Hofestädt[1], Falk Schreiber[2,3], Olaf Kruse[1], and Björn Sommer[2,3]; [1]Bielefeld University (Germany), [2]University of Konstanz (Germany), and [3]Monash University (Australia)*

9:50 SD&A-192
Immersive analysis and visualization of redox signaling pathways integrating experiments and computational modelling, *Alexandre Maes[1], Karen Druart[2], Sean Guégan[2], Xavier Martinez[2,3], Christophe Marchand[1], Stéphane Lemaire[1], and Marc Baaden[2]; [1]Institut de Biologie Physico-Chimique, UMR8226, CNRS, Sorbonne Universités, UPMC Université Paris 06, [2]Laboratoire de Biochimie Théorique, CNRS, UPR9080, Univ Paris Diderot, Sorbonne Paris Cité, PSL Research University, and [3]CNRS-LIMSI, VENISE team, Univ Paris-Sud (France)*

Imaging System Performance I Joint Session

Session Chairs: Elaine Jin, Nvidia Corporation (United States) and Jackson Roland, Apple Inc. (United States)

8:50 – 9:30 am
Regency A-B

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

8:50 PMII-182
Lessons from design, construction, and use of various multicameras, *Henry Dietz, Clark Demaree, Paul Eberhart, Chelsea Kuball, and Jong Wu, University of Kentucky (United States)*

9:10 PMII-183
Relative impact of key rendering parameters on perceived quality of VR imagery captured by the Facebook surround 360 camera, *Nora Pfund[1], Nitin Sampat[1], and Stephen Viggiano[2]; [1]Rochester Institute of Technology and [2]RIT School of Photographic Arts and Sciences (United States)*

Keynote: Imaging System Performance Joint Session

Session Chair: Elaine Jin, NVIDIA Corporation (United States)

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

9:30 – 10:10 am
Regency A-B

IQSP-208
Experiencing mixed reality using the Microsoft HoloLens, *Kevin Matherson, Microsoft Corporation (United States)*

Dr. Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

Keynote: Imaging and Astronomy, Prof. Joel Primack Joint Session

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Kurt Niel, University of Applied Sciences Upper Austria (Austria)

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

3:30 – 4:30 pm
Cypress B

COLOR-259
Computer vision and deep learning applied to simulations and imaging of galaxies and the evolving universe, *Joel Primack, University of California, Santa Cruz (United States)*

The keynote speaker is Dr. Joel R. Primack, Distinguished Professor of Physics Emeritus, University of California, Santa Cruz. Dr. Primack specializes in the formation and evolution of galaxies and the nature of the dark matter that makes up most of the matter in the universe. After helping to create what is now called the "Standard Model" of particle physics, Dr. Primack began working in cosmology in the late 1970s, and he became a leader in the new field of particle astrophysics. His 1982 paper proposed that a natural candidate for the dark matter is the lightest supersymmetric particle, still perhaps the leading candidate. He is one of the principal originators and developers of the theory of Cold Dark Matter, which has become the basis for the standard modern picture of structure formation in the universe. With support from NASA, NSF, and DOE, he has been using supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies under various assumptions, and comparing the predictions of these theories to the latest observational data. He organized and led the University of California systemwide Center for High-Performance AstroComputing, 2010-2015. Dr. Primack was one of the main advisors for the Smithsonian Air and Space Museum's 1996 IMAX film Cosmic Voyage, and he has worked with leading planetariums to help make the invisible universe visible.

Discussion: 360° Imaging Should Be 3D – But Why And How? Joint Session

3:30 – 4:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.
NOTE: Full list of panelists to be announced.

Imaging and Astronomy Afternoon Session JOINT SESSION

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Alessandro Rizzi, Università degli Studi di Milano (Italy)

4:30 – 5:10 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

4:30 COLOR-285
About color correction in astrophotography, *Alessandro Rizzi, Daniele Marini, and Cristian Bonanomi, Università degli Studi di Milano (Italy)*

4:50 SD&A-286
TileViz: Tile visualization for astro-chemistry, *Martial Mancip[1], Riccardo Spezia[1,2], Yannick Jeanvoine[2], and Cécile Balsier[1]; [1]CNRS and [2]Université d'Evry Val d'Essonnes (France)*

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 2 JOINT SESSION

Session Chair: Marc Baaden, IBPC (France)

4:30 – 5:10 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

4:30 SD&A-288
Interactive molecular graphics for augmented reality using HoloLens, *Christoph Müller, Michael Krone, Markus Huber, Verena Biener, Guido Reina, Daniel Weiskopf, and Thomas Ertl, University of Stuttgart (Germany)*

4:50 SD&A-289
Molecular Dynamics Visualization (MDV): Stereoscopic 3D display of biomolecular structure and interactions using the Unity game engine, *Michael Wiebrands, Chris Malajczuk, Andrew Woods, Andrew Rohl, and Ricardo Mancera, Curtin University (Australia)*

Imaging and Astronomy Discussion JOINT SESSION

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Daniele Marini, Università degli Studi di Milano (Italy)

5:10 – 5:30 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

Wednesday January 31, 2018

Robotic Vision Techniques for Navigation and Vision I JOINT SESSION

Session Chairs: Patrick Denny, Valeo Vision Systems (Ireland) and Darnell Moore, Texas Instruments (United States)

8:50 – 10:10 am
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

8:50 IRIACV-301
Reliable primitive approximation for estimation of robot grasping parameters using 3D-deep neural network, *Takuya Torii and Manabu Hashimoto, Chukyo University (Japan)*

9:10 IRIACV-302
Real-time visual loop closure detection for unmanned aerial vehicles, *Semih Karakaya[1], Can Erhan[1], Evangelos Sariyanidi[2], and Hakan Temeltas[1]; [1]Istanbul Teknik Üniversity (Turkey) and [2]Queen Mary University of London (United Kingdom)*

9:30 AVM-303
Semantic image segmentation using Encoder-Decoder Architecture Assisted by Global and Local Attention Models (EDA-GLAM), *Hao Xu, Siyang Li, and Chun-Chieh Kuo, Univeristy of Southern California (United States)*

9:50 AVM-304
A method for reducing the false positives in power line detection, *Alexander Cerón, University Militar Nueva Granada (Colombia)*

Keynote: Immersive Imaging JOINT SESSION

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

10:40 – 11:20 am
Grand Peninsula Ballroom D

PMII-320
Real-time capture of people and environments for immersive computing, *Shahram Izadi, perceptive IQ, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

Depth Sensing Joint Session

Session Chair: Calvin Chao, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

10:50 – 11:50 am
Cypress A

This session is jointly sponsored by: Image Sensors and Imaging Systems 2018, and 3D Image Processing, Measurement (3DIPM), and Applications 2018.

10:50 IMSE-325
Mobile 3D imaging using handheld lens array sheet and single camera, *Shoaib Soomro[1], Osman Eldes[1], Kaan Aksit[2], and Hakan Urey[1]; [1]Koç University (Turkey) and [2]Nvidia Research (United States)*

11:10 IMSE-326
A distance measurement method using a time-of-flight CMOS range image sensor with 4-tap output pixels and multiple time-windows, *Kohei Yamada, Akihito Komazawa, Taishi Takasawa, Keita Yasutomi, Keiichiro Kagawa, and Shoji Kawahito, Shizuoka University (Japan)*

11:30 IMSE-327
3D CMOS image sensor based on white pixel with off-center rectangular apertures, *Byoung-Soo Choi[1], Sang-Hwan Kim[1], Jimin Lee[1], Chang-Woo Oh[1], Seunghyuk Chang[2], JongHo Park[2], Sang-Jin Lee[2], and Jang-Kyoo Shin[1]; [1]Kyungpook National University and [2]Center for Integrated Smart Sensors (Republic of Korea)*

Robotic Vision Techniques for Navigation and Vision II Joint Session

Session Chairs: Patrick Denny, Valeo Vision Systems (Ireland) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

10:50 AVM-345
Pedestrian detection at night using deep neural networks and saliency maps (JIST-first), *Duyoung Heo, EunJu Lee, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:10 AVM-346
Context aware hyperspectral scene analysis, *Christian Winkens and Dietrich Paulus, University of Koblenz-Landau (Germany)*

11:30 AVM-347
Multiple pedestrian tracking in moving vehicle using online learning of random ferns and feature descriptor of pre-trained shallow convolutional neural networks, *SangJun Kim, Jaeyeal Nam, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:50 AVM-348
Raindrop detection considering extremal regions and salient features, *Vijay C S, Radhesh Bhat, and Vijaya Ragavan, PathPartner Technology Pvt Ltd. (India)*

12:10 AVM-349
Removing shadows and shading from road surfaces in real time, *Bruce Maxwell and Casey Smith, Tandent Vision Science, Inc. (United States)*

Immersive Imaging Joint Session

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

11:20 am – 12:40 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

11:20 PMII-350
SpinVR: Towards live-streaming 3D virtual reality video, *Donald Dansereau, Robert Konrad, Aniq Masood, and Gordon Wetzstein, Stanford University (United States)*

11:40 PMII-351
Towards a full parallax cinematic VR system, *Haricharan Lakshman, Dolby Labs (United States)*

12:00 PMII-352
Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation, *Jayant Thatte and Bernd Girod, Stanford University (United States)*

12:20 PMII-353
Image systems simulation for 360° camera rigs, *Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

Visualization Facilities Joint Session

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Andrew Woods, Curtin University (Australia)

3:30 – 5:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

3:30 ERVR-392
xREZ Art + Science Lab - facilities presentation, *Ruth West, University of North Texas (United States)*

3:50 SD&A-393
CADwalk: Life-size MR-AR-VR design experience – Optimising and validating mission critical work environments, *Gerhard Kimenkowski, CADwalk Global Pty Ltd. (Australia)*

4:10 ERVR-394
When one is not enough: Cross-platform and collaborative developments at the Emerging Analytics Center, *Dirk Reiners, Carolina Cruz-Neira, and Carsten Neumann, University of Arkansas at Little Rock (United States)*

4:30 SD&A-395
Multiplatform VR case study – Beacon Virtua, *Andrew Woods[1], Nick Oliver[1], and Paul Bourke[2]; [1]Curtin University and [2]University of Western Australia (Australia)*

4:50 SD&A-396
What will we see next? Current visualization facilities trends and future considerations, *Kurt Hoffmeister, Mechdyne Corp. (United States)*

5:10
SD&A Closing Remarks

Thursday February 1, 2018

Keynote: Imaging Sensors and Technologies for Automotive Intelligence JOINT SESSION

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Joyce Farrell, Stanford University (United States); and Darnell Moore, Texas Instruments (United States)

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

8:50 – 9:30 am
Grand Peninsula Ballroom B-C

PMII-415

Advances in automotive image sensors, *Boyd Fowler[1] and Johannes Solhusvik[2]; [1]OmniVision Technologies (United States) and [2]OmniVision Technologies Europe Design Center (Norway)*

Dr. Boyd Fowler joined OmniVision in December 2015 as the vice president of marketing and was appointed chief technology officer in July 2017. Dr. Fowler's research interests include CMOS image sensors, low noise image sensors, noise analysis, data compression, and machine learning and vision. Prior to joining OmniVision, he was co-founder and vice president of engineering at Pixel Devices, where he focused on developing high-performance CMOS image sensors. After Pixel Devices was acquired by Agilent Technologies, Dr. Fowler was responsible for advanced development of commercial CMOS image sensor products. In 2003, Dr. Fowler joined Fairchild Imaging as the CTO and vice president of technology, where he developed SCMOS image sensors for high-performance scientific applications. After Fairchild Imaging was acquired by BAE Systems, Dr. Fowler was appointed the technology director of the CCD/CMOS image sensor business. He has authored numerous technical papers, book chapters, and patents. Dr. Fowler received his MSEE and PhD in electrical engineering from Stanford University (1990 and 1995 respectively).

Imaging Sensors and Technologies for Automotive Intelligence JOINT SESSION

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Patrick Denny, Valeo Vision Systems (Ireland); and Joyce Farrell, Stanford University (United States)

9:30 – 9:50 am
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

9:30 IMSE-422

Partial reset HDR image sensor with improved fixed pattern noise performance, *Volodymyr Seliuchenko[1,2], Sharath Patil[1,3], Marcelo Mizuki[1], Saad Ahmad[1], and Maarten Kuijk[2]; [1]Melexis (Belgium), [2]Vrije University Brussel (Belgium), and [3]University of Massachusetts Lowell (United States)*

Camera Image Processing JOINT SESSION

Session Chair: Michael Kriss, MAK Consultants (United States)

10:50 am – 12:10 pm
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: Image Processing: Algorithms and Systems XVI, and Photography, Mobile, and Immersive Imaging 2018.

10:50 IPAS-439

Color interpolation algorithm for the Sony-RGBW color filter array, *Jonghyun Kim and Moon Gi Kang, Yonsei University (Republic of Korea)*

11:10 IPAS-440

High dynamic range imaging with a single exposure-multiplexed image using smooth contour prior, *Mushfiqur Rouf and Rabab Ward, University of British Columbia (Canada)*

11:30 IPAS-441

Enhancement of underwater color images by two-side 2-D quaternion discrete Fourier transform, *Artyom Grigoryan[1], Aparna John[1], and Sos Agaian[2]; [1]University of Texas at San Antonio and [2]City University of New York/CSI (United States)*

11:50 PMII-442

Automatic tuning method for camera denoise and sharpness based on perception model, *Weijuan Xi[1], Huanzhao Zeng[2], and Jonathan Phillips[2]; [1]Purdue University and [2]Google Inc. (United States)*

3D Scene Sensing and Object Recording JOINT SESSION

Session Chairs: William Puech, University of Montpellier (France) and Robert Sitnik, Warsaw University of Technology (Poland)

2:00 – 4:00 pm
Grand Peninsula Ballroom B-C

This session is jointly sponsored by: 3D Image Processing, Measurement (3DIPM), and Applications 2018, and Image Processing: Algorithms and Systems XVI.

2:00 3DIPM-460

An accurate and robust algorithm for tracking guitar neck in 3D based on modified RANSAC homography, *Zhao Wang and Jun Ohya, Waseda University (Japan)*

2:20 3DIPM-461

Skeleton-based dynamic hand gesture recognition using 3D depth data, *Dan Zhao, Beijing Institute of Technology (China)*

2:40 IPAS-462

Combining local and global optical flow for RGB-D point cloud alignment, *Sunho Kim and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:00 IPAS-463

Discrimination of active dynamic objects in stereo-based visual SLAM, *Ihtisham Ali, Olli Suominen, and Atanas Gotchev, Tampere University of Technology (Finland)*

3:20 IPAS-464

Error correction for time-of-flight images using validity classification, *Yunseok Song and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:40 3DIPM-465

How to capture aesthetic features of complex cultural heritage objects – active illumination data fusion, *Grzegorz Maczkowski[1], Eryk Bunsch[2], and Jakub Krzeslowski[1]; [1]Warsaw University of Technology and [2]King Jan III Museum Palace at Wilanow (Poland)*

Paper Schedule by Day/Time

Monday, January 29, 2018

8:50 am

AVM-105 Fundamental imaging system analysis for autonomous vehicles (Jenkin)

COIMG-101 Accelerating iterative image reconstruction via adaptive surrogate functions (O'Sullivan)

MOBMU-100 Cybersecurity and forensic challenges - A bibliographic review (Creutzburg)

SD&A-109 Use of VR to assess and treat weaknesses in human stereoscopic vision (Backus)

9:00 am

MWSF-113 Digital watermarking from inflated expectation to mainstream adoption (Rodriguez)

9:10 am

COIMG-102 Distributed modular framework for fast iterative CT reconstruction (Sridhar)

MOBMU-114 An integration of health tracking sensor applications and e-learning environments for cloud-based health promotion campaigns (Akopian)

SD&A-110 Emotional effects of car-based motion representations with stereoscopic images (Inami)

9:20 am

AVM-106 Optimizing automotive cameras for image quality (Heide)

9:30 am

COIMG-103 Ultrasonic model-based iterative reconstruction with spatially variant regularization for one-sided non-destructive evaluation (Almansouri)

MOBMU-115 Designing apps interoperable and functional on multiple mobile platforms using Google environment (Akopian)

SD&A-111 Mid-air imaging technique for architecture in public space (Sano)

9:40 am

IQSP-107 Color calibration of digital still cameras used on unmanned aerial vehicles (Farnand)

9:50 am

COIMG-472 Deep learning based sinogram correction for metal artifacts reduction (Karl)

MOBMU-116 Low-cost medical infrastructure: Triage as intelligent decision support (Liefold)

SD&A-112 A refocus-interface for diminished reality work area visualization (Maezawa)

10:00 am

IQSP-108 No reference prediction of quality metrics for H.264 compressed infrared image sequences for UAV applications (Hossain)

10:10 am

MOBMU-117 Review of interactive communication systems for business to business (B2B) services (Kaghyan)

10:30 am

MWSF-118 Boosting image forgery detection using resampling features and copy-move analysis (Mohammed)

10:40 am

IRIACV-125 Pose perceptual characteristics using HMD-based visual instruction; effect of front/rear view and viewpoint change methods (Sugiura)

MAAP-122 Material appearance issues: Cultural heritage research (Rushmeier)

VIPC-123 Technical overview of AV1: An open source video codec from the Alliance for Open Media (Xu)

10:50 am

AVM-145 P2020 - standard for automotive system image quality (Denny)

COIMG-130 Autonomous alpha matting using consensus equilibrium (Chan)

HVEI-500 The field of view, the field of resolution, and the field of contrast sensitivity (Watson)

MOBMU-135 Open mobile platform with geo-, color-, and spectrometrical sensor systems for quality assurance in research and development, design and production, application and maintenance as well as in education and training (Hofmann)

SD&A-140 Initial work on development of an open Streaming Media Standard for Field of Light Displays (SMFoLD) (Daniel)

10:55 am

MWSF-119 Image manipulation detection using sensor linear pattern (Fidrich)

11:00 am

IRIACV-126 Robust pose estimation with the stereoscopic camera in harsh environment (Niu)

11:10 am

COIMG-131 SLADS-Net: Supervised learning approach for dynamic sampling using deep neural networks (Zhang)

MOBMU-136 Volumetric terrain rendering with WebGL (van Rüschen)

SD&A-141 Simulation tools for light-field displays based on a mirco-lens array (Song)

11:20 am

AVM-146 LED flicker: Root cause, impact and measurement for automotive imaging applications (Deegan)

MAAP-150 Diffraction removal in an image-based BRDF measurement setup (Lucat)

MWSF-120 Privacy preserving forensics for JPEG images (Liu)

SRV-127 Predicting rapid fire growth (flashover) using a hybrid convolutional neural network for object recognition and segmentation (Yun)

VIPC-153 CrossEncoders: A complex neural network compression framework (Agarwal)

11:30 am

COIMG-132 A supervised learning approach for dynamic sampling in raman hyperspectral imaging (Simpson)

HVEI-501 Perceptual display: Apparent enhancement of scene detail and depth (Invited) (Myszkowski)

MOBMU-137 Characterization and correction of multispectral filter-on-chip CMOS-sensor-systems for spatial resolved spectral and color measurements (Dittrich)

SD&A-142 Full-parallax spherical light field display using mirror array (Yano)

11:40 am

AVM-147 Visual quality evaluation of the multi-camera visualization in automotive surround view systems (Griffin)

MAAP-151 Morphological characterization of rough surfaces (Turbil)

SRV-128 Using shape descriptors for UAV detection (Zenou)

VIPC-154 Multi-level machine learning-based early termination in VP9 partition search (Wang)

11:45 am

MWSF-121 Steganalyzing images of arbitrary size with CNNs (Tsang)

11:50 am

COIMG-133 Data-driven compressed sensing tomography (Kassubeck)

MOBMU-138 Creating input device transforms for Blackmagic Production Camera and Canon EOS 5D Mark III DSLR camera (Hasche)

SD&A-143 Angular and spatial sampling requirements in 3D light field displays (Hua)

12:00 pm

AVM-148 Detection probabilities: Performance prediction for sensors of autonomous vehicles (Geese)

MAAP-152 Three-dimensional hyperspectral imaging: A new method for human face acquisition (Gevaux)

SRV-129 About pixel densities in surveillance (Damjanovski)

VIPC-155 Texture segmentation based video compression using convolutional neural networks (Fu)

12:10 pm

COIMG-134 Feature engineering and explosive detection (Babaheidarian)

MOBMU-139 Comparing different approaches to create input device transforms (IDTs) for the RED Scarlet-X Camera (Hasche)

SD&A-144 Conversion of sparsely-captured light field into alias-free full-parallax multiview content (Sahin)

12:20 pm

AVM-149 Realistic image degradation with a measured PSF (Braun)

VIPC-156 Multi-reference video coding using stillness detection (Chen)

3:20 pm

HVEI-502 Lighting perceptual intelligence (Pont)

3:30 pm

COIMG-177 Advanced manufacturing research activities in the scaling of additive, battery, carbon fiber, and composites fabrication (Peter)

IQSP-169 Measuring the impact of flare light on dynamic range (Koren)

MAAP-165 Color prediction based on individual characterizations of the ink layers and print support (Van Song)

MWSF-158 Blind detection of image rotation and angle estimation (Goljan)

PMII-161 Image systems simulation for automotive intelligence (Blasinski)

SD&A-388 What use is 'time-expired' disparity and optic flow information to a moving observer? (Glennerster)

VIPC-173 Event recognition in personal photo collections: An active learning approach (Conci)

3:50 pm

AVM-162 Large scale collaborative autonomous vehicle simulation on smartphones (Kemeny)

COIMG-178 Automated in-situ defects detection in metal additive manufacturing parts (Paquit)

IQSP-170 Quantitative measurement of contrast, texture and color in an HDR scene enabling analysis of camera using image fusion compared to traditional digital cameras (Viard)

MAAP-166 Light interreflections and shadowing effects in a Lambertian V-cavity under diffuse illumination (Saint-Pierre)

VIPC-174 Generative adversarial networks for open set historical Chinese character recognition (Yu)

3:55 pm

MWSF-159 Display image-barcodes using blue/red channel embedding (Dinesh)

4:00 pm

HVEI-503 Applying insights from visual perception and cognition to the development of more effective virtual reality experiences (Interrante)

4:10 pm

AVM-163 Assessing the correlation between human driving behaviors and fixation patterns (Wang)

COIMG-179 Spectral neutron tomography for crystalline materials (Venkatakrishnan)

IQSP-171 Camera resolution and distortion: Advanced edge fitting (Burns)

MAAP-167 Interactive RGB transparency: A color rendering tool for superimposed translucent layers in digital images (Simonot)

VIPC-175 Using convolutional neural networks and transfer learning for Content-Based Image Retrieval (CBIR) (Mayer)

4:20 pm

MWSF-160 Deep learning regressors for quantitative steganalysis (Chen)

4:30 pm

AVM-164 Virtual simulation platforms for automated driving: Key care-abouts and usage model (Mody)

COIMG-180 Application of characterization, modeling and analytics towards understanding process-structure-property relationships in metallic 3D printing (Groeber)

MAAP-168 General method for estimating fluorescent Donaldson matrices (Tominaga)

PMII-172 VCX: An industry initiative to create an objective camera module evaluation for mobile devices (Wueller)

VIPC-176 Approach for machine-printed Arabic character recognition: The-state-of-the-art deep-learning method (Ko)

4:50 pm

COIMG-181 Separable models for cone-beam MBIR reconstruction (Balke)

Tuesday, January 30, 2018

8:50 am

COLOR-185 High-quality imaging micro-LED display based on quantum dot CSP technology (Kim)

IPAS-193 Deep pFibonacci scattering networks (Egiazarian)

MAAP-184 Digital appearance assessment methods and challenges (Ellens)

PMII-182 Lessons from design, construction, and use of various multicameras (Demaree)

SD&A-189 Mesoscopic rigid body modeling of the ExtraCellular Matrix's self assembly (Wong)

9:00 am

MWSF-197 Content protection: Beyond conditional access and digital rights management (Celik)

9:10 am

AVM-198 Lyft's approach to autonomous vehicles (Vincent)

COIMG-199 Tubule segmentation of fluorescence microscopy images based on convolutional neural networks with inhomogeneity correction (Lee)

COLOR-186 Color and quality enhancement of whiteboard contents for videoconferencing applications (Abebe)

HVEI-504 How are ocular behaviours affected by central and peripheral vision losses? A study based on artificial scotomas and gaze-contingent protocol (JPI-first) (David)

IPAS-194 An estimation method of human impression factors for objects from their 3D shapes using a deep neural network (Taguchi)

IRIACV-202 No-reference utility estimation with a convolutional neural network (Scott)

PMII-183 Relative impact of key rendering parameters on perceived quality of VR imagery captured by the Facebook surround 360 camera (Viggiano)

SD&A-190 Semantics for an integrative and immersive pipeline combining visualisation and analysis of molecular data (Trellet)

VIPC-205 Toward automatic and objective evaluation of synchronization in video of synchronized diving (Li)

9:30 am

COIMG-200 Development of screening echocardiogram for detection of asymptomatic left ventricular dysfunction (Pizlo)

COLOR-187 Optical characterization of the emissive properties of HDR/WCG displays using ICtCp color space and Fourier optics viewing angle instruments (Boher)

HVEI-505 Pilot study on the effects of the fixational eye movements on the contrast sensitivity (Sanchis-Jurado)

IPAS-195 Texture analysis and classification using Pix2Pix network and AlexNet (Lenson)

IQSP-208 Experiencing mixed reality using the Microsoft HoloLens (Matherson)

IRIACV-203 Haptic industrial robot control and bilateral teleoperation by using a virtual visual interface (Soyguder)

MAAP-209 Perceptual appearance similarity in 3D printing (Ludwig)

SD&A-191 3D-stereoscopic modeling and visualization of a Chlamydomonas reinhardtii cell (Sommer)

VIPC-206 Convolutional neural networks for the analysis of broadcasted tennis games (Tsagkatakis)

9:50 am

COIMG-201 Deep gang graffiti component analysis (Li)

COLOR-188 Visibility of natural background overlapped with on-screen contents of transparent displays (Yang)

HVEI-506 A dual channel spatial-remporal detection model (Ahumada)

IPAS-196 Learning adaptive parameter tuning for image processing (Frosio)

IRIACV-204 A 3D guitar fingering assessing system based on CNN-hand pose estimation and SVR-assessment (Wang)

MAAP-210 A model of visual opacity for translucent colorants (Midtfjord)

SD&A-192 Immersive analysis and visualization of redox signaling pathways integrating experiments and computational modelling (Baaden)

VIPC-207 A self powered device embedded in a sports ball for a better immersive experience (Ferzli)

10:30 am

MWSF-211 Towards order of processing operations detection in JPEG-compressed images with convolutional neural networks (Bayar)

10:40 am

AVM-216 Scalable autonomous vehicle mapping and localization on the edge (Puttagunta)

COLOR-221 Color characterization methods for a multispectral camera (Khan)

HVEI-507 Perceived dynamic range of HDR images with no semantic information (Valenzise)

IPAS-218 Sharpening image details using local phase congruency analysis (Rychagov)

VIPC-215 Perceptual optimization in video coding – a systematic approach (Katsavounidis)

10:50 am

COIMG-227 Simulation of rare events in images (Kubatur)

IQSP-231 Bridging the gap between imaging performance and image quality measures (Fry)

IRIACV-236 Machine vision system for rapid online detection of wooden breast syndrome in chicken fillets (Yoon)

MAAP-226 Simulating the appearance of materials (Jensen)

PMII-244 Manipulating image composition in post-capture (Gallo)

SD&A-246 Recent progress in volumetric 3D digital light photoactivatable dye displays (Lippert)

10:55 am

MWSF-212 Resampling forgery detection using deep learning and a-contrario analysis (Flenner)

11:00 am

COLOR-222 NASA's astronomy picture of the day: Popular and innovative images in modern astrophotography (Nemiroff)

HVEI-508 The preferred system gamma is primarily determined by the ratio of dynamic range of the original scene and the displayed image (Kane)

IPAS-219 Color visibility images and measures of image enhancement (Agaian)

11:10 am

COIMG-228 Top down approach to height estimation of sorghum with stereo cameras (Zakhor)

IQSP-232 The benefits of color over black-and-white images in task-oriented reconnaissance applications (Scarff)

IRIACV-237 An image processing based method for chewing detection using variable-intensity template (Fujimoto)

SD&A-247 Integral imaging system using locally controllable point light source array (Watanabe)

11:20 am

HVEI-509 Pupillometry of high dynamic range video viewing (Daly)

MWSF-213 Deep learning for detecting processing history of images (Boroumand)

VIPC-251 Interactive hand pose estimation: Boosting accuracy in localizing extended finger joints (Zhang)

11:30 am

COIMG-229 Recovery of Soil Moisture Active Passive (SMAP) instrument's active measurements via coupled dictionary learning (Fotiadou)

IQSP-233 Using the immersive methodology to assess the quality of videos transmitted in UDP and TCP-based scenarios (Farias)

IRIACV-238 Discriminating the presence of the cerebral aneurysm using shape features obtained from medical images of the cerebral vessel (Kikuchi)

MAAP-255 Interfaces for material appearance design (Rushmeier)

PMII-241 Improving reliability of phase-setection autofocus (Chen)

SD&A-248 Mobile integral imaging display using three-dimensional scanning (Erdenebat)

11:40 am

AVM-256 Multi-sensor fusion for automated driving: Selecting model and optimizing on embedded platform (Mody)

COLOR-223 Evaluation for faithful reproduction of star fields in a planetarium (JIST-first) (Tanaka)

HVEI-510 Estimating the subjective video stability of first-person videos (Ma)

VIPC-252 Efficient preprocessing and feature extraction for robust face recognition (Algharib)

11:45 am

MWSF-214 Satellite image forgery detection and localization using GAN and one-class classifier (Yarlagadda)

11:50 am

COIMG-230 Image modeling for fiber-reinforced composite materials (Li)

IQSP-234 Analysis of perceptual strength and physical strength parameters of videos impaired with two spatial artifacts (blockiness and blurriness) and one temporal artifact (packet-loss) (Farias)

IRIACV-240 Geometric calibration and image rectification of a multi-line scan camera for accurate 3D reconstruction (Antensteiner)

PMII-242 Improved depth from defocus using the spectral ratio (Morgan-Mar)

SD&A-249 Constructing stackable multiscopic display panels using microlenses and optical waveguides (Gotoda)

12:00 pm

AVM-257 Multi-sensor data fusion for vehicle detection in autonomous vehicle applications (Li)

COLOR-224 Distributed fast radio burst detection: Algorithm and application (Itschner)

HVEI-511 Viewer-aware intelligent mobile video system for prolonged battery life (Gao)

VIPC-253 Text/figure separation in document images using Docstrum descriptor and two-level clustering (Pohl)

12:10 pm

COIMG-471 Square coded aperture: A large aperture with extended depth of field (Zhang)

IQSP-235 Assessing the quality of video conferencing systems: Towards quality of communication (Shahid)

PMII-243 Hyperspectral mapping of oral and pharyngeal cancer: Estimation of tumor-normal margin interface using machine learning (Hegyi)

SD&A-250 Fast calculation method for full-color computer-generated hologram with real objects captured by a depth camera (Zhao)

12:20 pm

AVM-258 Camera radar fusion for increased reliability in ADAS applications (Zhong)

COLOR-225 Can Pop-Tart® wrappers be used to make safe eclipse glasses? (Carpenter)

VIPC-254 Prediction system for activity recognition with compressed video (Zhong)

3:30 pm

AVM-280 VOLA large-scale volumetric data for map-building, navigation, autonomy, and machine intelligence at global scale (Moloney)

COIMG-270 A shooting direction control camera based on computational imaging without mechanical motion (Takahashi)

COLOR-259 Computer vision and deep learning applied to simulations and imaging of galaxies and the evolving universe (Primack)

HVEI-512 Contextual effects in human gloss perception (Invited) (Hansmann-Roth)

IPAS-260 Robust linearized combined metrics of image visual quality (Egiazarian)

IRIACV-343 Computational ultrafast optical imaging for single-cell inspection and analysis (Invited) (Lam)

PMII-266 Multi-camera systems for AR/VR and depth sensing (Fletcher)

VIPC-263 A robust and accurate calibration method for out-of-focus camera (Hu)

3:50 pm

COIMG-271 Fast, automated indoor light detection, classification, and measurement (Hiller)

IPAS-261 1-Bit tensor completion (Tsagkatakis)

IRIACV-275 Featureless-region-based top window recognition for automatic industrial monitoring systems (Hsu)

PMII-267 IQ challenges developing Light's L16 computational camera (Sasinowski)

VIPC-264 Improving the efficiency of on-site operators in utility management: Combining hololens and AR for real-time check of electricity meters (Conci)

4:00 pm

AVM-281 Visual SLAM and localization – the hard cases (Enright)

HVEI-513 Assessing gloss perception of human facial skin across subject (Wang)

4:10 pm

COIMG-272 Superfast joint demosaicing and super-resolution (Glazistov)

IPAS-262 Blind image watermarking in wavelet-domain robust to printing and smartphone acquisition (Conci)

IRIACV-276 Outlier detection in large-scale traffic data by regression analysis (Ngan)

PMII-268 The promise of high resolution 3D imagery (Banks)

VIPC-265 Generation of stereoscopic image sequences from monocular videos using epipolar geometry (Goyal)

4:20 pm

AVM-282 Dense surround view computation with perspective correctness (Fuchs)

HVEI-514 Optimising texture visibility using LED luminaires (Invited) (Cuijpers)

4:30 pm

COIMG-273 Warping-based motion artifact compensation for multi-line scan light field imaging (Antensteiner)

COLOR-285 About color correction in astrophotography (Rizzi)

IRIACV-277 Part quality assessment using convolution neural networks in high pressure die casting (Cashion)

PMII-269 Light field perception enhancement for integral displays (Salahieh)

SD&A-288 Interactive molecular graphics for augmented reality using HoloLens (Krone)

4:40 pm

AVM-283 Vehicle pose estimation from drive recorder images by monocular SLAM and matching with rendered 3D point cloud of surrounding environment (Kurobe)

4:50 pm

COIMG-274 Illuminant estimation using ensembles of multivariate regression trees (van Beek)

HVEI-515 Disentangling simultaneous transparency and illumination changes (Invited) (Ennis)

IRIACV-278 Multi-view surface inspection using a rotating table (Kaichi)

SD&A-286 TileViz: Tile visualization for astro-chemistry (Mancip)

SD&A-289 Molecular Dynamics Visualization (MDV): Stereoscopic 3D display of biomolecular structure and interactions using the Unity game engine (Woods)

5:00 pm

AVM-284 Loop closure detection in simultaneous localization and mapping using learning based local patch descriptor (Shin)

5:10 pm

COIMG-473 Depth estimation using a multi-scale matched filter for decoding structured light reflected from a scene (Siddiqui)

IRIACV-279 Bringing machine intelligence to welding visual inspection: Development of low-cost portable embedded device for welding quality control (Gong)

5:20 pm

HVEI-516 Quantifying how humans trade off color and material in object identification (Invited) (Radonjić)

Wednesday, January 31, 2018

8:50 am

COLOR-295 Illuminant color estimation in an image under several illuminants based on gray-world assumption (Kawamura)

IPAS-305 Separation of scanned media using a strip based methodology (de Lima)

IQSP-298 Convolutional neural network and support vector regression for stereoscopic image quality assessment with reference (Chetouani)

IRIACV-301 Reliable primitive approximation for estimation of robot grasping parameters using 3D-deep neural network (Torii)

PMII-291 Extreme imaging using cell phones (Levoy)

SD&A-290 The history of stereoscopic video games for the consumer electronic market (Benoit)

VDA-294 Audience-targeted exploratory and explanatory visualization designs (Ma)

9:00 am

HVEI-517 The relation between MOS and pairwise comparisons and the importance of cross-content comparisons (Valenzise)

IMSE-292 Color channel reconstruction for multi-color multi-view images using disparity and color similarity-based local linear regression (Richter)

MWSF-309 Scaling media forensics (Doermann)

9:10 am

COLOR-296 Explanation of color lines based on a simple color image model (Fuller)

IMAWM-310 How does building a low cost vision sensor teach us about deep learning? (Yu)

IPAS-306 Methods and tools for denoising of complex valued images based on block-matching and high order singular value decomposition (Egiazarian)

IQSP-299 Advantages of incorporating perceptual component models into a machine learning framework for prediction of display quality (Choudhury)

IRIACV-302 Real-time visual loop closure detection for unmanned aerial vehicles (Temeltas)

SD&A-474 Over fifty years of working with stereoscopic 3D systems — Anecdotes, insights, and advice

9:20 am

HVEI-518 DeViQ – A deep no reference video quality model (Göring)

IMSE-293 Tutorial talk: Introduction to spectral response (QE) curves, their meaning and their measurement (Darmont)

9:30 am

AVM-303 Semantic image segmentation using Encoder-Decoder Architecture Assisted by Global and Local Attention Models (EDA-GLAM) (Li)

COLOR-297 Detection of color fading in printed customer content (Xiao)

IPAS-307 Automatic banknote stain detection (Yoon)

IQSP-300 NIMA: Neural image assessment (Talebi)

PMII-311 An overview of state-of-the-art algorithms for stack-based HDR imaging (Sen)

9:40 am

HVEI-519 The role of structure and textural information in image utility and quality assessment tasks (JPI-first) (Ling)

IMSE-313 Quantum efficiency and color (Kunze)

VDA-314 Visualization of complex familial and social structures (Hott)

9:50 am

AVM-304 A method for reducing the false positives in power line detection (Cerón)

IPAS-308 Rule-based optical character recognition for serial number on renminbi banknote (Hsieh)

PMII-312 Deep high dynamic range imaging of dynamic scenes (Ramamoorthi)

10:00 am

HVEI-520 A tutorial on correcting for multiple tests (Tyler)

VDA-315 Display infrastructure for virtual environments (DIVE) (JIST-first) (Wischgoll)

HVEI-521 Optimum space-frequency partition in subband image coding with human visual sensitivity and region-of-interest (Miyazaki)

HVEI-522 Predicting learning difficulty based on gaze and pupil response (Parikh)

HVEI-541 Colorizing color images (Funt)

HVEI-542 Investigating potential human tetrachromacy in individuals with tetrachromat genotypes using multispectral techniques (Jameson)

10:20 am

HVEI-540 Storyboard of thoughts: Using photography and illustration to visualize the mind (López-González)

10:30 am

MWSF-316 Natural steganography in JPEG compressed images (Denemark)

10:40 am

COLOR-321 Near-Infrared fusion for photorealistic image dehazing (Dümbgen)

PMII-320 Real-time capture of people and environments for immersive computing (Izadi)

10:50 am

AVM-345 Pedestrian detection at night using deep neural networks and saliency maps (JIST-first) (Ko)

HVEI-523 Towards subjective quality assessment for panoramic video (Invited) (Chen)

IMAWM-336 Depth and super-pixel extraction for augmenting human detection (Invited) (Asari)

IMSE-325 Mobile 3D imaging using handheld lens array sheet and single camera (Soomro)

IPAS-328 Real-time 3DRS motion estimation for frame-rate conversion (Pohl)

IQSP-340 Image quality benchmark of computational bokeh (Viard)

VDA-332 FitViz-Ad: A non-intrusive reminder that helps manage and encourage people with rheumatoid arthritis to be physically active (Heng)

10:55 am

MWSF-317 Can we augment a small learning set for improving the performances of a CNN-based steganalyzer? (Chaumont)

11:00 am

COLOR-323 Color appearance processing using iccMAX (Green)

11:10 am

AVM-346 Context aware hyperspectral scene analysis (Winkens)

HVEI-524 A framework for adaptive delivery of omnidirectional video (Invited) (Timmerer)

IMSE-326 A distance measurement method using a time-of-flight CMOS range image sensor with 4-tap output pixels and multiple time-windows (Yamada)

IPAS-329 Rician noise rejection in sparse representation (Elias)

IQSP-341 Measurement of noise using the dead leaves pattern (Artmann)

VDA-333 High quality volume rendering of dark matter simulations (Kaehler)

11:20 am

MWSF-318 Steganalysis into the wild: How to define a source? (Bas)

PMII-350 SpinVR: Towards live-streaming 3D virtual reality video (Konrad)

COLOR-324 Chromaticity matrix to tristimulus matrix conversion for RGB color spaces – even in the dark (Viggiano)

11:30 am

AVM-347 Multiple pedestrian tracking in moving vehicle using online learning of random ferns and feature descriptor of pre-trained shallow convolutional neural networks (Kim)

HVEI-525 Comparison of subjective quality evaluation methods for omnidirectional videos with DSIS and modified ACR (Invited) (Raake)

IMAWM-467 Vision based vehicle re-identification by fusion of multiple features (You)

IMSE-327 3D CMOS image sensor based on white pixel with off-center rectangular apertures (Choi)

IPAS-330 Registration of visible and infrared facial images for temperature measurement (Wang)

IQSP-342 Development of a perceptually calibrated objective metric for auto white balance (Jin)

VDA-334 A semi-automated method for measuring Fels indicators for skeletal maturity assessment in children (Gharabaghi)

11:40 am

PMII-351 Towards a full parallax cinematic VR system (Lakshman)

11:45 am

MWSF-319 Domain adaptation in steganalysis (Newman)

11:50 am

AVM-348 Raindrop detection considering extremal regions and salient features (Bhat)

HVEI-526 Quality of experience for a virtual reality simulator (Invited) (Brunnstrom)

IMAWM-338 Hierarchical Auto-associative Polynomial Convolutional Neural Network (HAP-CNN) for pattern classification (Martell)

IMSE-354 Dark current limiting mechanisms in CMOS image sensors (McGrath)

IPAS-331 Gradient management and algebraic reconstruction for single image super resolution (Delfin)

PMII-344 Statistic analysis of millions of digital photos 2018 (Wueller)

VDA-335 RemBrain: Exploring dynamic biospatial networks with mosaic-matrices and mirror glyphs (JIST-first) (Ma)

12:00 pm

PMII-352 Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation (Thatte)

12:10 pm

AVM-349 Removing shadows and shading from road surfaces in real time (Maxwell)

HVEI-527 Exploring the effects of subjective methodology on assessing visual discomfort in immersive multimedia (JPI-first) (Invited) (Li)

IMAWM-339 Learn a hybrid collaborative representation for fine-grained image classification (Xie)

VDA-355 Contrast enhancement effect on high dynamic range image registration using mutual information (Gedik)

12:20 pm

PMII-353 Image systems simulation for 360° camera rigs (Lian)

VDA-356 Deep variational auto-encoders for unsupervised glomerular classification (Lutnick)

12:30 pm

VDA-357 ViDy, ViGly: Visualization of dynamical flexibility of virtual N-Glycans on proteins (Besançon)

3:30 pm

AVM-358 Understanding vehicle E/E architecture topologies for automated driving: System partitioning and tradeoff parameters (Mody)

COLOR-361 Assessing the useful of similarity measures for multispectral face recognition (Gouton)

ERVR-392 xREZ Art + Science Lab - facilities presentation (West)

HVEI-528 Statistical identification of fixations in noisy eye movement data (Mulligan)

IMAWM-372 One-shot face recognition: A review (Invited) (Guo)

IMSE-360 Sub-electron low-noise CMOS image sensors (Rodríguez-Vázquez)

IPAS-381 A similarity measurement method for diffuse lung disease CT slice image retrieval (Wang)

IQSP-365 Image quality loss and compensation for visually impaired observers (Triantaphillidou)

MWSF-369 Study on color space for the performance of degraded face image recognition (Liu)

VDA-376 CNVis: A web-based visual analytics tool for exploring conference navigator data (Wei)

3:40 pm

IPAS-382 Blind estimation of white Gaussian noise variance in highly textured images (Egiazarian)

3:50 pm

AVM-359 Camera-aware neural architecture for robust automotive vision (Heide)

COLOR-362 Comparative study of biorthogonal wavelets accuracy in demosaicing algorithm based on wavelet analysis of luminance component (Gouton)

HVEI-529 Measuring video quality by eye response (Pappusetty)

IPAS-383 Color facial image representation with new quaternion gradients (Agaian)

IQSP-366 A full-reference image quality assessment metric for 3D synthesized views (Tian)

SD&A-393 CADwalk: Life-size MR-AR-VR design experience – Optimising and validating mission critical work environments (Kimenkowski)

VDA-377 A step towards automatic visual analytics pipeline generation (Karer)

3:55 pm

MWSF-370 Image scramble algorithm with robustness under transcoding (Kim)

4:00 pm

IPAS-220 Combined local and global image enhancement algorithm (Voronin)

4:10 pm

COLOR-363 Optimal color multiplexing for the low-cost structured light 3D capture system with two projectors (Lei)

ERVR-394 When one is not enough: Cross-platform and collaborative developments at the Emerging Analytics Center (Reiners)

HVEI-530 Quantifying visually induced motion sickness (VIMS) during the stereoscopic 3D viewing using VIMS level rating (JIST-first) (Hwang)

IMAWM-373 Face liveness detection based on joint analysis of RGB and near-infrared image of faces (Song)

IMSE-397 Multi-collection-gate image sensors – present status and perspective (Etoh)

IPAS-384 Combining pairs images of the which is fixed in the non-visible range (Semenishchev)

IQSP-367 No-reference image quality assessment using salient local binary patterns (Farias)

VDA-378 BGS: A large-scale graph visualization tool (Zhang)

4:20 pm

IPAS-385 Compression of signs of DCT coefficients for additional lossless compression of JPEG images (Egiazarian)

MWSF-371 Hybrid image encryption (Mayer)

4:30 pm

COLOR-364 Colorful insights supporting the modeling of creative processes across language, music, and emotion (Lebowsky)

IMAWM-374 CNN based facial landmark detection (Mao)

IMSE-398 A preliminary chip evaluation toward over 50Mfps burst global shutter stacked CMOS image sensor (Suzuki)

IPAS-386 Disparity estimation using fast motion-search and local image characteristics (Chang)

IQSP-368 Quality assessment of out-of-focus blurred images based on objects depth ordering and saliency (Larabi)

SD&A-395 Multiplatform VR case study – Beacon Virtua (Woods)

VDA-379 Distributed graph sampling methods (Zhang)

4:40 pm

IPAS-387 Flexible shape of seam for image retargeting with face detection (Tsubaki)

4:50 pm

IMAWM-421 Empirical study of image compression for palm vein recognition (Guo)

IMSE-399 Back to CCD's panels? An ultra-high speed CMOS sensor architecture (Krymski)

IPAS-389 Non-linear masking based contrast enhancement via illumination estimation (Hong)

SD&A-396 What will we see next? Current visualization facilities trends and future considerations (Hoffmeister)

VDA-380 A visual technique to analyze flow of information in a machine learning system (Chaudhuri)

5:00 pm

IPAS-390 Occlusion aware reduced angular candidates based light field depth estimation from an epipolar plane image (Mun)

5:10 pm

IMSE-400 Response curve programming of HDR image sensors based on discretized information transfer and scene information (Darmont)

IPAS-391 Two general models for gradient operators in imaging (Agaian)

5:20 pm

IMSE-401 Exploring hot pixel characteristics for 7 to 1.3 micron pixels (Chapman)

5:30 pm

COIMG-402 Estimating the UAVs' crash point based on optical flows' voting in the image plane (Hatano)

COIMG-403 Noise analysis and restrain of ghost imaging system (Qu)

IQSP-405 Smartphone calibration for crowd-sourced determination of the presence of cyanobacteria in water samples (Carpenter)

MOBMU-406 Development of a mobile deployable technical system for the secure and paperless exchange of information between general practitioners and doctors' practices out in the field and laboratories (Creutzburg)

MOBMU-407 Pokemon Go – Bibliographic review, security and privacy aspects, and forensic analysis (Creutzburg)

MOBMU-408 The strange world of keyloggers - An overview (Creutzburg)

PMII-245 Texture enhancement via high-resolution style transfer for single-image super-resolution (Ahn)

PMII-409 Multispectral, high dynamic range, time domain continuous imaging (Dietz)

SD&A-410 Computer-generated holography method based on orthographic projection using depth camera (Piao)

SD&A-411 Full-parallax and high-quality multiview 3D image acquisition method using camera slider (Kim)

SD&A-412 Projection type light field display using undulating screen (Kajimoto)

SD&A-413 Study of eye tracking type super multi-view display using time division multiplexing (Yendo)

VIPC-414 An interrupted projection using seam carving for 360-degree images (Tsubaki)

Thursday, February 1, 2018

8:50 am

PMII-415 Advances in automotive image sensors (Fowler)

9:10 am

COLOR-416 New gamut boundary target for defining the colour gamut of a printing system (Green)

ERVR-475 Surfing the wave of virtual reality and my cybercanoe (Leigh)

HVEI-531 Theoretically automated conversations: Collaborative artistic creativity for autonomous machines (López-González)

IMAWM-419 3D Shape Retrieval using volumetric and image convolutional neural networks: A meta-algorithmic approach (Shao)

9:30 am

COLOR-417 Media color adaptive gamma correction (Shin)

HVEI-539 Setting up the scene: The multisensory experience for VR (Miani)

IMAWM-420 A new fast template matching algorithm for object detection (Tang)

IMSE-422 Partial reset HDR image sensor with improved fixed pattern noise performance (Seliuchenko)

9:50 am

COLOR-418 Recent advances in detection and healing of streaks caused by dust in a sheetfed scanner (Kenzhebalin)

HVEI-532 Harnessing the power of 'visual' art to rapidly switch handedness in late adulthood: Neuroplasticity driven by drawing training (Likova)

IMAWM-375 A feature fusion strategy for human detection in omnidirectional camera imagery (Asari)

10:40 am

3DIPM-423 Blind mesh quality assessment based on convolutional neural network (El Hassouni)

COLOR-427 Color CLU-DBS halftoning based on Neugebauer primary area coverage: Improving the breed (Xi)

10:50 am

ERVR-432 Farmooo, a virtual reality farm simulation game designed for cancer pediatric patients to distract their pain during chemotherapy treatment (Tong)

HVEI-533 Art changes our way of cognitive and affective processing—But how to ecologically validly measure such processes? (Carbon)

IMAWM-443 Has mobile photography changed the users' behavior while ordering printed products? (Invited) (Fageth)

IMSE-438 Security imaging in an unsecure world (Johannesson)

IPAS-439 Color interpolation algorithm for the Sony-RGBW color filter array (Kim)

11:00 am

3DIPM-424 Stereo analysis by matching cliques of points (Bamidele)

COLOR-428 Monochrome hybrid, multilevel, halftone screen with unequal spatial resolution for a low-cost electrophotographic printer (Huang)

11:10 am

ERVR-433 Presence in virtual reality: Insights from fundamental and applied research (Mestre)

HVEI-534 Meaningful-engagements with online museum collections for children with chronic health conditions (Salomon)

IPAS-440 High dynamic range imaging with a single exposure-multiplexed image using smooth contour prior (Rouf)

11:20 am

3DIPM-425 Holostream: High-accuracy, high-speed 3D range video encoding and streaming across standard wireless networks (Bell)

COLOR-429 Novel color halftoning algorithm for ink savings (Jiang)

11:30 am

ERVR-434 From being there to feeling real: The effect of real world expertise and technology familiarity on presence in virtual environments (Parola)

HVEI-535 Mirroring the soul: Mirrors as the virtual reality of self-reflection in the history of art (Tyler)

IMAWM-444 Application of natural language processing to an online fashion marketplace (Norman)

IMSE-447 A near pixel depth from focus architecture for video rate depth estimation (Alacoque)

IPAS-441 Enhancement of underwater color images by two-side 2-D quaternion discrete Fourier transform (Grigoryan)

11:40 am

3DIPM-426 Synchronizing 3D point cloud from 3D scene flow estimation with 3D Lidar and RGB camera (Usami)

COLOR-430 Analysis of a visually significant bar code system based on circular coding (Sun)

11:50 am

ERVR-435 A neuroscientific approach to exploring fundamental questions in VR (Wade)

HVEI-536 Beurs' historical recipe and material perception of grapes in Dutch Golden Age still-lifes (Di Cicco)

IMAWM-445 Multimedia analytics platform for profiling keywords embedded in photo catalogues (Pallotti)

IMSE-448 Mobile GPU implementation of wide dynamic range image compression based on multi-scale histogram synthesis (Yang)

PMII-442 Automatic tuning method for camera denoise and sharpness based on perception model (Xi)

12:00 pm

COLOR-431 UV watermarking of images in clustered dot scenarios (Eschbach)

12:10 pm

ERVR-437 Exploring landscapes and their implications for virtual reality (Dolinsky)

HVEI-537 Saliency-based artistic abstraction with deep learning and regression trees (JIST-first) (Shakeri)

IMAWM-446 Use of color information in the analysis of fashion photographs (Li)

2:00 pm

3DIPM-460 An accurate and robust algorithm for tracking guitar neck in 3D based on modified RANSAC homography (Wang)

ERVR-449 Experiencing a slice of the sky: Immersive rendering and sonification of Antarctic astronomy data (West)

HVEI-538 Capturing reality (Jenison)

IMAWM-453 Semantic pose machines (Invited) (Savakis)

IMSE-456 Using wavelets to analyze RTS noise in irradiated CMOS image sensors (Hendrickson)

2:20 pm

3DIPM-461 Skeleton-based dynamic hand gesture recognition using 3D depth data (Zhao)

ERVR-450 Continuous-motion text input in virtual reality (Schulze)

IMSE-457 Lag-induced image artifacts in still imaging with CIS (Anzagira)

2:40 pm

ERVR-451 Recording and mobile virtual reality exploration of 3D-localized sensor data (Sommer)

IMAWM-454 Learning enhancement with mobile augmented reality (Shipway)

IMSE-458 Two calibration methods to improve the linearity of a CMOS image sensor (Wang)

IPAS-462 Combining local and global optical flow for RGB-D point cloud alignment (Ho)

3:00 pm

ERVR-452 Seeing the past: An augmented reality application for visualization the previous state of cultural heritage locations (Siekanski)

IMAWM-455 Person segmentation using convolutional neural networks with dilated convolutions (Ho)

IMSE-459 Characterization of discrete 2D-MTF using physical optics (Lenchenkov)

IPAS-463 Discrimination of active dynamic objects in stereo-based visual SLAM (Gotchev)

3:20 pm

IPAS-464 Error correction for time-of-flight images using validity classification (Song)

3:40 pm

3DIPM-465 How to capture aesthetic features of complex cultural heritage objects – active illumination data fusion (Maczkowski)

3:50 pm

ERVR-468 Evaluating commodity hardware and software for virtual reality assembly training (Kohl)

IMAWM-466 Deep learning for moving object detection from a single camera in UAVs (Invited) (Ye)

4:10 pm

ERVR-469 An authoring system for VR-based firefighting commanders training (Conci)

4:30 pm

ERVR-470 Analysis of video image based element for motion sickness (Lee)

IMAWM-337 Logo detection and recognition with synthetic images (Montserrat)

3D Image Processing, Measurement (3DIPM), and Applications 2018

Conference overview

Scientific and technological advances during the last decade in the fields of image acquisition, processing, telecommunications, and computer graphics have contributed to the emergence of new multimedia, especially 3D digital data. Nowadays, the acquisition, processing, transmission, and visualization of 3D objects are a part of possible and realistic functionalities over the internet. Confirmed 3D processing techniques exist and a large scientific community works hard on open problems and new challenges, including 3D data processing, transmission, fast access to huge 3D databases, or content security management.

The emergence of 3D media is directly related to the emergence of 3D acquisition technologies. Indeed, recent advances in 3D scanner acquisition and 3D graphics rendering technologies boost the creation of 3D model archives for several application domains. These include archaeology, cultural heritage, computer assisted design (CAD), medicine, face recognition, video games, and bioinformatics. New devices such as time-of-flight cameras open challenging new perspectives on 3D scene analysis and reconstruction.

Three-dimensional objects are more complex to handle than other multimedia data, such as audio signals, images, or videos. Indeed, only a unique and simple 2D grid representation is associated to a 2D image. All the 2D acquisition devices generate this same representation (digital cameras, scanners, 2D medical systems). Unfortunately (for the users), but fortunately (for scientists), there exist different 3D representations for a 3D object. For example, an object can be represented on a 3D grid (digital image) or in 3D Euclidian space. In the latter, the object can be expressed by a single equation (like algebraic implicit surfaces), by a set of facets representing its boundary surface, or by a set of mathematical surfaces. One can easily imagine the numerous open problems related to these different representations and their processing, a new challenge for the image processing community.

Awards: Best Paper Award and Best Student Paper given to the author(s) of two full papers presented at the conference, selected by the Organizing Committee.

3D Image Processing, Measurement (3DIPM), and Applications 2018

Wednesday, January 31, 2018

10:00 am – 4:00 pm Industry Exhibition

Depth Sensing Joint Session

Session Chair: Calvin Chao, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

10:50 – 11:50 am
Cypress A

This session is jointly sponsored by: Image Sensors and Imaging Systems 2018, and 3D Image Processing, Measurement (3DIPM), and Applications 2018.

10:50 IMSE-325
Mobile 3D imaging using handheld lens array sheet and single camera, *Shoaib Soomro[1], Osman Eldes[1], Kaan Aksit[2], and Hakan Urey[1]; [1]Koç University (Turkey) and [2]Nvidia Research (United States)*

11:10 IMSE-326
A distance measurement method using a time-of-flight CMOS range image sensor with 4-tap output pixels and multiple time-windows, *Kohei Yamada, Akihito Komazawa, Taishi Takasawa, Keita Yasutomi, Keiichiro Kagawa, and Shoji Kawahito, Shizuoka University (Japan)*

11:30 IMSE-327
3D CMOS image sensor based on white pixel with off-center rectangular apertures, *Byoung-Soo Choi[1], Sang-Hwan Kim[1], Jimin Lee[1], Chang-Woo Oh[1], Seunghyuk Chang[2], JongHo Park[2], Sang-Jin Lee[2], and Jang-Kyoo Shin[1]; [1]Kyungpook National University and [2]Center for Integrated Smart Sensors (Republic of Korea)*

11:50 am – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

10:10 – 10:40 am Coffee Break

3D Data Processing

Session Chairs: William Puech, University of Montpellier (France) and Robert Sitnik, Warsaw University of Technology (Poland)

10:40 am – 12:00 pm
Regency C

10:40 3DIPM-423
Blind mesh quality assessment based on convolutional neural network, *Ilyass Abouelaziz[1], Aladine Chetouani[2], and Mohamed El Hassouni[1]; [1]LRIT, Mohamed V University (Morocco) and [2]University of Orléans (France)*

11:00 3DIPM-424
Stereo analysis by matching cliques of points, *Frederick Stentiford and Ade Bamidele, University College London (United Kingdom)*

11:20 3DIPM-425
Holostream: High-accuracy, high-speed 3D range video encoding and streaming across standard wireless networks, *Tyler Bell, Jan Allebach, and Song Zhang, Purdue University (United States)*

11:40 3DIPM-426
Synchronizing 3D point cloud from 3D scene flow estimation with 3D Lidar and RGB camera, *Hiroki Usami[1], Hideo Saito[1], Jun Kawai[2], and Noriko Itani[2]; [1]Keio University and [2]Fujitsu Laboratories Ltd. (Japan)*

12:00 – 2:00 pm Lunch

3D Scene Sensing and Object Recording Joint Session

Session Chairs: William Puech, University of Montpellier (France) and Robert Sitnik, Warsaw University of Technology (Poland)

2:00 – 4:00 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: 3D Image Processing, Measurement (3DIPM), and Applications 2018, and Image Processing: Algorithms and Systems XVI.

2:00 3DIPM-460
An accurate and robust algorithm for tracking guitar neck in 3D based on modified RANSAC homography, *Zhao Wang and Jun Ohya, Waseda University (Japan)*

2:20 3DIPM-461
Skeleton-based dynamic hand gesture recognition using 3D depth data, *Dan Zhao, Beijing Institute of Technology (China)*

2:40 IPAS-462
Combining local and global optical flow for RGB-D point cloud alignment, *Sunho Kim and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:00 IPAS-463
Discrimination of active dynamic objects in stereo-based visual SLAM, *Ihtisham Ali, Olli Suominen, and Atanas Gotchev, Tampere University of Technology (Finland)*

3:20 IPAS-464
Error correction for time-of-flight images using validity classification, *Yunseok Song and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:40 3DIPM-465
How to capture aesthetic features of complex cultural heritage objects – active illumination data fusion, *Grzegorz Maczkowski[1], Eryk Bunsch[2], and Jakub Krzeslowski[1]; [1]Warsaw University of Technology and [2]King Jan III Museum Palace at Wilanow (Poland)*

Autonomous Vehicles and Machines 2018

Conference overview

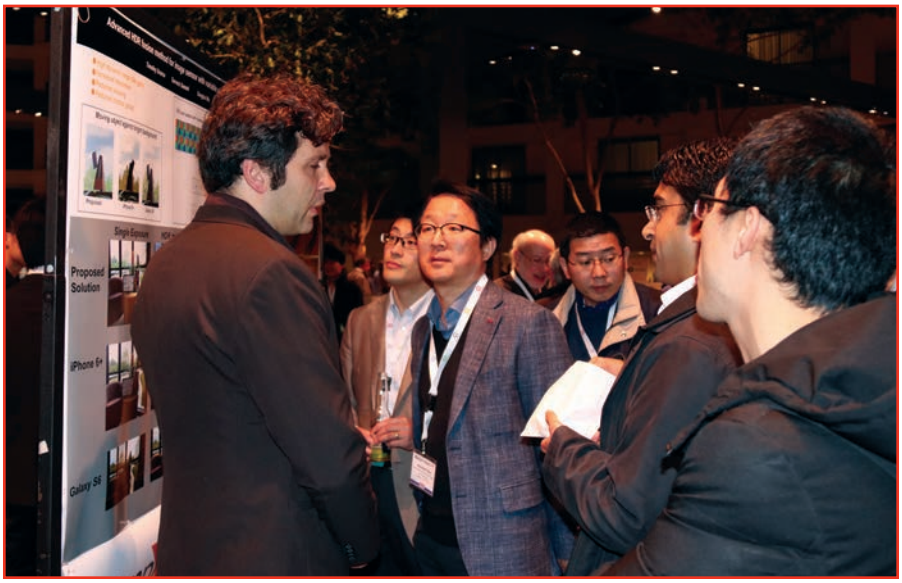
Advancements in sensing, computing, imaging processing, and computer vision technologies are enabling unprecedented growth and interest in autonomous vehicles and intelligent machines, from self-driving cars to unmanned drones to personal service robots. These new capabilities have the potential to fundamentally change the way people live, work, commute, and connect with each other and will undoubtedly provoke entirely new applications and commercial opportunities for generations to come.

The inaugural conference on Autonomous Vehicles and Machines (AVM) was successfully launched in 2017 at EI. In 2018, we will consider a broad range of topics as it relates to equipping vehicles and machines with the capacity to perceive dynamic environments, inform human participants, demonstrate situational awareness, and make unsupervised decisions on self-navigating. The conference seeks high-quality papers featuring novel research in areas intersecting sensing, imaging, vision and perception with applications including, but not limited to, autonomous cars, ADAS (advanced driver assistance system), drones, robots, and industrial automation. AVM welcomes both academic researchers and industrial experts to join the discussion. In addition to the main technical program, AVM will include interactive sessions / open forum between AVM speakers, committee members and conference participants.

Award

Best Paper Award given to the author(s) of a proceedings paper presented at the conference, selected by the Organizing Committee.

Conference Sponsor



Autonomous Vehicles and Machines 2018

Monday January 29, 2018

Automotive Camera Image Quality I Joint Session

Session Chairs: Stuart Perry, University of Technology Sydney (Australia) and Buyue Zhang, Intel Corporation (United States)

8:50 – 10:20 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

8:50 AVM-105
Fundamental imaging system analysis for autonomous vehicles, *Robin Jenkin, Nvidia Corp. (United States)*

9:20 AVM-106
Optimizing automotive cameras for image quality, *Felix Heide and Dave Tokic, Algolux (Canada)*

9:40 IQSP-107
Color calibration of digital still cameras used on unmanned aerial vehicles, *Susan Farnand, Rochester Institute of Technology (United States)*

10:00 IQSP-108
No reference prediction of quality metrics for H.264 compressed infrared image sequences for UAV applications, *Kabir Hossain, Claire Mantel, and Soren Forchhammer, Technical University of Denmark (Denmark)*

10:20 – 10:50 am Coffee Break

Automotive Camera Image Quality II Joint Session

Session Chairs: Luke Cui, Amazon (United States) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

10:50 AVM-145
P2020 - standard for automotive system image quality, *Patrick Denny, Valeo Vision Systems (Ireland)*

11:20 AVM-146
LED flicker: Root cause, impact and measurement for automotive imaging applications, *Brian Deegan, Valeo Vision Systems (Ireland)*

11:40 AVM-147
Visual quality evaluation of the multi-camera visualization in automotive surround view systems, *Vladimir Zlokolica[1,2], Mark Griffin[1], Aidan Casey[1], Daniela Solera[1], Brian Deegan[1], Patrick Denny[1], and Barry Dever[1]; [1]Valeo Vision Systems (Ireland) and [2]University of Novi Sad (Serbia)*

12:00 AVM-148
Detection probabilities: Performance prediction for sensors of autonomous vehicles, *Marc Geese, Ulrich Seger, and Alfredo Paolillo, Robert Bosch GmbH - Leonberg (Germany)*

12:20 AVM-149
Realistic image degradation with a measured PSF, *Christian Wittpahl, Hatem Ben Zakour, Matthias Lehmann, and Alexander Braun, Düsseldorf University of Applied Sciences (Germany)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Simulation for Autonomous Vehicles and Machines Joint Session

Session Chairs: Peter Catrysse, Stanford Univ. (United States); Patrick Denny, Valeo Vision System (Ireland); and Darnell Moore, Texas Instruments (United States)

3:30 – 4:50 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Photography, Mobile, and Immersive Imaging 2018.

3:30 PMII-161
Image systems simulation for automotive intelligence, *Henryk Blasinski, Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

3:50 AVM-162
Large scale collaborative autonomous vehicle simulation on smartphones, *Andras Kemeny[1,2], Emmanuel Icart[3], and Florent Colombet[2]; [1]Arts et Métiers ParisTech, [2]Renault-Nissan, and [3]Scale-1 Portal (France)*

4:10 AVM-163
Assessing the correlation between human driving behaviors and fixation patterns, *Mingming Wang and Susan Farnand, Rochester Institute of Technology (United States)*

4:30 AVM-164
Virtual simulation platforms for automated driving: Key care-abouts and usage model, *Prashanth Viswanath, Mihir Mody, Soyeb Nagori, Jason Jones, and Hrushikesh Garud, Texas Instruments India Ltd. (India)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Keynote: Future with Autonomous Vehicles
Session Chair: Buyue Zhang, Intel Corporation (United States)
9:10 – 10:10 am
Grand Peninsula Ballroom BC

AVM-198
Lyft's approach to autonomous vehicles, *Luc Vincent, Lyft, Inc. (United States)*

Dr. Luc Vincent is vice president of engineering at Lyft, where he leads the company's Marketplace & Autonomous Platform division. His responsibilities include real-time supply and demand matching, real-time pricing, mapping, and also Lyft's "Level 5" group, focused on Self-Driving Technology. Prior to Lyft, he spent 12 years at Google, most recently as Sr Director of Engineering, leading all imagery-related activities of Google's Geo group. His team of engineers, product managers, program managers, and operations experts was responsible for collecting ground-based, aerial, and satellite imagery at global scale and through computer vision, 3D modeling, and deep learning, make it universally accessible and useful to users around the world - from end-users on a mobile phone to geo scientists researching climate change. Dr. Vincent is recognized in particular for having bootstrapped Street View and turned it into an iconic Google product, available in over 80 countries around the globe. He earned his BS from Ecole Polytechnique (France), MS in computer science from University of Paris XI, and PhD in mathematical morphology from Ecole des Mines de Paris. In addition, he was a postdoctoral fellow in the Division of Applied Sciences of Harvard University.

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:40 pm Coffee Break

Keynote: Mapping and Localization
Session Chair: Buyue Zhang, Intel Corporation (United States)
10:40 – 11:40 am
Grand Peninsula Ballroom BC

AVM-216
Scalable autonomous vehicle mapping and localization on the edge, *Sravan Puttagunta, Civil Maps (United States)*

Sravan Puttagunta is a co-founder and chief executive officer of Civil Maps, an autonomous vehicle technology company that enables cars to have Cognition through AI, 3D mapping, advanced localization, and crowdsourcing. As CEO, he is executing on a vision for safer, smarter, fully autonomous driving. With his direction, Civil Maps is on track to triple revenue from last year and is providing key technology to several major automakers. He leads the company's technology teams, who are developing innovative ways for cars to localize in six dimensions (6D) and crowdsource 3D maps at a continental scale. In his previous work, he invented video fingerprinting for linear broadcast TV to track viewing habits and developed software that runs in more than 160 million TVs. He has written substantial portions of artificial intelligence (AI) algorithms for cars which map the world in 3D. Puttagunta holds a master's in electrical engineering and computer science from the University of California, Berkeley.

Sensor Fusion

Session Chairs: Umit Batur, Rivian Automotive (United States) and Darnell Moore, Texas Instruments (United States)

11:40 am – 12:40 pm
Grand Peninsula Ballroom BC

11:40 AVM-256
Multi-sensor fusion for automated driving: Selecting model and optimizing on embedded platform, *Shyam Jagannathan, Mihir Mody, Jason Jones, Pramod Swami, and Deepak Poddar, Texas Instruments India Ltd. (India)*

12:00 AVM-257
Multi-sensor data fusion for vehicle detection in autonomous vehicle applications, *Xin Li[1], Abu Hasnat Mohammad Rubaiyat[1], Yaser Fallah[2], and Gaurav Bansal[3]; [1]West Virginia University, [2]University of Central Florida, and [3]Toyota (United States)*

12:20 AVM-258
Camera radar fusion for increased reliability in ADAS applications, *Ziguo Zhong, Stanley Liu, Manu Mathew, and Aish Dubey, Texas Instruments (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Mapping and Localization

Session Chairs: Umit Batur, Rivian Automotive (United States) and Patrick Denny, Valeo Vision System (Ireland)

3:30 – 5:20 pm
Grand Peninsula Ballroom BC

3:30 AVM-280
VOLA large-scale volumetric data for map-building, navigation, autonomy, and machine intelligence at global scale, *David Moloney, Movidius (Intel) (Ireland)*

4:00 AVM-281
Visual SLAM and localization – the hard cases, *Catherine Enright and Bassam Abdallah, Valeo Vision Systems (Ireland)*

4:20 AVM-282
Dense surround view computation with perspective correctness, *Christian Fuchs and Dietrich Paulus, University of Koblenz-Landau (Germany)*

4:40 AVM-283
Vehicle pose estimation from drive recorder images by monocular SLAM and matching with rendered 3D point cloud of surrounding environment, *Akiyoshi Kurobe[1], Hideo Saito[1], and Hisashi Kinoshita[2]; [1]Keio University and [2]DENSO Corporation (Japan)*

5:00 AVM-284
Loop closure detection in simultaneous localization and mapping using learning based local patch descriptor, *Dong-won Shin and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Robotic Vision Techniques for Navigation and Vision I JOINT SESSION

Session Chairs: Patrick Denny, Valeo Vision System (Ireland) and Darnell Moore, Texas Instruments (United States)

8:50 – 10:10 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

8:50 IRIACV-301
Reliable primitive approximation for estimation of robot grasping parameters using 3D-deep neural network, *Takuya Torii and Manabu Hashimoto, Chukyo University (Japan)*

9:10 IRIACV-302
Real-time visual loop closure detection for unmanned aerial vehicles, *Semih Karakaya[1], Can Erhan[1], Evangelos Sariyanidi[2], and Hakan Temeltas[1]; [1]Istanbul Teknik Üniversity (Turkey) and [2]Queen Mary University of London (United Kingdom)*

9:30 AVM-303
Semantic image segmentation using Encoder-Decoder Architecture Assisted by Global and Local Attention Models (EDA-GLAM), *Hao Xu, Siyang Li, and Chun-Chieh Kuo, Univeristy of Southern California (United States)*

9:50 AVM-304
A method for reducing the false positives in power line detection, *Alexander Cerón, University Militar Nueva Granada (Colombia)*

10:00 am – 4:00 pm Industry Exhibition

10:10 – 10:50 pm Coffee Break

Robotic Vision Techniques for Navigation and Vision II JOINT SESSION

Session Chairs: Patrick Denny, Valeo Vision System (Ireland) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

10:50 AVM-345
Pedestrian detection at night using deep neural networks and saliency maps (JIST-first), *Duyoung Heo, EunJu Lee, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:10 AVM-346
Context aware hyperspectral scene analysis, *Christian Winkens and Dietrich Paulus, University of Koblenz-Landau (Germany)*

11:30 AVM-347
Multiple pedestrian tracking in moving vehicle using online learning of random ferns and feature descriptor of pre-trained shallow convolutional neural networks, *SangJun Kim, Jaeyeal Nam, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:50 AVM-348
Raindrop detection considering extremal regions and salient features, *Vijay C S, Radhesh Bhat, and Vijaya Ragavan, PathPartner Technology Pvt Ltd. (India)*

12:10 AVM-349
Removing shadows and shading from road surfaces in real time, *Bruce Maxwell and Casey Smith, Tandent Vision Science, Inc. (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

System, Imaging, and Vision Architecture

Session Chairs: Patrick Denny, Valeo Vision System (Ireland) and Darnell Moore, Texas Instruments (United States)

3:30 – 4:10 pm
Grand Peninsula Ballroom BC

3:30 AVM-358
Understanding vehicle E/E architecture topologies for automated driving: System partitioning and tradeoff parameters, *Mihir Mody, Jason Jones, Kedar Chitnis, Rajat Sagar, Gregory Shurtz, Yashwant Dutt, Manoj Koul, Biju Mg, and Aish Dubey, Texas Instruments India Ltd. (India)*

3:50 AVM-359
Camera-aware neural architecture for robust automotive vision, *Felix Heide and Dave Tokic, Algolux (Canada)*

Discussion: Autonomous Vehicles and Machines 2018
Moderators: Patrick Denny, Valeo Vision System (Ireland); Darnell Moore, Texas Instruments (United States); and Buyue Zhang, Intel Corporation (United States)
4:10 – 5:30 pm
Grand Peninsula Ballroom BC

The conference chairs invite AVM authors and participants to join an interactive session to discuss questions in a moderated open forum.

4:10
Autonomous Vehicles and Machines Authors Q&A

5:00
Open Discussion

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Keynote: Imaging Sensors and Technologies for Automotive Intelligence Joint Session
Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Joyce Farrell, Stanford University (United States); and Darnell Moore, Texas Instruments (United States)
8:50 – 9:30 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

PMII-415
Advances in automotive image sensors, *Boyd Fowler[1] and Johannes Solhusvik[2]; [1]OmniVision Technologies (United States) and [2]OmniVision Technologies Europe Design Center (Norway)*

Dr. Boyd Fowler joined OmniVision in December 2015 as the vice president of marketing and was appointed chief technology officer in July 2017. Dr. Fowler's research interests include CMOS image sensors, low noise image sensors, noise analysis, data compression, and machine learning and vision. Prior to joining OmniVision, he was co-founder and vice president of engineering at Pixel Devices, where he focused on developing high-performance CMOS image sensors. After Pixel Devices was acquired by Agilent Technologies, Dr. Fowler was responsible for advanced development of commercial CMOS image sensor products. In 2003, Dr. Fowler joined Fairchild Imaging as the CTO and vice president of technology, where he developed SCMOS image sensors for high-performance scientific applications. After Fairchild Imaging was acquired by BAE Systems, Dr. Fowler was appointed the technology director of the CCD/CMOS image sensor business. He has authored numerous technical papers, book chapters, and patents. Dr. Fowler received his MSEE and PhD in electrical engineering from Stanford University (1990 and 1995 respectively).

Imaging Sensors and Technologies for Automotive Intelligence Joint Session

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Patrick Denny, Valeo Vision System (Ireland); and Joyce Farrell, Stanford University (United States)

9:30 – 9:50 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

9:30 IMSE-422
Partial reset HDR image sensor with improved fixed pattern noise performance, *Volodymyr Seliuchenko[1,2], Sharath Patil[1,3], Marcelo Mizuki[1], Saad Ahmad[1], and Maarten Kuijk[2]; [1]Melexis (Belgium), [2]Vrije University Brussel (Belgium), and [3]University of Massachusetts Lowell (United States)*

Autonomous Vehicles and Machines Open Discussion
Moderators: Patrick Denny, Valeo Vision System (Ireland); Darnell Moore, Texas Instruments (United States); and Buyue Zhang, Intel Corporation (United States)
9:50 – 10:30 am
Grand Peninsula Ballroom BC

The conference chairs invite AVM committee members, authors, and conference participants to join an interactive session to discuss various topics in this open forum. Please join us in building the AVM community.

Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications

Conference overview

Color imaging has historically been treated as a constant phenomenon well described by three independent parameters. Recent advances in computational resources and in the understanding of the human aspects are leading to new approaches that extend the purely metrological view towards a perceptual view of color in documents and displays. Part of this perceptual view is the incorporation of spatial aspects, adaptive color processing based on image content, and the automation of color tasks, to name a few. This dynamic nature applies to all output modalities, e.g., hardcopy devices, but to an even larger extent to soft-copy displays.

Spatially adaptive gamut and tone mapping, dynamic contrast, and color management continue to support the unprecedented development of the display hardware spreading from mobile displays to large size screens and emerging technologies. This conference provides an opportunity for presenting, as well as getting acquainted, with the most recent developments in color imaging researches, technologies, and applications. Focus of the conference is on color basic research and testing, color image input, dynamic color image output and rendering, color image automation, emphasizing color in context and color in images, and reproduction of images across local and remote devices.

The conference covers also software, media, and systems related to color. Special attention is given to applications and requirements created by and for multidisciplinary fields involving color and/or vision.

Astro Photography Highlight

On Tuesday, Color Imaging XXIII hosts a series of four sessions on Imaging and Astronomy. Of particular note, Professor Joel Primack presents insights into his work using supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies under various assumptions, and comparing the predictions of these theories to the latest observational data. The morning session in this series will include presentation of selected images from NASA's library of astrophotographic images.

Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications

Monday January 29, 2018

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Surface Appearance Modeling and Reproduction JOINT SESSION

Session Chairs: Reiner Eschbach, Norwegian University of Science and Technology (Norway) and Monroe Community College (United States) and Mathieu Hebert, Université Jean Monnet de Saint Etienne (France)

3:30 – 4:50 pm
Cypress A

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Material Appearance 2018.

3:30 MAAP-165
Color prediction based on individual characterizations of the ink layers and print support, *Théo Phan Van Song[1,2], Christine Andraud[2], Luis Sapaico[1], and Maria Ortiz Segovia[1]; [1]Océ Print Logic Technologies — Canon Group and [2]Museum National d'Histoire Naturelle (France)*

3:50 MAAP-166
Light interreflections and shadowing effects in a Lambertian V-cavity under diffuse illumination, *Dorian Saint-Pierre[1], Rada Deeb[1], Damien Muselet[1], Lionel Simonot[1,2], and Mathieu Hebert[1]; [1]Université Jean Monnet de Saint Etienne and [2]Institut Pprime (France)*

4:10 MAAP-167
Interactive RGB transparency: A color rendering tool for superimposed translucent layers in digital images, *Lionel Simonot[1,2] and Mathieu Hebert[3]; [1]Institut Pprime, [2]Laboratoire Hubert Curien, and [3]Université Jean Monnet de Saint Etienne (France)*

4:30 MAAP-168
General method for estimating fluorescent Donaldson matrices, *Shoji Tominaga, Keita Hirai, and Takahiko Horiuchi, Chiba University (Japan)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 pm Women in Electronic Imaging Breakfast

Color & Displays

Session Chair: Gabriel Marcu, Apple Inc. (United States)

8:50 – 10:10 am
Cypress B

8:50 COLOR-185
High-quality imaging micro-LED display based on quantum dot CSP technology, *Dae-Sik Kim and Sung-Yeol Kim, Samsung Electronics (Republic of Korea)*

9:10 COLOR-186
Color and quality enhancement of whiteboard contents for videoconferencing applications, *Carlos Andrés Arango, Mekides Abebe, Muhammad Shahid, and Jon Yngve Hardeberg, Norwegian University of Science and Technology (Norway)*

9:30 COLOR-187
Optical characterization of the emissive properties of HDR/WCG displays using ICtCp color space and Fourier optics viewing angle instruments, *Pierre Boher[1], Thierry Leroux[1], and Pierre Blanc[2]; [1]ELDIM and [2]Laboratoires d'Essai de la FNAC (France)*

9:50 COLOR-188
Visibility of natural background overlapped with on–screen contents of transparent displays, *Choon-Woo Kim[1], Chang-Mo Yang[1], and Dong-Hyeok Lee[2]; [1]Inha University and [2]LG Display (Republic of Korea)*

10:00 AM – 7:30 pm Industry Exhibition

10:10 – 10:40 am Coffee Break

Imaging and Astronomy Morning Session

Session Chair: Daniele Marini, Università degli Studi di Milano (Italy)

10:40 AM – 12:40 pm
Cypress B

10:40 COLOR-221
Color characterization methods for a multispectral camera, *Haris Ahmad Khan[1,2] and Phil Green[1]; [1]Norwegian University of Science and Technology (Norway) and [2]University de Bourgogne (France)*

11:00 COLOR-222
NASA's astronomy picture of the day: Popular and innovative images in modern astrophotography, *Robert Nemiroff[1] and Jerry Bonnell[2]; [1]Michigan Technological University and [2]NASA's GSFC (United States)*

11:40 COLOR-223
Evaluation for faithful reproduction of star fields in a planetarium (JIST-first), *Midori Tanaka[1], Takahiko Horiuchi[1], Ken'ichi Otani[2], and Po-Chieh Hung[3]; [1]Chiba University, [2]Konica Minolta Planetarium Co., Ltd., and [3]Ex-Konica Minolta, Inc. (Japan)*

12:00 COLOR-224
Distributed fast radio burst detection: Algorithm and application, *Stephen Itschner, Xin Li, and Kevin Bandura, West Virginia University (United States)*

12:20 COLOR-225
Can Pop-Tart® wrappers be used to make safe eclipse glasses?, *Katherine Carpenter and Susan Farnand, Rochester Institute of Technology (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 am Coffee Break

Keynote: Imaging and Astronomy, Prof. Joel Primack Joint Session
Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Kurt Niel, University of Applied Sciences Upper Austria (Austria)
3:30 – 4:30 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

COLOR-259
Computer vision and deep learning applied to simulations and imaging of galaxies and the evolving universe, *Joel Primack, University of California, Santa Cruz (United States)*

The keynote speaker is Dr. Joel R. Primack, Distinguished Professor of Physics Emeritus, University of California, Santa Cruz. Dr. Primack specializes in the formation and evolution of galaxies and the nature of the dark matter that makes up most of the matter in the universe. After helping to create what is now called the "Standard Model" of particle physics, Dr. Primack began working in cosmology in the late 1970s, and he became a leader in the new field of particle astrophysics. His 1982 paper proposed that a natural candidate for the dark matter is the lightest supersymmetric particle, still perhaps the leading candidate. He is one of the principal originators and developers of the theory of Cold Dark Matter, which has become the basis for the standard modern picture of structure formation in the universe. With support from NASA, NSF, and DOE, he has been using supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies under various assumptions, and comparing the predictions of these theories to the latest observational data. He organized and led the University of California systemwide Center for High-Performance Astro-Computing, 2010-2015. Dr. Primack was one of the main advisors for the Smithsonian Air and Space Museum's 1996 IMAX film Cosmic Voyage, and he has worked with leading planetariums to help make the invisible universe visible.

Imaging and Astronomy Afternoon Session Joint Session

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Alessandro Rizzi, Università degli Studi di Milano (Italy)

4:30 – 5:10 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

4:30 COLOR-285
About color correction in astrophotography, *Alessandro Rizzi, Daniele Marini, and Cristian Bonanomi, Università degli Studi di Milano (Italy)*

4:50 SD&A-286
TileViz: Tile visualization for astro-chemistry, *Martial Mancip[1], Riccardo Spezia[1,2], Yannick Jeanvoine[2], and Cécile Balsier[1]; [1]CNRS and [2]Université d'Evry Val d'Essonnes (France)*

Imaging and Astronomy Discussion JOINT SESSION
Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Daniele Marini, Università degli Studi di Milano (Italy)

5:10 – 5:30 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday January 31, 2018

Color Modeling Applications

Session Chair: Phil Green, Norwegian University of Science and Technology (Norway)

8:50 – 9:50 am
Cypress B

8:50 COLOR-295
Illuminant color estimation in an image under several illuminants based on gray-world assumption, *Harumi Kawamura, Salesian Polytechnic (Japan)*

9:10 COLOR-296
Explanation of color lines based on a simple color image model, *Megan Fuller and Jae Lim, Massachusetts Institute of Technology (United States)*

9:30 COLOR-297
Detection of color fading in printed customer content, *Zuguang Xiao[1], Shaoyuan Xu[1], Eric Maggard[2], Mark Shaw[2], Katie Morse[2], and Jan Allebach[1]; [1]Purdue University and [2]HP Inc. (United States)*

10:00 AM – 4:00 pm Industry Exhibition

10:10 – 10:40 am Coffee Break

Color Appearance

Session Chair: Reiner Eschbach, Norwegian University of Science and Technology (Norway) and Monroe Community College (United States)

10:40 AM – 11:40 am
Cypress B

10:40 COLOR-321
Near-Infrared fusion for photorealistic image dehazing, *Frederike Dümbgen, Majed El Helou, Natalija Gucevska, and Sabine Süsstrunk, Ecole Polytechnique Fédérale de Lausanne (Switzerland)*

11:00 COLOR-323
Color appearance processing using iccMAX, *Phil Green[1], Max Derhak[2], Michele Conni[1], and Wei-Chun Hung[3]; [1]Norwegian University of Science and Technology (Norway), [2]Onyx Graphics (United States), and [3]National Taiwan University of Science and Technology (Taiwan)*

11:20 COLOR-324
Chromaticity matrix to tristimulus matrix conversion for RGB color spaces – even in the dark, *J. A. Stephen Viggiano, Nitin Sampat, and Nanette Salvaggio, Rochester Institute of Technology (United States)*

11:40 am – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Multispectral Analysis

Session Chair: Ivar Farup, Norwegian University of Science and Technology (Norway)

3:30 – 4:50 pm
Cypress B

3:30 COLOR-361
Assessing the useful of similarity measures for multispectral face recognition, *Mamadou Diarra[1,2], Pierre Gouton[1], and Jerome Kablan Adou[2]; [1]Univ. de Bourgogne (France) and [2]Université Félix Houphouet Boigny (Côte d'Ivoire)*

3:50 COLOR-362
Comparative study of biorthogonal wavelets accuracy in demosaicing algorithm based on wavelet analysis of luminance component, *Norbert Hounsou[1], Amadou Tidjani Sanda Mahama[2,3], Pierre Gouton[3], and Jean-Baptiste Thomas[3]; [1]University de Abomey-Calavi (Benin), [2]Institut de Mathématiques et de Sciences Physiques (Benin), and [3]University de Bourgogne (France)*

4:10 COLOR-363
Optimal color multiplexing for the low-cost structured light 3D capture system with two projectors, *Yang Lei[1] and Jan Allebach[2]; [1]HP Labs and [2]Purdue University (United States)*

4:30 COLOR-364
Colorful insights supporting the modeling of creative processes across language, music, and emotion, *Fritz Lebowsky[1] and Mónica López-González[2]; [1]STMicroelectronics (France) and [2]La Petite Noiseuse Productions (United States)*

Color Discussion
4:50 – 5:30 pm
Cypress B

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday February 1, 2018

Color Gamuts and More

Session Chair: Robert Ulichney, HP Labs, HP Inc. (United States)

9:10 – 10:10 am
Cypress B

9:10 COLOR-416
New gamut boundary target for defining the colour gamut of a printing system, *W. Craig Revie[1] and Phil Green[2]; [1]FFEI Ltd. (United Kingdom) and [2]Norwegian University of Science and Technology (Norway)*

9:30 COLOR-417
Media color adaptive gamma correction, *Jaemin Shin, Hyunsoo Oh, Kyeongman Kim, and Seong-Wook Han, S-Printing Solutions (Republic of Korea)*

9:50 COLOR-418
Recent advances in detection and healing of streaks caused by dust in a sheetfed scanner, *Daulet Kenzhebalin[1], Ni Yan[1], Peter Bauer[2], Jerry Wagner[2], and Jan Allebach[1]; [1]Purdue University and [2]HP Inc. (United States)*

10:10 – 10:40 am Coffee Break

Halftoning, Watermarking, Barcodes

Session Chair: Robert Ulichney, HP Labs, HP Inc. (United States)

10:40 am – 12:20 pm
Cypress B

10:40 COLOR-427
Color CLU-DBS halftoning based on Neugebauer primary area coverage: Improving the breed, *Weijuan Xi[1], Tal Frank[2], Ben-Shoshan Yotam[2], Robert Ulichney[3], and Jan Allebach[1]; [1]Purdue University (United States), [2]HP Indigo Division (Israel), and [3]HP Labs, HP Inc. (United States)*

11:00 COLOR-428
Monochrome hybrid, multilevel, halftone screen with unequal spatial resolution for a low-cost electrophotographic printer, *Wan-Eih Huang[1], Tongyang Liu[1], Kurt Bengtson[2], and Jan Allebach[1]; [1]Purdue University and [2]HP Inc. (United States)*

11:20 COLOR-429
Novel color halftoning algorithm for ink savings, *Wanling Jiang[1], Alex Veis[2], Yuval Ekstein[2], Robert Ulichney[3], and Jan Allebach[1]; [1]Purdue University, [2]HP Scitex Industrial Presses (Israel), and [3]HP Labs, HP Inc. (United States)*

11:40 COLOR-430
Analysis of a visually significant bar code system based on circular coding, *Yufang Sun[1], Robert Ulichney[2], Matthew Gaubatz[2], Stephen Pollard[3], Steven Simske[2], and Jan Allebach[1]; [1]Purdue University, [2]HP Labs, HP Inc. (United States), and [3]HP Labs, United Kingdom (United Kingdom)*

12:00 COLOR-431
UV watermarking of images in clustered dot scenarios, *Vlado Kitanovski[1], Reiner Eschbach[1,2], Marius Pedersen[1], and Jon Yngve Hardeberg[1]; [1]Norwegian University of Science and Technology (Norway) and [2]Monroe Community College (United States)*

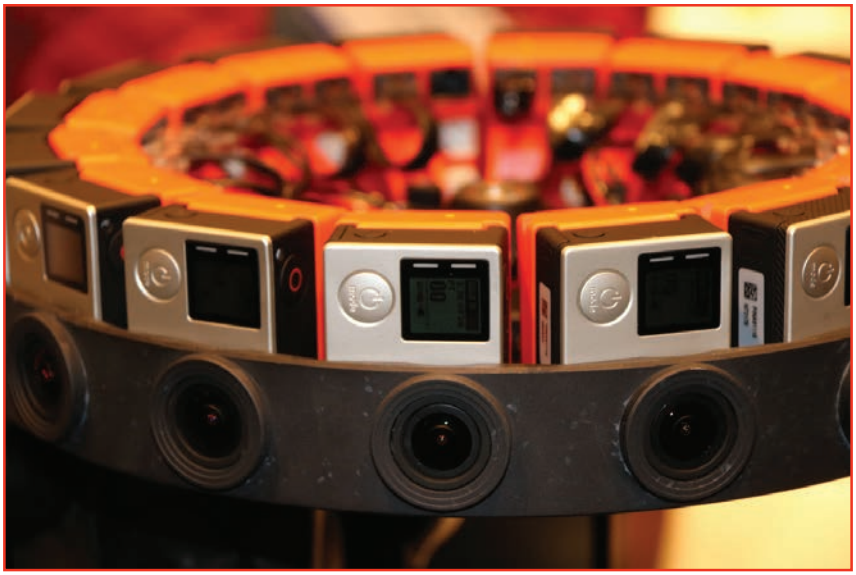
Computational Imaging XV

Conference overview

More than ever before, computers and computation are critical to the image formation process. 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 Session

This year Computational Imaging hosts a special session on Computational Imaging for Advanced Manufacturing. Presentations will cover such topics as advances in metallic 3D printing, neutron tomography, and more, presented by researchers at Oak Ridge National Laboratory and Wright-Patterson AFB.



Conference Chairs and Program Committee:
Charles A. Bouman, Purdue University (United States), and **Robert Stevenson,** University of Notre Dame (United States)

Computational Imaging XV

Monday January 29, 2018

Tomography

8:50 – 10:10 am
Harbour A-B

8:50 COIMG-101
Accelerating iterative image reconstruction via adaptive surrogate functions, *Ayan Mitra[1], David Politte[2], and Joseph O'Sullivan[1]; [1]Washington University in St. Louis and [2]Washington University School of Medicine (United States)*

9:10 COIMG-102
Distributed modular framework for fast iterative CT reconstruction, *Venkatesh Sridhar, Gregery Buzzard, and Charles Bouman, Purdue University (United States)*

9:30 COIMG-103
Ultrasonic model-based iterative reconstruction with spatially variant regularization for one-sided non-destructive evaluation, *Hani Almansouri[1], Singanallur Venkatakrishnan[2], Dwight Clayton[2], Yarom Polsky[2], Charles Bouman[1], and Hector Santos-Villalobos[2]; [1]Purdue University and [2]Oak Ridge National Laboratory (United States)*

9:50 COIMG-472
Deep learning based sinogram correction for metal artifacts reduction, *Muhammad Usman Ghani and W. Clem Karl, Boston University (United States)*

10:10 – 10:50 am Coffee Break

Smart Imaging

10:50 am – 12:30 pm
Harbour A-B

10:50 COIMG-130
Autonomous alpha matting using consensus equilibrium, *Stanley Chan[1], Xiran Wang[1], and Jason Juang[2]; [1]Purdue University and [2]HypeVR Inc. (United States)*

11:10 COIMG-131
SLADS-Net: Supervised learning approach for dynamic sampling using deep neural networks, *Yan Zhang[1], Dilshan Godaliyadda[2], Nicola Ferrier[1], Emine Gulsoy[3], Charles Bouman[2], and Charudatta Phatak[1]; [1]Argonne National Laboratory, [2]Purdue University, and [3]Northwestern University (United States)*

11:30 COIMG-132
A supervised learning approach for dynamic sampling in raman hyperspectral imaging, *Shijie Zhang[1], Zhengtian Song[1], Dilshan Godaliyadda[1], Dong Hye Ye[1], Atanu Sengupta[2], Gregery Buzzard[1], Charles Bouman[1], and Garth Simpson[1]; [1]Purdue University (United States) and [2]Dr. Reddy's Laboratory (India)*

11:50 COIMG-133
Data-driven compressed sensing tomography, *Marc Kassubeck[1], Stephan Wenger[1], Matthew Gomez[2], Eric Harding[2], Jens Schwarz[2], and Marcus Magnor[1]; [1]TU Braunschweig (Germany) and [2]Sandia National Laboratories (United States)*

12:10 COIMG-134
Feature engineering and explosive detection, *Parisa Babaheidarian and David Castañón, Boston University (United States)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Special Session on: Computational Imaging for Advanced Manufacturing JOINT SESSION

Session Chairs: Vincent Paquit and Hector Santos-Villalobos, Oak Ridge National Laboratory (United States)

3:30 – 5:10 pm
Harbour A-B

This session is jointly sponsored by: Computational Imaging XVI and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

3:30 COIMG-177
Advanced manufacturing research activities in the scaling of additive, battery, carbon fiber, and composites fabrication, *William Peter, Merlin Theodore, Lonnie Love, Ryan Dehoff, Vlastimil Kunc, and Vincent Paquit, Oak Ridge National Laboratory (United States)*

3:50 COIMG-178
Automated in-situ defects detection in metal additive manufacturing parts, *Vincent Paquit, James Ferguson, Sean Yoder, Michael Kirka, and Ryan Dehoff, Oak Ridge National Laboratory (United States)*

4:10 COIMG-179
Spectral neutron tomography for crystalline materials, *Singanallur Venkatakrishnan[1], Luc Dessieux[2], and Philip Bingham[1]; [1]Oak Ridge National Laboratory and [2]University of Tennessee Knoxville (United States)*

4:30 COIMG-180
Application of characterization, modeling and analytics towards understanding process-structure-property relationships in metallic 3D printing, *Michael Groeber, Edwin Schwalbach, Sean Donegan, Kevin Chaput, Todd Butler, and Jonathan Miller, Wright-Patterson AFB (United States)*

4:50 COIMG-181
Separable models for cone-beam MBIR reconstruction, *Thilo Balke[1], Michael Groeber[2], Gregery Buzzard[1], and Charles Bouman[1]; [1]Purdue University and [2]Wright-Patterson AFB (United States)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Image Analysis and Modeling I

9:10 – 10:10 am
Harbour A-B

9:10 COIMG-199
Tubule segmentation of fluorescence microscopy images based on convolutional neural networks with inhomogeneity correction, *Soonam Lee[1], Chichen Fu[1], Paul Salama[2], Kenneth Dunn[2], and Edward Delp[1]; [1]Purdue University and [2]Indiana University (United States)*

9:30 COIMG-200
Development of screening echocardiogram for detection of asymptomatic left ventricular dysfunction, *Irmina Gradus-Pizlo[1], Edward Delp[2], and Zygmunt Pizlo[1]; [1]University of California Irvine and [2]Purdue University (United States)*

9:50 COIMG-201
Deep gang graffiti component analysis, *He Li, Joonsoo Kim, and Edward Delp, Purdue University (United States)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Image Analysis and Modeling II

10:50 am – 12:30 pm
Harbour A-B

10:50 COIMG-227
Simulation of rare events in images, *Shruthi Kubatur and Mary Comer, Purdue University (United States)*

11:10 COIMG-228
Top down approach to height estimation of sorghum with stereo cameras, *Jihui Jin[1,2] and Avideh Zakhor[1]; [1]University of California, Berkeley and [2]Georgia Institute of Technology (United States)*

11:30 COIMG-229
Recovery of Soil Moisture Active Passive (SMAP) instrument's active measurements via coupled dictionary learning, *Konstantina Fotiadou[1,2], Grigorios Tsagkatakis[1], Mahta Moghaddam[3], and Panagiotis Tsakalides[1,2]; [1]Foundation for Research and Technology (Greece), [2]University of Crete (Greece), and [3]University of Southern California (United States)*

11:50 COIMG-230
Image modeling for fiber-reinforced composite materials, *Tianyu Li, Camilo Aguilar Herrera, and Mary Comer, Purdue University (United States)*

12:10 COIMG-471
Square coded aperture: A large aperture with extended depth of field, *Ruojun He[1], Yi Zhang[2], and Keigo Hirakawa[3]; [1]China University of Political Science and Law School (China), [2]Argo AI, LLC (United States), and [3]University of Dayton (United States)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Computational Imaging

3:30 – 5:30 pm
Harbour A-B

3:30 COIMG-270
A shooting direction control camera based on computational imaging without mechanical motion, *Keigo Takahashi and Tomohiro Yendo, Nagaoka University of Technology (Japan)*

3:50 COIMG-271
Fast, automated indoor light detection, classification, and measurement, *Craig Hiller and Avideh Zakhor, University of California, Berkeley (United States)*

4:10 COIMG-272
Superfast joint demosaicing and super-resolution, *Ivan Glazistov[1,2] and Xenya Petrova[1]; [1]Samsung R&D Institute Rus and [2]Lomonosov Moscow State University (Russian Federation)*

4:30 COIMG-273
Warping-based motion artifact compensation for multi-line scan light field imaging, *Nicole Brosch, Svorad Štolc, and Doris Antensteiner, AIT Austrian Institute of Technology GmbH (Austria)*

4:50 COIMG-274
Illuminant estimation using ensembles of multivariate regression trees, *Peter van Beek and R. Wayne Oldford, University of Waterloo (Canada)*

5:10 COIMG-473
Depth estimation using a multi-scale matched filter for decoding structured light reflected from a scene, *Hasib Siddiqui, Qualcomm Technologies Inc. (United States)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday January 31, 2018

10:00 am – 4:00 pm Industry Exhibition

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Computational Imaging XVI Interactive (Poster) Papers Session

5:30 – 7:00 pm
The Grove

The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

COIMG-402
Estimating the UAVs' crash point based on optical flows' voting in the image plane, *Yusaku Hatano, Chen Yi, and Jun Ohya, Waseda University (Japan)*

COIMG-403
Noise analysis and restrain of ghost imaging system, *Shaofan Qu, Beihang University (China)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

The Engineering Reality of Virtual Reality 2018

Conference overview

Virtual and augmented reality systems are evolving. In addition to research, the trend toward content building continues and practitioners find that technologies and disciplines must be tailored and integrated for specific visualization and interactive applications. This conference serves as a forum where advances and practical advice toward both creative activity and scientific investigation are presented and discussed. Research results can be presented and applications can be demonstrated.

Highlights

This year ERVR is expanding into joint sessions on Tuesday and Wednesday. On Tuesday ERVR is co-hosting the Bioinformatics sessions with Stereoscopic Displays and Applications XXIX. On Wednesday ERVR is co-hosting the Immersive Imaging sessions with two other conferences, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX. The Wednesday program also includes a reprise of the Visualization Facilities joint session with Stereoscopic Displays and Applications XXIX. On Thursday the core ERVR conference sessions kick off with a keynote by Dr. Jason Leigh, Director at the Laboratory for Advanced Visualization and Applications (LAVA), University of Hawai'i at Mãnoa; and Director Emeritus-Electronic Visualization Lab, University of Illinois at Chicago. Leigh teaches classes in Software Design and he has been teaching Video Game Design for over 10 years. In 2010 his video game design class enabled the University of Illinois at Chicago to be ranked among the top 50 video game programs in US and Canada.

Conference Chairs and Program Committee:
Margaret Dolinsky, Indiana University (United States), and **Ian E. McDowall**, Fakespace Labs, Inc. (United States)

The Engineering Reality of Virtual Reality 2018

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 1 Joint Session

Session Chair: Björn Sommer, University of Konstanz (Germany)

8:50 – 10:10 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

8:50 SD&A-189
Mesoscopic rigid body modeling of the ExtraCellular Matrix's self assembly, *Hua Wong, Nicolas Belloy, and Manuel Dauchez, University of Reims Champagne-Ardenne (France)*

9:10 SD&A-190
Semantics for an integrative and immersive pipeline combining visualisation and analysis of molecular data, *Mikael Trellet[1], Nicolas Ferey[1], Patrick Bourdot[1], and Marc Baaden[2]; [1]LIMSI and [2]IBPC (France)*

9:30 SD&A-191
3D-stereoscopic modeling and visualization of a Chlamydomonas reinhardtii cell, *Niklas Biere[1], Mehmood Ghaffar[1], Daniel Jäger[1], Anja Doebbe[1], Nils Rothe[1], Karsten Klein[2,3], Ralf Hofestädt[1], Falk Schreiber[2,3], Olaf Kruse[1], and Björn Sommer[2,3]; [1]Bielefeld University (Germany), [2]University of Konstanz (Germany), and [3]Monash University (Australia)*

9:50 SD&A-192
Immersive analysis and visualization of redox signaling pathways integrating experiments and computational modelling, *Alexandre Maes[1], Karen Druart[2], Sean Guégan[2], Xavier Martinez[2,3], Christophe Marchand[1], Stéphane Lemaire[1], and Marc Baaden[2]; [1]Institut de Biologie Physico-Chimique, UMR8226, CNRS, Sorbonne Universités, UPMC Université Paris 06, [2]Laboratoire de Biochimie Théorique, CNRS, UPR9080, Univ Paris Diderot, Sorbonne Paris Cité, PSL Research University, and [3]CNRS-LIMSI, VENISE team, Univ Paris-Sud (France)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Discussion: 360° Imaging Should Be 3D – But Why And How? Joint Session

3:30 – 4:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.
NOTE: Full list of panelists to be announced.

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 2 Joint Session

Session Chair: Marc Baaden, IBPC (France)

4:30 – 5:10 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

4:30 SD&A-288
Interactive molecular graphics for augmented reality using HoloLens, *Christoph Müller, Michael Krone, Markus Huber, Verena Biener, Guido Reina, Daniel Weiskopf, and Thomas Ertl, University of Stuttgart (Germany)*

4:50 SD&A-289
Molecular Dynamics Visualization (MDV): Stereoscopic 3D display of biomolecular structure and interactions using the Unity game engine, *Michael Wiebrands, Chris Malajczuk, Andrew Woods, Andrew Rohl, and Ricardo Mancera, Curtin University (Australia)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

10:00 am – 4:00 pm Industry Exhibition

Keynote: Immersive Imaging JOINT SESSION
Session Chair: Gordon Wetzstein, Stanford Univ. (United States)
10:40 – 11:20 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

PMII-320
Real-time capture of people and environments for immersive computing, *Shahram Izadi, perceptiveIO, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

Immersive Imaging JOINT SESSION

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

11:20 am – 12:40 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

11:20 PMII-350
SpinVR: Towards live-streaming 3D virtual reality video, *Donald Dansereau, Robert Konrad, Aniq Masood, and Gordon Wetzstein, Stanford University (United States)*

11:40 PMII-351
Towards a full parallax cinematic VR system, *Haricharan Lakshman, Dolby Labs (United States)*

12:00 PMII-352
Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation, *Jayant Thatte and Bernd Girod, Stanford University (United States)*

12:20 PMII-353
Image systems simulation for 360° camera rigs, *Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

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3:00 – 3:30 pm Coffee Break

Visualization Facilities JOINT SESSION

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Andrew Woods, Curtin University (Australia)

3:30 – 5:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

3:30 ERVR-392
xREZ Art + Science Lab - facilities presentation, *Ruth West, University of North Texas (United States)*

3:50 SD&A-393
CADwalk: Life-size MR-AR-VR design experience – Optimising and validating mission critical work environments, *Gerhard Kimenkowski, CADwalk Global Pty Ltd. (Australia)*

4:10 ERVR-394
When one is not enough: Cross-platform and collaborative developments at the Emerging Analytics Center, *Dirk Reiners, Carolina Cruz-Neira, and Carsten Neumann, University of Arkansas at Little Rock (United States)*

4:30 SD&A-395
Multiplatform VR case study – Beacon Virtua, *Andrew Woods[1], Nick Oliver[1], and Paul Bourke[2]; [1]Curtin University and [2]University of Western Australia (Australia)*

4:50 SD&A-396
What will we see next? Current visualization facilities trends and future considerations, *Kurt Hoffmeister, Mechdyne Corp. (United States)*

5:10
SD&A Closing Remarks

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Keynote: Dr. Jason Leigh
Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

9:00 – 10:10 am
Cypress C
ERVR Conference Introduction

ERVR-475
Surfing the wave of virtual reality and my cybercanoe, *Jason Leigh, University of Hawaii Manoa (United States)*

Dr. Jason Leigh is the director at the Laboratory for Advanced Visualization and Applications (LAVA), University of Hawai'i at Mānoa; and director emeritus of the Electronic Visualization Lab, University of Illinois at Chicago. He is a Fellow of the Institute for Health Research and Policy, and he has held research appointments at Argonne National Laboratory, and the National Center for Supercomputing Applications. Prof. Leigh's research expertise includes: Big data visualization; virtual reality; high performance networking; and video game design. He is co-inventor of the CAVE2 Hybrid Reality Environment, and SAGE: Scalable Adaptive Graphics Environment software, which has been licensed to Mechdyne Corporation & Vadiza Corporation, respectively. In 2010 he initiated a new multi-disciplinary area of research called Human Augmentics - which refers to the study of technologies for expanding the capabilities and characteristics of humans. Leigh teaches classes in software design and he has been teaching video game design for over 10 years. In 2010, his video game design class enabled the University of Illinois at Chicago to be ranked among the top 50 video game programs in the US and Canada.

10:10 – 10:50 am Coffee Break

Living the Vida VR! Presence and Being in VR!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

10:50 am – 12:30 pm
Cypress C

10:50 ERVR-432
Farmooo, a virtual reality farm simulation game designed for cancer pediatric patients to distract their pain during chemotherapy treatment, *Janice Ng, Henry Lo, Xin Tong, Diane Gromala, and Weina Jin, Simon Fraser University (Canada)*

11:10 ERVR-433
Presence in virtual reality: Insights from fundamental and applied research, *Daniel Mestre, CNRS and Aix-Marseille University (France)*

11:30 ERVR-434
From being there to feeling real: The effect of real world expertise and technology familiarity on presence in virtual environments, *Max J. Parola, Molly Beyer, Brandon Lane, Kathryn Hays, Meghan Kajihara, Luke Hillard, Danielle Poyser, and Ruth West, University of North Texas (United States)*

11:50 ERVR-435
A neuroscientific approach to exploring fundamental questions in VR, *Alex Wade[1], Cade McCall[1], Theodoros Karapanagiotidis[1], Elizabeth Jefferies[1], Jonny Smallwood[1], Guy Schofield[1], Aidan Horner[1], Tom Hartley[1], Catherine Preston[1], Milena Kaestner[1], Ryan Maloney[1], Marina Bloj[2], and Julie Harris[3]; [1]The University of York, [2]University of Bradford, and [3]University of Saint Andrews (United Kingdom)*

12:10 ERVR-437
Exploring landscapes and their implications for virtual reality, *Margaret Dolinsky, Indiana University (United States)*

12:30 – 2:00 pm Lunch

Look at Me Now! VR Applications!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

2:00 – 3:20 pm
Cypress C

2:00 ERVR-449
Experiencing a slice of the sky: Immersive rendering and sonification of Antarctic astronomy data, *Ruth West[1], Samuel Johnson[1], I Chen Yeh[1], Zach Thomas[1], Eitan Mendelowitz[2], and Michael Tarlton[1]; [1]University of North Texas and [2]Mount Holyoke College (United States)*

2:20 ERVR-450
Continuous-motion text input in virtual reality, *Janis Jimenez and Jürgen Schulze, Univ. of California, San Diego (United States)*

2:40 ERVR-451
Recording and mobile virtual reality exploration of 3D-localized sensor data, *Artur Baltabayev[1], Jean Buesche[1], Martin Kern[1], Gabriel Scheibler[1], Karsten Klein[1,2], Falk Schreiber[1,2], and Björn Sommer[1,2]; [1]University of Konstanz (Germany) and [2]Monash University (Australia)*

3:00 ERVR-452
Seeing the past: An augmented reality application for visualization the previous state of cultural heritage locations, *Piotr Siekanski[1], Eryk Bunsch[2], and Robert Sitnik[1]; [1]Warsaw University of Technology and [2]Museum of King Jan III's Palace at Wilanów (Poland)*

3:20 – 3:50 pm Coffee Break

Get 'er Done! In VR!

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Ian McDowall, Intuitive Surgical / Fakespace Labs (United States)

3:50 – 5:00 pm
Cypress C

3:50 ERVR-468
Evaluating commodity hardware and software for virtual reality assembly training, *Emma Dodoo[1], Brittney Hill[2], Austin Garcia[3], Adam Kohl[3], Anastacia MacAllister[3], Jonathan Schlueter[3], Melynda Hoover[3], and Eliot Winer[3]; [1]Pennsylvania State University, [2]Georgia State University, and [3]Iowa State University (United States)*

4:10 ERVR-469
An authoring system for VR-based firefighting commanders training, *Nicola Conci[1], Paolo Busetta[2], and Diego Puel[2]; [1]Università degli Studi di Trento and [2]Delta Informatica (Italy)*

4:30 ERVR-470
Analysis of video image based element for motion sickness, *Jaephil Lee[1], Seonyoung lee[1], Jeonghyun Ahn[1], Yongwoo Lee[2], and HyungSeok Kim[1]; [1]Konkuk University and [2]Samsung Display (Republic of Korea)*

4:50
Conference Chair Closing Remarks

Human Vision and Electronic Imaging 2018

Conference overview

The conference on Human Vision and Electronic Imaging celebrates its 30th anniversary this year, and continues tradition exploring the role of human perception and cognition in the design, analysis, and use of electronic media systems. Over the years, it has brought together researchers, technologists and artists, from all over the world, for a rich and lively exchange of ideas. We believe that understanding the human observer is fundamental to the advancement of electronic media systems, and that advances in these systems and applications drive new research into the perception and cognition of the human observer. Every year, we introduce new topics through our Special Sessions, centered on areas driving innovation at the intersection of perception and emerging media technologies. The HVEI website (http://hvei.eecs.northwestern.edu) includes additional information and updates.

Award

Student Best Paper Award

Events

Monday evening HVEI Banquet and Talk
Thursday evening Museum Field Trip to San Francisco Museum of Modern Art
Daily End-of-Day Discussions

Conference Sponsor

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Conference Chairs: **Bernice E. Rogowitz**, Visual Perspectives (United States); **Thrasyvoulos N. Pappas**, Northwestern University (United States); and **Huib de Ridder**, Technische University Delft (the Netherlands)

Program Committee: **Albert J. Ahumada**, NASA Ames Research Center (United States); **Jan P. Allebach**, Purdue University (United States); **Erhardt Barth**, University zu Lubeck (Germany); **Walter R. Bender**, Sugar Labs (United States); **Michael H. Brill**, Datacolor (United States); **Kjell Brunnström**, ACREO (Sweden); **Claus-Christian Carbon**, University of Bamberg (Germany); **Damon M. Chandler**, Shizuoka University (Japan); **Scott J. Daly**, Dolby Labs., Inc. (United States); **Ulrich Engelke**, Commonwealth Scientific and Industrial Research Organisation (Australia); **Elena A. Fedorovskaya**, Rochester Institute of Technology (United States); **James A. Ferwerda**, Rochester Institute of Technology (United States); **Jennifer L. Gille**, Qualcomm Technologies, Inc. (United States); **Sergio R. Goma**, Qualcomm Technologies, Inc. (United States); **Hari Kalva**, Florida Atlantic University (United States); **Stanley A. Klein**, University of California, Berkeley (United States); **Patrick Le Callet**, University de Nantes (France); **Lora T. Likova**, The Smith-Kettlewell Eye Research Institute (United States); **Monica Lopez-Gonzalez**, La Petite Noiseuse Productions (United States); **Mark E. McCourt**, North Dakota State University (United States); **Laura McNamara**, Sandia National Laboratories (United States); **Jeffrey B. Mulligan**, NASA Ames Research Center (United States); **Karol Myszkowski**, Max-Pianck-Institut für Informatik (Germany); **Adar Pelah**, University of York (United Kingdom); **Eliezer Peli**, Schepens Eye Research Institute (United States); **Sylvia Pont**, Technische University Delft (the Netherlands); **Judith A. Redi**, Technische University Delft (the Netherlands); **Hawley K. Rising**, Consultant (United States); **Sabine Süsstrunk**, École Polytechnique Fédérale de Lausanne (Switzerland); **Christopher W. Tyler**, The Smith-Kettlewell Eye Research Institute (United States); **Andrew B. Watson**, NASA Ames Research Center (United States); and **Michael A. Webster**, University of Nevada, Reno (United States)

Human Vision and Electronic Imaging 2018

Monday, January 29, 2018

Welcome to HVEI 2018 and 30th Anniversary Kick-off

Session Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)

10:40 – 10:50 am
Grand Peninsula Ballroom A

Keynote Session I: Human Vision Approaches to Image Quality for Images, Video and Stereo Applications

Session Chairs: Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)

10:50 am – 12:10 pm
Grand Peninsula Ballroom A

10:50 HVEI-500

The field of view, the field of resolution, and the field of contrast sensitivity, *Andrew Watson, Apple Inc. (United States)*

Dr. Andrew Watson is a senior vision scientist at Apple, with expertise in psychophysics, neuropsychology, and applied psychology. Prior to joining Apple, Dr. Watson was the Senior Scientist for Vision Research at NASA Ames Research Center in California. He is the author of more than 100 papers and six patents on topics in vision science and imaging technology. Dr. Watson is Vice Chair for Vision Science and Human Factors of the International Committee on Display Measurement. In 2007 he received the Otto Schade Award from the Society for Information Display, and in 2008 the Special Recognition Award from the Association for Research in Vision and Ophthalmology. In 2011, he received the Presidential Rank Award from the President of the United States.

11:30 HVEI-501

Perceptual display: Apparent enhancement of scene detail and depth (Invited), *Karol Myszkowski, MPI Informatik (Germany)*

Prof. Karol Myszkowski is a senior researcher at the Max Planck Institut Informatik, Saarbruecken, Germany. In the period from 1986 till 1992 he worked for Integra, Inc. a Japan-based, company specialized in developing rendering and global illumination software. He received his PhD (1991) in computer science from Warsaw University of Technology (Poland). In 2011 he was awarded with a lifetime professor title by the President of Poland. His research interests include global illumination and rendering, perception issues in graphics, high dynamic range imaging, and stereo 3D. He co-authored the book High Dynamic Range Imaging, and participated in various committees and editorial boards. He also co-chaired Rendering Symposium in 2001, ACM Symposium on Applied Perception in Graphics and Visualization in 2008, Spring Conference on Computer Graphics 2008, and Graphicon 2012.

Discussion: Human Vision Approaches to Image Quality for Images, Video and Stereo Applications

Session Chairs: Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)

12:10 – 12:30 pm
Grand Peninsula Ballroom A

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:20 pm Coffee Break

Keynote Session II: Human Behavior in Real-World Environments
Session Chairs: Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)
3:20 – 4:40 pm
Grand Peninsula Ballroom A

3:20 HVEI-502
Lighting perceptual intelligence, *Sylvia Pont, Delft University of Technology (Netherlands)*

Prof. Sylvia Pont was appointed Antoni van Leeuwenhoek professor in 2016. She has worked at the faculty of Industrial Design Engineering at TU Delft since 2008. In the light and vision labs, within the Perceptual Intelligence Lab, her group works on studies in design, perception, optics and rendering of light and its interactions with material, shape and space. From September 1999 to 2008 she worked in the Physics of Man group of the department of physics and astronomy of Utrecht University. Her postdoctoral research into 'ecological optics' included studies into reflectance, texture, and light fields. January 2004 she got an appointment as an assistant professor and started her project entitled 'Ecological Plenoptics of Natural Scenes', for which she was granted a 'VIDI Vernieuwingsimpuls' by the Netherlands Organisation for Scientific Research (NWO). This project concerned studies into the description of the appearance of natural materials and natural light fields.

4:00 HVEI-503
Applying insights from visual perception and cognition to the development of more effective virtual reality experiences, *Victoria Interrante, University of Minnesota (United States)*

Prof. Victoria Interrante's research focuses on applying insights from visual perception and cognition to the development of more effective virtual reality experiences and the more effective communication of complex information through visual imagery. In this work, she enjoys collaborating with colleagues in a wide variety of fields, from architectural design and neuropsychology to engineering and medicine. Prof. Interrante is a recipient of the 1999 Presidential Early Career Award for Scientists and Engineers, "the highest honor bestowed by the U.S. government on outstanding scientists and engineers beginning their independent careers", and a 2001-2003 McKnight Land-Grant Professorship from the University of Minnesota. At the University of Minnesota, Prof. Interrante is currently serving as the director of the Center for Cognitive Sciences and as a member of the graduate faculty of the Program in Human Factors. In recent years, she has also served as chair of the technical track on Graphics, Animation and Gaming at the 2015 Grace Hopper Celebration of Women in Computing.

Discussion: Human Behavior in Real-World Environments
Session Chairs: Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)
4:40 – 5:00 pm
Grand Peninsula Ballroom A

5:00 – 6:00 pm All-Conference Welcome Reception

HVEI Banquet and Demo Session
Hosts: Thrasyvoulos Pappas, Northwestern University; and Bernice Rogowitz, Visual Perspectives (United States)
6:30 – 10:00 pm
Offsite; details provided with registration

Join us for a celebration of 30 years of HVEI, as we roast and toast the people and events that have shaped this unique, multidisciplinary community. We'll convene over a family-style meal at a local Lebanese/Middle Eastern restaurant.

Bernice Rogowitz and Thrasos Pappas, HVEI conference co-chairs for 30 and 20 years, respectively, will share photos, stories, and artifacts from past conferences. Everyone is welcome to share their experiences and memories as well! We'll also show some fun visual illusions provided by members of the community as we mingle before the Banquet.

This banquet—supported by Qualcomm—is hosted by the conference on Human Vision and Electronic Imaging, but is open to everyone interested in the intersection of human vision/cognition, imaging technology, and art.

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Fundamental Issues in Visual Detection

Session Chair: Jeffrey Mulligan, NASA Ames Research Ctr. (United States)

9:10 – 10:10 AM
Grand Peninsula Ballroom A

9:10 HVEI-504
How are ocular behaviours affected by central and peripheral vision losses? A study based on artificial scotomas and gaze-contingent protocol (JPI-first), *Erwan David[1], Patrick Le Callet[1], Matthieu Perreira Da Silva[1], and Pierre Lebranchu[1,2]; [1]Université de Nantes and [2]Nantes CHU (France)*

9:30 HVEI-505
Pilot study on the effects of the fixational eye movements on the contrast sensitivity, *Vicent Sanchis-Jurado[1], Álvaro Pons[1], Edward Fry[2], and Sophie Triantaphillidou[2]; [1]University de Valencia (Spain) and [2]University of Westminster (United Kingdom)*

9:50 HVEI-506
A dual channel spatial-remporal detection model, *Albert Ahumada[1], Jihyun Yeonan-Kim[2], and Andrew Watson[1]; [1]Consultant and [2]San Jose State University Foundation (United States)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:40 am Coffee Break

Perceptual Issues in High Dynamic Range Imaging

Session Chair: Damon Chandler, Shizuoka University (Japan)

10:40 – 11:40 am
Grand Peninsula Ballroom A

10:40 HVEI-507
Perceived dynamic range of HDR images with no semantic information, *Vedad Hulusic[1], Giuseppe Valenzise[2], and Frederic Dufaux[2]; [1]LTCI, Télécom ParisTech, Université Paris-Saclay and [2]Laboratoire des Signaux et Systèmes, Université Paris-Sud (France)*

11:00 HVEI-508
The preferred system gamma is primarily determined by the ratio of dynamic range of the original scene and the displayed image, *David Kane[1], Antoine Grimaldi[1], Emin Zerman[2], Vedad Hulusic[2], and Giuseppe Valenzise[2,3]; [1]Universitat Pompeu Fabra (Spain), [2]Telecom ParisTech (France), and [3]L2S, CNRS (France)*

11:20 HVEI-509
Pupillometry of high dynamic range video viewing, *Grant Mullikan, Evan Gitterman, and Scott Daly, Dolby Laboratories, Inc. (United States)*

Mobile Devices and Perception

Session Chair: Sergio Goma, Qualcomm Inc. (United States)

11:40 am – 12:20 pm
Grand Peninsula Ballroom A

11:40 HVEI-510
Estimating the subjective video stability of first-person videos, *Biao Ma and Amy Reibman, Purdue University (United States)*

12:00 HVEI-511
Viewer-aware intelligent mobile video system for prolonged battery life, *Peng Gao, Mark McCourt, Jinhui Wang, and Na Gong, North Dakota State University (United States)*

12:20 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Special Session: Perceptual Interactions in Material, Color and Illumination

Session Chair: Sylvia Pont, Delft University of Technology (Netherlands)

3:30 – 5:50 pm
Grand Peninsula Ballroom A

3:30 HVEI-512
Contextual effects in human gloss perception (Invited), *Sabrina Hansmann-Roth[1], Sylvia Pont[2], and Pascal Mamassian[3]; [1]University of Iceland (Iceland), [2]Delft University of Technology (Netherlands), and [3]École Normale Supérieure (France)*

4:00 HVEI-513
Assessing gloss perception of human facial skin across subject, *Jing Wang[1], Carla Kuesten[2], Gopa Majmudar[2], and Thrasyvoulos Pappas[1]; [1]Northwestern University and [2]Amway Corporation (United States)*

4:20 HVEI-514
Optimising texture visibility using LED luminaires (Invited), *Raymond Cuijpers[1] and Huihui Wang[1,2]; [1]Eindhoven University of Technology (Netherlands) and [2]Zhejiang University (China)*

4:50 HVEI-515
Disentangling simultaneous transparency and illumination changes (Invited), *Robert Ennis and Katja Doerschner, Justus-Liebig-University Giessen (Germany)*

5:20 HVEI-516
Quantifying how humans trade off color and material in object identification (Invited), *Ana Radonjić, Nicolas Cottaris, and David Brainard, University of Pennsylvania (United States)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

HVEI Tuesday Discussion with Wine
5:50 – 7:00 pm
Grand Peninsula Ballroom A

Please join us for a lively discussion of today's presentations. Enjoy a glass of wine and then participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.

Wednesday January 31, 2018

Perceptual Approaches to Image Quality

Session Chair: Thrasyvoulos Pappas, Northwestern University (United States)

9:00 – 10:00 am
Grand Peninsula Ballroom A

9:00 HVEI-517
The relation between MOS and pairwise comparisons and the importance of cross-content comparisons, *Emin Zerman[1], Vedad Hulusic[1], Giuseppe Valenzise[2], Rafal Mantiuk[3], and Frederic Dufaux[2]; [1]Télécom ParisTech (France), [2]CNRS, L2S, UMR 8506 (France), and [3]University of Cambridge (United Kingdom)*

9:20 HVEI-518
DeViQ - A deep no reference video quality model, *Steve Göring, Janto Skowronek, and Alexander Raake, Technische University Ilmenau (Germany)*

9:40 HVEI-519
The role of structure and textural information in image utility and quality assessment tasks (JPI-first), *Suiyi Ling[1], Patrick Le Callet[1], and Zitong Yu[2]; [1]Polytech Nantes/Université de Nantes and [2]University of Nantes (France)*

10:00 am – 4:00 pm Industry Exhibit

Human Vision and Electronic Imaging 2018 Interactive (Poster) Papers Oral Previews

Session Chair: Scott Daly, Dolby Laboratories (United States)

10:00 – 10:30 am
Grand Peninsula Ballroom A

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Human Vision and Electronic Imaging 2017 Interactive Papers Session at 5:30 pm on Wednesday.

10:00 HVEI-520
A tutorial on correcting for multiple tests, *Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States)*

10:05 HVEI-521
Optimum space-frequency partition in subband image coding with human visual sensitivity and region-of-interest, *Haruhiko Miyazaki and Masashi Kameda, Iwate Prefectural University (Japan)*

10:10 HVEI-522
Predicting learning difficulty based on gaze and pupil response, *Saurin Parikh[1,2] and Hari Kalva[1]; [1]Florida Atlantic University (United States) and [2]Nirma University (India)*

10:15 HVEI-541
Colorizing color images, *Ligeng Zhu and Brian Funt, Simon Fraser University (Canada)*

10:20 HVEI-540
Storyboard of thoughts: Using photography and illustration to visualize the mind, *Mónica López-González, La Petite Noiseuse Productions (United States)*

10:25 HVEI-542
Investigating potential human tetrachromacy in individuals with tetrachromat genotypes using multispectral techniques, *Vladimir A. Bochko[1], and Kimberly A. Jameson[2]; [1]University of Vaasa (Finland) and [2]University of California Irvine (United States)*

10:30 – 10:50 am Coffee Break

Special Session: Perceptual Image Quality for Virtual and Augmented Reality Systems

Session Chair: Kjell Brunnstrom, RISE Acreo AB (Sweden)

10:50 am – 12:30 pm
Grand Peninsula Ballroom A

10:50 HVEI-523
Towards subjective quality assessment for panoramic video (Invited), *Yingxue Zhang and Zhenzhong Chen, Wuhan University (China)*

11:10 HVEI-524
A framework for adaptive delivery of omnidirectional video (Invited), *Christian Timmerer, Alpen-Adria-Universität Klagenfurt and Bitmovin (Austria)*

11:30 HVEI-525
Comparison of subjective quality evaluation methods for omnidirectional videos with DSIS and modified ACR (Invited), *Ashutosh Singla[1], Werner Robitza[2], and Alexander Raake[1]; [1]Technische University Ilmenau and [2]Telekom Innovation Laboratories, Deutsche Telekom AG (Germany)*

11:50 HVEI-526
Quality of experience for a virtual reality simulator (Invited), *Kjell Brunnstrom[1,2], Mårten Sjöström[2], Imran Muhammad[3], Magnus Pettersson[3], and Mathias Johanson[4]; [1]RISE Acreo AB, [2]Mid Sweden University, [3]HIAB, and [4]Alkit Communications AB (Sweden)*

12:10 HVEI-527
Exploring the effects of subjective methodology on assessing visual discomfort in immersive multimedia (JPI-first) (Invited), *Jing Li[1], Junle Wang[2], Marcus Barkowsky[1], and Patrick Le Callet[1]; [1]Université de Nantes and [2]Ars Nova Systems (France)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Physiological Measurements for Vision and Image Quality Research

Session Chair: Bernice Rogowitz, Visual Perspectives (United States)

3:30 – 4:30 pm
Grand Peninsula Ballroom A

3:30 HVEI-528
Statistical identification of fixations in noisy eye movement data, *Jeffrey Mulligan, NASA Ames Research Ctr. (United States)*

3:50 HVEI-529
Measuring video quality by eye response, *Deepti Pappusetty and Hari Kalva, Florida Atlantic University (United States)*

4:10 HVEI-530
Quantifying visually induced motion sickness (VIMS) during the stereoscopic 3D viewing using VIMS level rating (JIST-first), *Alex Hwang[1], Hongwei Deng[1,2], Zhongpai Gao[1,3], and Eli Peli[1]; [1]Harvard Medical School (United States), [2]Hospital of Jinan University (China), and [3]Shanghai Jiao Tong University (China)*

HVEI Wednesday Discussion with Wine
4:30 – 5:30 pm
Grand Peninsula Ballroom A

Please join us for a lively discussion of today's presentations. Enjoy a glass of wine and then participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

The Neuroscience and Experience of Multisensory Integration

Session Chair: Thrasyvoulos Pappas, Northwestern University (United States)

9:10 – 10:10 am
Grand Peninsula Ballroom A

9:10 HVEI-531
Theoretically automated conversations: Collaborative artistic creativity for autonomous machines, *Mónica López-González, La Petite Noiseuse Productions (United States)*

9:30 HVEI-532
Harnessing the power of 'visual' art to rapidly switch handedness in late adulthood: Neuroplasticity driven by drawing training, *Lora Likova, Smith-Kettlewell Eye Research Instituite (United States)*

10:10 – 10:50 am Coffee Break

Art and Perception: Representation, Experience, and Understanding

Session Chair: Bernice Rogowitz, Visual Perspectives (United States)

10:50 am – 12:30 pm
Grand Peninsula Ballroom A

10:50 HVEI-533
Art changes our way of cognitive and affective processing—But how to ecologically validly measure such processes?, *Claus-Christian Carbon, University of Bamberg, Research group EPÆG (Ergonomics, Psychological Aesthetics, Gestalt), and Bamberg Graduate School of Affective and Cognitive Sciences (BaGrACS) (Germany)*

11:10 HVEI-534
Meaningful-engagements with online museum collections for children with chronic health conditions, *Eliron Salomon, Online Museum for Self Improvement (OMSI) (Israel)*

11:30 HVEI-535
Mirroring the soul: Mirrors as the virtual reality of self-reflection in the history of art, *Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States)*

11:50 HVEI-536
Beurs' historical recipe and material perception of grapes in Dutch Golden Age still-lifes, *Francesca Di Cicco, Maarten Wijntjes, and Sylvia Pont, Delft University of Technology (Netherlands)*

12:10 HVEI-537
Saliency-based artistic abstraction with deep learning and regression trees (JIST-first), *Hanieh Shakeri, Michael Nixon, and Steve Dipaola, Simon Fraser University (Canada)*

12:30 – 2:00 pm Lunch

Keynote: Visual Representation in Art, Imaging and Visualization with Tim Jenison of Tim's Vermeer Fame
Session Chair: Claus-Christian Carbon, University of Bamberg (Germany)
2:00 – 2:40 pm
Grand Peninsula Ballroom A

HVEI-538
Capturing reality, *Tim Jenison, NewTek, Inc. (United States)*

Tim Jenison founded Texas-based computer software and hardware producer NewTek, specializing in tools for the gathering and editing of desktop video media. Following the formation of the company in Topeka, Kansas, alongside the late Paul Montgomery, NewTek went on to become renowned for the creation of the Commodore Amiga video tools DigiView and DigiPaint, which were highly popular applications at the time. Jenison later appeared as the subject of the feature documentary "Tim's Vermeer" (2014), about his efforts to digitally recreate the painting technique of the Dutch baroque painter Johannes Vermeer. In his early life, Jenison took inspiration from his electrical engineer father, and a lot of his own early work came as a result of his obsession with music; as a youth he played in rock bands, although his main love was customizing and improving their instruments and studio equipment. Among his successes with NewTek were the Video Toaster for the Amiga and later Windows, a product which won the 1993 Emmy Award for Technical Achievement, and latterly animation system LightWave 3D, live broadcast system TriCaster, and slow motion replay system 3PLAY. A casual art fan himself, Jenison was inspired by the writings of artist David Hockney and art historian Philip Steadman to see whether rumoured primitive photographic techniques in Vermeer's paintings were possible. "Tim's Vermeer," directed by magician Teller and featuring his partner, Jenison's friend Penn Jillette, documented his artistic process. The film earned an Oscar nomination for Best Documentary Feature in 2014.

2:40 – 3:30 pm
Grand Peninsula Ballroom A

Panel: Visual Representation in Art, Imaging and Visualization with Tim Jenison of Tim's Vermeer fame
Panel Moderator: Claus-Christian Carbon, University of Bamberg (Germany)
Panelists: Thrasyvoulos Pappas, Northwestern University (United States); Sylvia Pont, Delft University of Technology (Netherlands); Bernice Rogowitz, Visual Perspectives (United States); David Stork, Rambus Labs (United States); and Christopher Tyler, Smith-Kettlewell Eye Research Institute (United States)

3:30 – 4:00 PM Coffee Break

HVEI Closing Discussion and Celebration
3:30 – 4:30 pm
Grand Peninsula Ballroom A

Please join us for a lively discussion of today's presentations. Enjoy a glass of wine and then participate in an interactive, moderated discussion, where key topics and questions are discussed from many perspectives, reflecting the diverse HVEI community.

SFMOMA Museum Visit & Dinner

4:30 – 10:00 pm
Offsite - details provided with registration

Join your HVEI colleagues for an excursion to the SFMOMA and for a late dinner after the museum visit. Depart from the HVEI conference room at 4:30 pm. Visit SFMOMA 5:30 - 8:00 pm. Gather informally for dinner at 8:00 pm.

Image Processing: Algorithms and Systems XVI

Conference overview

Image Processing: Algorithms and Systems continues the tradition of the past conference Nonlinear Image Processing and Pattern Analysis in exploring new image processing algorithms. It also reverberates the growing call for integration of the theoretical research on image processing algorithms with the more applied research on image processing systems.

Specifically, the conference aims at highlighting the importance of the interaction between linear, nonlinear, and transform-based approaches for creating sophisticated algorithms and building modern imaging systems for new and emerging applications.

Award

Best Paper

Conference Chairs: **Sos S. Agaian**, The University of Texas at San Antonio (United States); **Karen 0. Egiazarian**, Tampere University of Technology (Finland); and **Atanas P. Gotchev,** Tampere University of Technology (Finland)

Program Committee: **Gözde Bozdagi Akar**, Middle East Technical University (Turkey); **Junior Barrera**, University de São Paulo (Brazil); **Jenny Benois-Pineau**, Bordeaux University (France); **Giacomo Boracchi**, Politecnico di Milano (Italy); **Reiner Creutzburg**, Technische Hochschule Brandenburg (Germany); **Alessandro Foi**, Tampere University of Technology (Finland); **Paul D. Gader**, University of Florida (United States); **John C. Handley**, Xerox Corporation. (United States); **Vladimir V. Lukin**, National Aerospace University (Ukraine); **Vladimir Marchuk**, Don State Technical University (Russian Federation); **Alessandro Neri**, Radiolabs (Italy); **Marek R. Ogiela**, AGH University of Science and Technology (Poland); **Ljiljana Platisa**, University Gent (Belgium); **Françoise Prêteux**, Mines ParisTech (France); **Giovanni Ramponi**, University degli Studi di Trieste (Italy); **Ivan W. Selesnick**, Polytechnic Institute of New York University (United States); and **Damir Sersic**, University of Zagreb (Croatia)

Image Processing: Algorithms and Systems XV

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Neural Networks in Image Processing Applications

8:50 – 10:10 am
Sandpebble B

8:50 IPAS-193
Deep pFibonacci scattering networks, *Federica Battisti[1], Marco Carli[1], Eleonora De Paola[1], and Karen Egiazarian[2]; [1]Università degli Studi Roma TRE (Italy) and [2]Tampere University of Technology (Finland)*

9:10 IPAS-194
An estimation method of human impression factors for objects from their 3D shapes using a deep neural network, *Koichi Taguchi[1], Manabu Hashimoto[1], Kensuke Tobitani[2], and Noriko Nagata[2]; [1]Chukyo University and [2]Kwansei Gakuin University (Japan)*

9:30 IPAS-195
Texture analysis and classification using Pix2Pix network and AlexNet, *Mark Lenson, Florida Atlantic University (United States)*

9:50 IPAS-196
Learning adaptive parameter tuning for image processing, *Jingming Dong, Iuri Frosio, and Jan Kautz, Nvidia Corporation (United States)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 11:10 am Coffee Break

Image Enhancement and Filtering Algorithms

11:10 – 11:50 am
Sandpebble B

11:10 IPAS-218
Sharpening image details using local phase congruency analysis, *Andrey Shcherbinin, Michael Rychagov, Konstantin Kolchin, and Seung-Hoon Han, Samsung Electronics (Russian Federation)*

11:30 IPAS-219
Color visibility images and measures of image enhancement, *Artyom Grigoryan and Sos Agaian, University of Texas at San Antonio (United States)*

11:50 AM – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Image Processing Algorithms I

3:30 – 4:30 pm
Sandpebble B

3:30 IPAS-260
Robust linearized combined metrics of image visual quality, *Oleg Ieremeiev[1], Vladimir Lukin[1], Nikolay Ponomarenko[2], and Karen Egiazarian[2]; [1]National Aerospace University (Ukraine) and [2]Tampere University of Technology (Finland)*

3:50 IPAS-261
1-Bit tensor completion, *Anastasia Aidini[1,2], Grigorios Tsagkatakis[2], and Panagiotis Tsakalides[1,2]; [1]University of Crete and [2]Foundation for Research and Technology (FORTH) (Greece)*

4:10 IPAS-262
Blind image watermarking in wavelet-domain robust to printing and smartphone acquisition, *Andrea Leopardi, Davide Soresina, Davide Marcantonio, Alain Malacarne, Nicola Conci, and Giulia Boato, Università degli Studi di Trento (Italy)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Image Processing Systems

8:50 – 10:10 am
Sandpebble B

8:50 IPAS-305
Separation of scanned media using a strip based methodology, *Osborn de Lima[1], Eli Saber[1], Kevin Merrill[2], and Mark Shaw[2]; [1]Rochester Institute of Technology and [2]HP Inc. (United States)*

9:10 IPAS-306
Methods and tools for denoising of complex valued images based on block-matching and high order singular value decomposition, *Mykola Ponomarenko, Vladimir Katkovnik, and Karen Egiazarian, Tampere University of Technology (Finland)*

9:30 IPAS-307
Automatic banknote stain detection, *Jiho Yoon[1], Sangwook Baek[1], Euison Choi[2], Hyunji Jo[2], and Chulhee Lee[1]; [1]Yonsei University and [2]R&D center of Nautilus Hyosung Inc. (Republic of Korea)*

9:50 IPAS-308
Rule-based optical character recognition for serial number on renminbi banknote, *Yu-Shiuan Tsai[1], Yi-Yu Hsieh[2], Chih-Hui Ho[3], Ya-Ching Chang[2], Yao-Yuan Chang[2], Heng-Jyun Lin[2], Han-Yang Wang[2], Yu-Chen Chou[2], and Jen-Hui Chuang[2]; [1]National Taiwan Ocean University (Taiwan), [2]National Chiao Tung University (Taiwan), and [3]University of California, San Diego (United States)*

10:00 am – 4:00 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Image Processing Algorithms II

10:50 am – 12:10 pm
Sandpebble B

10:50 IPAS-328
Real-time 3DRS motion estimation for frame-rate conversion, *Petr Pohl, Igor Kovliga, Valery Anisimovskiy, Alexey Gruzdev, and Roman Arzumanyan, Samsung R&D Institute Russia (Russian Federation)*

11:10 IPAS-329
Rician noise rejection in sparse representation, *Leandro Delfin[1], Raul Pinto Elias[1], Humberto de Jesus Ochoa Dominguez[2], Osslan Osiris Vergara Villegas[2], and Dante Mujica Vargas[1]; [1]CENIDET and [2]UACJ (Mexico)*

11:30 IPAS-330
Registration of visible and infrared facial images for temperature measurement, *C.Y.N. Dwith[1,2], Pejhman Ghassemi[1], Joshua Pfefer[1], Jon Casamento[1], and Quanzeng Wang[1,2]; [1]U.S. Food and Drug Administration and [2]University of Maryland (United States)*

11:50 IPAS-331
Gradient management and algebraic reconstruction for single image super resolution, *Leandro Delfin, CENIDET (Mexico)*

12:10 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Image Processing: Algorithms and Systems XVI Interactive (Poster) Papers Oral Previews

3:30 – 5:20 pm
Sandpebble B

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Image Processing: Algorithms and Systems XVI Interactive Papers Session at 5:30 pm on Wednesday.

3:30 IPAS-381
A similarity measurement method for diffuse lung disease CT slice image retrieval, *Mengjiao Wang and Rujie Liu, Fujitsu R&D Center Co., Ltd. (China)*

3:40 IPAS-382
Blind estimation of white Gaussian noise variance in highly textured images, *Mykola Ponomarenko[1], Nikolay Gapon[2], Viacheslav Voronin[2], and Karen Egiazarian[1]; [1]Tampere University of Technology (Finland) and [2]Don State Technical University (Russian Federation)*

3:50 IPAS-383
Color facial image representation with new quaternion gradients, *Artyom Grigoryan and Sos Agaian, University of Texas at San Antonio (United States)*

4:00 IPAS-220
Combined local and global image enhancement algorithm, *Viacheslav Voronin[1], Evgeny Semenishchev[1], Mykola Ponomarenko[2], and Sos Agaian[3]; [1]Don State Technical University (Russian Federation), [2]Tampere University of Technology (Finland), and [3]CUNY/ The College of Staten Island (United States)*

4:10 IPAS-384
Combining pairs images of the which is fixed in the non-visible range, *Evgeny Semenishchev and Viacheslav Voronin, Don State Technical University (Russian Federation)*

4:20 IPAS-385
Compression of signs of DCT coefficients for additional lossless compression of JPEG images, *Oleksandr Miroshnichenko[1], Mykola Ponomarenko[2], Vladimir Lukin[1], and Karen Egiazarian[2]; [1]National Aerospace University (Ukraine) and [2]Tampere University of Technology (Finland)*

4:30 IPAS-386
Disparity estimation using fast motion-search and local image characteristics, *Yong-Jun Chang and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

4:40 IPAS-387
Flexible shape of seam for image retargeting with face detection, *Ikuko Tsubaki and Kazuo Sasaki, Tokyo University of Technology (Japan)*

4:50 IPAS-389
Non-linear masking based contrast enhancement via illumination estimation, *Soonyoung Hong, Minsub Kim, and Moon Gi Kang, Yonsei University (Republic of Korea)*

5:00 IPAS-390
Occlusion aware reduced angular candidates based light field depth estimation from an epipolar plane image, *Ji-Hun Mun and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

5:10 IPAS-391
Two general models for gradient operators in imaging, *Artyom Grigoryan and Sos Agaian, University of Texas at San Antonio (United States)*

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Camera Image Processing JOINT SESSION

Session Chair: Michael Kriss, MAK Consultants (United States)

10:50 am – 12:10 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Image Processing: Algorithms and Systems XVI, and Photography, Mobile, and Immersive Imaging 2018.

10:50 IPAS-439
Color interpolation algorithm for the Sony-RGBW color filter array, *Jonghyun Kim and Moon Gi Kang, Yonsei University (Republic of Korea)*

11:10 IPAS-440
High dynamic range imaging with a single exposure-multiplexed image using smooth contour prior, *Mushfiqur Rouf and Rabab Ward, University of British Columbia (Canada)*

11:30 IPAS-441
Enhancement of underwater color images by two-side 2-D quaternion discrete Fourier transform, *Artyom Grigoryan[1], Aparna John[1], and Sos Agaian[2]; [1]University of Texas at San Antonio and [2]City University of New York/CSI (United States)*

11:50 PMII-442
Automatic tuning method for camera denoise and sharpness based on perception model, *Weijuan Xi[1], Huanzhao Zeng[2], and Jonathan Phillips[2]; [1]Purdue University and [2]Google Inc. (United States)*

12:10 – 2:00 pm Lunch

3D Scene Sensing and Object Recording JOINT SESSION

Session Chairs: William Puech, University of Montpellier (France) and Robert Sitnik, Warsaw University of Technology (Poland)

2:00 – 4:00 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: 3D Image Processing, Measurement (3DIPM), and Applications 2018, and Image Processing: Algorithms and Systems XVI.

2:00 3DIPM-460
An accurate and robust algorithm for tracking guitar neck in 3D based on modified RANSAC homography, *Zhao Wang and Jun Ohya, Waseda University (Japan)*

2:20 3DIPM-461
Skeleton-based dynamic hand gesture recognition using 3D depth data, *Dan Zhao, Beijing Institute of Technology (China)*

2:40 IPAS-462
Combining local and global optical flow for RGB-D point cloud alignment, *Sunho Kim and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:00 IPAS-463
Discrimination of active dynamic objects in stereo-based visual SLAM, *Ihtisham Ali, Olli Suominen, and Atanas Gotchev, Tampere University of Technology (Finland)*

3:20 IPAS-464
Error correction for time-of-flight images using validity classification, *Yunseok Song and Yo-Sung Ho, Gwangju Institute of Science and Technology (Republic of Korea)*

3:40 3DIPM-465
How to capture aesthetic features of complex cultural heritage objects – active illumination data fusion, *Grzegorz Maczkowski[1], Eryk Bunsch[2], and Jakub Krzeslowski[1]; [1]Warsaw University of Technology and [2]King Jan III Museum Palace at Wilanow (Poland)*

Image Quality and System Performance XV

Conference overview

We live in a visual world. The perceived quality of images is of crucial importance in industrial, medical, and entertaining application environments. Developments in camera sensors, image processing, 3D imaging, display technology, and digital printing are enabling new or enhanced possibilities for creating and conveying visual content that informs or entertains. Wireless networks and mobile devices expand the ways to share imagery.

The power of imaging rests directly on the visual quality of the images and the systems that produce them. As the images are generally intended to be viewed by humans, consideration of the role of human visual perception is intrinsic to the effective assessment of image quality.

This conference brings together engineers and scientists from industry and academia who strive to understand what makes a high-quality image and how to assess the requirements and performance of modern imaging systems. It focuses on both objective and subjective methods for evaluating the perceptual quality of images and includes applications throughout the imaging chain from image capture, through processing, to output, printed or displayed, video or still, 2D or 3D, LDR or HDR.

Awards: Best Student Paper and Best Paper

Conference Sponsors

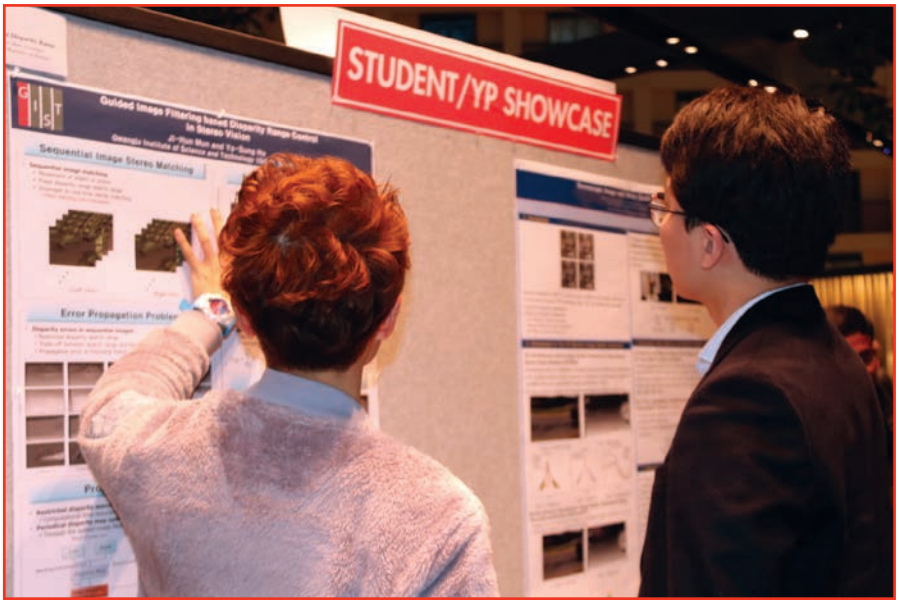


Photo: San Francisco Travel Association

Conference Chairs: **Elaine Jin,** Nvidia Corporation (United States) and **Stuart Perry**, University of Technology Sydney (Australia)

Program Committee: **Nicolas Bonnier**, Apple Inc. (United States); **Alan Bovik**, University of Texas at Austin (United States); **Peter Burns**, Burns Digital Imaging; **Brian Cooper**, Lexmark International, Inc. (United States); **Luke Cui**, Amazon (United States); **Mylène Farias**, University of Brasilia (Brazil); **Susan Farnand**, Rochester Institute of Technology (United States); **Frans Gaykema**, Océ Technologies B.V. (Netherlands); **Jukka Häkkinen**, University of Helsinki (Finland); **Dirk Hertel**, E Ink Corporation (United States); **Robin Jenkin**, Nvidia Corporation (United States); **Mohamed-Chaker Larabi**, University of Poitiers (France); **Toshiya Nakaguchi**, Chiba University (Japan); **Göte Nyman**, University of Helsinki (Finland); **Jonathan Phillips**, Google Inc. (United States); **Reza Safaee-Rad**, Qualcomm Technologies Inc. (Canada); **Sophie Triantaphillidou**, University of Westminster (United Kingdom)

Image Quality and System Performance XV

Monday, January 29, 2018

Automotive Camera Image Quality I Joint Session

Session Chairs: Stuart Perry, University of Technology Sydney (Australia) and Buyue Zhang, Intel Corporation (United States)

8:50 – 10:20 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

8:50 AVM-105
Fundamental imaging system analysis for autonomous vehicles, *Robin Jenkin, NVIDIA Corp. (United States)*

9:20 AVM-106
Optimizing automotive cameras for image quality, *Felix Heide and Dave Tokic, Algolux (Canada)*

9:40 IQSP-107
Color calibration of digital still cameras used on unmanned aerial vehicles, *Susan Farnand, Rochester Institute of Technology (United States)*

10:00 IQSP-108
No reference prediction of quality metrics for H.264 compressed infrared image sequences for UAV applications, *Kabir Hossain, Claire Mantel, and Soren Forchhammer, Technical University of Denmark (Denmark)*

10:20 – 10:50 am Coffee Break

Automotive Camera Image Quality II Joint Session

Session Chairs: Luke Cui, Amazon (United States) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Image Quality and System Performance XV.

10:50 AVM-145
P2020 - standard for automotive system image quality, *Patrick Denny, Valeo Vision Systems (Ireland)*

11:20 AVM-146
LED flicker: Root cause, impact and measurement for automotive imaging applications, *Brian Deegan, Valeo Vision Systems (Ireland)*

11:40 AVM-147
Visual quality evaluation of the multi-camera visualization in automotive surround view systems, *Vladimir Zlokolica[1,2], Mark Griffin[1], Aidan Casey[1], Daniela Solera[1], Brian Deegan[1], Patrick Denny[1], and Barry Dever[1]; [1]Valeo Vision Systems (Ireland) and [2]University of Novi Sad (Serbia)*

12:00 AVM-148
Detection probabilities: Performance prediction for sensors of autonomous vehicles, *Marc Geese, Ulrich Seger, and Alfredo Paolillo, Robert Bosch GmbH - Leonberg (Germany)*

12:20 AVM-149
Realistic image degradation with a measured PSF, *Christian Wittpahl, Hatem Ben Zakour, Matthias Lehmann, and Alexander Braun, Düsseldorf University of Applied Sciences (Germany)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision,
Greg Corrado, Google, Inc. (United States)

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Camera Image Quality I

Session Chair: Mohamed Chaker Larabi, Université de Poitiers (France)

3:30 – 4:50 pm
Regency C

3:30 IQSP-169
Measuring the impact of flare light on dynamic range, *Norman Koren, Imatest LLC (United States)*

3:50 IQSP-170
Quantitative measurement of contrast, texture and color in an HDR scene enabling analysis of camera using image fusion compared to traditional digital cameras, *Clément Viard, DxO (France)*

4:10 IQSP-171
Camera resolution and distortion: Advanced edge fitting, *Peter Burns[1] and Don Williams[2]; [1]Burns Digital Imaging and [2]Image Science Associates (United States)*

4:30 PMII-172
VCX: An industry initiative to create an objective camera module evaluation for mobile devices, *Dietmar Wueller, Image Engineering GmbH & Co. KG (Germany)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 pm Women in Electronic Imaging Breakfast

Imaging System Performance I Joint Session

Session Chairs: Elaine Jin, Nvidia Corporation (United States) and Jackson Roland, Apple Inc. (United States)

8:50 – 9:30 am
Regency A-B

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

8:50 PMII-182
Lessons from design, construction, and use of various multicameras, *Henry Dietz, Clark Demaree, Paul Eberhart, Chelsea Kuball, and Jong Wu, University of Kentucky (United States)*

9:10 PMII-183
Relative impact of key rendering parameters on perceived quality of VR imagery captured by the Facebook surround 360 camera, *Nora Pfund[1], Nitin Sampat[1], and Stephen Viggiano[2]; [1]Rochester Institute of Technology and [2]RIT School of Photographic Arts and Sciences (United States)*

Keynote: Imaging System Performance Joint Session
Session Chair: Elaine Jin, Nvidia Corporation (United States)
9:30 – 10:10 am
Regency A-B

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

IQSP-208
Experiencing mixed reality using the Microsoft HoloLens, *Kevin Matherson, Microsoft Corporation (United States*

Dr. Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Imaging System Performance II

Session Chair: Frans Gaykema, Océ Technologies (Netherlands)

10:50 am – 12:30 pm
Regency C

10:50 IQSP-231
Bridging the gap between imaging performance and image quality measures, *Edward Fry[1], Sophie Triantaphillidou[1], Ralph Jacobson[1], John Jarvis[1], and Robin Jenkin[2]; [1]University of Westminster (United Kingdom) and [2]ON Semiconductor (United States)*

11:10 IQSP-232
The benefits of color over black-and-white images in task-oriented reconnaissance applications, *Cicely DiPaulo and Lawrence Scarff, UTC Aerospace Systems (United States)*

11:30 IQSP-233
Using the immersive methodology to assess the quality of videos transmitted in UDP and TCP-based scenarios, *Mylène Farias and Helard Martinez, University of Brasilia (Brazil)*

11:50 IQSP-234
Analysis of perceptual strength and physical strength parameters of videos impaired with two spatial artifacts (blockiness and blurriness) and one temporal artifact (packet-loss), *Alexandre Silva[1] and Mylène Farias[2]; [1]Federal Institute of Triangulo Mineiro and [2]University of Brasília (Brazil)*

12:10 IQSP-235
Assessing the quality of video conferencing systems: Towards quality of communication, *Muhammad Shahid and Jon Yngve Hardeberg, Norwegian University of Science and Technology (Norway)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Keynote: Imaging and Astronomy, Prof. Joel Primack JOINT SESSION
Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Kurt Niel, University of Applied Sciences Upper Austria (Austria)
3:30 – 4:30 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

COLOR-259
Computer vision and deep learning applied to simulations and imaging of galaxies and the evolving universe, *Joel Primack, University of California, Santa Cruz (United States)*

The keynote speaker is Dr. Joel R. Primack, Distinguished Professor of Physics Emeritus, University of California, Santa Cruz. Dr. Primack specializes in the formation and evolution of galaxies and the nature of the dark matter that makes up most of the matter in the universe. After helping to create what is now called the "Standard Model" of particle physics, Dr. Primack began working in cosmology in the late 1970s, and he became a leader in the new field of particle astrophysics. His 1982 paper proposed that a natural candidate for the dark matter is the lightest supersymmetric particle, still perhaps the leading candidate. He is one of the principal originators and developers of the theory of Cold Dark Matter, which has become the basis for the standard modern picture of structure formation in the universe. With support from NASA, NSF, and DOE, he has been using supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies under various assumptions, and comparing the predictions of these theories to the latest observational data. He organized and led the University of California systemwide Center for High-Performance Astro-Computing, 2010-2015. Dr. Primack was one of the main advisors for the Smithsonian Air and Space Museum's 1996 IMAX film Cosmic Voyage, and he has worked with leading planetariums to help make the invisible universe visible.

Imaging and Astronomy Afternoon Session JOINT SESSION

Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Alessandro Rizzi, Università degli Studi di Milano (Italy)

4:30 – 5:10 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

4:30 COLOR-285
About color correction in astrophotography, *Alessandro Rizzi, Daniele Marini, and Cristian Bonanomi, Università degli Studi di Milano (Italy)*

4:50 SD&A-286
TileViz: Tile visualization for astro-chemistry, *Martial Mancip[1], Riccardo Spezia[1,2], Yannick Jeanvoine[2], and Cécile Balsier[1]; [1]CNRS and [2]Université d'Evry Val d'Essonnes (France)*

Imaging and Astronomy Discussion JOINT SESSION
Session Chairs: Susan Farnand, Rochester Institute of Technology (United States) and Daniele Marini, Università degli Studi di Milano (Italy)

5:10 – 5:30 pm
Cypress B

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Image Quality and System Performance XV.

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Machine Learning and Image Quality

Session Chair: Sophie Triantaphillidou, University of Westminster (United Kingdom)

8:50 – 10:00 am
Regency C

8:50 IQSP-298
Convolutional neural network and support vector regression for stereoscopic image quality assessment with reference, *Aladine Chetouani, University of Orléans (France)*

9:10 IQSP-299
Advantages of incorporating perceptual component models into a machine learning framework for prediction of display quality, *Anustup Choudhury and Scott Daly, Dolby Laboratories, Inc. (United States)*

9:30 IQSP-300
NIMA: Neural image assessment, *Hossein Talebi and Peyman Milanfar, Google Research (United States)*

10:00 am – 4:00 pm Industry Exhibition

10:00 – 10:50 am Coffee Break

Camera Image Quality II

Session Chair: Mylène Farias, University of Brasilia (Brazil)

10:50 am – 12:10 pm
Regency C

10:50 IQSP-340
Image quality benchmark of computational bokeh, *Clément Viard, DxO (France)*

11:10 IQSP-341
Measurement of noise using the dead leaves pattern, *Uwe Artmann, Image Engineering GmbH & Co. KG (Germany)*

11:30 IQSP-342
Development of a perceptually calibrated objective metric for auto white balance, *Elaine Jin[1] and Yixuan Wang[2]; [1]Nvidia Corporation and [2]Apple Inc. (United States)*

11:50 PMII-344
Statistic analysis of millions of digital photos 2018, *Dietmar Wueller[1] and Reiner Fageth[2]; [1]Image Engineering GmbH & Co. KG and [2]CeWe (Germany)*

12:10 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Image Quality Modeling

Session Chair: Peter Burns, Burns Digital Imaging (United States)

3:30 – 4:50 pm
Regency C

3:30 IQSP-365
Image quality loss and compensation for visually impaired observers, *Sophie Triantaphillidou[1], Edward Fry[1], Vicent Sanchis-Jurado[2], and Álvaro Pons[2]; [1]University of Westminster (United Kingdom) and [2]University de Valencia (Spain)*

3:50 IQSP-366
A full-reference image quality assessment metric for 3D synthesized views, *Shishun Tian, Lu Zhang, Luce Morin, and Olivier Déforges, Institut National des Sciences Appliquées de Rennes (France)*

4:10 IQSP-367
No-reference image quality assessment using salient local binary patterns, *Pedro Garcia Freitas, Welington Akamine, and Mylène Farias, University of Brasília (Brazil)*

4:30 IQSP-368
Quality assessment of out-of-focus blurred images based on objects depth ordering and saliency, *Sid Ahmed Fezza[1] and Mohamed Chaker Larabi[2]; [1]National Institute of Telecommunications and ICT (Algeria) and [2]Université de Poitiers (France)*

Image Quality Panel
Panel Moderator: Robin Jenkin, Nvidia Corporation (United States)

4:50 – 5:30 pm
Regency C

Image Quality and System Performance XV Interactive (Poster) Papers Session

5:30 – 7:00 pm
The Grove

The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

IQSP-405
Smartphone calibration for crowd-sourced determination of the presence of cyanobacteria in water samples, *Katherine Carpenter, Susan Farnand, and Anthony Vodacek, Rochester Institute of Technology (United States)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Image Sensors and Imaging Systems 2018

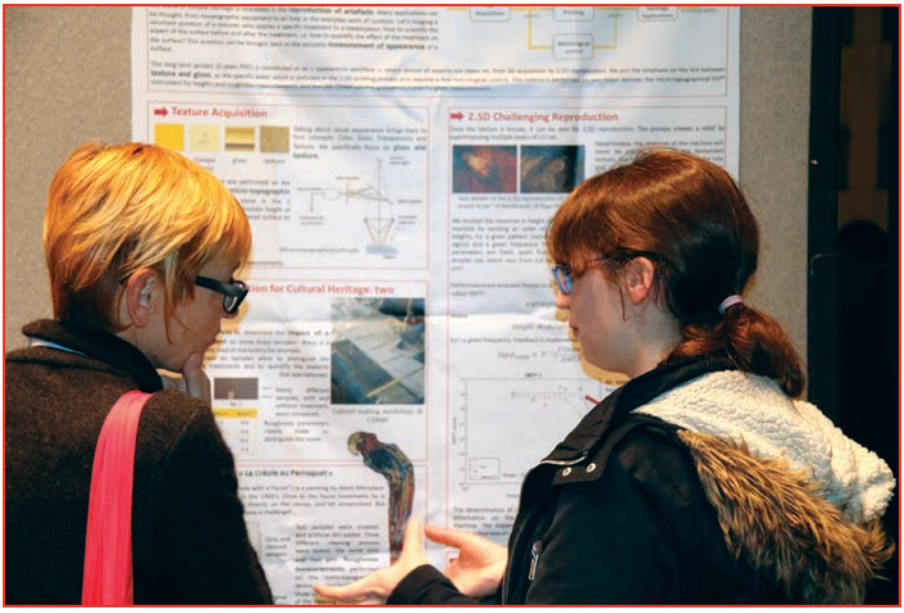
Conference overview

Solid state optical sensors and solid state cameras have established themselves as the imaging systems of choice for many demanding professional applications such as scientific and industrial applications. The advantages of low-power, low-noise, high-resolution, high-geometric fidelity, broad spectral sensitivity, and extremely high quantum efficiency have led to a number of revolutionary uses.

This conference aims at being a place of exchanges and at giving the opportunity to a quick publication of new works in the areas of solid state detectors, solid state cameras, new optical concepts, and novel applications. To encourage young talent, a best student paper contest is organized.

Awards: Best Paper, Best Student Paper

Conference Sponsors



Conference Chairs: **Arnaud Darmont**, APHESA SPRL (Belgium), **Arnaud Peizerat**, Commissariat à l'Énergie Atomique (France); and **Ralf Widenhorn**, Portland State University (United States);

Program Committee: **Morley M. Blouke**, Portland State University (retired) (United States); **Nick Bulitka**, Lumenera Corp. (Canada); **Calvin Chao**, Taiwan Semiconductor Manufacturing Company (Taiwan); **Glenn H. Chapman,** Simon Fraser University (Canada); **Tobi Delbrück**, Institute of Neuroinformatics, University of Zurich and ETH Zurich (Switzerland); **James A. DiBella**, Imperx (United States); **Antoine Dupret**, Commissariat à l'Énergie Atomique (France); **Boyd A. Fowler**, OmniVision Technologies, Inc. (United States); **Rihito Kuroda**, Tohoku University (Japan); **Kevin J. Matherson**, Microsoft Corp. (United States); **Clemenz Portmann**, Google Inc. (United States); **Alice L. Reinheimer**, e2v (United States); **Gilles Sicard**, Commissariat a l'Energie Atomique (France); **Nobukazu Teranishi**, University of Hyogo (Japan); **Jean-Michel Tualle**, University Paris 13 (France); **Orly Yadid-Pecht**, University of Calgary (Canada); and **Xinyang Wang**, GPIXEL (China)

Image Sensors and Imaging Systems 2018

Wednesday, January 31, 2018

Color and Spectral Imaging

Session Chair: Ralf Widenhorn, Portland State University (United States)

8:50 – 9:40 am
Cypress A

8:50
Conference Opening Remarks

9:00 IMSE-292
Color channel reconstruction for multi-color multi-view images using disparity and color similarity-based local linear regression, *Daniel Kiesel, Thomas Richter, Jürgen Seiler, and André Kaup, Friedrich-Alexander University Erlangen-Nuremberg (Germany)*

9:20 IMSE-293
Tutorial talk: Introduction to spectral response (QE) curves, their meaning and their measurement, *Arnaud Darmont, APHESA SPRL and Imaging Courses (Belgium)*

Keynote: Color and Spectral Imaging
Session Chair: Ralf Widenhorn, Portland State University (United States)
9:40 – 10:20 am
Cypress A

IMSE-313
Quantum efficiency and color, *Jörg Kunze, Basler AG (Germany)*

Dr. Jörg Kunze received his PhD in Physics from the University of Hamburg (2004). He joined Basler in 1998, where he started as an electronics developer and where he currently is the team leader of New Technology. Dr. Kunze serves as an expert for image sensors, camera hardware, noise, color fidelity, 3D- and computational imaging and he develops new algorithms for color image signal processing. The majority of the Basler patents name him as inventor.

10:00 am – 4:00 pm Industry Exhibition

10:20 – 10:50 am Coffee Break

Depth Sensing JOINT SESSION

Session Chair: Calvin Chao, Taiwan Semiconductor Manufacturing Co. Ltd. (Taiwan)

10:50 – 11:50 am
Cypress A

This session is jointly sponsored by: Image Sensors and Imaging Systems 2018, and 3D Image Processing, Measurement (3DIPM), and Applications 2018.

10:50 IMSE-325
Mobile 3D imaging using handheld lens array sheet and single camera, *Shoaib Soomro[1], Osman Eldes[1], Kaan Aksit[2], and Hakan Urey[1]; [1]Koç University (Turkey) and [2]Nvidia Research (United States)*

11:10 IMSE-326
A distance measurement method using a time-of-flight CMOS range image sensor with 4-tap output pixels and multiple time-windows, *Kohei Yamada, Akihito Komazawa, Taishi Takasawa, Keita Yasutomi, Keiichiro Kagawa, and Shoji Kawahito, Shizuoka University (Japan)*

11:30 IMSE-327
3D CMOS image sensor based on white pixel with off-center rectangular apertures, *Byoung-Soo Choi[1], Sang-Hwan Kim[1], Jimin Lee[1], Chang-Woo Oh[1], Seunghyuk Chang[2], JongHo Park[2], Sang-Jin Lee[2], and Jang-Kyoo Shin[1]; [1]Kyungpook National University and [2]Center for Integrated Smart Sensors (Republic of Korea)*

Keynote I: Technology and Design for High Performance Imaging
Session Chair: Arnaud Darmont, APHESA SPRL (Belgium)
11:50 am – 12:30 pm
Cypress A

IMSE-354
Dark current limiting mechanisms in CMOS image sensors, *Dan McGrath, BAE Systems (United States)*

Dr. Dan McGrath is Sr. Principal II Semiconductor Engineer at BAE Systems. Dr. McGrath has worked for 38 years specializing in the device physics of silicon-based pixels, CCD and CIS, and in the integration of image-sensor process enhancements in the manufacturing flow. He chose his first job because it offered that "studying defects in image sensors means doing physics" and has kept this passion front-and-center in his work. He has pursued this work at Texas Instruments, Polaroid, Atmel, Eastman Kodak, Aptina, and BAE Systems and has worked with manufacturing facilities in France, Italy, Taiwan, and the United States. His publications include the first megapixel CCD and the basis for dark current spectroscopy (DCS). He received his PhD from The Johns Hopkins University.

Image Sensors and Imaging Systems Wednesday Morning Author Q&A

Session Chair: Arnaud Darmont, APHESA SPRL (Belgium)

12:30 – 12:45 pm
Cypress A

12:45 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

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3:00 – 3:30 pm Coffee Break

Keynote II: Technology and Design for High Performance Imaging
Session Chair: Arnaud Peizerat, CEA (France)
3:30 – 4:10 pm
Cypress A

IMSE-360

Sub-electron low-noise CMOS image sensors, *Angel Rodríguez-Vázquez, Universidad de Sevilla (Spain)*

Prof. Ángel Rodriguez-Vazquez (IEEE Fellow, 1999) conducts research on the design of analog and mixed-signal front-ends for sensing and communication, including smart imagers, vision chips and low-power sensory-processing microsystems. He received his Bachelor's (University of Seville, 1976) and PhD in physics-electronics (University of Seville, 1982) with several national and international awards, including the IEEE Rogelio Segovia Torres Award (1981). After research stays at UC Berkeley and Texas A&M University, he became a Full Professor of Electronics at the University of Sevilla in 1995. He co-founded the Institute of Microelectronics of Sevilla, under the umbrella of the Spanish Council Research (CSIC) and the University of Sevilla and started a research group on Analog and Mixed-Signal Circuits for Sensors and Communications. In 2001 he was the main promotor and co-founder of the start-up company AnaFocus Ltd. and served as CEO, on leave from the University, until June 2009, when the company reached maturity as a worldwide provider of smart CMOS imagers and vision systems-on-chip. He has authored 11 books, 36 additional book chapters, and some 150 journal articles in peer-review specialized publications. He was elected Fellow of the IEEE for his contributions to the design of chaos-based communication chips and neuro-fuzzy chips. His research work has received some 6,954 citations; he has an h-index of 42 and an i10-index of 143.

High Speed Imaging

Session Chair: Arnaud Peizerat, CEA (France)

4:10 – 5:10 pm
Cypress A

4:10 IMSE-397
Multi-collection-gate image sensors – present status and perspective, *Takeharu Etoh, Ritsumeikan University (Japan)*

4:30 IMSE-398
A preliminary chip evaluation toward over 50Mfps burst global shutter stacked CMOS image sensor, *Manabu Suzuki, Masashi Suzuki, Rihito Kuroda, and Shigetoshi Sugawa, Tohoku University (Japan)*

4:50 IMSE-399
Back to CCD's panels? An ultra-high speed CMOS sensor architecture, *Alex Krymski, Alexima (United States)*

Image Sensors and Imaging Systems 2018 Interactive (Poster) Papers Oral Previews

Session Chair: Ralf Widenhorn, Portland State University (United States)

5:10 – 5:30 pm
Cypress A

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Image Sensors and Imaging Systems 2018 Interactive Papers Session at 5:30 pm on Wednesday.

5:10 IMSE-400
Response curve programming of HDR image sensors based on discretized information transfer and scene information, *Arnaud Darmont, APHESA SPRL (Belgium)*

5:20 IMSE-401
Exploring hot pixel characteristics for 7 to 1.3 micron pixels, *Glenn Chapman[1], Rohan Thomas[1], Parham Purbakht[1], Klinsmann Meneses[1], Israel Koren[2], and Zahava Koren[2]; [1]Simon Fraser University (Canada) and [2]University of Massachusetts Amherst (United States)*

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Keynote: Imaging Sensors and Technologies for Automotive Intelligence JOINT SESSION

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Joyce Farrell, Stanford University (United States); and Darnell Moore, Texas Instruments (United States)

8:50 – 9:30 am

Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

PMII-415

Advances in automotive image sensors, *Boyd Fowler[1] and Johannes Solhusvik[2]; [1]OmniVision Technologies (United States) and [2]OmniVision Technologies Europe Design Center (Norway)*

Dr. Boyd Fowler joined OmniVision in December 2015 as the vice president of marketing and was appointed chief technology officer in July 2017. Dr. Fowler's research interests include CMOS image sensors, low noise image sensors, noise analysis, data compression, and machine learning and vision. Prior to joining OmniVision, he was co-founder and vice president of engineering at Pixel Devices, where he focused on developing high-performance CMOS image sensors. After Pixel Devices was acquired by Agilent Technologies, Dr. Fowler was responsible for advanced development of commercial CMOS image wsensor products. In 2003, Dr. Fowler joined Fairchild Imaging as the CTO and vice president of technology, where he developed SCMOS image sensors for high-performance scientific applications. After Fairchild Imaging was acquired by BAE Systems, Dr. Fowler was appointed the technology director of the CCD/CMOS image sensor business. He has authored numerous technical papers, book chapters, and patents. Dr. Fowler received his MSEE and PhD in electrical engineering from Stanford University (1990 and 1995 respectively).

Imaging Sensors and Technologies for Automotive Intelligence JOINT SESSION

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Patrick Denny, Valeo Vision Systems (Ireland); and Joyce Farrell, Stanford University (United States)

9:30 – 9:50 am

Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

9:30 IMSE-422

Partial reset HDR image sensor with improved fixed pattern noise performance, *Volodymyr Seliuchenko[1,2], Sharath Patil[1,3], Marcelo Mizuki[1], Saad Ahmad[1], and Maarten Kuijk[2]; [1]Melexis (Belgium), [2]Vrije University Brussel (Belgium), and [3]University of Massachusetts Lowell (United States)*

9:50 – 10:50 am Coffee Break

Keynote: Novel Vision Techniques and Applications

Session Chair: Nick Bulitka, Lumenera Corp (Canada)

10:50 – 11:30 am

Cypress A

IMSE-438

Security imaging in an unsecure world, *Anders Johannesson, Axis Communications AB (Sweden)*

Dr. Anders Johannesson is a senior expert engineer at Axis Communications AB in Lund, Sweden. He received his BS in physics (1987) and his PhD (1992); both from Lund University, Sweden. His thesis work involved imaging polarimetry and spectroscopy of features in the solar atmosphere. This work was continued at Caltech, (United States). He has also been involved in development within industrial and consumer imaging at a number of companies in Europe including Dialog Semiconductor. He joined Axis Communications in 2006 and is part of the core technology team for surveillance and security imaging. His focus is on the image sensor.

Novel Vision Techniques and Applications

Session Chair: Nick Bulitka, Lumenera Corp (Canada)

11:30 am – 12:20 pm

Cypress A

11:30 IMSE-447

A near pixel depth from focus architecture for video rate depth estimation, *Simon Emberger[1,2], Laurent Alacoque[3], Antoine Dupret[1], Gilles Sicard[1], and Jean Louis de Bougrenet de la Tocnaye[2]; [1]CEA, [2]IMT-Atlantique, and [3]Minatec Campus (France)*

11:50 IMSE-448

Mobile GPU implementation of wide dynamic range image compression based on multi-scale histogram synthesis, *Jie Yang, Douglas McDonald, Ulian Shahnovich, and Orly Yadid-Pecht, University of Calgary (Canada)*

12:10

Novel Techniques and Applications Author Q&A

12:20 – 2:00 pm Lunch

Noise, Performance, and Characterization

Session Chair: Arnaud Darmont, APHESA SPRL (Belgium)

2:00 – 3:30 pm

Cypress A

2:00 IMSE-456

Using wavelets to analyze RTS noise in irradiated CMOS image sensors, *Benjamin Hendrickson, Portland State University (United States)*

2:20 IMSE-457

Lag-induced image artifacts in still imaging with CIS, *Leo Anzagira, Orit Skorka, Pulla Reddy Ailuri, and Radu Ispasoiu, ON Semiconductor Corporation (United States)*

2:40 IMSE-458

Two calibration methods to improve the linearity of a CMOS image sensor, *Fei Wang and Albert Theuwissen, Technische University Delft (Netherlands)*

3:00 IMSE-459
Characterization of discrete 2D-MTF using physical optics, *Victor Lenchenkov, Orit Skorka, Robert Gravelle, Ulrich Boettiger, and Radu Ispasoiu, ON Semiconductor Corporation (United States)*

3:20
Noise, Performance, and Characterization Author Q&A

3:30 – 3:50 pm Coffee Break

Image Sensors and Imaging Systems 2018 Wrap-up Q&A

3:50 – 4:20 pm

Cypress A
Conference Closing Remarks
Wrap-up Author Q&A

Imaging and Multimedia Analytics in a Web and Mobile World 2018

Conference overview

The recent progress in web, social networks, and mobile capture and presentation technologies has created a new wave of interest in imaging and multimedia topics, from multimedia analytics to content creation and repurposing, from engineering challenges to aesthetics and legal issues, from content sharing on social networks to content access from Smart Phones with cloud-based content repositories and services. Compared to many subjects in traditional imaging, these topics are more multi-disciplinary in nature. This conference provides a forum for researchers and engineers from various related areas, both academic and industrial to exchange ideas and share research results in this rapidly evolving field.

Conference Sponsors

Conference Chairs: **Jan P. Allebach**, Purdue University (United States); **Zhigang Fan**, Apple Inc. (United States); and **Qian Lin**, HP Labs, HP Inc. (United States)

Program Committee: **Gady Agam,** Illinois Institute of Technology (United States); **Vijayan K. Asari**, University of Dayton (United States); **Reiner Fageth**, CEWE Stifung & Co. KGaA (Germany); **Yi Fang,** New York University Abu Dhabi (United States); **Michael J. Gormish**, Ricoh Innovations, Inc. (United States); **Yandong Guo,** Microsoft Corporation (United States); **Ali Jahanian,** MIT CSAIL Lab (United States); **Ramakrishna Kakarola,** Picartio Inc. (United States); **Xiaofan Lin,** A9.com, Inc. (United States); **Changsong Liu,** Tsinghua University (China); **Yung-Hsiang Lu,** Purdue University (United States); **Binu Nair,** University of Dayton Research Institute (United States); **Mu Qiao,** Shutterfly, Inc. (United States); **Alastair M. Reed,** Digimarc Corp. (United States); **Andreas Savakis,** Rochester Institute of Technology (United States); **Bin Shen,** Google Inc. (United States); **Wiley H. Wang**, Ditto.com (United States); **Jane You,** The Hong Kong Polytechnic University (Hong Kong, China); and **Buyue Zhang,** Intel Corporation (United States)

Imaging and Multimedia Analytics in a Web and Mobile World 2018

Wednesday, January 31, 2018

Keynote: Deep Learning for Recognition and Detection I
Session Chair: Qian Lin, HP Labs, HP Inc. (United States)
9:10 – 10:10 am
Harbour A-B

IMAWM-310
How does building a low cost vision sensor teach us about deep learning?, *Tianli Yu, Morpx Inc. (United States)*

Dr. Tianli Yu is the CEO and co-founder of Morpx Inc., a startup based in Hangzhou that delivers innovative computer vision hardware and software. He received his PhD in ECE from the University of Illinois at Urbana Champaign (2006). After graduation, he's been a senior computer vision researcher in Motorola Labs working on the embedded stereo depth camera for Motorola's phones. Later, Dr. Yu joined like.com and designed algorithms to assist shoppers in finding their personal styles. Like.com was eventually acquired by Google in 2010. After working for a few years in the design of large scale visual search and recognition algorithms for Google Shopping, Dr. Yu founded Morpx with his friend Frank Ran in late 2013. Morpx is the second time in his career that he is working to build an ultra-compact and super energy efficient computer vision system.

10:00 am – 4:00 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Deep Learning for Recognition and Detection II

Session Chair: Jane You, The Hong Kong Polytechnic University (Hong Kong)

10:50 AM – 12:30 pm
Harbour A-B

10:50 IMAWM-336
Depth and super-pixel extraction for augmenting human detection (Invited), *Theus Aspiras, Hussin Ragb, and Vijayan Asari, University of Dayton (United States)*

11:30 IMAWM-467
Vision based vehicle re-identification by fusion of multiple features, *Geng Yang[1], Jane You[2], Zhenhua Guo[3], and Qin Li[1]; [1]Shenzhen Genvict Technologies Co., Ltd. (China), [2]The Hong Kong Polytechnic University (Hong Kong), and [3]Tsinghua University Shenzhen Graduate School (China)*

11:50 IMAWM-338
Hierarchical Auto-associative Polynomial Convolutional Neural Network (HAP-CNN) for pattern classification, *Patrick Martell, University of Dayton Research Institute (United States)*

12:10 IMAWM-339
Learn a hybrid collaborative representation for fine-grained image classification, *Wenyang Xie[1], Bao-Di Liu[1], Xue Li[2], and Yan-Jiang Wang[1]; [1]University of China University of Petroleum (Huadong) and [2]Tsinghua University (China)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Deep Learning for Face Recognition

3:30 – 5:10 PM
Harbour A-B

3:30 IMAWM-372
One-shot face recognition: A review (Invited), *Yandong Guo and Lei Zhang, Microsoft Research (United States)*

4:10 IMAWM-373
Face liveness detection based on joint analysis of RGB and near-infrared image of faces, *Lingxue Song and Changsong Liu, Tsinghua University (China)*

4:30 IMAWM-374
CNN based facial landmark detection, *Ruiyi Mao[1], Qian Lin[2], and Jan Allebach[1]; [1]Purdue University and [2]HP Labs, HP Inc. (United States)*

4:50 IMAWM-421
Empirical study of image compression for palm vein recognition, *Zhenhua Guo[1], Qin Li[2], Yujiu Yang[1], and Jane You[3]; [1]Tsinghua University (China), [2]Shenzhen Institute & Information Techology (China), and [3]The Hong Kong Polytechnic University (Hong Kong)*

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Deep Learning for Recognition and Detection III

Session Chair: Zhigang Fan, Apple Inc. (United States)

9:10 – 10:10 AM
Harbour A-B

9:10 IMAWM-419
3D Shape retrieval using volumetric and image convolutional neural networks: A meta-algorithmic approach, *Ruiting Shao[1], Yang Lei[2], Jian Fan[2], and Jerry Liu[2]; [1]Purdue University and [2]HP Inc. (United States)*

9:30 IMAWM-420
A new fast template matching algorithm for object detection, *Jichao Jiao[1], Weihua Tang[2], Xin Wang[1], and Zhongliang Deng[1]; [1]Beijing University of Posts and Telecommunications and [2]China State Construction Engineering Corporation (China)*

9:50 IMAWM-375
A feature fusion strategy for human detection in omnidirectional camera imagery, *Hussin Ragb and Vijayan Asari, University of Dayton (United States)*

10:10 – 10:50 AM Coffee Break

Multimedia Analytics in Online Systems

10:50 am – 12:30 pm
Harbour A-B

10:50 IMAWM-443
Has mobile photography changed the users' behavior while ordering printed products? (Invited), *Reiner Fageth, CEWE Stiftung & Co. KGAA (Germany)*

11:30 IMAWM-444
Application of natural language processing to an online fashion marketplace, *Kendal Norman[1], Zhi Li[1], Young-Taek Oh[1], Gautam Golwala[2], Sathya Sundaram[2], and Jan Allebach[1]; [1]Purdue University and [2]Poshmark Inc. (United States)*

11:50 IMAWM-445
Multimedia analytics platform for profiling keywords embedded in photo catalogues, *Emiliano Pallotti, Federica Mangiatordi, Andrea Bernardini, and Licia Capodiferro, Fondazione Ugo Bordoni (Italy)*

12:10 IMAWM-446
Use of color information in the analysis of fashion photographs, *Zhi Li[1], Gautam Golwala[2], Sathya Sundaram[2], and Jan Allebach[1]; [1]Purdue University and [2]Poshmark Inc. (United States)*

12:30 – 2:00 pm Lunch

Mobile Image Analytics and Augmented Reality

2:00 – 3:20 pm
Harbour A-B

2:00 IMAWM-453
Semantic pose machines (Invited), *Ying-Kai Huang and Andreas Savakis, Rochester Institute of Technology (United States)*

2:40 IMAWM-454
Learning enhancement with mobile augmented reality, *Xunyu Pan and Joseph Shipway, Frostburg State University (United States)*

3:00 IMAWM-455
Person segmentation using convolutional neural networks with dilated convolutions, *David Ho[1] and Qian Lin[2]; [1]Purdue University and [2]HP Labs, HP Inc. (United States)*

3:20 – 3:50 pm Coffee Break

Multi-Media Object Detection

Session Chair: Jan Allebach, Purdue University (United States)

3:50 – 4:50 pm
Harbour A-B

3:50 IMAWM-466
Deep learning for moving object detection from a single camera in UAVs (Invited), *Dong Hye Ye, Qiulin Chen, Jing Li, Juan Wachs, and Charles Bouman, Purdue University (United States)*

4:30 IMAWM-337
Logo detection and recognition with synthetic images, *Daniel Mas Montserrat[1], Qian Lin[2], Jan Allebach[1], and Edward Delp[1]; [1]Purdue University and [2]HP Labs, HP Inc. (United States)*

Intelligent Robotics and Industrial Applications using Computer Vision 2018

Conference overview

This conference brings together real-world practitioners and researchers in intelligent robots and computer vision to share recent applications and developments. Topics of interest include the integration of imaging sensors supporting hardware, computers, and algorithms for intelligent robots, manufacturing inspection, characterization, and/or control.

The decreased cost of computational power and vision sensors has motivated the rapid proliferation of machine vision technology in a variety of industries, including aluminum, automotive, forest products, textiles, glass, steel, metal casting, aircraft, chemicals, food, fishing, agriculture, archaeological products, medical products, artistic products, etc. Other industries, such as semiconductor and electronics manufacturing, have been employing machine vision technology for several decades. Machine vision supporting handling robots is another main topic. With respect to intelligent robotics another approach is sensor fusion – combining multi-modal sensors in audio, location, image and video data for signal processing, machine learning and computer vision, and additionally other 3D capturing devices.

There is a need of accurate, fast, and robust detection of objects and their position in space. Their surface, the background and illumination is uncontrolled, in most cases the objects of interest are within a bulk of many others. For both new and existing industrial users of machine vision, there are numerous innovative methods to improve productivity, quality, and compliance with product standards. There are several broad problem areas that have received significant attention in recent years. For example, some industries are collecting enormous amounts of image data from product monitoring systems. New and efficient methods are required to extract insight and to perform process diagnostics based on this historical record. Regarding the physical scale of the measurements, microscopy techniques are nearing resolution limits in fields such as semiconductors, biology, and other nano-scale technologies. Techniques such as resolution enhancement, model-based methods, and statistical imaging may provide the means to extend these systems beyond current capabilities. Furthermore, obtaining real-time and robust measurements in-line or at-line in harsh industrial environments is a challenge for machine vision researchers, especially when the manufacturer cannot make significant changes to their facility or process.

Awards

Best Paper, Best Student Paper

Intelligent Robotics and Industrial Applications using Computer Vision 2018

Monday January 29, 2018

Surveillance in Robotics, Vision, and Inspection JOINT SESSION

Session Chair: Sreenath Vantaram, Apple Inc. (United States)

10:40 am – 12:20 pm
Sandpebble C

This session is jointly sponsored by: Intelligent Robotics and Industrial Applications using Computer Vision 2018, and Surveillance Session: Applications and Algorithms.

10:40 IRIACV-125
Pose perceptual characteristics using HMD-based visual instruction; effect of front/rear view and viewpoint change methods, *Shin Kinoshita, Yoshihiko Nomura, Ryota Sakamoto, and Tokuhiro Sugiura, Mie University (Japan)*

11:00 IRIACV-126
Robust pose estimation with the stereoscopic camera in harsh environment, *Longchuan Niu, Sergey Smirnov, Jouni Mattila, and Atanas Gotchev, Tampere University of Technology (Finland)*

11:20 SRV-127
Predicting rapid fire growth (flashover) using a hybrid convolutional neural network for object recognition and segmentation, *Kyongsik Yun, Jessi Bustos, and Thomas Lu, NASA Jet Propulsion Laboratory (United States)*

11:40 SRV-128
Using shape descriptors for UAV detection, *Eren Unlu[1], Emmanuel Zenou[1], and Nicolas Riviere[2]; [1]ISAE-SUPAERO and [2]ONERA (France)*

12:00 SRV-129
About pixel densities in surveillance, *Vlado Damjanovski, ViDi Labs Pty Ltd. (Australia)*

12:20 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision,
Greg Corrado, Google, Inc. (United States)

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Special Session on: Computational Imaging for Advanced Manufacturing JOINT SESSION

Session Chairs: Vincent Paquit and Hector Santos-Villalobos, Oak Ridge National Laboratory (United States)

3:30 – 5:10 pm
Harbour A-B

This session is jointly sponsored by: Computational Imaging XVI and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

3:30 COIMG-177
Advanced manufacturing research activities in the scaling of additive, battery, carbon fiber, and composites fabrication, *William Peter, Merlin Theodore, Lonnie Love, Ryan Dehoff, Vlastimil Kunc, and Vincent Paquit, Oak Ridge National Laboratory (United States)*

3:50 COIMG-178
Automated in-situ defects detection in metal additive manufacturing parts, *Vincent Paquit, James Ferguson, Sean Yoder, Michael Kirka, and Ryan Dehoff, Oak Ridge National Laboratory (United States)*

4:10 COIMG-179
Spectral neutron tomography for crystalline materials, *Singanallur Venkatakrishnan[1], Luc Dessieux[2], and Philip Bingham[1]; [1]Oak Ridge National Laboratory and [2]University of Tennessee Knoxville (United States)*

4:30 COIMG-180
Application of characterization, modeling and analytics towards understanding process-structure-property relationships in metallic 3D printing, *Michael Groeber, Edwin Schwalbach, Sean Donegan, Kevin Chaput, Todd Butler, and Jonathan Miller, Wright-Patterson AFB (United States)*

4:50 COIMG-181
Separable models for cone-beam MBIR reconstruction, *Thilo Balke[1], Michael Groeber[2], Gregery Buzzard[1], and Charles Bouman[1]; [1]Purdue University and [2]Wright-Patterson AFB (United States)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Machine Vision and Deep Learning

Session Chair: Juha Röning, University of Oulu (Finland)

9:10 – 10:10 am
Sandpebble C

9:10 IRIACV-202
No-reference utility estimation with a convolutional neural network, *Edward Scott and Sheila Hemami, Northeastern University (United States)*

9:30 IRIACV-203
Haptic industrial robot control and bilateral teleoperation by using a virtual visual interface, *Servet Soyguder[1] and Tayfun ABUT[2]; [1]Firat University and [2]Mus Alparslan University (Turkey)*

9:50 IRIACV-204
A 3D guitar fingering assessing system based on CNN-hand pose estimation and SVR-assessment, *Zhao Wang and Jun Ohya, Waseda University (Japan)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Machine Vision and Imaging

Session Chair: Kurt Niel, University of Applied Sciences Upper Austria (Austria)

10:50 am – 12:30 pm
Sandpebble C

10:50 IRIACV-236
Machine vision system for rapid online detection of wooden breast syndrome in chicken fillets, *Seung-Chul Yoon, Brian Bowker, Kurt Lawrence, and Hong Zhuang, US Department of Agriculture-Agricultural Research Service (United States)*

11:10 IRIACV-237
An image processing based method for chewing detection using variable-intensity template, *Atsuto Fujimoto[1], Takaaki Ohkawauchi[2], Junji Yamato[3], and Jun Ohya[1]; [1]Waseda University, [2]Teikyo University, and [3]Kogakuin University (Japan)*

11:30 IRIACV-238
Discriminating the presence of the cerebral aneurysm using shape features obtained from medical images of the cerebral vessel, *Kosei Kikuchi, Takanobu Yagi, Rong Xu, and Jun Ohya, Waseda University (Japan)*

11:50 IRIACV-240
Geometric calibration and image rectification of a multi-line scan camera for accurate 3D reconstruction, *Bernhard Blaschitz, Svorad Štolc, and Doris Antensteiner, AIT Austrian Institute of Technology GmbH (Austria)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Pattern Recognition and Inspection

Session Chair: Henry Ngan, Hong Kong Baptist University (Hong Kong)

3:30 – 5:30 pm
Sandpebble C

3:30 IRIACV-343
Computational ultrafast optical imaging for single-cell inspection and analysis (Invited), *Edmund Lam, The University of Hong Kong (Hong Kong)*

3:50 IRIACV-275
Featureless-region-based top window recognition for automatic industrial monitoring systems, *Mei-Hsuan Ho[1], Yu-Hsuan Tsai[2], Chang-Tao Hsu[2], and Jen-Hui Chuang[1]; [1]NCTU Computer Science and Information Engineering and [2]NCTU Computer Vision and Research Center (Taiwan)*

4:10 IRIACV-276
Outlier detection in large-scale traffic data by regression analysis, *Philip Lam[1], Lili Wang[1], Henry Ngan[1], Nelson H.C. Yung[2], and Michael K. Ng[1]; [1]Hong Kong Baptist University and [2]The University of Hong Kong (Hong Kong)*

4:30 IRIACV-277
Part quality assessment using convolution neural networks in high pressure die casting, *Kelly Cashion[1], Nilesh Powar[1], Robert De Neff[2], and Robert Kress[3]; [1]University of Dayton Research Institute, [2]Honda North America, and [3]Honda Transmission Manufacturing (United States)*

4:50 IRIACV-278
Multi-view surface inspection using a rotating table, *Tomoya Kaichi[1], Shohei Mori[1], Hideo Saito[1], Junichi Sugano[2], and Hideyuki Adachi[2]; [1]Keio University and [2]ViSCO Technologies, Ltd. (Japan)*

5:10 IRIACV-279
Bringing machine intelligence to welding visual inspection: Development of low-cost portable embedded device for welding quality control, *Yifu Gong, Zhibin Lin, Jinhui Wang, and Na Gong, North Dakota State University (United States)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday January 31, 2018

Robotic Vision Techniques for Navigation and Vision I JOINT SESSION

Session Chairs: Patrick Denny, Valeo Vision Systems (Ireland) and Darnell Moore, Texas Instruments (United States)

8:50 – 10:10 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

8:50 IRIACV-301
Reliable primitive approximation for estimation of robot grasping parameters using 3D-deep neural network, *Takuya Torii and Manabu Hashimoto, Chukyo University (Japan)*

9:10 IRIACV-302
Real-time visual loop closure detection for unmanned aerial vehicles, *Semih Karakaya[1], Can Erhan[1], Evangelos Sariyanidi[2], and Hakan Temeltas[1]; [1]Istanbul Teknik Üniversity (Turkey) and [2]Queen Mary University of London (United Kingdom)*

9:30 AVM-303
Semantic image segmentation using Encoder-Decoder Architecture Assisted by Global and Local Attention Models (EDA-GLAM), *Hao Xu, Siyang Li, and Chun-Chieh Kuo, Univeristy of Southern California (United States)*

9:50 AVM-304
A method for reducing the false positives in power line detection, *Alexander Cerón, University Militar Nueva Granada (Colombia)*

10:00 am – 4:00 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Robotic Vision Techniques for Navigation and Vision II

Session Chairs: Patrick Denny, Valeo Vision Systems (Ireland) and Darnell Moore, Texas Instruments (United States)

10:50 am – 12:40 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Intelligent Robotics and Industrial Applications using Computer Vision 2018.

10:50 AVM-345
Pedestrian detection at night using deep neural networks and saliency maps (JIST-first), *Duyoung Heo, EunJu Lee, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:10 AVM-346
Context aware hyperspectral scene analysis, *Christian Winkens and Dietrich Paulus, University of Koblenz-Landau (Germany)*

11:30 AVM-347
Multiple pedestrian tracking in moving vehicle using online learning of random ferns and feature descriptor of pre-trained shallow convolutional neural networks, *SangJun Kim, Jaeyeal Nam, and ByoungChul Ko, Keimyung University (Republic of Korea)*

11:50 AVM-348
Raindrop detection considering extremal regions and salient features, *Vijay C S, Radhesh Bhat, and Vijaya Ragavan, PathPartner Technology Pvt Ltd. (India)*

12:10 AVM-349
Removing shadows and shading from road surfaces in real time, *Bruce Maxwell and Casey Smith, Tandent Vision Science, Inc. (United States)*

12:40 – 2:00 PM Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Material Appearance 2018

Conference overview

The rapid and continuous development of rendering simulators and devices such as displays and printers offers interesting challenges related to how the appearance of materials is understood. Over the years, researchers from different disciplines, including metrology, optical modeling and digital simulation, have studied the interaction of incident light with the texture and surface geometry of a given object, as well as the optical properties of distinct materials. Thanks to those efforts, we have been able to propose method for characterizing the optical and visual properties of many materials, propose affordable measurement methods, predict optical properties or appearance attributes, and render with high accuracy 2.5D and 3D objects and scenes.

This conference offers the possibility to share research results and establish new collaborations among academic and industrial researchers from these related fields.

Award: Best Student Paper

Conference Sponsors

Conference Chairs: **Mathieu Hebert,** Université Jean Monnet de Saint Etienne (France); **Francisco H. Imai,** Apple Inc. (United States); and **Ingeborg Tastl,** HP Inc. Labs, HP Inc. (United States)

Program Committee: **Marc Ellens**, X-Rite, Inc. (United States); **Susan P. Farnand,** Rochester Institute of Technology (United States); **Roland Fleming**, Justus-Liebig-Universitiit Giessen (Germany); **Jon Yngve Hardeberg,** Norwegian University of Science and Technology (Norway); **Susanne Klein,** Hewlett-Packard Ltd. (United Kingdom); **Gary Meyer,** University of Minnesota (United States); **Gael Obein,** Conservatoire National des Arts et Metiers (France); **Maria Ortiz Segovia,** Océ Print Logic Technologies (France); **Carinna Parraman,** University of the West of England (United Kingdom); **Holly Rushmeier,** Yale University (United States); **Lionel Simonot**, Université de Poitiers (France); **Takuroh Sone**, Ricoh Japan (Japan); **Sabine Süsstrunk,** École Polytechnique Fédérale de Lausanne (Switzerland); **Shoji Tominaga,** Chiba University (Japan); and **Philipp Urban**, Fraunhofer Institute for Computer Graphics Research IGD (Germany)

Material Appearance 2018

Monday, January 29, 2018

Keynote: Appearance Issues in Cultural Heritage
Session Chairs: Mathieu Hebert, Université Jean Monnet de Saint Etienne (France) and Ingeborg Tastl, HP Labs, HP Inc. (United States)
10:40 – 11:20 AM
Cypress A

MAAP-122
Material appearance issues: Cultural heritage research, *Holly Rushmeier, Yale University (United States)*

Prof. Holly Rushmeier is a professor in the Yale department of computer science. Her research interests include shape and appearance capture, applications of perception in computer graphics, modeling material appearance and developing computational tools for cultural heritage. Prof. Rushmeier received her BS, MS and PhD in mechanical engineering from Cornell University (1977, 1986 and 1988 respectively). Between receiving the BS and returning to graduate school in 1983 she worked as an engineer at the Boeing Commercial Airplane Company and at Washington Natural Gas Company (now a part of Puget Sound Energy). In 1988 she joined the mechanical engineering faculty at Georgia Tech. At the end of 1991, she joined the computing and mathematics staff of the National Institute of Standards and Technology, focusing on scientific data visualization. From 1996 to early 2004, Dr. Rushmeier was a research staff member at the IBM T.J. Watson Research Center. At IBM she worked on a variety of data visualization problems in applications ranging from engineering to finance. She also worked in the area of acquisition of data required for generating realistic computer graphics models, including a project to create a digital model of Michelangelo's Florence Pieta, and the development of a scanning system to capture shape and appearance data for presenting Egyptian cultural artifacts on the World Wide Web.

Surface Appearance Measurement

Session Chair: Lionel Simonot, Institut Pprime (France)

11:20 am – 12:20 pm
Cypress A

11:20 MAAP-150
Diffraction removal in an image-based BRDF measurement setup, *Antoine Lucat[1,2,3], Ramon Hegedus[4], and Romain Pacanowski[1,2,3]; [1]Institut d'Optique Graduate School (France), [2]University de Bordeaux (France), [3]INRIA (France), and [4]Department of Cognitive Science (Germany)*

11:40 MAAP-151
Morphological characterization of rough surfaces, *Colette Turbil, Iryna Gozhyk, and Ingve Simonsen, SVI UMR 125 CNRS/Saint-Gobain Recherche (France)*

12:00 MAAP-152
Three-dimensional hyperspectral imaging: A new method for human face acquisition, *Lou Gevaux[1], Cyprien Adnet[2], Pierre Seroul[2], Raphael Clerc[1], Alain Trémeau[1], Jean-Luc Perrot[3], and Mathieu Hebert[1]; [1]Univ Lyon, UJM-Saint-Etienne, CNRS, Institut d Optique Graduate School, Laboratoire Hubert Curien, [2]Newtone Technologies, and [3]University Hospital of Saint Etienne (France)*

12:20 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Surface Appearance Modeling and Reproduction JOINT SESSION

Session Chairs: Reiner Eschbach, Norwegian University of Science and Technology (Norway) and Monroe Community College (United States) and Mathieu Hebert, Université Jean Monnet de Saint Etienne (France)

3:30 – 4:50 pm
Cypress A

This session is jointly sponsored by: Color Imaging XXIII: Displaying, Processing, Hardcopy, and Applications, and Material Appearance 2018.

3:30 MAAP-165
Color prediction based on individual characterizations of the ink layers and print support, *Théo Phan Van Song[1,2], Christine Andraud[2], Luis Sapaico[1], and Maria Ortiz Segovia[1]; [1]Océ Print Logic Technologies — Canon Group and [2]Museum National d'Histoire Naturelle (France)*

3:50 MAAP-166
Light interreflections and shadowing effects in a Lambertian V-cavity under diffuse illumination, *Dorian Saint-Pierre[1], Rada Deeb[1], Damien Muselet[1], Lionel Simonot[1,2], and Mathieu Hebert[1]; [1]Université Jean Monnet de Saint Etienne and [2]Institut Pprime (France)*

4:10 MAAP-167
Interactive RGB transparency: A color rendering tool for superimposed translucent layers in digital images, *Lionel Simonot[1,2] and Mathieu Hebert[3]; [1]Institut Pprime, [2]Laboratoire Hubert Curien, and [3]Université Jean Monnet de Saint Etienne (France)*

4:30 MAAP-168
General method for estimating fluorescent Donaldson matrices, *Shoji Tominaga, Keita Hirai, and Takahiko Horiuchi, Chiba University (Japan)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Keynote: Appearance Assessment
Session Chair: Ingeborg Tastl, HP Labs, HP Inc. (United States)
8:50 – 9:30 am
Cypress A

MAAP-184
Digital appearance assessment methods and challenges, *Marc Ellens, X-Rite, Inc. (United States)*

Dr. Marc S. Ellens is a senior research scientist with X-Rite in Grand Rapids, MI. He received his PhD in computer aided geometric design from the University of Utah. Employed at X-Rite for 13 years, he has been involved in research and development efforts toward the capture and reproduction of appearance. Dr. Ellens has presented at numerous conferences including the Nvidia GPU Technology conference, Autodesk's Automotive Innovation Forums, AATCC LED Lighting Conference, and SPIE Color Image Conference and Materials Conference. He is named in three patents related to material visualization and reproduction and has been a member of ACM SIGGRAPH for more than 15 years.

Appearance Assessment

Session Chair: Takuroh Sone, Ricoh Company, Ltd. (Japan)

9:30 – 10:10 am
Cypress A

9:30 MAAP-209
Perceptual appearance similarity in 3D printing, *Michael Ludwig[1], Nathan Moroney[2], Ingeborg Tastl[2], and Melanie Gottwals[2]; [1]University of Minnesota and [2]HP Labs, HP Inc. (United States)*

9:50 MAAP-210
A model of visual opacity for translucent colorants, *Helene Midtfjord, Phil Green, and Peter Nussbaum, Norwegian University of Science and Technology (Norway)*

10:10 – 10:50 am Coffee Break

10:00 am – 7:30 pm Industry Exhibition

Keynote: Appearance Rendering
Session Chair: Lionel Simonot, Institut Pprime (France)
10:50 – 11:30 am
Cypress A

MAAP-226
Simulating the appearance of materials, *Henrik Jensen, University of California, San Diego (United States)*

Prof. Henrik Wann Jensen is a professor at the University of California at San Diego, where he works in the computer graphics lab. His research is focused on realistic image synthesis, global illumination, rendering of natural phenomena, and appearance modeling. His contributions to computer graphics include the photon mapping algorithm for global illumination, and the first technique for efficiently simulating subsurface scattering in translucent materials. He is the author of "Realistic Image Synthesis using Photon Mapping," AK Peters 2001. He has rendered images that have appeared on the front covers of the National Geographic Magazine and the SIGGRAPH proceedings. He previously worked at Stanford University, Massachusetts Institute of Technology (MIT), Weta, Pixar, and at mental images. He received his MSc and PhD in computer science from the Technical University of Denmark. He is the recipient of an Academy Award (Technical Achievement Award) from the Academy of Motion Picture Arts and Sciences for pioneering research in rendering translucent materials. He also received a Sloan Fellowship, and was selected as one of the top 10 scientists by Popular Science magazine.

Discussion: Interfaces for Material Appearance Design
Session Chairs: Mathieu Hebert, Université Jean Monnet de Saint Etienne (France) and Ingeborg Tastl, HP Labs, HP Inc. (United States)
11:30 am – 12:30 pm
Cypress A

MAAP-255
Interfaces for material appearance design, *Holly Rushmeier, Yale University (United States)*

Computer graphics systems have elaborate systems of menus for specifying reflectance, transmittance and texture for objects. These menus are generally based on the computational structures that will be used (e.g. Specifying parameters like a "Phong exponent"), rather than on how people view or think about material appearance. Further, the systems apply to virtual materials only — not necessarily materials that will be physically produced. Only a few projects have explored other paradigms for specification — such as virtually painting test objects, rather than tweaking parameters. Little work has been done on the display requirements in terms of resolution, color reproduction and dynamic range required. The constraints of real material manufacture have not been incorporated. The role of VR and AR in material design has not be explored. This discussion will ask the audience to contribute their experiences with using and developing interfaces, and ideas for new research directions in this area.

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

Symposium Demonstration Session

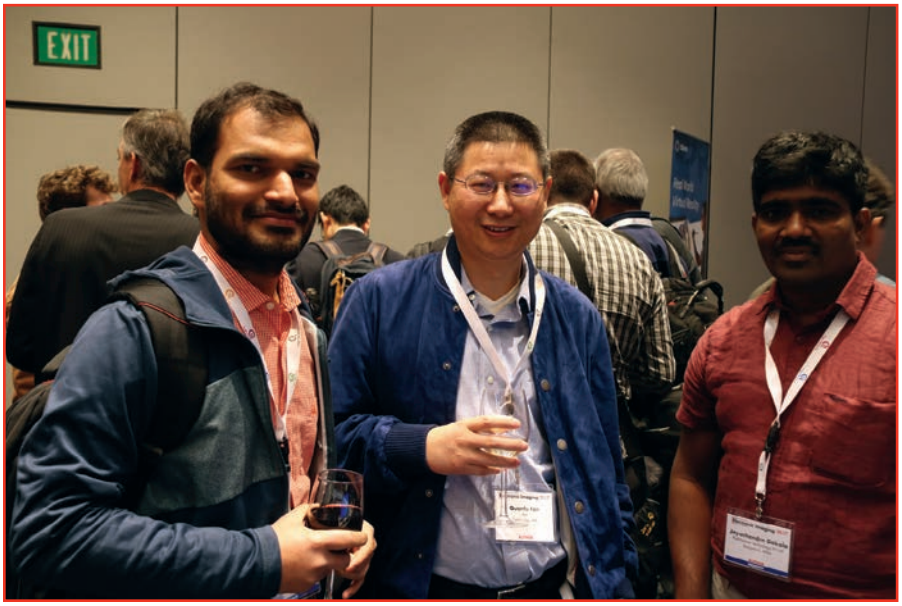
5:30 – 7:30 pm
Grand Peninsula Ballroom E

Media Watermarking, Security, and Forensics 2018

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, 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, 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 structures abstract describing the work in progress and preliminary results is initially required and the full paper is required only a few weeks before the conference. A strong focus on how research results are applied in practice by industry also gives the conference its unique flavor.



Media Watermarking, Security, and Forensics 2018

Monday, January 29, 2018

Keynote: Digital Watermarking from Inflated Expectation to Mainstream Adoption
Session Chair: Gaurav Sharma, University of Rochester (United States)
9:00 – 10:00 am
Cypress C

MWSF-113
Digital watermarking from inflated expectation to mainstream adoption, *Tony Rodriguez, Digimarc Corporation (United States)*

Tony Rodriguez has been an integral leader of innovation efforts at Digimarc since 1996 and currently serves as chief technology officer for Digimarc. He has 25 years' experience in computer science and image processing research and development. At Digimarc, he has held senior software engineering and research positions, focused on the development and application of digital watermarking and other content identification technologies. Before joining Digimarc, he worked at Intel Architecture Labs as a senior software engineer focused on video segmentation and streaming technologies. Rodriguez is a named inventor of numerous patents and the author of several published papers on the topic of Digital Watermarking and a chapter in the book, Multimedia Security Handbook, published in 2005.

10:00 – 10:30 am Coffee Break

Forensics and Steganalysis

Session Chair: Patrick Bas, CNRS (France)

10:30 am – 12:10 pm
Cypress C

10:30 MWSF-118
Boosting image forgery detection using resampling features and copy-move analysis, *Tajuddin Manhar Mohammed[1], Jason Bunk[1], Lakshmanan Nataraj[1], Jawadul Bappy[2], Arjuna Flenner[3], B.S. Manjunath[4], Shivkumar Chandrasekaran[4], Amit Roy-Chowdhury[2], and Lawrence Peterson[3]; [1]Mayachitra, Inc., [2]University of California, Riverside, [3]NAVAIR, and [4]University of California, Santa Barbara (United States)*

10:55 MWSF-119
Image manipulation detection using sensor linear pattern, *Miroslav Goljan, Jessica Fridrich, and Matthias Kirchner, Binghamton University (United States)*

11:20 MWSF-120
Privacy preserving forensics for JPEG images, *Huajian Liu, Martin Steinebach, and Richard Stein, Fraunhofer SIT (Germany)*

11:45 MWSF-121
Steganalyzing images of arbitrary size with CNNs, *Clement Fuji Tsang and Jessica Fridrich, Binghamton University (United States)*

12:10 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Watermarking and Steganalysis

Session Chair: Mehmet Celik, NexGuard Labs (Netherlands)

3:30 – 4:45 pm
Cypress C

3:30 MWSF-158
Blind detection of image rotation and angle estimation, *Miroslav Goljan, Binghamton University (United States)*

3:55 MWSF-159
Display image-barcodes using blue/red channel embedding, *Karthik Dinesh and Gaurav Sharma, University of Rochester (United States)*

4:20 MWSF-160
Deep learning regressors for quantitative steganalysis, *Mo Chen, Mehdi Boroumand, and Jessica Fridrich, Binghamton University (United States)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Keynote: Content Protection, Beyond Conditional Access and Digital Rights
9:00 – 10:00 am
Cypress C

MWSF-197

Content protection: Beyond conditional access and digital rights management, *Mehmet Celik, NexGuard Labs (Netherlands)*

Dr. Mehmet Celik is a principle scientist and the director of research at NexGuard Labs in Kudelski Group. After receiving his PhD from University of Rochester (2004), he joined Philips Research. He was part of the Content-Identification group which spun-off as Civolution in 2008. He led the research team at Civolution, where he helped develop renowned solutions based on watermarking and fingerprinting algorithms. Audience measurement solution based on audio watermarking was acquired by Kantar Media in 2014 and is now deployed in various countries. Broadcast monitoring and TV analytics solution based on video watermarking and audio/video fingerprinting was acquired by 4C-Insights in 2015 and is now tracking over 2100 channels in 76 countries. Forensic tracking solutions based on audio/video watermarking was acquired by Kudelski Group in 2016 and is now used by all major studios and deployed on over 100,000 movie screens. These solutions have been recognized by the National Academy of Television Arts & Sciences with Technology & Engineering Emmy® Awards in 2016 and 2018. Dr. Celik is now focusing on challenges around forensic tracking of live sports & premium content when distributed via broadcast or over-the-top.

10:00 AM – 7:30 pm Industry Exhibition

10:00 – 10:30 am Coffee Break

Deep Learning Forensics

Session Chair: Miroslav Goljan, Binghamton University (United States)

10:30 am – 12:10 pm
Cypress C

10:30 MWSF-211

Towards order of processing operations detection in JPEG-compressed images with convolutional neural networks, *Belhassen Bayar and Matthew Stamm, Drexel University (United States)*

10:55 MWSF-212

Resampling forgery detection using deep learning and a-contrario analysis, *Arjuna Flenner[1], Tajuddin Manhar Mohammed[2], Jason Bunk[2], Lakshmanan Nataraj[2], Jawadul Bappy[3], B.S. Manjunath[2], Shivkumar Chandrasekaran[2], Amit Roy-Chowdhury[3], and Lawrence Peterson[1]; [1]NAVAIR, [2]Mayachitra, Inc., and [3]University of California, Riverside (United States)*

11:20 MWSF-213

Deep learning for detecting processing history of images, *Mehdi Boroumand and Jessica Fridrich, Binghamton University (United States)*

11:45 MWSF-214

Satellite image forgery detection and localization using GAN and one-class classifier, *Sri Kalyan Yarlagadda[1], David Güera Cobo[1], Paolo Bestagini[2], Fengqing Zhu[1], Stefano Tubaro[2], and Edward Delp[1]; [1]Purdue University (United States) and [2]Politecnico di Milano (Italy)*

12:10 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

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3:00 – 3:30 pm Coffee Break

Panel: Deep Learning, Shallow Understanding?
Panelists: Matt Cragun, Nvidia Corporation (United States); Edward Delp, Purdue University (United States); Jessica Fridrich, Binghamton University (United States); and Jonathon Shlens, Google Inc. (United States)

Panel Moderator: Nasir Memon, New York University (United States)
3:30 – 5:00 pm
Cypress C

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Keynote: DARPA MediFor Progress and Challenges
Session Chair: Adnan Alattar, Digimarc Corporation (United States)
9:00 – 10:00 am
Cypress C

MWSF-309
Scaling media forensics, *David Doermann, DARPA (United States)*

Dr. David Doermann joined DARPA in April 2014. His areas of technical interest span language and media processing and exploitation, vision and mobile technologies. He comes to DARPA with a vision of increasing capabilities through joint vision/language interaction for triage and forensics applications. Dr. Doermann holds a Doctor of Philosophy in computer science and a Master of Science in computer science from the University of Maryland, College Park. He has authored more than 250 peer-reviewed journal and conference papers and book chapters and is the co-editor of the Handbook of Document Image Processing and Recognition. *In 2014, Dr. Doermann was elected a Fellow of the IEEE for contributions to research and development of automatic analysis and processing of document page imagery.*

10:00 AM – 4:00 pm Industry Exhibition

10:00 – 10:30 am Coffee Break

Steganography and Steganalysis

Session Chair: Jessica Fridrich, Binghamton University (United States)

10:30 am – 12:10 pm
Cypress C

10:30 MWSF-316
Natural steganography in JPEG compressed images, *Tomas Denemark[1], Patrick Bas[2], and Jessica Fridrich[1]; [1]Binghamton University (United States) and [2]CNRS (France)*

10:55 MWSF-317
Can we augment a small learning set for improving the performances of a CNN-based steganalyzer?, *Mehdi Yedroudj, Marc Chaumont, and Frédéric Comby, LIRMM Montpellier France (France)*

11:20 MWSF-318
Steganalysis into the wild: How to define a source?, *Patrick Bas[1], Quentin Giboulot[2], and Remi Cogranne[2]; [1]CNRS and [2]Troyes University of Technology (France)*

11:45 MWSF-319
Domain adaptation in steganalysis, *Li Lin[1], Jennifer Newman[1], Stephanie Reinders[1], Yong Guan[1], and Min Wu[2]; [1]Iowa State University and [2]University of Maryland, College Park (United States)*

12:10 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Biometrics and Encryption

Session Chair: Robert Ulichney, HP Labs, HP Inc. (United States)

3:30 – 4:50 pm
Cypress C

3:30 MWSF-369
Study on color space for the performance of degraded face image recognition, *Xinwei Liu[1,2], Christophe Charrier[1], Marius Pedersen[2], and Patrick Bours[2]; [1]Normandie University (France) and [2]Norwegian University of Science and Technology (Norway)*

3:55 MWSF-370
Image scramble algorithm with robustness under transcoding, *Chanyul Kim, Inkwon Choi, Minwoo Park, Kwangpyo Choi, and Jeonghoon Park, Samsung Electronics Co., Ltd. (Republic of Korea)*

4:20 MWSF-371
Hybrid image encryption, *Martin Steinebach[1], Huajian Liu[1], Felix Mayer[1], and Richard Stein[2]; [1]Fraunhofer SIT and [2]Technische Universität Darmstadt (Germany)*

4:45
Conference Closing Remarks

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2018

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*.

Awards: Best Paper and Best Student Paper

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

Program Committee: **John Adcock**, FX Palo Alto Laboratory Inc. (United States); **Sos Agaian**, The University of Texas at San Antonio (United States); **Faouzi Alaya Cheikh**, Norwegian University of Science and Technology (Norway); **Noboru Babaguchi**, Osaka University (Japan); **Nina Bhatti,** HP Inc. (United States); **C.L. Philip Chen,** University of Macau (Macao); **Chang Wen Chen**, The State University of New York at Buffalo (United States); **David Cook**, Consultant (Namibia); **Matthew Cooper,** FX Palo Alto Laboratory (United States); **Kenneth Crisler**, Motorola, Inc. (United States); **Francesco De Natale,** University degli Studi di Trento (Italy); **Alberto Del Bimbo**, University degli Studi di Firenze (Italy); **Stefan Edlich,** Technische Fachhochschule Berlin (Germany); **Atanas Gotchev,** Tampere University of Technology (Finland); **Alan Hanjalic,** Technische University Delft (the Netherlands); **Alexander Hauptmann**, Carnegie Mellon University (United States); **Winston Hsu,** National Taiwan University (Taiwan); **Gang Hua,** Stevens Institute of Technology (United States); **Catalin Lacatus**, Qualcomm Technologies, Inc. (United States); **Xin Li,** West Virginia University (United States**); Qian Lin,** HP Inc. (United States); **Gabriel Marcu,** Apple Inc. (United States); **Vasileios Mezaris,** Informatics and Telematics Institute (Greece); **Chong-Wah Ngo,** City University of Hong Kong (China); **Sethuraman Panchanathan,** Arizona State University (United States); **Kari Pulli,** Meta Company (United States); **Yong Rui,** Microsoft Corporation (China); **Olli Silvén,** University of Oulu (Finland); **John Smith,** IBM Thomas J. Watson Research Center (United States); **Hari Sundaram,** Arizona State University (United States); **Jarmo Takala,** Tampere University of Technology (Finland); **Marius Tico,** Apple, Inc. (United States); **Meng Wang,** National University of Singapore (Singapore); **Rong Yan,** Facebook Inc. (United States); and **Jun Yang**, Facebook Inc. (United States))

Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2018

Monday, January 29, 2018

Mobile Forensics

8:50 – 9:10 am
Sandpebble B

8:50 MOBMU-100
Cybersecurity and forensic challenges - A bibliographic review, *Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)*

Mobile Health and Services

9:10 – 10:30 am
Sandpebble B

9:10 MOBMU-114
An integration of health tracking sensor applications and e-learning environments for cloud-based health promotion campaigns, *Girish Vaidyanathan Natarajan[1], Devasena Prasad[1], Sahak Kaghyan[1], David Akopian[1], Martin Evans[1,2], Deborah Parramedina[2], and Yin Zenong[1]; [1]The University of Texas at San Antonio and [2]The University of Texas at Austin (United States)*

9:30 MOBMU-115
Designing apps interoperable and functional on multiple mobile platforms using Google environment, *Devasena Inupakutika[1], Chetan Basutkar[1], Sahak Kaghyan[1], David Akopian[1], Patricia Chalela[2], and Amelie G.Ramirez[2]; [1]The University of Texas at San Antonio and [2]University of Texas Health Science at San Antonio (United States)*

9:50 MOBMU-116
Low-cost medical infrastructure: Triage as intelligent decision support, *Marius Liefold, Dennis Wagner, Alexander Pokraka, and Thomas Schrader, Technische Hochschule Brandenburg (Germany)*

10:10 MOBMU-117
Review of interactive communication systems for business to business (B2B) services, *Sahak Kaghyan, Shubham Sarpal, Andrei Zorilescu, and David Akopian, The University of Texas at San Antonio (United States)*

10:30 – 10:50 am Coffee Break

Cameras, Sensors, Supporting Methods

10:50 am – 12:30 pm
Sandpebble B

10:50 MOBMU-135
Open mobile platform with geo-, color-, and spectro-metrical sensor systems for quality assurance in research and development, design and production, application and maintenance as well as in education and training, *Dietrich Hofmann, Paul-Gerald Dittrich, Randolf Margul, Daniel Kraus, and Daniel Schererz, Technologie- und Innovationspark Jena GmbH (Germany)*

11:10 MOBMU-136
Volumetric terrain rendering with WebGL, *Raoul van Rüschen[1], Simon McCallum[2], and Reiner Creutzburg[1]; [1]Technische Hochschule Brandenburg (Germany) and [2]Norwegian University of Science and Technology (NTNU) (Norway)*

11:30 MOBMU-137
Characterization and correction of multispectral filter-on-chip CMOS-sensor-systems for spatial resolved spectral and color measurements, *Paul-Gerald Dittrich[1], Maik Rosenberger[2], Dietrich Hofmann[1], and Gunther Notni[2]; [1]Technologie- und Innovationspark Jena GmbH and [2]TU Ilmenau (Germany)*

11:50 MOBMU-138
Creating input device transforms for Blackmagic Production Camera and Canon EOS 5D Mark III DSLR camera, *Eberhard Hasche, Oliver Karaschewski, and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)*

12:10 MOBMU-139
Comparing different approaches to create input device transforms (IDTs) for the RED Scarlet-X Camera, *Eberhard Hasche, Oliver Karaschewski, and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)*

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

5:00 – 6:00 pm All-Conference Welcome Reception

Wednesday, January 31, 2018

10:00 am – 4:00 pm Industry Exhibition

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

Mobile Devices and Multimedia: Enabling Technologies, Algorithms, and Applications 2018 Interactive (Poster) Papers Session

5:30 – 7:00 pm
The Grove
The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

MOBMU-406
Development of a mobile deployable technical system for the secure and paperless exchange of information between general practitioners and doctors' practices out in the field and laboratories, *Knut Bellin[1], Christian Sauer[2], Marcel Haase[2], Pascal Schröder[2], René Mewes[2], and Reiner Creutzburg[1]; [1]Technische Hochschule Brandenburg and [2]vireq software solutions GmbH & Co. KG (Germany)*

MOBMU-407
Pokemon Go – Bibliographic review, security and privacy aspects, and forensic analysis, *Vadim Kushnir, Knut Bellin, and Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)*

MOBMU-408
The strange world of keyloggers - An overview, *Reiner Creutzburg, Technische Hochschule Brandenburg (Germany)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Photography, Mobile, and Immersive Imaging 2018

Conference overview

Photography, Mobile, and Immersive Imaging 2018 builds on the previous "Digital Photography and Mobile Imaging" conference by expanding its scope to cover the immersive imaging fields of virtual reality, augmented reality and mixed reality. It serves to bring together researchers, scientists, and engineers working in the fields of mobile camera, computational photography and VR/AR/MR to discuss recent progress in the development of both 2D/3D camera and immersive imaging systems. The technical scope includes novel Input HW and system architecture design, device calibration, image/video artifact corrections, enhancement, rendering, pipelines, 3A algorithms, image quality metrics, new computational imaging feature and usage cases.

This conference includes paper presentations, presentation-only talks, joint sessions with other Electronic Imaging conferences with overlapping interests, and a panel session on Immersive Imaging.

Awards

Best Paper Award and Best Student Paper Award

Conference Sponsor

Conference Chairs: **Zhen He**, Intel Corporation (United States); **Feng Li**, Intuitive Surgical, Inc. (United States); and **Jon S. McElvain**, Dolby Labs, Inc. (United States); and **Nitin Sampat**, Rochester Institute of Technology (United States);

Program Committee: **Ajit Bopardikar**, Samsung R&D Institute India Bangalore Pvt. Ltd. (India); **Peter Catrysse**, Stanford University (United States); **Henry Dietz**, University of Kentucky (United States); **Joyce E, Farrell**, Stanford University (United States); **Boyd Fowler**, OminVision Technologies, Inc. (United States); **Sergio Goma**, Qualcomm Technologies, Inc. (United States); **Francisco Imai**, Apple Inc. (United States); **Pramati Kalwad**, National Institute of Technology Karnataka, Surathkal (India); **Michael Kriss**, MAK Consultants (United States); **Jiangtao (Willy) Kuang**, OminVision Technologies (United States); **Kevin Matherson**, Microsoft Corporation (United States); **Lingfei Meng**, Mura Incorporated (United States); **David Morgan-Mar**, Canon Information Systems Research Australia Pty Ltd (CISRA) (Australia); **Bo Mu**, BAE Systems Imaging Solutions (United States); **Oscar Nestares**, Intel Corporation (United States); **Kari Pulli**, Meta Company (United States); **Jackson Roland**, Apple Inc. (United States); **Radka Tezaur**, Intel Corporation (United States); **Gordon Wetzstein**, Stanford University (United States); and **Dietmar Wueller**, Image Engineering GmbH & Co. KG (Germany)

Photography, Mobile, and Immersive Imaging 2018

Monday, January 29, 2018

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Simulation for Autonomous Vehicles and Machines Joint Session

Session Chairs: Peter Catrysse, Stanford Univ. (United States); Patrick Denny, Valeo Vision Systems (Ireland); and Darnell Moore, Texas Instruments (United States)

3:30 – 4:50 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, and Photography, Mobile, and Immersive Imaging 2018.

3:30 PMII-161
Image systems simulation for automotive intelligence, *Henryk Blasinski, Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

3:50 AVM-162
Large scale collaborative autonomous vehicle simulation on smartphones, *Andras Kemeny[1,2], Emmanuel Icart[3], and Florent Colombet[2]; [1]Arts et Métiers ParisTech, [2]Renault-Nissan, and [3]Scale-1 Portal (France)*

4:10 AVM-163
Assessing the correlation between human driving behaviors and fixation patterns, *Mingming Wang and Susan Farnand, Rochester Institute of Technology (United States)*

4:30 AVM-164
Virtual simulation platforms for automated driving: Key care-abouts and usage model, *Prashanth Viswanath, Mihir Mody, Soyeb Nagori, Jason Jones, and Hrushikesh Garud, Texas Instruments India Ltd. (India)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Imaging System Performance I Joint Session

Session Chairs: Elaine Jin, Nvidia Corporation (United States) and Jackson Roland, Apple Inc. (United States)

8:50 – 9:30 am
Regency A-B

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

8:50 PMII-182
Lessons from design, construction, and use of various multicameras, *Henry Dietz, Clark Demaree, Paul Eberhart, Chelsea Kuball, and Jong Wu, University of Kentucky (United States)*

9:10 PMII-183
Relative impact of key rendering parameters on perceived quality of VR imagery captured by the Facebook surround 360 camera, *Nora Pfund[1], Nitin Sampat[1], and Stephen Viggiano[2]; [1]Rochester Institute of Technology and [2]RIT School of Photographic Arts and Sciences (United States)*

Keynote: Imaging System Performance Joint Session

Session Chair: Elaine Jin, Nvidia Corporation (United States)

9:30 – 10:10 am
Regency A-B

This session is jointly sponsored by: Image Quality and System Performance XV, and Photography, Mobile, and Immersive Imaging 2018.

IQSP-208
Experiencing mixed reality using the Microsoft HoloLens, *Kevin Matherson, Microsoft Corporation (United States)*

Dr. Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

10:00 AM – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Imaging Algorithms

Session Chairs: Radka Tezaur, Intel Corporation (United States) and Dietmar Wueller, Image Engineering GmbH & Co. KG (Germany)

10:50 am – 12:30 pm
Regency A-B

10:50 PMII-244
KEYNOTE: Manipulating image composition in post-capture (Invited), *Orazio Gallo, Nvidia Research (United States)*

11:30 PMII-241
Improving reliability of phase-setection autofocus, *Chin-Cheng Chan and Homer Chen, National Taiwan University (Taiwan)*

11:50 PMII-242
Improved depth from defocus using the spectral ratio, *David Morgan-Mar and Matthew Arnison, Canon Information Systems Research Australia (Australia)*

12:10 PMII-243
Hyperspectral mapping of oral and pharyngeal cancer: Estimation of tumor-normal margin interface using machine learning, *Alex Hegyi[1], Chris Holsinger[2], and Shamik Mascharak[2]; [1]PARC, a Xerox company and [2]Stanford University (United States)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Imaging Systems

Session Chairs: David Morgan-Mar, Canon Information Systems Research Australia (Australia) and Nitin Sampat, Rochester Institute of Technology (United States)

3:30 – 4:50 pm
Regency A-B

3:30 PMII-266
Multi-camera systems for AR/VR and depth sensing (invited), *Ram Narayanswamy and Evan Fletcher, Occipital Inc. (United States)*

3:50 PMII-267
IQ challenges developing Light's L16 computational camera (invited), *John Sasinowski, Light Labs (United States)*

4:10 PMII-268
The promise of high resolution 3D imagery (invited), *Paul Banks, TetraVue (United States)*

4:30 PMII-269
Light field perception enhancement for integral displays, *Basel Salahieh, Yi Wu, and Oscar Nestares, Intel Corporation (United States)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Keynote: Mobile HDR Imaging
Session Chairs: Zhen He, Intel Corporation (United States) and Jiangtao Kuang, Qualcomm Technologies, Inc. (United States)
8:50 – 9:30 am
Regency A-B

PMII-291
Extreme imaging using cell phones, *Marc Levoy, Google Inc. (United States)*

Dr. Marc Levoy is a computer graphics researcher and Professor Emeritus of computer science and electrical engineering at Stanford University and a principal engineer at Google. He is noted for pioneering work in volume rendering, light fields, and computational photography. Dr. Levoy first studied computer graphics as an architecture student under Donald P. Greenberg at Cornell University. He received his BArch (1976) and MS in Architecture (1978). He developed a 2D computer animation system as part of his studies, receiving the Charles Goodwin Sands Memorial Medal for this work. Greenberg and he suggested to Disney that they use computer graphics in producing animated films, but the idea was rejected by several of the Nine Old Men who were still active. Following this, they were able to convince Hanna-Barbera Productions to use their system for television animation. Despite initial opposition by animators, the system was successful in reducing labor costs and helping to save the company, and was used until 1996. Dr. Levoy worked as director of the Hanna-Barbera Animation Laboratory from 1980 to 1983. He then did graduate study in computer science under Henry Fuchs at the University of North Carolina at Chapel Hill, and received his PhD (1989). While there, he published several important papers in the field of volume rendering, developing new algorithms (such as volume ray tracing), improving efficiency, and demonstrating applications of the technique. He joined the faculty of Stanford's Computer Science Department in 1990. In 1991, he received the National Science Foundation's Presidential Young Investigator Award. In 1994, he co-created the Stanford Bunny, which has become an icon of computer graphics. He took a leave of absence from Stanford in 2011 to work at GoogleX as part of Project Glass. In 2014 he retired from Stanford to become full-time at Google, where he currently leads a team in Google Research that works broadly on cameras and photography. One of his projects is HDR+ mode for the Nexus and Google Pixel smartphones. In 2016 the French agency DxO gave the Pixel the highest rating ever given to a smartphone camera. See more https://en.wikipedia.org/wiki/Marc_Levoy.

Mobile HDR Imaging

Session Chairs: Zhen He, Intel Corporation (United States) and Jiangtao Kuang, Qualcomm Technologies, Inc. (United States)

9:30 – 10:10 am
Regency A-B

9:30 PMII-311
An overview of state-of-the-art algorithms for stack-based HDR imaging (invited), *Pradeep Sen, University of California, Santa Barbara (United States)*

9:50 PMII-312
Deep high dynamic range imaging of dynamic scenes (invited), *Ravi Ramamoorthi, University of California, San Diego (United States)*

10:00 am – 4:00 pm Industry Exhibition

10:10 – 10:40 am Coffee Break

Keynote: Immersive Imaging JOINT SESSION
Session Chair: Gordon Wetzstein, Stanford Univ. (United States)
10:40 – 11:20 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

PMII-320
Real-time capture of people and environments for immersive computing, *Shahram Izadi, perceptiveIO, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

Immersive Imaging JOINT SESSION

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

11:20 am – 12:40 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

11:20 PMII-350
SpinVR: Towards live-streaming 3D virtual reality video, *Donald Dansereau, Robert Konrad, Aniq Masood, and Gordon Wetzstein, Stanford University (United States)*

11:40 PMII-351
Towards a full parallax cinematic VR system, *Haricharan Lakshman, Dolby Labs (United States)*

12:00 PMII-352
Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation, *Jayant Thatte and Bernd Girod, Stanford University (United States)*

12:20 PMII-353
Image systems simulation for 360° camera rigs, *Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Panel: Immersive Imaging
Panel Moderator: Nitin Sampat, Rochester Institute of Technology (United States)
3:30 – 4:50 pm
Regency A-B

Photography, Mobile, and Immersive Imaging 2018 Interactive (Poster) Papers Session

5:30 – 7:00 pm
The Grove

The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

PMII-409
Multispectral, high dynamic range, time domain continuous imaging, *Henry Dietz, Paul Eberhart, and Clark Demaree, University of Kentucky (United States)*

PMII-245

Texture enhancement via high-resolution style transfer for single-image super-resolution, *Il Jun Ahn and Woo Hyun Nam, Samsung Electronics Co. Ltd. (Republic of Korea)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Thursday, February 1, 2018

Keynote: Imaging Sensors and Technologies for Automotive Intelligence Joint Session
Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Joyce Farrell, Stanford University (United States); and Darnell Moore, Texas Instruments (United States)
8:50 – 9:30 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

PMII-415

Advances in automotive image sensors, *Boyd Fowler[1] and Johannes Solhusvik[2]; [1]OmniVision Technologies (United States) and [2]OmniVision Technologies Europe Design Center (Norway)*

Dr. Boyd Fowler joined OmniVision in December 2015 as the vice president of marketing and was appointed chief technology officer in July 2017. Dr. Fowler's research interests include CMOS image sensors, low noise image sensors, noise analysis, data compression, and machine learning and vision. Prior to joining OmniVision, he was co-founder and vice president of engineering at Pixel Devices, where he focused on developing high-performance CMOS image sensors. After Pixel Devices was acquired by Agilent Technologies, Dr. Fowler was responsible for advanced development of commercial CMOS image sensor products. In 2003, Dr. Fowler joined Fairchild Imaging as the CTO and vice president of technology, where he developed SCMOS image sensors for high-performance scientific applications. After Fairchild Imaging was acquired by BAE Systems, Dr. Fowler was appointed the technology director of the CCD/CMOS image sensor business. He has authored numerous technical papers, book chapters, and patents. Dr. Fowler received his MSEE and PhD in electrical engineering from Stanford University (1990 and 1995 respectively).

Imaging Sensors and Technologies for Automotive Intelligence Joint Session

Session Chairs: Arnaud Darmont, APHESA SPRL (Belgium); Patrick Denny, Valeo Vision Systems (Ireland); and Joyce Farrell, Stanford University (United States)

9:30 – 9:50 am
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Autonomous Vehicles and Machines 2018, Image Sensors and Imaging Systems 2018, and Photography, Mobile, and Immersive Imaging 2018.

9:30 IMSE-422

Partial reset HDR image sensor with improved fixed pattern noise performance, *Volodymyr Seliuchenko[1,2], Sharath Patil[1,3], Marcelo Mizuki[1], Saad Ahmad[1], and Maarten Kuijk[2]; [1]Melexis (Belgium), [2]Vrije University Brussel (Belgium), and [3]University of Massachusetts Lowell (United States)*

9:50 – 10:50 am Coffee Break

Camera Image Processing Joint Session

Session Chair: Michael Kriss, MAK Consultants (United States)

10:50 am – 12:10 pm
Grand Peninsula Ballroom BC

This session is jointly sponsored by: Image Processing: Algorithms and Systems XVI, and Photography, Mobile, and Immersive Imaging 2018.

10:50 IPAS-439

Color interpolation algorithm for the Sony-RGBW color filter array, *Jonghyun Kim and Moon Gi Kang, Yonsei University (Republic of Korea)*

11:10 IPAS-440

High dynamic range imaging with a single exposure-multiplexed image using smooth contour prior, *Mushfiqur Rouf and Rabab Ward, University of British Columbia (Canada)*

11:30 IPAS-441

Enhancement of underwater color images by two-side 2-D quaternion discrete Fourier transform, *Artyom Grigoryan[1], Aparna John[1], and Sos Agaian[2]; [1]University of Texas at San Antonio and [2]City University of New York/CSI (United States)*

11:50 PMII-442

Automatic tuning method for camera denoise and sharpness based on perception model, *Weijuan Xi[1], Huanzhao Zeng[2], and Jonathan Phillips[2]; [1]Purdue University and [2]Google Inc. (United States)*

Stereoscopic Displays and Applications XXIX

Conference overview

The World's Premier Conference for 3D Innovation

The Stereoscopic Displays and Applications conference (SD&A) focuses on developments covering the entire stereoscopic 3D imaging pipeline from capture, processing, and display to perception. The conference brings together practitioners and researchers from industry and academia to facilitate an exchange of current information on stereoscopic imaging topics. The highly-popular conference demonstration session provides authors with a perfect additional opportunity to showcase their work. Large-screen stereoscopic projection is available, and presenters are encouraged to make full use of these facilities during their presentations. Publishing your work at SD&A offers excellent exposure—across all publication outlets, SD&A has the highest proportion of papers in the top 100 cited papers in the stereoscopic imaging field (Google Scholar, May 2013).

Awards: Best use of stereoscopy in a presentation, Best film (animation) and Best film (live action)

Events

Monday evening 3D Theater

Conference Sponsors

3-D FILM ARCHIVE

CHRISTIE

LA 3-D Movie Festival

DepthQ

Conference Chairs: **Andrew J. Woods,** Curtin University (Australia); **Gregg E. Favalora,** Draper (United States); **Nicolas S. Holliman,** Newcastle University (United Kingdom); and **Takashi Kawai,** Waseda University (Japan)

Demonstrations Chair: **Björn Sommer**, University of Konstanz (Germany)

Program Committee: **Neil A. Dodgson,** Victoria University of Wellington (New Zealand); **Davide Gadia,** University degli Studi di Milano (Italy); **Hideki Kakeya,** University of Tsukuba (Japan); **Stephan R. Keith,** SRK Graphics Research (United States); **Michael Klug,** Magic Leap, Inc. (United States); **John D. Stern,** Intuitive Surgical, Inc. (Retired) (United States); and **Chris Ward,** Lightspeed Design, Inc. (United States)

Founding Chair: **John O. Merritt,** The Merritt Group (United States)

Stereoscopic Displays and Applications XXIX

Monday, January 29, 2018

Stereoscopic Developments

Session Chair: Takashi Kawai, Waseda University (Japan)

8:50 – 10:20 am
Grand Peninsula Ballroom D

8:50 SD&A-109
Use of VR to assess and treat weaknesses in human stereoscopic vision, *Benjamin Backus, James Blaha, Manish Gupta, Brian Dornbos, and Tuan Tran, Vivid Vision, Inc. (United States)*

9:10 SD&A-110
Emotional effects of car-based motion representations with stereoscopic images, *Jo Inami[1], Ryo Kodama[2], Yusuke Hasegawa[1], Nobushige Fujieda[2], and Takashi Kawai[1]; [1]Waseda University and [2]Toyota Central R&D Labs., Inc. (Japan)*

9:30 SD&A-111
Mid-air imaging technique for architecture in public space, *Ayaka Sano and Naoya Koizumi, The University of Electro-Communications (Japan)*

9:50 SD&A-112
A refocus-interface for diminished reality work area visualization, *Momoko Maezawa, Shohei Mori, and Hideo Saito, Keio Univeristy (Japan)*

10:10
SD&A Opening Remarks

10:20 – 10:50 am Coffee Break

Autostereoscopic Displays 1: Light-field

Session Chair: John Stern, Intuitive Surgical, Inc. (United States)

10:50 AM – 12:30 pm
Grand Peninsula Ballroom D

10:50 SD&A-140
Initial work on development of an open Streaming Media Standard for Field of Light Displays (SMFoLD), *Jamison Daniel[1], Benjamin Hernandez Arreguin[1], Stephen Kelley[2], C. E. (Tommy) Thomas[2], Paul Jones[2], and Chris Chinnock[3]; [1]Oak Ridge National Laboratory, [2]Third Dimension Technologies, and [3]Insight Media (United States)*

11:10 SD&A-141
Simulation tools for light-field displays based on a mirco-lens array, *Weitao Song[1,2], Dongdong Weng[1,3], Yue Liu[1,3], and Yongtian Wang[1,3]; [1]Advanced Innovation Center for Future Visual Entertainment (China), [2]Nanyang Technological University (Singapore), and [3]Beijing Institute of Technology (China)*

11:30 SD&A-142
Full-parallax spherical light field display using mirror array, *Hiroaki Yano and Tomohiro Yendo, Nagaoka University of Technology (Japan)*

11:50 SD&A-250
Fast calculation method for full-color computer-generated hologram with real objects captured by a depth camera, *Yu Zhao[1], Shahinur Alam[1], Seok-Hee Jeon[2], and Nam Kim[1]; [1]Chungbuk National University and [2]Incheon National University (Republic of Korea)*

12:10 SD&A-144
Conversion of sparsely-captured light field into alias-free full-parallax multiview content, *Erdem Sahin[1], Suren Vagharshakyan[1], Robert Bregovic[1], Gwangsoon Lee[2], and Atanas Gotchev[1]; [1]Tampere University of Technology (Finland) and [2]ETRI (Republic of Korea)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

SD&A Keynote 1
3:30 – 4:30 pm
Grand Peninsula Ballroom D

It is clear that optic flow is useful to guide an observer's movement and that binocular disparity contributes too. Both cues are important in recovering scene structure. What is less clear is how the information might be useful after a few seconds, when the observer has moved to a new vantage point and the egocentric frame in which the information was gathered is no longer applicable.

SD&A-388
What use is 'time-expired' disparity and optic flow information to a moving observer?, *Andrew Glennerster, University of Reading (United Kingdom)*

Prof. Andrew Glennerster studied medicine at Cambridge before working briefly with Michael Morgan at UCL then doing a DPhil and an EU-funded postdoc with Brian Rogers on binocular stereopsis (1989 - 1994). He held an MRC Career Development Award (1994 - 1998) with Andrew Parker in Physiology at Oxford including a year with Suzanne McKee in Smith-Kettlewel, San Francisco. He continued work with Andrew Parker on a Royal Society University Research Fellowship (1999 - 2007) which allowed him to set up a virtual reality laboratory to study 3D perception in moving observer, funded for 12 years by the Wellcome Trust. He moved to psychology in Reading in 2005, first as a Reader and now as a professor, where the lab is now funded by EPSRC.

5:00 – 6:00 pm All-Conference Welcome Reception

SD&A Conference 3D Theatre

6:00 – 7:30 pm
Grand Peninsula Ballroom D

This ever-popular session of each year's Stereoscopic Displays and Applications Conference showcases the wide variety of 3D content that is being produced and exhibited around the world. All 3D footage screened in the 3D Theater Session is shown in high-quality polarized 3D on a large screen. The final program will be announced at the conference and 3D glasses will be provided.

SD&A Conference Annual Dinner

7:50 – 10:00 pm
Offsite - details provided with registration

The annual informal dinner for SD&A attendees. An opportunity to meet with colleagues and discuss the latest advances. There is no host for the dinner. Information on venue and cost will be provided on the day at the conference.

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 1 JOINT SESSION

Session Chair: Björn Sommer, University of Konstanz (Germany)

8:50 – 10:10 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

8:50 SD&A-189
Mesoscopic rigid body modeling of the ExtraCellular Matrix's self assembly, *Hua Wong, Nicolas Belloy, and Manuel Dauchez, University of Reims Champagne-Ardenne (France)*

9:10 SD&A-190
Semantics for an integrative and immersive pipeline combining visualisation and analysis of molecular data, *Mikael Trellet[1], Nicolas Ferey[1], Patrick Bourdot[1], and Marc Baaden[2]; [1]LIMSI and [2]IBPC (France)*

9:30 SD&A-191
3D-stereoscopic modeling and visualization of a Chlamydomonas reinhardtii cell, *Niklas Biere[1], Mehmood Ghaffar[1], Daniel Jäger[1], Anja Doebbe[1], Nils Rothe[1], Karsten Klein[2,3], Ralf Hofestädt[1], Falk Schreiber[2,3], Olaf Kruse[1], and Björn Sommer[2,3]; [1]Bielefeld University (Germany), [2]University of Konstanz (Germany), and [3]Monash University (Australia)*

9:50 SD&A-192
Immersive analysis and visualization of redox signaling pathways integrating experiments and computational modelling, *Alexandre Maes[1], Karen Druart[2], Sean Guégan[2], Xavier Martinez[2,3], Christophe Marchand[1], Stéphane Lemaire[1], and Marc Baaden[2]; [1]Institut de Biologie Physico-Chimique, UMR8226, CNRS, Sorbonne Universités, UPMC Université Paris 06, [2]Laboratoire de Biochimie Théorique, CNRS, UPR9080, Univ Paris Diderot, Sorbonne Paris Cité, PSL Research University, and [3]CNRS-LIMSI, VENISE team, Univ Paris-Sud (France)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:50 am Coffee Break

Autostereoscopic Displays 2: Volumetric, Integral, Stackable, and Holographic

Session Chair: Gregg Favalora, Draper (United States)

10:50 am – 12:30 pm
Grand Peninsula Ballroom D

10:50 SD&A-246
Recent progress in volumetric 3D digital light photoactivatable dye displays, *Shreya Patel, Jian Cao, Anthony Spearman, Cecilia O'Brien, and Alexander Lippert, Southern Methodist University (United States)*

11:10 SD&A-247
Integral imaging system using locally controllable point light source array, *Hayato Watanabe, Masahiro Kawakita, Naoto Okaichi, Hisayuki Sasaki, and Tomoyuki Mishina, Science and Technology Research Laboratories, NHK (Japan)*

11:30 SD&A-248
Mobile integral imaging display using three-dimensional scanning, *Munkh-Uchral Erdenebat[1], Ki-Chul Kwon[1], Erkhembaatar Dashdavaa[1], Jong-Rae Jeong[2], and Nam Kim[1]; [1]Chungbuk National University and [2]Suwon Science College (Republic of Korea)*

11:50 SD&A-249
Constructing stackable multiscopic display panels using microlenses and optical waveguides, *Hironobu Gotoda, National Institute of Informatics (Japan)*

12:10 SD&A-143
Angular and spatial sampling requirements in 3D light field displays, *Hong Hua, The University of Arizona (United States)*

12:30 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Discussion: 360° Imaging Should Be 3D – But Why And How? Joint Session
3:30 – 4:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.
NOTE: Full list of panelists to be announced.

Stereoscopic Applications: VR to Immersive Analytics in Bioinformatics 2 Joint Session

Session Chair: Marc Baaden, IBPC (France)

4:30 – 5:10 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

4:30 SD&A-288
Interactive molecular graphics for augmented reality using HoloLens, *Christoph Müller, Michael Krone, Markus Huber, Verena Biener, Guido Reina, Daniel Weiskopf, and Thomas Ertl, University of Stuttgart (Germany)*

4:50 SD&A-289
Molecular Dynamics Visualization (MDV): Stereoscopic 3D display of biomolecular structure and interactions using the Unity game engine, *Michael Wiebrands, Chris Malajczuk, Andrew Woods, Andrew Rohl, and Ricardo Mancera, Curtin University (Australia)*

Symposium Demonstration Session
5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

Stereoscopic History

Session Chair: Nicolas Holliman, University of Newcastle (United Kingdom)

8:50 – 9:10 am
Grand Peninsula Ballroom D

8:50 SD&A-290
The history of stereoscopic video games for the consumer electronic market, *Ilicia Benoit, NYSA (United States)*

SD&A Keynote 2
Session Chair: Nicolas Holliman, University of Newcastle (United Kingdom)
9:10 – 10:10 am
Grand Peninsula Ballroom D

SD&A-474
Over fifty years of working with stereoscopic 3D systems — Anecdotes, insights, and advice illustrated by many examples of stereoscopic imagery, both good and bad, *John Merritt, The Merritt Group (United States)*

Senior Consulting Scientist John O. Merritt is an internationally recognized expert in the operational use of stereoscopic 3D displays and the application of research and development in sensory and perceptual science to remote-presence systems. He brings over 30 years of experience and extensive practical and theoretical knowledge of spatial perception and stereoscopic video applications to every project. Merritt's early work in overhead reconnaissance as a Naval Air Intelligence Officer, combined with his years of experience as a 3D-display design consultant, make him uniquely qualified to assess the strengths and weaknesses of advanced 3D imaging systems. Merritt has extensive experience comparing task performance in 3D vs. 2D evaluation studies. Since completing his graduate work in sensory and perceptual psychology at Harvard University, he has provided vision research and human factors engineering consulting services to a broad range of industrial and government clients. As a senior research scientist at Perceptronics in Woodland Hills, CA, he headed a number of R&D projects related to vision and visual-simulator displays.

10:00 AM – 4:00 pm Industry Exhibition
10:10 – 10:40 am Coffee Break

Keynote: Immersive Imaging Joint Session
Session Chair: Gordon Wetzstein, Stanford Univ. (United States)
10:40 – 11:20 am
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

PMII-320
Real-time capture of people and environments for immersive computing, *Shahram Izadi, perceptiveIO, Inc. (United States)*

Dr. Shahram Izadi is co-founder and CTO of perceptiveIO, a new Bay Area startup working on bleeding-edge research and products at the intersection of real-time computer vision, applied machine learning, novel displays, sensing, and human-computer interaction. Prior to perceptiveIO, Dr. Izadis was a research manager at Microsoft, managing a team of researchers and engineers, called Interactive 3D Technologies, working on moonshot projects in the area of augmented and virtual reality and natural user interfaces.

Immersive Imaging Joint Session

Session Chair: Gordon Wetzstein, Stanford Univ. (United States)

11:20 am – 12:40 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, Photography, Mobile, and Immersive Imaging 2018, and Stereoscopic Displays and Applications XXIX.

11:20 PMII-350
SpinVR: Towards live-streaming 3D virtual reality video, *Donald Dansereau, Robert Konrad, Aniq Masood, and Gordon Wetzstein, Stanford University (United States)*

11:40 PMII-351
Towards a full parallax cinematic VR system, *Haricharan Lakshman, Dolby Labs (United States)*

12:00 PMII-352
Perceptual evaluation of six degrees of freedom virtual reality rendering from stacked omnistereo representation, *Jayant Thatte and Bernd Girod, Stanford University (United States)*

12:20 PMII-353
Image systems simulation for 360° camera rigs, *Trisha Lian, Joyce Farrell, and Brian Wandell, Stanford University (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Visualization Facilities JOINT SESSION

Session Chairs: Margaret Dolinsky, Indiana University (United States) and Andrew Woods, Curtin University (Australia)

3:30 – 5:30 pm
Grand Peninsula Ballroom D

This session is jointly sponsored by: The Engineering Reality of Virtual Reality 2018, and Stereoscopic Displays and Applications XXIX.

3:30 ERVR-392
xREZ Art + Science Lab - facilities presentation, *Ruth West, University of North Texas (United States)*

3:50 SD&A-393
CADwalk: Life-size MR-AR-VR design experience – Optimising and validating mission critical work environments, *Gerhard Kimenkowski, CADwalk Global Pty Ltd. (Australia)*

4:10 ERVR-394
When one is not enough: Cross-platform and collaborative developments at the Emerging Analytics Center, *Dirk Reiners, Carolina Cruz-Neira, and Carsten Neumann, University of Arkansas at Little Rock (United States)*

4:30 SD&A-395
Multiplatform VR case study – Beacon Virtua, *Andrew Woods[1], Nick Oliver[1], and Paul Bourke[2]; [1]Curtin University and [2]University of Western Australia (Australia)*

4:50 SD&A-396
What will we see next? Current visualization facilities trends and future considerations, *Kurt Hoffmeister, Mechdyne Corp. (United States)*

5:10
SD&A Closing Remarks

Stereoscopic Displays and Applications XXIX Interactive (Poster) Papers Session

5:30 – 7:00 pm
The Grove

The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

SD&A-410
Computer-generated holography method based on orthographic projection using depth camera, *Yan-Ling Piao[1], Seo-Yeon Park[1], Hui-Ying Wu[1], Sang-Keun Gil[2], and Nam Kim[1]; [1]Chungbuk National University and [2]Suwon University (Republic of Korea)*

SD&A-411
Full-parallax and high-quality multiview 3D image acquisition method using camera slider, *Byeong-Jun Kim, Ki-Chul Kwon, Jae-Min Lee, Young-Tae Lim, and Nam Kim, Chungbuk National University (Republic of Korea)*

SD&A-412
Projection type light field display using undulating screen, *Masahiro Kajimoto and Tomohiro Yendo, Nagaoka Univ. of Technology (Japan)*

SD&A-413
Study of eye tracking type super multi-view display using time division multiplexing, *Yuta Takahashi and Tomohiro Yendo, Nagaoka University of Technology (Japan)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

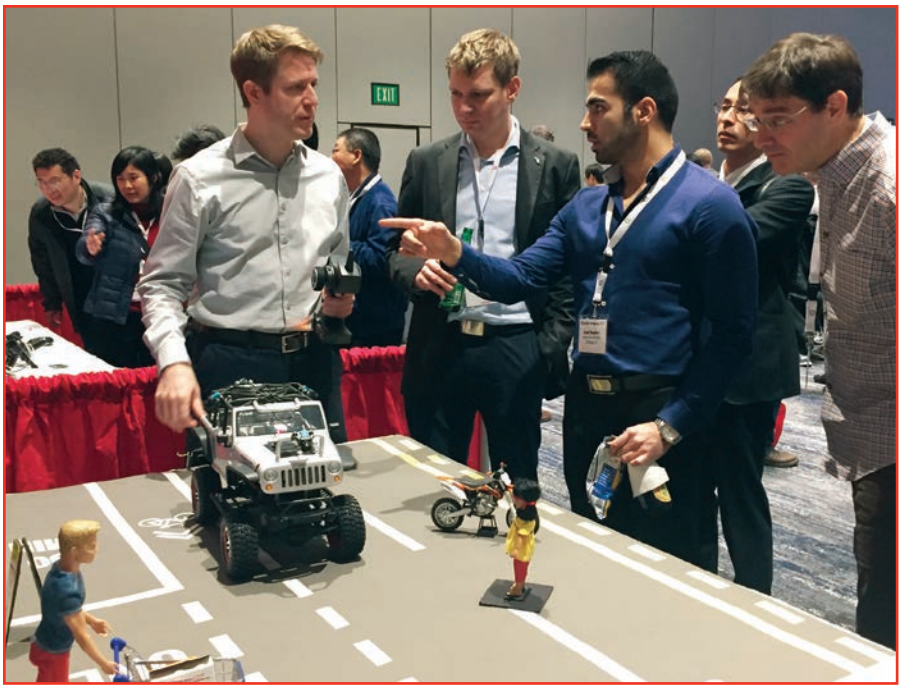
Visual Information Processing and Communication IX

Conference overview

Interdisciplinary research has led to advances in visual information processing, storage, and transmission that enable many new applications. The types of visual information are varied, and include photos, stereo images, video, graphics, light fields, omnidirectional, volumetric and spectral images. This conference is designed to provide a forum for exchanging ideas and sharing research findings in this evolving field.

Topics include:

- Compression of visual information: image, video, graphics, and light-field coding, compression standards, very-low bit rate coding, high quality image/video/graphics coding, volumetric data coding
- Media over networks: media streaming, video over wireless networks, error resilience, scalability, quality of service, cross-layer optimization for improved media delivery, streaming media delivery networks
- Visual information processing: filtering, interpolation (e.g. deinterlacing, frame-rate conversion), restoration, compressed-domain processing, superresolution, multimodal media processing
- Visual information representations: multiresolution analysis, subbands, wavelets, sparse decompositions for visual data, related estimation, analysis, and reconstruction algorithms
- Pattern matching of visual data: machine learning, augmented reality, mobile applications
- Object-based methods: segmentation and tracking
- Synthetic imaging and rendering: stereo, multiview and 3D video, synthetic image/video and graphics representations, 3D and animated 3D models, virtual reality, visualization and display techniques
- Application systems: DTV, electronic cinema, multimedia content retrieval, man-machine interface, imaging/video surveillance
- Media system design: hardware and software architectures and implementation issues, scalable computations, low-power implementations, multicore algorithm design
- Compression of medical imaging information
- Other timely topics related to visual information communication and processing



Conference Chairs: **Fengqing Maggie Zhu**, Purdue University (United States); **Amy Reibman**, Purdue University (United States); **and Edward Delp**, Purdue University (United States)

Program Committee: **Stuart Bennett**, University of Cambridge (United Kingdom); **Mustafa Jaber**, NantOmics (United States); **Anastacia Macallister**, Iowa State University (United States); **Grigorios Tsagkatakis**, Institute of Computer Science, FORTH (Greece)

Visual Information Processing and Communication IX

Monday, January 29, 2018

Keynote: Image and Video Compression
Session Chair: Zoe Liu, Google, Inc. (United States)
10:40 – 11:20 am
Sandpebble A

VIPC-123

Technical overview of AV1: An open source video codec from the Alliance for Open Media, *Yaowu Xu, Google, Inc. (United States)*

Dr. Yaowu Xu is currently the tech lead manager of the video coding research team at Google. The team has been responsible for developing and defining VP9, the core video technology of the WebM project. Prior to joining Google, Dr. Xu was the vice president of codec development at On2 Technologies. He was the co-creator of On2's VPx series codecs including VP32, VP4, VP5, VP6, VP7 and VP8. These codecs were broadly adopted by the industry and have fueled the phenomenal growth of web video. Dr. Xu's education includes a BS in physics, an MS and a PhD in nuclear engineering from Tsinghua University at Beijing, China. He also holds an MS and a PhD in electrical and computer engineering from the University of Rochester. Dr. Xu has published many technical papers in the area of image processing on leading journals and international conferences. He also holds many patents and has numerous patent applications pending in the area of digital video compression. Dr. Xu's research and development experiences include digital video compression and processing, real time video encoding and decoding, mobile video, image processing, pattern recognition and machine learning. His current research focuses on advanced algorithms for digital video compression.

Image and Video Compression

Session Chair: Zoe Liu, Google, Inc. (United States)

11:20 am – 12:40 pm
Sandpebble A

11:20 VIPC-153
CrossEncoders: A complex neural network compression framework, *Chirag Agarwal, Mehdi Sharifzadeh, and Dan Schonfeld, University of Illinois at Chicago (United States)*

11:40 VIPC-154
Multi-level machine learning-based early termination in VP9 partition search, *Yang Xian[1], Yunqing Wang[2], Yingli Tian[1], Yaowu Xu[2], and James Bankoski[2]; [1]The City University of New York and [2]Google Inc. (United States)*

12:00 VIPC-155
Texture segmentation based video compression using convolutional neural networks, *Chichen Fu[1], Di Chen[1], Edward Delp[1], Zoe Liu[2], and Fengqing Zhu[1]; [1]Purdue University and [2]Google, Inc. (United States)*

12:20 VIPC-156
Multi-reference video coding using stillness detection, *Di Chen[1], Zoe Liu[2], Yaowu Xu[2], Fengqing Zhu[1], and Edward Delp[1]; [1]Purdue University and [2]Google, Inc. (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Overview of Modern Machine Learning and Deep Neural Networks - Impact on Imaging and the Field of Computer Vision, *Greg Corrado, Google, Inc. (United States)*

Dr. Greg Corrado, co-founder of Google Brain, principal scientist, and director of augmented intelligence research at Google, provides an overview of modern machine learning and deep neural networks, with particular attention to its impact on imaging and the field of computer vision.

Dr. Corrado is a senior research scientist interested in biological neuroscience, artificial intelligence, and scalable machine learning. He has published in fields ranging across behavioral economics, neuromorphic device physics, systems neuroscience, and deep learning. At Google he has worked for some time on brain inspired computing, and most recently has served as one of the founding members and the co-technical lead of Google's large scale deep neural networks project. Prior to joining Google, Dr. Corrado was a staff research scientist at IBM. He received his MS in computer science and PhD in neuroscience from Stanford University.

3:00 – 3:30 pm Coffee Break

Deep Learning for Image Analysis

Session Chair: Edward Delp, Purdue University (United States)

3:30 – 4:50 pm
Sandpebble A

3:30 VIPC-173
Event recognition in personal photo collections: An active learning approach, *Kashif Ahmad, Mohamed Mekhalfi, and Nicola Conci, Università degli Studi di Trento (Italy)*

3:50 VIPC-174
Generative adversarial networks for open set historical Chinese character recognition, *Xiaoyi Yu, Jun Sun, and Satoshi Naoi, Fujitsu R&D Co. Limited (China)*

4:10 VIPC-175
Using convolutional neural networks and transfer learning for Content-Based Image Retrieval (CBIR), *Felix Mayer, Maximilian Li, Martin Steinebach, and Marcel Schaefer, Fraunhofer SIT (Germany)*

4:30 VIPC-176
Approach for machine-printed Arabic character recognition: The-state-of-the-art deep-learning method, *Daegun Ko, Changhyung Lee, Donghyeong Han, Hyeongsu Ohk, Ki-Min Kang, and Seong-Wook Han, HP Inc. (Republic of Korea)*

5:00 – 6:00 pm All-Conference Welcome Reception

Tuesday, January 30, 2018

7:15 – 8:45 am Women in Electronic Imaging Breakfast

Computer Vision Applications in Sports

Session Chair: Fengqing Zhu, Purdue University (United States)

9:10 – 10:10 am
Sandpebble A

9:10 VIPC-205
Toward automatic and objective evaluation of synchronization in video of synchronized diving, *Xin Li and Yixin Du, West Virginia University (United States)*

9:30 VIPC-206
Convolutional neural networks for the analysis of broadcasted tennis games, *Grigorios Tsagkatakis[1], Mustafa Jaber[2], and Panagiotis Tsakalides[1]; [1]Foundation for Research and Technology (FORTH) (Greece) and [2]NantVision Inc. (United States)*

9:50 VIPC-207
A self powered device embedded in a sports ball for a better immersive experience, *Rony Ferzli and Adel Elsherbini, Intel Corporation (United States)*

10:00 am – 7:30 pm Industry Exhibition

10:10 – 10:40 pm Coffee Break

Keynote: Image and Video Analytics
Session Chair: Grigorios Tsagkatakis, Foundation for Research and Technology (FORTH) (Greece)
10:40 – 11:20 pm
Sandpebble A

VIPC-215
Perceptual optimization in video coding - a systematic approach, *Ioannis Katsavounidis, Netflix (United States)*

Dr. Ioannis Katsavounidis received the Diploma (BS/MS) from the Aristotle University of Thessaloniki, Greece, (1991) and his MS and PhD from the University of Southern California, Los Angeles, (1992 and 1998 respectively), all in electrical engineering. From 1996 to 2000, he worked in Italy as an engineer for the high-energy physics department of the California Institute of Technology. From 2000 to 2007, he worked at InterVideo, Inc., in Fremont, CA, as director of software for advanced technologies, in charge of MPEG2, MPEG4 and H.264 video codec development. Between 2007 and 2008, he served as CTO of Cidana, a mobile multimedia software company in Shanghai, China, covering all aspects of DTV standards and codecs. From 2008 to 2015 he was an associate professor with the department of electrical and computer engineering at the University of Thessaly in Volos, Greece, teaching undergraduate and graduate courses in signals, controls, image processing, video compression, and information theory. He is currently a senior research scientist at Netflix, working on video quality and video codec optimization problems. His research interests include image and video quality, compression and processing, information theory, and software-hardware optimization of multimedia applications.

Image and Video Analytics

Session Chair: Grigorios Tsagkatakis, Foundation for Research and Technology (FORTH) (Greece)

11:20 am – 12:40 pm
Sandpebble A

11:20 VIPC-251
Interactive hand pose estimation: Boosting accuracy in localizing extended finger joints, *Cairong Zhang, Guijin Wang, Hengkai Guo, Xinghao Chen, Fei Qiao, and Huazhong Yang, Tsinghua University (China)*

11:40 VIPC-252
Efficient preprocessing and feature extraction for robust face recognition, *Huda Algharib and Osman Serdar Gedik, Ankara Yildirim Beyazit (Turkey)*

12:00 VIPC-253
Text/figure separation in document images using Docstrum descriptor and two-level clustering, *Valery Anisimovskiy, Ilya Kurilin, Andrey Shcherbinin, and Petr Pohl, Samsung R&D Institute Russia (Russian Federation)*

12:20 VIPC-254
Prediction system for activity recognition with compressed video, *Chengzhang Zhong and Amy Reibman, Purdue University (United States)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Fast, Automated 3D Modeling of Buildings and Other GPS Denied Environments, *Avideh Zakhor, University of California, Berkeley (United States)*

Professor Avideh Zahkor discusses fast, automated 3D modeling of buildings and other GPS denied environments with examples from her work in 3D reality capture, and visual and metric documentation of building interiors. Dr. Zakhor is a serial entrepreneur with startups in outdoor mapping, indoor mapping, and micro-lithography, currently CEO and founder of Indoor Reality, a Silicon Valley startup with products in 3D reality capture, and visual and metric documentation of building interiors.

Dr. Zakhor has been faculty member at University of California, Berkeley since 1994 where she holds the Qualcomm Chair in the electrical engineering and computer science department. She co-founded OPC technology in 1996, which was acquired by Mentor Graphics in 1998, and UrbanScan Inc. in 2005, acquired by Google in 2007. UrbanScan created the first fully automated 3D outdoor mapping system for 3D exterior models of buildings in urban environments. She has received a number of best paper awards in 3D computer vision, image processing, signal processing, is an IEEE fellow, and received the presidential young investigator award in 1992. Dr. Zakhor received her BSc in electrical engineering, from the California Institute of Technology (1983), and her MS (1985) and PhD (1987) in electrical engineering and computer science from MIT.

3:00 – 3:30 pm Coffee Break

Imaging Systems

Session Chair: Amy Reibman, Purdue University (United States)

3:30 – 4:30 pm
Sandpebble A

3:30 VIPC-263
A robust and accurate calibration method for out-of-focus camera, *Xiaowei Hu[1], Guijin Wang[1], Jinnan Wang[1], Pengfei Sun[1], Jingtao Fan[1], Feng Chen[1], and Yiyuan Xie[2]; [1]Tsinghua University and [2]Southwest University of Science and Technology (China)*

3:50 VIPC-264
Improving the efficiency of on-site operators in utility management: Combining hololens and AR for real-time check of electricity meters, *Nicola Conci[1], Lorenzo Orlandi[1,2], and Daniele Sevegnani[2]; [1]Università degli Studi di Trento and [2]ARCODA (Italy)*

4:10 VIPC-265
Generation of stereoscopic image sequences from monocular videos using epipolar geometry, *Vasundhara Goyal and Dan Schonfeld, University of Illinois at Chicago (United States)*

Symposium Demonstration Session

5:30 – 7:30 pm
Grand Peninsula Ballroom E

Wednesday, January 31, 2018

10:00 am – 4:00 pm Industry Exhibition

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

The following works will be presented at the EI 2018 Symposium Interactive Papers Session.

VIPC-414
An interrupted projection using seam carving for 360–degree images, *Ikuko Tsubaki and Kazuo Sasaki, Tokyo University of Technology (Japan)*

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

Visualization and Data Analysis 2018

Conference overview

The Conference on Visualization and Data Analysis (VDA) 2018 covers all research and development and application aspects of data visualization and visual analytics. Since the first VDA conference was held in 1994, the annual event has served as a major venue for visualization researchers and practitioners from around the world to present their work and share their experiences.

Award: Kostas Pantazos Memorial Award for Outstanding Paper

Conference Sponsor

Kitware

Conference Chairs: **Thomas Wischgoll,** Wright State University. (United States); **Song Zhang,** Mississippi State University (United States); **David Kao,** NASA Ames Research Center (United States); and **Yi-Jen Chiang**, New York University (United States)

Program Committee: **Madjid Allili,** Bishop's University (Canada); **Abon Chaudhuri,** WalmartLabs (United States); **Guoning Chen**, University of Houston (United States); **Joseph Cottam**, Indiana University (United States); **Sussan Einakian,** University of Alabama in Huntsville (United States); **John Gerth,** Stanford University (United States); **Matti Gröhn,** Finnish Institute of Occupational Health (Finland); **Christopher Healey,** North Carolina State University (United States); **Mario Hlawitschka,** University of Leipzig (Germany); **Halldor Janetzko,** University of Konstanz (Germany); **Ming Jiang,** Lawrence Livermore National Laboratory (United States); **Alark Joshi,** University of San Francisco (United States); **Andreas Kerren**, Linnaeus University (Sweden); **Peter Lindstrom,** Lawrence Livermore National Laboratory (United States); **Lars Linsen,** Jacobs University Bremen GmbH (Germany); **Zhanping Liu,** Old Dominion University (United States); **Aidong Lu,** University of North Carolina at Charlotte (United States); **G. Elisabeta Marai,** University of Illinois at Chicago (United States); **Donald Pellegrino,** The Dow Chemical Co. (United States); **Theresa-Marie Rhyne,** Computer Graphics and E-Learning (United States); **René Rosenbaum,** meeCoda (Germany); **Jibonananda Sanyal,** Oak Ridge National Lab. (United States); **Pinaki Sarder,** University of Buffalo (United States); **Graig Sauer,** Towson University (United States); **Inga Scheler,** Technische University Kaiserslautern (Germany); **Tobias Schreck,** Graz University of Technology (Austria); **Jürgen Schulze,** University of California, San Diego (United States); **Chad Steed,** Oak Ridge National Laboratory (United States); **Kalpathi Subramanian,** University of North Carolina at Charlotte (United States); **Shigeo Takahashi,** University of Aizu (Japan); **Chaoli Wang,** Michigan Technological University (United States); **Tino Weinkauf,** Royal Institute of Technology (Sweden); and **Leishi Zhang,** Middlesex University London (United Kingdom)

Wednesday January 31, 2018

Keynote: Purpose-designed Visualization
8:50 – 9:40 AM
Sandpebble A

VDA-294

Audience-targeted exploratory and explanatory visualization designs, *Kwan-Liu Ma, University of California, Davis (United States)*

Prof. Kwan-Liu Ma is a professor of computer science and the chair of the Graduate Group in Computer Science (GGCS) at the University of California-Davis, where he directs VIDI Labs and UC Davis Center of Excellence for Visualization. His research spans the fields of visualization, computer graphics, high-performance computing, and user interface design. Prof. Ma received his PhD in computer science from the University of Utah (1993). During 1993-1999, he was with ICASE/NASA Langley Research Center as a research scientist. He joined UC Davis in 1999. Prof. Ma is presently leading a team of over 25 researchers pursuing research in scientific visualization, information visualization, visual analytics, visualization for storytelling, visualization interface design, and immersive visualization. For his significant research accomplishments, Prof. Ma received the NSF Presidential Early-Career Research Award (PECASE) in 2000, was elected an IEEE Fellow in 2012, and received the 2013 IEEE VGTC Visualization Technical Achievement Award. Professor Ma actively serves the research community by playing leading roles in several professional activities including VizSec, Ultravis, EGPGV, IEEE VIS, IEEE PacificVis, and IEEE LDAV. He has served as a papers co-chair for SciVis, InfoVis, EuroVis, PacificVis, and Graph Drawing.

Complex Visualization

9:40 – 10:20 am
Sandpebble A

9:40 VDA-314
Visualization of complex familial and social structures, *John Hott, Worthy Martin, and Kathleen Flake, University of Virginia (United States)*

10:00 VDA-315
Display infrastructure for virtual environments (DIVE) (JIST-first), *Thomas Wischgoll, Madison Glines, Tyler Whitlock, Bradley Guthrie, Corinne Mowrey, Pratik Parikh, and John Flach, Wright State University (United States)*

10:00 am – 4:00 pm Industry Exhibition

10:20 – 10:50 am Coffee Break

Medical Visualization

10:50 am – 12:10 pm
Sandpebble A

10:50 VDA-332
FitViz-Ad: A non-intrusive reminder that helps manage and encourage people with rheumatoid arthritis to be physically active, *Tim Bodyka Heng, Ankit Gupta, and Christopher Shaw, Simon Fraser University (Canada)*

11:10 VDA-333
High quality volume rendering of dark matter simulations, *Ralf Kaehler; SLAC and KIPAC (United States)*

11:30 VDA-334
A semi-automated method for measuring Fels indicators for skeletal maturity assessment in children, *Sara Gharabaghi and Thomas Wischgoll, Wright State University (United States)*

11:50 VDA-335
RemBrain: Exploring dynamic biospatial networks with mosaic-matrices and mirror glyphs (JIST-first), *Chihua Ma[1], Filippo Pellolio[2], Daniel Llano[3], Robert Kenyon[1], and G. Elisabeta Marai[1]; [1]University of Illinois at Chicago, [2]HERE Technologies, and [3]University of Illinois at Urbana-Champaign (United States)*

Visualization and Data Analysis 2018 Interactive (Poster) Papers Oral Previews

12:10 – 12:40 pm
Sandpebble A

In this session interactive poster authors will each provide a brief oral preview of their poster presentation, which will be presented fully in the Visualization and Data Analysis 2018 Interactive Papers Session at 5:30 pm on Wednesday.

12:10 VDA-355
Contrast enhancement effect on high dynamic range image registration using mutual information, *Ibrahim Atli[1,2], Ahmet Saraçoğlu[2], and Osman Serdar Gedik[1,2]; [1]Yildirim Beyazit University and [2]Kuartis Technology and Consulting (Turkey)*

12:20 VDA-356
Deep variational auto-encoders for unsupervised glomerular classification, *Brendon Lutnick[1], Rabi Yacoub[1], Kuang-Yu Jen[2], John Tomaszewski[1], Sanjay Jain[3], and Pinaki Sarder[1]; [1]University of Buffalo, [2]University of California, Davis, and [3]Washington University in St. Louis (United States)*

12:30 VDA-357
ViDy, ViGly: Visualization of dynamical flexibility of virtual N-Glycans on proteins, *Camille Besançon, Alexandre Guillot, Sébastien Blaise, Manuel Dauchez, Nicolas Belloy, Jessica Jonquet-Prevoteau, and Stéphanie Baud, University of Reims (France)*

12:40 – 2:00 pm Lunch

Plenary Session

2:00 – 3:00 pm
Grand Peninsula Ballroom D

Ubiquitous, Consumer AR Systems to Supplant Smartphones, *Ronald T. Azuma, Intel, Corp. (United States)*

Dr. Ronald T. Azuma, researcher and augmented reality pioneer, shares his vision for achieving ubiquitous, consumer AR systems. Recent large investments in augmented reality reflect the commercial interest in its inherent potential to replace current smartphone technology, but much remains to be done. In his talk, Dr. Azuma gives a vision for achieving this goal, which requires not just solving numerous technical challenges but also determining new, compelling AR experiences that will establish AR as a new platform and novel form of media.

Dr. Azuma leads a team in Intel Labs that designs and prototypes novel experiences and key enabling technologies to enable new forms of media. These technology areas include computational imaging and photography, computational displays, and head-worn displays. Dr. Azuma is recognized as a pioneer and innovator in augmented reality, and has held prominent leadership roles in that research area, including leading and implementing research projects and demonstrations in areas such as AR, visualization, and mobile applications. Dr. Azuma received his BSc (1988) in electrical engineering from University of California, Berkeley, and MS (1990) and PhD (1995) in computer science from University of North Carolina, Chapel Hill. Prior to joining Intel, he was a research leader at Nokia Research Center Hollywood, and a senior researcher at Hughes Research Laboratories.

3:00 – 3:30 pm Coffee Break

Visual Analytics

3:30 – 5:10 pm
Sandpebble A

3:30 VDA-376
CNVis: A web-based visual analytics tool for exploring conference navigator data, *Samuel Bailey[1], Justin Wei[2], Chaoli Wang[1], Denis Parra[3], and Peter Brusilovsky[4]; [1]University of Notre Dame (United States), [2]University of North Texas (United States), [3]Pontificia Universidad Católica de Chile (Chile), and [4]University of Pittsburgh (United States)*

3:50 VDA-377
A step towards automatic visual analytics pipeline generation, *Benjamin Karer, Inga Scheler, and Hans Hagen, University of Kaiserslautern (Germany)*

4:10 VDA-378
BGS: A large-scale graph visualization tool, *Fangyan Zhang[1], Song Zhang[1], Christopher Lightsey[1], Sarah Harun[1], and Pak Wong[2]; [1]Mississippi State University and [2]ACT (United States)*

4:30 VDA-379
Distributed graph sampling methods, *Fangyan Zhang, Song Zhang, and Christopher Lightsey, Mississippi State University (United States)*

4:50 VDA-380
A visual technique to analyze flow of information in a machine learning system, *Abon Chaudhuri, Walmart Labs (United States)*

Symposium Interactive Papers (Poster) Session

5:30 – 7:30 pm
The Grove

Meet the Future: A Showcase of Student and Young Professionals Research

5:30 – 7:30 pm
The Grove

EI 2018 Short Course Descriptions

Sunday, January 28, 2018

EI01: Stereoscopic Display Application Issues

8:00 am – 5:45 pm

Course Length: 8 hours
Course Level: Intermediate
Instructors: John O. Merritt, The Merritt Group and Andrew J. Woods, Curtin University
Fee*: Member: $485 / **Non-member:** $535 / **Student:** $220
**prices for all increase by $50 after January 8, 2018*

When correctly implemented, stereoscopic 3D video displays can provide significant benefits in many areas, including endoscopy and other medical imaging, remote-control vehicles and telemanipulators, stereo 3D CAD, molecular modeling, 3D computer graphics, 3D visualization, and video-based training. This course conveys a concrete understanding of basic principles and pitfalls that should be considered in transitioning from 2D to 3D displays, and in testing for performance improvements. In addition to the traditional lecture sessions, there is a "workshop" session to demonstrate stereoscopic hardware and 3D imaging/display principles, emphasizing the key issues in an ortho-stereoscopic video display setup, and showing video from a wide variety of applied stereoscopic imaging systems.

Learning Outcomes

- List critical human factors guidelines for stereoscopic display configuration & implementation.
- Calculate optimal camera focal length, separation, display size, and viewing distance to achieve a desired level of depth acuity.
- Calculate comfort limits for focus/fixation mismatch and on-screen parallax values, as a function of focal length, separation, convergence, display size, and viewing distance factors.
- Set up a large-screen stereo display system using AV equipment readily available at most conference sites for slides and for full-motion video.
- Evaluate the trade-offs among currently available stereoscopic display technologies for your proposed applications.
- List the often-overlooked side-benefits of stereoscopic displays that should be included in a cost/benefit analysis for proposed 3D applications.
- Avoid common pitfalls in designing tests to compare 2D vs. 3D displays.
- Calculate and demonstrate the distortions in perceived 3D space due to camera and display parameters.
- Design and set up an orthostereoscopic 3D imaging/display system.
- Understand the projective geometry involved in stereo modeling.
- Understand the trade-offs among currently available stereoscopic display system technologies and determine which will best match a particular application.

Intended Audience: Engineers, scientists, and program managers involved with video display systems for applications such as: medical imaging & endoscopic surgery, simulators & training systems, teleoperator systems (remote-control vehicles & manipulators), computer graphics, 3D CAD systems, data-space exploration and visualization, and virtual reality.

John O. Merritt is a display systems consultant at The Merritt Group, Williamsburg, MA, with more than 25 years' experience in the design and human-factors evaluation of stereoscopic video displays for telepresence and telerobotics, scientific visualization, and medical imaging.

Andrew J. Woods is manager of the Curtin HIVE visualization facility and a research engineer at Curtin University's Centre for Marine Science and Technology in Perth, Western Australia. He has more than 20 years of experience working on the design, application, and evaluation of stereoscopic image and video capture and display equipment.

EI02: Advanced Image Enhancement and Deblurring

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Advanced
Instructor: Majid Rabbani, consultant
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

This course presents some of the advanced algorithms used in contrast enhancement, noise reduction, sharpening, and deblurring of still images and video. Applications include consumer and professional imaging, medical imaging, forensic imaging, surveillance, and astronomical imaging. Many image examples complement the technical descriptions.

Learning Outcomes

- Understand advanced algorithms used for contrast enhancement such as CLAHE, Photoshop Shadows/Highlights, and Dynamic Range Compression (DRC).
- Understand advanced techniques used in image sharpening such as advanced variations of nonlinear unsharp masking, etc.
- Understand recent advancements in image noise removal, such as bilateral filtering and nonlocal means.
- Understand how motion information can be utilized in image sequences to improve the performance of various enhancement techniques.
- Understand Wiener filtering and its variations for performing image deblurring (restoration).

Intended Audience: Scientists, engineers, and technical managers who need to understand and/or apply the techniques employed in digital image processing in various products in a diverse set of applications such as medical imaging, professional and consumer imaging, forensic imaging, etc. will benefit from this course. Some knowledge of digital filtering (convolution) and frequency decomposition is necessary for understanding the deblurring concepts.

Majid Rabbani has more than 35 years of experience in digital imaging. After a 33-year career at Kodak Research Labs, he retired in 2016 with the rank of Kodak Fellow. Currently, he is a visiting professor at Rochester Institute of Technology (RIT). He is the co-recipient of the 2005 and 1988 Kodak C. E. K. Mees Awards and the co-recipient of two Emmy Engineering Awards in 1990 and 1996. He has 44 issued US patents and is the co-author of the book Digital Image Compression Techniques *published in 1991 and the creator of six video/CDROM courses in the area of digital imaging. Rabbani is a Fellow of SPIE and IEEE and a Kodak Distinguished Inventor. He has been an active educator in the digital imaging community for the past 31years.*

NEW for 2018 EI03: Optimizing Computer Vision and Neural Network Applications using OpenVX

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Introductory (OpenVX architecture and its relation to other related APIs) to intermediate (the practical programming aspects, requiring familiarity with C++).
Instructors: Kari Pulli, Meta, and Radhakrishna Giduthuri, Advanced Micro Devices
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Khronos Group is a not for profit, member-funded consortium to create royalty-free open standards for hardware acceleration. OpenVX is an API for computer vision and neural network acceleration, especially important in real-time and safety-critical use cases. Khronos Group is also readying a standard interchange format for map training frameworks to inference engines.

This course covers Khronos standards related to neural networks and computer vision. A set of examples for neural networks and computer vision mapped to graph API are discussed. Also covered is the deployment model that pre-compiles a graph to create optimized binaries for deployment use cases, such as, inference neural networks. The course includes hands-on practice session that gets the participants started on solving real computer vision and neural networks problems using Khronos standards.

Learning Outcomes
Understanding the architecture of Khronos standards for computer vision and neural networks; getting fluent in actually using OpenVX for real-time computer vision and neural network inference tasks.

Intended Audience: Engineers, researchers, and software developers who develop vision and neural network applications and want to benefit from transparent HW acceleration. Also, managers that want to get a general understanding of the structure and uses of Khronos standards.

Kari Pulli is CTO at Meta. Before joining Meta, he worked as CTO of the Imaging and Camera Technologies Group at Intel influencing the architecture of future IPUs. He was VP of Computational Imaging at Light and before that he led research teams at NVIDIA Research (Senior Director) and at Nokia Research (Nokia Fellow) on computational photography, computer vision, and augmented reality. He headed Nokia's graphics technology, and contributed to many Khronos and JCP mobile graphics and media standards, and wrote a book on mobile 3D graphics. Pulli holds CS degrees from the University of Minnesota (BSc), University of Oulu (MSc, Lic. Tech.), the University of Washington (PhD); and an MBA from the University of Oulu. He has taught and worked as a researcher at Stanford, Univ. Oulu, and MIT.

Radhakrishna Giduthuri is a software architect at Advanced Micro Devices (AMD) focusing on development of computer vision and neural network acceleration libraries for AMD GPUs. He has extensive background with software design and performance tuning for various computer architectures ranging from general purpose DSPs, customizable DSPs, media processors, heterogeneous processors, GPUs, and several CPUs. He is a member of Khronos OpenVX and NNEF working groups, and editor of OpenVX safety-critical specification. For several years, he was a member of SMPTE video compression standardizing committee. He is an active member of IEEE Signal Processing Society and winner of outstanding leadership and professional services award for IEEE Central Area in 2016. Radhakrishna holds an M.Tech. from IIT Kharagpur, India.

NEW for 2018 EI04: 3D Point Cloud Processing

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Introductory
Instructor: Gady Agam, Illinois Institute of Technology
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Point clouds are an increasingly important modality for imaging with applications ranging from user interfaces to street modeling for GIS. Range sensors such as the Intel RealSense camera are becoming increasingly small and cost effective thus opening a wide range of applications. The purpose of this course is to review the necessary steps in point cloud processing and introduce fundamental algorithms in this area.

Point cloud processing is similar to traditional image processing in some sense yet different due to the 3D and unstructured nature of the data. In contrast to a traditional camera sensor which produces a 2D array of samples representing an image, a range sensor produces 3D point samples representing a 3D surface. The points are generally unorganized and so are termed "cloud". Once the points are acquired there is a need to store them in a data structure that facilitates finding neighbors of a given point in an efficient way. The point cloud often contains noise and holes which can be treated using noise filtering and hole filling algorithms. For computational efficiency purposes the point cloud may be down sampled. In an attempt to further organize the points and obtain a higher level representation of the points, planar or quadratic surface patches can be extracted and segmentation can be performed. For higher level analysis key points can be extracted and features can be computed at their locations. These can then be used to facilitate registration and recognition algorithms. Finally, for visualization and analysis purposes the point cloud may be triangulated. The course discusses and explains the steps described above and introduces the increasingly popular PCL (Point Cloud Library) open source framework for processing point clouds.

Learning Outcomes
- Describe fundamental concepts for point cloud processing
- Develop algorithms for point cloud processing
- Incorporate point cloud processing in your applications
- Understand the limitations of point cloud processing
- Use industry standard tools for developing point cloud processing applications

Intended Audience: Engineers, researchers, and software developers who develop imaging applications and/or use camera sensors for inspection, control, and analysis.

Gady Agam is an associate professor of computer science at the Illinois Institute of Technology. He is the director of the Visual Computing Lab at IIT which focuses on imaging, geometric modeling, and graphics applications. He received his PhD from Ben-Gurion University (1999).

EI05: Perception and Cognition for Imaging

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Introductory/Intermediate
Instructor: Bernice Rogowitz, Visual Perspectives
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Imaging, visualization, and computer graphics provide visual representations of data in order to communicate, provide insight, and enhance problem solving. The human observer actively processes these visual representations using perceptual and cognitive mechanisms that have evolved over millions of years. The goal of this tutorial is to provide an introduction to these processing mechanisms, and to show how this knowledge can guide the decisions we make about how to represent data visually, how we visually represent patterns and relationships in data, and how we can use human pattern recognition to extract features in the data.

Learning Outcomes

- Understand basic principles of spatial, temporal, and color processing by the human visual system.
- Explore basic cognitive processes, including visual attention and semantics.
- Develop skills in applying knowledge about human perception and cognition to interactive visualization and computer graphics applications.

Intended Audience: Imaging scientists, engineers, application developers, and domain experts using imaging systems in their analysis of financial, medical, or other data. Students interested in understanding imaging systems from the perspective of the human user and anyone interested in how the visual world is processed by our eye-brain system.

Bernice Rogowitz is a multidisciplinary scientist, working at the intersection of human perception, imaging, and visualization. She received her BS in experimental psychology from Brandeis University, a PhD in vision science from Columbia University, and was a post-doctoral Fellow in the Laboratory for Psychophysics at Harvard University. For many years, she was a scientist and research manager at the IBM T.J. Watson Research Center and is currently active in research and teaching through her consulting company, Visual Perspectives. Her work includes fundamental research in human color and pattern perception, novel perceptual approaches for visual data analysis and image semantics, and human-centric methods to enhance visual problem solving in medical, financial, and scientific applications. As the founder and co-chair of the IS&T Conference on Human Vision and Electronic Imaging, she is a leader in defining the research agenda for human-computer interaction in imaging, driving technology innovation through research in human perception, cognition, and aesthetics. Rogowitz is a Fellow of IS&T and SPIE, a Senior Member of IEEE, and a 2015 IS&T Senior Member.

EI06: 3D Video Processing Techniques for Immersive Environments

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Intermediate
Instructor: Yo-Sung Ho, Gwangju Institute of Science and Technology
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

With the emerging market of 3D imaging products, 3D video has become an active area of research and development in recent years. 3D video is the key to provide more realistic and immersive perceptual experiences than the existing 2D counterpart. There are many applications of 3D video, such as 3D movie and 3DTV, which are considered the main drive of the next-generation technical revolution. Stereoscopic display is the current mainstream technology for 3DTV, while autostereoscopic display is a more promising solution that requires more research endeavors to resolve the associated technical difficulties. This short course lecture covers the current state-of-the-art technologies for 3D contents generation. After defining the basic requirements for 3D realistic multimedia services, we cover various multi-modal immersive media processing technologies. Also addressed is the depth estimation problem for natural 3D scenes and several challenging issues of 3D video processing, such as camera calibration, image rectification, illumination compensation, and color correction. The course discusses MPEG activities for 3D video coding, including depth map estimation, prediction structure for multi-view video coding, multi-view video-plus-depth coding, and intermediate view synthesis for multi-view video display applications.

Learning Outcomes

- Understand the general trend of 3D video services.
- Describe the basic requirements for realistic 3D video services.
- Identify the main components of 3D video processing systems.
- Estimate camera parameters for camera calibration.
- Analyze the captured data for image rectification and illumination compensation.
- Apply image processing techniques for color correction and filtering.
- Estimate depth map information from stereoscopic and multi-view images.
- Synthesize intermediate views at virtual viewpoints.
- Review MPEG and JCT-3V activities for 3D video coding.
- Design a 3D video system to handle multi-view video-plus-depth data.
- Discuss various challenging problems related to 3D video services.

Intended Audience: Scientists, engineers, technicians, or managers who wish to learn more about 3D video and related processing techniques. Undergraduate training in engineering or science is assumed.

Yo-Sung Ho has been developing video processing systems for digital TV and HDTV, first at Philips Labs in New York and later at ETRI in Korea. He is currently a professor at the school of electrical and computer engineering at Gwangju Institute of Science and Technology (GIST) in Korea, and also Director of Realistic Broadcasting Research Center at GIST. He has given several tutorial lectures at various international conferences, including the 3DTV Conference, the IEEE International Conference on Image Processing (ICIP), and the IEEE International Conference on Multimedia & Expo (ICME). He earned his PhD in electrical and computer engineering at the University of California, Santa Barbara. He has been an associate editor of IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT).

NEW for 2018 EI07: Digital Camera Image Quality Tuning

8:00 am – 12:15 pm

Course Length: 4 hours
Course Level: Introductory/Intermediate
Instructor: Luke Cui, Amazon
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

A critical step in developing a digital camera product is image quality tuning – a process to balance and set camera operating parameters that generate the best raw images, hide defects inherent to each camera technology, and make the images appear to be most pleasing. Image quality tuning is complex and full of pitfalls but yet directly impacts the competitiveness of the product and customer satisfaction. The course covers the complete engineering process as well as fundamental science and techniques with practical examples including 1) 3A tuning; 2) objective image quality tuning; 3) subjective image quality tuning; 4) image quality evaluation and competitive benchmarking; and 5) nuts and bolts in managing the process.

Learning Outcomes
- Understand the camera image quality tuning goals.
- Understand the hardware capabilities and limitation based on specifications and testing.
- Understand the features, capabilities, limitations, and turnabilities of the image processing pipelines.
- Deep dive into the tuning process and workflow.
- Explore 3A models, the tuning processes, metrics, and testing.
- Deep dive into various ISP modules and image processing techniques.
- Learn about camera module variations and camera per module factory calibration.
- Understand subjective image quality and competitive benchmarking for tuning.
- Discuss new trends in digital camera image quality performance.
- Image quality review of top three cellphone cameras of the year.

Intended Audience: Engineers, scientists, and program managers involved with digital camera development.

Luke Cui has been hands-on working on imaging systems for more than twenty-five years with a BS in optics, MS in color science and PhD in human vision. He has been involved with the delivery of numerous market-proven digital imaging systems, working from photons, lenses, sensors, cameras, color science, imaging processing, image quality evaluation systems, to psychophysics and human vision. He has more than sixty patents and patent applications. He has worked for Macbeth Co. on standard lighting, color formulation, spectrophotometry, and colorimetry, led high speed document scanner optical imaging system development at Lexmark International, working from lens design to final image pipeline tuning, and led camera tuning of most Surface products on the market at Microsoft, covering from system specification, ISP evaluation, selection, and all phases of camera tuning. Currently he is with PrimeAir at Amazon.

EI19: Color and Calibration in Mobile Imaging Devices

8:00 – 10:00 am

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructors: Kevin J. Matherson, Microsoft Corporation, and Uwe Artmann, Image Engineering GmbH & Co. KG
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

When an image is captured using a digital imaging device it needs to be rendered. For consumer cameras this processing is done within the camera and covers various steps like dark current subtraction, flare compensation, shading, color compensation, demosaicing, white balancing, tonal and color correction, sharpening, and compression. Each of these steps has a significant influence on image quality. In order to design and tune cameras, it is important to understand how color camera hardware varies as well as the methods that can be used to calibrate such variations. This course provides the basic methods describing the capture and processing of a color camera image. Participants get to examine the basic color image capture and how calibration can improve images using a typical color imaging pipeline. In the course, participants are shown how raw image data influences color transforms and white balance. The knowledge acquired in understanding the image capture and calibration process can used to understand tradeoffs in improving overall image quality.

Learning Outcomes
- Understand how hardware choices in compact cameras impact calibrations and the type of calibrations performed and how such choices can impact overall image quality.
- Describe basic image processing steps for compact color cameras.
- Understand calibration methods for mobile camera modules.
- Describe the differences between class calibration and individual module calibration.
- Understand how spectral sensitivities and color matrices are calculated.
- Understand how the calibration light source impacts calibration
- Describe required calibration methods based on the hardware chosen and the image processing used.
- Appreciate artifacts associated with color shading and incorrect calibrations.
- Learn about the impacts of pixel saturation and the importance of controlling it on color.
- Learn about the impact of tone reproduction on perceived color (skin tone, memory colors, etc.)

Intended Audience: People involved in the design and image quality of digital cameras, mobile cameras, and scanners would benefit from participation. Technical staff of manufacturers, managers of digital imaging projects, as well as journalists, and students studying image technology are among the intended audience.

Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

Uwe Artmann studied photo technology at the University of Applied Sciences in Cologne following an apprenticeship as a photographer, and finished with the German 'Diploma Engineer'. He is now CTO at Image Engineering, an independent test lab for imaging devices and manufacturer of all kinds of test equipment for these devices. His special interest is the influence of noise reduction on image quality and MTF measurement in general.

EI20: Introduction to CMOS Image Sensor Technology

8:00 – 10:00 am

Course Length: 2 hours
Course Level: Beginner/Intermediate
Instructor: Arnaud Darmont, Aphesa
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

This short course is a good refresher for image sensor and camera design engineers but is primarily targeted for newcomers to the technology or to less technical people who need to have a better understanding of the CMOS imaging technology. The course starts from the light and light sources and follows the natural path through the imaging system until an image is available out of a camera. Lenses, microlenses, color filters, photodiodes, pixel circuits, pixel arrays, readout circuits, and analog-to-digital conversion are described in details. The description includes an analysis of the noise sources, signal-to-noise, dynamic range, and the most important formulas are provided.

Introduction to CMOS image sensors technology: silicon material properties; photodiode operation; basic and more advanced pixel designs including color filters, microlenses, back side illumination, global shutters; sensor level design; packaging; and wafer foundry processes. The course also includes a brief introduction to image sensor characterization based on

the EMVA1288 and explanations of the main differences between mobile, industrial, and scientific sensors. The course also explains the differences between CMOS and CCD. The course is updated yearly with some most recent information.

Learning Outcomes
- Understand the terminology used in the field of image sensors.
- Understand the design tradeoffs and the design trends.
- Understand the performance limitations of each sensor or technology type.
- Be able to select or specify the right sensor for an application.

Intended Audience: The short course is intended for engineers and technical managers involved with the design, use, or specification of CMOS image sensors. To some extent, less technical people involved with image sensors and cameras will be able to follow the course and gain valuable information.

Arnaud Darmont is owner and CEO of Aphesa, a company founded in 2008 specializing in image sensor consulting, custom camera design, the EMVA1288 standard, and camera benchmarking. He holds a degree in electronic engineering from the University of Liège (Belgium). Prior to founding Aphesa, he worked for more than seven years in the field of CMOS image sensors and high dynamic range imaging. He is a member of the EMVA1288 working group since 2006.

NEW for 2018 EI21: Resolution in Imaging Devices: Concepts and Measurements

10:15 am – 12:15 pm

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructors: Kevin J. Matherson, Microsoft Corporation, and Uwe Artmann, Image Engineering GmbH & Co. KG
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

Resolution is often used to describe image quality of electronic imaging systems. Components of an imaging system such as lenses, sensors, and image processing impact the overall resolution and image quality achieved in devices such as digital and mobile phone cameras. While image processing can in some cases improve the resolution of an electronic camera, it can also introduce artifacts as well. This course is an overview of spatial resolution methods used to evaluate electronic imaging devices and the impact of image processing on the final system resolution. The course covers the basics of resolution and impacts of image processing, international standards used for the evaluation of spatial resolution, and practical aspects of measuring resolution in electronic imaging devices such as target choice, lighting, sensor resolution, and proper measurement techniques.

Learning Outcomes
- Understand terminology used to describe resolution of electronic imaging devices.
- Describe the basic methods of measuring resolution in electronic imaging devices and their pros and cons.
- Understand point spread function and modulation transfer function.
- Learn slanted edge spatial frequency response (SFR).
- Learn Siemens Star SFR.
- Contrast transfer function.
- Difference between and use of object space and image space resolution.
- Describe the impact of image processing functions on spatial resolution.
- Understand practical issues associated with resolution measurements.
- Understand targets, lighting, and measurement set up.
- Learn measurement of lens resolution and sensor resolution.
- Appreciate RAW vs. processed image resolution measurements.
- Learn cascade properties of resolution measurements.
- Understand measurement of camera resolution.
- Understand the practical considerations when measuring real lenses.
- Specifying center versus corner resolution.
- Learn about impact of actuator tilt.
- Learn about impact of field curvature.
- Understand through-focus MTF.

Intended Audience: Managers, engineers, and technicians involved in the design and evaluation of image quality of digital cameras, mobile cameras, video cameras, and scanners would benefit from participation. Technical staff of manufacturers, managers of digital imaging projects, as well as journalists and students studying image technology are among the intended audience.

Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a Masters and PhD in optical sciences from the University of Arizona.

Uwe Artmann studied photo technology at the University of Applied Sciences in Cologne following an apprenticeship as a photographer and finished with the German 'Diploma Engineer'. He is now the CTO at Image Engineering, an independent test lab for imaging devices and manufacturer of all kinds of test equipment for these devices. His special interest is the influence of noise reduction on image quality and MTF measurement in general.

NEW for 2018 EI22: Fundamentals of Spectral Measurements for Color Science

10:15 am – 12:15 pm

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructor: David R. Wyble, Avian Rochester, LLC
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

This short course begins by defining the basic terms surrounding the instruments and quantities used in spectral measurements in the color field. It covers the operation and construction of spectrophotometers and spectroradiometers by discussing the function of each of the various subsystems present in the devices. Instrument standardization (calibration) and the application of CIE geometries for reflectance and transmittance are also covered. To evaluate instruments, the concepts of precision and accuracy of measurement devices are introduced along with practical suggestions for the analysis of instrument performance. The overall goal is to fully understand the procedures and concepts that lead to proper spectral measurements, the basis for colorimetric calculations.

Learning Outcomes
- Identify the components of spectrophotometers and spectroradiometers and the functions of each.
- Define the standardization (calibration) process of spectrophotometers and understand the implications of standardization upon the measurement process.
- Interpret measurement requirements and select appropriate measurement parameters and geometries for various applications.
- Understand the point of "hand-off" from spectral measurements to colorimetric calculations.

Intended Audience: Color engineers and technologists responsible for making and interpreting color measurements of any type. A technical background is not required, although an understanding of basic scientific principles will be very helpful.

David R. Wyble is president and founder of Avian Rochester, LLC. Since 2011, Avian Rochester has been delivering color standards; traditional and custom measurements; and consulting services to the color industry. Prior to founding Avian Rochester, Wyble was a color scientist within the Munsell Color Science Laboratory, at the Rochester Institute of Technology, and before that a Member of Research & Technology Staff at Xerox Corp. He holds a BS in computer science and a MS and PhD in color science from RIT and Chiba University, respectively.

NEW for 2018 EI23: Practical Insights into Implementing a CINEMATIC VR Capture System

1:30 – 3:30 pm

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructors: Nitin Sampat and J. A. Stephan Viggiano, Rochester Institute of Technology
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

Virtual Reality is experiencing an explosive growth in a variety of applications. Two of the leading applications are gaming and cinema, the latter being often referred to as "cinematic VR". Cinematic VR requires very high quality cameras to meet the expectations of consumers used to viewing the content in a movie theater. This content should also be free of distortions commonly encountered with fish-eye lenses to capture a large portion of the sphere being captured.

A few companies have started offering solutions for high quality cinematic VR content; Google, Facebook, Jaunt, and Lytro are some of the leaders with a solution. The challenge with all these solutions is handling the very large amount of data generated and the associated, very long rendering times. Additionally, the calibration and optimization of the imaging pipeline present new (relative to conventional photography) challenges in every aspect of making a VR movie – from data handling, storage, calibration, rendering, editing, audio and output onto a headset – not to mention the costs associated with each sub-system.

We have successfully built, calibrated, and used the open source, FB Surround 360 camera to generate VR content. The FB 360 camera can output 8K, stereo content and is the highest quality camera one can deploy for cinematic VR applications. In building and using said camera, we have gained a significant insight into VR workflows and the many challenges that present themselves at the different stages of the process.

With this course, we share practical insights into the process and help the attendee gain an appreciation into what it takes to build such a system. Recommendations for design – hardware and software, imaging pipeline optimization and preferences/suggestions from creative users of such a system, are offered

Learning Outcomes

- Appreciation of available capture solutions for cinematic VR capture.
- Understand bandwidth requirements, hardware options and data handling of VR content.
- Technology, issues and challenges in implementing (and improving) a VR capture pipeline, including:
  - Calibration of exposure, neutral balance, black level, geometric, and fall-off calibration
  - Rendering (stitching)
  - Editing
  - Spatial audio
  - Viewing/projecting VR content
- Example of VR content. Review of encountered problems and recommended solutions.

Intended Audience: People involved in the design and use of VR cameras will benefit greatly from this course. Technical staff of manufacturers, managers of VR products/teams, students, researchers, and anyone interested in gaining a practical insight into this fast evolving field will receive a "jumpstart" into this new and exciting medium.

Nitin Sampat is a professor in the photographic sciences department at the Rochester Institute of Technology in Rochester, NY where he teaches and conducts research in the areas such as photography, color science, image processing, and imaging quality. His current research is focused on building, testing, calibrating and deploying the 8K stereo, and Facebook Surround 360 camera for VR capture applications. He previously worked at the Laboratory for Laser Energetics designing and building imaging systems for deployment in nuclear fusion, Questra Corporation which offered strategic consulting for designing digital cameras and pipelines, and Hewlett Packard Research Labs where his research focused on measuring and controlling color in art reproduction applications as well as high speed digital printers. He has consulted and taught workshops in digital imaging for imaging companies around the globe. He is one of the founders of Coloryoke, Inc, a company offering color matching solutions to the art reproduction market. He was Symposium chair of the Electronic Imaging Symposium for 3 years and founded and chaired the conference on Digital Photography (now, the conference of Photography, Mobile and Immersive Imaging).

J. A. Stephen Viggiano, PhD, is assistant professor in photographic sciences at Rochester (NY) Institute of Technology's School of Photographic Arts and Sciences, and was Principal and Founder of Acolyte Color Research, a consulting and research firm specializing in solutions to problems in color science and technology. Viggiano also taught statistics at RIT's School of Mathematical Sciences, and graduate faculty at RIT's School of Printing Management and Sciences. He worked at the RIT Research Corporation until its closing in 2001, where he had risen to the position of Principal Imaging Scientist.

NEW for 2018 EI24: Camera Image Quality Benchmarking

1:30 – 3:30 pm

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructors: Henrik Eliasson, Eclipse Optics
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

The purpose of this short course is to show it is possible to compare the image quality of consumer imaging systems in a perceptually relevant manner. Because image quality is multi-faceted, generating a concise and relevant evaluative summary of photographic systems can be challenging. Indeed, benchmarking the image quality of still and video imaging systems requires that the assessor understands not only the capture device itself, but also the imaging applications for the system. This course explains how objective metrics and subjective methodologies are used to benchmark image quality of photographic still image and video capture devices. The course will review key image quality attributes and the flaws that degrade those attributes, including causes and consequences of the flaws on perceived quality. Content will touch on various subjective evaluation methodologies

as well as objective measurement methodologies relying on existing standards from ISO, IEEE/CPIQ, ITU and beyond. The course focus is on consumer imaging systems, so the emphasis will be on the value of using objective metrics which are perceptually correlated and generating benchmark data from the combination of objective and subjective metrics.

Learning Outcomes
- Identify defects that degrade image quality in natural images and what component of the camera should/could be improved for better image quality.
- Be aware of existing image quality standards and metrics.
- Understand how to judge the overall image quality of a camera.
- Evaluate the impact various output use cases can have on overall image quality.
- Describe an image quality lab and measurement protocols.
- Understand how to compare the image quality of a set of cameras.

Intended Audience: Image scientists, engineers, or managers who wish to learn more about image quality and how to evaluate still and video cameras for various applications. A good understanding of imaging and how a camera works is assumed.

Henrik Eliasson is an image analysis and image sensor specialist working at Eclipse Optics in Sweden. He has extensive experience in image quality assessment, previously working as a camera systems engineer at Sony Ericsson/Sony Mobile Communications and Axis Communications. He has been a key contributor in the CPIQ initiative, now run by IEEE, and a Swedish delegate to the ISO TC42 committee on photography standards. He has published work in a broad range of camera related areas, from optical simulations to camera color characterization and image sensor crosstalk investigations. Eliasson is a Senior member of SPIE.

EI25: Computer Vision for Autonomous Driving

1:30 – 3:30 pm

Course Length: 2 hours
Course Level: Introductory to intermediate
Instructors: Rony Ferzli, Intel Corporation
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

Computer visions algorithms are the backbone for any autonomous driving system. These algorithms play a key role in the perception and scene understanding enabling vehicles to operate not only under normal conditions, but also to adjust for unusual situations. The goal of the course is to present building blocks or ingredients needed for autonomous vehicles scenarios (such as lane departure warning, distance estimation, vehicle detection, traffic light detection, pedestrian detection, tracking, and sign detection) using classical approaches as well as latest research using deep learning. The short course also touches on design choices related to tradeoffs between complexity, performance, and accuracy. In addition, the course focuses on ADAS platforms, SDK tools, and how these can be used to develop and test computer vision algorithms.

Learning Outcomes
- Understand the ADAS challenges.
- Understand ADAS scenarios.
- Describe the latest research in computer vision related to ADAS.
- Identify available platforms and tools to start development.
- Understand the complexity of each scenario and CV algorithm selection process based on a set of criteria (quality, performance, cost, power).

Intended Audience: Engineers, scientists, and students who need to acquire technical knowledge about computer vision algorithms used in Advanced Driver Assistance Systems (ADAS) and available tools used for development.

Rony Ferzli received his BE and ME in electrical engineering from the American University of Beirut, Lebanon (1999 and 2002 respectively). He received his PhD in electrical engineering from Arizona State University (ASU), Tempe (2007). From 2007 to 2012, he worked in the R&D Unified Communications Group at Microsoft Corp., Redmond, WA, designing next generation video codecs for video conferencing products. Ferzli joined Intel Corporation in 2012 where he is currently a platform architect engineer at the Internet of Things Group (IoTG), researching and enabling computer vision and machine learning algorithms for Intel ADAS platforms. Prior to his current role, he worked on mobile devices SOC media technologies and next generation graphics as well as developing algorithms for HDTVs pre and post processing. He has more than 50 publications and patents in research areas such as image and video processing, DSP architectures and real-time systems, neural networks, and mixed-signal design. He holds several awards such as the Intel Division Award and IEEE SPS 2015 best paper award.

EI08: Introduction to Digital Color Imaging

1:30 – 5:45 pm

CANCELLED

Course Length: 4 hours
Course Level: Introductory
Instructor: Gaurav Sharma, University of Rochester
Fee*: Member: $275 / **Non-Member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

NEW for 2018 EI09: Using Cognitive and Behavioral Sciences and the Arts in Artificial Intelligence Research and Design

1:30 – 5:45 pm

Course Length: 4 hours
Course Level: Introductory/Intermediate
Instructor: Mónica López-González, La Petite Noiseuse Productions
Fee*: Member: $275 / **Non-Member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

A major goal of machine learning and autonomous systems research is to create human-like intelligent machines. Despite the current surge of sophisticated computational systems available, from natural language processors and pattern recognizers to surveillance drones and self-driving cars, machines are not human-like, most fundamentally, in regards to our capacity to integrate past with incoming multi-sensory information to creatively adapt to the ever-changing environment. To create an accurate human-like machine entails thoroughly understanding human processes and behavior. The complexity of the mind/brain and its cognitive processes necessitates that multidisciplinary expertise and lines of research must be brought together and combined. This introductory to intermediate course presents a multidisciplinary perspective about method, data, and theory from the cognitive and behavioral sciences and the arts not yet used in artificial intelligence research and design. The goal of this course is to provide a theoretical framework from which to build highly efficient and integrated cognitive-behavioral-computational models to advance the field of artificial intelligence.

Learning Outcomes
- Identify the major, yet pressing, failures of contemporary autonomous intelligent systems.
- Understand the challenges of implementation of and necessary mindset needed for integrative, multidisciplinary research.
- Review latest findings in the cognitive and behavioral sciences, particularly learning, attention, problem solving, decision-making, emotion perception, and spontaneous creative artistic thinking.

- Explain how relevant findings in the cognitive and behavioral sciences and the arts apply to the advancement of efficient and autonomous intelligent systems.
- Discuss various research solutions for improving current computational frameworks.

Intended Audience: Computer and imaging scientists, mathematicians, statisticians, engineers, program managers, system and software developers, and students in those fields interested in exploring the importance of using multidisciplinary concepts, questions, and methods within cognitive science, a fundamental and necessary field to build novel mathematical algorithms for computational systems.

Monica Lopez-Gonzalez, a polymath and disruptor, is a multilingual cognitive scientist, educator, entrepreneur, multidisciplinary artist, public speaker, science communicator, theorist, and writer. She merges questions, methods, data, and theory from both the sciences and the arts to better understand and unleash our creative thinking and making capacities as human beings. She's the co-founder and executive scientific and artistic director of La Petite Noiseuse Productions, a unique company at the forefront of innovative science-art integration. López-González holds BA in psychology and French, and MA and PhD in cognitive science, all from JHU and a Certificate of Art in photography from MICA. She held a postdoctoral fellowship in the JHU School of Medicine. She is a committee member and session co-chair of HVEI.

EI10: Fundamentals of Deep Learning

1:30 – 5:45 pm

Course Length: 4 hours
Course Level: Intermediate. Basic machine learning exposure and prior experience programming using a scripting language helpful.
Instructors: Raymond Ptucha, Rochester Institute of Technology, and Allison Gray, Nvidia Corporation
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Deep learning has been revolutionizing the machine learning community winning numerous competitions in computer vision and pattern recognition. Success in this space spans many domains including object detection, classification, speech recognition, natural language processing, action recognition and scene understanding. In some cases, results are on par with and even surpassing the abilities of humans. Activity in this space is pervasive, ranging from academic institutions to small startups to large corporations. This short course encompasses the two hottest deep learning fields: convolutional neural networks (CNNs) and recurrent neural networks (RNNs), and then gives attendees hands-on training on how to build custom models using popular open source deep learning frameworks. CNNs are end-to-end, learning low level visual features and classifier simultaneously in a supervised fashion, giving substantial advantage over methods using independently solved features and classifiers. RNNs inject temporal feedback into neural networks. The best performing RNN framework, Long Short Term Memory modules, are able to both remember long term sequences and forget more recent events. This short course describes what deep networks are, how they evolved over the years, and how they differ from competing technologies. Examples are given demonstrating their widespread usage in imaging, and as this technology is described, indicating their effectiveness in many applications.

There are an abundance of approaches to getting started with deep learning, ranging from writing C++ code to editing text with the use of popular frameworks. After understanding how these networks are able to learn complex systems, a hands-on portion provided by NVIDIA's Deep Learning Institute, we demonstrate usage with popular open source utilities to build state-of-the-art models. An overview of popular network configurations and how to use them with frameworks is discussed. The session concludes with tips and techniques for creating and training deep neural networks to perform classification on imagery, assessing performance of a trained network, and modifications for improved performance.

Learning Outcomes
- To become familiar with deep learning concepts and applications.
- To understand how deep learning methods, specifically convolutional neural networks and recurrent neural networks work.
- To gain hands-on experience building, testing, and improving the performance of deep networks using popular open source utilities.

Intended Audience: Engineers, scientists, students, and managers interested in acquiring a broad understanding of deep learning. Prior familiarity with basics of machine learning and a scripting language are helpful.

Raymond Ptucha is an assistant professor in computer engineering at the Rochester Institute of Technology specializing in machine learning, computer vision, robotics, and embedded control. Ptucha was a research scientist with Eastman Kodak Company for 20 years where he worked on computational imaging algorithms and was awarded 26 US patents with another 23 applications on file. He graduated from SUNY/Buffalo with a BS in computer science (1988) and a BS in electrical engineering (1989). He earned a MS in image science (2002) and PhD in computer science from RIT (2013). He was awarded an NSF Graduate Research Fellowship in 2010 and his PhD research earned the 2014 Best RIT Doctoral Dissertation Award. Ptucha is a passionate supporter of STEM education and is an active member of his local IEEE chapter and FIRST robotics organizations.

Allison Gray is a solutions architect at NVIDIA and supports customers interested in using graphics processing units to help them accelerate their applications. Before coming to Nvidia Corporation, she was a research engineer at the National Renewable Energy Laboratory in the Concentrating Solar Power group. She performed surface characterization testing on large aperture solar concentrators. She earned her BS and MS in mechanical engineering from the University of Nevada, Las Vegas specializing in thermal sciences. She earned an MS in image science from the Rochester Institute of Technology.

EI11: Perceptual Metrics for Image and Video Quality in a Broader Context: From Perceptual Transparency to Structural Equivalence

1:30 – 5:45 pm

Course Length: 4 hours
Course Level: Intermediate (Prerequisites: Basic understanding of image compression algorithms; background in digital signal processing and basic statistics: frequency-based representations, filtering, distributions.)
Instructors: Thrasyvoulos N. Pappas, Northwestern University, and Sheila S. Hemami, Draper
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

The course examines objective criteria for the evaluation of image quality that are based on models of visual perception. The primary emphasis will be on image fidelity, i.e., how close an image is to a given original or reference image, but we will broaden the scope of image fidelity to include structural equivalence. Also discussed is no-reference and limited-reference metrics. An examination of a variety of applications with special emphasis on image and video compression is included. We examine near-threshold

perceptual metrics, which explicitly account for human visual system (HVS) sensitivity to noise by estimating thresholds above which the distortion is just-noticeable, and supra-threshold metrics, which attempt to quantify visible distortions encountered in high compression applications or when there are losses due to channel conditions. The course also considers metrics for structural equivalence, whereby the original and the distorted image have visible differences but both look natural and are of equally high visual quality. This short course takes a close look at procedures for evaluating the performance of quality metrics, including database design, models for generating realistic distortions for various applications, and subjective procedures for metric development and testing. Throughout the course we discuss both the state of the art and directions for future research.

Learning Outcomes

- Gain a basic understanding of the properties of the human visual system and how current applications (image and video compression, restoration, retrieval, etc.) attempt to exploit these properties.
- Gain an operational understanding of existing perceptually-based and structural similarity metrics, the types of images/artifacts on which they work, and their failure modes.
- Understand current distortion models for different applications and how they can be used to modify or develop new metrics for specific contexts.
- Understand the differences between sub-threshold and supra-threshold artifacts, the HVS responses to these two paradigms, and the differences in measuring that response.
- Understand criteria by which to select and interpret a particular metric for a particular application.
- Understand the capabilities and limitations of full-reference, limited-reference, and no-reference metrics, and why each might be used in a particular application.

Intended Audience: Image and video compression specialists who wish to gain an understanding of how performance can be quantified. Engineers and scientists who wish to learn about objective image and video quality evaluation. Managers who wish to gain a solid overview of image and video quality evaluation. Students who wish to pursue a career in digital image processing. Intellectual property and patent attorneys who wish to gain a more fundamental understanding of quality metrics and the underlying technologies. Government laboratory personnel who work in imaging.

Thrasyvoulos N. Pappas received SB, SM, and PhD in electrical engineering and computer science from MIT (1979, 1982, and 1987, respectively). From 1987 until 1999, he was a member of the technical staff at Bell Laboratories, Murray Hill, NJ. He is currently a professor in the department of electrical and computer engineering at Northwestern University, which he joined in 1999. His research interests are in image and video quality and compression, image and video analysis, content-based retrieval, perceptual models for multimedia processing, model-based halftoning, and tactile and multimodal interfaces. Pappas has served as co-chair of the 2005 SPIE/IS&T Electronic Imaging (EI) Symposium, and since 1997 he has been co-chair of the EI Conference on Human Vision and Electronic Imaging. Pappas is a Fellow of IEEE and SPIE. He is currently serving as Vice President-Publications for the Signal Processing Society of IEEE. He has also served as Editor-in-Chief of the IEEE Transactions on Image Processing (2010-12)*, elected member of the Board of Governors of the Signal Processing Society of IEEE (2004-06), chair of the IEEE Image and Multidimensional Signal Processing (now IVMSP) Technical Committee, and technical program co-chair of ICIP-01 and ICIP-09.*

Sheila S. Hemami received a BSEE from the University of Michigan (1990), MSEE and PhD from Stanford University (1992 and 1994). She was most recently at Northeastern University as professor and chair of the electrical engineering and computer science department at the College of Engineering; with Hewlett-Packard Laboratories in Palo Alto, California in 1994; and with the School of Electrical Engineering at Cornell University from 1995-2013. She is currently Director, Strategic Technical Opportunities, at Draper, Cambridge, MA. Her research interests broadly concern communication of visual information from the perspectives of both signal processing and psychophysics. She was elected a Fellow of the IEEE in 2009 for contributions to robust and perceptual image and video communications. Hemami has held various visiting positions, most recently at the University of Nantes, France and at Ecole Polytechnique Fédérale de Lausanne, Switzerland. She has received numerous university and national teaching awards, including Eta Kappa Nu's C. Holmes MacDonald Award. She was a Distinguished Lecturer for the IEEE Signal Processing Society in 2010-2011, was editor-in-chief for the IEEE Transactions on Multimedia *from 2008-2010. She has held various technical leadership positions in the IEEE.*

NEW for 2018 EI12: Optics and Hardware Calibration of Compact Camera Modules

1:30 – 5:45 pm

Course Length: 4 hours
Course Level: Introductory/Intermediate
Instructors: Kevin J. Matherson, Microsoft Corporation, and Uwe Artmann, Image Engineering GmbH & Co. KG
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Digital and mobile imaging camera and system performance is determined by a combination of sensor characteristics, lens characteristics, and image processing algorithms. Smaller pixels, smaller optics, smaller modules, and lower cost result in more part-to-part variation driving the need for calibration to maintain good image quality. This short course provides an overview of issues associated with compact imaging modules used in mobile and digital imaging. The course covers optics, sensors, actuators, camera modules and the camera calibrations typically performed to mitigate issues associated with production variation of lenses, sensor, and autofocus actuators.

Learning Outcomes

- Describe illumination, photons, sensor, and camera radiometry.
- Select optics and sensor for a given application.
- Understand the optics of compact camera modules used for mobile imaging.
- Understand the difficulties in minimizing sensor and camera modules.
- Assess the need for per unit camera calibrations in compact camera modules.
- Determine camera spectral sensitivities.
- Understand autofocus actuators and why per unit calibrations are required.
- How to perform the various calibrations typically done in compact camera modules (relative illumination, color shading, spectral calibrations, gain, actuator variability, etc.).
- Equipment required for performing calibrations.
- Compare hardware tradeoffs such as temperature variation, its impact on calibration, and overall influence on final quality.

Intended Audience: People involved in the design and image quality of digital cameras, mobile cameras, and scanners will benefit from participation. Technical staff of manufacturers, managers of digital imaging projects, as well as journalists and students studying image technology are among the intended audience.

Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a Masters and PhD in optical sciences from the University of Arizona.

Uwe Artmann studied photo technology at the University of Applied Sciences in Cologne following an apprenticeship as a photographer and finished with the German 'Diploma Engineer'. He is now the CTO at Image Engineering, an independent test lab for imaging devices and manufacturer of all kinds of test equipment for these devices. His special interest is the influence of noise reduction on image quality and MTF measurement in general.

EI26: Introduction to Image Quality Testing: Targets, Software, and Standards

3:45 – 5:45 pm

Course Length: 2 hours
Course Level: Introductory
Instructors: Peter Burns, Burns Digital Imaging, and Don Williams, Image Science Associates
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

This course introduces imaging performance evaluation for image capture and provides a foundation for more advanced topics, e.g., system characterization and performance benchmarking. We adopt a scenario-based approach by describing several situations where imaging performance needs evaluation. Each of these, from design to quality assurance for manufacturing, is addressed in terms of suggested methods, color test charts, and standard reporting. For several important attributes, we describe international standards, guidelines, and current best practice. We demonstrate how testing standards can be adapted to evaluate capture devices ranging from cameras to scientific detectors. Examples are drawn from various applications, including consumer, museum, mobile, and clinical imaging.

Learning Outcomes
- Understand the difference between imaging performance and image quality.
- Describe performance standards, guidelines, and current best practices.
- Understand how color-encoding, image resolution, distortion, and noise are evaluated.
- Compare various commercial analysis software products and (color, resolution) test charts.
- Select evaluation methods and test targets to meet your project needs.
- Identify sources of system variability and understand measurement error.

Intended Audience: Image scientists, quality engineers, and others evaluating digital camera and scanner performance. No background in imaging performance (optical distortion, color-error, MTF, etc.) evaluation will be assumed.

Peter Burns is a consultant working in imaging system evaluation, modeling, and image processing. Previously he worked for Carestream Health, Xerox, and Eastman Kodak. A frequent instructor and speaker at technical conferences, he has contributed to several imaging standards. He has taught imaging courses at Kodak, SPIE, and IS&T technical conferences, and at the Center for Imaging Science, RIT.

Don Williams, founder of Image Science Associates, was with Kodak Research Laboratories. His work focuses on quantitative signal and noise performance metrics for digital capture imaging devices and imaging fidelity issues. He co-leads the TC 42 standardization efforts on digital print and film scanner resolution (ISO 16067-1, ISO 16067-2), scanner dynamic range (ISO 21550), and is the editor for the second edition to digital camera resolution (ISO 12233).

NEW for 2018 EI27: High-Dynamic-Range Theory and Technology

3:45 – 5:45 pm

Course Length: 2 hours
Course Level: Introductory/Intermediate
Instructors: Alessandro Rizzi, University of Milano, and John McCann, McCann Imaging
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

High Dynamic Range (HDR) imaging is a continuously evolving part of color. HDR painting was invented in the Renaissance. Fifty years ago HDR was a research topic in understanding scenes in non-uniform illumination (Edwin Land's "Mondrians"). Twenty years ago HDR used multiple exposures to attempt to capture a wider range of scene information (Debevec-Malik's program and Fairchild's Survey). Ten-plus years ago interest evolved to recreating HDR scenes by integrating widely-used LCD with LED illumination (Helge Seetzen's Brightsides Displays). Today, the evolution continues in the current sales of HDR televisions using OLED and Quantum Dot technologies. As well, standards for HDR video media formats remain an active area of research. This course reviews all of HDR.

This course reviews the science and technology underlying the evolution of HDR imaging from silver-halide photography to HDR TVs. One emphasis will be on measuring the actual physical limitations of scene capture, scene display, and most important the interaction of these systems with human vision. It is easy to forget that vision is itself a high-dynamic-range sensor with very sophisticated spatial-image-processing algorithms. A second emphasis is on the differences between single-pixel and spatial comparison HDR algorithms. It also describes the partnership between HDR hardware and the human vision that receives, processes, and enjoys HDR reproductions.

High dynamic range (HDR) imaging records and displays more information than conventional imaging. Non-uniform illumination increases the range of light from a scene. HDR techniques are often associated with recording natural images, such as the Ansel Adams's Zone system. After a detailed description of the dynamic range problem in image acquisition, this course focuses on standard methods of creating and manipulating HDR images, replacing myths with scene measurements, camera images, and visual appearances. The course presents measurements about the limits of accurate camera acquisition (range and color) and the usable range of light for displays presented to human vision. It discusses the principles of tone rendering and the role of HDR spatial comparisons.

Learning Outcomes
- Explore the history of HDR imaging.
- Understand dynamic range and quantization: the 'salame' metaphor.
- Compare single and multiple-exposures for scene capture.
- Measure optical limits in acquisition and display: scene dependent effects of glare.
- Measure limits of RAW scene capture in LDR and HDR scenes.

- Measure limits of human vision and calculate retinal luminance for models of vision.
- Discuss current HDR TV systems and standards: tone-rendering vs. spatial HDR methods.

Intended Audience: Anyone interested in using HDR imaging: science and applications. This includes students, color scientists, imaging researchers, medical imagers, software and hardware engineers, photographers, cinematographers, and production specialists.

Alessandro Rizzi is Full Professor at the department of computer science at the University of Milan, teaching fundamentals of digital imaging and colorimetry. He is doing research since 1990 in the field of digital imaging with a particular interest on color, visualization, photography, HDR, and on the perceptual issues related to digital imaging, interfaces, and lighting. He is the head of the MIPS Lab at the department of computer science. He has been one of the founders of the Italian Color Group, Secretary of CIE Division 8, IS&T Fellow and Vice President. In 2015 he received the Davies medal from the Royal Photographic Society. Rizzi is co-chair of the IS&T conference "Color Imaging: Displaying, Processing, Hardcopy and Applications", topical editor for Applied Color Science *of the* Journal of Optical Society of America, *associate editor of* Journal of Electronic Imaging, *member of several program committees of conferences related to color and digital imaging, and author of more than 300 scientific works.*

John McCann received a degree in biology from Harvard College (1964). He worked in, and managed, the Vision Research Laboratory at Polaroid from 1961 to 1996. He has studied human color vision, digital image processing, large format instant photography, and the reproduction of fine art. His publications and patents have studied Retinex theory, color constancy, color from rod/cone interactions at low light levels, appearance with scattered light, and HDR imaging. He is a Fellow of IS&T and the Optical Society of America (OSA). He is a past President of IS&T and the Artists Foundation, Boston. He is the IS&T/OSA 2002 Edwin H. Land Medalist and IS&T 2005 Honorary Member.

Monday, January 29, 2018

NEW for 2018 EI13: Deep Learning for Image and Video Processing

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Introductory/Intermediate
Instructors: Jonathon Shlens and George Toderici, Google, Inc.
Fee*: Member: $275 / **Non-Member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Deep learning has profoundly changed the field of computer vision in the last few years. Many computer vision problems have been recast with techniques from deep learning and in turn achieved state of the art results and become industry standards. In this tutorial we will provide an overview about the central ideas of deep learning as applied to computer vision. In the course of this tutorial we will survey the many applications of deep learning to image and video problems. The goal of this tutorial is to teach the central and core ideas and provide a high level overview of how deep learning has influenced computer vision.

Learning Outcomes
- Motivations for deep learning in computer vision.
- Recent progress in applying deep learning for vision.
- Architectures for image classification and image regression.
- Survey of image recognition and localization techniques.
- Tools for performing deep learning
- Advances in image synthesis and image compression.
- Architectures for video classification and summarization.

Intended Audience: Anyone interested in the manipulation and analysis of images and videos — both science and applications. This includes students, color scientists, imaging researchers, medical imagers, software and hardware engineers, photographers, cinematographers, and production specialists.

Jonathon Shlens received his PhD in computational neuroscience from UC San Diego (2007) where his research focused on applying machine learning towards understanding visual processing in real biological systems. He was previously a research fellow at the Howard Hughes Medical Institute, a research engineer at Pixar Animation Studios and a Miller Fellow at UC Berkeley. He has been at Google Research since 2010 and is currently a research scientist focused on building scalable vision systems. During his time at Google, he has been a core contributor to deep learning systems including the recently open-sourced TensorFlow. His research interests have spanned the development of state-of-the-art image recognition systems and training algorithms for deep networks.

George Toderici received his PhD in computer science from the University of Houston (2007) where his research focused on 2D-to-3D face recognition, and joined Google in 2008. His current work at Google Research is focused on lossy multimedia compression using neural networks. His past projects include the design of neural-network architectures and various classical approaches for video classification, YouTube channel recommendations, and video enhancement.

NEW for 2018 EI28: Camera Noise Sources and its Characterization Using International Standards

8:30 – 10:30 am

Course Level: Introductory to intermediate
Course Length: 2 hours
Instructors: Kevin J. Matherson, Microsoft Corporation, and Uwe Artmann, Image Engineering GmbH & Co. KG
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

This short course provides an overview of noise sources associated with "light in to byte out" in digital and mobile imaging cameras. The course discusses common noise sources in imaging devices, the influence of image processing on these noise sources, the use of international standards for noise characterization, and simple hardware test setups for characterizing noise.

Learning Outcomes
- Become familiar with basic noise source in mobile and digital imaging devices.
- Learn how image processing impacts noise sources in digital imaging devices.
- Make noise measurements based on international standards: EMVA 1288, ISO 14524, ISO 15739, and visual noise measurements.
- Describe simple test setups for measuring noise based on international standards.
- Predict system level camera performance using international standards.

Intended Audience: People involved in the design and image quality of digital cameras, mobile cameras, and scanners would benefit from participation. Technical staff of manufacturers, managers of digital imaging

projects, as well as journalists and students studying image technology are among the intended audience.

Kevin J. Matherson is a director of optical engineering at Microsoft Corporation working on advanced optical technologies for consumer products. Prior to Microsoft, he participated in the design and development of compact cameras at HP and has more than 15 years of experience developing miniature cameras for consumer products. His primary research interests focus on sensor characterization, optical system design and analysis, and the optimization of camera image quality. Matherson holds a masters and PhD in optical sciences from the University of Arizona.

Uwe Artmann studied photo technology at the University of Applied Sciences in Cologne following an apprenticeship as a photographer, and finished with the German 'Diploma Engineer'. He is now CTO at Image Engineering, an independent test lab for imaging devices and manufacturer of all kinds of test equipment for these devices. His special interest is the influence of noise reduction on image quality and MTF measurement in general.

NEW for 2018 EI15: Digital Imaging and Astro Photography

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Introductory
Instructor: Daniele L.R. Marini, Università degli Studi di Milano, Retired
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Photography is a fundamental tool for Astronomy and Astrophysics that try to capture the nature of the Universe by collecting electromagnetic radiation emitted or reflected by cosmic objects. Astro photography is not only a professional activity, but also an amateur activity. From the viewpoint of the Electronic Imaging Symposium, astro photography covers a wide range of issues, from image processing, to sensor characteristics, to image and color rendering and image reproduction. We can distinguish between two main phases: how an image is taken and how an image is rendered and for which purpose. The course will clarify these issues by an introductory overview.

Learning Outcomes
- Understand the process of astro photography using DSLR and CCD cameras.
- Identify the critical problems of low light and long exposure digital image capture.
- Understand the role of contrast and color rendering when imaging astronomic data.

Intended Audience: Scientists and engineers in the area of astronomy and astrophysics; amateur astronomers; engineers and technicians involved in the design and evaluation of image quality of digital cameras for this specific application; researchers and software developers in the area of image enhancement.

Daniele L.R. Marini graduated in physics at Università degli Studi di Milano (1972). He taught computer graphics, image processing, and fundamentals of digital communications at the school of Computer Science while doing research in these same fields. His focus in the last 20 years has been on digital imaging, with particular interest in computational modeling of human visual perception and contributed to the study and development of innovative algorithms in this field. He has published more than 200 papers and scientific communications. He is Fellow of IS&T.

NEW for 2018 EI29: Introduction to TensorFlow

3:15 – 5:15 pm

Course Level: Introductory
Course Length: 2 hours
Instructors: Magnus Hyttsten, Google, Inc.
Fee*: Member: $175 / **Non-member:** $200 / **Student:** $65
**prices for all increase by $50 after January 8, 2018*

TensorFlow is an open-source software library for machine learning. It is used to define, train, and test machine learning models, which can later be served on a variety of platforms - servers to mobile devices. In this workshop, you get an introduction using TensorFlow. We will go through the basics, and by the end of the course, you will know how to build deep neural network models on your own.

Prerequisites: Bring your laptop installed with TensorFlow by following instructions on tensorflow.org. Alternatively, we can provide Google Cloud instances of TensorFlow that you can use (no installation required). If you have a Google Cloud account, we can also share a TensorFlow cloud image that you can use.

Learning Outcomes
- Become familiar with TensorFlow programming environment.
- Learn how to build models related to regression and classification.
- Understand what deep neural networks are and how to build them.
- Create a deep neural network that is able to classify digits based on raw pixel input.

Intended Audience: Scientists or developers that want to get started with TensorFlow.

Magnus Hyttsten is a senior staff developer advocate for TensorFlow at Google. He focuses on all things TensorFlow - from making sure that the developer community is happy to help developing the product. He has been speaking at many major events including Google I/O, AnDevCon, Machine Learning meetups, etc. Right now, he is fanatically and joyfully focusing on TensorFlow for Mobile as well as creating Reinforcement Learning models.

Tuesday, January 30, 2018

NEW for 2018 EI14: 3D Imaging

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Introductory
Instructor: Gady Agam, Illinois Institute of Technology
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

The purpose of this course is to introduce algorithms for 3D structure inference from 2D images. In many applications, inferring 3D structure from 2D images can provide crucial sensing information. The course begins by reviewing geometric image formation and mathematical concepts that are used to describe it, and then moves to discuss algorithms for 3D model reconstruction.

The problem of 3D model reconstruction is an inverse problem in which we need to infer 3D information based on incomplete (2D) observations. We discuss reconstruction algorithms which utilize information from multiple views. Reconstruction requires the knowledge of some intrinsic and extrinsic camera parameters and the establishment of correspondence between views. Also discussed are algorithms for determining camera parameters (camera calibration) and for obtaining correspondence using epipolar constraints between views. The course introduces relevant 3D imaging software components available through the industry standard OpenCV library.

Learning Outcomes
- Describe fundamental concepts in 3D imaging.
- Develop algorithms for 3D model reconstruction from 2D images.
- Incorporate camera calibration into your reconstructions.
- Classify the limitations of reconstruction techniques.
- Use industry standard tools for developing 3D imaging applications.

Intended Audience: Engineers, researchers, and software developers who develop imaging applications and/or use camera sensors for inspection, control, and analysis. The course assumes basic working knowledge concerning matrices and vectors.

Gady Agam is an associate professor of computer science at the Illinois Institute of Technology. He is the director of the visual computing lab at IIT which focuses on imaging, geometric modeling, and graphics applications. He received his PhD from Ben-Gurion University (1999).

EI16: Joint Design of Optics and Image Processing for Imaging Systems

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Introductory to intermediate
Instructors: David Stork, Rambus Labs
Fee*: Member: $275/ **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

For centuries, optical imaging system design centered on exploiting the laws of the physics of light and materials (glass, plastic, reflective metal,) to form high-quality (sharp, high-contrast, undistorted,) images that "looked good." In the past several decades, the optical images produced by such systems have been ever more commonly sensed by digital detectors and the image imperfections corrected in software. The new era of electro-optical imaging offers a more fundamental revision to this paradigm, however, now the optics and image processing can be designed jointly to optimize an end-to-end digital merit function without regard to the traditional quality of the intermediate optical image. Many principles and guidelines from the optics-only era are counterproductive in the new era of electro-optical imaging and must be replaced by principles grounded on both the physics of photons and the information of bits. This short course describes the theoretical and algorithmic foundations of new methods of jointly designing the optics and image processing of electro-optical imaging systems. The course also focuses on the new concepts and approaches rather than commercial tools.

Learning Outcomes
- Describe the basics of information theory.
- Characterize electro-optical systems using linear systems theory.
- Compute a predicted mean-squared error merit function.
- Characterize the spatial statistics of sources.
- Implement a Wiener filter.
- Implement spatial convolution and digital filtering.
- Make the distinction between traditional optics-only merit functions and end-to-end digital merit functions.
- Perform point-spread function engineering.
- Become aware of the image processing implications of various optical aberrations.
- Describe wavefront coding and cubic phase plates.
- Utilize the power of spherical coding.
- Compare super-resolution algorithms and multi-aperture image synthesizing systems.
- Simulate the manufacturability of jointly designed imaging systems.
- Evaluate new methods of electro-optical compensation.

Intended Audience: Optical designers familiar with system characterization (f#, depth of field, numerical aperture, point spread functions, modulation transfer functions,) and image processing experts familiar with basic operations (convolution, digital sharpening, information theory).

David Stork is distinguished research scientist and research director at Rambus Labs and a Fellow of the International Association for Pattern Recognition. He holds 40 US patents and has written nearly 200 technical publications including eight books or proceedings volumes such as Seeing the Light, Pattern Classification (2nd ed.) *and* HAL's Legacy. *He has given more than 230 technical presentations on computer image analysis of art in 19 countries.*

Wednesday, January 31, 2018,

NEW for 2018 EI17: Build Your Own VR Display: An Introduction to VR Display Systems for Hobbyists and Educators

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Introductory
Instructors: Hayato Ikoma and Robert Konrad, Stanford University; Keenan Molner, Playground Global, and Nitish Padmanaban, Stanford University
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

Wearable computing is widely anticipated to be the next computing platform for consumer electronics and beyond. In many wearable computing applications, most notably virtual and augmented reality (VR/AR), the primary interface between a wearable computer and a user is a near-eye display. A near-eye display in turn is only a small part of a much more complex system that delivers these emerging VR/AR experiences. Other key components of VR/AR systems include low-latency tracking of the user's head position and orientation, magnifying optics, sound synthesis, and also content creation. In can be challenging to understand all of these technologies in detail as only limited and fragmented educational material on the technical aspects of VR/AR exist today. This course serves as a comprehensive introduction to VR/AR technology to conference attendees. We will teach attendees how to build a head-mounted display (HMD) from scratch. Throughout the course, different components of the VR system are taught and implemented, including the graphics pipeline, stereo rendering, lens distortion with fragment shaders, head orientation tracking with inertial measurement units, positional tracking, spatial sound, and cinematic VR content creation. At the end, attendees will have built a VR display from scratch and implemented every part of it. All hardware components are low-cost and off-the-shelf; the list will be shared with attendees. For maximum accessibility, all software is implemented in WebGL and using the Arduino platform. Source code will be provided to conference attendees.

Learning Outcomes
- Understand and be able to implement the various systems comprising today's VR display systems with low-cost DIY components.
- Learn about DIY system hardware and software.
- Understand the basic computer graphics pipeline.
- Learn basic OpenGL, WebGL, and GLSL (for shader programming) and how to implement via Javascript with Three.js to run in a browser.
- Understand stereoscopic perception and rendering.
- Evaluate head mounted display optics and how to correct for lens distortion.
- Explore orientation tracking and how to perform sensor fusion on IMU data.
- Use positional tracking via a DIY system that reverse engineers the Vive Lighthouse.
- Learn omnidirectional stereo (ODS) VR video format and current methods of capturing VR content.
- Explore spatial Audio representations for 3D sound reproduction.

Intended Audience: For this introductory-level course, some familiarity with programming, basic computer graphics, penGL, and the Arduino platform would be helpful. However, all required software and hardware concepts will be introduced in the course.

Hayato Ikoma is a PhD student at the department of electrical engineering, Stanford University, working with Professor Gordon Wetzstein. His current research interest is in signal processing and optimization, particularly for image processing. He is also interested in virtual reality related technologies and served as a teaching assistant for a virtual reality class at Stanford University. Before coming to Stanford University, he worked as a research assistant to develop new computational imaging techniques for an optical microscope and a space telescope at MIT Media Lab and Centre de Mathématiques et Leurs Applications at École Normal Supérieure de Cachan (CMLA, ENS Cachan) in France.

Robert Konrad is a 3rd year PhD candidate in the electrical engineering department at Stanford University, advised by Professor Gordon Wetzstein. His research interests lie at the intersection of computational displays and human physiology with a specific focus on virtual and augmented reality systems. He has recently worked on relieving vergence-accommodation and visual-vestibular conflicts present in current VR and AR displays, as well as computationally efficient cinematic VR capture systems. Konrad has been the head TA for the VR course taught at Stanford that Professor Wetzstein and he started in 2015. He received is BA from the ECE department at the University of Toronto (2014), and an MA from the EE Department at Stanford University (2016).

Keenan Molner, is a recent graduate of the electrical engineering from Stanford University, earning both his BS and MS with a focus on computational imaging and hardware. During his masters' studies, he worked with Prof. Gordon Wetzstein's Computational Imaging group, with projects ranging from Time of Flight cameras, to vergence-accomodation studies, to positional tracking hardware. During 2016 he helped develop the hardware for Prof. Wetzstein's EE267: Virtual Reality class, for which he also served as a teaching assistant. Molner currently works at Playground Global on optoelectric sensing systems.

Nitish Padmanaban is a second year PhD student at Stanford EE. He works in the Stanford computational imaging lab on optical and computational techniques for virtual and augmented reality. In particular, he spent the last year working on building and evaluating displays to alleviate the vergence-accommodation conflict, and also looked into the role of the vestibular system conflicts in causing motion sickness in VR. He graduated with a BS in EECS from UC Berkeley (2015), during which he focused primarily on signal processing.

Thursday, February 1, 2018

NEW for 2018 EI18: Introduction to Probabilistic Models for Inference and Estimation

8:30 am – 12:45 pm

Course Length: 4 hours
Course Level: Intermediate
Instructor: Gaurav Sharma, University of Rochester
Fee*: Member: $275 / **Non-member:** $300 / **Student:** $95
**prices for all increase by $50 after January 8, 2018*

The course aims at providing attendees a foundation in inference and estimation using probabilistic models. Starting from the broad base of probabilistic inference and estimation, the course develops the treatment of specific techniques that underlie many current day machine learning and inference algorithms. Topics covered include a review of concepts from probability and stochastic processes, IID and Markov processes, basics of inference and estimation, Maximum Aposteriori Probability (MAP) and Maximum Likelihood (ML), expectation maximization for ML estimation, hidden Markov models, and Markov and conditional random fields. The pedagogical approach is to illustrate the use of models via concrete examples: each model is introduced via a detailed toy example and then illustrated via one or two actual application examples.

Learning Outcomes
- Describe and intuitively explain fundamental probabilistic concepts such independence, Bayes' rule, and stationarity.
- Explain the basis of Maximum Aposteriori Probability (MAP) and Maximum Likelihood (ML) detection and estimation rules.
- Describe how latent variables and sequential dependence underlie expectation maximization and hidden Markov Models.
- Develop simple applications of probabilistic models for computer vision and image processing problems.
- Cite and explain application examples involving the use of probabilistic models in computer vision, machine learning, and image processing.

Intended Audience: Engineers, scientists, students, and managers interested in understanding how probabilistic models are used in inference and parameter estimation problems in today's machine learning and computer vision applications and in applying such models to their own problems. Prior familiarity with the basics of probability and with matrix vector operations are necessary for a thorough understanding, although attendees lacking this background will still be able to develop an intuitive high-level understanding.

Gaurav Sharma has more than two decades of experience in the design and optimization of color imaging systems and algorithms that spans employment at the Xerox Innovation Group and his current position as a professor at the University of Rochester in the departments of electrical and computer engineering and computer science. Additionally, he has consulted for several companies on the development of new imaging systems and algorithms. He holds 51 issued patents and has authored more than a 190 peer-reviewed publications. He is the editor of the Digital Color Imaging Handbook *published by CRC Press and served as the Editor-in-Chief for the SPIE/IS&T* Journal of Electronic Imaging *from 2011 through 2015. Sharma is a fellow of IS&T, IEEE, and SPIE.*

General Information

Registration

Onsite Registration and Badge Pick-Up Hours

Sunday 28 January..... 7:00 am to 8:00 pm
Monday 29 January ..... 7:00 am to 5:00 pm
Tuesday 30 January..... 8:00 am to 5:00 pm
Wednesday 31 January ..... 8:00 am to 5:00 pm
Thursday 1 February ..... 8:30 am to 5:00 pm

Symposium Registration

Symposium Registration Includes: Admission to all technical sessions, coffee breaks, the Symposium Reception, exhibition and demonstration session, 3D theater, and support of free access to all the EI proceedings papers on the IS&T Digital Library. Separate registration fees are required for short courses.

Short Course Registration

Courses and workshops are priced separately. Course-only registration includes your selected course(s), course notes, coffee breaks, and admittance to the exhibition. Courses will take place in various meeting rooms at the Hyatt Regency San Francisco Airport. Room assignments are noted on the course admission tickets and distributed with registration materials.

Refund Information

To cover bank charges and processing fees, there is a cancellation fee of $75 until 20 January 2018. After that date, the cancellation fee is 50% of the total plus $75. All requests for refunds must be made in writing. No refunds will be given after 20 February 2018.

Author/Presenter Information

Speaker AV Preparation

Conference Office

Open during Registration Hours

Each conference room has an LCD projector, screen, lapel microphone, and laser pointer. All presenters are encouraged to visit the Speaker AV Prep Room to confirm that their presentation and personal laptop is compatible with the audiovisual equipment supplied in the conference rooms. Speakers who have requested special equipment, prior to the request deadline, are asked to report to the AV Prep Room to confirm their requested equipment is available.

No shared laptops are provided.

Policies

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IS&T, or their officially designated event management, in their sole discretion, reserves the right to accept or decline an individual's registration for an event. Further, IS&T, or event management, reserves the right to prohibit entry or remove any individual whether registered or not, be they attendees, exhibitors, representatives, or vendors, who in their sole opinion are not, or whose conduct is not, in keeping with the character and purpose of the event. Without limiting the foregoing, IS&T and event management reserve the right to remove or refuse entry to any attendee, exhibitor, representative, or vendor who has registered or gained access under false pretenses, provided false information, or for any other reason whatsoever that they deem is cause under the circumstances.

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The Society for Imaging Science and Technology (IS&T; imaging.org) is dedicated to ensuring a harassment-free environment for everyone, regardless of gender, gender identity/expression, race/ethnicity, sexual orientation, disability, physical appearance, age, language spoken, national origin, and/or religion. As an international, professional organization with community members from across the globe, IS&T is committed to providing a respectful environment where discussions take place and ideas are shared without threat of belittlement,

About IS&T

The Society for Imaging Science and Technology (IS&T)—the organizer of the Electronic Imaging Symposium—is an international non-profit dedicated to keeping members and other imaging professionals apprised of the latest developments in the field through conferences, educational programs, publications, and its website. IS&T encompasses all aspects of imaging, with particular emphasis on digital printing, electronic imaging, color science, sensors, virtual reality, photofinishing, image preservation, and hybrid imaging systems.

IS&T offers members:

- Free, downloadable access to more than 6,000 papers from IS&T conference proceedings via www.ingentaconnect.com/content/ist
- A complimentary online subscription to the *Journal of Imaging Science & Technology* or the *Journal of Electronic Imaging*
- Reduced rates on products found in the IS&T bookstore, including technical books, conference proceedings, and journal subscriptions
- Reduced registration fees at all IS&T sponsored conferences—a value equal to the difference between member and nonmember rates alone—and short courses
- Access to the IS&T member directory
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- An honors and awards program
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condescension, or harassment in any form. This applies to all interactions with the Society and its programs/events, whether in a formal conference session, in a social setting, or on-line.

Harassment includes offensive verbal comments related to gender, sexual orientation, etc., as well as deliberate intimidation; stalking; harassing photography, recording, or postings; sustained disruption of talks or other events; inappropriate physical contact; and unwelcome sexual attention. Please note that the use of sexual language and/or imagery is never appropriate, including within conference talks, online exchanges, or the awarding of prizes. Participants asked to stop any harassing behavior are expected to comply immediately.

Those participating in IS&T activities who violate these or IS&T's Publications Policy may be sanctioned or expelled from the conference and/or membership without a refund at the discretion of IS&T. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact the IS&T Executive Director or e-mail incident.report@imaging.org immediately. Please note that all reports are kept confidential and only shared with those who "need to know"; retaliation in any form against anyone reporting an incident of harassment, independent of the outcome, will not be tolerated.

Identification
To verify registered participants and provide a measure of security, IS&T will ask attendees to present a government issued Photo ID at registration to collect registration materials. Individuals are not allowed to pick up badges for attendees other than themselves. Further, attendees may not have some other person participate in their place at any conference-related activity. Such other individuals will be required to register on their own behalf to participate.

Capture and Use of a Person's Image
By registering for an IS&T event, I grant full permission to IS&T to capture, store, use, and/or reproduce my image or likeness by any audio and/or visual recording technique (including electronic/digital photographs or videos), and create derivative works of these images and recordings in any IS&T media now known or later developed, for any legitimate IS&T marketing or promotional purpose. By registering for an IS&T event, I waive any right to inspect or approve the use of the images or recordings or of any written copy. I also waive any right to royalties or other compensation arising from or related to the use of the images, recordings, or materials. By registering, I release, defend, indemnify and hold harmless IS&T from and against any claims, damages or liability arising from or related to the use of the images, recordings or materials, including but not limited to claims of defamation, invasion of privacy, or rights of publicity or copyright infringement, or any misuse, distortion, blurring, alteration, optical illusion or use in composite form that may occur or be produced in taking, processing, reduction or production of the finished product, its publication or distribution.

Payment Method
Registrants for paid elements of the event, who do not provide a method of payment, will not be able to complete their registration. Individuals with incomplete registrations will not be able to attend the conference until payment has been made. IS&T accepts VISA, MasterCard, American Express, Discover, Diner's Club, checks and wire transfers. Onsite registrations can also pay with Cash.

Audio, Video, Digital Recording Policy
Conferences, courses, and poster sessions: For copyright reasons, recordings of any kind are prohibited without prior written consent of the presenter. Attendees may not capture nor use the materials presented in any meeting room without written permission. Consent forms are available at Speaker Check-In. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their recording media.

Exhibition Hall: For security and courtesy reasons, recordings of any kind are prohibited unless one has explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their recording media and to leave the exhibition hall. Your registration signifies your agreement to be photographed or videotaped

by IS&T in the course of normal business. Such photos and video may be used in IS&T marketing materials or other IS&T promotional items.

Laser Pointer Safety Information/Policy
IS&T supplies tested and safety-approved laser pointers for all conference meeting rooms. For safety reasons, IS&T requests that presenters use provided laser pointers. Use of a personal laser pointer represents user's acceptance of liability for use of a non- IS&T-supplied laser pointer. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct, but output must be verified because manufacturer labeling may not match actual output. Misuse of any laser pointer can lead to eye damage.

Underage Persons on Exhibition Floor Policy
For safety and insurance reasons, no one under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Unauthorized Solicitation Policy
Unauthorized solicitation in the Exhibition Hall is prohibited. Any non-exhibiting manufacturer or supplier observed to be distributing information or soliciting business in the aisles, or in another company's booth, will be asked to leave immediately.

Unsecured Items Policy
Personal belongings should not be left unattended in meeting rooms or public areas. Unattended items are subject to removal by security. IS&T is not responsible for items left unattended.

Wireless Internet Service Policy
At IS&T events where wireless is included with your registration, IS&T provides wireless access for attendees during the conference and exhibition but cannot guarantee full coverage in all locations, all of the time. Please be respectful of your time and usage so that all attendees are able to access the internet.

Excessive usage (e.g., streaming video, gaming, multiple devices) reduces bandwidth and increases cost for all attendees. No routers may be attached to the network. Properly secure your computer before accessing the public wireless network. Failure to do so may allow unauthorized access to your laptop as well as potentially introduce viruses to your computer and/or presentation. IS&T is not responsible for computer viruses or other computer damage.

Mobile Phones and Related Devices Policy
Mobile phones, tablets, laptops, pagers, and any similar electronic devices should be silenced during conference sessions. Please exit the conference room before answering or beginning a phone conversation.

Smoking
For the health and consideration of all attendees, smoking is not permitted at any event elements, such as but not limited to: plenaries, conferences, workshops, courses, poster sessions, hosted meal functions, receptions, and in the exhibit hall. Most facilities also prohibit smoking in all or specific areas. Attendees should obey any signs preventing or authorizing smoking in specified locations.

Hold Harmless
Attendee agrees to release and hold harmless IS&T from any and all claims, demands, and causes of action arising out of or relating to your participation in the event you are registering to participate in and use of any associated facilities or hotels.

Event Cancellation
If for some unforeseen reason IS&T should have to cancel the event, registration fees processed will be refunded to registrants. Registrants will be responsible for cancellation of travel arrangements or housing reservations and the applicable fees.

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