IEEE International Conference on Computational Photography

ICCP 2018 May 4-6

Carnegie Mellon University, Pittsburgh, PA

Message from the Chairs

Welcome to Pittsburgh, PA, and the 2018 IEEE International Conference on Computational Photography (ICCP). Our three-day program includes 17 accepted papers, 3 keynote talks, 8 short invited talks, 44 posters, 9 demos, and a reception at the Phipps Conservatory. This year, we received 35 paper submissions. To select the papers from these submissions, we invited 60 experts to join the Program Committee. We used the CMT conference management service provided by Microsoft Research to manage the submission and selection of papers from beginning to end. After the submission deadline, the Program / Paper Chairs distributed the papers to the Program Committee, so that each paper had at least 3 reviews, with most papers getting 4 reviews.

Reviewers were given 8 weeks to complete their reviews, after which the authors were given 1 week to write rebuttals. The committee discussed the rebuttals and reviews until a conclusion was reached for each paper. The 17 accepted papers give an acceptance rate of 48%. All the accepted papers are presented as orals.

ICCP has a separate call for posters and demos. These are not considered publications, instead participants are invited to discuss their best recent work, even if it has been recently published, or will be soon published, elsewhere.

The conference has a single track for all the papers, invited talks and keynotes, posters, and tutorials. The proceedings of ICCP 2018 are being provided via a web link at the conference. All papers in the conference will be made available through the IEEE Computer Society Digital Library and through IEEE Xplore.

We wish to thank all members of the organizing committee, reviewers, authors, and the CMT team for the hard work and professionalism that has gone into making ICCP 2018 a top-rate conference. Our thanks also go to the organizers of previous ICCPs for their helpful advice and support.

We are grateful to the sponsors as well, and we are happy to report that ICCP 2018 has seen a significant amount of industrial support, which is further evidence of the relevance and importance of this community.

Finally, we wish all the attendees a highly stimulating, informative, and enjoyable conference.

Aswin C. Sankaranarayanan, Andreas Velten and Ravi Ramamoorthi
Program Co-Chairs

Chairs

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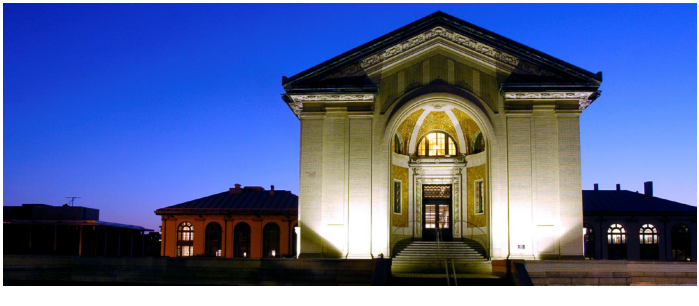
We invite you to learn more about Carnegie Mellon University and the Department of Electrical and Computer Engineering by finding us on social media and checking our website frequently to stay in touch with the exciting and groundbreaking achievements that happen daily in our ECE community.



Keynote Speakers

Rethinking Structured Light

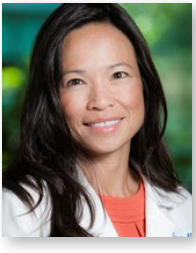
Kyros Kutulakos

Professor of Computer Science, University of Toronto

Even though structured-light triangulation is a decades-old problem, much remains to be discovered about it---with potential ramifications for computational imaging more broadly.

I will focus on two specific aspects of the problem that are influenced by recent developments in our field. First, programmable coded-exposure sensors vastly expand the degrees of freedom of an imaging system, essentially redefining what it means to capture images under structured light. I will discuss our efforts to understand the theory and expanded capabilities of such systems, and to build custom CMOS sensors that realize them. Second, I will outline our recent work on turning structured-light triangulation into an optimal encoding-decoding problem derived from first principles. This opens the way for adaptive systems that can learn on their own how to optimally control their light sources and sensors, and how to convert the images they capture into accurate 3D geometry.

About Dr. Kutulakos: Kyros Kutulakos is a Professor of Computer Science at the University of Toronto. He received his PhD degree from the University of Wisconsin-Madison in 1994 and his BS degree from the University of Crete in 1988, both in Computer Science. Kyros has been a pioneer in the area of computational light transport, developing theoretical tools and computational cameras to analyze light propagation in real-world environments. He is the recipient of an Alfred P. Sloan Fellowship, an Ontario Premier's Research Excellence Award, a Marr Prize in 1999, a Marr Prize Honorable Mention in 2005, and four other paper awards (CVPR 1994, ECCV 2006, CVPR 2014, CVPR 2017). He was Program Co-Chair of CVPR 2003 and ICCV 2013, and also served as Program Co-Chair of the second ICCP conference back in 2010.



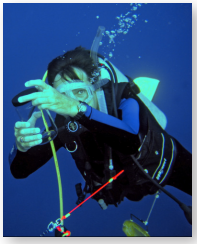
Molecular Navigation for Cancer Diagnosis and Surgery - Imaging Tumors and Nerves

Quyen Nguyen

Professor of Surgery, University of California at San Diego

Molecular imaging with fluorescence provides enhanced visual definition between diseased and normal tissue and have been shown to decrease PSM in both animal models and patients. Molecular imaging with fluorescence can also provide enhanced visualization of important structures such as nerves to improve preservation and minimize inadvertent injury. In presentation we will discuss the development of nerve and tumor markers combinations to improve intraoperative visualization – aka color-coded surgery.

About Dr. Nguyen: Dr. Nguyen is a Professor in the Department of Surgery at the University of California San Diego (UCSD). She received her combined MD/PhD degree from Washington University, School of Medicine in St. Louis, MO. She is board certified in both Head and Neck Surgery and Neurotology/Skull Base Surgery and is the fellowship director for the ACGME accredited fellowship in Neurotology/Skull Base Surgery at UCSD. She has subspecialty interest in facial nerve reanimation and supportive procedures for patients with facial paralysis including nerve substitutions, cross facial, platinum eyelid weight placement, lower lid ectropion repair, brow ptosis repair and temporalis tendon transfer. She has been awarded the Presidential Early Career Award for Scientists and Engineers (PECASE, April 2014).



Seeing the Underwater World Through the Eyes of Animals

Sönke Johnsen

Professor in the Department of Biology, Duke University

The appearance of visual scenes and the information that can be extracted from them naturally depends on the characteristics of the sensor. Animal visual systems vary significantly in a number of functional parameters including: spatial and temporal resolution, spectral sensitivity and dimensionality of color space, and the ability to discriminate both linear and circular polarization. Our position as humans is both privileged and limited in that we have very high spatial resolution, but limited spectral range, relatively poor color vision, and no useful polarization sensitivity. Therefore our view, and the view of many of our imaging systems, is not typically representative of what other animals see. Computational power and our knowledge of animal visual systems has now risen to the point where we can model how the world looks to other species, which has opened doors to further investigation in multiple fields, both basic and applied. This talk uses several examples from the marine world to make the general point that how an animal (or a human) sees the world profoundly affects how it can interact with it.

About Dr. Johnsen: Originally trained in mathematics and art, Sönke Johnsen has studied camouflage, signaling, and non-human visual modalities for the last 30 years. He is particularly interested in vision and camouflage in the open ocean, but has also worked on coastal and terrestrial species, magnetoreception, nocturnal illumination, and human cataracts. His research combines mathematical analyses with behavioral and morphological studies and in situ measurements and observations. His field work primarily involves open-ocean research cruises that use SCUBA and deep-sea submersibles. In addition to exploring the evolution and diversity of the optical and visual tricks that animals perform, Professor Johnsen is interested in improving communication between theoretical and experimental scientists, biologists and physicists, and scientists and artists. Outreach is a strong focus, and Johnsen's research has been presented in numerous magazines, newspapers and television shows. Professor Johnsen has also written two books, The Optics of Life and Visual Ecology, and is currently working on a third for a lay audience. In his spare time, he is an avid nature photographer and amateur farmer.

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Accepted Demos

D1) 24k Video from a Mantis Array Camera

D2) Accommodating the Human Eye by Building Virtual Worlds with Dense Focal Stacks

D3) Dynamic Photometric Stereo Method using Multi-tap CMOS Image Sensor

D4) Compressed Color Light Field Camera

D5) KRISM: Krylov subspace-based optical computing of hyperspectral images

D6) Focal Track: Depth and Accommodation with Oscillating Lens Deformation

D7) Dual Structured Light 3D using a 1D Sensor

D8) PhlatCam: Lensless camera with optimized phase mask design

D9) Looking around corners using active computational imaging

Accepted Posters

P1) Confocal Non-Line-of-Sight Imaging with the Light Cone Transform

P2) Statistical Tomography of Microscopic Life

P3) Energy-efficient Imaging Pipelines for Computer Vision

P4) Dynamic Photometric Stereo Method using Multi-tap CMOS Image Sensor

P5) Occluder Aided Computational Periscopy

P6) Fast Integral Image Estimation at 1% measurement rate

P7) Time-resolved Light Transport Decomposition for Thermal Photometric Stereo

P8) Learning Privacy Preserving Encodings through Adversarial Training

P9) Tracking Radioactive Sources through Sensor Fusion of Omnidirectional LIDAR and Isotropic Rad-detectors

P10) Depth and Transient Imaging with Compressive SPAD Array Cameras

P11) Learning Invariant Riemannian Geometric Representations Using Deep Nets

P12) Deep Learning Based Sinogram Correction for Metal Artifact Reduction

P13) Illuminant Spectra-based Source Separation Using Flash Photography

P14) A Perceptual Measure for Deep Single Image Camera Calibration

P15) Non-Uniform Blind Deblurring by Reblurring

P16) Single-photon 3D Imaging with Deep Sensor Fusion

P17) Motion-resolved Quantitative Differential Phase Contrast

P18) Single-exposure 3D microscopy with DiffuserCam

P19) Aperture Supervision for Monocular Depth Estimation

P20) Deep Diffusers - machine learning for lensless imaging

P21) 6-DOF Motion Blur Synthesis and Performance Evaluation of Light Field Deblurring

P22) Compressive epsilon photography for post-capture control in digital imaging

P23) Parameter-free Accelerated Gradient Descent for Phase Retrieval

P24) Evaluation of Lateral Resolution of Light Field Cameras

P25) Submodular Trajectory Optimization for Aerial 3D Scanning

P26) Computed Axial Lithography: how to build the Replicator from Star Trek

P27) Tracking Multiple Objects Outside the Line of Sight using Speckle Imaging

P28) A Deep Learning Framework for Light Field Reconstruction from Minimal Measurements

P29) Deep Surface Light Fields

P30) Image Deblurring for Material Science Applications in Optical Microscopy

P31) Single Image Rolling Shutter Rectification

P32) 4D Human Body Correspondences from Panoramic Depth Maps

P33) Solving Inverse Computational Problems using Deep Pixel-level Prior

P34) Compressive Hyperspectral Microscopy of Nanomaterials

P35) Physics-based time-of-flight renderer

P36) Signal Processing Based Pile-up Compensation for Gated Single-Photon Avalanche Diodes

P37) Interferometric measurement of sensor MTF

P38) Diffuse optical imaging for breast cancer monitoring

P39) EDR: Retinomorphic Event-Driven Representations for Motion Vision

P40) Exposure: A White-Box Photo Post-Processing Framework

P41) Determining Generic Point Configurations From Unlabeled Path or Loop Lengths

P42) Texture Analysis of Spatial Frequency Domain Imaging of Biological Tissue

P43) PPGSecure: Biometric Presentation Attack Detection Using Photoplethysmograms

P44) Computational X-ray Imaging using Document Scanners

Program

	Friday, May 04 - Morning Session
8:15 – 9:00	Registration
9:00 – 9:15	Welcome
9:15 – 10:30	Session 1 — 3 talks (20 minute talk + 5 minute Q&A)
	Towards Photography Through Realistic Fog *Guy Satat, Matthew Tancik, Ramesh Raskar*
	Focal Sweep Imaging with Multi-focal Diffractive Optics *Yifan (Evan) Peng, Xiong Dun, Qilin Sun, Felix Heide, Wolfgang Heidrich*
	Invited talk: Corner Cameras *Katie Bouman*
10:30 – 11:00	Coffee Break
11:00 – 12:00	Keynote 1 - Prof. Kyros Kutulakos, University of Toronto *Rethinking Structured Light*
12:00 – 1:30	Lunch
	Afternoon Session
1:30 – 2:45	Session 2 — 3 talks (20 minute talk + 5 minute Q&A)
	Deep Learning for the Design of Nano-photonic Structures *Itzik Malkiel, Michael Mrejen, Achiya Nagler, Uri Arieli, Lior Wolf, Haim Suchowski*
	Acquiring and Characterizing Plane-to-Ray Indirect Light Transport *Hiroyuki Kubo, Suren Jayasuriya, Takafumi Iwaguchi, Takuya Funatomi, Yasuhiro Mukaigawa, Srinivasa Narasimhan*
	Dynamic Heterodyne Interferometry *Tomohiro Maeda, Achuta Kadambi, Schechner Yoav, Ramesh Raskar*
2:45-3:15	Coffee Break
3:15-4:30	Session 3 -- 3 talks (20 minutes talk + 5 minutes Q&A)
	Fast and Accurate Reconstruction of Compressed Color Light Field *Ofir Nabati, Raja Giryes, David Mendlovic*
	BLADE: Filter Learning for General Purpose Computational Photography *Pascal Getreuer, Ignacio Garcia-Dorado, John Isidoro, Sungjoon Choi, Frank Ong, Peyman Milanfar*
	Invited talk: Deep HDR Image and Video Reconstruction *Nima Khademi Kalantari*
6:30-9:30	Reception at Phipps Conservatory
	Saturday, May 05 - Morning Session
8:30 – 9:00	Registration
9:00 – 10:40	Session 4 — 4 talks (20 minute talk + 5 minute Q&A)
	Invited talk: Looking to Listen at the Cocktail Party *Bill Freeman*
	Invited talk: Light Sensitive Displays *Anat Levin*
	Invited talk: Deep Tissue Imaging with Near-Infrared for Disease Detection and Monitoring *Jana Kainerstorfer*

	Invited Talk: Mobile Bio-behavioral Sensing *Ashutosh Sabharwal*
10:30 - 11:00	Coffee Break
11:00 – 12:00	Keynote 2 - Prof. Quyen Nguyen, UC San Diego *Molecular Navigation for Cancer Diagnosis and Surgery - Imaging Tumors and Nerves*
12:00 - 1:30	Lunch
	Afternoon Session
1:30 - 3:10	Session 5 — 4 talks (20 minute talk + 5 minute Q&A)
	Learning to See through Reflections *Meiguang Jin, Sabine Süsstrunk, Paolo Favaro*
	Learned Perceptual Image Enhancement *Hossein Talebi, Milanfar Peyman*
	ReBlur2Deblur: Deblurring Videos via Self-Supervised Learning *Huaijin Chen, Jinwei Gu, Orazio Gallo, Ming-Yu Liu, Ashok Veeraraghavan, Kautz Jan*
	Automatic Estimation of Modulation Transfer Functions *Matthias Bauer, Valentin Volchkov, Michael Hirsch, Bernhard Schölkopf*
3:10 - 6:30	Poster and Demo Session
6:45 -	Happy Hour at the Porch Restaurant
	Sunday, May 06 - Morning Session
8:30 – 9:00	Registration
9:00 - 10:40	Session 6 — 4 talks (20 minute talk + 5 minute Q&A)
	ADP: Automated Differentiation Ptychography *Sushobhan Ghosh, Youssef Nashed, Oliver Cossairt, Aggelos Katsaggelos*
	SH-ToF: Micro Resolution Time-of-Flight Imaging with Superheterodyne Interferometry *Fengqiang Li, Florian Willomitzer, Prasanna V. Rangarajan, Mohit Gupta, Andreas Velten, Oliver Cossairt*
	Invited Talk: Synthetic Apertures for Long Range Sub-diffraction Imaging *Jason Holloway*
	Invited Talk: Coherence Engineering and Light-Field Imaging *Jason Fleischer*
10:40 – 11:00	Coffee Break
11:00 – 12:00	Keynote 3 -- Prof. Sonke Jonsen, Duke University *Seeing the Underwater World through the Eyes of Animals*
12:00 – 1:30	Lunch
	Afternoon Session
1:30 – 3:10	Session 7 — 4 talks (20 minute talk + 5 minute Q&A)
	Reconfigurable Rainbow PIV for 3D Flow Measurement *Jinhui Xiong, Qiang Fu, Ramzi Idoughi, Wolfgang Heidrich*
	Rolling Shutter Imaging on The Electric Grid *Mark Sheinin, Schechner Yoav, Kyros Kutulakos*
	Towards Transient Imaging at Interactive Rates with Single-photon Detectors *David Lindell, Matthew O'Toole, Gordon Wetzstein*
	Near-Light Photometric Stereo using Circularly Placed Point Light Sources *Chao Liu, Srinivasa Narasimhan, Artur Dubrawski*
3:10 - 3:30	Concluding remarks and awards ceremony