Technology Office Seminar Series 2011–2012

"To promote strong collaboration and inspire new ideas"

6 March, 11:00 AM
Auditorium

Prof. Vivek Goyal

RESEARCH LABORATORY OF ELECTRONICS AT MIT

Compressive Depth Acquisition Cameras (CoDAC): Principles and Demonstrations

Abstract

LIDAR systems and time-of-flight cameras use time elapsed from transmitting a pulse and receiving a reflected response, along with scanning by the illumination source or a 2D sensor array, to acquire depth maps. We introduce a method for compressive acquisition of scene depth with high spatial and range resolution using a single, omnidirectional, time-resolved photodetector and no scanning components. This opens up possibilities for accurate and high-resolution 3D sensing using a compact device.

In contrast to compressive photography, the information of interest – scene depths – is nonlinearly mixed in the measured data. The depth map reconstruction relies on parametric signal modeling of the impulse response of piecewise-planar scenes. We use parametric deconvolution to achieve much finer depth resolution than dictated by the illumination pulse width and detector bandwidth alone. Spatial resolution in our framework is rooted in patterned illumination or patterned reception followed by decoupling the inverse problems of range estimation and spatial resolution recovery during computational processing.

We have demonstrated compressive depth map reconstruction for both near- and medium-range scenes, at low light levels, and with and without the presence of a partially transmissive occluder. Our CoDAC system is robust to ambient light and can adapt its optical output power based on scene content. We have also recently assembled a low-cost CoDAC prototype using commercial off-the-shelf hardware components.

About the Speaker

Vivek Goyal received a B.S. degree in mathematics and a B.S.E. degree in electrical engineering from the University of Iowa, Iowa City, where he received the John Briggs Memorial Award for the top undergraduate across all colleges. He received M.S. and Ph.D. degrees in electrical engineering from the University of California, Berkeley, where he received the Eliahu Jury Award for outstanding achievement in systems, communications, control, or signal processing.

His previous positions include Member of Technical Staff in the Mathematics of Communications Research Department of Bell Laboratories, Lucent Technologies; and Senior Research Engineer for Digital Fountain, Inc., Fremont, CA. His research interests include computational imaging, sampling, quantization, and decision making.

Professor Goyal was awarded the IEEE Signal Processing Society Magazine Award and an NSF CAREER Award. He served on the IEEE Signal Processing Society's Image and Multiple Dimensional Signal Processing Technical Committee, is a permanent Co-chair of the SPIE Wavelets and Sparsity conference series, and is a TPC Co-chair of the IEEE International Conference on Image Processing 2016. He is a co-author of a forthcoming textbook available for download at FourierAndWavelets.org, and he will present tutorials on teaching signal processing at IEEE ICASSP 2012 and IEEE ICIP 2012.

23 September

Prof. Christopher Carr

MIT Department of Earth, Atmospheric and Planetary Sciences

17 October

Prof. Julie Shah

MIT Department of Aeronautics and Astronautics

29 November

Prof. Tomás Palacios

MIT Department of Electrical Engineering and Computer Science

10 January

Prof. Michael Watts

MIT RLE

16 February

Prof. Ernest Fraenkel

MIT Department of Biological Engineering

26 April

Prof. Sangbae Kim

MIT Department of Mechanical Engineering

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