ECE Seminar

2019 ECE SPEAKER SERIES

Qi Guo

PhD Student
School of Engineering and Applied Sciences
Harvard University

Tues. Dec. 3, 2019 @ 12:10 PM
8 St. Mary's Street, PHO 339
Faculty Host: Vivek Goyal
Light refreshments will be available outside of 339 at 12:00 PM

Bio-inspired Depth Sensing Using Computational Optics

Abstract: Jumping spiders rely on accurate depth perception for predation and navigation. They accomplish depth perception, despite their tiny brains, by using specialized optics. Each principal eye includes a multitiered retina that simultaneously receives multiple images with different amounts of defocus, and distance is decoded from these images with seemingly little computation. In this talk, I will introduce two depth sensors that are inspired by jumping spiders. They use computational optics and build upon previous depth-from-defocus algorithms in computer vision. Both sensors operate without active illumination, and they are both monocular and computationally efficient.

The first sensor synchronizes an oscillating deformable lens with a photosensor. It produces depth and confidence maps at more than 100 frames per second and has the advantage of being able to extend its working range through optical accommodation. The second sensor uses a custom-designed metalens, which is an ultra-thin device with 2D nano-structures that modulate traversing light. The metalens splits incoming light and simultaneously forms two differently-defocused images on a planar photosensor, allowing the efficient computation of depth and confidence from a single snapshot in time.

Bio: Qi Guo is a PhD student at Harvard University advised by Todd Zickler. He combines optics and computer vision algorithms to create computational sensors. He received his bachelors degree in automation from Tsinghua and has interned at Facebook, Nvidia, and Baidu. He received the Best Student Paper as a co-author at ECCV 2016 and the Best Demo Award at ICCP 2018.