Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Next generation localization microscopy - or - how and why to ruin a perfectly good microscope. "

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Assistant Professor Yoav Shechtman leads the Nano-Bio-Optics lab at the Technion, Israel Institute of Technology. Yoav Finished all degrees at the Technion: BSc in Physics and Electrical Engineering (2007), Phd (2013), and then spent three years as a postdoc at Stanford University (2016), developing super-resolution microscopy methods with W.E. Moerner. His research interests lie mainly in developing and applying optical and signal processing methods for nanoscale imaging challenges. Specifically, Yoav focuses on aspects of single/multiple particle localization and tracking under challenging conditions, e.g. three-dimensional, multicolor, and high throughput imaging, using advanced optical, signal processing and machine learning techniques. The techniques developed in the lab are applied to challenges ranging from basic science, i.e. observing chromatin dynamics in 3D, to biomedical applications, i.e. developing ultra-sensitive assays for bacterial growth. Recent awards and recognitions: 2017 Zuckerman Faculty Scholar, 2018 Early Career Award of the International Association for Medical and Biological Engineering (IAMBE), 2018 European Research Council starting grant, 2019 Uzi and Michal Halevy Award for Innovative Applied Engineering, 2020 International Union for Pure and Applied Biophysics (IUPAB) Young Investigator Prize and Medal, 2020 Morton and Beverley Rechler Prize for Excellence in Research.

ABSTRACT

In localization microscopy, the positions of individual nanoscale point emitters (e.g. fluorescent molecules) are determined at high precision from their point-spread functions (PSFs). This enables highly precise single/multiple-particle-tracking, as well as super-resolution microscopy, namely single molecule localization microscopy (SMLM). To obtain 3D localization, we employ PSF engineering – namely, we physically modify the standard PSF of the microscope, to encode the depth position of the emitter. In this talk I will describe how this method enables unprecedented capabilities in localization microscopy; specific applications include dense emitter fitting for super-resolution microscopy, multicolor imaging from grayscale data, volumetric multi-particle tracking/imaging, dynamic surface profiling, and high-throughput in-flow colocalization in live cells. We often combine the optical encoding method with neural nets (deep-learning) for decoding, i.e. image reconstruction; however, our use of neural nets is not limited to image processing - we use nets to design the optimal optical acquisition system in a task-specific manner.

Friday, February 19th
12:00 Noon

Seminar will be presented virtually via Zoom:
https://go.unc.edu/j5W3E