3D COMPUTATIONAL MICROSCOPY OF DYNAMIC SAMPLES

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Key Words: Computational, imaging, 3D, coded aperture.

This talk will describe computational imaging methods for fast capture and reconstruction of 3D and 4D images in a commercial microscope. Our experimental setups employ inexpensive illumination-side and detection-side coding of angle (Fourier) space with simple hardware. The result is high-resolution intensity and phase images that span a large field-of-view, breaking the diffraction limit of the objective lens used and achieving high space-bandwidth-time product. We demonstrate real-time Gigapixel microscopy for in vitro biological cells and extend our methods to 3D imaging and algorithmic self-calibration. Through an end-to-end design of both the optical system and the computational algorithms, we achieve real-time 3D and phase recovery with digital aberration correction and mitigation of multiple scattering effects