THE UNIVERSITY OF CHICAGO

COMPUTATIONAL AND APPLIED MATHEMATICS
Inverse Problems & Imaging Seminar

PATRICK LA RIVIERE
Department of Radiology
The University of Chicago

Computational Phase Diversity Methods in Adaptive Optics for Microscopy

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Jones 226, 5747 South Ellis Avenue

ABSTRACT

Adaptive optics, pioneered in astronomy to correct for aberrations in the atmosphere, is currently an active area of research in microscopy. One common approach in astronomy uses a laser to create artificial "guide stars" in the sky. Wavefront sensors then measure the distorted wavefront reaching the ground from these point sources and the information can be used to reshape deformable mirrors in order to correct the distortion in other structures in the field of view. A similar approach is possible in microscopy but requires the use of bulky and expensive femtosecond lasers to create virtual point sources in tissue. We are exploring the use of a purely computational technique called phase diversity that seeks to estimate the tissue-distorted wavefront by acquiring two or more images in which additional known distortions are purposely added to the imaging system. These couple with the unknown distortions and give rise to a phase-retrieval type of inverse problem. I will present an overview of the problem and some preliminary results and observations we have made together with our collaborators at NIH.

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