COMPUTATIONAL IMAGING FOR DIC MICROSCOPY: CURRENT USE IN LIVE-CELL IMAGING

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The increasing availability of computing power and storage has driven the desire for quantitative imaging in microscopy. Computational optical-sectioning microscopy (COSM) has become a viable alternative to confocal microscopy for three-dimensional fluorescence imaging. The success of COSM has lead to the development of model-based computational methods for DIC microscopy. Through our ongoing research in computational imaging for DIC we have shown that it is possible to overcome the main limitations of traditional DIC microscopy: direction sensitivity and nonlinear imaging [1-4]. Our computational imaging methods use the information in two DIC images of the same field of view acquired with orthogonal shear directions to extract fundamental specimen properties such as phase and amplitude.

Processing DIC data with our methods yields linear phase images as well as absorption images of the same field of view. These resultant images convey similar type of information as Zernike phase contrast and bright field microscopy images through a single microscopy mode. Methods based on a diffraction-limited imaging model [1, 4] account for the blurring effects due to the point-spread function of the objective lens yielding quantitative images with better clarity.

In this presentation, we will show results obtained with our computational methods from DIC images of yeast cells and bovine endothelial cultured cells. The utility of our methods, with respect to live-cell imaging, as well as computational DIC methods developed by other research groups will be discussed.

References

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