Public Abstract

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Department:Biological Engineering

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Title:True depth-resolved polarization sensitive optical coherence tomography

Tissues with organized structures show unique optical polarization properties. For example, muscle fibers and nerve fibers show strong optical birefringence which could be used as a fingerprint for diagnosis of many structure-altering diseases. Optical coherence tomography (OCT) is a non-invasive, high-resolution optical imaging modality and has been previously applied to measure depth-resolved sample polarization properties. However, conventional OCT systems cannot image the local optical properties inside the sample because polarization properties of the backscattered light can be altered by all tissue layers above the detection depth. In this project, we developed novel polarization-sensitive OCT systems and image processing algorithms to obtain the true depth-resolved local polarization properties. A theoretical framework was constructed to extract local polarization properties from cumulative measurements. Extensive experimental studies were conducted to validate the algorithms. As an application of the measured local optical axis, we successfully visualized fibers bundles in cardiac muscle samples. This new methodology could find a variety of applications in disease diagnosis and material characterization.