OCT
STATE OF THE ART AND ITS FUTURE DEVELOPMENT

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Optical coherence tomography can perform micron-scale, cross-sectional imaging of microstructure in tissues *in situ* and in real time. Cross-sectional images are generated by scanning an optical beam across the tissue and measuring the echo time delay and intensity of backreflected light from internal tissue microstructures. The resulting two-dimensional data array represents the optical backreflection within a cross-sectional slice of the tissue. OCT is based on an interferometric technique with light sources emitting temporal partially coherent electromagnetic radiation, known as white light interferometry. Classic OCT systems use a mechanically scanned reference arm delay.[1] In these OCT systems imaging speeds are limited to several hundreds of lines per second. Recently, there have been important advances in OCT technology which enable dramatic increases in imaging speed over standard time domain OCT systems. These new techniques are known as "Fourier domain" OCT because time delays of light echoes are measured using the interference spectrum of light reflected back from the tissue.[2] OCT with Fourier domain detection can be performed in two ways: Spectral OCT using a spectrometer with a multichannel analyzer or swept source OCT using a rapidly tunable laser source. The first demonstration of biomedical imaging using OCT with spectral detection was reported in 2002.[3] The Spectral OCT system uses a spectrometer and high speed, high dynamic range CCD camera. Because Spectral OCT does not require moving parts, data acquisition speeds can be extremely rapid. Furthermore, since all of the reflected light is measured at once rather than light which returns from a given depth, this is a dramatic increase in detection speed and sensitivity up to 100times higher than in classic OCT instruments.

There are many possibilities offered by OCT with Fourier domain detection, which are still unexplored and which can be applied either to biomedical imaging or to metrological applications. Further modifications of the Fourier domain OCT techniques can enable measuring additional physical parameters like: spatial (in-depth and transverse) distribution of the absorption/scattering coefficient, or flow velocities. These measurements can be performed in weakly scattering media with high speeds up to 200kHz of line rate, with more than 100dB sensitivity and with micron-scale resolution.

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