MICROSCOPIC OPTICAL COHERENCE HOLOGRAPHY

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MOTIVATION: Optical Coherence Tomography (OCT) is a non-invasive and label-free imaging method, which is widely applied in medical imaging. It is a low-coherence interferometric technique which typically uses infrared light for a deep penetration depth into biological tissue. The desired *depth of field* however directly limits the *lateral resolution* when working with focussed Gaussian beams, as they are inversely related. In order to use a higher numerical aperture for detection in OCT, this dilemma has to be overcome.

METHODS & RESULTS: One solution is to use Bessel beams instead of Gaussian beams, which are scanned across the sample. A solution for engineering a multicolour Bessel beam was implemented with a phase-only spatial light modulator in the image plane and an iterative Fourier transform algorithm [1].

For higher acquisition speed, full-field recording is favourable to scanning the scattering sample with a Bessel beam. OCT can be combined with reconstruction methods from digital holography to achieve an extended focus numerically [2]. Full-field holograms are recorded at many wavelengths with a tunable laser and a very fast sCMOS camera, thus eliminating the need for scanning. An off-axis-configuration allows for separation of autocorrelation and crosscorrelation terms in the recorded interference images.

Different approaches are considered to reconstruct three-dimensional image data from the acquired holograms and to fill in missing low spatial frequencies [3,4]. A custom propagator-based approach and an iterative forward-/backward model approach are presented. The experimental setup, underlying theoretical concepts, reconstruction results and current obstacles will be shown.

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