Abstract: Spatiotemporal Illumination Model for 3D Image Fusion in Optical Coherence Tomography

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Optical coherence tomography (OCT) is a non-invasive, micrometer-scale imaging modality that has become a clinical standard in ophthalmology. By raster-scanning the retina, sequential cross-sectional image slices are acquired to generate volumetric data. In-vivo imaging suffers from discontinuities between slices that show up as motion and illumination artifacts. We present a new illumination model that exploits continuity in orthogonally raster-scanned volume data [1]. Our novel spatiotemporal parametrization adheres to illumination continuity both temporally, along the imaged slices, as well as spatially, in the transverse directions. Yet, our formulation does not make inter-slice assumptions, which could have discontinuities. This is the first optimization of a 3D inverse model in an image reconstruction context in OCT. Evaluation in 68 volumes from eyes with pathology showed reduction of illumination artifacts in 88% of the data, and only 6% showed moderate residual illumination artifacts. The method enables the use of forward-warped motion corrected data [2], which is more accurate, and enables supersampling and advanced 3D image reconstruction in OCT [3, 4].

References

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