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An In-painting Method For Combining Multiple SD-OCT Scans With Applications To Z-motion Recovery, Noise Reduction and Longitudinal Studies.

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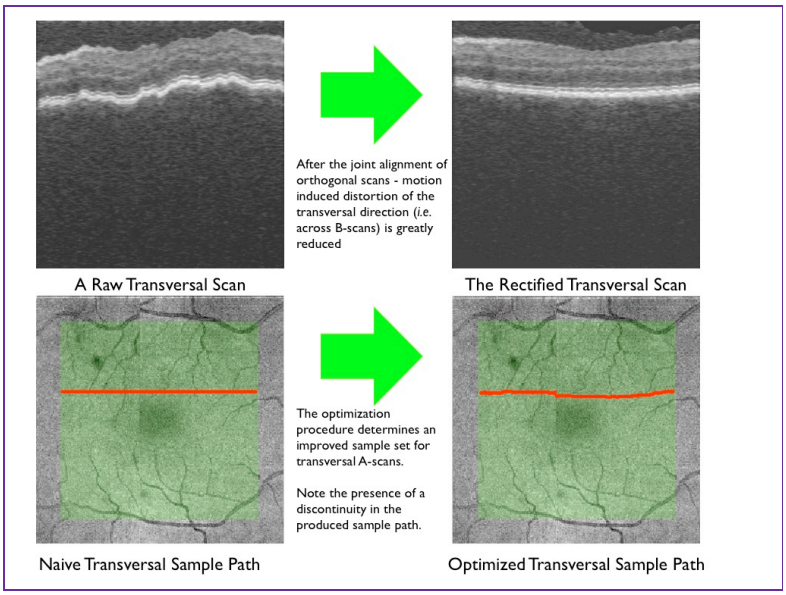
Abstract: **Purpose:**
Eye motion during scan aquisition of SD-OCT volumes produces motion artifacts, and missing or poorly sampled regions, that ultimately hinder diagnosis and interfere with registration of multiple scans in longitudinal studies. We propose a method of combining multiple scans to produce a single rectified volume. The method can also be used to recover z-motion and remove in scans, as well as produce residual images and volumes for use in longitudinal analysis of disease progression.
Methods:
Single 3D SD-OCT (Cirrus HD-OCT; Carl Zeiss Meditec, Inc., Dublin, CA) scans and orthogonal raster 3D SD-OCT (Bioptigen SDOCT; Bioptigen, Inc., Research Triangle Park, NC) scan pairs were included in the study. Both scan types were used in computing the distributions over scleral and non-scleral shape. Given two scans, with orthogonal raster acquisition patterns, an optimization method motived by texture in-painting was used to select and stitch together a locally optimal collection of b-scan patches into a 3D volume. In the process, the relative z-motion of the eye in each scan is recovered. Figure 1 shows a transversal raster scan before and after rectification, the A-scan samples sites are linear in the left and automatically determined on the right.
Results:
Statistical shape models (based on PCA) were estimated of both scleral shape, over samples of annotated B-scans, and non-scleral shape over annotated transversal scans, derived from 3D-OCT scans of healthy subjects. The assessment measured the scleral shape along transversal images (across B-scans), see figure. In the perfect overlap area (figure, green box, a 63% area in scan pairs) 94.1% of the corrected transversal scans were more likely to have been sampled from the scleral shape distribution than the non-scleral shape distribution (at 98% confidence). 1.63 A-scans were used to estimate A-scan intensities in the combined volume, reducing visual noise.
Conclusions:
This automatic method produces a single combined scan with low residual z-motion and improved noise characteristics.



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