Distortion-free, Free-hand OCT Imaging

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Technology description

Invention novelty: The current invention is a hand-held OCT system that is able to provide distortion free images in real time from free-hand manual scanning.
The system consists of a handheld OCT probe, as well as high speed software for image reconstruction and scanning speed correction. In conventional OCT systems, a mechanical scanner steers the OCT probe beam to perform lateral scans. When surgeons manually scan the OCT probe integrated with a surgical tool across the target, the time-varying A-scans can be acquired sequentially and can be used to form pseudo B-scan images. Due to the non-constant scanning velocity of the surgeon's hand, the pseudo B-scan results in a non-uniform spatial sampling rate in lateral dimension, introduction image artifacts. The current invention solves this problem .
Technical Details:
Johns Hopkins researchers have developed a hand-held OCT system that eliminates the use of a mechanical scanner. Image distortion induced by non-constant scanning velocity in free hand scanning is corrected by extracting displacement between adjacent A-scans with the cross correlation coefficient (XCC) between adjacent A-scans, in real time. Methods for this, including position tracking and speckle decorrelation, have recently been adopted by the OCT community. Compared to a position tracking system, the speckle decorrelation technique may achieve better accuracy because the dimension of OCT speckles are in the order of micrometers; a well calibrated position tracking system can only achieve sub-millimeter resolution, which is insufficient for high-resolution OCT with a micrometer-resolution. A series of experimental calibrations show that lateral displacement between adjacent A-scans can be extracted quantitatively based on XCC. With the displacement extracted, we were able to correct the artifact induced by the nonconstant scanning velocity.
Data Availability: Under CDA/NDA
Publication(s)/Associated Cases: Distortion-free freehand-scanning OCT implemented with real-time scanning speed variance correction. Optics Express 2012.
Categories: Software
Keywords: OCT, image artifact, freehand, speckle decorrelation,

Advantages

- Eliminates artifacts and distortion by smartly processing images to determine spacing between them
- The algorithm can be parallelized using GPGPU processing and therefore implemented in real-time

- Free-hand operation is convenient and offers applications not previously available

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