A deep learning-based segmentation method of anterior segment in SS-OCT

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PURPOSE

- Anterior segment (AS) OCT (optical coherence tomography) is considered a crucial imaging technique to examine the AS of the eye.
- We propose a segmentation method based on a novel deep learning (DL) architecture for the swept source (SS) OCT volumes.
- The segmentation of AS images is required for quantifying these images using different techniques such as beam geometry correction as well as AS-OCT Angiography (AS-OCTA).

METHODS

- A prototype algorithm based on computer vision techniques was developed to segment the anterior and posterior corneal and iris surfaces of iridocorneal scans.
- We used the prototype algorithm to generate the ground truth images for training.
- The images generated by segmentation errors were excluded from the training set by manual grading (Fig 1).
- A total of 14,309 images from 53 volumes (11 subjects) with PLEX® Elite 9000 (ZEISS, Dublin, CA) with 6x6x6 mm cube scans (3072 pixels x 500 A-lines x 500 B-scans) were used to train a model (Bagherinia et al., *IOVS* June 2022, Vol.63, 2060).
- Data augmentations, including geometrical and photometric, were applied to increase the training set to 143,090.

A novel deep learning solution for AS iridocorneal segmentation in SS-OCT

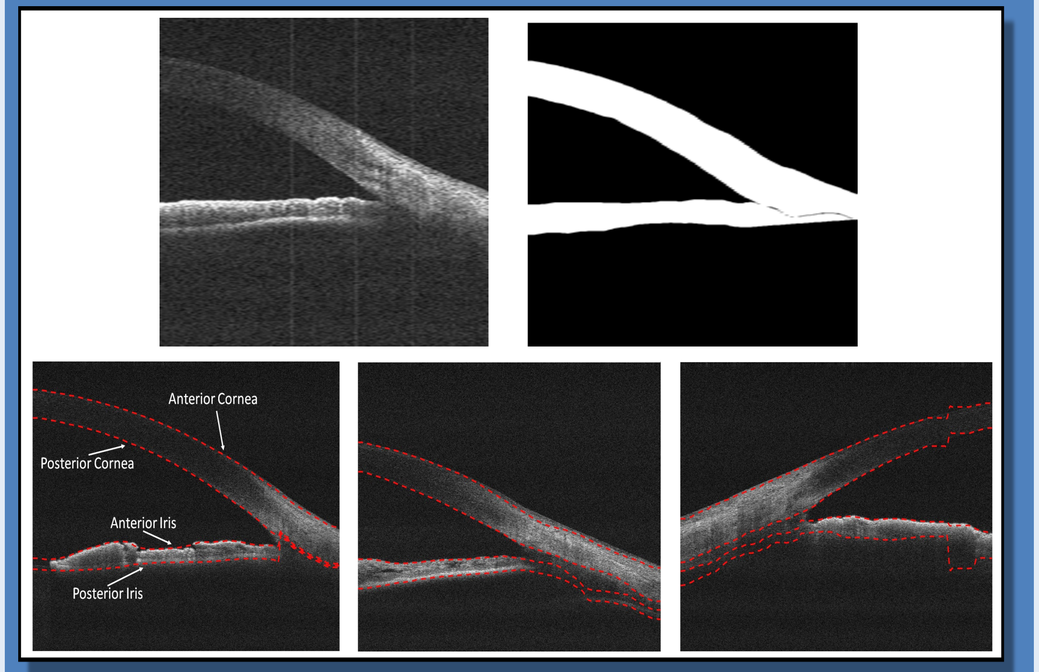

Figure 1. Example of a training image and corresponding segmentation as the ground truth generated by a prototype algorithm (top). Examples of OCT images for three grading categories (bottom) {from left to right: 3 Acceptable, 2 Partially Acceptable, 1 Fail}.

Surface	Success Rate (%)
Anterior Cornea	97
Posterior Cornea	92
Anterior Iris	99
Posterior Iris	89

Table 1. Success rate (acceptable = 3) for each segmented surface

- The performance of the algorithm was evaluated using 579 images randomly selected across the 6x6x6 mm cube data from 29 scans (6 subjects) and reported by human manual grading.
- The segmentation was reviewed by human graders who rated the level of segmentation quality as being (3) acceptable, (2) partially acceptable, and (1) failed. The success rate of each segmented surface was reported.

RESULTS

- Figure 1 shows examples of 6 mm x 6 mm OCT B-scan images, the corresponding ground truth, and examples of segmentation results overlaid with OCT images for three grading categories.
- Table 1 shows a table of the success rate (acceptable = 3) for each segmented surface.
- The success rate of the anterior iris segmentation is high at 99% due to the sharp contrast at this surface.
- The success rate for all surfaces in the same image is 86% for grade 3, and 94% for grades to be at least 2.

CONCLUSIONS

- We prototyped a deep learning solution for AS iridocorneal segmentation using a limited number of subjects.
- The preliminary performance of the algorithm shows that anterior segment segmentation is valuable for generating more accurate AS-OCTA vasculature maps and be used for beam geometry correction.

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Disclosures: RK (C), HB (E), ZN (E) : Carl Zeiss Meditec, Inc.