Quantitative Assessment of Retinal Layer Distortions and Subretinal Fluid in SD-OCT Images

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A modern tool for age-related macular degeneration (AMD) investigation is Optical Coherence Tomograph (OCT) that can produce high resolution cross-sectional images about retinal layers. AMD is one of the most frequent reasons of blindness in economically advanced countries. AMD means the degeneration of macula which is responsible for central vision. Since AMD affects only this area of the retina, unattended patients lose their fine shape-, and face recognition, reading ability and central vision [1].

The constant growing of AMD patient population is more and more challenging. Consequently, there is a need for more precise measurements and search for new OCT features for earlier and more efficient treatment. Quantitative assessment of retinal features in course of AMD is not yet fully explored. Existing OCT systems are partially suited to monitoring the progress of the disease. There are some typical symptoms of AMD that can be sensitive retreatment criteria. Digital image processing can help the quantitative assessment of the OCT features of AMD by providing automatic tools to detect abnormalities and to describe, by objective metrics, the current state and longitudinal changes during disease evolution and treatment.

In this paper, we deal with automatic localization of subretinal fluid areas and also analyze retinal layers, since layer information can help localizing fluid regions. Image quality is improved by a noise filtering and contrast enhancement method using fuzzy operator [2]. This operator can highlight major retinal layers so we analyzed vertical profiles of the filtered image and high intensity steps in pixel density are assumed to correspond to change of tissues. We present an algorithm that automatically delineates seven retinal layers, successfully localizes subretinal fluid regions, and computes their extent and volume. We show our result using a set of SD-OCT images. The quantitative information can also be visualized in anatomical context for visual assessment. Our results were verified by ophthalmologists and they found the segmentation, quantification and also the visualization technique useful.

Acknowledgements

This research was supported by the European Union and the State of Hungary, co-financed by the European Social Fund in the framework of TÁMOP-4.2.2.D-15/1/KONV-2015-0024 'National Excellence Program'. The authors are grateful to Dr. Rózsa Dégi and Dr. Attila Kovács for providing the OCT data sets and their medical expertise. The authors also thank Dr. József Dombi for suggesting the use of fuzzy operators for image preprocessing.

References

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