Abstract: Segmentation of Retinal Low-Cost Optical Coherence Tomography Images Using Deep Learning

Timo Kepp[1], Helge Sudkamp[2], Claus von der Burchard[3], Hendrik Schenke[3], Peter Koch[2], Gereon Hüttmann[2,4], Johann Roider[2], Mattias P. Heinrich[1], Heinz Handels[1]

[1]Institut für Medizinische Informatik, Universität zu Lübeck
[2]Medizinisches Laserzentrum Lübeck GmbH
[3]Klinik für Ophthalmologie, Universität zu Kiel
[4]Institut für Biomedizinische Optik, Universität zu Lübeck
kepp@imi.uni-luebeck.de

The treatment of age-related macular degeneration (AMD) requires continuous eye examinations using optical coherence tomography (OCT). The need for treatment is indicated by the presence or change of disease-specific OCT-based biomarkers. Therapeutic response and recurrence patterns of patients, however, vary widely between individuals and represent a major challenge for physicians. Therefore, the monitoring frequency plays an important role in the success of AMD therapy. While a higher monitoring frequency would have a positive effect on the success of the treatment, it can only be achieved with a home monitoring solution in practice. One of the most important requirements of an OCT system for home monitoring is computer-aided quantification of pathological changes using specific OCT-based biomarkers. In this work, retinal scans of a novel self-examination low-cost full-field OCT (SELF-OCT) system are segmented for the first time using a deep learning approach [1]. A convolutional neural network (CNN) is used to segment the entire retina as well as pigment epithelial detachments (PED) as biomarkers. Due to the special acquisition technique of the SELF-OCT system, densely sampled volumes are generated, making a 3D CNN architecture a natural choice for OCT segmentation. In contrast to current state of the art methods, the 3D CNN receives a complete OCT volume as input instead of individual 2D-B scans. It is shown that our approach can segment the retina with high accuracy, while segmenting the PED remains difficult because of the low contrast of these structures in the OCT images. In addition, it is shown that the use of a convolutional denoising autoencoder as refinement step corrects segmentation errors caused by artifacts in the OCT image.

References

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