Glaucoma

SYNTHETIC IMAGE GENERATION OF CIRCUMPAPILLARY OPTICAL COHERENCE TOMOGRAPHY IMAGES FOR DEEP-LEARNING BASED GLAUCOMA DETECTION

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Deep learning (DL) requires large data sets for training, which is challenging to collect. Inn the present work we used generative models create large numbers of synthetic optical coherence tomography (OCT) images to train such DL networks for glaucoma detection. The aim of this work was to assess whether generative models can synthesize circumpapillary optic nerve head OCT images of normal and glaucomatous eyes and determine the usability of synthetic images for training DL models for glaucoma detection. Image gradeability and authenticity of sysnthetic images were evaluated on a clinical set of 100 real and 100 synthetic images by 2 clinical experts. DL networks for glaucoma detection were trained with real or synthetic images and evaluated on independent internal and external test data sets. Glaucoma detection performance of the DL networks was assessed using area under the curve (AUC) analysis. A total of 990 normal and 862 glaucomatous eyes were analyzed. Evaluations of the clinical set were similar for gradeability (expert 1: 92.0%; expert 2: 93.0%) and authenticity (expert 1: 51.8%; expert 2: 51.3%). The best-performing DL network trained on synthetic images had AUC scores of 0.97 (95% CI, 0.95-0.99) on the internal test data set and 0.90 (95% CI, 0.87-0.93) on the external test data set, compared with AUCs of 0.96 (95% CI, 0.94-0.99) on the internal test data set and 0.84 (95% CI, 0.80-0.87) on the external test data set for the network trained with real images. An increase in the AUC for the synthetic DL network was observed with the use of larger synthetic data set sizes. In conclusion DL networks trained with synthetic OCT images for glaucoma detection were comparable with networks trained with real images. These results suggest potential use of generative models in the training of DL networks and as a means of data sharing across institutions without patient information confidentiality issues.