Modern retinal image analysis – a rich resource for screening and diagnosis

Prof. Bart ter Haar Romeny
Eindhoven University of Technology NL and Northeastern University Shenyang CN

Diabetes is exploding in China, affecting today over 12% of the population. In many cases it is undetected. Early treatment may halt the disease, so an early warning system by screening may prevent high societal costs. With diabetes, blood vessels start to leak. These and other changes can be seen easily in high-resolution in-vivo images of the retina fundus, which are cheap and easy to acquire.

RetinaCheck (2014-2019) was a screening program for the early detection of diabetic retinopathy projected for 24 million people in Liaoning. Partners are Northeastern University Shenyang (NEU), Eindhoven University of Technology (TU/e), He Eye Care Group in Shenyang and the camera manufacturing company i-Optics in the Netherlands.

Many image processing methods have been developed by NEU and TU/e for automated and quantitative computer-aided diagnosis of the retinal mages. Innovative 'brain-inspired' image analysis algorithms are developed in the consortium, i.e. based on models of human visual perception.

A validation study has been set up within the large Shengjing Hospital Diabetes department in Shenyang, correlating and validating the many image features to the many patient's diabetic metadata, to validate the classification and prediction power of the algorithms. In the Netherlands we collaborated with the "Maastricht Study", the world's largest phenotyping cohort study to diabetes, including 5000 normal and 5000 diabetes patients.

Deep neural residual networks turned out to be highly efficient in classification, and supported our earlier findings on the sensitivity for especially the minute changes of the retinal vasculature. 55 scientific papers were published from this study.