

## **Computer-aided Detection, Modeling, and Analysis of Retinal Vascular Architecture for the Diagnosis of Retinopathy**

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The structure of the blood vessels in the retina is affected by diabetes, hypertension, arteriosclerosis, retinopathy of prematurity, and other conditions through modifications in shape, width, and tortuosity. Quantitative analysis of the architecture of the vasculature of the retina could assist in monitoring the evolution and stage of pathological processes, their effects on the visual system, and the response to treatment. Computer-aided detection, modeling, and quantitative analysis of features related to the retinal vascular architecture could assist in consistent, quantitative, and accurate assessment of pathological processes by ophthalmologists. This seminar provides details on digital image processing and pattern recognition techniques for the detection of retinal blood vessels and modeling for quantitative analysis of the temporal arcades. The techniques include Gabor filters, morphological image processing methods, and the Hough transform. A graphical user interface has been developed to facilitate clinical application of the methods. Evaluation of the methods with a dataset of retinal fundus images of 11 normal individuals and 11 patients with proliferative diabetic retinopathy resulted in area under the receiver operating characteristic curve of up to 0.87. Work is in progress on the application of the methods to the diagnosis of retinopathy of prematurity.