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Retinal vascular geometry: Challenges and applications

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The retinal vasculature geometry offers a unique and easily accessible "window" to study the early structural changes caused by the influence of systemic, environmental and genetic factors on the human microcirculation due to non-invasive visualization using specialized fundus cameras, and hence subjected to image analysis. These geometry changes reflect cumulative response to aging, cardiovascular risk factors, inflammation, nitric oxide-dependent endothelial dysfunction, and other processes.

However, the range of factors influencing variation in retinal vascular geometry has not been fully investigated. In fact, a number of preliminary studies have shown interesting correlations between vascular measurements changes and diseases predictions and associations. Consequently, efficient and accurate measurement of the various retinal vessels geometry features may allow early diagnosis (and therefore prompt management) of such conditions and thus impact on national priorities for disease screening and prevention. However, progress is limited by two factors: the time-consuming nature of manual or semi-manual measurements; and the limited accuracy of their measurements.

Therefore, further work is clearly needed to validate the estimates of vessel diameter measurements and to determine whether the developed techniques are more accurate and have a better predictive value on outcomes compared to older techniques. There is a strong need to develop automated techniques for measuring the RVG features to be able to establish their uniformly standard normal measurements for implementing these techniques in clinical practices. In addition, these predictive features should be dimensionless measurements to be used for comparing between measurements from different images of the same individual and between measurements of individuals in the clinical settings.

Biography

Bashir Al-Diri has completed his Ph.D. from the Lincoln School of Computer Science at the University of Lincoln. His main research is concerned with the development of computer vision algorithms to analyse retinal blood vessels for characterization of retinopathy. He developed a set of robust fully automated techniques for retinal vascular segmentation and measurement, which provides a unique combination of good segmentation and superior measurement performance. It is thus uniquely well-suited to act as a base for research into the diagnosis of vascular diseases that cause measurable changes to the geometry of retinal vessels.

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