Towards Development of A Computerised System for Screening and Monitoring of Diabetic Retinopathy

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Abstract—One of the complications of diabetes can lead to vision problems when it occurs in the retina which is known as diabetic retinopathy (DR). In practice, to diagnose and monitor DR severity, ophthalmologists observe the presence of several pathologies in colour retinal fundus images. However, this approach is tedious and time consuming, especially in the case of screening for early detection. Several techniques have been developed to achieve the final goal that is an automated DR screening system. This paper presents three kinds of approach towards the development of a computerised DR screening and monitoring system. The first approach is pathology-based methods. This approach detects and analyses several pathologies such as microaneurysms, haemorrhages, exudates and changes of retinal vessels. This approach achieves the performance results of more than 90% of accuracy, sensitivity and specificity for detection of the pathologies. The second approach is retinal structure-based methods. This approach detects optic disc, macula and foveal avascular zone (FAZ). The FAZ determination successfully achieves the accuracy of around 97%. DR severity has been proven to have strong correlation up to 0.912 with the enlargement of FAZ. The third approach is deep learning-based methods. This approach has achieved promising results with accuracy of more than 95% in screening and grading the severity of the DR. The third approach offers several advantages compared to the two previous ones in which this approach does not need to specifically detect the presence of pathologies nor the retinal structure to determine DR grade. However, this approach needs huge dataset to learn. The next development is to implement the deep learning based method into a low-cost embedded system.

Keywords—*Diabetic retinopathy, screening, fundus image, DR pathologies, foveal avascular zone, deep learning*

978-1-5386-0549-3/17/$31.00 ©2017 IEEE