An Approach to Detecting Diabetic Retinopathy Based on Integrated Shallow Convolutional Neural Networks

Abstract

The early detection of Diabetic Retinopathy (DR) is critical for diabetics to lower the blindness risks. Many studies represent that Deep Convolutional Neural Network (CNN) based approaches are effective to enable automatic DR detection through classifying retinal images of patients. Such approaches usually depend on a very large dataset composed of retinal images with predefined classification labels to support their CNN training. However, in some occasions, it is not so easy to get enough well-labelled images to act as model training samples. At the same time, when a CNN becomes deeper, its training will not only take much longer time, but also be more likely to lead to overfitting, especially on a large training dataset. Therefore, it is meaningful to explore a simpler CNN based approach that is still effective on small datasets to classify retinal images. In this paper, an approach to retinal image classification is proposed based on the integration of multi-scale shallow CNNs. Experiments on public datasets show that, on small datasets, the proposed approach can improve the classification accuracy by 3% compared with current representative integrated CNN learning approaches. On the bigger dataset, the proposed approach can improve the classification accuracy by 3% to 9% compared with other representative approaches such as traditional CNN, LCNN and VGG16noFC. The evaluation also represents that, though the classification accuracy of the proposed approach declines by 6% on the smallest dataset containing only 10% samples of the original dataset, its time cost declines to about 30% of that on the original dataset.

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