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Diabetic Retinopathy Grading Using ResNet Convolutional Neural Network (Conference Paper)

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Abstract

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Designing and developing automated systems to detect and grade Diabetic Retinopathy (DR) is one of the recent research areas in the world of medical image applications since it is considered one of the main causes of total blindness for people who have diabetes in the mid-age. In this paper, a complete pipeline for retinal fundus images processing and analysis has been described, implemented and evaluated. This pipeline has three main stages: (i) image pre-processing, (ii) features extraction and (iii) classification. In the first stage, the image has been pre-processed using different transformations to standardize the images and to enhance the images quality. It has been proven that Gaussian filtering is quite effective in this context to enhance the images contrast. In the second and third stage, the convolution neural network (CNN), one of the best neural network architecture for image analysis applications, has been used. The concept of transfer learning and fine tuning have been advocated in this paper and applied for ResNet18 using the publicly available Kaggle dataset. The problem of DR diagnosis has been handled as a multi-class classification problem where there are five levels of the disease severity (0 - No DR, 1 - Mild, 2 - Moderate, 3 - Severe, 4 - Proliferative DR). The final model has achieved accuracy of 70 %, recall of 50% and specificity of 88% outperforming other models built from scratch with less training time and proving the efficiency of transfer learning in this context. The training process has considered the problem of imbalanced dataset using two different ways and it has been discovered that using imbalanced dataset sampler is a very efficient solution. The final model developed in this research could be used as the main unit for a computer aided system to be hosted online for DR detection and diagnosis. © 2020 IEEE.

SciVal Topic Prominence ⓘ

Topic: Retina Image | Microaneurysm | Diabetic Retinopathy

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