Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy

Introduction

Diabetes has an eye-related consequence called diabetic retinopathy (DB). It typically results from blood vessel injury in the retinal tissue (back layer of the eye). Early signs of colour blindness can include blurriness, floaters, black or empty patches in the field of vision, and challenges with perception. It necessitates continuous observation, and if complications arise, life expectancy may be shortened. If left untreated and without a diagnosis, it might result in blindness. There is currently no treatment for the medicinal drug. While the progression of diabetic retinopathy may be slowed or stopped by medication. Diabetes management can be used to carefully treat mild instances.

Literature Survey [1]

The suggested technique employs an Alex net Convolutional Neural Network (CNN) to identify diabetes on a fundus picture. The dataset used for this experiment was filtered into 580 photos of normal and exudates from 1200 fundus images in the MESSIDOR database. The dataset for the CNN algorithm has been split into two parts: the training dataset and the testing dataset. On 50% of the training dataset, this approach achieves greater than 90% accuracy, while the remaining 50% of the training dataset is used for testing. The results show roughly 85%.

Advantages: CNN has been used to diagnose diabetic retinopathy, and it does so with good accuracy (which is a widely used method in medical image analysis and classification).

Limitations: Despite having a good accuracy, only 580 photos were used for both training and testing despite the fact that the dataset needed to train the neural network was insufficient. Additionally, it has trouble spotting tiny exudates on the image.

[2] In order to categorize diabetic retinopathy into 5 classes—No DR, Mild DR, Moderate DR, Severe DR, and Proliferative DR—the proposed system created a CNN architecture. They have examined earlier attempts to identify DR using CNN, and they have improved CNN's networks to increase accuracy and efficiency. They have attained a 75% accuracy on the dataset of 80000 photos.

Advantages: The overfitting problem has been resolved and a larger dataset was used to train the CNN. To categorize DR, they employed a 5-class problem. The correct healthy eye has been identified.

Limitations: There is some issues in classification to distinguish between the mild, moderate and severe cases of DR.

[3] To assess the fundus image and forecast the stage, such as No DR, Moderate DR (a combination of mild and moderate), they employed a Deep Convolutional Neural Network (DCNN). Severe DR, Non-Proliferative DR (severe NPDR, and Proliferative DR). Nearly 3468 fundus photos from various clinics that were available on Kaggle over time were used. A accuracy of greater than 80% has been attained.

Advantages: Comparing it to other CNN-based approaches, it has competitive accuracy, sensitivity, and specificity.

Disadvantages: When a model is trained on a small dataset and fails when used on a larger dataset, this is known as overfitting.

[4] The proposed model is based on the DenseNet121 architecture. A speciality about this is, each output of a convolution layer (feature map) is concatenated with the subsequent layers of the same block. It classifies DR as 5 classes based on the level of DR which comprises of No DR, Slight DR, Medium DR, Severe DR and PDR. The proposed method has used 2 datasets (Messidor and APTOS) by a cross-testing approach so that the model can acquire the complex features.

Advantages: The model was designed to detect DR at early stages.

Limitations: As they have used cross-testing approach with unbalanced data the accuracy is low compared to the state of art methods. Also, the model had difficulty to classify the Slight NDPR class.

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