Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy

Introduction:

Diabetic Retinopathy (DB) is a complication of diabetes that influences the eyes. Damage to blood vessels in the tissue of the retina, the back layer of the eye, typically causes it. Blurriness, floaters, dark or empty areas in the vision, and difficulty recognizing color blindness are some of the early symptoms. It necessitates constant monitoring, and in the event of complications, it may shorten life expectancy. If it is not diagnosed and treated, it can blind you. The medication cannot be cured at this time. Diabetic retinopathy can be stopped or slowed down with treatment. Diabetes management may be used carefully to treat mild cases.

Literature Survey:

[1] The diabetes on a fundus image is identified by the proposed method, which makes use of an Alex net Convolutional Neural Network (CNN).The dataset that was used came from the MESSIDOR database. It has 1200 images of the fundus and was divided into 580 images of normal and exudates for the project. The dataset has been divided into two parts for the CNN process: the training dataset and the testing dataset. On 50% of the training dataset, this method achieves accuracy greater than 90%, and the remaining 50% of the dataset is used for testing. The tests give an accuracy of about 85%.

Advantages: The CNN, which is a widely used method in medical image analysis and classification, has been used to detect diabetic retinopathy with good accuracy.

Limitations: Even though the images received a good accuracy, only 580 were utilized for both training and testing, despite the fact that the dataset was insufficient to train the neural network. Additionally, it had trouble identifying the image's smaller exudates.

[2] In order to categorize diabetic retinopathy in the fundus imagery into five categories—No DR, Mild DR, Moderate DR, Severe DR, and Proliferative DR—the proposed system developed a CNN architecture. They have examined previous efforts to detect DR using CNN, and they have altered the networks in CNN to improve its accuracy and efficiency. They have achieved a 75% accuracy on the dataset of 80000 images.

Advantages: The overfitting issue has been resolved by using a larger dataset to train the CNN.They have classified DR using a five-class problem. The healthy eye has been correctly identified.

Limitations: Classification of DR into mild, moderate, and severe forms presents some challenges.

[3] To analyze the fundus image and predict the stage, they used a Deep Convolutional Neural Network (DCNN), which includes No DR, Moderate DR (a combination of mild and moderate Non-Proliferative DR), and Severe DR (severe NPDR and Proliferative DR).Over a period of time, they have almost used 3468 fundus images from various Kaggle clinics.They have achieved an accuracy rate of over 80%.

Advantages: When compared to other methods that are based on CNN, it has achieved accuracy, sensitivity, and specificity that are on par with the best.

Disadvantages: When a model is trained with a small dataset and fails when applied to a new dataset, an overfitting problem occurs.

[4] The architecture used in the proposed model is DenseNet121.This is unique in that each feature map output from a convolution layer is concatenated with the subsequent layers of the same block. Based on the severity of the disease, it divides DR into five categories: PDR, No DR, Slight DR, Medium DR, and Severe DR. Cross-testing two datasets—Messidor and APTOS—has been used in the proposed method to enable the model to acquire complex features.

Advantages: The model was created to catch DR early on.

Limitations: They used a cross-testing strategy with unbalanced data, so their accuracy is lower than that of current methods. Additionally, the model had trouble categorizing the Slight NDPR class.

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