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Detection of Diabetic Retinopathy using Deep learning along with CNN: A Review

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ABSTRACT: Diabetic Retinopathy(DR) is a disease that affects the retina of eyes of the people having diabetes. DR is a major concern for people having diabetes above 50 years of age. The symptoms of it include Microaneurysm, Hemorrhage, red lesions. The early detection of this is very necessary. As the number of diabetes patients is increasing every year and hence is the risk of developing DR. The deep learning along with Convolutional Neural Network(CNN) model emerging as new technology could help in improving the accuracy of prediction as well as earlier and timely detection of DR.

KEYWORDS: Diabetic Retinopathy, Deep learning, CNN.

I. INTRODUCTION

Diabetic Retinopathy is a complication of diabetes mellitus in diabetic patients. If it is not treated at the proper time, this can lead to blindness over time. The DR is classified mainly into 5 stages. The manual method for the detection of DR can cause a lot of time. Also, there are chances of misinterpretation. The newly introduced technique for the detection of DR is the use of deep learning along with CNN. Deep learning is a subset of Machine Learning which is in the set of Artificial Intelligence. It mimics the human brain. The CNN is one of the neural network architectures used in deep learning. It has mainly three layers namely, the input layer, hidden layers, and output layer. In short, it is called a deep neural network. It is mainly used for image recognition and classification applications. In such applications, the deep neural network model is trained to identify the input images and classify them accordingly.

The Paper is organized as follows. Section II describes the literature survey for the paper. Finally, Section III presents the conclusion.

II. LITERATURE REVIEW

S.Sreng(2013) presented a system for automated detection of lesions in retinal fundus images which can be an aid in the detection of diabetic retinopathy[1]. Exudates are the early sign of diabetic retinopathy so the proper detection of these lesions is an essential task in an automatic retinal screening. On the research work leading to automatic analysis of exudate detection, the knowledge of Optic Disk (OD) location is very useful. An efficient algorithm is used to detect the OD and exudate which are the most important features for the early detection of diabetic retinopathy.

Doshi(2016) proposed a method for the detection of DR using Deep Convolutional Neural Network(DCNN) [2]. In this method, deep learning combined with CNN is used for the detection and classification of DR into 5 stages. Firstly, the image is preprocessed which includes the histogram equalization, min-max normalization. Then is the model training using CNN. After training & learning, the images are classified based on the trained model & get the output as one among the 5 stages among No DR, mild, moderate, severe, Proliferative DR.

Alsaffar(2017) presented a work of reviewing the deep CNN in image classification. This technique has created an upsurge in image classification problems[3]. The CNN works similarly to the neural network in the human brain. They can be used to train a model. The CNN is an Artificial Neural Network that has the specificity of ability to learn. The CNN has 3 layers which have the input layer, hidden layers, output layer. The hidden layer in turn consists of Convolutional layer, pooling layers, fully connected layers. The images are classified based on the deep CNN model.

Junjun Pan (2018) proposed a method for DR detection based on deep convolutional neural networks for the localization of discriminative regions[4]. They developed a novel ResNet18-based CNN architecture for DR detection, which is trained with weak supervision using image-level annotations only without object or patch-level labels. The retinal images were classified into 4 classes; No DR, Mild DR, Moderate DR, Severe DR, and Proliferative DR. The dataset was first pre-processed, followed by data augmentation. Then they provided Region Scoring Map (RSM) to show certain regions of the fundus image in terms of severity level. This method achieved 78.4% accuracy in test data.

Sairaj Burewar (2018) proposed a method for DR detection by retinal segmentation with region merging using CNN[5]. This method mainly consists of three steps; Pre-processing, Retinal Segmentation, and Image classifier. The pre-processing step consists of black box removal & image resizing, augmentation, green channel extraction, and image enhancement. After these processes, the retinal segmentation is done using U-Net. Then image classifier is used to identify the images as five classes according to the severity of DR.

Zentao gao (2019) proposed a method of diagnosing DR using a deep neural network[6]. The first step is data collection, then is data annotation. The data is being annotated by the ophthalmologists. The next step is to process the data which is called the data preprocessing. Then data augmentation is performed to reduce data shortages and make full use of available information. DR Diagnosis by Deep Convolutional Neural Network (DCNN) such as Inception-V3, the model is trained and classify the DR by the image provided by the fundus.

Sehrish qummar(2019) proposed a method of DR detection using Deep Learning Ensemble approach[7]. This method can encrypt the complexities and work to classify various diabetic retinopathy categories with extremely high accuracy, especially in the early stages. Kaggle's public database of retina images is used to train one set of five deep convolution neural network model resulting in coding of the rich features and improve the classification of the various DR categories. Test results show that the proposed model detects all DR categories in contrast to current methods and works better

Gayathri S(2020) proposed a new method on Automated classification of diabetic retinopathy through reliable feature selection[8]. Here SURF and BRISK Techniques are used for extracting the features from the input image. Then the extracted features are passed through the MR-MR technique for feature selection and ranking. The most relevant 30 features are selected. The strongest 30 features are applied to the classifier for training. The performance is analyzed using the 10-fold cross-validation method. SVM is used to evaluate the classifier. The classifier classifies the input image into two, DR affected or not.

III. CONCLUSION

More accurate and faster techniques for the detection of DR are very important. Deep learning along with CNN can be an important addition to the costlier techniques such as Optical Coherence Tomography(OCT) that are not accessible to every section of society. The deep learning technique can also help doctors to save time for the early detection of it. It can also be a speedier technique to detect as well as grading of it. This can much more help the doctors to give earlier prescription to the patients.



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