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# Retinal Image Analysis for Detection of Diabetic Retinopathy

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**ABSTRACT:** Diabetic Retinopathy is most common disease in the world. Diabetic Retinopathy causes blindness to the person. Early detection and timely treatment reduce the problem to increase. Many researchers develop the system or model for detection of diabetic retinopathy using different methods. More researchers use fundus images for detection.

Deep learning gives more effective results for detection of diabetic retinopathy. Deep learning uses neural networks. Convolutional neural networks use images for processing. Image processing is a powerful technique for classification of normal images or DR images. The proposed system analyzes the presence of microaneurysms, exudates, and blood vessels in fundus images using convolutional neural network algorithms that embed deep learning as a core component accelerated with GPU (Graphics Processing Unit) which will perform medical image detection and segmentation with high performance and low-latency inference.

**KEYWORDS:** EYE, Diabetic Retinopathy, Deep Learning.

## I. INTRODUCTION

The eye is the most important organ of the human body that provides more information to the brain. There are more than one retinal diseases. Most common of them are floaters, retinal tear, retinal detachment, diabetic retinopathy, macular hole, macular degeneration, retinal vein occlusion, epiretinal membrane. In that, the most common disease is diabetic retinopathy. This diabetic retinopathy occurs due to high blood sugar in the body, which causes blindness. Diabetic retinopathy is in the retina of the eye.

There are lesions in the retina of the eye. The lesions are hemorrhages, microaneurysms, exudates, and new blood vessels. Vision impairment caused by diabetic retinopathy can be slowed down or averted completely if diabetic retinopathy is detected in its early stages. The current problem while detecting and classifying diabetic retinopathy is that it is a time-consuming, manual process which involves a trained clinician going over retinal fundus images. We have detected the early symptoms of diabetic retinopathy by the help of CNN, image processing, and image analysis. After all, we have predicted the presence of diabetic retinopathy in given retinal images with its accuracy.

## II. LITERATURE REVIEW

Automated Diabetic Retinopathy Detection Based on Binocular Siamese-Like Convolutional Neural Network.

In this paper, Xianglong Zeng, Haiquan Chen, Yuan Luo, and Wenbin Ye proposed a novel convolutional neural network model with the Siamese-like architecture. It is trained with a transfer learning technique. Different from the previous works, the proposed model accepts binocular fundus images as inputs and learns their correlation to help to make a prediction [1].

Automatic Detection of Diabetic Retinopathy: A Review on Datasets, Methods and Evaluation Metrics

Muhammad Mateen, Junhao Wen, Mehdi Hassan, Nasrullah Nasrullah, Song Sun, and Shaikat Hayat presented a detailed review of the detection of DR with three major aspects: retinal datasets, DR detection methods, and performance evaluation metrics. Furthermore, this study also covers the author's observations and provides future directions in the end of diabetic retinopathy to overcome the research challenges for the research community [2].

Multitasking Deep Learning Model for Detection of Five Stages of Diabetic Retinopathy:-

Sharmin Majumder, Graduate Student Member, IEEE, and Nasser Kehtarnavaz, In this paper they proposed a multitask deep learning model to detect all the five stages of DR more accurately than existing methods. The developed multitask model consists of one classification model and one regression model, each with its own loss function. After

training the regression model and the classification model separately, the features extracted by these two models are concatenated and inputted to a multilayer perceptron network to classify the five stages of DR.[3]

Diabetic Retinopathy Detection Using Prognosis of Microaneurysm and Early Diagnosis System for Non-Proliferative Diabetic Retinopathy Based on Deep Learning Algorithms

Lifeng Qiao , Ying Zhu 2, And Hui Zhou In this paper they proposed the entropy image computed by using the green component of fundus photograph is proposed. In addition, image enhancement by unsharp masking (UM) is utilized for preprocessing before calculating the entropy images. The backchannel CNN incorporating the features of both the entropy images of the gray level and the green component preprocessed by UM is also proposed to improve the detection performance of referable DR by deep learning. Diabetic retinopathy detection using red lesion localization and convolutional neural networks. In this study, they designed a lesion localization model using a deep network patch-based approach. their goal was to reduce the complexity of the model while improving its performance[4]

### III. METHODOLOGY

The proposed system analysis the presence of microaneurysm in fundus image using convolutional neural network algorithms that embeds deep learning as a core component accelerated with GPU(Graphics Processing Unit) which will perform medical image detection and segmentation with high-performance and low-latency inference.

The semantic segmentation algorithm is utilized to classify the fundus picture as normal or infected. Semantic segmentation divides the image pixels based on their common semantic to identify the feature of micro aneurysm. This provides an automated system that will assist ophthalmologists to grade the fundus images as early NPDR.

### IV. PROPOSED SYSTEM

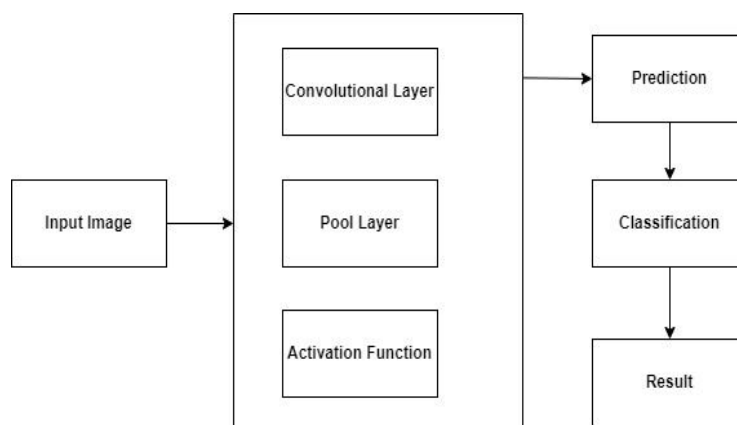


Fig.1 System Architecture

Above fig.1 shows the proposed system architecture , which involves three different layers for image processing. After processing the input image it goes to prediction layer, to predict the type of diabetic retinopathy symptoms. And that predicted image have classified in the four different stages of Diabetic retinopathy.

#### ALGORITHM:

##### Convolutional Neural Network:

A Convolutional neural network (CNN) is a neural network that has one or more convolutional layers and are used mainly for image processing, classification, segmentation and also for other auto correlated data.

**POOL Layer** - Pooling in convolutional neural networks is a technique for generalizing features extracted by convolutional filters and helping the network recognize features independent of their location in the image.

##### Activation Function:-

RELU :- Stands for Rectified linear unit. It is the most widely used activation function. Chiefly implemented in hidden layers of Neural network. Equation :-  $A(x) = \max(0,x)$ . It gives an output x if x is positive and 0 otherwise.

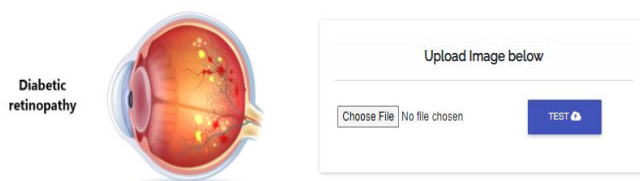


**SETUP:** Our system successfully executed on i3 processor nwith 4 GB RAM. To run this program we have used python version 3.7.8 on visual studio.We have successfully installed TensorFloe and Kers on Visual Studio and on Google ColabJupiter Notebook.After we have ran code cell by cell. System executed successfully . For thr image datasets we needed accurate image data so we have taken images datasets from Kaggle dataset.

• **IMPLEMENTED SYSTEM**

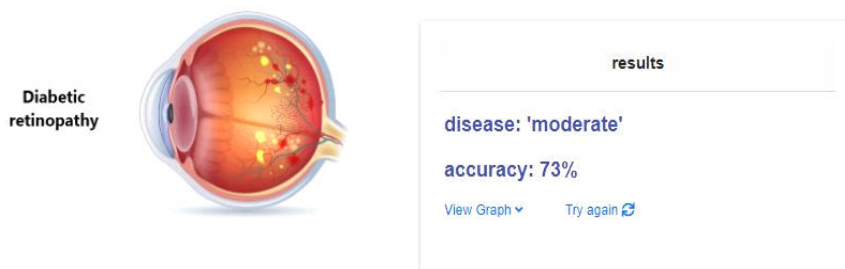
**INPUT-** the image will be taken by using the interface provided from system.

Diabetic Retinopathy



**Result:-** The result of the proposed system will be in form of the type of deaseses(1-severe, 2-prolifirative, 3- moderate , 4-DR) in given input image along with the accuracy percentage of that result.

Diabetic Retinopathy



**Advantages:-**

- i. Make learning fun and interactive.
- ii. Create an addiction to learning.
- iii. Gives learners the opportunity to see real-world applications.
- iv. Offers real-time feedback.
- v. Early detection of eye decrease enhances user experience.

**Disadvantages:-**

- i. Although diabetic retinopathy has provided a significant platform to be deployed in human eye fields, it is still difficult to implement successfully.
- ii. Lack of required concentration of design elements may result in unexpected output from retinal image analysis.

• **conclusion**

The proposed model has a Siamese-like architecture which accepts binocular fundus images as inputs and predicts the possibility of RDR for each eye by utilizing the physiological and pathological correlation of both eyes. The evaluation



result shows that proposed binocular model achieves high performance with an AUC of 0.951 and a sensitivity of 82.2% on the high specificity operating point and a specificity of 70.7% on the high sensitivity operating point, which outperforms that of existing monocular model based on Inception V3 network. A binocular model is also trained for the original five-class DR classification task. This result also demonstrates that the proposed model has great potential to assist ophthalmologists to diagnose RDR more efficiently and improve the screening rate of RDR.

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