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Classification of Retinal Image for Early Detection of Diabetic Retinopathy Using Deep Learning

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Abstract: ***Diabetic retinopathy is a disease which cause of blindness due to diabetes. For this reason, it is very important to detect diabetic retinopathy in early stages. A deep learning-based approach is used for the early detection of diabetic retinopathy from retinal images. The proposed approach consists of two steps. In the first stage, pre treatments were performed to remove retinal images from different data sets and standardize them to size. In the second stage, classification is done by the help of Convolutional Neural Network using deep learning algorithm and 98.5% success is achieved. The difference of this technique from similar studies is that instead of creating the feature set manually as in traditional methods, the deep learning network automatically constructs and trained by using CPU and GPU in a very short time.***
Keywords: CNN, Early detection, Artificial intelligence, Deep learning, Machine-learning, Fundus Image, Optical coherence tomography, Ophthalmology.

I. INTRODUCTION

Blindness which is caused by diabetes can be prevented in the world. Diabetic retinopathy is a complication of diabetes which can also affect various parts of the body. When the eye blood vessels have a high level of glucose in the retina, the vision will be blurred and can cause blindness eventually. This is known as diabetic retinopathy. Regular screening is very important in order to detect the early stages of diabetic retinopathy for timely treatment to prevent or delay further deterioration. This project will detect the abnormalities in the retina using image processing techniques. Artificial neural network can quickly process a large number of fundus image and help to reduce the cost and increase productivity and efficiency for ophthalmologists. Diabetic retinopathy is common cause of blindness due to diabetic. That is why, early detection of diabetic retinopathy is very important. A deep learning-based approach can be used for detection of diabetic retinopathy from retinal images. The most prominent difference between Convolutional Neural Network which is deep learning algorithm instead of creating the feature, set manually as in traditional methods. The deep learning network automatically constructs in a very short time by using CPU and GPU. Timing also plays a vital role which can be achieved by this project.

A. This automatic feature extraction uses deep learning techniques and iterative learning to continuously improve outcomes.
B. It is relatively lower cost than manual methods.
C. This system is highly scalable process with quick response time.

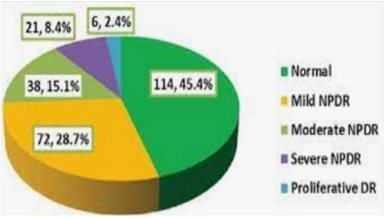
Taking into consideration the major problem of diabetic retinopathy complication that affects eyes. Diabetic retinopathy damage blood vessels of the light-sensitive tissue at the back of the eye (retina).At first, diabetic retinopathy might cause no symptoms or only mild vision problems. But it can lead to serious problem which eventually turn into
vision loss. The person who has type 1 or type 2 diabetes may be diabetic retinopathy can develop. The person having diabetes and the uncontrolled blood sugar level is, the more likely you are to develop this eye complication.

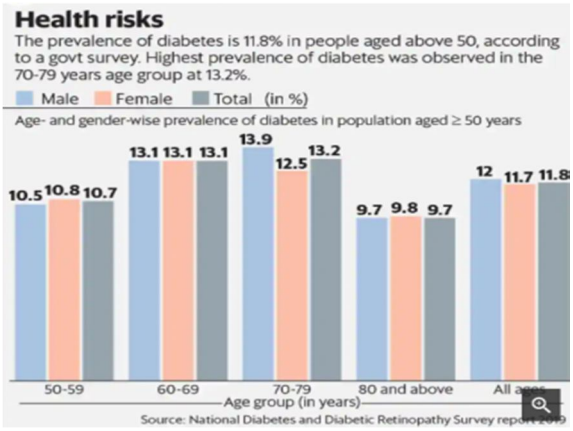
II. LITERATUER SURVEY

In paper [1] many causes of vision may be reduced prevented or treated. With an aging global population, the increases for eye health services are increasing. We estimated the commonness and same contribution of preventing causes of blindness and vision reduce globally from 1990 to 2020 and reduce the eye problems. We compare the results with the World Health Assembly Global Action Plan (WHA GAP) target of a 25% global reduction from 2010 to 2019 in prevent vision reduction, defined as cataract and under evaluated refractive error.

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In paper [2]: In this paper, the author uses V transform algorithm and histogram equalization techniques. In this method, the accuracy rate is 97% .The obtained result shows accuracy and efficiency in the diagnosis of Diabetic retinopathy.
In paper [3], In this ,the author uses deep learning along with convolution neural network algorithm .They have standardized both methods to get a success rate of 98.5% detection of Diabetic Retinopathy disease .Another sub-branch of deep learning known as Artificial neural network is also implemented
In paper [4]: In this paper the author proposed a method of blood vessels extraction from retinal images which consists of three stages: Pre-processing, processing and post processing.
In paper [5]: A hybridized system for the detection of Diabetic Retinopathy in a patch based processing was proposed. Here it mainly concentrates on detection of Proliferative diabetic retinopathy and non-proliferative diabetic retinopathy.

III. DESCRIPTION OF MODULES

A. Admin

Administrator or ophthalmologists will import fundus images form database and process the fundus image. While process the images different images will be formed and the result will display in the system. Administrator or ophthalmologists also can detect the different stages of diseases as well as eyes in normal condition or abnormal.

B. Image Processing

This technique is used for detection of diabetic retinopathy and it will detect the various abnormal conditions of eyes. It can be done by cropping the inner circle of the retina and Due to the wide scalable nature of the data sets and large number of image sources, these images are often considered as the artifacts which are not diagnostically applicable. In order to maintain the difficulties of these image variations and to standardize the image, image preprocessing step has to be followed. Initially, the images' pixel values should be scaled to the value in the range of 0 to 1. Then these scaled images are downsized to a standardized resolution of 512 x 512 pixel dimensions. This places it into a square. As scaling resizes the digital image, it is considered to be the remarkable process in image processing technology. Considering the vector based graphical images, the basic image should be resized using the geometrical alterations, without compromising the quality of the image. When considering Raster graphical image, a robust fresh image should be generated with lower or higher quantity of pixels. If the number of pixels is scaled down, then the image might lose its quality. Thus the scaling of image is important in maintaining the image quality. It will enable the image segmentation by segmenting the retinal disorders of the given set of images.

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IV. WORKING PROCEDURE

This project detect diabetic retinopathy uses the classification system of Normal, Mild and Higher stages to classify the NPDR and PDR . Firstly background study of fundus images to determine the features to extract and use. Similarity and differences of fundus images are analyzed. Used Matlab Image Processing Toolbox for features extraction. After getting the values of the features from the images, Convolutional Neural Network (ANN) would be studied and applied for automatic detection. The results are tested for accuracy and troubleshooting or fine-tuning of the codes might be required. Finally, a Graphical User Interface (GUI) to access the automated program would be developed and all the findings and results would be recorded and documented.

V. RESULT

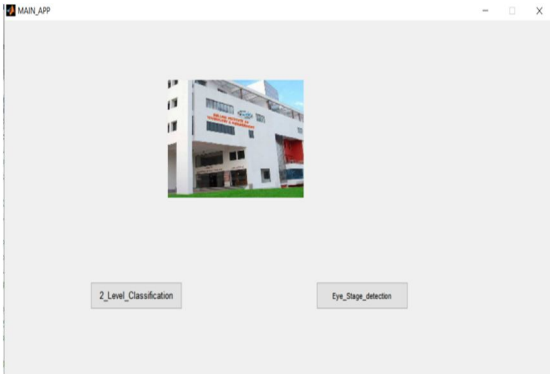


Fig1.Detection of Diabetic retinopathy

This is app for detecting different stages of Diabetic retinopathy

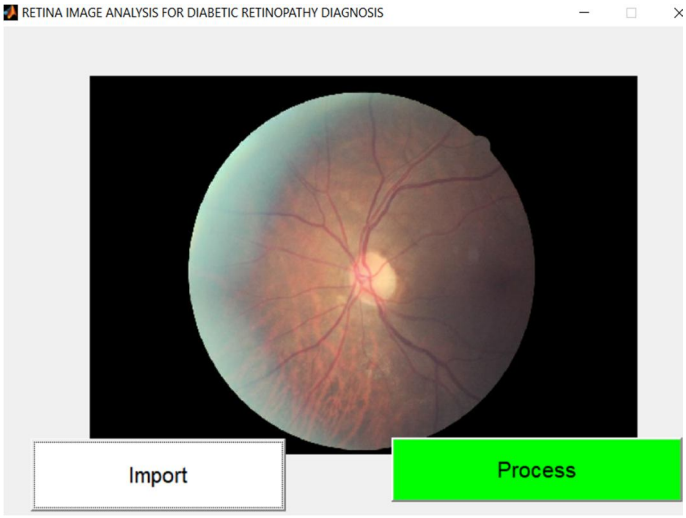


Fig2. Importing image from database

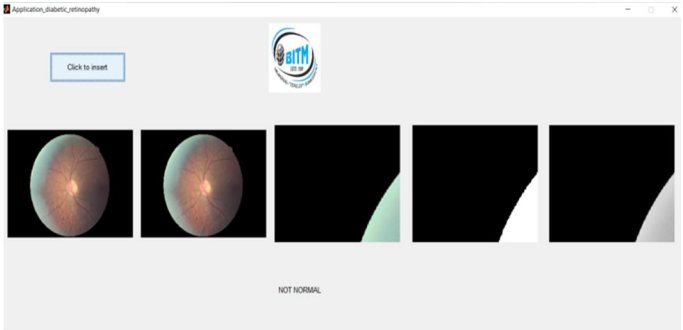


Fig3. Detecting the diabetic retinopathy

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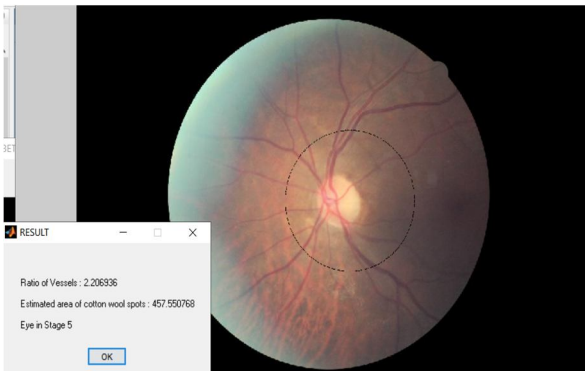


Fig. different stage of disease, ratio of blood vessels and cotton wool spots.

VI. CONCLUSION

Based on the results of the classifier, this project has a sensitivity of 80% and a specificity of 20%. It is able to achieve a fairly accurate classification for mild and higher stages but not for normal class resulting in a possible high false alarm. This might be improved by fine tuning the threshold values used on the images and more images could be used to improve the overall system. For this project, various techniques of image processing ware used to extract the features, namely blood vessels, exudates, micro aneurysms and texture properties from fundus images.

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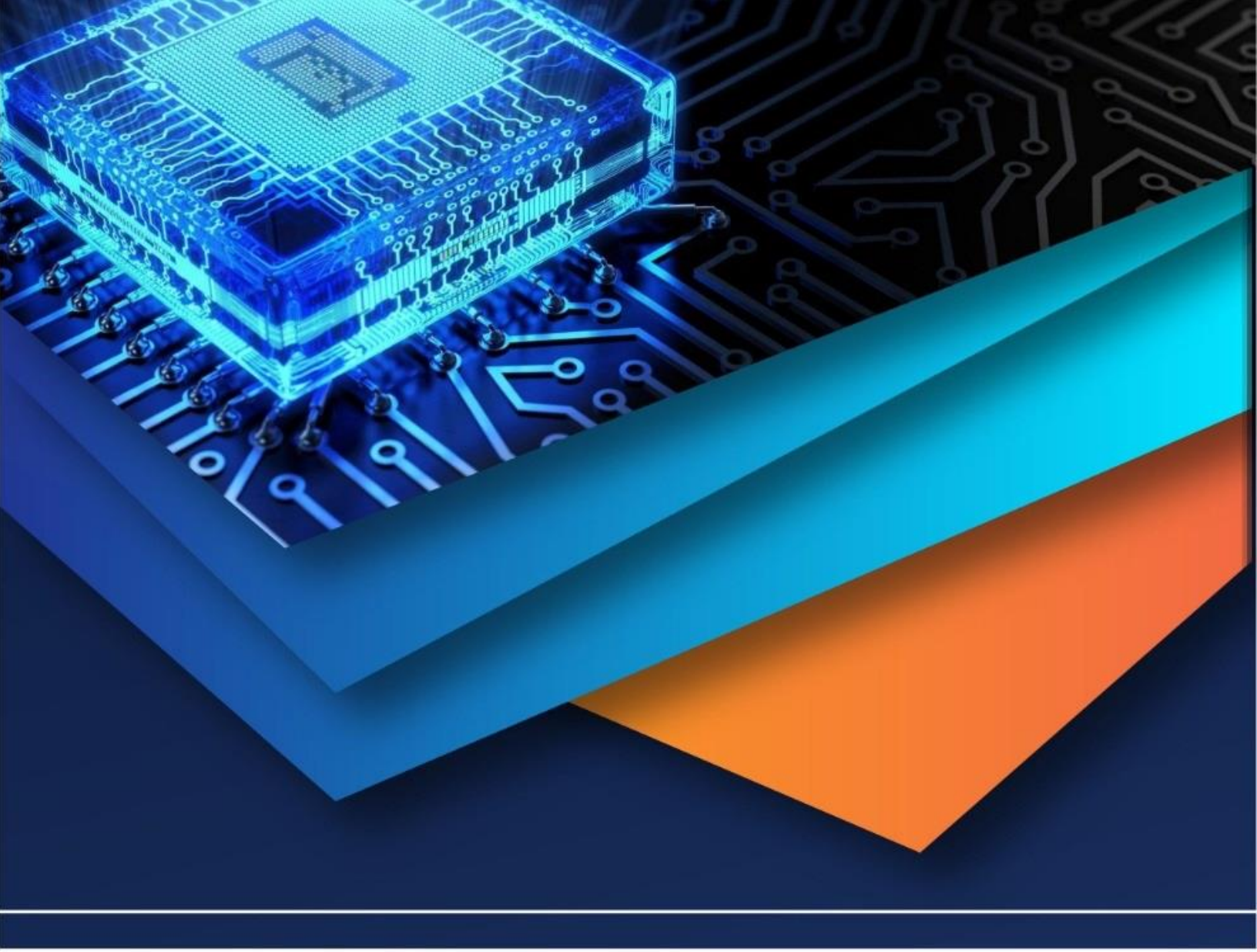
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