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DETECTION OF DIABETIC RETINOPATHY STAGES USING IMAGE SEGMENTATION

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Abstract - Diabetic retinopathy is one of the leading causes of blindness (DR). Diabetic retinopathy is a diabetes-related eye disease. Early DR detection would aid in preventing permanent vision loss. A technique for digital image processing has been developed using retinal or fundus images that are collected from the patient's retina. The main objective of the project is to identify and stop irreversible vision loss. It can be achieved by using digital image processing or image segmentation.

Key Words: Diabetic Retinopathy (DR), Retinal Images, Image Processing.

1.INTRODUCTION

Diabetes is caused by the impairment of the body's tissue to process blood glucose resulting in an increase of plasma glucose. It affects all the vital organs of the body, especially the Kidney, Brain, and Eye resulting in diabetic nephropathy, neuropathy, and retinopathy respectively. In 2010, 0.8 million people globally were declared blind and another 3.7 million were visually impaired because of diabetic retinopathy. At present, a minimum of 366 million people are suffering from diabetes around the world and approximately 41.6% of them are suffering from any form of DR. It is estimated that by the year 2030 total number of people with DR will be 191 million. Diabetic retinopathy occurs when the blood-supplying vessels of the retina become unimpaired. The consequence of damage to the small blood vessels and nerves of the retina is diabetic retinopathy. The earliest changes leading to diabetic retinopathy include narrowing of the retinal arteries associated with reduced retinal blood flow; malfunction of the inner retina neurons, accompanied later by improvements in the activity of the outer retina, associated with gradual changes in visual performance; blood-retina barrier malfunction that protects the retina from many substances Up to 80% of people who have had diabetes for 20 years or longer have diabetic retinopathy. A patient can only detect it at its advanced stage when treatment is very complicated and people often lose their eyesight. With proper eye care and surveillance, at least 90 percent of new cases will be minimized. Doctors suggest every diabetic patient consult an ophthalmologist every six months. But rural poor people cannot afford to go to a doctor every six months. In a fundus picture, there are primarily five anatomical components, the recognition of which is essential for diabetic retinopathy diagnosis, namely optic disc, blood vessel, exudate, microaneurysm, and hemorrhage.

2.AIM OF THE PROJECT

This project mainly focuses on the prediction of diabetic retinopathy disease. CNN model can be trained by using training datasets and CNN will give the probability of the eye infected with diabetics Our objective is to train our model by providing training datasets to it and our goal is to detect the severity of diabetic retinopathy disease accurately.

3.LITERATURE SURVEY

We studied some papers for the development of this portal. Yuchen Wu et al proposed a transfer learning-based approach for detecting diabetic retinopathy (DR) disease, which is a severe complication of diabetes affecting the eyes. The authors have used the Kaggle dataset and improved it using different methods, including pre-training of the neural networks on the ImageNet dataset. The images were then classified into five types of DR diseases based on their severity.

The study has reported a classification accuracy of 60% using the proposed approach, which is an improvement over earlier approaches. The authors have also suggested that future work should focus on developing new techniques for early diagnosis of this severe disease to assist doctors.

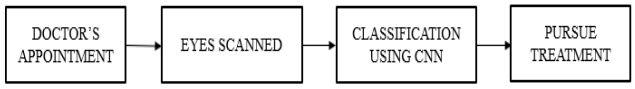
Transfer learning is a widely used technique in the field of computer vision, where pre-trained models are used to improve the performance of new models. It is interesting to see its application in the detection of DR disease, which is a critical healthcare problem worldwide. Overall, this work appears to be promising, and the results achieved by the authors could have significant implications for the early diagnosis of DR disease.

4.EXPERIMENTATION DETAILS AND PROPOSED FEATURES

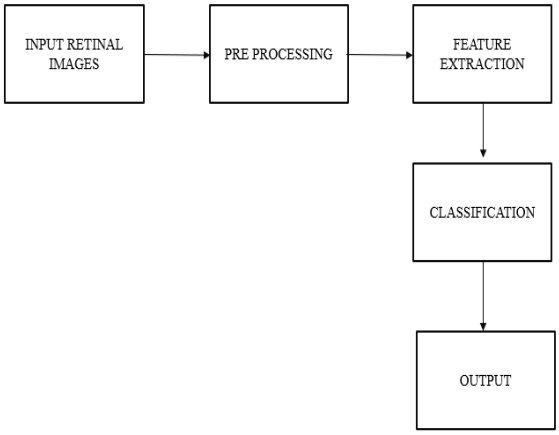
In the paper, they developed a network with CNN architecture and data augmentation which can identify the intricate features involved in the classification task such as micro-aneurysms, exudate and hemorrhages on the retina and consequently provide a diagnosis automatically and without user input. Network was trained using a high-end graphics processor unit (GPU) on the publicly available Kaggle dataset and demonstrate impressive results, particularly for a high-level classification task. On the data set of 80,000 images used our proposed CNN achieves a sensitivity of 95% and an accuracy of 75% on 5,000 validation images.

PROPOSED FEATURES

In recent years most of the image processing researchers indulged in the development of machine learning especially deep learning approaches in the field of Hand-written Our proposed methodology strongly emerged based on these key aspects of diseases severity classification from the fundus images. In general, especially classification of diseases with the proposed architecture a CNN. Following these basic steps to achieve maximum accuracy from the images dataset are:



5.SYSTEM ARCHITECTURE



SYSTEM ARCHITECTURE DESCRIPTION:

INPUT RETINAL IMAGES

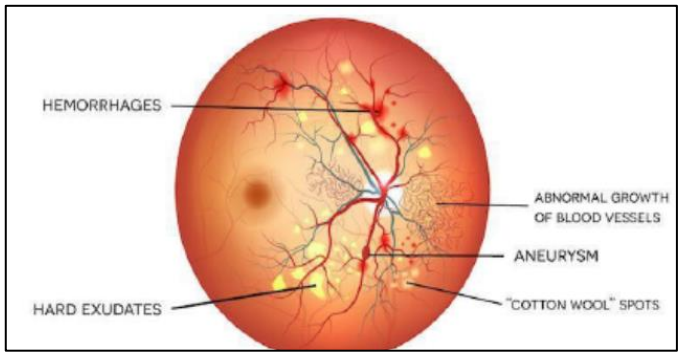
To input retinal images, you will need a device that is capable of capturing and storing digital images of the retina. Some newer smartphones are equipped with cameras that have the ability to capture images of the retina. These images may not be as high-resolution as those captured by specialized cameras, but they can still be useful for certain purposes. Once you have a device that can capture retinal images, you can input the images by transferring them to a computer

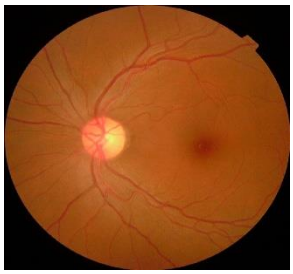
PREPROCESSING

In detecting abnormalities associated with fundus image, the images have to be Pre-Processed in order to correct the problems of uneven illumination problem, nonsufficient contrast between exudates and image background pixels and presence of noise in the input fundus image. Preprocessing is an essential step in retinal image analysis which attenuates image variation by normalizing the original image with a reference model

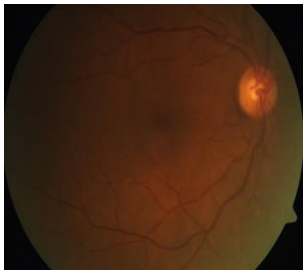
CLASSIFICATION

The main objective of classification is to group the image into regions with same property or characteristics. Classification is generally the first stage in any attempt to analyze or interpret an image automatically. Classification bridges the gap between low-level image processing and high-level image processing. It involves the detection, recognition, and measurement of objects in images. The role of classification is crucial in most tasks requiring image analysis.

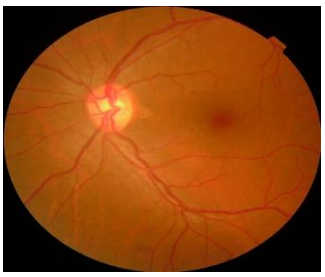


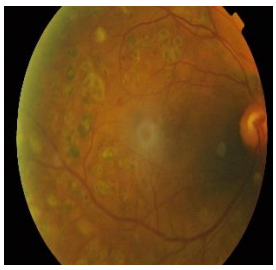


1. NO DR

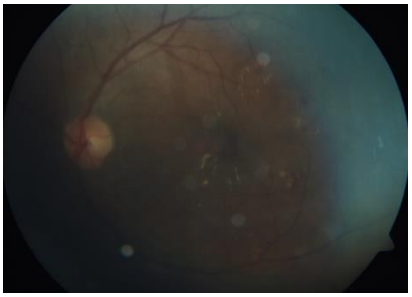


2. MILD DR





3. MODERATE DR **4. SEVERE DR**



5. PROLIFERATIVE DR

FEATURE EXTRACTION

Feature extraction is the process of extracting useful information from an image to be used for a specific task. In the context of retinal images, this could include extracting features such as blood vessels, optic disc, and other structures within the eye. These features can be used to diagnose and monitor various eye conditions such as glaucoma and diabetes.

OUTPUT

The output of retinal images is quantitative measurements or numerical data extracted from the image A diagnosis or interpretation of the image based on the presence or absence of certain features or abnormalities. A summary of the findings from the analysis of the retinal image is obtained.

6.CONCLUSION

Image segmentation techniques perform well compared to the methods used in practice. The outcome of the image segmentation techniques is dependent on many factors such as intensity, texture, and image content. In our project, a fast and efficient method for extracting blood vessels, and hard exudates in color eye fundus image has been presented. The simulation outcomes on the retinal dataset demonstrate how the proposed methodology can be used with retinal images and enhances blood vessels and hard exudates detection to reduce human error or to provide service in remote areas A significant screening method for the early diagnosis of diabetic retinopathy is presented in our project work. The proposed method utilizes less computation time to automatically identify important clinical features in retinal images such as blood vessels and hard exudates.

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