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# Diabetic Retinopathy using Inception V3 Model

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***Abstract:*** ***The retina of the eye is affected by a diabetic condition known as diabetic retinopathy (DR). It causes damage to the light source based on the blood vessels in the human retina. If diabetes is not properly treated, it is more likely to occur, making it the most common cause of visual impairment in adults during their working years. There are procedures for detecting DR, but they need an ophthalmologist to manually examine the retinal image. Deep Convolution neural networks based on the Inception V3 model are used in the design.***
***The model was about 97 percent accurate after undergoing GPU training on 35,126 images that eyePACS made available for public viewing on the Kaggle website. 1***
***Keywords: CNN, Deep learning, Inception V3, retinal images, Diabetic***

## I. INTRODUCTION

The common conditions affecting diabetic patients is diabetic retinopathy (DR). In which the retina is damaged and causes blindness. The only symptom at this early stage is inflammation. It affects the blood vessels in the retina and causes complete distortion of vision due to leakage of fluid. DR is estimated to have contributed to almost
In 2002, 6 million people had nearly 6% global vision impairment. The main problem is the lack of qualified doctors in rural areas where the prevalence of diabetes is highest.
There are four phases of diabetic retinopathy. In the mild stage of non-proliferative retinopathy, which is the initial stage, only microaneurysms may be present. In the second stage, In which the blood vessels lose their ability to transport blood due to dilation and inflammation. This stage is called moderate non-proliferative retinopathy. In the third stage, the retina lose its blood supply due to high levels of blood vessel blockage.
This stage is called as a non- proliferative retinopathy. The final stage, known as proliferative diabetic retinopathy, is an advanced stage in which retinal growth factors stimulate the growth of new blood vessels along the inner surface of the retina in some of the vitreous gel that fills the eye. Each stage has its own unique features and characteristics. But some of them may go unnoticed by doctors, causing them to misdiagnose patients. The result is the idea of developing a solution for automated DR detection. If DR is in an advanced stage, it can cause vision loss. 2.6% of blindness in the world is caused by DR. Microaneurysm development is a sign of moderate NPDR. Inter-retinal microvascular anomalies and variations in venous calibre are also discernible at this stage. When NPDR is severe, the arteries enlarge to the point where blood flow is significantly restricted. New blood vessels are then inserted to replace the damaged ones.

## II. EXISTING SYSTEM

The existing system used a high-accuracy deep learning model to detect the stage of diabetic retinopathy, some authors or researchers used a small dataset to train their deep learning model. Much work also failed to account for class imbalance in the datasets they used.
In the current systems, they classify the stages of diabetic retinopathy based on the formation of microaneurysms, in this stage deviations in the venous calibre of the vascular abnormality are also observed, they call it as non-proliferative diabetic retinopathy or simply called NPDR. Severe NPDR Causes the arteries to enlarge, which greatly affects the movement of blood in the blood.
The damaged blood vessels are then replaced with new ones. Enrique Carrera et al recommend a method based on Support Vector Machine to identify the diagnosis of retinopathy. In this method, capillaries, microaneurysms, and hard exudates are separated during the initialization step to obtain attributes for SVM. The accuracy of the regression test on the STARE data was 94.6%.

### *A. Draw Backs of Existing System*

In the existing method of diabetic retinopathy screening takes more time and hamper by shortage of ophthalmologist with the needed training. Slight NPDR is highly hard to diagnose because it symbols including decreased retinal pericytes, blood flow slow and increase the leukocyte adhesion.

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## III. PROPOSED SYSTEM.

We use the autonomous deep learning based method for detecting Diabetic retinopathy stages. Capture a single snapshot of the human eye in this recommended method. The suggested method make use of accurate screening procedure for early detection of diabetic retinopathy. The technique was generated with Keras and a TensorFlow backend for python. The data sets that are used in this system is freely available in the web.

The inception V3 model is used to develop a proposed system. What we taken the images are different sizes, from different people and captures the images from different cameras. So this may be noisy, we have to convert this noisy data into required format, it involves various pre-processing steps and make this to suitable for training.

### *A. Advantages of Proposed System*

*1)* In this system we used the deep learning model for diagnosing the diabetic retinopathy, this method could be used with all databases.

*2)* We introduce a simple technique to addressing the imbalance of diabetic retinopathy databases and this method can be used with other images.

*3)* This method achieved an accuracy score of 95% which is better than the existing system.

## IV. METHODOLOGY

In this model, the treatment of diabetic retinopathy uses a series of several approaches. The recognition of diabetic retinopathy is a key advance of this proposed technique.

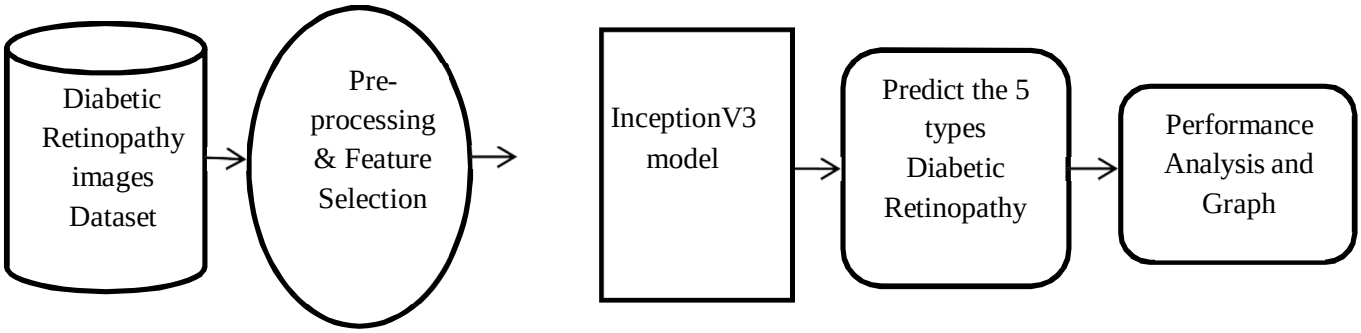



Fig: System architecture

### *A. Step 1: Collection of Datasets*

During the first phase. we created a form to collect all source datasets for training and testing purposes. We have also provided the dataset in the model folder. the dataset contains 2222 images of diabetic retinopathy that we obtained from eyePACS via the Kaggle website.

The Kaggle platform offers a substantial collection of high-resolution fundus photographs taken under various circumstances. On a scale of 0 to 4, a clinician (trained pathologist) graded the data set for the presence of diabetic retinopathy in each image using the following scale.

No DR, Mild DR, Moderate DR, Sever DR, Proliferative DR or 0 means no DR

Photos were taken using a wide variety of different camera models and configurations. As a result, some images may be blurry or dark. The diabetic retinopathy image was included in the dataset for quantitative analysis. These individual values of the considered properties is calculated using this dataset.

### *B. Step 2: Data Pre-processing*

Data pre-processing improves certain visual properties or reduces unwanted distortion to produce better image information that is important for later processing. When both input and output contain multiple images. "Preprocessing" refers to activities that are performed to achieve the least possible amount of abstraction. In this case Keras Image DataGenerator is used. Keras

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imageDataGenerator is a fantastic tool! Our system allows us to edit our photos in real time, even while still in training. As images of each exercise area are sent to the model, we can make any arbitrary changes we wish.
Pre-processing is necessary to guarantee that the data set is consistent and displays only relevant features. This step is necessary to reduce the workload of the process that follows. The images are then segmented to distinguish between normal and abnormal substances.

*1) Image Enhancement with Keras*

The ImageDataGenerator class used by keras made adding to our photos simple. It includes various methods for data enhancement, such as standardization, rotation, shifts, twists, and intensity adjustments. The ImageDataGenerator class ensures that the model receives new iterations of photos at each epoch. Moreover, it only returns modified images, not adding them to the original corpus. If this were the case, repeated exposure to the original photos would cause our system to become overfit. We load the images and their labels for this paper. An ImageDataGenerator (224,224) was then used to scale the image, as all images must be the same size to be recognized. Then create a numpy array from the images.

*C. Step 3: Algorithm*

The CNN-based deep learning image classification algorithm known as inception v3 has been updated. This approach is an improved version of Google inception v1 basic internet core framework that was released in 2014. It was created by the Google team as indicated by
As the name suggests, it was created by the Google team.
A. Accounting for less complex convolutions
b. Irregular convolutions based on spatial factorization
C. Usefulness of adjunctive approaches
d. Reduce the effective area of the grid

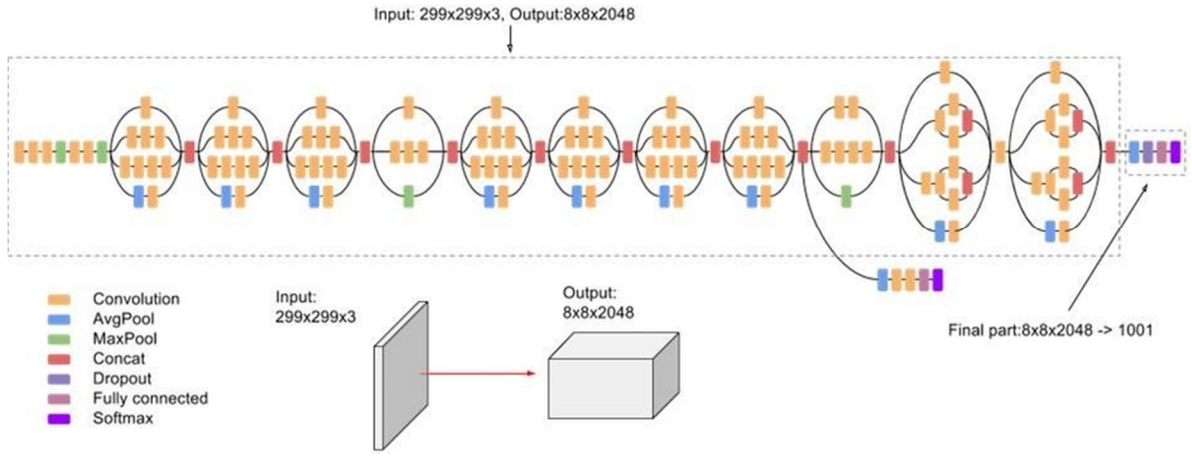



Fig: Inception V3 model

The total number of layers in the inception v3 model is 42, which is a slight improvement over the inception v1 and v2 forms. The efficiency of this model is truly astounding Below are the values for
Accuracy, precision, recall, and F-measure by trained model.
Accuracy: 0.977
Accuracy: 0.922
Rate: 0.977
F_recall: 0.977

*D. Step 4: Five types of diabetic retinopathy:*

*1)* No DR
*2)* Mild

3) Moderate
4) Heavy
5) Proliferative DR

a) *Non proliferative DR:* The early stage of diabetic retinopathy is also considered to be the more common of the 2 cases of the disease, there was no aberrant formation of blood vessels. The walls of retinal blood vessels are more vulnerable to NPDR. This caused microaneurysms to protrude from the walls of small blood vessels, which can normally cause fluid and blood to leak into the eye. It changes the diameter of the larger eye arteries by causing them to dilate. The small nerve fibres of the retina can swell and the main part of the eye can also lead to swelling.
b) *Mild non-proliferative DR:* Microaneurysms that bloom in the eye vessels represent the initial stage of the disease. These swollen, ballooning areas can break and leak fluid into your eye, impairing vision.
c) *Moderate non-proliferative DR:* The next stage of diabetic retinopathy occurs when the swollen vessels begin to burst and lose their ability to transport blood. This stage can begin to change the appearance of the eye. The blood vessels feeding the eye are blocked due to a significant increase in the number and size of the balloon-like swellings.
d) *Severe non-proliferative DR:* At this stage, the swelling and fluid block even more blood vessels. At this point, the blood began to clot, avoiding nutrients to reach certain areas of the eye. These areas begin to grow unconsciously, signalling the eye to grow new blood vessels to change blocked and damaged ones. A number of blood vessels are blocked, leading to blocked blood supply to the eye. This triggers the growth of new blood vessels, a signal sent by the brain, to compensate for the loss of blood supply.
e) *Proliferative DR:* PDR occurs when the retinal blood vessels close, cutting off nutrition to the retinal tissue. Abnormal new blood vessels, called neovascularization, can form as the body's response to damaged native vessels. These abnormal blood vessels can cause bleeding inside the eye. Scar tissue, high eye pressure or insufficient blood flow lead to blindness if not treated properly. Early neovascularization occurs, avoids surgery, and can preserve vision.

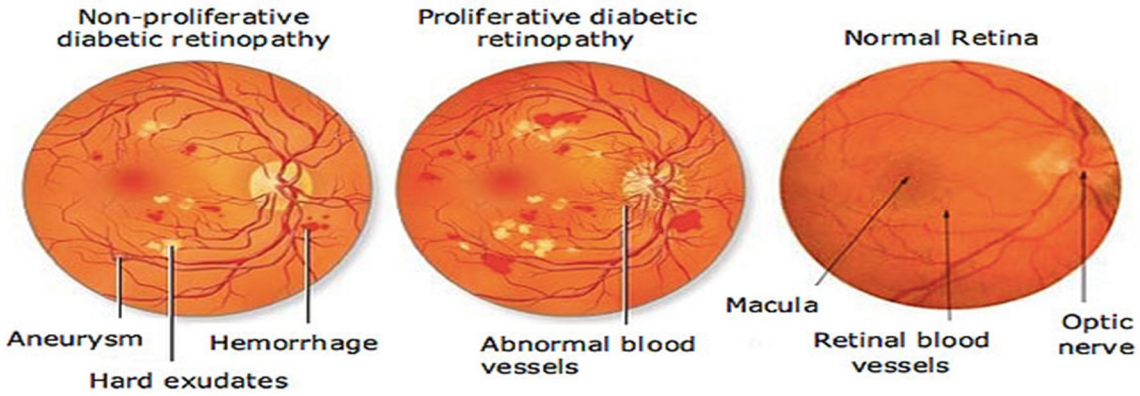



Fig:Types of Diabetic Retinopathy

## V. FUTURE SCOPE

We use a jupyternote book to build the software and it was success. Using python web application our project was successfully tested. This may be linked to mobile application to access easy. The scope of the projects, it has the large Dataset of eye images. It is mainly interested on the detection of diabetic retinopathy. The probability of the eye infected with diabetics is given by Inception V3 model. More Accuracy in image recognition problems. This system automatically detects the necessary features without any human supervision.

## VI. CONCLUSION

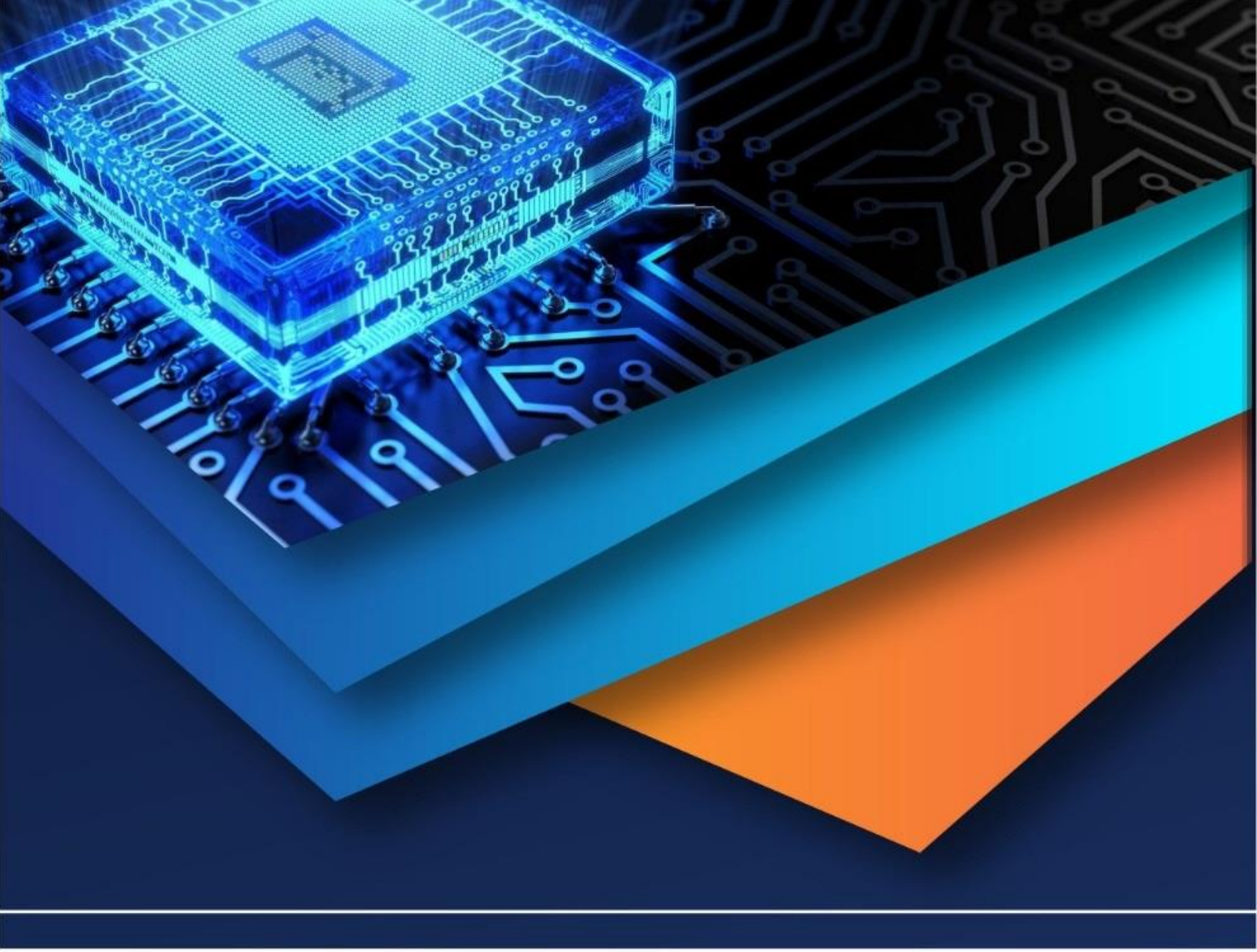
In rural areas have problem of lack of doctors to recognition of diabetic retinopathy So this automated system can reduce the manual work necessary for detection. This model Uses deep neural network to differentiate the eye images, thus relies less on human extraction of features and offers a more complete method of diabetic retinopathy detection. We can increase the dataset much more and retaining a learning algorithm with new retinal pictures, efficiency is also increases with datasets. Future work could be benefits for both the surgeons and patients. Patient may believe the system to provide an actual diagnosis, while surgeons could believe it to lighten their burden some workload.

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