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DIABETIC RETINOPATHY PREDICTION USING RESIDUAL NEURAL NETWORK

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ABSTRACT: Nowadays most of the people are suffering from diabetics, most of the diabetic patients are suffering from vision loss due to glucose level are high in eye nerves, due to increase in blood pressure in retina in eye most of the people loss their vision. Doctors can't identify early stage of this disease, so to provide better solution to this problem and identify the disease stage called diabetic retinopathy we are doing this project. In this project we are using residual neural network algorithm called resnet152, by comparing different algorithms in deep learning algorithms and machine learning algorithms residual neural network algorithms give best result. Residual neural networks give best results in less time when comparing deep learning algorithms.

Keywords: Deep Learning, Residual Neural Network , Diabetic Retinopathy, fundus Image.

INTRODUCTION:

In this project we are using Resnet152 to identify the early stage of Diabetic Retinopathy Disease, We are using Residual neural network algorithms to identify the Disease stages. In this process first hospital administration took the patient fundus image.

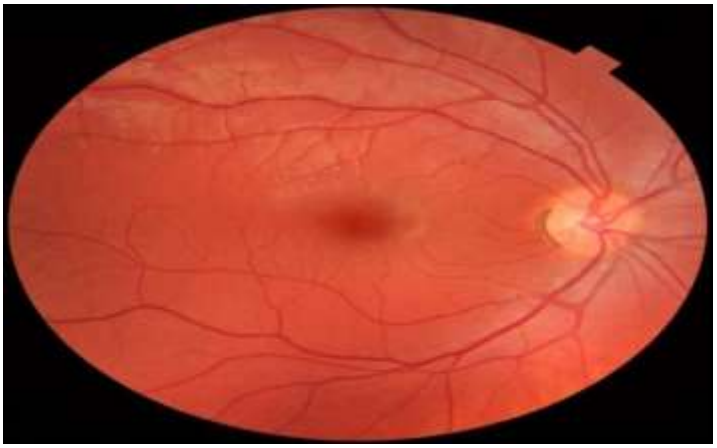

Figure 1. Fundus image

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After Admin login into website , Admin can upload fundus image to website by click upload button. After clicking the upload button the present page redirected to another page in that page fundus image process and report of the patient can print in the form of graph in the same page.

To took the patient fundus image hospital uses fundus cameras to capture patient retinal image. In Diabetic Retinopathy disease we have 5 stages , those are **No DR, Mild DR, Moderate DR, Server DR, Proliferate DR.**

In the starting stage of this disease, non-proliferative the blood vessels in the eye are larger in some spots ,in some spots blood vessels are blocked ,small blood vessels are bleeding and another thing retinal hemorrhages and fluid will leak into the retinal of eye.

Hospital management uses fundus cameras to capture patient retina image. To upload fundus image in website ,we are designing a website with signup , signin and result print page using **HTML , CSS** and **FLASK** framework using python. To identify the early stage of disease we are using classification algorithms ,to process the image and upload dataset to model we are using python ,python can install required libraries to process the dataset and model ,we are using pytorch libraries for process the model. After getting the patient results we are storing those results to database ,we are using postgresql to built database.

Related Work:

In a particular topic it includes an overview of existing approaches that employed "Deep Learning" for DR automatic early detection.

- *Development and validation of a deep learning algorithm for DR automatic detection* Applied a deep learning to learn an algorithm for automatically detection of DR. Deep learning has ablity to program an algorithm itself because it is a computational methods and learning from a large set of examples that demonstrate the desired behavior. These techniques are uses in clinical imaging. The EyePACS-1 included 963 images from 4997 patients, the Messidor-2 had 1748 images from 874 patients. For the accuracy detection the algorithm had an area under the receiver operating curve of 0.991(EyePACS- 1) and 0.990 (Messidor-2) [5]. The automatic detection of DR is of vital importance, as it is the fundamental cause of irreversible vision loss in the working age or young age of populace in the world.
- Classification of DR images is very difficult even for trained clinicians. Therefore, using DCNN (Deep Convolutional Neural Network) for the classification of DR with an accuracy of 94.5% [6]. Currently, a novel DCNN, which plays out the beginning time identification by recognizing all microaneurysms (MAs), the first indication of DR, alongside accurately allotting names to retinal fundus pictures which had five classes. The architecture was tested on kaggle dataset and got the output of 0.851 QWK score and 0.844 AUC score. In the early stage recognition, the model showed the sensitivity of 98% and specificity of 94% which shows the effectiveness of technique [7]. An ensuring dataset fidelity by master verification of class labels improves acknowledgement of unobtrusive highlights and found that preprocessing with contrast limited AHE. Transfer learning on models from ImageNet improve accuracies to 74.5%, 68.8%, and 57.2%.tarting stage of DR can prevent this type of disease with correct tratment. A new feature extraction method that is Modified Xception Architecture has shown in the picture for the diagnosis of DR disease. This method shows that modified deep feature

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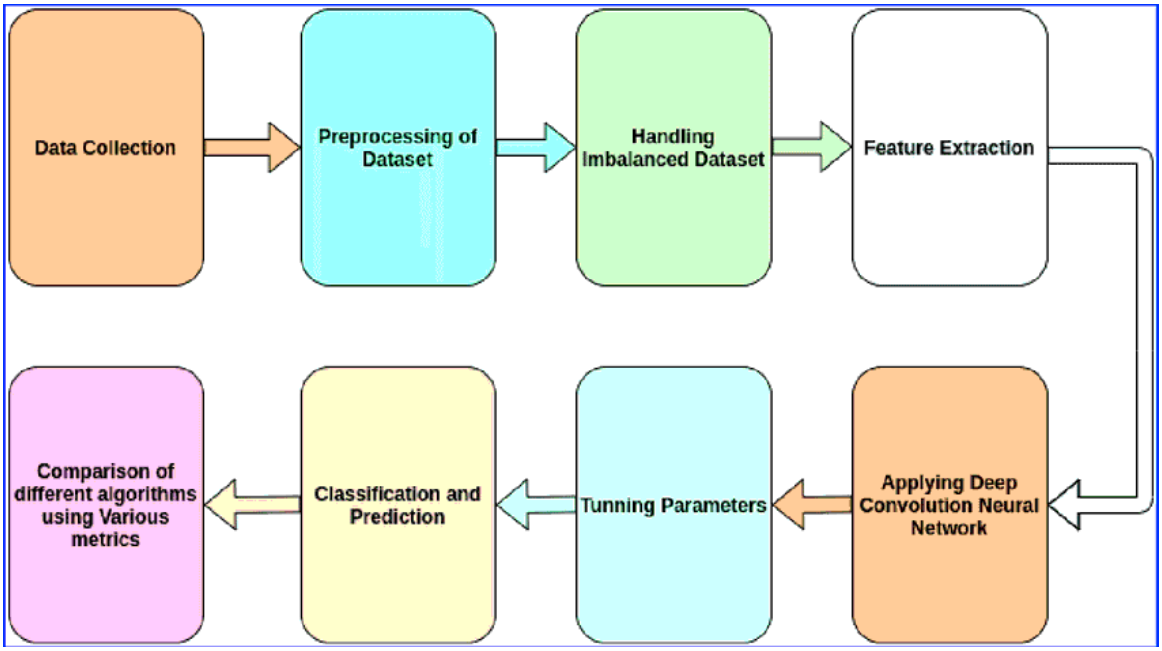
extractor improves DR classification with an accuracy of 83.09% versus 79.59% when compared with the original xception architecture [9].

- The target is to automate the discovery of DR and access the seriousness with high efficiency, through a general possible methodology. Explore the utilization of different CNN architectures on pictures from the dataset in the wake of being subjected to suitable image processing techniques. The final results acquired through training. VGG16 gave an accuracy of 71.7% whereas the same for VGG19 gave 76.9% and Inception v3 was 70.2% [10] Sadly the specific identification of the DR stage is famously precarious and requires expert human understanding of fundus pictures. Right now an automatic deep learning based method for DR stage identification by individual photography of human fundus. The method can be utilized as a method for early stage detection with sensitivity and specificity of 0.99 and QWK score is 0.925466 on APTOS Dataset [11].

PROPOSED METHOD:

Architecture Diagram :



ImageAcquition:

It converts retinal image into an array of numerical data that should be stored in computer. ImageAcquition is done by using some cameras that should be used in a medical department.

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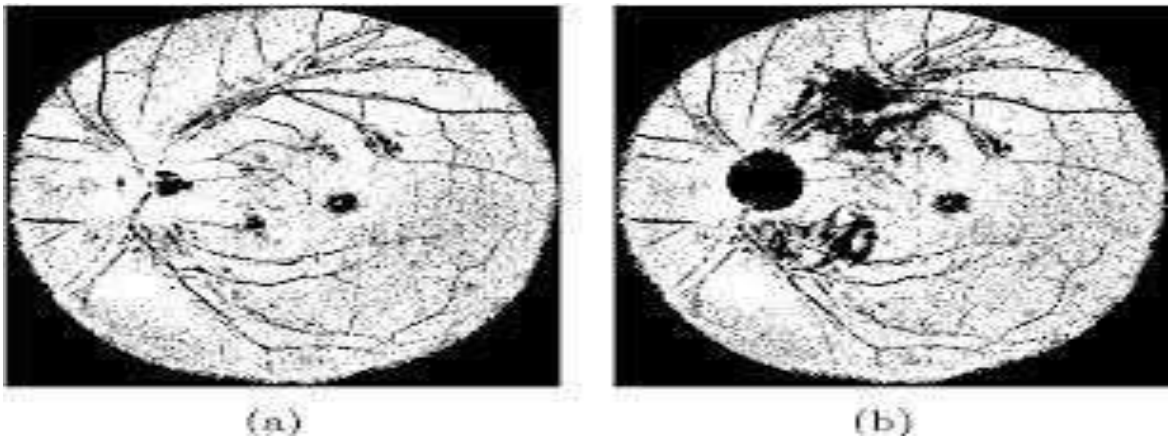
Preprocessing:

In preprocessing of an data , remove the noise data on the image ,it removes noisy and unwanted data. When we do preprocessing on image ,then it will resize the data. Another operation on image are 1) Pixel brightness transformations/Brightness corrections

2) Geometric Transformations

3)Image Filtering and Segmentation

4)Fourier transform and Image restauration.



(a) (b)

3)Feature Extraction:

Feature Extraction is one of the dimensionality reduction process, it divide the data into groups. When we take larger data sets then we cannot process all data ,from larger dataset we can gather some data satisfy all data characters and give the better result.

4) Feature Selection:

When we are taking larger datasets then we cannot test all the image to Predict the desired output and improve the performance of the model .

Using Feature Selection technique we can reduce size of input variables which used to test the model to predict the output.

5) Classification:

We are using Residual neural network152 algorithm, in this algorithm 152 hidden layers are there to process the input images and identify the early stage of Diabetic Retinopathy Disease.

We are using classification algorithm, it means by taking input and expected output it will predict the future result for unknown input. In this algorithm we training the images and predict the stages of disease.

DATASET:

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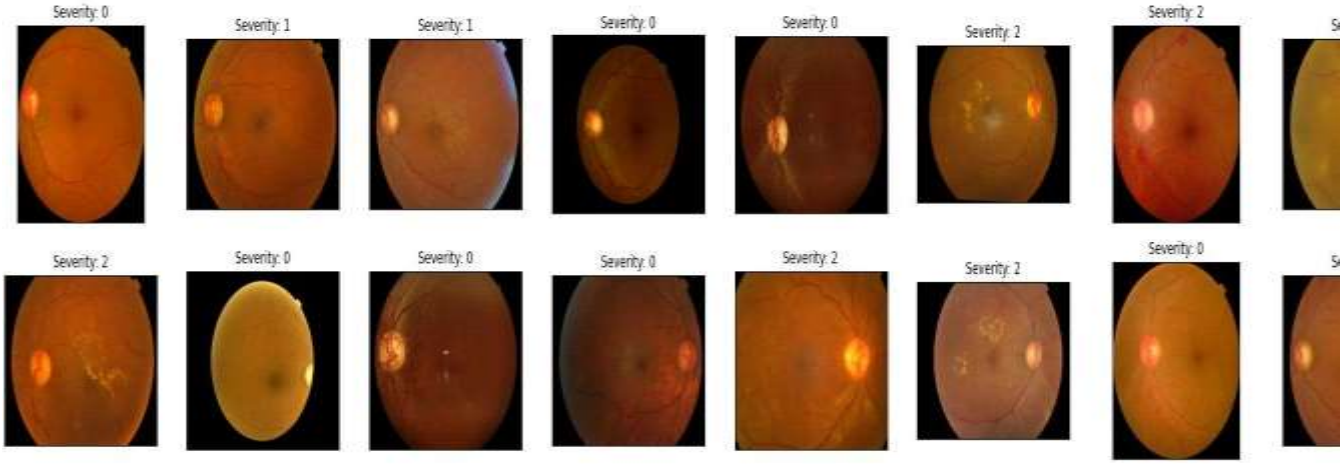
In this project we are using APTOS2019-blindness-detection dataset from Kaggle datasets. This dataset contains **3662** training images , testing images are **1928.**

This dataset contain 6 different files ,each file used for different purposes.

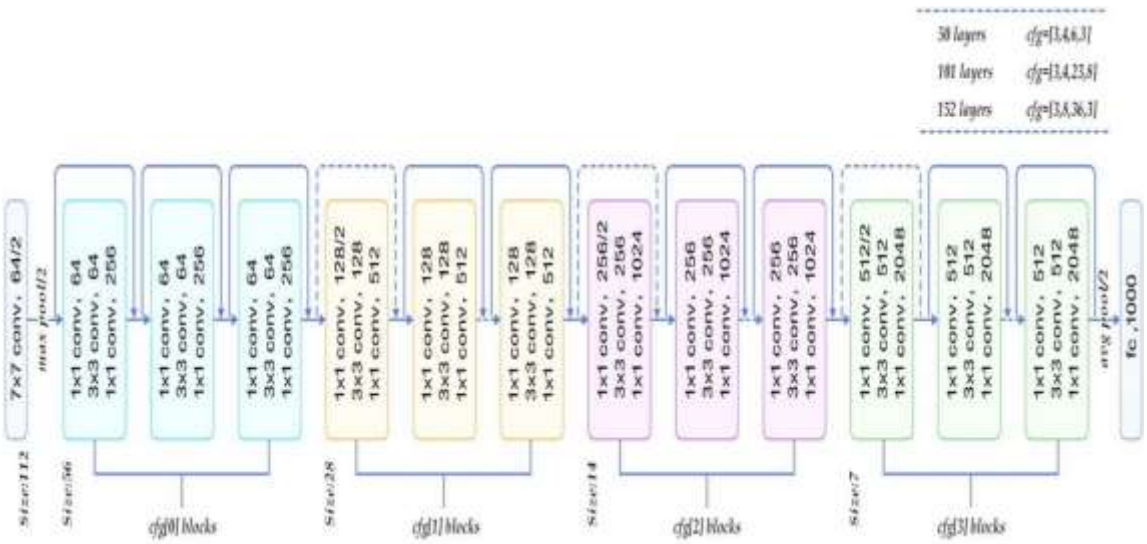
- classifier.pt : It contain a classification algorithm to process the input images
- test_images: It contain 1928 images to test the classification model.

Different Types of input training images



3) train_images: It contain 3662 images to process and train the model to predict the desired output. 4) sample_submission.csv,5) test.csv, 6)train.csv

RESNET152:



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`torchvision.models.resnet152(pretrained: bool = False, progress: bool = True, **kwargs: Any)` → torchvision.models.resnet.ResNet

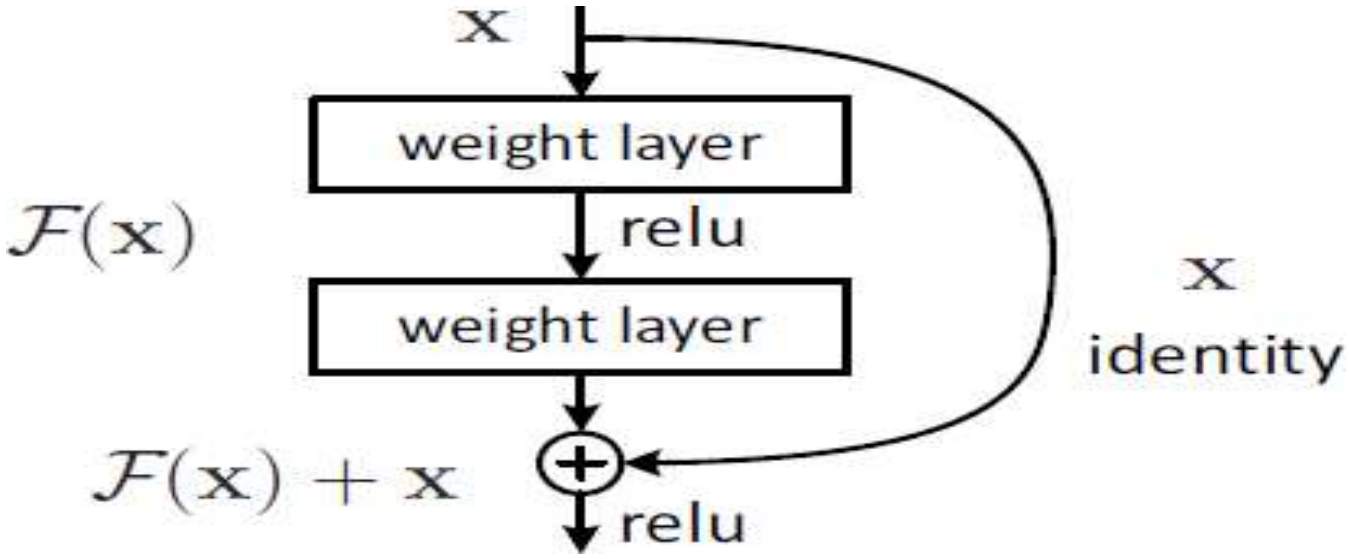
ResNet-152 model from "Deep Residual Learning for Image Recognition".

Parameters

- **pretrained** (*bool*) – If True, returns a model pre-trained on ImageNet
- **progress** (*bool*) – If True, displays a progress bar of the download to stderr

Skip Connection:

Resnet uses skip connection technique, in which output of one layer is send to input to another layer.



Hence, the output $H(x)= F(x) + x$. The weight layers actually are to learn a way of residual mapping: $F(x)=H(x)-x$. Even if there is vanishing gradient for the weight layers, we always still have the identity x to transfer back to earlier layers. Compare to another algorithms error rate is lower in Resnet algorithms.

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Error rate in Different algorithms are

method	top-1 err.	top-5 err.
VGG [41] (ILSVRC'14)	-	8.43†
GoogLeNet [44] (ILSVRC'14)	-	7.89
VGG [41] (v5)	24.4	7.1
PReLU-net [13]	21.59	5.71
BN-inception [16]	21.99	5.81
ResNet-34 B	21.84	5.71
ResNet-34 C	21.53	5.60
ResNet-50	20.74	5.25
ResNet-101	19.87	4.60
ResNet-152	**19.38**	**4.49**

Table 4. Error rates (%) of **single-model** results on the ImageNet validation set (except † reported on the test set).

Output:

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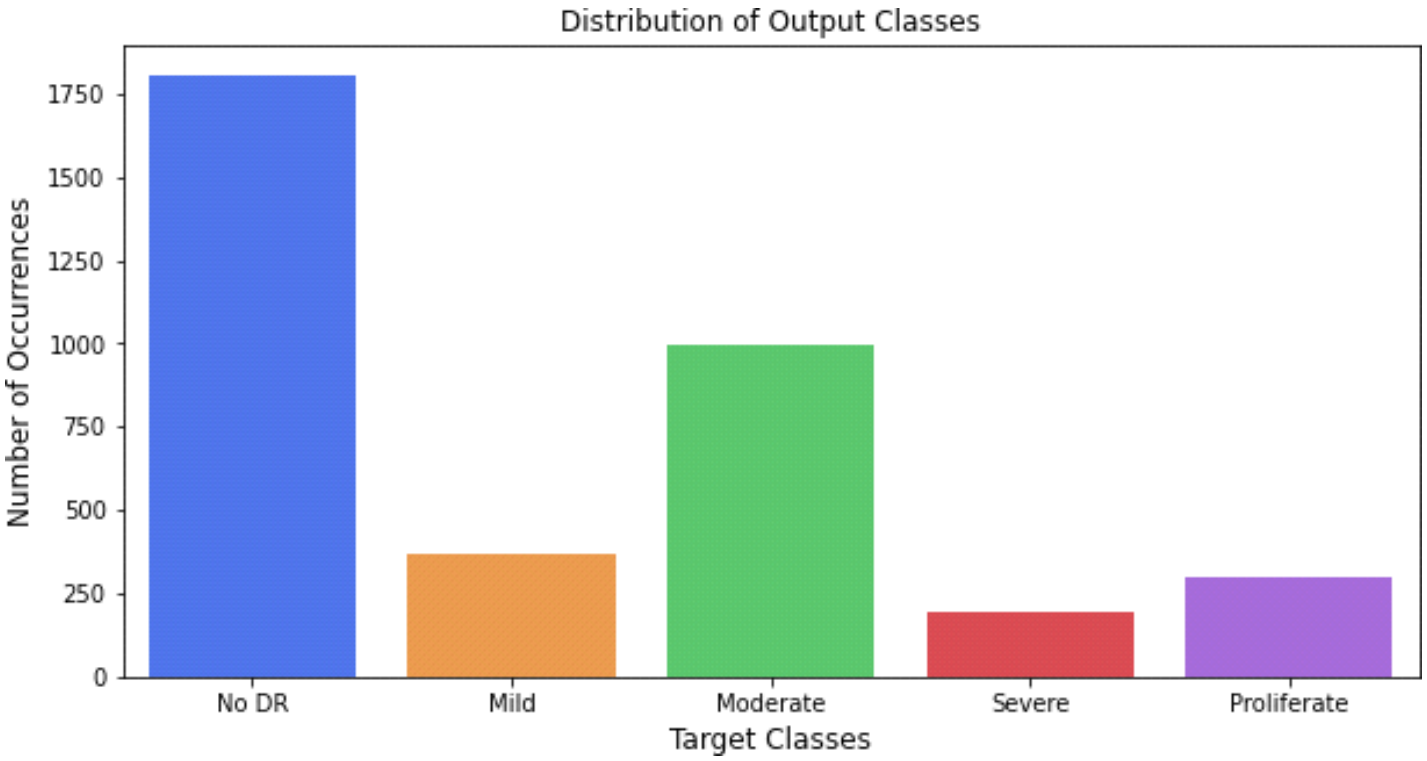

- **No DR**: Patient did not have Diabetic Retinopathy Disease.
- **Mild DR**: This is early stage of Diabetic Retinopathy.
- **Moderate DR**: In this stage some part of retinal effected by Diabetic Retinopathy.
- **Server DR**: In this stage most of the eye is effected by Diabetic Retinopathy.
- **Proliferate DR**: Total eye is effected by Diabetic Retinopathy , at this stage there is no treatment and prevention of disease, the patient will lose the vision.

ACCURACY:

Accuracy is the fraction to the number of correctly predicted values to total number of predicted values.

. This project give 90+ accuracy for 100 epoches running in training dataset.

Output graph:

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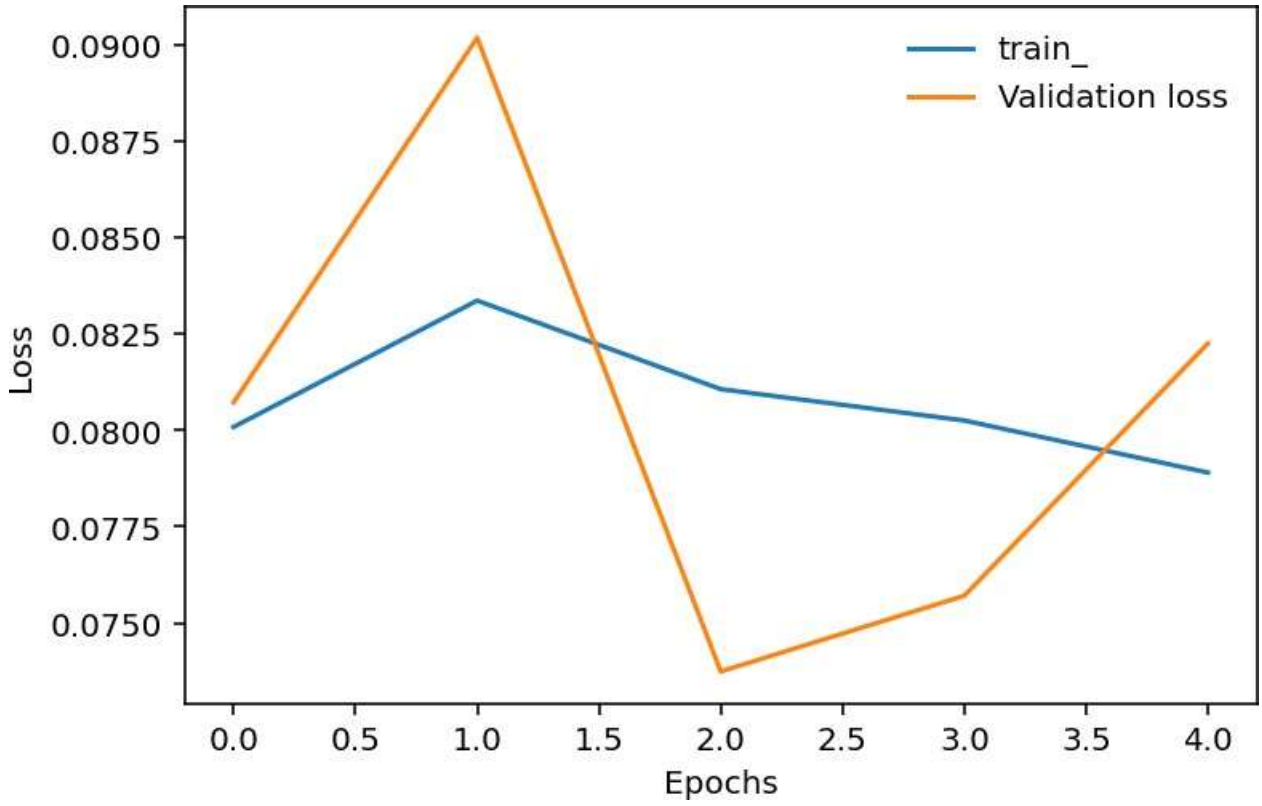

For 100 epoches it gives 97% accuracy.

Conclusion:

In this project high blood cells are detected in Retina, By detecting holes in retinal cells o fundus image ,those are remove by using preprocessing techniques. By using Resnet152 classification algorithm we are detecting different stages of Diabetic Retinopathy Disease. It will give the best results based on the dataset we are taking,We are considering Aptos-2019 -blindness-Detection,This project gives the expected results for Diabetic Patient.

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