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IS MACHINE LEARNING HELPFUL IN DIABETIC RETINOPATHY?

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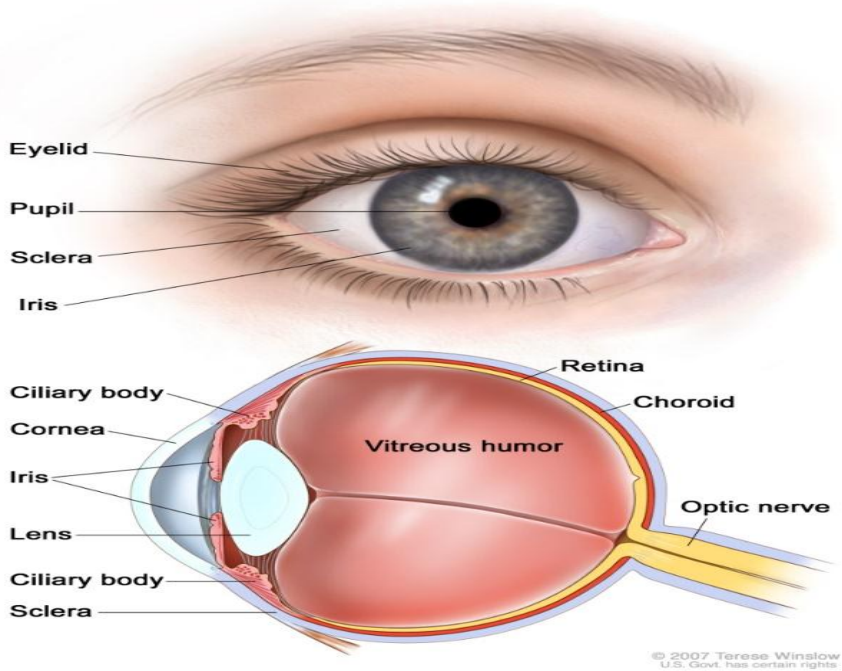
ABSTRACT

Nowadays Diabetes been the common disease in whole world and its rapidly spreading. It is happening due to modern and sedentary lifestyle, junk foods, etc. family has at least one patient of this. Why diabetes considers as dangerous disease? Because diabetes don't come alone it comes with lot of other diseases. Diabetes patient not only suffer from high sugar but also suffer through high BP, arthritis, heart diseases kidney failure, nerves and eyes. Diabetes cause damage to eyes that leads to poor vision and most severely blindness. Diabetes retinopathy is cause of blindness for people having diabetes, so we have decided to create a screening system which will help us to detect diabetes retinopathy. Since there is no cure for diabetes, because treatment just include regular medicines, exercise and diet. An eye is an important organ of our body. So in order to avoid vision loss the only solution will be early detection of it. In our project we create system which will detect if the images of that retina will have diabetes retinopathy or not. We trained our dataset to give prediction over test data and gave the accuracy over it.

I. INTRODUCTION

We hypothesized that such satisfaction should provide through Machine-learning system by evaluating color fundus photographs of the retina of patients without diabetic retinopathy and predicting whether that patient will develop mild or worse disease, symptoms in future or have a disease Regular methods of diagnosis are time consuming, which can further lead to increase in retinal complications. Due to thickening in the central part of the retina vision impairment occurs which can lead to unrepairable vision impairment. Every disease shows symptoms before coming but diabetic retinopathy may not show any symptoms at first but finding it early can help you take precaution to protect your vision.



Automated processes for the recognition of diabetic retinopathy are important for solving these problems. When high blood sugar levels damage blood vessels in the retina Diabetic retinopathy occurs Furthermore, only a small proportion of these patients require retinal intervention within 2 years, highlighting the need to identify patients at high risk of developing diabetic retinopathy and of disease progression. A Machine learning algorithm convolves an input having a defined weight matrix which is helpful to extract specific image features

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without losing space arrangement information. We initially evaluate different architectures to determine the best performing algorithm (B2G) for the binary classification task. At last we address the issue of insufficient sample size and training with inadequate data

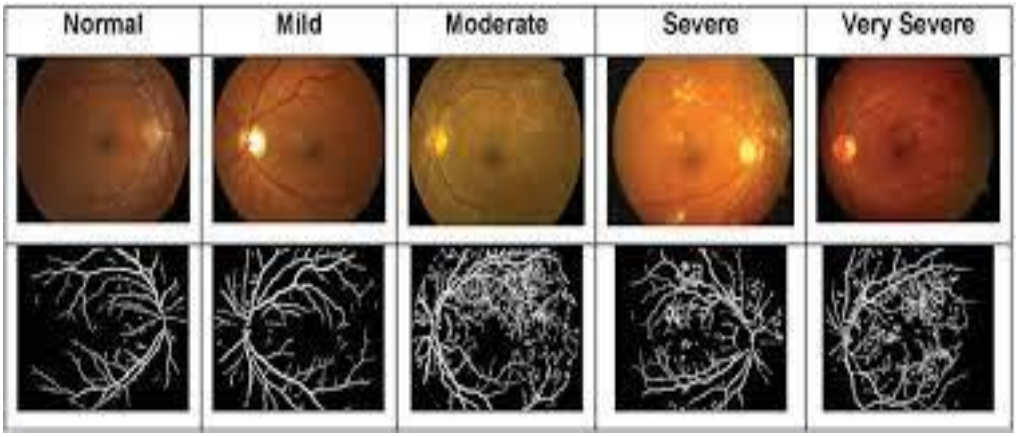
Scope:

A deep-learning system has been created that used color fundus photographs to predict the development of mild or worse diabetic retinopathy within 2 years, for patients with diabetes. Early detection is the only solution for this, therefore while screening fundus images we can do feature extraction for optic disc, vessel's also spots can get extracted.

Related Work:

Diagnosis of pathological findings in fundoscopy, a medical technique to visualize the retina, depends on a complex range of features and localizations within the image.

Images of prototypical retinal disease stages are shown in below figure.



In order to reduce the burden on ophthalmologists and diagnostic inconsistencies between manual readers computer-aided diagnosis of diabetic retinopathy has been explored. Additional methods of detecting micro aneurysms and grading DR involving KNN support vector machines and ensemble-based methods yielded sensitivities and specificities within the 90% range using various feature extraction techniques and preprocessing algorithms.

In CNN studied, the sensitivities and specificities obtained for DR fundus images are in the range of 90% for binary classification categories of mild vs. moderate or severe datasets.

II. LITERATURE SURVEY

From all the paper used for literature survey we found some solutions for problems countered while dealing with this project. Such as noise, images contrast issue, dataset issues. It used Image analysis techniques for the automated and early discovery of the Diabetic retinopathy, by the use of Image processing among many other analysis techniques for vessel enhancement. PCA is applied for improved feature selection. A survey based on algorithms for automatic detection of retinopathy while considering digital color retinal images.(preprocessing, localization and segmentation of the optic disk, segmentation of the retinal vasculature, localization of the macula and segmentation of retinopathy.

III. METHODOLOGY

The overall architecture is presented. DL has been widely used in DR detection and classification. It can successfully learn the features of input data even when many heterogeneous sources integrated

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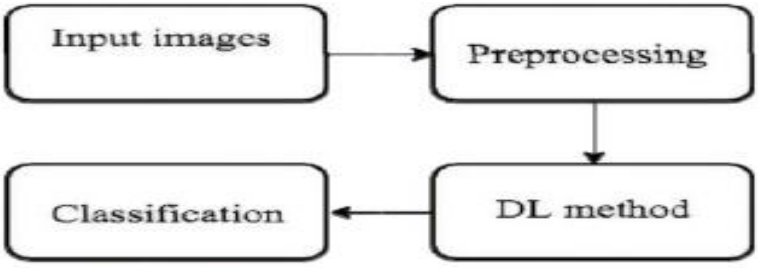

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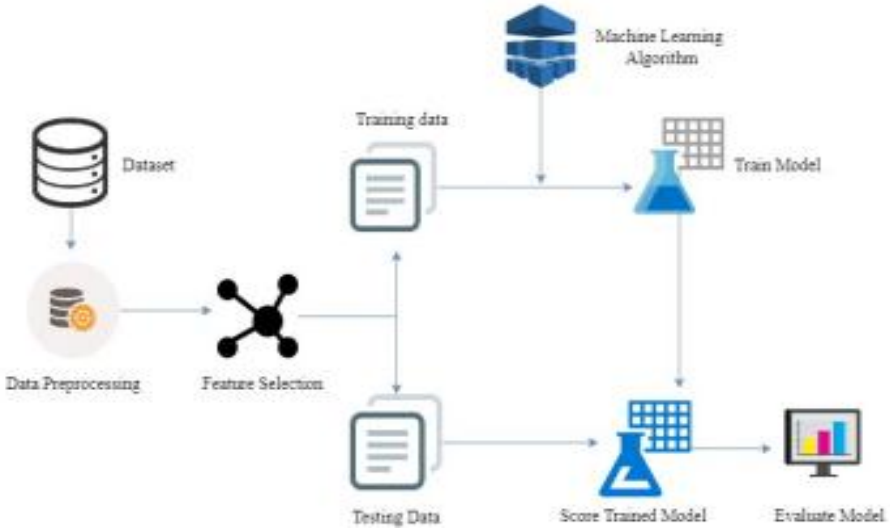
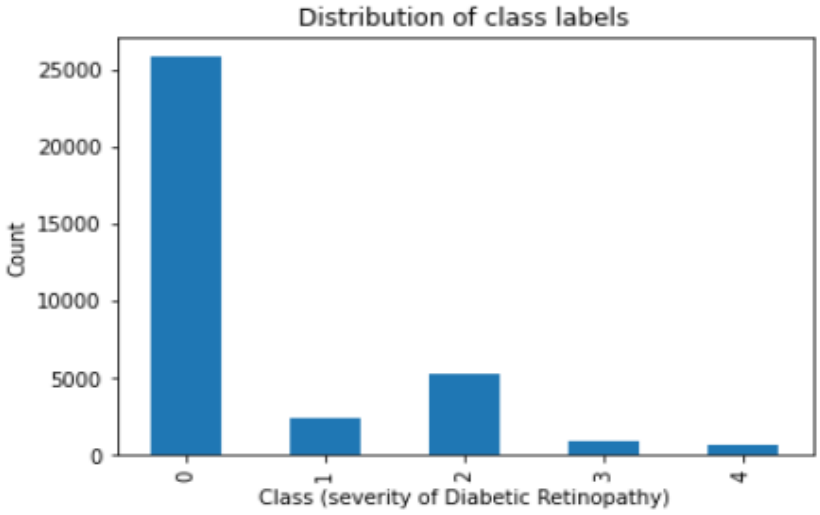


1: Basic Analysis

Fundus Images Analysis:

Fundus imaging is the process where a 2-D representation of the 3-D retinal tissues which are semi-transparent in nature are projected onto the imaging plane using reflected light. Intensity of images represents the amount of reflected light of a specific waveband.

Images are classifies on the basis of severity of diabetic retinopathy



2: Image pre-processing:

After basic Analysis, the images are then presented to the appropriate eye for viewing and the viewer's brain recreates the three-dimensional view. All images were converted to a hierarchical data format for preprocessing, data augmentation, and training.

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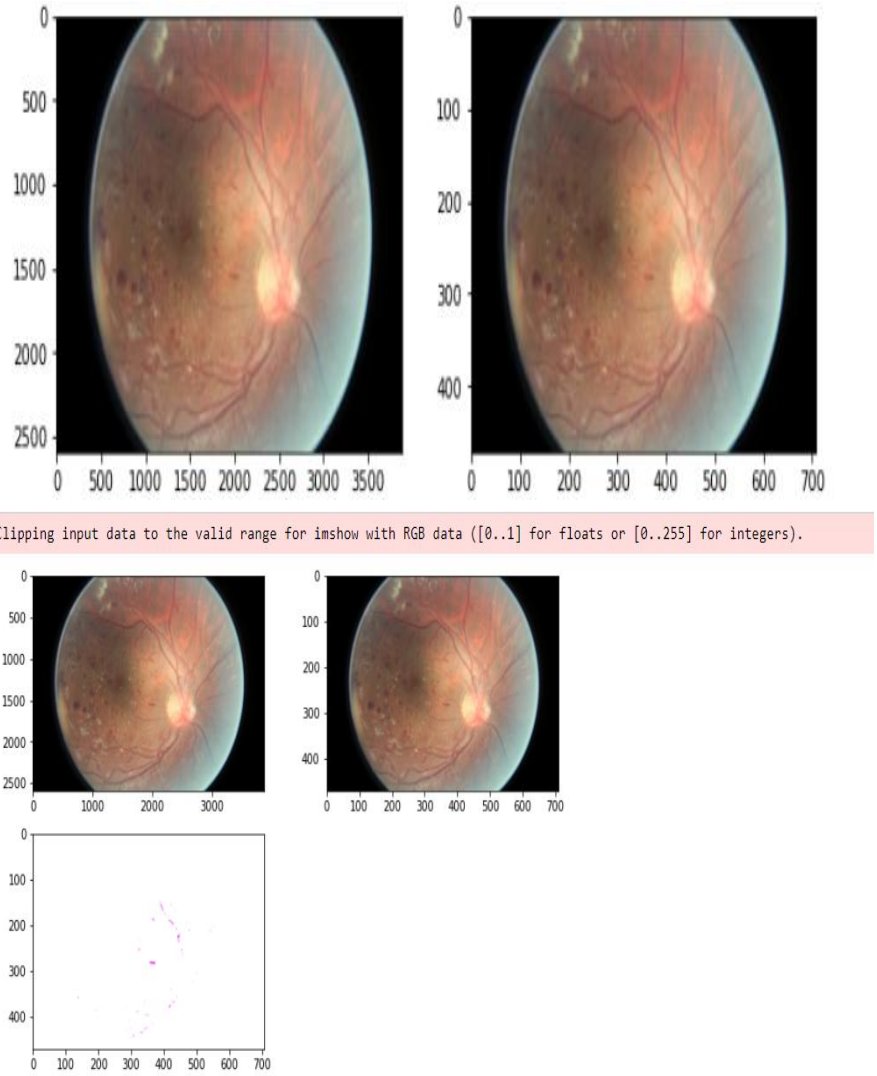
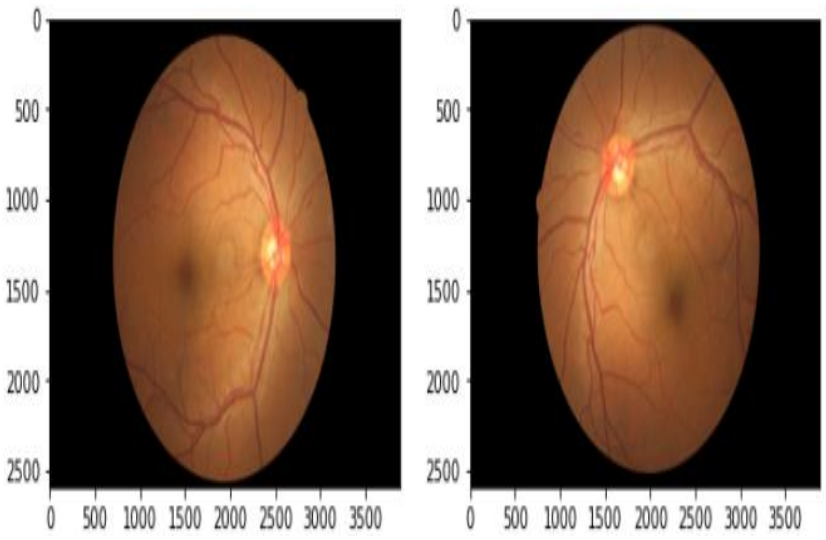


3: Evaluation:

For the training purpose, the retinal images needs to undergo more pre-processing before applying further algorithms of image evaluation Many pre-processing techniques such as contrast adjustment, average filtering, adaptive histogram equalization.We augmented the number of images in real-time to improve network localization capability and reduce over fitting.



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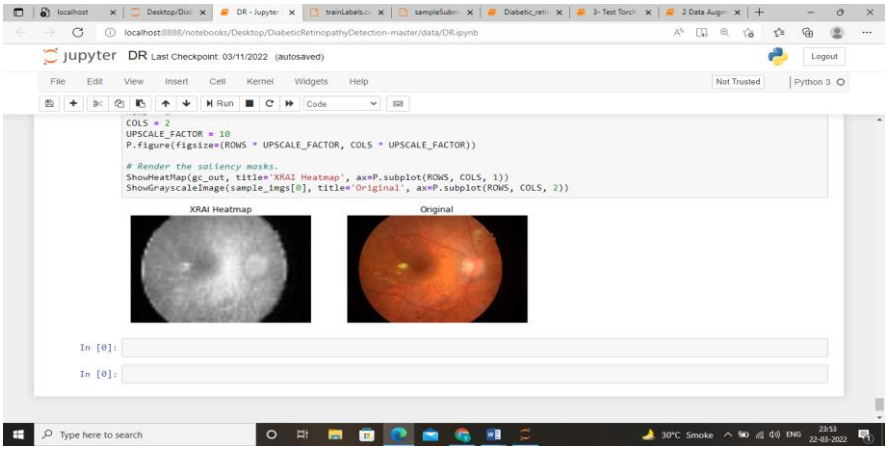
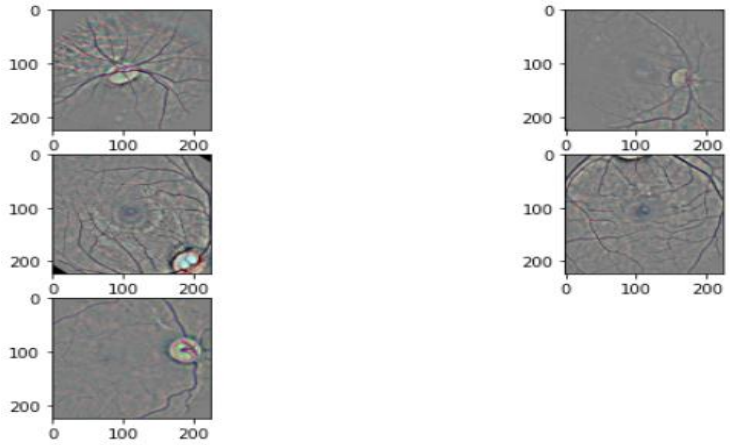


4: Feature Extraction:

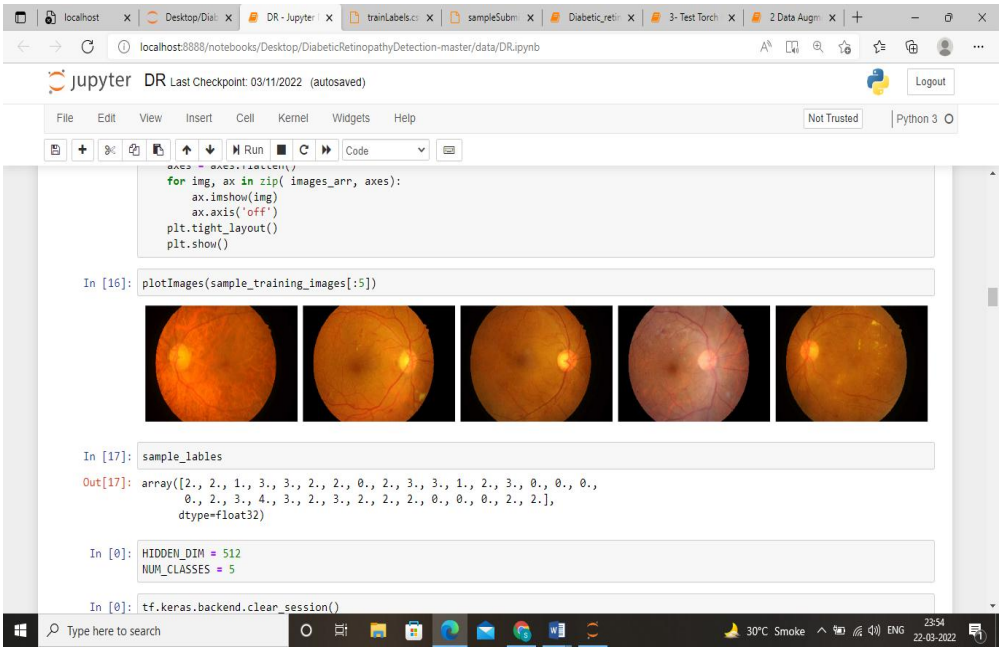
The aim of texture analysis is texture recognition and texture based shape analysis.

Feature extraction can be done in two steps.

1. Features detecting optic nerve.
2. Features detecting diseases.



5: Training Dataset



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Algorithm and Libraries:

KNN:

KNN algorithm is a supervised algorithm that deals with similarity used for machine learning. KNN acronym for K-Nearest Neighbors. It is a classification algorithm that makes a prediction over a target variable based on a defined number of nearest neighbor variables.

Libraries used for Different tasks:

Matplotlib, Numpy and Pandas for label analysis.Opencv2, PIL for importing and working on images and Matplotlib for plotting image also torch for loading and transforming image for feature extraction. For training the dataset sklearn and for applying algorithm.

Dataset:

We used image datasets to train an automated classifier for this study. We collected over 250 Diabetic retinopathy images from a Kaggle which contains 5-class labels for classification.

IV. RESULTS

- Machine learning techniques are applied on the dataset and the segregation is done using two algorithms.
- One of which is KNN as it has the highest accuracy of 90%.
- Tried these models with huge datasets with minimal or no misplaced characteristic values so that it will disclose added insight and healthier predictability.
- ML system designed include the transfer learning combined with Analysis and Preprocessing on images and then transfer learning for feature extraction. In order extract optic nerve, disc and grading of images for better view of image.
- In order to avoid model from over fitting, fixed number of iterations are used. (Like 90 in one set). We split the training dataset into two parts, train and test.

V. DISCUSSION

In DR Screening and prediction deep learning and machine learning shows high specificity and sensitivity. Here we tested on 250 images which gives AUC of 0.89 for KNN which is an excellent prediction. Using KNN for this is because it shows more accuracy over testing data than training data, unlike SVM algorithm which do exactly opposite of it. Here in my project, a review of the different techniques relating to how the DR disease could be detected at an early stage was presented .In which made use of the preprocessing, segmentation & the feature extraction scheme and Training the data and Automated detection offers an opportunity to prevent a significant proportion of vision loss .Our Solution is not 100% valid but it just an Approach to Fasten the Process of Detection of Diabetes Retinopathy and Prevention of it.

VI. LIMITATIONS

Many of them have not considered unhealthy images, high computation time, consideration of small databases, noise effects were not considered:

1: No automated optimization technique:

2: Machine learning has typically obtained promising outcomes in the domain of DR spotting and recognition, still the context of DL models is not completely known and is discriminate to be a black box.

3: Training with inadequate data

4: DL software typically needs a significant number of diabetic data for training. When the training range is limited, it cannot yield sufficient results in form of accuracy.

VII. CONCLUSION

Diabetes is one of the serious disease and its patients are increasing in number. Also it is causing other serious health issues one of which is diabetic retinopathy. Machine learning is helpful in this situation to detect it in short time. Many deep learning model were created before for DR detection. So by doing all literature survey and analysing those models, we have finalized that what problems can occur in model and how will we handle it. Finally we created machine learning system in takes dataset and pre-processed it and then transformed it for

optic nerve detection. After this training of data and KNN algorithm is used on image dataset and validated on test dataset. After all processing done model gives accuracy over 90%. Hence it helps to detect Diabetic retinopathy.

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