

Diabetic Retinopathy

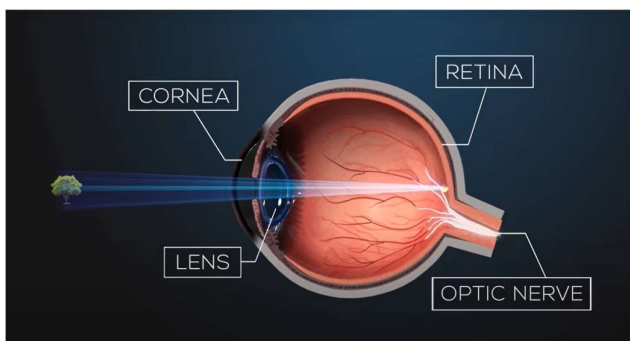
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Abstract: Over a period of time one of the consequences of diabetes could be damage to the retina of the eye causing problems with eyesight the condition is as known as diabetic retinopathy. It is common complication of diabetes. To understand diabetic retinopathy let's have look in the below image.



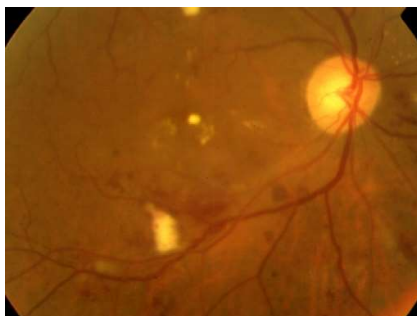
The part of the front of the eye is called the cornea, the light passes through the cornea and hits the lens, the lens focuses the light on the last of the eye onto a light-sensitive lining called a retina, before exiting the last part of the eye through the optic nerve there are blood-vessels that pass by the retina and exit the last part of the eye through the center of the optic nerve. Over time out of controlled high sugar levels can affect this blood-vessels as a result, they might leak blood or any other fluids causing swelling and damage to the retina. Before

the edges of diabetic retinopathy there are no symptoms or very mild symptoms that go unnoticed with the progression of diabetic retinopathy and the following signs and symptoms may occur. Floating in the case of your vision. Floaters are small black spots or strings that wrap around the posterior chamber of the eye through which you can see the spots. I had to face these kinds of problems, just like at night. Pain or pressure in one or both eyes. Diabetic retinopathy usually affects both eyes. According to the survey, about 1 in 10 people have diabetes and 1 in 3 people have diabetic retinopathy. It is important to find out if someone has diabetic retinopathy. If left untreated, it can cause blindness. If a person has diabetes, he can prevent or slow the development of diabetic retinopathy by taking certain medications, dieting, exercising regularly, controlling high blood pressure or high cholesterol, and avoiding alcohol and smoking, so diagnosis early and regular eye exams. Important for effective retinopathy treatment, including optimal blood sugar control through diet, exercise and medication.

Introduction: Today we are able to collect the resource to house outpatient eye doctors and there for medical technicians travel several places and collect the retina images diagnosed. Through the images they differenced the scale 0 to 4.

- 0 – No diabetic retinopathy
- 1 - Mild diabetic retinopathy
- 2 - Moderate diabetic retinopathy
- 3 – Severe diabetic retinopathy
- 4 – Proliferative diabetic retinopathy

Machine learning allows Pasadena images treating the diagnosis of new retinal images based on what model has learned idly reducing lifelong blindness in the aesthetic condition, this is faster and more cost-effective method for diabetic patients especially those deciding in rural areas. Dataset contains more than 35,000 retina images from different clinics. These images were taken with different camaras and image conditions contributing to a wider variety and noise in the dataset. In general, diabetic retinopathy is indicated by the presence of white patches in a retina or higher density of blood vessels.



This is the example of image which were in dataset. In image engineering we have to reduce the noise in the image through collagen blow sanitize the radius of the circle in each image and lastly, we place the black border in the image by the mean pixel value of a retina. The model used is convolucional neural networks. It's use for image classification. So now as we know deep-learning algorithms are used to learn from a big dataset. Several deep-learning algorithms have high specificity and sensitivity for classification or identification of diseases through

medical diagrams. DR screening is currently used in deep learning. DR screening means identifying a visually impaired patient. The patient should be referred to an ophthalmologist for treatment. There are many challenges in DR screening, including deep learning. Such as end-to-end learning and multitasking can share a multi-scale function that breaks down complex layers and on the other hand improves the effectiveness of DR assessment. Assessment is based on discovery and distribution. In Deep-Learning, we have some methods by which they provide a quality image evaluation of the site according to real-time usage. This is a very important addition to DR screening.

DEEP LEARNING:

Deep learning is a branch of machine learning that consists of a technique that contains the necessary classification layers of a nonlinear process stage which is a classification direction for unmanaged aspects. A good aspect of deep learning is the computer aided medical diagnostic method. Deep learning for medical analysis includes classification, segmentation, discovery, retrieval and image registration.

Now a days deep learning widely used in DR detection. Deep learning is best technique of learn the features of input images while there is so many heterogeneous sources integrated in the dataset. Deep learning has so many techniques like sparse coding, CNN, auto encoder, Boltzmann Machines. All these methods have one good feature like when number of trained data raises the performance of these methods will also increase. CNN is partially more used rather then other methods in the medical image analysis.

CNN:

CNN stands for convolutional neural networks. CNN architecture has three main layers (i) Convolution layers (CONV) (ii) pooling layers and (iii) Connected layers(FC). Convolution layer is convolving the image for extracting the feature. Pooling layer reduce the dimensions of the feature maps and it follow the CONV. FC is a compact feature which describe the input image. For pretraining images CNN has so many architectures like AlexNet, Inception-v3, ResNet. There is one architecture which called transfer learning it is training images very fast. So usually the process used to detect and classify images by the deep-learning method first collect data-set and by applying the useful features so images can improve. This is overall flow of the project.

Let's see how CNN works in this scenario.

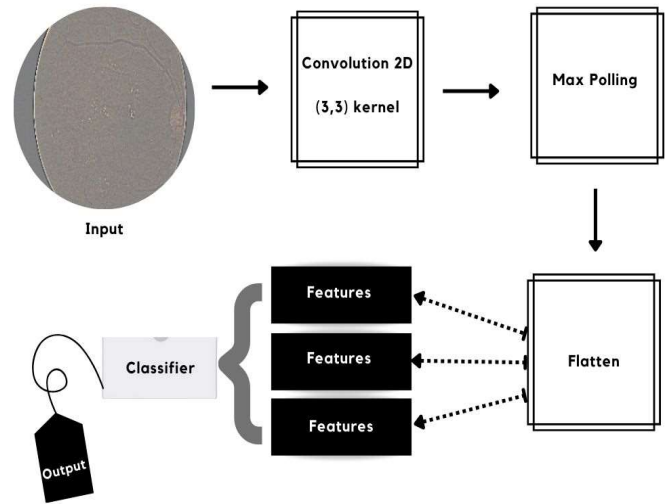
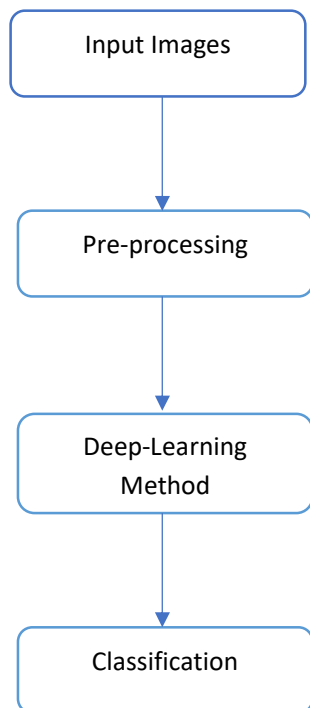
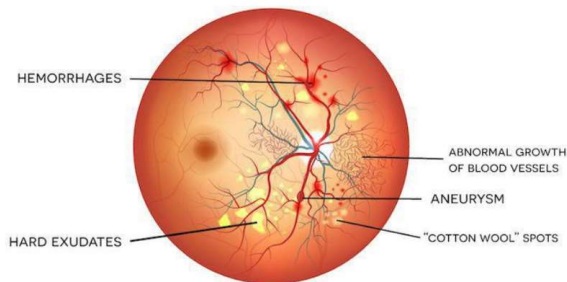
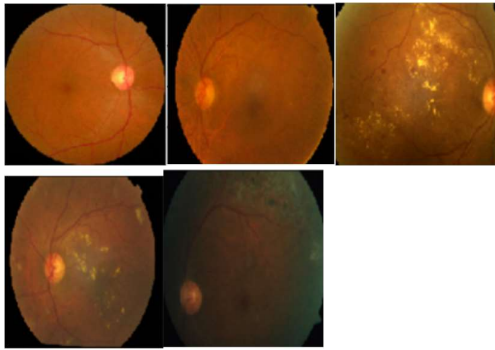


Image Processing:

In the dataset we have only retina images and those are capture by fundus photography. Fundus photography means it involve rear part of an eye. There are specialized camaras for fundus photography. Normal fundus photographs of the right eye and the left eye, seen from front so that left in each image is the to the person right. In the images we can clearly see that it contains artifacts, some of images have low focus or more exposed or less exposed also there is brightness issue also. This all aspects are affecting for predicting the resulting because of this so many issue sometimes doctor can not resolve the patient has the retinopathy or not because low quality of images.

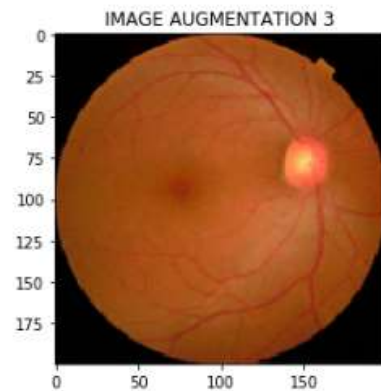
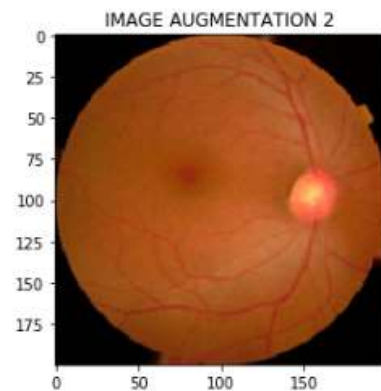
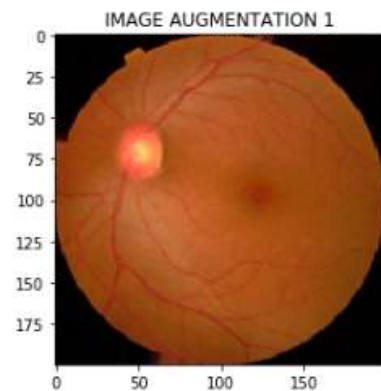




Above image is sample data of retina image of an eye which contain diabetic retinopathy. So as we discuss low quality image can't sufficient for this scenario so to solve this issue we can use some of techniques of OpenCV. We can use gaussian blur for distinctive feature in the image. Gaussian blue works like first image convolved with gaussian filter so low pass filter will remove the high frequency components. After the apply all the operation differ cent all the images in different folder and then apply TSNE visualization for convert RGB images to grey images.

Image augmentations:

With the help of Image Data Generator class generate robustness by add new images.



SVM:

SVMs are officially classified as discriminatory it is characterized by a distinct hyperplane. At the end Bye, given the preparation information (take control) The calculation gives an ideal hyperplane that adapts Example Support vector is the process of making a machine Ready to find an ideal data test is attached

group photos into their specific section specific PDR, NPDR or general. SVM is a powerful system organize and recreate information. Regulation the parameters are tested using a Bolster vector machine learning topics can be divided into drawings various classifications into composite auxiliary vectors to fit nonlinear curves into classified data, SVM use part power to outline data alternative space where hyperplane used to partitioning. Diabetes in this article retinopathy (DR) levels in humans can be identified by filtering photos of human funds for the proximity of bloodshed. SVM classified 20 funds prepared with photos view specific levels of DR. 18 for normal eyes photos are used for training and 12 photos are used as tests Set the detection rate to 86% and the infected person 10 photos and 5 of diabetic retinopathy taken before training the image is used for testing purposes and has a detection rate 82% .Table 1. Shows normal eye recognition speed figures and Pictures Affected by Diabetes.

KNN:

KNN is the machine learning algorithm which build a model only of storing the training dataset. For new input data this algorithm finds the closest point to predict the result. That's why this algorithm also known as K- nearest neighbours. KNN consider exactly one nearest neighbour which is closest which one is closest training data point for that point we have to make prediction.

DECISION TREE:

Decision trees are most commonly used for classification and regression functions. Whether the decision tree works on a different concept. The main algorithm J.R. Created by Quinlan, it works on a greedy top-down search by locating available branches without turning back. The tree can be "inflated" by dividing the source set into subsets based on the attribute value test. This process is

repeated on each of the received subsets called repeating partitions. The iteration completes if the node subset target variable has the same value or if no other value is included in the estimate during partition. The decision tree taxonomy does not require domain knowledge or parameter configuration and is therefore suitable for exploratory knowledge discovery. Decision trees can handle high-dimensional data. The overall conclusion is the exact accuracy of the tree classification. Decision tree induction is a widely used advertising method to learn classification knowledge. The decision categorizes the tree pattern and selects some leaf noodles from the tree root, producing a pattern classification. The example starts with the root node of a tree, examines the specifics of that node, and sorts the tree branch by moving it down according to the attribute value in the image above. This process is repeated for the root subtree on the new node.

GAUSSIAN NAIVE BAYES:

Naive Bayes is a simple yet effective potential classification model of machine learning that influences Bayes' theorem. Bayes' theorem is a formula that gives the conditional probability that an event A will occur when another event occurred before B. the mathematical theorem of naïve bayes is:

$$P(A|B) = [P(B|A)*P(A)] / P(B)$$

The Naive Bayes method assumes that predictors contribute equally and independently to the selection of the output class. Although the assumption of the Naive Bayes model that all predictors are independent of each other is improbable in practice, this assumption yields a satisfactory result in most cases. Naive Bayes is often used for text classification because the data level is often large.

Naive Bayes is the simplest and most powerful algorithm. Despite recent major advances in machine learning, it has proven its worth. It has been used in applications ranging from text analysis to recommendation systems.

RESULTS:

Algorithm	Training Accuracy	Testing Accuracy
CNN	94.49	72.35
CNN with SVM	99.5	71.88
CNN with KNN	86.48	72.22
CNN with Decision tree	99.5	64.09
CNN with Gaussian Naive bayes	35.09	31.47

2. <https://www.rsisinternational.org/journals/ijr-si/digital-library/volume-5-issue-1/11-13.pdf>
3. <https://www.kaggle.com/code/mahipalsingh/cnn-ml-classifier/notebook>
4. <https://www.nature.com/articles/s41467-021-23458-5>

CONCLUSION:

This article prepares SVM with the highlights of the classifier Known image, i.e. image whose DR level is now known. this process is known as SVM Classification Education. This one the test fund is attached as an SVM contribution after the photo specify the level of diabetes on the yield classified retinopathy. Early diagnosis and treatment are shown. Prevent vision loss and blindness. Retrieved by retina images The fundus camera is used to diagnose DR. For future work, Automated DR screening methods help save time and costs and the patient's view, compared to manual procedures Diagnosis.

REFERENCES:

1. <https://towardsdatascience.com/blindness-detection-diabetic-retinopathy-using-deep-learning-on-eye-retina-images-baf20fcf409e>