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Diabetic Retinopathy Detection Using CNN

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ABSTRACT
Diabetic retinopathy is one of the eye diseases which causes blindness if it left untreated.Diabetic retinopathy is a condition that may occur in people who have diabetes. Diabetic retinopathy affects blood vessels in the light-sensitive tissue called the retina that lines the back of the eye. It is the most common cause of vision loss among people with diabetes and the leading cause of vision impairment and blindness a system where we extract retinal blood vessels for detecting eye diseases. Manually extracting the retinal blood vessels is a long task there are many automated methods are available to extract blood vessels. The disease can get severe if it is not treated properly at its early stages. The damage in the retinal blood vessel eventually blocks the light that passes through the optical nerves which makes the patient with Diabetic Retinopathy blind. Therefore, in our research we wanted to find out a way to overcome this problem and thus using the help of **Convolutional Neural Network** (ConvNet), we were able to detect multiple stages of severity for Diabetic Retinopathy.

Keywords: Deep Learning, Convolutional Neural Network, Data Augmentation, Resnet, diagnose at the earliest stage.

I. INTRODUCTION

Diabetic Retinopathy is a disease which is caused due to long term diabetes. It is a ocular manifestation of diabetes and around 80 percent of population having diabetes for more than 10 or more years has some stage of the disease. Also, the longer a person is in this disease there higher are the chances of having DR (Diabetic Retinopathy) in his visual system. Researches shows that it contributes around 5% of total cases of blindness. According to 'WHO' estimation 347 million of world population is having the disease diabetes and about 40-45% of them have some stage of the disease. There are various factors affecting the disease like age of diabetes, poor control, pregnancy but Researches shows that progression to vision impairment can be slowed or averted if DR is detected in early stage of the disease. One can see large no. of population suffering from the disease but still testing is done manually by trained professionals in real life which is quite time taking and lengthy process and usually due to miscommunication and delayed results eventually leads to delayed treatment and ignorance. So, aim of the project is to provide anautomated, suitable and sophisticated approach using image processing and pattern recognition so that DR can be detected at early levels easily and damage to retina can be minimized.

Treatment of diabetic retinopathy varies depending on the extent of the disease. People with diabetic retinopathy may need laser surgery to seal leaking blood vessels or to discourage other blood vessels from leaking. Your Doctor of Optometry might need to inject medications into the eye to decrease inflammation or stop the formation of new blood vessels. People with advanced cases of diabetic retinopathy might need a surgical procedure to remove and replace the gel-like fluid in the back of the eye, called the vitreous. Surgery may also be needed to repair a retinal detachment. This is a separation of the light-receiving lining in the back of the eye. If you are diabetic, you can help prevent or slow the development of diabetic retinopathy by: • Taking your prescribed medication • Sticking to your diet • Exercising regularly • Controlling high blood pressure • Avoiding alcohol and smoking. The mainobjective of the project is to detect thediabetic retinopathy and to decrease the complication of diabetes mellitus that affect vision, and avoids swelling and leaking of fluids and blood. This project helps to detect the disease in earlier stage. It aims to train a CNN with the diabetic retinopathy images as found on the Kaggle. classify high-resolution retinal images into 5 stages of disease based on severity.

System Architecture

Figure represents our proposed system architecture. Here, In First phase I have used ATPOS 2019 Kaggle dataset from which input image is taken. Then in second phase preprocessing

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is done on the dataset so that training of model will improve. In this phase various technique like cropping, resizing, converting to gray and gaussian blur is has applied. Then in third phase of architecture feature extraction is there which includes various features like Microaneurysm, exudates, hemorrhages and blood vessels. Here, in this phase various features are extracted and the in fourth phase classification is done by detecting it has DR or No DR, Mild, Severe, Moderate, Prolificated.

Fig 1: Work Flow Diagram

Dataset

For the present project we used data sets of high-resolution retinal color images. Kaggle data set [4] was provided by EyePACS, a free platform for retinopathy screening. The data set consists of 88,696 images of 44,348 subjects, one image for each eye. The images in this dataset come from different models and types of cameras and feature very mixed quality. A clinician has rated the presence of diabetic retinopathy in each image on a scale of 0 to 4, according to International Clinical Diabetic Retinopathy severity scale (ICDR):
0 – No DR
1 – Mild DR
2 – Moderate DR
3 – Severe DR
4 – Proliferative DR

Image Pre-processing and Data Augumentation

Image Pre-processing: Image Preprocessing are the steps taken to format images before they are used by model training and inference. This includes, but is not limited to resizing, orienting, and color correction.

Image Augumentation: Image Augumentation are manipulations applied to images to create different versions of similar content in order to expose the model to a wider array of training examples. For example, randomly altering rotation, brightness, or scale of an input image requires that a model consider what an image subject looks like in a variety of situation.

Deep Learning

Traditionally, machine learning models are trained to perform useful tasks based on manually designed features extracted from the raw data, or features learned by other simple machine learning models. In deep learning, the computers learn useful representations and features automatically, directly from the rawdata, by passing this manual and difficult step. By far the most common models in deep learning are various variants of artificial neural networks, but there are others. The main common characteristic of deep learning methods is their focus on feature learning: automatically learning representations of data. This is the primary difference between deep learning approaches and more "classical" machine learning. Discovering features and performing a task is merged into one problem, and therefore both improved during the triggered by convolution neural networks (CNNs) [1], a powerful way to learn useful representations of images and other structured data. There aredifferent CNN architecture used for the study.
LetNet
One of the earliest successfularchitecture of CNNs.
Developed by Yann Lecun
Originally used to read digits in images

VGGNeT
Runner-Up in the ILSVRC 2014.
Developed by Karen Simonyan and Andrew Zisserman

ResNet
Trained on very deep networks (up to 1200 layers).
Won first in the ILSVRC 2015 classification task.

Convolution layer

The convolution layer builds an image recognition classifier whose bias and weights are based on the concept of gradient descent. That means the activation map the layer builds should be

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able to classify the image properly at the same time it should be of less error. After constructing the activation map of size 3x3, it slides the window over the entire image matrix which is called convolving and replaces the image matrix with the newvalues obtained from convolving. The output is passed to the pooling layer.

Pooling layer

The pooling layer reduces the spatial volume of the output and we use Max pooling which means we take a pool of size 3x3 from the image matrix (output of 1st layer) and finds the highest number in the pool and replace the entire pool with that highest number. Thus, by this way, we reduce the spatial volume. For first two passes we keep the pool size as 3x3 and gradually decreasing it to 2x2 in the next pass.

RELU

CNN's have a RELU layer to perform operation on elements. The output is a rectified feature map.

Flattening

This will be a brief breakdown of the flattening process and how we move from pooled to flattened layers when working with Convolutional Neural Networks.

Fully Connected layer

The fully connected input layer takes the output of the previous layers and flattens them to a single vector value. Then it applies weights to the features to classify the labels. At last, it calculates probability for each of the labels. The label with high probability will be matched for the given input image. Thus, by this way, we can get our detection and classification done.

Dropout

Dropout states how many nodes of the current layer need to be cut off or disconnected from the next layer. This is to ensure the redundancy exists naturally in the model so that no onespecific node predicts the certain class of the image.

Result Analysis

We first imported all the libraries which are required to implement Resnet50. They by using Sequential method creating a sequential model that means all the layers of the model will be arranged in sequence. Here we have imported Image Data Generator from Keras.Preprocessing. Then creating the object of Image Data Generator for both training and testing data and passing the folder which has train data to the object and similarity passing the folder which has test data to the object t. The image Data Generator will automatically label all the data .we initialize the model by specifying that the model is a Sequential model. Added relu(Rectified Linear Unit) activation to each layers so that all the negative values are not passed to the next layer. After creating the entire convolution, pass the data to the dense layer and flatten the vector which comes out of the convolutions. The output of this will be the summary of the model which got created is given below fig 2

Fig 2: summary of the model

With val_loss (Keras validation loss) and val_acc (Keras validation Accuracy), many cases can be possible like below:

- Val_loss starts increasing, val_acc starts decreasing. This means model is cramming values not learning
- Val_loss starts increasing, val_acc also increases. This could be case of overfitting or

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diverse probability values in cases where softmax is being used in output layer.

- Val_loss starts decreasing, val_acc starts increasing. This is also fine as that means model built is learning and working fine.

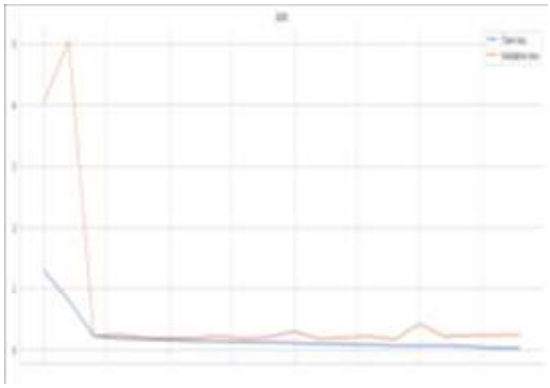

Fig :Val_loss

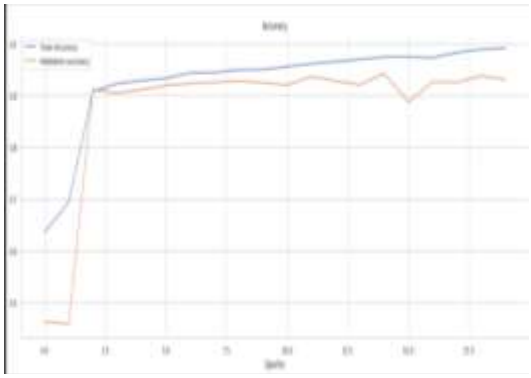

Fig: Val_acc

II. CONCLUSION AND FUTURE SCOPE

On success of our project we can quickly detect Diabetic Retinopathy with high accuracy from our trained neural network and our system will help to reduce the damage cause by diabetic retinopathy at early stage. Our report generation system will give analysis of patient's eye and will help doctors to take quick action. Our system can be further enhanced by training our neural network model on different eye disease so one can get one stop solution for all eye diseases.

In future in order to improve efficiency and better results I would like to employ below modifications in the project

- Increase size of test and training data set.
- To use better morphological analysis algorithms to get clearer features
- Retrain Eyenet Automatically.

REFERENCES

[1]. k. Simonyan and A. Zisserman, "Very deep convolutional networks for large-scale image recognition, "arXiv preprint arXiv:1409.1556, 2014.

[2]. Kaggledataset: https://www.kaggle.com/c/diabetic-retinopathydetection/data

[3]. Dataset link 2019: "https://www.kaggle.com/c/aptos2019-blindness-detection"

[4]. weightFile:"https://www.kaggle.com/datasets/alanlands23/densenet"

[5]. Diagnosing diabetic retinopathy with deep learning, Robert Bogucki, Sepetember 3, 2015.

[6]. "Severity Classification of Fundus Images for diabetic retinopathy", Jason Su, Stanford University.

[7]. Sarki, R, Michalska, S, Ahmed, K, Wang, H. & Zhang, Y, Convolutional neural networks for mild diabetic retinopathy detection: An experimental study (2019).

[8]. Alyoubi, W., Abulkhair, M, &Shalash, W, Diabetic retinopathy fundus image classification and lesions localization system using deep learning. Sensors 21, 3704 (2021)

[9]. MichaelNielsen,"neuralnetworkanddeeplearning.com/chap6.html"

[10]. Imran Qureshi, Jun Ma, and Qaisar Abbas "Recent Development on Detection Methods for the Diagnosis of Diabetic Retinopathy"