Eye Disease Identification Using Deep Learning Model

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Abstract:
Retinal fundus images are a valuable source of information for ophthalmologists to diagnose retina problems. Early detection can improve chances of cure and prevent blindness. Retinal problems like diabetic retinopathy and retinitis pigmentosa can be diagnosed using retinal fundus images by medical experts. In recent times, machine learning research has focused on diagnosing diseases like diabetic retinopathy by extracting features and then classifying the image. This paper talks about the CNN model. On the other hand, the deep learning model (CNN model) provides an average accuracy of 90%.

Keywords: Fundus Images, Machine learning, Retinal, Diabetic Retinopathy,

Introduction

Vision is one of the most important human senses, lack of which can affect productivity and independence of a person [1-2]. Retinal diseases affect millions of people and may result in loss of vision if the disease is not diagnosed and treated early [3]. Early treatment options that are available may cure or slow the onset of the disease. Patients treated get several more years of vision in their life [4-6]. In India, although there are several hospitals and eye clinics in the cities, the doctor to patient ratio is still low. In rural areas, there is lack of both infrastructure and availability of ophthalmologists [7-10]. Remote image acquisition and diagnostic It is possible to automate the process of disease detection [11] and refer the patient to the doctor for further consultation. Several such clinical decision support systems have been developed especially to diagnose diabetic retinopathy, age related macular disorder using advances in digital image processing and machine learning [12].

As mentioned above, eye detection techniques have their advantages and disadvantages. However, several researchers have used these methods to build automatic eye detection systems in recent years. Overall, there are very few review studies published in academic databases which simultaneously address all the types of eye detection. Current eye health promotion activities can benefit by drawing on experiences gained by health promotion activities in other health topics especially on the use of social research and behavioral models to understand factors determining health decision making and the appropriate choice of methods and settings. The challenge ahead is to put into practice what we know does work.

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Methodology

A set of eye images is collected and perform any pre-processing operations to make them suitable for the developed model. The model uses number of layers including pooling layer and fully connected layers as shown in the Fig. 1. The developed model is analysed in various dimensions including ROC curve and Confusion matrix.

Figure 1: Eye Disease Identification Model

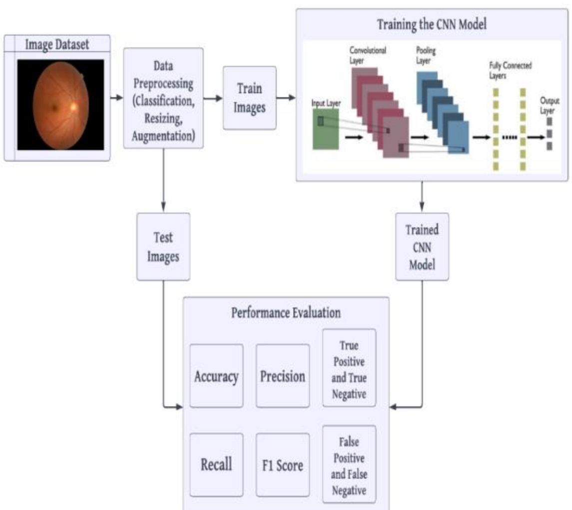


Image Input

Here, fundus image data of eight different categories is collected, each category consists of 1800 images and stored in the folder and in overall 80% of this dataset is

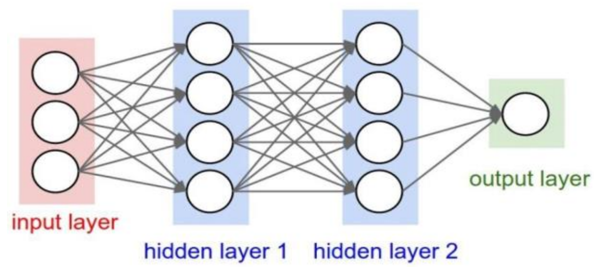
Pre-processing

This stage involves the conversion of images into suitable form, such that this can be used easily and also make it suited for a particular training algorithm. Pre-processing here mainly involves resizing of images, initially the photos were of 512x512 size then we resized it to 28x28, and data augmentation was done to increase the diversity in data.

CNN Model

Basically training/testing the data or the machine using some recognized methods like convolution neural network (CNN) or Deep Neural Network algorithm. some classification algorithms. Deep Learning algorithms are used in a variety of applications in nontraditional fields, such as: Medical, email filtering, voice recognition, computer vision (CV).

Figure 2: Eye Disease Identification

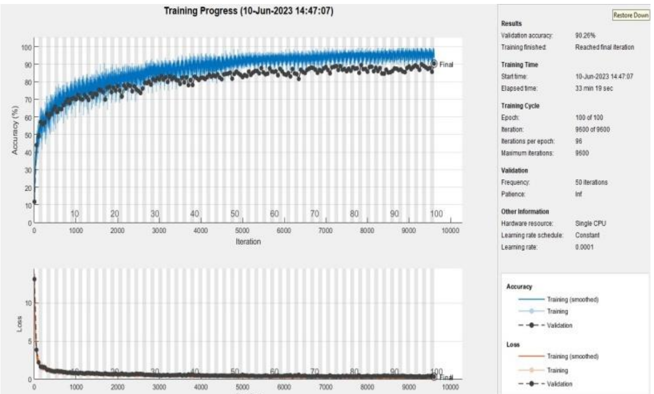


The above diagram is the eye disease identification. Machine learning algorithms construct models based on a small amount of reference data, also called training data. They can make predictions and decisions even though they are not programmed explicitly to do so. ML algorithms are used in a variety of applications in nontraditional fields, such as: Medical, email filtering, voice recognition, computer vision (CV).

RESULTS AND DISCUSSIONS

Firstly, we collected 1800 fundus image dataset of seven different diseases then we segregated them into different classes. Then the images were resized to 28x28 to process it in CNN, here the whole dataset has been randomly split into 80-20 for training and testing which means 80% of the dataset in each class which comes around 1440 images were used for training and 20% of the dataset in each class which comes around 360 images. For this set up over all accuracy was observed to be with more than 90% In each of the folds.

Figure 3: mAP plot



Confusion plots have columns that correspond to the real class and rows that correspond to the projected class (output class) (target class). Diagonal cells denote correctly detected observations. Off-diagonal cells reflect misclassified observations. The confusion plot depicts the correctness of the proposed model, which is around 90 percent.

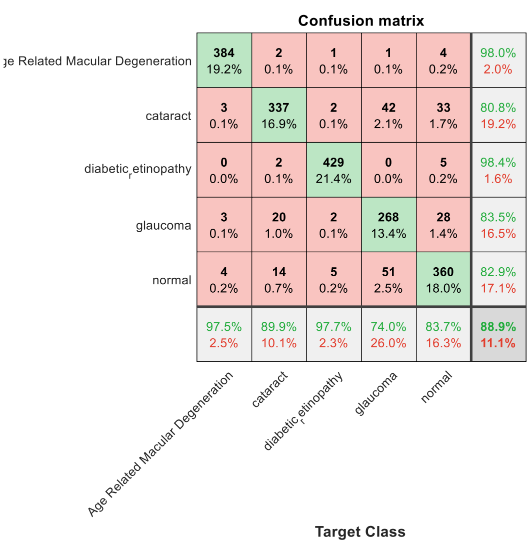


Figure 4: Confusion Matrix

The AUC is a measure of the overall performance of the model across all possible classification thresholds. Figure 5 represents the area under the ROC curve. The AUC value ranges from 0 to 1, where a value of 1 indicates a perfect classifier that can perfectly separate the positive and negative instances, while a value of 0.5 suggests a classifier that performs no better than random guessing.

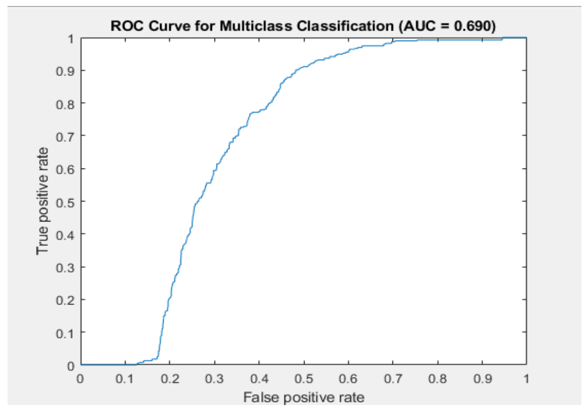


Figure 5: ROC and AUC plot

Ater 5-fold validation accuracy of respective folds are plotted as in figure 6. The highest accuracy of 96% has been observed in fold1.

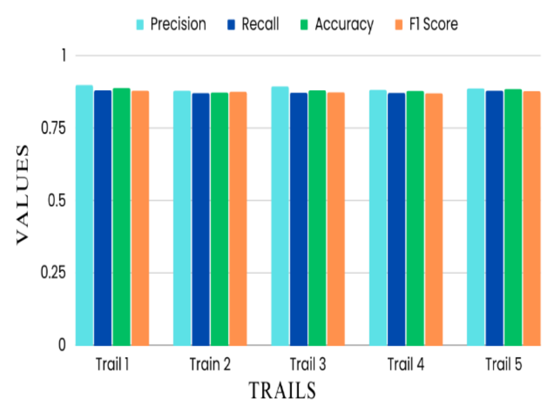


Figure 6: Accuracy for 5-fold

CONCLUSION:

The above model uses the CNN architecture for its feature extraction and classification between different diseases using folder name as labels. The model can efficiently detect different diseases with around 91 percent accuracy. CNN may be time and resource consuming although it gives consistent and precise results every time. The proposed system can be used as a proprietary diagnostic tool for the purpose of self-diagnosis or by general physicians. The proper diagnosis can lead way to a proper treatment and help prevent vision loss.

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