END SEMESTER REPORT

On

BLINDNESS DETECTION USING DEEP LEARNING

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<u>End-Semester Report (2019-20)</u>

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PROJECT TITLE: BLINDNESS DETECTION USING DEEP LEARNING

ABSTRACT

Diabetic retinopathy (DR) is a common complication of diabetes and one of the major causes of blindness in the active population. Many of the complications of DR can be prevented by blood glucose control and timely treatment. Since the varieties and the complexities of DR, it is really difficult for DR detection in the time-consuming manual diagnosis. In this Project we propose a CNN approach to diagnosing DR and accurately classifying its severity. We develop a network with CNN architecture and data augmentation which can identify the different stages of the DR. We train this network using a high-end graphics processor unit (GPU) on the publicly available Kaggle dataset and demonstrate impressive results, particularly for a high-level classification task.

Keywords – Image Classification, CNN, Object identification, Neural Networks,

INTRODUCTION

Approximately four hundred and twenty million people worldwide have been diagnosed with diabetes mellitus. The prevalence of this disease has doubled in the past 30 years and is only expected to increase, particularly in Asia.[1] Of those with diabetes, approximately one-third are expected to be diagnosed with diabetic retinopathy (DR), a chronic eye disease that can progress to irreversible vision loss. Automated techniques for diabetic retinopathy diagnoses are essential to solving these problems. While deep learning using classification in general has achieved high validation accuracies, multi-stage classification results are less impressive, particularly for early-stage disease as shown in Fig 1

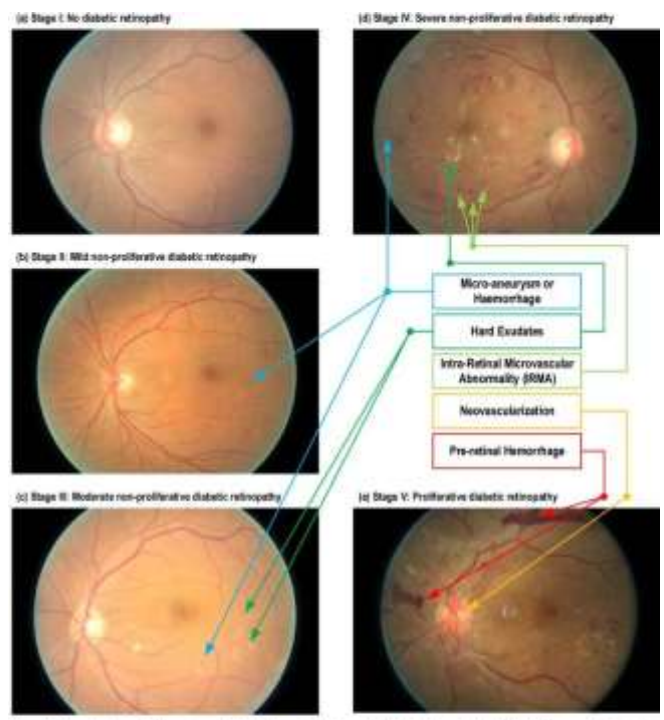


Fig1 shows some different condition of eyes

In this project we are trying to implement deep learning-based CNN method for the problem of classifying DR. We initially evaluate different architectures to determine the best performing algorithm and aim to achieve literature reported performance levels. And then seek to train multi-class models including various methods of data preprocessing and data augmentation to both improve test accuracy as well as increase our effective dataset sample size.

PROBLEM STATEMENT

- The growth of the Diabetic Retinopathy a chronic eye disease that can progress to irreversible vision loss.
- Difficulty to classify the human eye images into the different classes using the automated analysis system capable of assigning a score based on the different classes.

LITERATURE REVIEW

In the paper [2] by Alex Krizhevsky, Ilya Sutskever and Geoffrey E. Hinton the authors trained a large, deep convolutional neural network to classify the 1.2 million high-resolution images in the ImageNet LSVRC-2010 contest into the 1000 different classes. On the test data, they achieved top-1 and top-5 error rates of 37.5% and 17.0% which is considerably better than the previous state-of-the-art. The neural network, which has 60 million parameters and 650,000 neurons, consists of five convolutional layers, some of which are followed by max-pooling layers, and three fully-connected layers with a final 1000-way softmax. To make training faster, they used non-saturating neurons and a very efficient GPU implementation of the convolution operation. To reduce overfitting in the fully-connected layers they employed a recently-developed regularization method called “dropout” that proved to be very effective. They also entered a variant of this model in the ILSVRC-2012 competition and achieved a winning top-5 test error rate of 15.3%, compared to 26.2% achieved by the second-best entry.

In the paper [3] by Matthew Zeiler and Rob Fergus they researched large Convolutional Network models which have recently demonstrated impressive classification performance on the ImageNet benchmark (Krizhevsky et al., 2012). In this paper they address both issues. They introduce a novel visualization technique that gives insight into the function of intermediate feature layers and the operation of the classifier. Used in a diagnostic role, these visualizations allow them to model architectures that outperform Krizhevsky et al. on the ImageNet classification benchmark. They also perform an ablation study to discover the performance contribution from different model layers. They showed that ImageNet model generalizes well to other datasets: when the softmax classier is retrained, it convincingly beats the current state-of-the-art results on Caltech-101 and Caltech-256 datasets.

OBJECTIVES

With our project we are trying to achieve following objectives:

1. Image classification using deep learning-based CNN model.
2. Performance Analysis of trained model.

METHODOLOGY

Image classification deals with understanding the images and their context with respect to the categories. In order to group a set of data into different classes or categories, the relationship between the data and the classes into which they are classified is understood by the machine learning algorithms.

- Deep Learning gains popularity due to its supremacy in terms of accuracy over image classification[4]. Here are two graphs depicting the difference between traditional machine learning and deep learning as shown in fig 2.

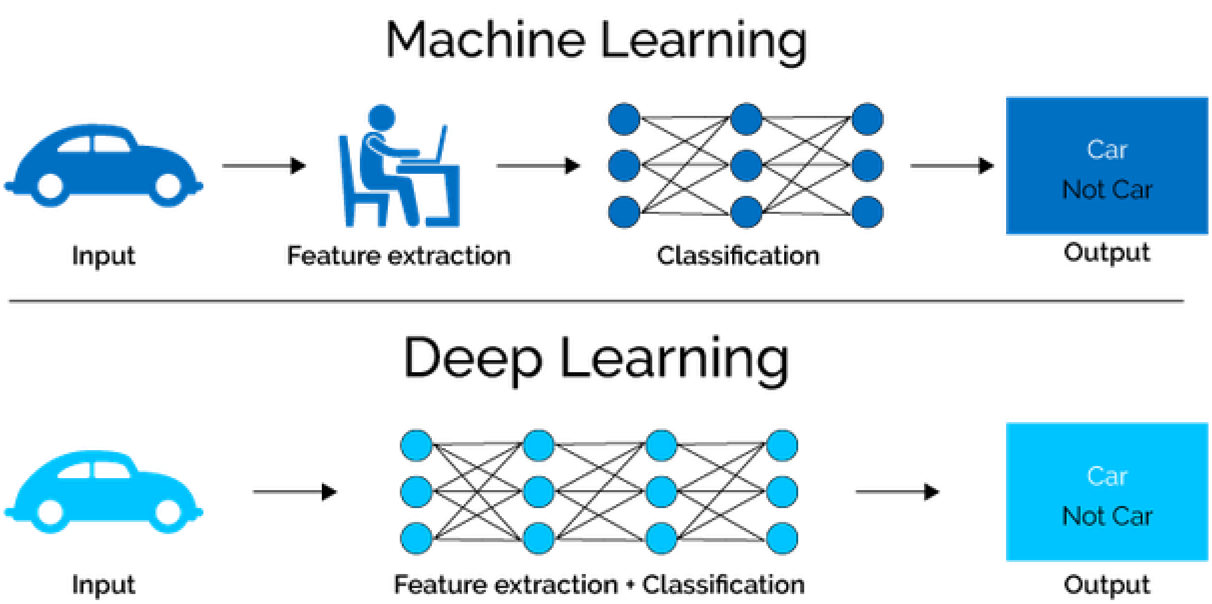


Fig 2 Difference between Machine learning and Deep learning

Reducing lighting-condition effects: as we will see, images come with many different lighting conditions, some images are very dark and difficult to visualize.

As shown in figure 3 this project include these 3 major steps:-

1. Features extraction.
2. Image classification - which deals with understanding the images and their context with respect to the categories. In order to group a set of data into different classes or categories, the relationship between the data and the classes into which they are classified is understood by the deep learning algorithms.

For the Classification we used Python syntax for this project. As a framework we are trying used Keras, which is a high-level neural network API written in Python After the classification we check its Performance Analysis of trained model.

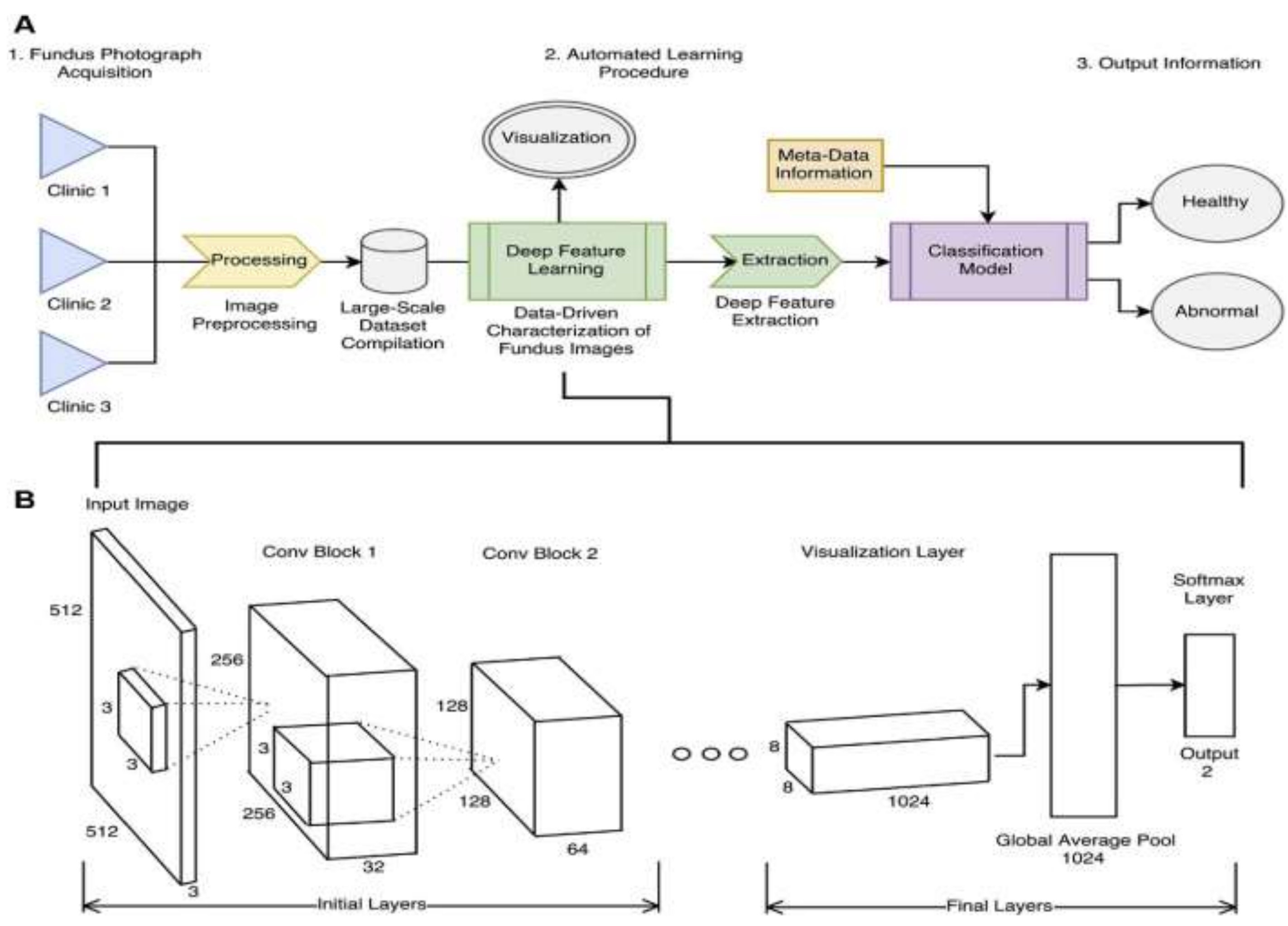


Fig 3 Mechanism of Deep Learning

In this Project, we are using the iterative lifecycle model, in this model the development begins by specifying and implement just part of the software, which is then reviewed in order to identify supplementary requirements. Moreover, in the iterative model, the iterative process starts with a simple accomplishment of a small set of the software requirements, which iteratively enhance the developing versions until the complete system is implemented and ready to be deployed as shown in fig 4.

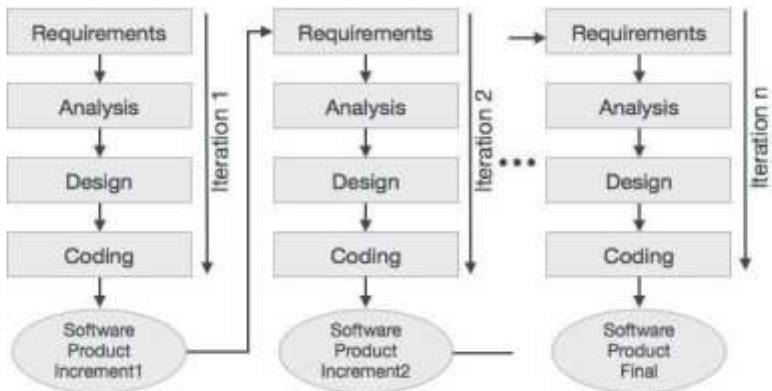


Fig 4: Iterative SDLC

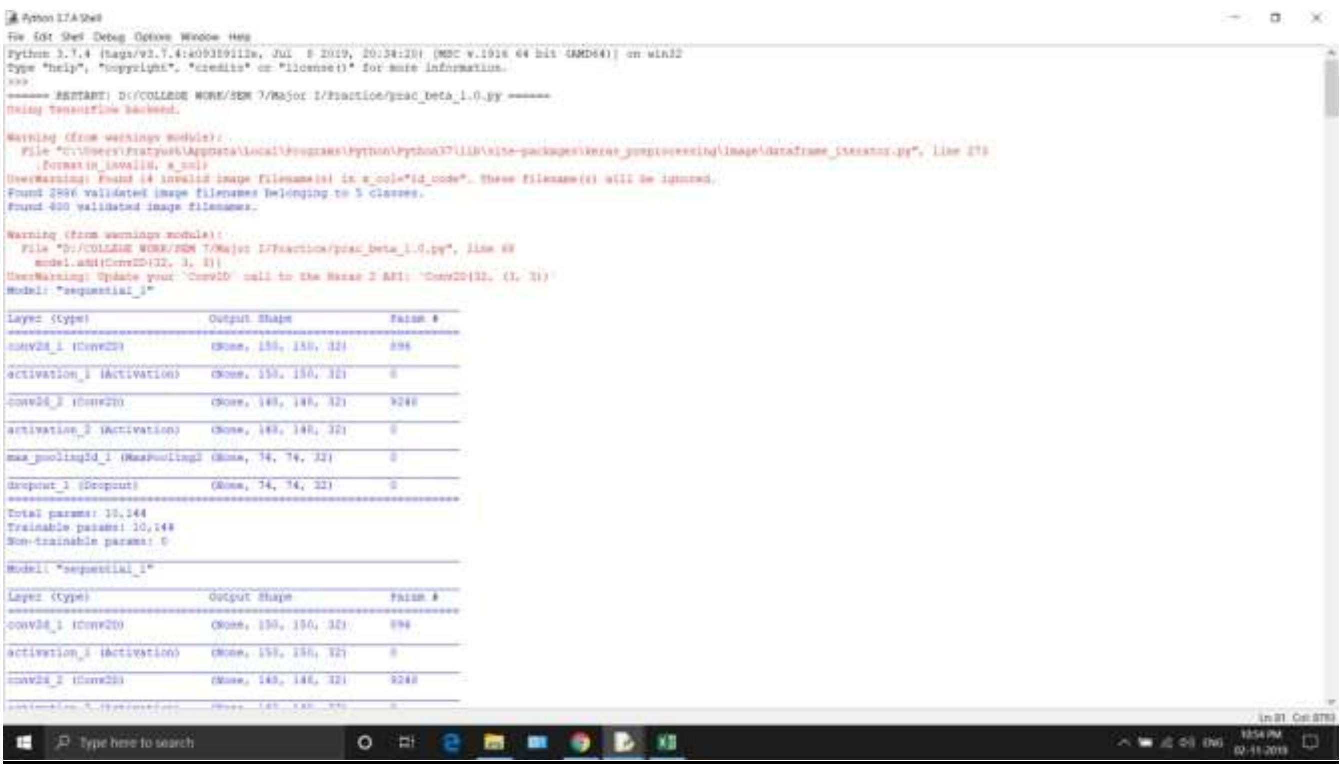
<u>CODE METHODOLOGY –</u>

1. Split the data into train and validation dataset and define the parameter like train_data,validation_data,train_sample,batch_size etc.
2. Check the image data format.
3. Define the image data generator and train generator.
4. Define the validation generator.
5. Add the model in neural network with convolutional, activation, dropout, pooling and normalization layers.
6. Add dense and output layers with an output function such as softmax.
7. Compile the model and test for unseen data and the check the accuracy of validation data and the training data.

CONCLUSION

1. CNN model was implemented and images are classified.
2. Training accuracy of the model achieved is 68.37 and validation accuracy of 72.39.

Screenshots



SYSTEM REQUIREMENTS

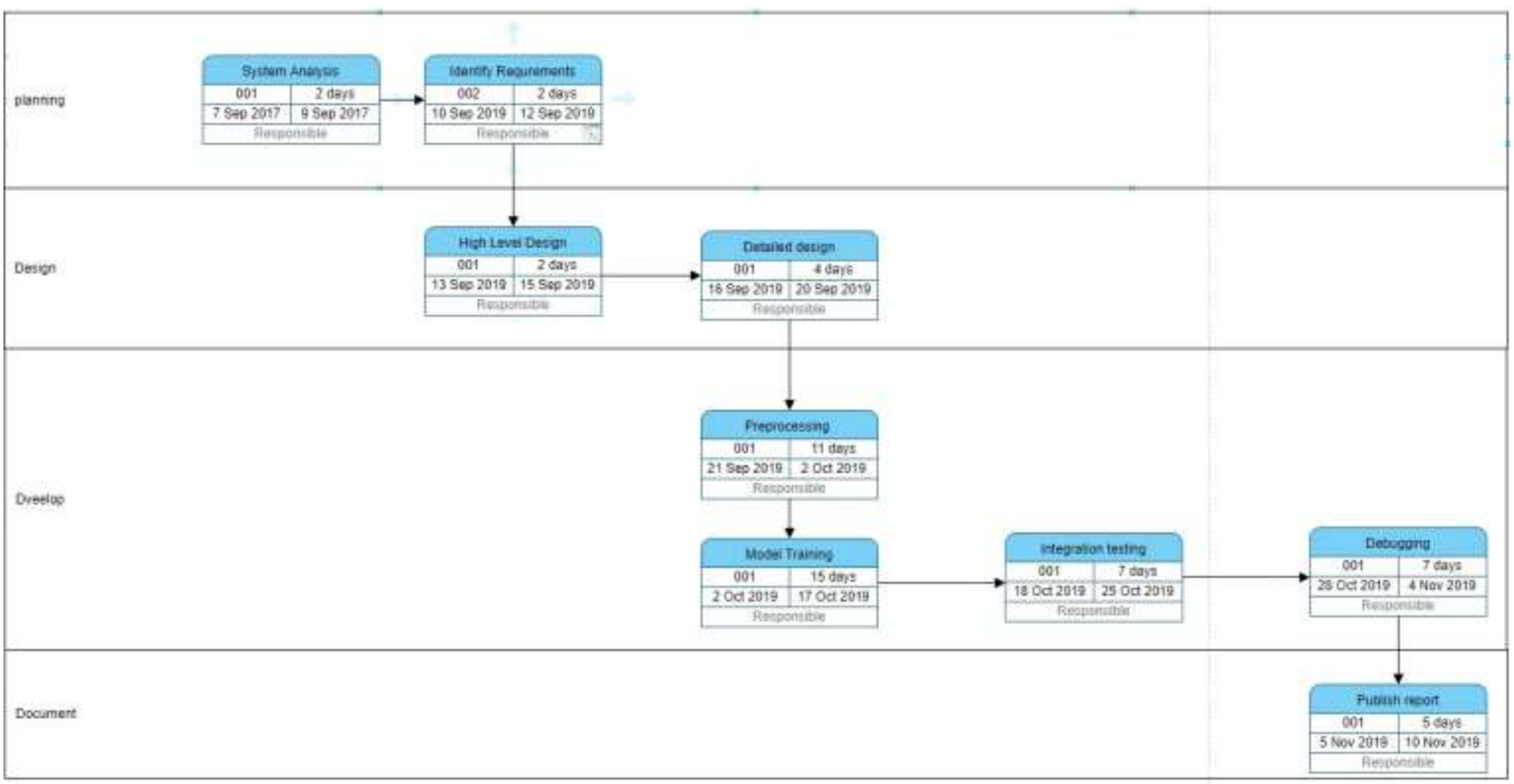
Hardware Interface:

- i5 5th Gen and above processor supported by windows 10.
- Minimum RAM requirements for proper functioning of latest windows 10 is 12 GB.
- NVIDIA GTX Series graphics card which is also equivalent to AMD ryzen series

Software Interface:

- The system is developed in ‘python 3.0+’ and Anaconda Python distribution
- Windows 10

SCHEDULE



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[4] https://towardsdatascience.com/aptos-2019-blindness-detection-520ae2a4acc

<u>Mid-Semester Report Draft verified by</u>

Project Guide **(Name & Sign)**	**HOD** **(Dept. of Systemics)**