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Diabetic Retinopathy Detection using DeepLearning Techniques

M. Abirami[1], M. Vignesh[2*], K. Vikramsriram[3], E. Shivanithyesh[4]

[1]Assistant Professor, Dept. of Computer Science and Engg., Panimalar Institute of Technology, Chennai, India
[2,3,4]Student, Dept. of Computer Science and Engineering, Panimalar Institute of Technology, Chennai, India

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***Abstract*:** There are several deep learning techniques that are used to perform the predictive analytics over big data in various medical tasks. Predictive analytics in medical healthcare is a challenging task yet ultimately helping the practitioners handle big data-informed timely decisions about patient's medical health and treatment. This paper discusses the predictive analytics in healthcare. Patient's medical record is obtained for experimental research. The two architectures of deep learning are implemented. Performance and accuracy of these applied algorithms are implemented and compared. Different deep learning techniques used in this research that reveals which algorithm is best suited for the prediction of diabetes over the patient. This paper aims to help doctors and practitioners in early stage to predict diabetic retinopathy using deep learning techniques.

***Keywords*: Dataset, ResNet, Convolutional Neural Network.**

1. Introduction

Healthcare industry is a very large and sensitive meta data and must be carefully handled. One of the growing extremely fatal diseases all over the world is Diabetes Mellitus. Medical professionals require a reliable prediction system to diagnose this disease. Some of the useful deep learning techniques for examining the data from diverse perspectives and synopsizing it into valuable information. The accessibility and availability of huge amounts of data are able to provide us useful knowledge unless certain data mining techniques are applied to it. The main goal to this is to determine new patterns and interpret these patterns to deliver acute significant and useful information for the process. Diabetes may leads to heart disease, kidney disease, nerve damage, and blindness. Diabetes data mining in an efficient way for a crucial concerns. The data mining techniques and its way be discovered to create the appropriate approaches and techniques for an efficient classification of Diabetes dataset and in extracting it data patterns. In this study, medical bioinformatics analyses is done in diabetes prediction. The WEKA software is employed as a mining tool in diabetics diagnosis. The Pima Indian diabetes Data base was acquired from UCI repository that used for future analysis. The dataset was researched and analyzed to build an effective model that used to predict and diagnoses diabetes disease.

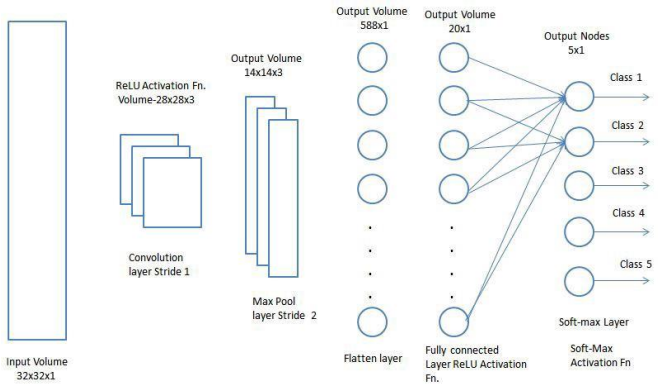
Diabetic Retinopathy may be a complication of diabetes that's caused thanks to the changes within the blood vessels of the retina and is one among the leading causes of blindness in the developed world. Up to this , Diabetic Retinopathy remains screened manually by ophthalmologist which may be a time consuming process and hence this paper aims at automatic diagnosis of the disease into its different stages using deep learning. In our approach, we trained a Deep Convolutional Neural Network model on an outsized dataset consisting of around 35,000 images to automatically diagnose and thereby classify high resolution fundus images of the retina into five stages supported their severity. Within this paper, an application system is made which takes the input parameters because the patient's details along side the fundus image of the attention . A trained deep Convolutional neural network model will further extract the features of the fundus images and later with the assistance of the activation functions like Relu and softmax along with optimizing techniques like Adam an output is obtained. The output obtained from the Convolutional Neural Network (CNN) model and therefore the patient details will collectively make a uniform report. In this study, we aim to apply the bootstrapping resembling technique to enhance the accuracy and then applying ResNet, CNN and compare their performance. The idea of Machine learning is to predict the longer term from past data. Machine learning focuses on the event of Computer Programs which will change when exposed to new data and therefore the basics of Machine Learning, implementation of an easy machine learning algorithm using python. It feed the training data to an algorithm, and therefore the algorithm uses thistraining data to offer predictions on a replacement test data.

Fig. 1. Process of machine learning

Machine learning are often roughly separated in to three categories. Supervised learning program is given to both the input file and therefore the corresponding labelling to find out the info that has got to be labelled by a person's being beforehand. Unsupervised learning has no labels. It is directly fed to the learning algorithm. This algorithm has got to discover the clustering of the input file. Finally, Reinforcement learning dynamically interacts with its environment and it receives positive or feedback to enhance its performance.

Deep learning is a part of machine learning in artificial intelligence that has networks able to adapt in learning unsupervised data that are unlabeled or unstructured . This proess is otherwise known as deep neural learning or deep neural networks.

The Deep Learning consists of an algorithm called Convolutional Neural Network(ConvNet/CNN) which gets the input image, assign importance (learnable weights and biases) to various aspects/objects in that image and be able to distinguish one from the other. The pre-processing required in a ConvNet is much lesser as compared to the other classification algorithms. In Deep Learning primitive methods filters are hand-engineered that comes with enough training, Convolutional Networks have the ability to learn these filters/characteristics.



2. Existing System

Apart from a binocular model for the various classes of Diabetic Retinopathy detection task is also trained and evaluated to further prove the effectiveness of the binocular design. The final result shows that, on a 10% validation set, the binocular model achieves a kappa score of 0.829 which is higher than that of existing non ensemble model. In the end the analogy between confusion matrices obtained through models with paired and unpaired inputs is performed and it demonstrates that the binocular architecture does improve the classification performance.

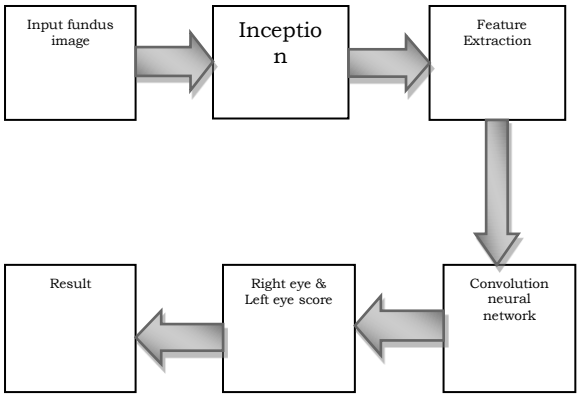
3. Proposed System

The proposed model implements CNN for the automated DR detection. Several stages of DR are classified such as normal, moderate NPDR swelling, mild NPDR- small areas of balloon like swellings in the retinal blood vessels ; distortion of blood vessels, severe NPDR- Blocked blood vessels can cause abnormal growth factor secretion, PDR- growth factors induce proliferation of new blood vessels in the inner part of the retina. Colored fundus images are implemented as the input to the CNN model. CNN removes disortednoise to recognize the improvement like exudates from the fundus images micro-aneurysms. The accuracy of around 95% is achived in this meathod for a classification od two classes that is the model detecting the presence of DR at an accuracy of 85% for a 5 class classification which is present in the DR then it's severity is also obtained. The classification of diabetic retinopathy has been regarded as a crucial step in the management of evaluation. vision impairment or even irreversible blindness are lead by inadequate treatment in diabetics.

Fundus images are examined and are dragonized to fine the disease. Deep CNN reduces the complexity of the neural network, so it is widely used in deep learning. The model for training the CNN model are some set of images in the training

database is passed to those modles. The convolution layer of convolutional neural networks will brings out features from the source image. The obtained features are made under sampled to lessen the dimensionality of the obtained features so as to get further important features by the pooling layers. These aspects are flattened by the flatten layer into a vector that creates the input to a totally connected layer. Totally connected layer joins all other layers in the model and activation of analysis is done. This is so crucial for the efficiency of stage wise classification.

4. Architecture Diagram



5. Implementation of Modules

A. Module description

1) Data collection and preparation

- The Kaggle Diabetic Retinopathy Detection mission dataset includes vibrant fundus photographs which can be categorized zero, one, two, three or four for ordinary, slight, mild, extreme and prolific DR, consecutively.
- We have lowered the DR classification into binary lessons.
- A subset, of size 3662 fundus images, of the publicly available Eye Pacs dataset that is uploaded on Kaggle Diabetic Retinopthy Detection challenge was used for model training and testing.
- For neural network model training, 2600 images were selected from the normal fundus images dataset for the healthy class, and 330 images were selected from each of the remaining four classes and put in the unhealthy class.
- For neural network model testing, 732 fundus images were selected from the normal dataset for healthy class and for the unhealthy class.

2) Image Preprocessing

- The fundus images were cropped from the middle snap shots to do away with the black surrounding pixels using Opencv Python.
- After cropping, the images have been resized to 300x300.
- The neighborhood average was deducted from each pixel.
- A sample end result of the photograph reprocessing performed at the fundus images could also be visible.
- Jupyter IDE was used for picture preprocessing.

3) Convolutional Neural Network

- Transfer learning method is a mostly implemented training methods of convolution neural network.
- By uploading the weights of Inception blocks pre-trained on Image Net data set, the model would hava a better weights initialization before making the gradient optimization.
- Moreover, considering the huge variation between the Image Net dataset and the fundus images data set, none of layers in weight-sharing Inception blocks are been frozen

4) Matching Score

- The confusion matrices of predicted results of left eye, right eye, and both eyes together.
- The predicted results of the left eye and the right eye have very similar distribution patterns, indicating that the data partition method preserves the original image categories distribution of left eyes and right eyes.

6. Conclusion

The detection process starting from data collection and processing, image preprocessing and finally convolutional neural network model building and evaluation along with the best accuracy on public test set being the higher accuracy score as a result provides great insights about the detection of the diabetic retinopathy disease. Early detection of diabetic retinopathy is of very important for the patient to reduce its impact and to take the necessary preventive remedies avoiding its occurrence in the future. Therefore, this prediction model is presented to improve the accuracy of occurrence of a diabetic retinopathy with the scope of early detection under the aid of artificial intelligence.

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