Deep Learning Neural Network with Semi supervised Segmentation for Predicting Retinal and Cancer Cell Diseased Images.

Veena Chandran, Dinesh Kumar A, Geetha P.K,Nidhya R

Abstract—**In medical field, diagnosis of diseases competently carried out by using the image processing. So that to retrieve the relevant data from the amalgamation of resulting image is too difficult. Here the segmentation done by semi supervised learning then the result is tuned by using Deep Learning Neural Network. Higher tuning of results will leads to efficient detection of disease. The experiment done by using retinal image data sets in order to predict any disease affected or not. The aim of this paper is to keenly predict diseased image or not by the efficient tuning of image.**

Keywords—segmentation; semi supervised learning; Neural network; Deep learning neural network.

I. INTRODUCTION

Nowadays diseases related to eye are increasing and many people fell in to blindness. Image processing is the area which leads with image analysis and which involves the study of feature extraction, segmentation and classification. The process of recognizing the patterns that are used to the performance of an image .Diabetic retinopathy one of the complicated disease which affects to the retina and outcome is the total blindness. The technique segmentation is the method of identifying regions of pixels in an image so as to find out the correlation with objects. The programmed mining of blood vessels in retinal images is one of the important step in computer aided diagnosis and treatment of diabetic retinopathy, glaucoma, arteriosclerosis, obesity, retinal artery occlusion and hypertension. Segmentation can be done by supervised, unsupervised or semi supervised. Here using semi supervised segmentation method because of easy to use labeled data and unlabeled data together. Semi supervised segmentation have much applications in medical image data sets. To efficient tuning purpose, the segmented output classified under the neural network. Neural Network has good performance in non linear data bases such a way that multi-layer neural network could accurately estimated to any linear or non-linear capacity. Through tuning the incomplete data , can achieve the estimate prediction of the whole data with the generalization capability of neural network. By using neural network easy to store information of the continuous quantity ,by using adjacent sampling points relationship. Neural network store the continuous quantity so as to reduce the amount of storage space. For analysis of medical images , we can consider the ideal storage medium for the continuous quantity is the neural network. In neural network deep learning neural network is an advanced methodology for better tuning of image. The architecture composed of multiple non linear transformations which could be able to learn deeply with high level abstraction.

II. COMPARATIVE STUDY

The authors Ahmed Hamza Asad, Ahmad Taher Azar, Mohamed Mostafa M. Fouad and Aboul Ella Hassanien proposed the[5] Ant colony system for retinal blood vessel segmentation. The automated extraction[5] of blood vessels in retinal images is a major step in early diagnoses of diabetic retinopathy. Authors presents an approach for automatic segmentation of blood vessels in retinal images using[5] ACS based on features that are simple, fast in computation. The method improves the features by adding new discriminant feature which is selected by CFS heuristic[5] within the best features set. Based on Euclidean distance[5] improves the performance based on probability theory.

The method for detection of brain tumour in MRI images focused to mean shift segmentation[4]. The author Vishal B Padole[4] established Mean shift algorithm is an efficient method of clustering, which segments the magnetic resonance image (MRI) into multiple separated regions having homogeneous properties[4]. Then on using Ncut method on MRI[4] it need more time for segmentation because of more graph nodes are developed which causes the issue to solve this algorithm. Here an image segmentation algorithm has been implemented and it is based on the conventional mean shift algorithm[4] and Ncut algorithm[4].

The method multi column deep neural network for image classification[3] by the author Dan Cires¸an ,Ueli Meier and J¨urgen Schmidhuber introduced the segmented output can be processed under deep learning neural network [3] and will acquire high accuracy of result. Here[3] multi column deep neural network used for recognizing characters, traffic signals etc. Deeply learning process enhances the neural network tuning capability and resulting high performance.

Jason Weston, Fr´ed´eric Ratle and Ronan Collobert[2] introduced very useful two methods together such a way that semi supervised segmentation and deep learning neural network. To improve supervised learning for deep architectures one jointly learns an embedding task[2] using unlabeled data. The results both confirm previous results and generalize them. Here researchers using shallow architectures depicts[2] embedding unlabeled data as a separate pre-processing step and using embedding as a

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regularizer . More specifically, by generalized these approaches to the case where train a semi-supervised embedding[2] jointly with a supervised deep multi-layer architecture on any (or all) layers of the network.

Image processing with neural network is the important concept and detail described by the authors[1] M. Egmont-Petersen, D. de Ridder and H. Handels . Here several theoretical results regarding the approximation capabilities of ANNs have been proven. Feed-forward ANNs[1] with two hidden layers can approximate any (even discontinuous) function to an arbitrary accuracy. For other (non)parametric classifiers[1], the relation between the size of the training set and the expected error rate has been studied theoretically. Convergence to the global minimum[1] of the risk function (squared error) cannot be guaranteed is the one of the obstacle in developing a more profound statistical foundation for trained ANNs[1]. Authors deeply discussed about the large body of work on application of ANNs presented in the last decade provides users with many rules such as how to set the various parameters[1]. Also, methods which avoiding the problem of overtraining[1] that ensemble training in large data set.

MUpstart - A Constructive Neural Network Learning Algorithm[8] is discussed about multi category pattern classification. The Constructive neural network[8] learning algorithms offer a powerful approach to inductive learning for pattern classification applications. Here the authors has developed MUpstart[8], a provably convergent extension of the *Upstart* algorithm to handle multi-category classification [8]and real-valued pattern parameters. The real time experiments[8] have demonstrated the feasibility of this algorithm on practical pattern classification tasks.

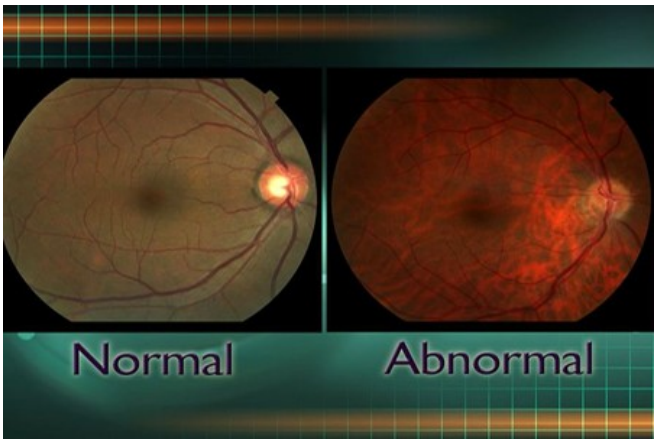

Fig 1 Normal and abnormal Retinal image

Blindness is one of the major diseases. Diabetic retinopathy, glaucoma, arteriosclerosis, obesity, retinal artery occlusion and hypertension etc cause to blindness. The early symptom is that structural difference of retina layers. Retina layers damaged by unwanted obstacles such as blocks, clots or fragile like structures. So it is better to identify the person have eye disease or not by the image processing . Many new technologies are implanting in image processing .

To easily identify the cancer cells from the normal cell is providing better application in medical field. By the help of image processing various identification methods are going on.

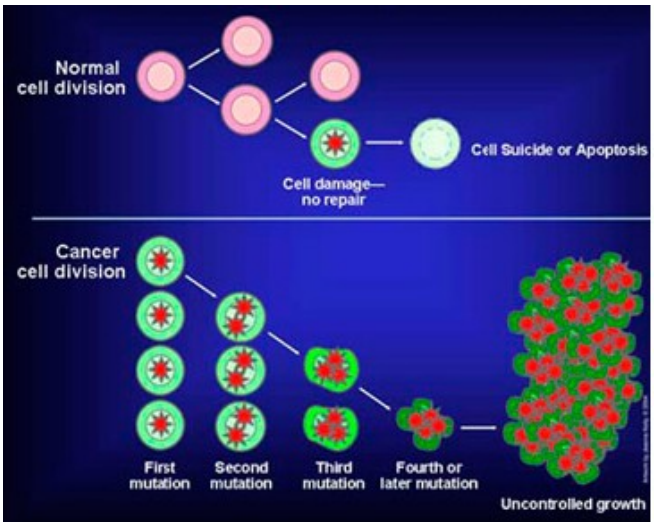

Fig 2 Cancer cells growth

III. PROPOSED METHOD

For efficient prediction of retina and cancer disease it is better to use segmentation. In segmentation semi supervised segmentation is advanced one and providing less labors and highly automatic segmentation. Semi Supervised Learning (SSL) using both labeled and un labeled data. After the segmentation ,segmented output is used for Deep Learning. In our work Deep Learning Neural Network is using for the further tuning of segmented output.

The complete result of the work based on the completion of each module successfully. So in order to do each levels the modules implementation carried out. First module is optimization model from which the maxima and minima pixel values are selected and is gives to next module. Second module is similarity measures from where the pixel similarity calculated based on location or color. Third module is computational complexity from which data and time complexity measured because of entire work used in medical data set and which is large one. Fourth one is the application to collection of images in which we not only taking single image segmentation, our method implements to multiple images. Fifth module is deep learning neural network(DLNN) which provides complete tuning of image and predicting diseased image or not. Deep Learning methodology using the input image as semi supervised segmented output. In this module training the image with labeled data and un labeled data because of Deep learning could satisfies to both supervised segmentation and un supervised segmentation. Last module is the performance evaluation from this module CPU performance time for running each image and accuracy calculated based on PSNR (Peak Signal Noise Ratio). High accuracy is obtained by implementing SSL with DLNN.

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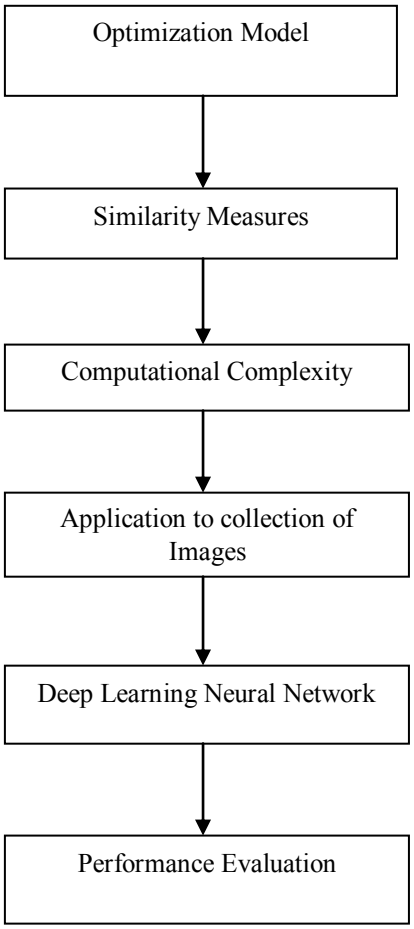

Fig 3 Modules

For the identification of diseased image or non diseased image firstly detecting vessels and non vessels. The Vessels are the ideal blood vessels and background pixels, unwanted obstacles are non vessels. We are using two types of data bases which are STARE and DRIVE. Depends to these databases training is doing for each image. By using the equipment slit lamp ophthalmologist easy to find out the front parts of the eye. A camera may be attached to the slit lamp to take photographs of different parts of eye. So easier to detect a foreign obstacle, such as metal fragment or an infected or injured area on the cornea.[12] STARE(Structured Analysis of the Retina) images captured by TOPCON TRV 50 fundus camera at a 35^0 field of view and 24 bit gray scale resolution and have spatial resolution 700*605 pixels.[12] DRIVE (Digital Retinal Images for Vessel Extraction) images captured by canon CR5 camera at 45^0 field of view 24 bit with spatial resolution of 565*584 pixels. Training doing for input image by neural network .In information technology , a neural network is the collection of programs and which lies under the area of soft computing that have similarity the operation of human brain.

Deep Learning Neural Network is a set of algorithms and lies under the branch of machine learning. The algorithm have distributed architecture and different levels .So increasing number of hidden layers increasing the capability for finding small parts of image. The use of different levels of abstraction clearly identifying the vessel or non vessel. Such away able to determine diseased image or non diseased image.

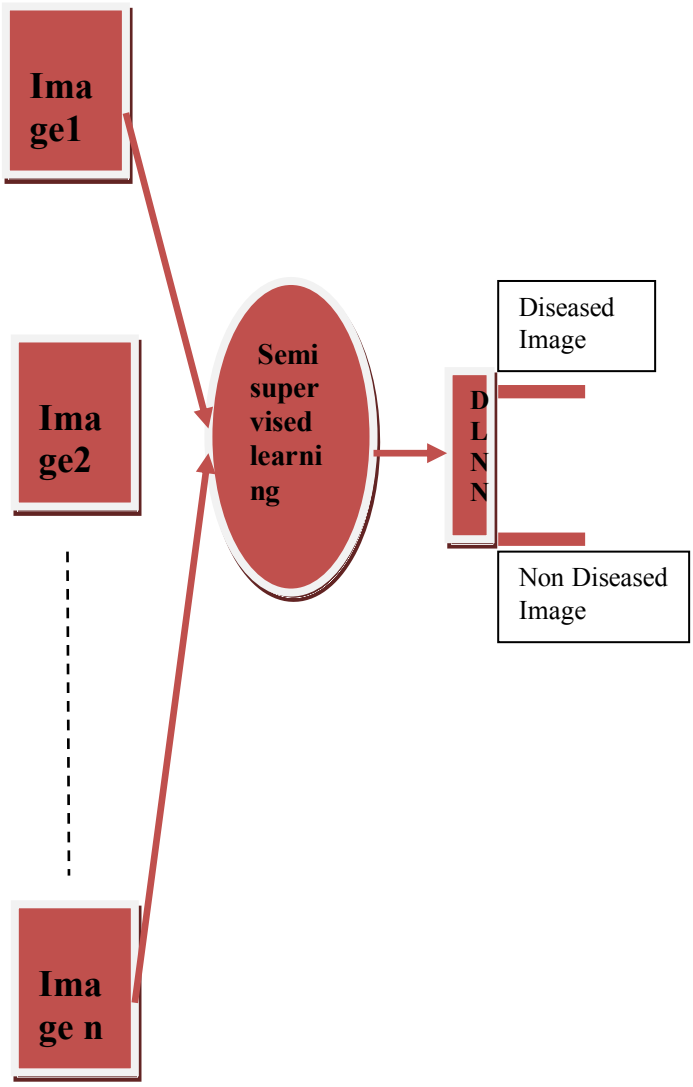

Fig 4 Data Flow Diagram

From the Fig 4 easily understood the flow of research work such a that predicting diseased image or non diseased image.

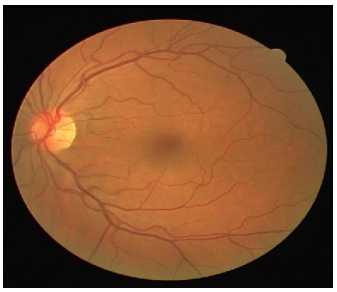

Fig 5 Retina testing image

Deep Learning Neural Network (DLNN) training multi number of images and find out the vesseled or non vesseled part so as to predict diseased or not.

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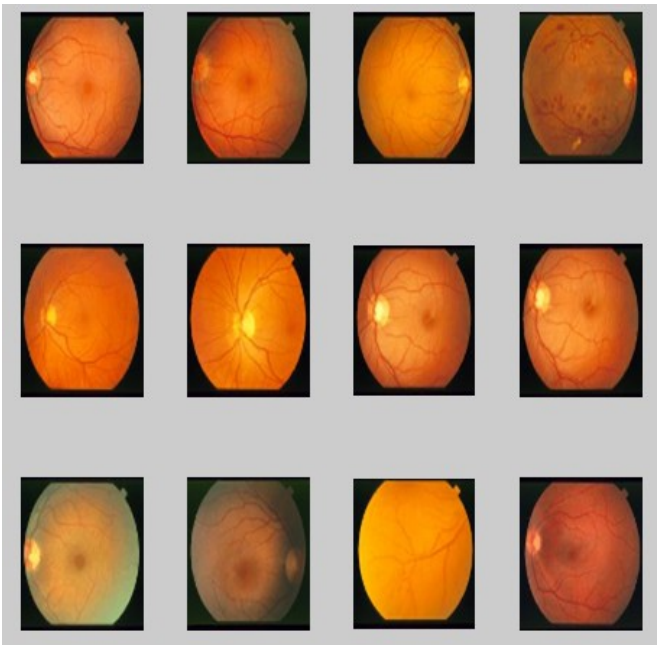

Fig 6 Multi image training data set

Through the training data set which contain trained images of both diseased and non diseased. Next find out threshold image and then output post processed image.

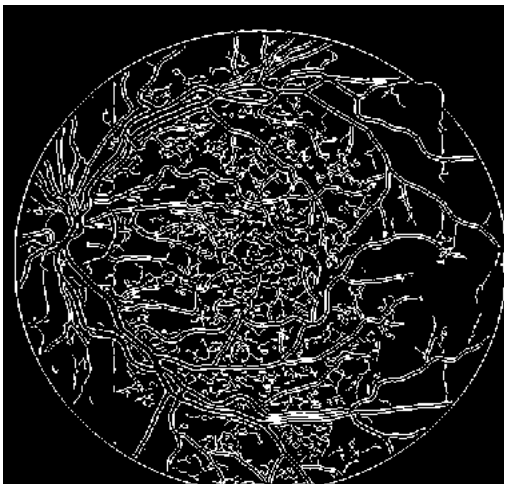

Fig 7 Threshold image

From the threshold value easily processed to output image such away that vesseled part and non vesseled part are determined. Feature extraction carried out by giving the threshold value to input parameter.

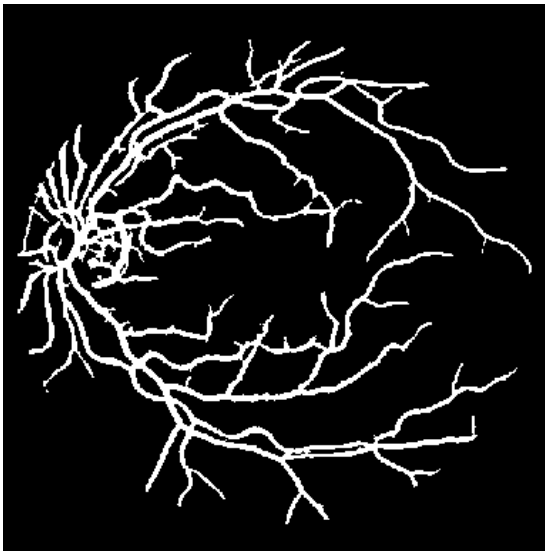

Fig 8 Post processed image

From this stage application of Deep Neural Network implemented and efficiently tuning carried out.

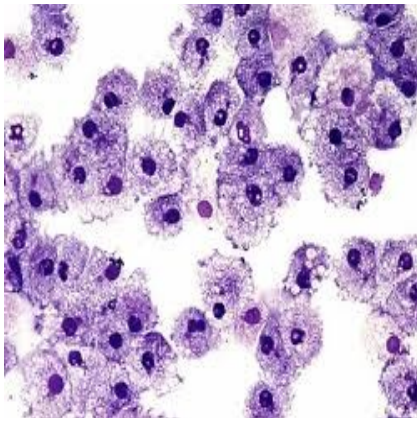

Fig 9 Cancer input image

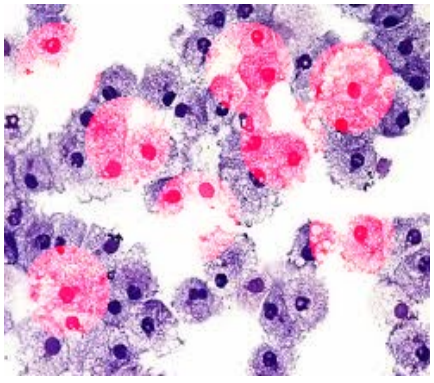

Fig 10 Cancer cell Nuclei marked with red circles

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Algorithm PROPOSED APPROACH
1: /* SSL with DLNN */
2: Extraction of the green channel of retinal input image
3: Remove of the central light reflexion .
5: Doing homogenization with background.
6: Obtain vessels-enhanced image.
7: Drawing probability map through the image.
8: Compute threshold image
9: for each pixel in the threshold image do
10: Compute its maxima and minima value such that 1 or 0
11: Obtain Post processed image
12: /*Post processed image give as input to Deep Learning Neural Network */
13: Find out vessel and non vessel.
14: Tuning the layer w.r.t training data set.
15: if find out blocks or un wanted obstacles
16: Display as Diseased Image
17: else
18: Display as Non diseased image.
19: end if

IV. PERFORMANCE ANALYSIS

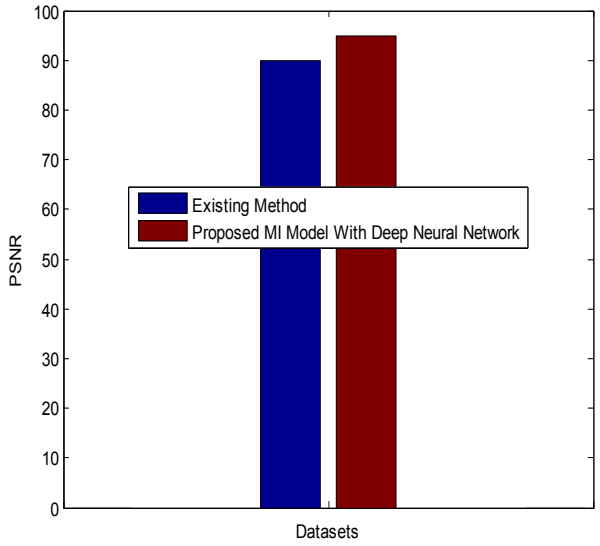

Fig 11 Accuracy measurement

$$PSNR = \frac{No\ of\ Correctly\ Segmented\ Pixels}{Pixels\ with\ Noise}$$

Accuracy evaluated based on PSNR(Peak Signal Noise Ratio).

CPU performance time is calculated for each image .If the image is diseased one should take more time for training because training depends to complexity of image. If the image is not complex CPU time will take less. So some values are high and some other values are low.

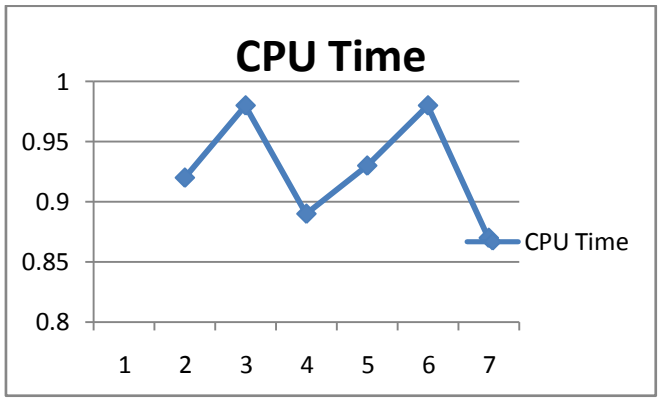

Fig 12 CPU Performance for different images

V. CONCLUSION

This research work mainly focused to medical field and used medical image data sets. Application of Deep Learning Neural Network with Semi supervised segmentation is done and find out this method gives high accuracy than existing methods. To improve the tuning of images layer by layer the Deep Neural Network is best which applied in semi supervised segmented output. So successfully predicting diseased image or non diseased image .

The practical application of this method to entire health care environment and providing an easy system to enhance the prediction of diseases is the future work. The same way the method will check with other diseases and find out to use disease detection. Here, multiple image segmentation is stronger and resulting high performance.

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