International Journal of Engineering & Technology, 7 (4) (2018) 3026-3029

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET
doi: 10.14419/ijet.v7i4.14895
Research paper

Micro aneurysms detection using artificial neural networks

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Abstract

Blindness caused by diabetic related issues was increasing day by day, it only affects the eyes but also other sensory, internal and external organs of the body. The major cause of blindness is due to high glucose levels in the nerves nearby optic disc. Diabetic issues of eyes were known as diabetic retinopathy. For reducing the effect of diabetes in the functionality of the eyes regular screening and identification of problems while they were in the initial stages was very important. Early identification of abnormalities in the eyes such as damage to the vessels of eye, exudates, and microaneurysms will help to reduce the effect of diabetic retinopathy. This paper deals in identifying all the three procedures differently and leaves in result damage in the exudates.

Keywords: *Microneurosyms; Ann; Fundus Images.*

1. Introduction

Diabetic retinopathy is a complication of diabetes in the people that causes blindness in many countries. In the UNITED STATES, it was estimated that every year 12% of the diabetic people were affected by eye infected disease which might cause permanent blindness [1]. In Singapore, more than 50% new cases that were treated for blindness and eye disease are caused due to diabetics [2]. As rising in number those who are affected eye disease causing by diabetics Singapore acquired first place. Mostly 10% of the population more than 40 years of age were affected with diabetes in this successive group of people 20% were affected by different types of diabetic retinopathy [3].
To identify various problems caused by diabetic retinopathy, regular screenings were conducted on retinal images captured by the fundus camera but this requires a vast number of images for different levels of screening. Also, initial identification of exudates and MA regions in retinal images will help in providing accurate results, this requires an automatic procedure which clearly reduces the cost and provides results in no matter of time [4].
If the portion excludes blood vessels in the eye gets damaged results by "Diabetic retinopathy." Losses in small vessels would be known as the microvascular disease while injuries due to the arteries would be the macrovascular disease.

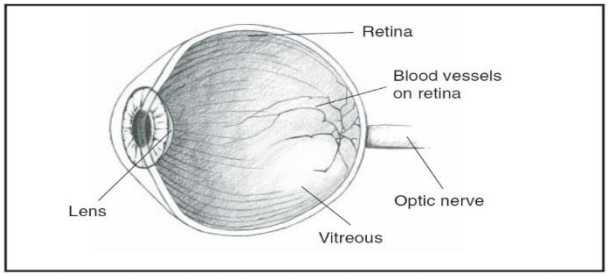


Fig. 1: Human Eye Cross-Sectional View.

2. Methodology

Our predominant goal of the paper is imposing an automated quick process for screening diabetic retinopathy and looking at the defects accurately. Diabetic retinopathy in non-proliferative diabetes retinopathy or proliferative diabetic retinopathy, these levels can lead to visible impairment or maybe blindness. Our providing gadget will help ophthalmologists in detecting the effect of diabetic retinopathy on the eye, this also reduces waiting span and reduces the cost of identification of errors for accurate treatment to the patient to prevent visual loss.
In this paper, our proposing scheme initial stage was developed to understand the fundus images and then helps in extracting features for classification or for extraction of data. These enhanced fundus images were subjected to classification and their differences will be processed using MATLAB image processing toolbox.
All the features extracted i.e., histogram, contrast et.c., from fundus image were subjected to Artificial Neural Network (ANN) that helps for automatic detection of MA from the images using the below approach. All the results obtained were tested for accuracy else accuracy was not enough then these images will be fine-tuned.
For recorded proof of implementation and make to know other how simple this can be accessed a GUI for automatic detection of MA was developed and results were discussed below.

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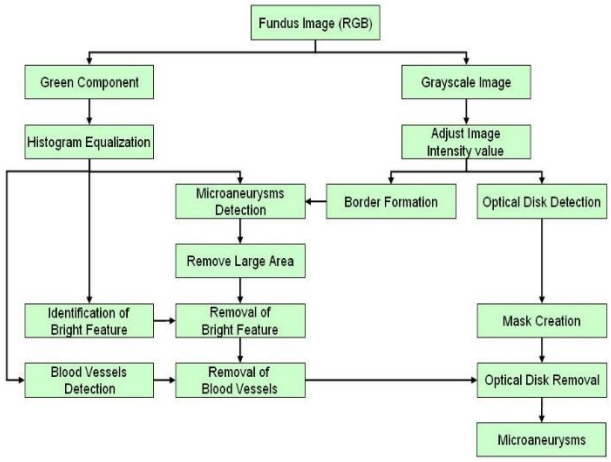


Fig. 2: Block Diagram for Microaneursyms Detection.

Retinal fundus photographs texture analysis may be measured the use of pixel intensities, grayscale including coarseness, smoothness or regularity. The primary types of computation are structural, statistical and spectral. Structural is the association of texture factors even as spectral is the evaluation based totally on a spatial frequency area. Statistically based totally on the depth relationship of the pixels in statistical capabilities like co-occurrence matrix. Grayscale based spatial distribution changed into measured the usage of co-occurrence matrix with characteristic calculated including ENERGY, CONTRAST, HOMOGENEITY, and CORRELATION [7].

Two texture residences of the image are measurable. After contrast enhancement became carried out on the fundus photo using histogram equalization entropy changed into measured at the inexperienced component of the photograph at the same time as homogeneity is with the aid of using Gray-Level Co-prevalence Matrix on the grayscale photo.

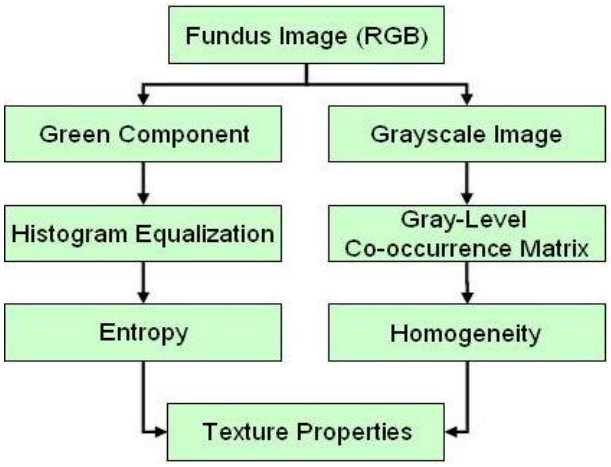


Fig. 3: Block Diagram for Texture Identification.

ANN, in engineering, may be applied for pattern classifiers or nonlinear adaptive filters. Through train, ANN can analyze and revel in that used for a highly correct type of facts into exceptional lessons. The rating is based on the information gained from learning and stored in the form of interconnecting weights which are in its hidden layers. It is continually preferred to have a big set of uniformly spread schooling statistics. [10-11]

The ANN used for this mission is a lower back-propagated feed forward network, and a supervised learning technique is carried out to train NN. Supervised studying is a process that it is skilled priory the ANN and suits them with entering information to get output results. Our technique used the weights adjustment approach and underwent schooling for a massive-scale dataset, and it was examined on an enter photograph to acquire the fine degree of correct results in identifying microaneurysm. Classification by means of ANN used in this project as shown in the figure underneath.

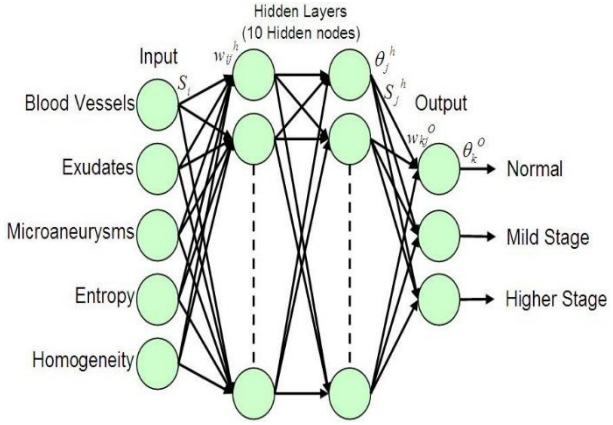


Fig. 4: Back Propagated Feed Forward Artificial Neural Network Classifier.

In this method, the enter layer is designed to simply accept the five facts values using activation characteristic, or goal feature the next level layers tunned those. There are ten neurons for every "hidden layer, and the skilled network might output binary numbers which constitute the three different tiers.

3. Results

The information received from the snapshots divided into two quantities. 70% of the records are used for schooling purposes while the closing 30% used for testing. All the facts are normalized to the range among zero and 1 to have a uniformly unfold and additionally to balance every weight of the neuron inside the ANN. The exceptional instructions for output or schooling records are represented as binary numbers as proven in the table under.

The original fundus image selected by the image number selection. Then analyze button needs to be clicked, this will perform features extraction for blood vessels by extracting blood vessels from green portion of the image, microaneurysms separately, exudates, and texture features. Some of the feature of the images were displayed at various textboxes near classification mode. These values were subjected to normalization before feed as input for ANN classification procedure. One of the three classes, namely Normal, Mild or Higher would be displayed in the textbox to indicate the stage of the subject. Developing GUI will allow doctors or nurses to perform quick analysis and observation without the need for programming skills.

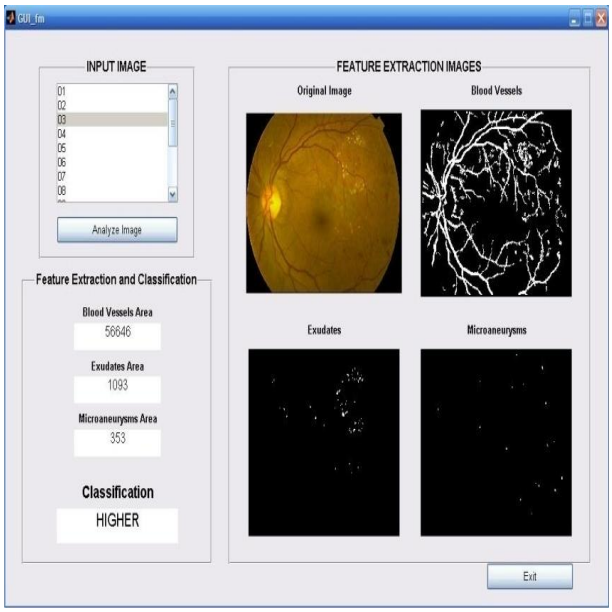
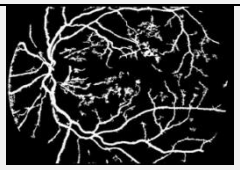
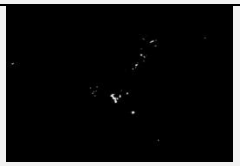
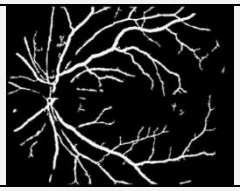
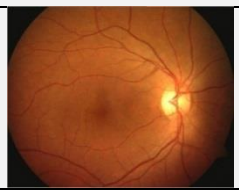
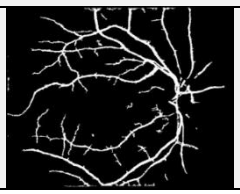


Fig. 5: GUI Representation of Proposed ANN.

Table 1: Representation of Different Stages

S.No	Classes	Binary Representation	Images	Vascular tree	Microaneurysm detection	ANN output
1	Normal	00				
2	Mild Stage	01				
3	Higher Stage	10				

4. Conclusion

The outcomes of the ANN classifier has a sensitivity of eighty% and a specificity of 20% which focused high accuracy. A fairly correct category for slight and better tiers however now not suitable for normal class this results in a probable high false alarm. This may be advanced by exceptional-tuning the edge values used at the snapshots and needs to educate more photographs may want to help in enhancing the overall machine overall performance. In this paper, various techniques of photo processing were studied and applied to extract the capabilities and part of the fundus photo, specifically blood vessels, exudates, microaneurysms and texture homes (homogeneity and entropy) from the fundus pics. This outcomes in powerful training an ANN by back propagation algorithm to carry out class and a majority of these showcased by using GUI development for easing to understand the technique.

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