A MODEL FOR AUTOMATIC DETECTION OF RETINA DISEASES.

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Abstract : The human eye is an essential part of the human body. Retina is a light-delicate layer at the back of the eye that spreads around 65 percent of its inside surface. Infected eyes have vascular insufficiencies, which means the system of vessels which supplies blood to the retina is immature. Segmentation of retinal layers from OCT images is fundamental to diagnose the progress of retinal diseases. This research work proposed a technique to segment the retina images based on neural network approach. The proposed technique utilizes gray-level co-occurrence matrix technique for feature extraction and artificial neural network for classification. MATLAB tool is used for implementation of the proposed technique. Results of the proposed technique are compared with the existing techniques such as ANN with filter approach, ANN with filter/SFS approach, and ANN with SFS approach. Classification accuracy and ROC curve are parameters that are used for evaluation of the results of proposed technique.

IndexTerms - *Segmentation, OCT images , gray-level co-occurrence matrix , ANN, SFS approach, ROC curve.*

INTRODUCTION

The human eye is an essential part of the human body. It is well designed to collect all the significant information about the environment around us. The retina is the third and internal layer of the eye which is a light-unstable layer of tissue. The optics of the eye influence a photo of the visual world on the retina (through the cornea and central to point), which serves much an undefined limit from the film in a camera. Light striking the retina begins a course of engineered and electrical events that finally trigger nerve inspirations. To the best of our insight, there is no current business related to separation between the genuine retinal territory and the antiquities for retinal region recognition in a SLO picture. The three principle ventures for building our structure contains:

1. Determination of highlights that can be utilized to recognize the retinal zone and the ancient rarities;
2. Choice of features that are most applicable to the classification;
3. Generation of the classifier that can classify out the retinal surface from SLO pictures.

I. IMAGE PROCESSING

Image processing is very wide topic to research in computer science. Image processing is designed to metamorphose an image towards its digital nature and conduct some operation to produce or acquire good quality results as per our concern or requirements. Two sort of modus operandi are used in image processing.

II. IMAGE SEGMENTATION

Image processing describes image segmentation as such chief practice of image processing. Image segmentation is a practice which is designed to split an image towards its segments. A few image segmentation techniques are there to segment the image towards a number of lumps based on beyond doubt image aspects like image pixel intensity value, color, texture etc. Categorization of image segmentation technique pivots on the modus, which is used to segment the image.
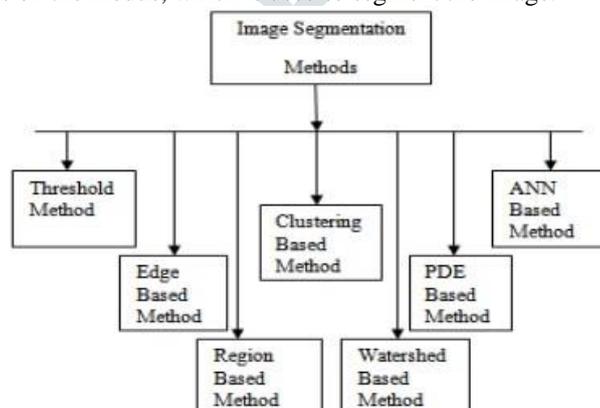

Figure 1.2: Image Segmentation Methods

2.1 Problem Formulation

Retinal image processing is significantly required in diagnosing and treatment of numerous illnesses influencing the retina and the choroid behind it. Determination and treatment of a few issue influencing the retina and the choroid behind it require catching a grouping of fundus pictures utilizing the fundus camera. These pictures are to be handled for better conclusion and arranging of treatment. Retinal picture division is extraordinarily required to remove certain highlights that may help in determination and treatment. Additionally enrollment of retinal pictures is extremely valuable in separating the movement parameters that assistance in making a total guide for the retina and additionally in retinal following. Screening program of eye output in huge amount of retinal pictures required to be inspected by ophthalmologists. Manual diagnosis is typically executed by investigating the pictures from a patient, as not all pictures depicts symbol of diabetic retinopathy. It enhances the time and diminishes the efficiency ophthalmologists. Therefore, vasculature segmentation may save workload of the ophthalmologists and may help to characterize the discovered lesions and to recognize false positive. This research work proposed an algorithm for segmentation of retina images on the basis of neural network.

3.1 Objectives

i) To propose an algorithm for segmentation of retina images based on neural networks.

ii) To reduce the semantic gap for ophthalmologist from developed algorithm.

iii) To compare the developed algorithm with state of art techniques.

4.*1* Methodology

The methodology of the proposed system consists of two phases. Phase 1 describes the steps for pre-processing and phase 2 describes the steps required for detection.

Histogram: Histograms are a kind of bar plot for numeric information that gathering the information into receptacles. After you make a Histogram protest, you can alter parts of the histogram by changing its property estimations. This is especially valuable for rapidly adjusting the properties of the containers or changing the show.

Segmentation: Image processing describes image segmentation as such chief practice of image processing. Image segmentation is a practice which is designed to split an image towards its segments. For petitions like image compression and object recognition it is additional handy, because of these application, it is in competent to exercise the whole image. So for further processing of an image it is necessary to segment the image.

    A.Approach based on discontinuity detection

In this exercise image is segmented towards region on the basis of discontinuity. This procedure move closer in this wing, edges sort attributable to intensity discontinuity are make out and associated to shape scope of regions.

    B.Approach based on similarity detection

In this affair image is divided towards segments by reason of consistency. The techniques that move nearer under this policy are: Thresholding technique, Region growing technique and Region splitting and merging. These all cleave the picture towards zone that has concurrent group of pixels. The clustering technique too uses this strategy. These split the picture towards group of clusters which have concurrent aspects on the basis of few blemished standard.
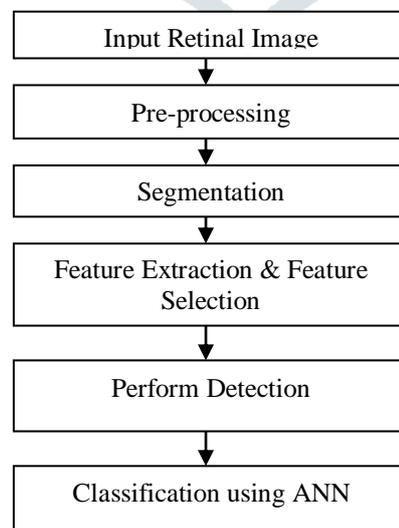
Input Retinal Image

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Pre-processing

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Segmentation

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Feature Extraction & Feature Selection

↓

Perform Detection

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Classification using ANN

Figure 3.1: Proposed Technique

ANN: In its most general form, an artificial neural network is a apparatus that is planned to model the manner in which the brain execute a certain work or area of concern. To attain better presentation, neural networks utilize a huge inter-connection of basic computing cells called as "neurons" or "processing units". It look like the brain in two ways:

- Knowledge is captured by the system by the process of learning.

- Inter neuron association strengths called as synaptic weights are utilized to stock up the data.

The framework used to play out the learning technique is known as a learning computation, the limit of which is to alter the synaptic weights of the framework in a think way in order to achieve a coveted outline objective. The change of synaptic weights gives the customary strategy to the outline of neural systems. Such an approach is the nearest to direct versatile channel hypothesis, which is as of now entrenched and effectively connected in such various fields as communications, control, radar, sonar, seismology, and bio-medical engineering.

Phase 1: Steps for pre-processing
- Separate the input retinal pictures into non-overlapping blocks.

- Extract RGB parts from the unique color retinal picture.

- After gray-level transformation, utilize histogram equalization to increase the contrast and to enhance the value of retinal picture.

- Utilize a huge median filter for removing noise from the picture.

Median Filter: The center channel is a nonlinear propelled filtering procedure, much of the time used to oust commotion from a photo or banner. Such commotion diminishment is a run of the mill pre-handling advance to enhance the consequences of later preparing (for instance, edge recognition on a picture). Median filtering is comprehensively used as a piece of mechanized picture planning in light of the fact that, under particular conditions, it stick edges while emptying commotion, additionally having applications in flag handling.

Phase 2: The detection algorithm is based on four steps.
- Noise Reduction.

- Linear pattern with Gaussian-like profile improvement.

- Cross curvature evaluation.

- Linear filtering.

Noise Reduction : Pictures are frequently corrupted by clamors. Noise can happen and acquired amid picture catch, transmission, and so on. Noise expulsion is a vital undertaking in picture handling. When all is said in done the consequences of the commotion expulsion affect the nature of the picture handling systems. A few procedures for commotion expulsion are entrenched in shading picture handling.

RESULTS AND DISCUSSION

The figure below shows the input retinal image. By utilizing this input image, histogram and pre-processing of the input image is performed.
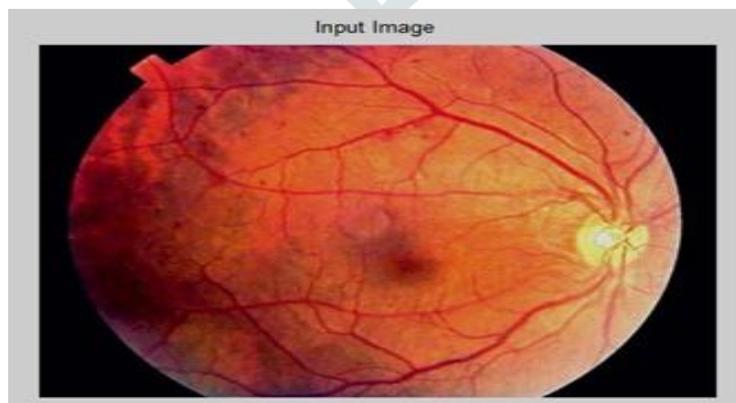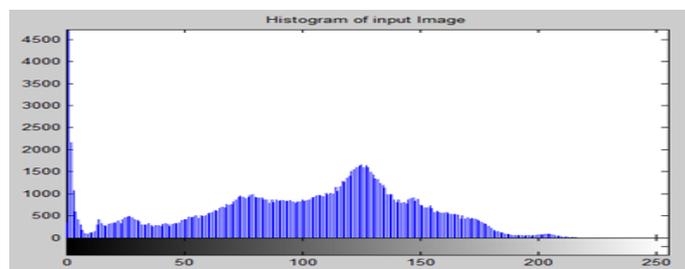

Figure 4.1: Input Image

Figure 4.2: Histogram of Input Image

Above figure shows the histogram of the input retinal image. A histogram is an exact depiction of the scattering of numerical data. It is a measure of the probability movement of a tireless variable and was first introduced by Karl Pearson. It is a sort of structured presentation.
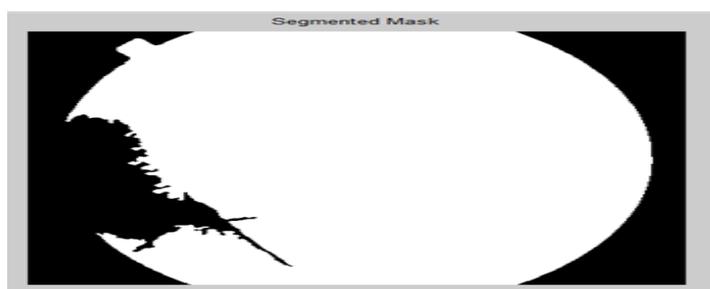

Figure 4.3: Segmented Mask

Above figure shows the segmented mask. Segmentation is the technique to identify chosen areas of pictures as part of a ordinary group. Doctors routinely fragment structures in restorative pictures to encourage the treatment of patients. Covers are especially useful on the off chance that you utilize other picture investigation programs that expect you to supply a veil. Veils can likewise be utilized to show a mind boggling region of intrigue.

Figure 4.4: Segmented Image

Above figure shows the segmented image. *Segmentation* divides a *picture* in different areas consisting every pixel with same attributes. To be important and helpful for picture investigation and translation, the areas ought to firmly identify with delineated questions or highlights of premium.
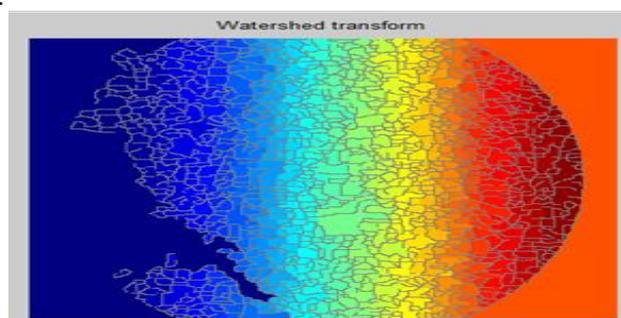

Figure 4.7: Watershed Transform

The above figure shows the watershed transformation of an image. The watershed transform is the technique for decision for picture division in the field of scientific morphology. The watershed change can be named a district based division approach.
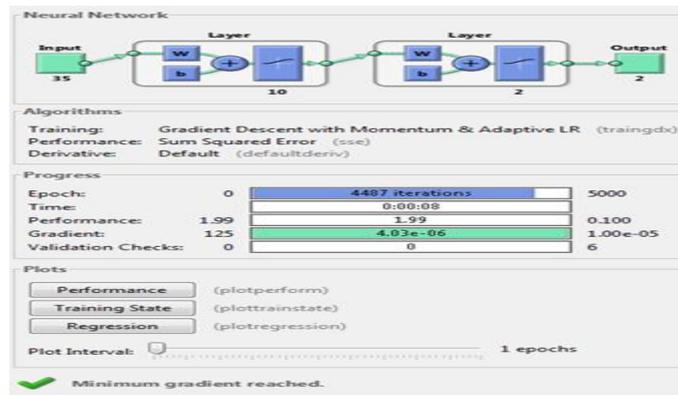
Figure 4.8: Classification using ANN

The above figure shows the classification performed using artificial neural network. A classification is anrequested arrangement of related classes used to amass information as per its likeness. It comprises of codes and descriptors and permits overview reactions to be put into significant classes keeping in mind the final aim to deliver helpful information. A grouping is a valuable device for anybody creating factual overviews

Table 4.1: Comparison of the existing techniques with the proposed technique based on Classification Accuracy

Techniques	Classification Accuracy
ANN with Filter Approach Filter	89.36
ANN with Filter /SFS Approach	88.88
ANN with SFS Approach	90.48
ANN with proposed feature set approach	96.05

The above table shows the comparison of the existing techniques like ANN with filter approach, ANN with filter/SFS approach, ANN with SFS approach on the basis of classification accuracy. The classification accuracy of ANN with filter approach is 89.36, ANN with filter/SFS approach has classification accuracy of 88.88, and ANN with SFS approach has classification approach of 90.48. The proposed technique based on feature set approach has classification accuracy of 96.05. This table demonstrates that the classification accuracy of the proposed feature set approach is better than the existing techniques.
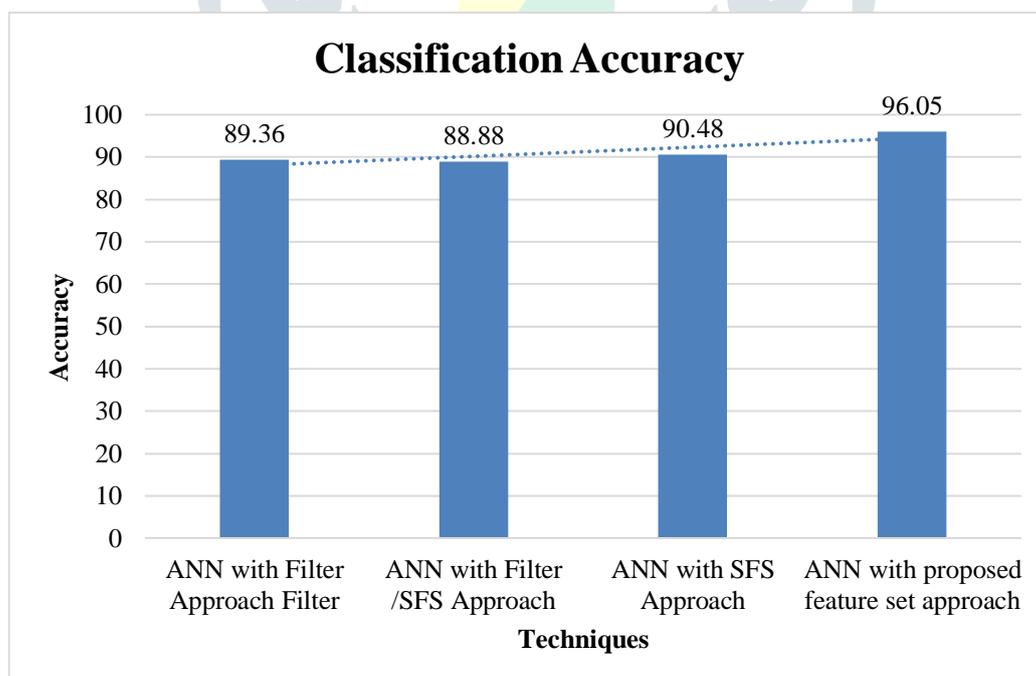

Figure 4.9: Showing the Comparison of the existing techniques with the proposed technique based on Classification Accuracy

The figure above shows the comparison of the various existing techniques like ANN with filter approach, ANN with filter/SFS approach, ANN with SFS approach based on the classification accuracy. The figure depicts that the proposed feature set approach outperforms the various existing techniques on the basis of classification approach.

Table 4.2: Comparison of the existing techniques with the proposed technique based on ROC area under curve

Techniques	ROC
ANN with Filter Approach Filter	0.9549
ANN with Filter /SFS Approach	0.9533
ANN with SFS Approach	0.9613
ANN with proposed feature set approach	0.9805

The above table shows the comparison of the existing techniques like ANN with filter approach, ANN with filter/SFS approach, ANN with SFS approach on the basis of receiver operating characteristic. The ROC of ANN with filter approach is 0.9549, ANN with filter/SFS approach has ROC of 0.9533, and ANN with SFS approach has ROC of 0.9613. The proposed technique based on feature set approach has ROC of 0.9805. This table demonstrates that the ROC of the proposed feature set approach is better than the existing techniques.

Conclusion & Future Scope

Segmentation of retinal layers from OCT pictures is basic to diagnose the development of retinal diseases. This research work proposed a technique to segment the retina images based on neural network approach. The proposed technique utilizes gray-level co-occurrence matrix technique for feature extraction and artificial neural network for classification. MATLAB tool is used for implementation of the planned technique. Outcomes of the planned technique are compared with the existing techniques such as ANN with filter approach, ANN with filter/SFS approach, and ANN with SFS approach. Classification accuracy and ROC curve are parameters that are used for evaluation of the results of planned technique. The classification accuracy of ANN with filter approach is 89.36, ANN with filter/SFS approach has classification accuracy of 88.88, and ANN with SFS approach has classification approach of 90.48. The planned technique based on feature set approach has classification accuracy of 96.05.The ROC of ANN with filter approach is 0.9549, ANN with filter/SFS approach has ROC of 0.9533, and ANN with SFS approach has ROC of 0.9613. The planned technique based on feature set approach has ROC of 0.9805. Experimental results demonstrate that the proposed feature set technique gives better classification accuracy and ROC curve than the other existing techniques. In future, we can use fuzzy logic to further enhance the results. Also, for feature extraction, principle component analysis and relief algorithm can be utilized. For matching, other variant of neural network can be used in future.

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