A Region Selective Model for Prediction of Glaucoma Disease Patients

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***Abstract*—**The eye region or the iris feature analysis can be done to predict the existence of Glaucoma disease. In this paper a more adaptive model is defined to identify the patients of Glaucoma disease. The proposed model used the segmentation adaptive textural feature processing to identify the existence of critical region. The proposed model used the mathematical operators and distance specific analysis to separate the core cup and disc regions. Once the regions are identified, the ratio based analysis is performed to identify the glaucoma patients. The experimental results identified that the proposed model has identified the glaucoma patients accurately.

Keywords*—Glaucoma; Retina;, Region; Segmentation; Disc; Cup;*

I. INTRODUCTION

The symptoms of various diseases impact the eye or the iris region. The eye feature analysis can be done to observe the symptoms of these disease and to predict the existence of the disease. The image processing methods provides the automated method to classify the disease or the disease criticality in patients. The common retinal diseases include Glaucoma disease or the diabetes. The eye region and the features can be analyzed to identify these diseases. These diseases affect the structure of eye elements. By observing the disc and cup size and ratio, the disease can be predicted. The image processing methods are required to apply to extract the effective region and to predict the existence of the disease. The basic process model of retinal disease processing for disease prediction is shown in figure 1.

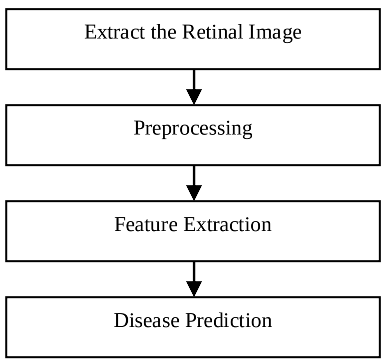

Figure 1 : Basic Model of Retinal Disease Processor

Figure 1 has provided the basic model for retinal disease processing with specification of each stage. The retinal disease identification requires the eye or the iris image. These images can be acquired through high resolution cameras and the images must be taken by an expert. More clear the image will be, more effective and accurate decision can be derived from that image. Once the image is available, the preprocessing methods are applied on the image to convert to normalized form. In this stage, the image feature improvement and the size level adjustments are done. After the preprocessing image, the actual processing form of retinal image is obtained. The normalized image is processed to extract the disease specific features. The features must be specific to the target disease for which the analysis is obtained. These acquired features are finally processed by some rule or classifier to recognize the actual disease.

A. Medical Image Processing

The medical image processing is required to measure the medical image, identify the effective regions and to generate the disease specific features. The visual features of the image, regions and the features can be extracted by applying the segmentation methods. These methods are also dependent on the image type, image quality, organ under observation and the considered disease. Various segmentation and feature generation methods were applied by the researchers to improve the accuracy of disease prediction. The adaptive region extraction and region processing is required to improve the prediction results. Various mathematical filters and segmentation methods are available to improve the accuracy and significance of disease prediction.

In this paper, a textural features and segmentation driven ratio analysis method is defined to predict the glaucoma disease in patients. The proposed model used the mathematical operators and distance based analysis for disease prediction. In this section, the basic characterization and features of medical disease processing and glaucoma disease processing is defined. The standard model for medical disease processing is provided in this section. In section II, the work provided by earlier researchers is discussed. In section III, the proposed research method is defined. In section IV, the analysis results for glaucoma disease prediction are provided. In section V, the conclusion is provided.

II. RELATED WORK

Researchers have provided various methods for identification of glaucoma disease patients. In this section, the work provided by the researchers is discussed. Author[1] has used the image processing method with cup and disc ratio analysis for identification of glaucoma disease. Author used the contour with blood vessel analysis to identify the region. The pixel density based analysis is applied with conditional analysis to identify the disease. Author[2] has provided the analysis on the textual features to identify the retinal disease. The energy signature evaluation was done by the author and processed on various classifiers to separate the normal and glaucomatous images. The wavelet generated textual and energy features are analyzed by the author using probabilistic and decision driven classifiers such as Naive bays, random forest and neural network. Author[3] used textural reduced and effective features using wavelet decomposition and some composite filters The energy adaptive filters first extracted the effective textual information from retinal images and later on some classifier was applied on the generated features to perform effective classification of glaucoma images. Author applied various classifiers to verify the accuracy of classification models. Author[4] has used the fractal dimension specific metric method to diagnose the glaucoma disease. The procedural evaluation and rotational variation was evaluated by the author to signify the rotational variance. The dimension reduction with shape derivation was used by the author to recognize the cup and disc area effectively. The rotation specific object consideration was also adapted by the author. The irregular shape evaluation was considered by the author with size ratio derivation to separate the normal and glaucoma disease images.

Author[5] has identified the retinal nerve area on fundus images. The progressive degeneration was analyzed by the author to recognize the structural features on retinal images. Author used the Retinal nerve based fiber layer to analyze the fundus images to identify the presence of glaucoma in the retinal images. The radial point based features are generated by the author to generate the shaded effective region. Author[6] processed the discriminated modeling on the pixel area to generate the angle specific effective features. The generated features are processed by the SVM method for effective classification of glaucoma disease. The angle features evaluation so that the region modeling is done to generate the sample point. Author[7] used the visual and textural features to analyze the retinal pressure and to extract the optic disc region. The optic nerve fibers on the retinal regions are analyzed by the author to identify the disc area. The thickness of the region was analyzed with structural features to diagnose the features for glaucoma disease. Author[8] improved the retinal features and nerve features on retinal images to extract the effective visible features. Author applied various image processing method to filter these features and to extract the effective feature region over the retinal image. Author[9] applied the supervised learning method on the retinal features to classify the retinal images in terms of glaucoma detection. The optic disc features were analyzed by the author and processed on convolutional neural network for classification of glaucoma disease. The visual cortex based feature processing and extreme learning was analyzed to generate and process the visual patterns. Author[10] defined the optic disc region analysis using the edge and contour fitting evaluation method. The smoothing filters are processed on blood vessel and morphological feature evaluation so that the disc segmentation will be implied. The active contour based disc boundary and smoothing region extraction was applied by the author.

Author[11] used the detection, segmentation and classification based method for identification of retinal images. The feature driven analytical evaluation was defined by the author to generate the vascular tree on the retinal images and to generate the feature vector. Author has applied the segmented feature processor with multiple integrated operations to process the blood vessel features on the retinal images. Author[12] improved the recognition of glaucoma disease by improving the segmentation method. Author has contributed a multistage segmentation approach for identification of optic disc area. Author processed the textural and color features collectively to identify the desired region. Author[13] processed to different morphological method to generate the effective pixel features on the color retinal images. The methods were applied to extract the key region and to generate the vessel for retinal images. Author[14] defined a method to generate the connected structural features. The bifurcation point based region segmentation method was applied with numerical and structural feature evaluation. Author[15] processed the visual and textural features of retinal images in termsmicroaneurysms, hemorrhages and macular edema. Author applied the segmentation method to generate the effective region features. The dispersive feature based stretch transformation was applied for extraction of key region.

III. RESEARCH METHODOLOGY

The proposed research model is defined to identify the existence of glaucoma disease in the retinal images. The proposed work is defined as the three phase evaluation on the individual retinal image. In the earlier stage, the preprocessing method such as histogram analysis and morphological operators are applied to rectify the image. After adjusting the brightness and contrast, the segmentation method is applied to extract the effective region. The segmentation is applied based on intensity evaluation. The textural features of retinal image are analyzed along with morphological operators to separate the regions over the retinal image. The background, vessel region, core effective region and non effective are separated. The vessel region and core effective region is processed further to perform the block specific analysis. In this stage, the window adaptive analysis is performed to identify the core cup and disc region and to identify the region boundaries. The textural and bound based analysis is performed in this stage. Once the effective region is identified, the statistical evaluation is performed to separate the normal and disease infected retinal images. The proposed method is provided in this research as the algorithmic flow in figure 2.

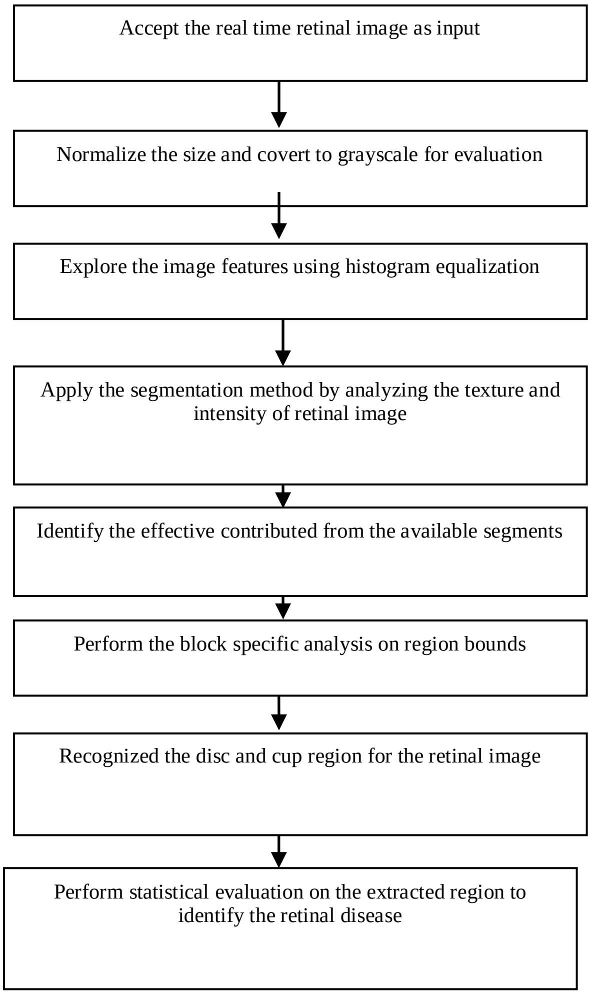

Figure 2: Proposed Model

Figure 2 shows the actual flow of work provided to separate the normal and disease images. The real time image is taken as input to the disease identification system. The high quality color images are taken in this research to test the proposed model. The size level and color level transition is done to normalize the image in preprocessing stage. The histogram equalization is applied on this preprocessing stage to improve the image features. The mathematical operators are also applied on this image to improve the image features. Now in first processing stage of this work, the intensity level analysis is applied to perform segmentation over the image. In this stage, the regions are separated on the high resolution retinal image. The regions are separated and the effective decision driven region is identified in this stage. The cyclic process is performed to analyze the intensity variation exist within the image. The evaluation is performed to distinguish the regions based on intensity and textural strength range. Now the effective region is divided in smaller blocks and the analysis on the block intensity is done to identify the region bounds. The curvature region evaluation is done to recognize the cup and disc area accurately. After recognizing the disc and cup regions, the ratio based analysis is performed to generate the decision rule for separation of disease and normal image.

IV. RESULTS

In this paper, a textual features based distance analysis method is defined to identify the glaucoma patients. The proposed model is applied on real time images captured from the external web source. The high resolution images are extracted from https://www5.cs.fau.de/research/data/fundus-images/. The High-Resolution Fundus (HRF) dataset images are analyzed by applying the mathematical operators to identify the effective region and features to identify the glaucoma patients. The proposed model is applied on three different samplesets of 10, 15 and 25 retinal images. The analysis work is done under accuracy parameter. The analytical results obtained for each sampleset are shown in figure 3.

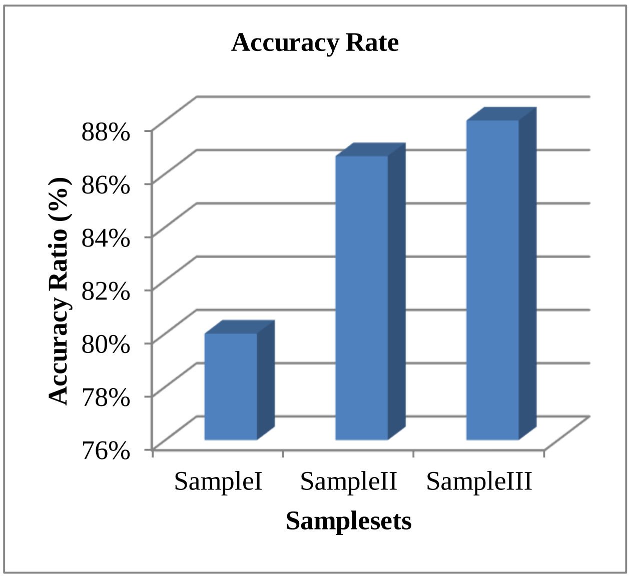

Figure 3 : Analysis Results

Figure 3 has provided the analysis results obtained for this research. The samplesets are provided on x axis and y axis represents the accuracy rate. The results identified as a significant accuracy rate is achieved from this research. The figure shows that the higher accuracy over 80% is achieved for each dataset.

V. CONCLUSION

The retinal disease can be analyzed to identify the existence of Glaucoma disease. In this paper, the textural features and the region specific evaluation is performed to identify the glaucoma patients. The proposed model extracted the region features by applying the mathematical operators and the distance based textural feature analysis. Based on this prior evaluation, the effective disc and cup regions are identified. Later, the ratio based analysis is applied to identify the glaucoma patients. The model is applied on three different samplesets and the analytical results shows that the model achieved the higher accuracy to identify the glaucoma patients.

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