A Survey of the Prevalence and different Techniques for Glaucomatous Image Classification

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ABSTRACT
The recent advance in glaucoma classification method and improvements in the accuracy of classification. An Automated clinical decision support systems are designed to create effective decision support systems for the identification of disease , it is used to extract structural, contextual, or textural features from retinal images which are use to distinguish between normal and diseased samples. The effectiveness is gauged of the resultant ranked and selected subsets of features using a random forest , support vector machine, sequential minimal optimization, and na¨ıve Bayes classification strategies. This paper presents a detailed review on existing classification approaches that have applied to glaucoma classification.

Index Terms
Glaucoma, data mining, feature extraction, image texture, wavelet transforms, biomedical optical imaging**.**

1. INTRODUCTION
Glaucoma is one of the eye diseases which caused because of increased in intraocular pressure (IOP) due to the malfunction of the drainage structure of the eyes. If glaucoma disease is not get the proper treatment at the proper time it permanently damaging vision in the infected eye and leads to completely blindness. There is a small space In the front portion of eye is called anterior chamber of eye. Aqueous humor is nothing but a liquid which flow in-and -out of chamber. A clear liquid, aqueous humor nourishes and bathes nearby tissues. Aqueous humor is also use to maintain the intraocular pressure of eye. By producing a small amount of aqueous humor the pressure within eye is maintain when an equal amount flows out of the eye through a microscopic drainage system called trabecular meshwork. Decreased drainage or increase production of aqueous humor results in increased intraocular pressure. Elevated intraocular pressure the major risk factor of causing glaucoma. increased intraocular pressure affects wrostly , within the eye it damages optic nerve through which retina sendslight to the brain where they are understand as image and makes vision possible. Glaucoma blindness increases the independence of aging people. Near about 60 million people are estimated by the prevalent model at the current time, are suffering from glaucoma. Furthermore, in countries, like India, it is estimated that near about 11.2 million people having the age over the 40 suffer from glaucoma. Due to this reason glaucoma has become second leading cause of peripheral blindness worldwide and results in the neurodegeneration of the optic nerve. So it becomes necessary of detection of glaucoma disease as early as possible and provides a better treatment. It is believed that these numbers can be curtailed with effective detection and proper treatment options for glaucom[5].

For the detection and management of glaucoma, recent advances in biomedical imaging offer effective quantitative imaging alternatives, in light of the diagnostic challenge at hand. There are two prominent techniques employed for quantitatively analyzing structural and functional abnormalities in the eye both to observe variability and to quantify the progression of the disease objectively These techniques are optical coherence tomography and multifocal electroretinograph (mfERG). For the glaucoma diagnosis an investigation of the retina using the Heidelberg Retina Tomograph (HRT) is usually follows, which is a con- focal laser scanning system developed by Heidelberg Engineering. The 3-dim images of the retina to be obtained and analyzed by HRT. This way the topography of the optical nerve head, called papilla, can be followed over time and any changes be quantitatively characterized. The first step in automatic diagnosis of retinal images is pre-processing .The need of pre-processing is that quality of image is usually not good. Hence, To improves the quality of the retinal image Z Score Normalization is used. For automatic glaucoma recognition two central issues are given below:

- feature extraction from the retinal images and
- classification based on the chosen feature extracted.

Features extracted from the images are further having types as structural features or texture features. Disk area, disk diameter, rim area, cup-to-disk ratio, cup area, cup diameter, and topological features extracted from the image are belongs to the structural features. At this point, it is important to make a distinction between wavelet feature selection and the general feature selection discussed in pattern recognition methods. Both selection methods are target to obtain a compact representation of the image for classification. These both methods are not same exactly. Using texture features classification of glaucoma is done effectively. For classification of the images both selection methods aim at obtaining a compact representation. However, there are two techniques which are different . First, of it is for general feature selection methods, and the explicit knowledge of the feature extraction process may not always be available. The input to the general feature selection process is usually a vector of values representing the different features without any apriori information about how these features were obtained. On the other hand, the wavelet feature selection methods can take advantage of the tree structure of the wavelet decomposition for the selection process[7]. The few anatomical structures are relatively used to described eye; glaucoma is a disease whose mechanisms are largely limited to the eye.

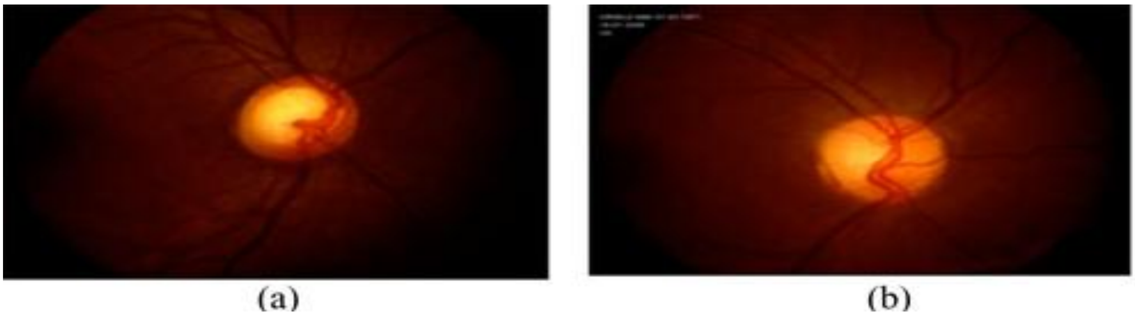


Fig 2.1: Typical fund images of eye(a) normal and (b) glaucoma[6]

2. GLAUCOMA CLASSIFICATION

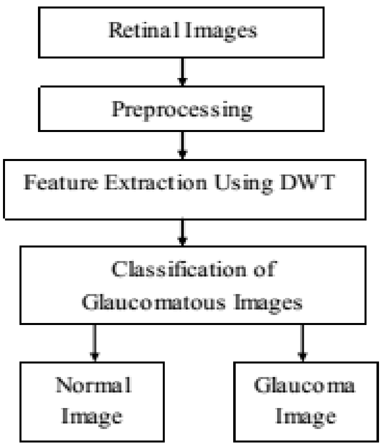
In glaucoma, the pressure within the eyes vitreous chamber rises and compromises the blood vessels of the optic nerve head, leading to eventual permanent loss of axons of the vital ganglion cells.

Glaucoma classification is done to sort out the infected images of eye. Figure 2.1 including diseased infected and normal image images of eye.

The rest of this paper is organized as follows:

In Section II the glaucoma classification is explained in detail. Section III contains the architecture of glaucoma classification system. Section IV will describe the related work of glaucoma classification and classification technics using discrete wavelet transform. Finally, we make conclusions in Section V.

3. ARCHITECTURE OF GLAUCOMA CLASSIFICATION



3.1 Block diagram of classification of glaucoma and normal retinal images

There are following are the steps have to follow for classification of glaucoma images. This Figure3.1 shows the overall working of system. Figure shows the block diagram of classification for Glaucoma and Normal Retinal Image. First step is to get the image and after then preprocessing is to normalize the image. Then after features extraction step is there in this step the features that represents whole image, instead of tacking complete image for classification these features are further give to classify normal and infected image.

3.1 Preprocessing

Preprocessing is done for the removal of noises presented in the Image. For the removal of noise one method is used known as Contrast Limited Adaptive Histogram Equalization. Instead of selecting whole image, CLAHE selects small regions in the image. The main purpose of applying histogram equalization was to assign the intensity values of pixels in the input image, so as to the output image contained a uniform distribution of intensities, and then to increase the dynamic range of the histogram of an images. image preprocessing is required in equalization of the irregular illumination associated with retinal images. In preprocessing step, the noises presented in the image are removed. The CLAHE (Contrast Limited Adaptive Histogram Equalization) method is used to remove the noise. First CLAHE selects small regions in the image, rather than the entire image.

3.2 Features Extraction

After pre-processing feature extraction process is carried out. In feature extraction phase features of image are extracted . These features are helpful for identification or verification of individual. Extracted features from captured images are stored in database for further process of classification.

3.3 Classification

Classification of glaucoma and normal images is done using various classification techniques. Classification of selected subsets of features is done using a support vector machine, random forest, sequential minimal optimization, and naive Bayes classification strategies.

4. RELATED WORK

This section glances through various glaucoma classification methods based on the features extracted.

Fig 3.2: (a) and (b) Shows the difference between before and after process of Z-Score Normalization

4.1 Optical Coherenc Ttomography

Brian Brown describe **examination** modes that are recently available multifocal electroretinogram (mfERG) and optical coherence tomography (OCT) along with the advantage and disadvantage. OCT is commonly using to measured retinal thickness to assess glaucoma and macular conditions, for example, macular thickness. Overall retinal thickness is measured using repeatability of OCT so that judgments of real change of retinal thickness can be made. In OCT reference Beam and radiation that are emerging from the eye are compare[1].

4.2 Causal-Associational Network

Sholom M. Weiss describes CASNET model that characterizes the clinical Course and pathophysiological mechanisms of treated and untreated diseases. Patient's, observation, pathophysiological states, classifications of disease are three important parts of a CASNET model. As observations are recorded and these observation are then associated with the appropriate intennediate states. These state summarizes the mechanisms of disease . Though CASNET model is developed for describe pathophysiological medical events, many different complex processes can be describe by CASNET models [2][3].

4.3 Texture and Higher Order Spectra (HOS) Feature

U. Rajendra Acharya describes the glaucoma detection method by combining two types of features are the higher Order Spectra and texture features. These features are extracted from images for the diagnosis purpose. These features are clinically significant which help to easily differentiate the normal and abnormal images[4].

4.4 Wavelet-Fourier Analysis

E. A. Essock describes wavelet-Fourier analysis (WFA) which involved three major steps that are as :

- feature extraction
- feature optimization
- classification

First of all features are extracted from the images. The main purpose of this study is to detect glaucoma in its earliest stages[8].

4.5 Proper Orthogonal Decomposition

M. Balasubramanian describes POD which is an example of the technique in which structural features are used for identification of glaucomatous progression. Significant changes across samples are gauge using pixel level information[9].

4.6 Discrete Wavelet Transform

I. Daubechies describes DWT. Decomposition of an image is analysed by DWT and coarse approximation is obtained using low pass filtering to get more details about image high pass filtering is applied.

The goal of this study is, thus, to automatically classify normal eye images and diseased glaucoma eye images.

5. CONCLUSION

Summarizing we can say that glaucoma classification has various phases as image enrollment, preprocessing, feature extraction and classification. Based on the overall survey we can say that Classification is normally based on feature extraction. The various methods and issues in glaucoma classification are discussed in this paper. There is need of efficient method for glaucoma classification system which will reduce computational time and increase efficiency

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