Automatic Glaucoma Detection by Using Images Processing Technique

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Abstract: The Aim of this work however technology overcomes the issues of glaucoma. This paper presents a distinct forms of image processing strategies utilized for the detection of glaucoma eye disease. Manual analysis of ophthalmic Pictures is time intense and accuracy depends on the experience of the professionals. Automatic analysis of retinal images and other technologies is becoming an important tool nowadays. Automation aids in detection, diagnosis and prevention of risks associated with the diseases. Image Process Techniques are very beneficial in diagnosing the eye diseases. Lightweight enters the attention through membrane, pupil and lens. These lightweight rays are directly centered focused on the tissue layer. The tissue layer commute light rays into pulsation sent through the nervus opticus to our brain, whenever they are accepted as pictures. Glaucoma is an eye fixed disease that damages the nervus opticus and causes blindness. Glaucoma is additionally known as silent crook of sight. The sole resolution is early detection of Glaucoma and timely treatment. Medication is available in several forms.

Keywords: Glaucoma, Classification of glaucoma, Methods to Diagnose, Parameters, Adaptive histogram equalization.

I. Introduction

Glaucoma is a watch unwellness that gently steals your vision. World Health Organization (WHO) declares that Glaucoma is that second leading explanation for sightlessness [1].   Usually, glaucoma has no symptoms in its early stages [2]. Although not accurate treatment, glaucoma be able to lead to blindness[1]. Still with regular eye exams, early detection, and treatment, you'll able to define your sight. The intraocular fluid cannot drain because the eyes becomes sttoped up because the fluid build up, causes pressure to make with in attention [2].
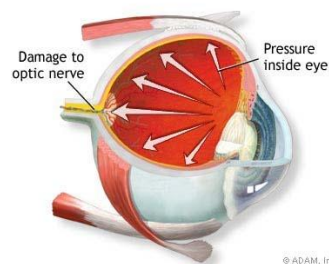

Fig.1. Damage Optic Nerve [1]

High pressure damages the smart carnial optic nerve and ends up vision loss.

A .Healthy Eye

Light enter the attention through tissue layer, pupil and lens and these lightweight rays are directly focused onto the membrane , the smart tissue lining the back of the eye. The membrane converts lightweight rays into pulse sent through the optic nerve to our brain, when they are acceptable as pictures.

B. Eye Diseases

Like many elements of the body, the attention is prone to infections or diseases. There are not s early symptoms in eye disease and sometimes even the pain does not exist as a result of not several notice any modification in their vision till the disease has reach out its final stage. There are distinct types of eye diseases are exist, all of these being common eye diseases. The subsequent may be a list of human eye disease like Age

related macular degeneration, diabetic retinopathy and glaucoma are the foremost offtimes discovered eye diseases in rural and semi urban areas[3].

C. Glaucoma

The word glaucoma emanates from Greek word, that means "clouded or blue-green hue".[2] Glaucoma is the second leading reason behind visiual impairments.[3] Glaucoma caused by increased eye pressure and damages the optic tract.[2] Glaucoma tends to develop with none symptoms till finish.[2] Diseases of the optic tract .It is a condition that causes injury your eye's optic tract and gets worse over time. Its typically connected with a build from pressure within attention. Glaucoma tends to be transmissible and turns up late in life.once optic tract fibers get broken   develops blind spots sometimes go unobserved till optic nerve is significantly broken. Leading reson behind visual impairment within the us, particularly for older folks unobserved till optic tract is significantly broken..Early detection and treatment are keys to preventing vision loss for glaucoma[2][3]
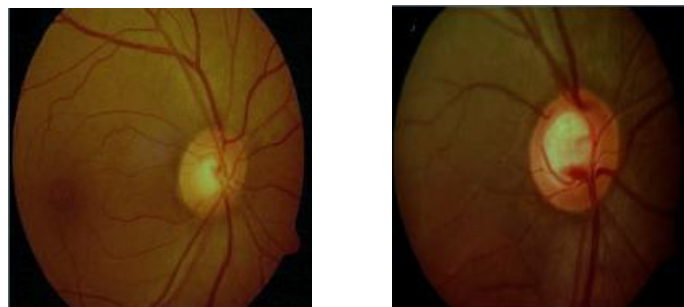

Fig.2. Normal Eye Image Glaucomatous fundus image [2]

Causes
Blood flow to optic tract is reduced by Dilating eye drops, Blocked are restricted voidance in eye, Medications, like as corticosteroids, poor high pressure.
Symptoms
The signs and symptoms of glaucoma vary betting on the sort and stages of your condition.
1.Glaucoma Symptoms severe eye pain
2.nausea
3.vomiting
4.redness in your eye unexpected vision disturbances
4.seeing coloured rings around lights
5.sudden blurred vision

D. Types of Glaucoma

There are two forms of Glaucoma
   a) Open angle glaucoma: It is that the foremost common variety of glaucoma, also known as wide-angle glaucoma.[2] As a result of partial blockage of drainage canal during which pressure will increases slowly as fluid does not drain properly.[2]During which the angle between the iris and tissue layer is 40-45 degree. The symptoms of open angle glaucoma is incredibly early stages its no symptoms, gentle pain within the eye, loss of sight. Risk issue of glaucoma in case history, age 40-60, skinny tissue layer, diabetes and high myopia.
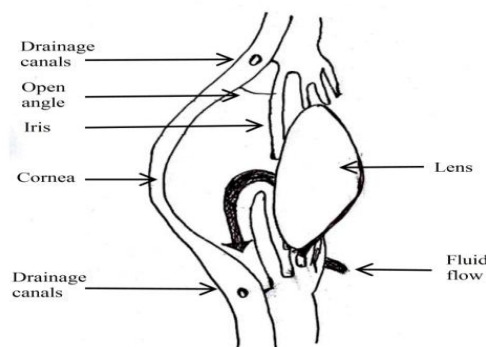

Fig.3.(a.) Open angle glaucoma [2]

b) Closure angle glaucoma: It additionally as "acute glaucoma"[2] As a result of the sharp and complete blockage of liquid body substance.[2] During which pressure increase intensly resulting in loss of vision sharply.[2] It has growing due to narrow drainage angle, thin and droopy iris[2] The symptoms of closure angle glaucoma are severe pain, pressure of the attention, cloudiness of the cornea, vomiting and eye extremely sensitive to light or the risk factor are People over 35 years of age, Family History, Poor short-distance vision(far sightedness), Eye injury or eye surger and,Diabetes.
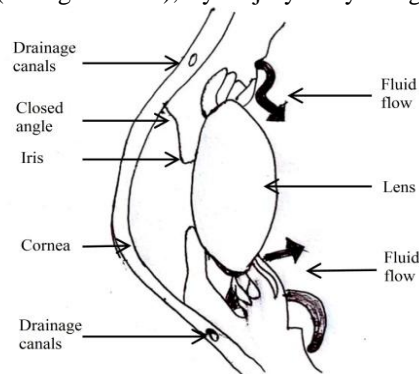

Fig.3.(b) Angle closure glaucoma [2]

II. Related Work

Nauman Zahoor M. et al.[2017] proposed Disc segmentation from retinal images is the initial step in just starting the diagnostic tool for early Glaucoma detection. presented a novel hierarchical technique for quick and correct Optic Disc localization and segmentation.

John A.et al.[2017] proposed fuzzy based decision making framework to subdue the issue diagnosis of glaucoma at initial strage fuzzy rule based allows expert knowledge to consider symptoms of patient and then based on the rules developed gives a precise decision. Later the acquired results are compared with the ophthalmologist and observations are found to be 80.3% accurate.

Bhatt M. et al. [2017] proposed detection and tracing of optic disc (OD) in retinal fundus pictures. method proposed here introduces a distinctive concept of fractal analysis in its own way, exploiting the geometric construction of eye called Pixel Based Multi Fractal Analysis (PBMFA). authors used method for outcome has been completely real-time implemented and also in entire automation of DR detection with an economical end product designed for the market analysis of hundred fifty images have been tested and verified from the public databases.

Kumar Naveen B.. et al. [2016] presented a brief of different kind of image processing methods employed for the detection of Glaucoma, most lethal eye disease.Author fundus camera has been used for the study. Atheesan S. et al.[2016] Proposed Digital Image Processing Technique to identify glaucoma disease from funduscopic images using. Author used glaucoma is identified through cup to disc ratio calculation and by the preference of the blood vessels. Automatic Glaucoma. The problems and drawbacks of current manual procedure of detecting glaucoma with naked human eyes can be overcome by Automatic Glaucoma Detection.

Minar J. et al.[2016] proposed a novel method for extraction of blood vessels and veins from medical image of human eye . Author used adaptive histogram equalization by CLAHE algorithm of green channel of fundus retinal image.Author results of detection over DRIVE between 96.07 % - 97.19 %.

ELBALAOUI A. et al. [2016] presented a novel method to detect blood vessels in the fundus retinal images. Author used three filtters Vesselness filter Hessian multiscale enhancement filter Adaptive thresholding. Author was Compared to the result approaches by other researchers, our algorithm for detection of blood vessels has the benefit that it is appropriate to all types of retinal images, healthy as well as abnormal.

Harini R. et al.[2016] Parposed Automated method of disease detection can be used against the manual method of observing several retinal fundus images to save time . Author used method in this paper for DR detection by utilizing Fuzzy C-Means (FCM)clustering and morphological image processing is proposed. The proposed method achieves 100% Sensitivity, 95.83% Specificity and 96.67% of Accuracy.

Aloudat M. et al.[2015] proposed Haar filter that aims to calculating the angle of open and closed glaucoma as a first step of determining the thickness of the liquid available on the cornea. Author Compares the result with the Patients of the Jordanian Governmental hospital (Al Ameera Basma Hospital). The patients had ages ranging between years old, and all of them had eye-related sickness.

Elshazly H et al. [2014] proposed the problem of diagnosis of a Primary Open Angle Glaucoma (POAG) disease which is hard to identify in early stage. Author tends to get an early and accurate diagnosis of

glaucoma. Author introduced three classifiers namely Neural Network (NN), Decision Tree (DT) and Fuzzy Logic classifiers to evaluate performance. The POAG dataset was obtained from the department of ophthalmology of Egypt Air hospital. Author concluded that the results showed in ROT classifier reaches significantly high accuracy in all performance measures of medical diagnosis.

III. METHODS TO DIAGNOSE GLAUCOMA

3.1 Tonometry

Tonometry calculates the pressure within your eye. In that case a doctor or technician use a instrument known as Tonometer toward calculate the internal pressure of the attention. By using a little device a little quantity of pressure is applied to the attention or by a warm blow of air. diagnosed with pressure higher than 20 mm Hg. However, some individuals will have.The vary for normal pressure is 12-22 mm Hg Virtually glaucoma cases are glaucoma at pressures between 12 -22mm Hg.if the value is exceed from the normal value the person has more chances of glaucoma. Eye pressure is exclusive to every person [5].

Fig. 4.(a) :- Tonometry [13]

3.2. Gonoiscopy

To observe your eye's drainage angle. Gonioscopy has the profit that it helps ophthalmologist to have a apparent look at the drainage angle to determine the kind of glaucoma . Ophthalmologist is not capable to see your eye's drainage angle by look at the front of your eye. Ophthalmologists confirm if you have open-angle glaucoma (where the drainage angle is not working capably enough), closed-angle glaucoma (where the drainage angle is at least incompletely blocked) by examining drainage angle with a mirrored lens [5].

Fig. 4.(b):- Gonioscopy [13]

3.3. Perimetry

Take a look at your face, or peripheral, vision The visual view test take a look at can check for blank spots in your vision. The take a look at of this result shows your ophthalmologist if and whenever blank spots appear in your field of vision. The test is performed using abowl-shaped instrument known as a perimeter .In normal eye vision loss area are almost zero or in the case of glaucoma the vision loss area are more[5].

Figure. 4(c):- Perimetry [14]

3.4. Pachymetry

Evaluate the thickness of your membrane.The thickness of the membrane will distress eye pressure readings, pachymetry is employed to live membrane thickness. A probe known as a pachymeter is employed to calculate membrane thickness thickness by gently inserting it on the membrane. A very thin membrane could increase your risk of glaucoma [5].

Fig.4.(d):- Pachymetry [15]

3.5. Ophthalmoscopy

This diagnostic formula helps the doctor examine your optic tract for glaucoma injury. Eye drops are want to dilate so pupil so the doctor will see through your eye to look at the form and colour of the optic tract.[5]

IV. Result & Discussion

Adaptive Histogram Equalization: Adaptive Histogram Equalization be a mainframe picture giving out method used to recover contrast in image. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms , The conservative histogram equalization effort formula is straightforward inflicting data loss. The paper conferred associate adaptive histogram-based formula within which the data entropy remains constant. The method introduce factor ☐ in the grey level mapping method, and takes the data entropy as the target achieve to adaptively modify the spacing of 2 adjacent grey levels within the new histogram. thus it avoids excessive grey picture element merger and excessive bright native areas of the image. Experiments give you an idea about that the enhanced formula might successfully improve visual effects below the basis of constant data entropy. it's useful in CT image process.

An analysis of sixty fundus images have been tested and verified from the public database. 30 glaucoma images and normal images with the age group of 20 to 70 years. Images are stored in jpg format with an image size of 3504x2336 pixel. A fundus camera is intended to get photos of the inner surface of the attention. A fundus camera is one amongst the foremost admired devices used for Ophthalmoscopy and employed by doctor to diagnose eye disease as well as to monitor their progression. The primary step is pre-processing of image information to get rid of the non-uniform background which can ensue to non-uniform illumination or variation within the pigment color of eye blood vessels. As a second step, varied teams of texture features were extracted from each digital retinal fundus image. The two teams of normal and glaucoma features were normalized. During this research , the normalizing features were extracted by using adaptive histogram equilization method. The planned algorithmic rule uses many steps to pre-process the input fundus image. the primary step is to settle on the green channel of input image, as a result of this channel contains most information with blood vessels and veins in retinal fundus image .The blood vessels is segmented by green channel . True Negative (TN) is that the variety of traditional pictures classified as traditional pictures. False Negative (FN) is that of variety of glaucomatous pictures classified as traditional. True Positive (TP) is that of variety of glaucoma images classified as glaucoma. False Positive (FP) is that of variety of normal pictures classified as glaucomatous.

In our work, PNN able to classified successfully with accuracy rate of 80.9%, sensitivity 96.7%, specificity 93.9% and positive predictive accuracy (PPV) 96.7% which is clinically significant. Sensitivity is the probability of abnormal class is classified as abnormal.

Table 1- Classified Table

Age	accuracy rate	sensitivity	specificity	positive predictive accuracy
20 to 70	80.9%	96.7%	93.9%	96.7%
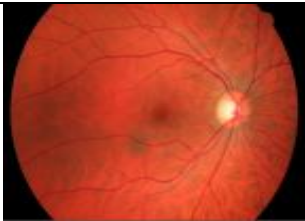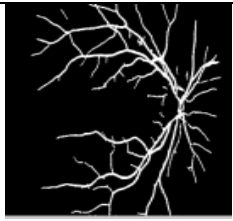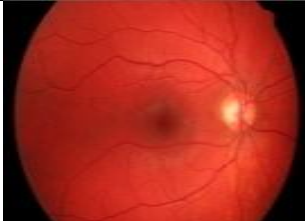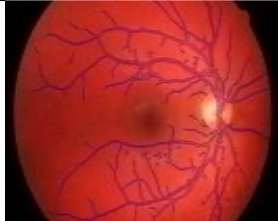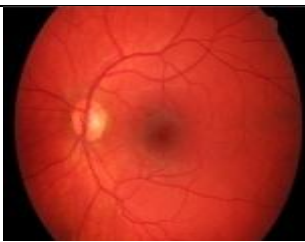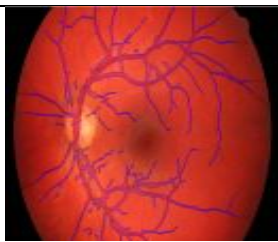
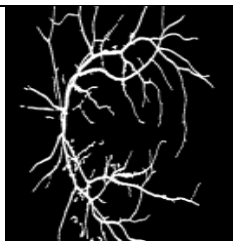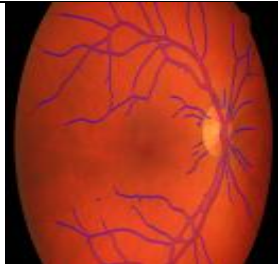| - Sr. No.	Original Fundus Image	Green Channel image	Extracted blood vessels	Result
1.				Normal Image
2.				Glauco matous Image
3.				Glauco matous Image
4.				Normal Image
I. 5.				Normal Image

Fig. 4.1. Detection results : Retinal images from DRIVE database, results of the proposed method, the ground truth manual.(a) Input image (b) Enhanced green channel image (c) segmented blood vessels.

V. Conclusion

It is over that the injury done by glaucoma is irreversible. Early detection and treatment of glaucoma is that the only clarification for detection and diagnosis of glaucoma, there are multiple medical tests are available ,but on behalf of some tests image processing techniques are applied on the retinal fundus images and getting more accurate result though it. The center detection algorithm is an advantage in the sense that it can be competently used for selection of Optic disc region from the many objects which are segmented using edge detection .In future we will deeply work on Glaucoma detection technique using various image processing methods.

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