REVIEW ON PREDICTION OF RETINAL DISEASES USING IMAGE PROCESSING TECHNIQUES

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Abstract : Eyesight is most precious thing. In human eye, retina is attached to the inner surface which plays the important role for eyesight. Healthy retina is required for central vision. Imagine, if we are losing our eyesight how the world will be. Any disease in the retina like floaters, macular degeneration, macular hole, retinal detachment, diabetic retinopathy, etc. leads to serious problems. Nowadays Retinal diseases are found to be frequent cause of blindness. So, Identifying retinal diseases at the early stage can prevent the blindness. The screening of retinal based diseases can potentially reduce the risk of blindness. The main goal of our proposed system is the early diagnosis of retinal diseases using fundus images and to automatically detect and classify retinal diseases without human supervision. Image Processing is having its significance for disease detection. Therefore, our method will predict the retinal disease using image processing techniques and display the result as type of disease predicted.

IndexTerms **- Retina, retinal diseases, macular degeneration, diabetic eye disease, glaucoma, retinal detachment, macular hole, prediction, image processing.**

I. INTRODUCTION

The human eye is an important organ which reacts to light and pressure. As a sense organ, the eye allows vision. Human eyes help to provide a three dimensional, moving image, normally coloured in daylight. It is composed of retina, pupil, iris, cornea, and lens.

In human eyes, retina plays a vital role in visualization. The retina is the innermost, light-sensitive, thin layer of tissue that lines the back of the eye on the inside. It is located near the optic nerve. The purpose of the retina is to receive light that the lens has focused, convert the light into neural signals, and send these signals on to the brain for visual recognition.

The retina processes light through a layer of photoreceptor cells. These are essentially light-sensitive cells, responsible for detecting qualities such as color and light-intensity. The retina processes the information gathered by the photoreceptor cells and sends this information to the brain via the optic nerve. Basically, the retina processes a picture from the focused light, and the brain is left to decide what the picture is. Due to the retina's vital role in vision, damage to it can cause permanent blindness. Without a healthy retina, you can't read, drive, or see fine details. A retinal disorder or disease affects this very important tissue, which, in turn, can affect vision to the point of blindness. The following Figure 1 shows fundus image of healthy retina.

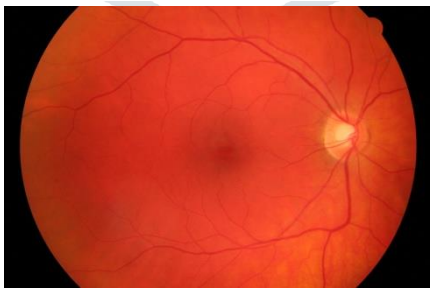

figure 1. healthy retina fundus image

Common retinal conditions include floaters, macular degeneration, diabetic eye disease, glaucoma, retinal detachment, macular hole.

Floaters: Floaters are little "cobwebs" or specks that float about in your field of vision. They are small, dark, shadowy shapes that can look like spots, thread-like strands, or squiggly lines. They move as your eyes move and seem to dart away when you try to look at them directly. They do not follow your eye movements precisely, and usually drift when your eyes stop moving. Most people have floaters and learn to ignore them; they are usually not noticed until they become numerous or more prominent. Floaters can become apparent when looking at something bright, such as white paper or a blue sky. The retinal image of floaters is shown in figure 2.

Macular degeneration: Macular degeneration, or age-related macular degeneration (AMD), is a leading cause of vision loss in 60 and older. It is a disease that destroys your sharp, central vision. You need central vision to see objects clearly and to do tasks

such as reading and driving. AMD affects the macula, the part of the eye that allows you to see fine detail. It does not hurt, but it causes cells in the macula to die. The retinal image showing macular degeneration is shown below in figure 3. There are two types: wet and dry. Wet AMD happens when abnormal blood vessels grow under the macula. These new blood vessels often leak blood and fluid. Wet AMD damages the macula quickly. Blurred vision is a common early symptom. Dry AMD happens when the light-sensitive cells in the macula slowly break down. You gradually lose your central vision. A common early symptom is that straight lines appear crooked.

figure 2. floaters

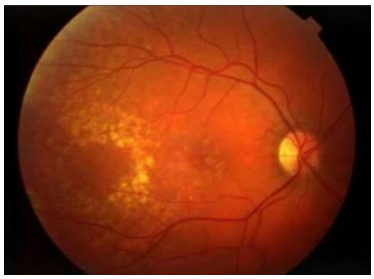

figure 3. macular degeneration

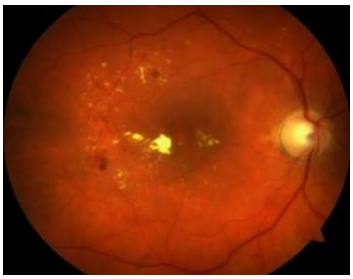

figure 4. diabetic retinopathy

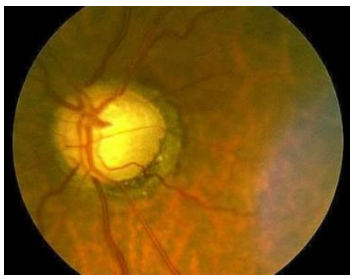

figure 5. glaucoma

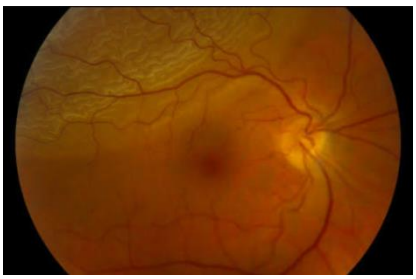

figure 6. retinal detachment

figure 7. macular hole

Diabetic eye disease: Diabetic eye disease is a group of eye conditions that can affect people with diabetes.
Diabetic Retinopathy- It affects blood vessels in the light-sensitive tissue called the retina that lines the back of the eye. It is the most common cause of vision loss among people with diabetes and the leading cause of vision impairment and blindness among working-age adults. The retinal image showing diabetic retinopathy condition is as shown in figure 4.
Diabetic macular edema (DME)- A consequence of diabetic retinopathy, DME is swelling in an area of the retina called the macula.
Glaucoma: Glaucoma is a condition that causes damage to your eye's optic nerve and gets worse over time. It's often linked to a buildup of pressure inside your eye. Glaucoma tends to be inherited and may not show up until later in life. The image of retina suffered from glaucoma is as shown in figure 5.
Retinal detachment: A retinal detachment lifts or pulls the retina from its normal position. It can occur at any age, but it is more common in people over age 40. It affects men more than women and whites more than African Americans. A retinal detachment is also more likely to occur in people who are extremely nearsighted, have had a retinal detachment in the other eye, have a family history of retinal detachment, had cataract surgery, other eye diseases or disorders, had an eye injury. Symptoms include an increase in the number of floaters, which are little "cobwebs" or specks that float about in your field of vision, and/or light flashes in the eye. It may also seem like there is a "curtain" over your field of vision. A retinal detachment is a medical emergency. If not promptly treated, it can cause permanent vision loss. The image of retinal detachment is shown in figure 6.
Macular hole: A macular hole is a small break in the macula, located in the center of the eye's light-sensitive tissue called the retina. The macula provides the sharp, central vision we need for reading, driving, and seeing fine detail. A macular hole can cause blurred and distorted central vision. Macular holes are related to aging and usually occur in people over age 60. The retina showing macular hole is shown in figure 7.

Retinal diseases can be identified with aging, diabetes, alternately different diseases, trauma of the eye, or family history. Retinal diseases are found to be frequent cause of blindness for working age population. So, diagnosis of these diseases is needed at an early stage before it becomes worse to prevent the blindness. With the help of image processing techniques, it is possible to predict the diseases from the retinal fundus images.

II. LITERATURE REVIEW

R. Sivakumar, R. Tamilselvi, N. Archana, N. Deepthi and N. Priyadharisini [1] proposed the automatic detection of the retinal disease by three stages which are segmentation, feature extraction and classification. In segmentation, features extracted from the segmented region are mean, mode, entropy, RMS value, variance and standard deviation. The correlation coefficient and similarity index features that are used gives perfect variation level between various diseases. These features extracted are used for classifying the diseases depending upon the feature ranges.

R. Priya and P. Aruna [2] analyzed diabetic retinopathy and three models such as Probabilistic neural plan (PNN), Bayesian arrangement and support vector machine (SVM) were compared. The massiveness of the disease spread in the retina can be recognised by extracting the appearance of the retina. The effectiveness of the right arrangement can be improved by extracting superior features and eventually expanding the number of information for each class also likewise by joining with different pattern classification models.

Parul and Neetu Sharma [3] proposed that the disease recognition and classification approaches are specific to human organ and image type. One of such disease class includes Identification of retinal disease for example, such that glaucoma detection or diabetic detection. It defines a study on disease recognition approaches such as SVM, DCT, HMM and PCA approaches and also defines the image processing operations applied to filter the medical image and to perform disease area segmentation. It describes a work on medical image processing, classification and disease recognition. It has defined the basic filteration model to improve the image features so that effective disease detection will be performed.

Langade Umesh, Malkar Mrunalini, and Swati Shinde [4] described the application of various image processing which are enhancement, feature extraction, image fusion and machine learning techniques which are Naive Bayes, KNN, SVM, PCA etc for detection of eye diseases. Image processing techniques and machine learning algorithms is used. Eye disease detection and recognition can be achieved with the use of Image Processing and Data Mining techniques.

C.K.Balasundari, R.Ulagammal, J.Sivapriya, S .Vino Sakthiya, M.Sathya [5] proposed diagnosis of retinal diseases using image processing techniques, for Diabetic Retinopathy, retina image is converted from RGB to gray scale, the median filter is used to reduce the effect of noise, image enhanced by using Contrast limited Adaptive Histogram Equalization, then morphological operation closing applied on the enhanced image to close the same intensity values. In ARMD, the fundus images are classified into 3RGB channel, green component is used for higher contrast between the drusen and the background, Adaptive Histogram equalization is used to enhance image, the threshold value chosen from the intensity characteristics applied to detect drusen. In Retinoblastoma, RGB image is converted into gray scale image, the median filter and Gaussian filter is used to remove the noise and smooth the image, thresholding to provide black and white version of RGB image, then to decompose the real and imaginary components of a image in frequency domain the Fast Fourier Transform is used. In glaucoma, to extract correct disc and cup boundaries Super pixel segmentation is used. K-Means clustering algorithm is applied.

Sandra Morales , Kjersti Engan, Valery Naranjo and Adrian Colomer [6] investigated bigotry capabilities in the adjustment of fundus images to differentiate amidst anatomization and advantageous images. For this purpose, the accomplishment of local binary patterns (LBP) as a adjustment descriptor for retinal images has been explored and compared with added descriptors such as LBP description and belted actualization quantization. Five experiments were planned and approved for the suggested system acquiring guaranteeing outcomes. For each experiment, a few classifiers were tried. A normal affectability also specificity higher over 0. 86 on the whole the cases and very nearly about 1 whats more 0. 99, respectively, for AMD identification were attained. These outcomes infer that the strategy will be a hearty algorithm to describing retina composition also can be advantageous in an analysis help framework to retinal ailment screening. It performed automatic detection of retinal vessels and various retinal pathology has been highlighted.

II. PROPOSED METHODOLOGY

The input retina fundus image is obtained from digital fundus camera, then image is detected by image processing techniques such as preprocessing, feature extraction, classification. Finally the result will be displayed as no disease/healthy retina or type of retinal disease which is predicted. The flowchart of process is shown in the figure 8 below.

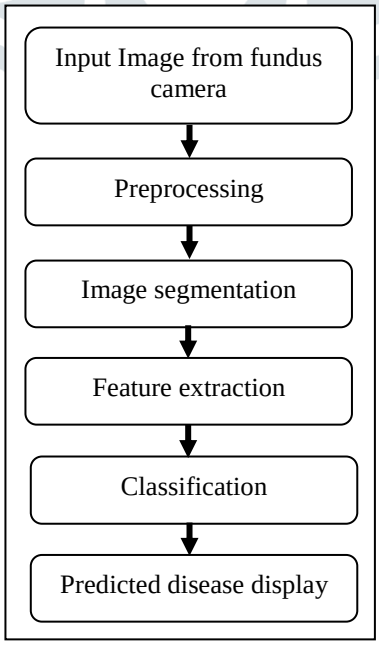

figure 8. flowchart of proposed methodology

III. Conclusion

As retina plays vital role in vision of eye, if retina gets damaged due to any reason it leads to severe problem of vision which causes blindness. So, early detection of retinal disorder or disease is an important task in present situation. The retinal diseases which have been commonly detected are discussed in this paper. The paper has defined the basic methodology which includes preprocessing of an input fundus image, image segmentation, feature extraction, classification and display of the type of retinal disease. Paper described the work on retinal disease prediction using image processing techniques for effective prediction.

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