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QUANTIFICATION AND IDENTIFICATION OF VITREOUS HEMORRHAGE DISEASEUSING DIGITAL IMAGE PROCESSING BY OTSU METHOD

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Abstract: The Diabetic retinopathy can be find out using the Otsu method. The Otsu method can be used on the fundus images which are taken for the detection of the Vitreous Hemorrhage. The Fundus images taken are used for finding the Vitreous Hemorrhage which is caused by delicate new blood vessels bleed into the vitreous. The detection of the Vitreous Hemorrhage is manually by the retina specialist without any software support; hence the detection accuracy depends on the experience of the retina specialist himself. This Technique will help doctors to find the Vitreous Hemorrhage with the maximum accuracy.

Keywords: Diabetic retinopathy, Fundus Images, Vitreous Hemorrhage.

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INTRODUCTION

Diabetic Retinopathy

Diabetic related eye diseases are the commonest cause of vision defects and blindness in the developed countries. Monitoring the health of the retina is important for those people with signs of diabetic retinopathy (DR). Vitreous Hemorrhage delicate new blood vessels bleed into the vitreous of abnormal retinas and are one of the most prevalent lesions at the early stages of diabetic retinopathy. Color fundus images are used to detect Vitreous Hemorrhage in retinal images. Figure 1.1 shows a unhealthy retina with its main features and Hemorrhage.

Manual detection of Hemorrhage by retinopathy specialist doctors as they have to spend a great deal of time in the analysis and diagnosis of retinal photographs. The technique for Hemorrhage detection has great significance in saving cost, time and labor. Image processing techniques for Hemorrhage detection can help in extracting the location, size and severity grade of Hemorrhage in the retinal images.

Diabetic retinopathy, the most common diabetic eye disease, occurs when blood vessels in the retina change. Sometimes these vessels swell and leak fluid or even close off completely. In other cases, abnormal new blood vessels grow on the surface of the retina. Diabetic retinopathy usually affects both eyes. People who have diabetic retinopathy often don't notice changes in their vision in the disease's early stages. But as it progresses, diabetic retinopathy usually causes vision loss that in many cases cannot be reversed [7].
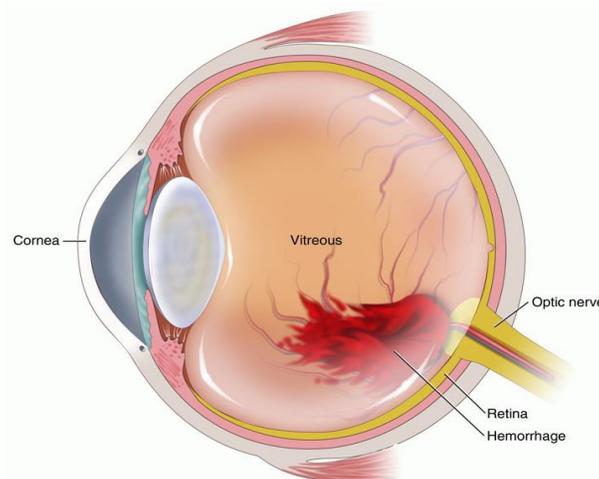

Figure 1.1:- Vitreous Haemorrhage

Proliferative diabetic retinopathy (PDR), it is type of Diabetic Retinopathy, mainly occurs when many of the blood vessels in the retina close, preventing enough blood flow. In an attempt to supply blood to the area where the original vessels closed, the retina responds by growing new blood vessels.

The Vitreous Hemorrhage it is type of Proliferative diabetic retinopathy (PDR), it delicate new blood vessels bleed into the vitreous the gel in the center of the eye preventing light rays from reaching the retina. If the vitreous hemorrhage is small, you may see a few new, dark floaters. A very large hemorrhage might block out all vision, allowing you to perceive only light and dark. Vitreous hemorrhage alone does not cause permanent vision loss. When the blood clears, your vision may return to its former level unless the macula has been damaged.
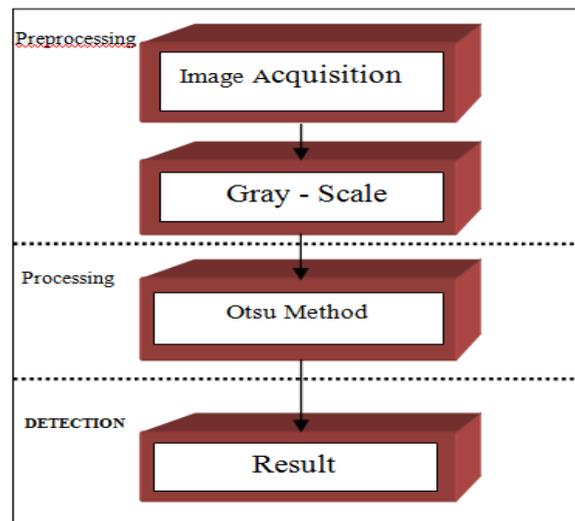
2. FLOW CHART

Figure 2.1:- Flow Chart

3. EXPERIMENTAL DETAILS
The proposed system is based on the following three parts that are as follows

1. Preprocessing
2. Processing
3. Detection
   3.1 Preprocessing
   3.1.1 Fundus photography

Image is acquired from fundus camera. Fundus photography, the creation of a photograph of the interior surface of the eye, including the retina, optic disc, macula, and posterior pole. Here, database images are used.

3.1.2 Gray-Scale Image:-

The images received from the Fundus Camera must be converted to the Gray scale image because though the images are in gray matter the Red Green Blue components are not visible in the image. Thus removing of this RGB component will help to perform the operations easily. This RGB images are converted to grayscale images by eliminating the hue and saturation information while retaining the luminance. Thus making the property of the image 2196 x 1958 x 3 to 2196 x 1958.

3.2 Processing

3.2.1 Otsu Method:-

Otsu's method is used to automatically perform histogram shape based image thresholding, or the reduction of a graylevel image to a binary image. The algorithm assumes that the image to be thresholded contains two classes of pixels or bi-modal histogram then calculates the optimum threshold separating those two classes so that their combined spread is minimal. Thresholding is a simple but effective method to separate objects from the background.
[2] [3] [4] [5] Otsu's thresholding technique is based on a discriminate analysis which partitions the image into two classes $C1$ and $C2$ at gray level t such that C1={0,1,2,..t} and C2 = {t +1,t + 2, L -1}, where L is the total number of the gray levels of the image. Let the number of pixels at the ith gray level be n_i, and n be the total number of pixels in a given image. The probability of occurrence of gray level i is defined as

$$P_i = \frac{n_i}{n}$$

$C1$ and $C2$ are normally corresponding to the object of interested and the background, the probabilities of the two classes are ω_0 and ω_1

$$\omega_0 = \sum_{i=0}^{t} P_i$$

$$\omega_1 = \sum_{i=t|+1}^{L-1} P_i$$

Thus, the means of the two classes can be computed as:

287

$$\mu_0(t) = \sum_{i=0}^{t} i\rho_i / \omega_0(t)\mu_1(t)$$

$$\mu_1(t) = \sum_{i=t|+1}^{L-1} i\rho_i / \omega_1(t)$$

Let σ_B^2 and σ_T^2 be the between-class variance and total variance respectively. An optimal threshold t can be obtained by maximizing the between-class variance.

$$t^* = Arg \left\{ \begin{matrix} max \\ 0 \leq i \leq L - 1 \end{matrix} \left(\frac{\sigma_B^2}{\sigma_T^2} \right) \right\}$$

Where, the between class variance σ_B^2 and total σ_T^2 variance are defined as:

$$\sigma_B^2 = \omega_0 \left(\mu_0 - \mu_T \right)^2 + \omega_1 \left(\mu_1 - \mu_T \right)^2$$

$$\sigma_T^2 = \sum_{i=0}^{L-1} (i - \mu_T)^2$$

The total mean of the whole image μ_T is defined as:

$$\mu_T = \sum_{i=0}^{L-1} (iP_i)$$

An equivalent, but simpler formula for obtaining optimal threshold t^* is as follows:

$$t^* = Arg \begin{matrix} max \\ 0 \leq t \leq L \end{matrix} \left\{ \omega_0 \left(\mu_0 - \mu_T \right)^2 + \omega_0 (\mu_1 - \mu_T)^2 \right\}$$

Otsu's method of thresholding gray level images is efficient for separating an image into two classes where two types of fairly distinct classes exist in the image.

3.3 Detection

Figure 3.3.1(a) shows Input image, of an unhealthy retina with its main features and hemorrhages. Figure 3.3.2(b) shows Histogram of image. Figure 3.3.1(c) shows Output image, where it found Vitreous **Hemorrhage** with exact position of the infected area.
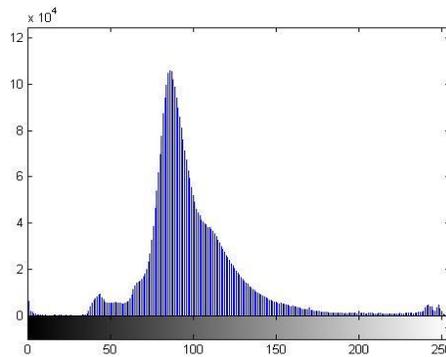
Figure 3.3.1(a) Input Image

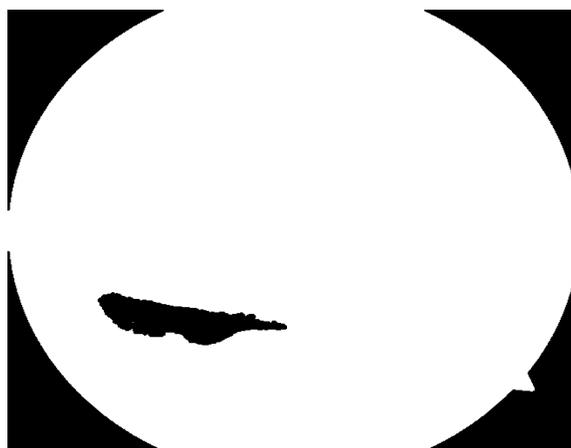**Figure 3.3.1(b) Histogram of image**

Figure 3.3.1(c) Output Image

4. Conclusion

The Vitreous Hemorrhage can be found precisely according to the length, breadth and the exact position of the infected area by the Otsu method. This technique can help the doctors for the analysis of Vitreous Hemorrhage.

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