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Diagnosis of Retinal Detachment via Blood Vessel Analysis using Multi threshold Image Binarization

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Abstract: ***In the eye retina is the innermost layer. A retina is the light-sensitive tissue lining the back of the eye. Retinal detachment is disorder of eye. It is described as a very critical condition in which all layers of retina are pull away from its normal position. Due Retinal detachment can lead to visual impairment or loss of vision. So, diagnosis of Retinal detachment disease in earlier stage is very important. This study aims to diagnosis retinal detachment position from blood vessels of retina. The process of extracting the normal and detach retinal position conducted by the Four Steps: image pre-processing, Apply Filter, Multi threshold with image Binarization, Extracting the retinal blood vassals, extract the position of Retinal detachment disease. In this research work we used the local dataset of Aravid_eye_care hospital from IEEE website which contain the retinal detachment fundas image. In this work we exact the one features of Retinal Detachment disease i.e. blood vessels of Retina. Also, we compare the healthy retina and detachment position of retina from blood vessels.***

Keywords: Retinal Detachment, Feature Extraction, Blood Vessels, Database, Preprocessing

Abbreviations:
RGB: Red, Green and Blue
Lab: Laboratory

I. INTRODUCTION

The retinal detachment is disorder of eye in which the retina gets detached from the choroid layer underneath it. In retinal detachment the Nero sensor layer get separated from retinal pigment epithelium [1].

Retinal detachments are by using the flowing symptoms:

A. Increase number of flashes in front of eye. It is
B. also called photopsia.
C. Increase number of floaters in front of eye.
D. Loss of vision.
E. Blurred vision.
F. Reduced side (peripheral) vision
G. Etc….

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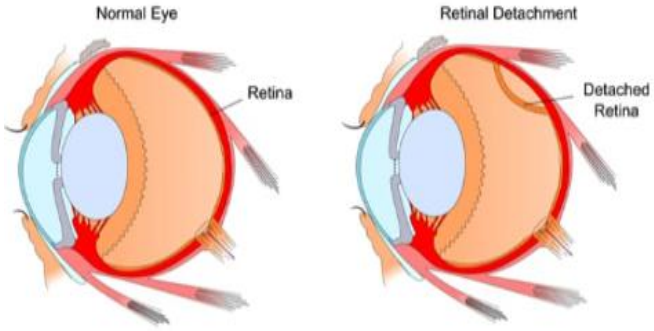


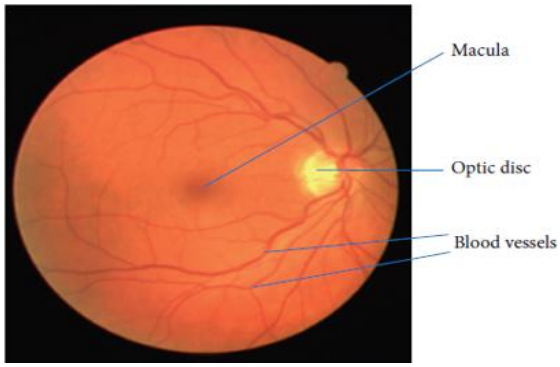
[Fig.1: Show the Difference Between Normal Eye and Retinal Detachment Eye [1]]

The blood vessels are classified into two types i.e. arteries and veins. Arteries transfer oxygenated blood and are more brilliant while vein transfer deoxygenated blood to lungs and liver and darker than arteries. The blood vessels can change due to hypertension-like veins are abnormally wide which is primarily a retinal disorder [8].

Arteries get reduced in pancreatic disorder and high blood pressure results in thickened arteries can causes the disorder of hypertension and stroke. It can change blood vessels [9].

Exact and programmed evaluation of retinal pictures has been considered as a useful asset for the determination of retinal problems like diabetic retinopathy, hypertension, etc [10]. in retina Veins have differing contrast due to which the more obscure vessels (thick vessels) can be extracted effectively utilizing standard methods referenced in the literature while it is hard to extricate the vessels having unfortunate differentiation (dainty vessels) [2]. The blood vessels are in charge of giving blood to the whole retinal region [11]. Age and other causes can cause damage to the retinal blood vessels [3]. Different sorts of eye irregularities are demonstrated by changes in vessel tree structure [12]. A genuine vessel tree construction ought to contain data about exact thickness of veins in the retinal pictures. A genuine vessel tree construction should contain data about exact thickness of veins in the retinal pictures. Optic circle and fovea can be situated by tracing the vessel tree [4].

Blood vessels of retina are main structures in many ophthalmological images. In certain applications, such vessels are the principal interest of the picture [5]. Following Image shown, the blood vessels and Oculus Dexter in retina.

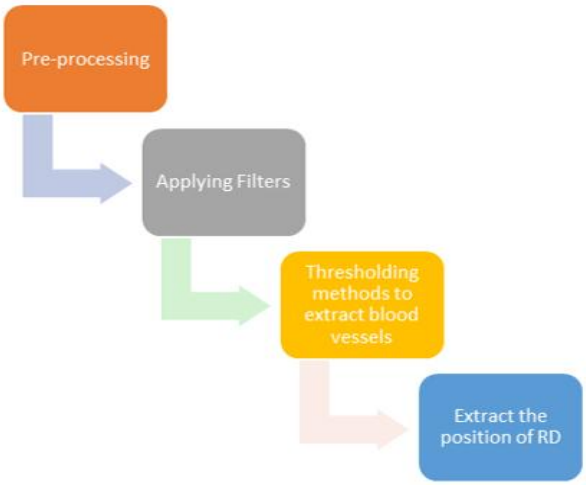


[Fig.2: Retinal Image Showing Blood Vessels and Oculus Dexter]

II. PROPOSED METHODOLOGY

A method is proposed to automatic detect the blood vessels from retina. By using this methodology, we detect blood vessel as well as the extract the feature that if the retina detach. Then at that position blood vessels have absent or not shown.

Retinal detachment is caused by a hole or tear in the retina that allows fluidto enter and accumulate in the retina. This f luid builds up and causes the retina to peel away from the un derlying tissue. The area ofthe retinal detachment loses its bl ood supply and does not function so the blood verses are not visible at the position of retinal detachment.

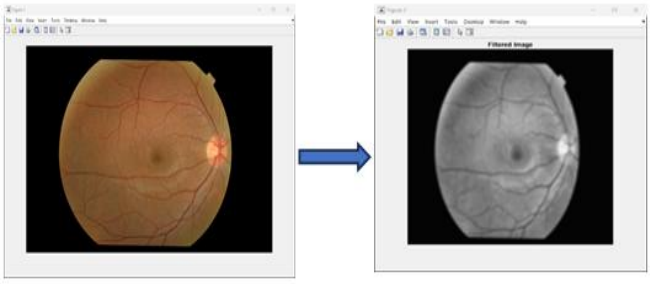


[Fig.3: Flowchart of Methodology]

Pre-processing: In the Pre-processing we remove the noise from the background and enhance the image. also resize images for better visualization or to fit them into a specific layout. After that we convert the RGB image into LAB color space LAB is less sensitive to lighting changes compared to RGB. This makes it advantageous for picture handling assignments where you need to maintain color consistency despite variations in illumination. Also used the histogram Equalization on the Gary scale image rearranging the intensity values to enhance contrast.

Apply Filter: In this Section to extract the feature of blood vessels of retina we apply various filters operation. The Filter operation is divided into three sections Edge detector, smooth filters and grayscale image filter [6] in this paper we used averaging filter for smooth the enhance image to extract the features.

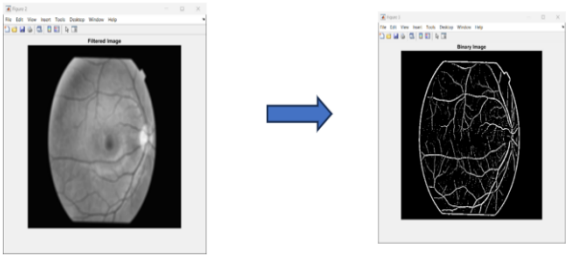
The type of low pass filter is averaging filters used in digital image processing for to smooth to blur an image for reducing noise and intensity variations between adjacent pixels. An averaging filter is replacing each pixel's value of an image with average values of the pixel surrounding neighborhood, effectively averaging out rapid intensity changes.



(a) **(b)**

[Fig.4: In the Above (a) Show the RGB Retinal Image, (b) Show Applying Averaging Filter Output]

Thresholding methods to extract the vessels: in this step for extracting the blood vessels we apply the threshold method. The threshold method is used to convert an image into the binary image for extract the features. Binary image produces the good contrast and show the d strong requirement in several areas like remote sensing, vision, biomedical image analysis, fault detection [7]



(C) **(d)**

[Fig,5: In Above Image (c) Image Show Averaging Filter Output (d) Shows Output of Threshold Method for Extract Blood Vessels]

By Using this proposed methodology, we extract the features of normal retina and detach retinal position in retinal images. following features shows the difference between the normal retinal area and retinal detachment area.

Thresholding is done with Otsu's method to convert the image to binary

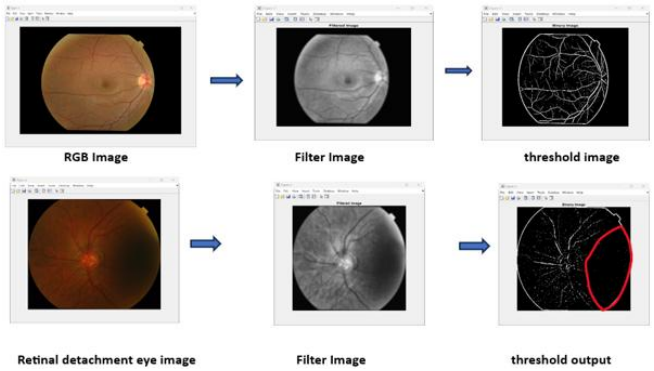
$$T = argmin \sum_{i=1}^{2} w_i\ (T)\sigma_i^2(T) \quad \ldots \quad (1)$$

Equation 1: Otsu's Thresholding Equation

Where,

w1(T), w2(T) are the class probabilities for background and foreground.

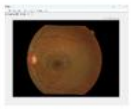
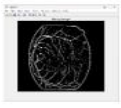
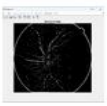
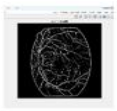
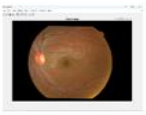
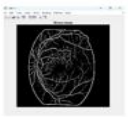
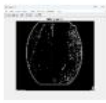
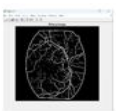
σ_2^1 (T) σ_2^2 (T) are the variances of the two classes.



[Fig.6: Difference Between Normal Retinal and Retinal Detachment Position]

Following table shows the difference between Normal and detachment retina position

Table-I: Difference Between Normal Retina and Retinal Detachment Position

Normal Retina		Detachment retina	
			
			
			
			

In the above Table I. result show the normal retina and detached retina by using boarder, the difference between normal retina and detachment retinal blood vessels is shown in above figure. The area where the retina is detached at that area the blood vessels is not visible and in the normal retina (healthy retina) all the blood vessels are visible.

III. CONCLUSION

In this paper we study related some methods by using that we extract the blood vessel of retina. Also, we compare the normal retina and detach retina position. The position where the retina is detached at that position the blood vessels is not visible. And the future work we try to extract another feature of retinal detachment disease like size, area, diameter, color etc. also, we apply the classification techniques to diagnosis of severity of disease.

DECLARATION STATEMENT

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been sponsored or funded by any organization or agency. The independence of this research is a crucial factor in affirming its impartiality, as it has been conducted without any external sway.
- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Authors Contributions:** The authorship of this article is contributed equally to all participating individuals.

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Sharayu Rajesh Patil, Has completed, M.S. in Regulatory Affairs, Northeastern University, Boston, Massachusetts, USA (GPA 3.9/4.0) B.Tech in Bioengineering, MIT-ADT University (Top 10%) She has Publications in, Healthcare Regulation, Bioengineering, Biomedical Device Evaluation, Clinical Compliance, Global Regulatory Standards, Patient-Centered Innovation, She has Integrating advanced bioengineering knowledge with regulatory expertise, and she ensures that biomedical solutions meet rigorous safety and efficacy standards. She graduated among the top 10% from MIT-ADT University's Bioengineering program and later earned a Master of Science in Regulatory Affairs from Northeastern University in Boston, Massachusetts, USA (GPA 3.9/4.0). Leveraging her strong academic foundation and hands-on device evaluation experience, she effectively aligns scientific complexities with regulatory requirements. Through interdisciplinary collaboration, peer-reviewed contributions, and advocacy for best practices, she promotes responsible innovation. Patil's efforts advance patient-centered care and shape global healthcare policy, reflecting leadership in the evolving biomedical and regulatory landscape.