Discernment of Retinal Anomalies in Fundus Images for Diabetic Retinopathy
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Abstract— Retinal abnormalities can lead to permanent blindness hence retinal analysis plays a critical role in diagnosis of retinal anomalies. This paper highlights a very simple and straightforward approach to identify the retinal disorders such as diabetic retinopathy. The drusen clearly shows the presence of diabetes and other retinal disorders. The results can be further extended for clinical suites.

Index Terms— Fundus image, Diabetic Retinopathy, drusen, threshold.

I. INTRODUCTION
The human eye is composed of retina being the posterior region of eyeball is a thin layer which is highly responsible for visual recognition. Any damage to retina can cause permanent blindness hence early precautionary steps are necessary. The major important parts of retina are Macula, Optic disc and blood vessels. The typical anatomy of retina is shown in Fig.1.

![Fig.1 Anatomy of retina](image1.png)

Retinal disorders such as Glaucoma, Cataract, Diabetic Retinopathy and AMD are the most commonly found retinal anomalies in a human eye. Such diseases require early diagnosis and immediate medical measures. The studies show that almost 75\% of the people have eye correction where 64\% use glasses and 11\% use contact lenses. Visual impairment due to retinal disorders is a significant cause around the world. Apart from medical measures, awareness and wider knowledge regarding retinal disorders seems to be mandatory. Recent studies show that about a decade ago the risk factor for retinal diseases prevailed more for aged people than the youngsters. But now the younger generation aged 30-40 is more prone to the retinal disorders due to their sophisticated day today lifestyle. Irreversible blindness is becoming a serious issue around worldwide [15]. A typical diseased retina commonly called as drusen is depicted in Fig.2.

![Fig.2. Normal Retina- Diseased Retina (Drusen)](image2.png)

The people with diabetes are at high risk for retinal disorders such as Diabetic Retinopathy (DR). DR is the most commonly found retinal disorders in human beings leading to Age-related Macular Degeneration (AMD) by gradual progression in disease. The diabetic retinopathy can be progressed into various stages such as Micro-aneurysms, hemorrhages, hard exudates and cotton wool spots [13][14]. Due to the presence of these anomalies the Macula can be disrupted for visual representation by leading to AMD or
even disappearance of macula. A typical diabetic Retinopathy with degenerated macula is shown in Fig.3. This paper highlights the segmentation of retinal diseases.

![Fig.3. Diabetic Retinopathy](image)

**II. EXISTING WORK**


**III. PROPOSED METHODOLOGY**

This paper focuses on the segmentation of retinal diseases from a retinal image and to identify the presence of Diabetes and AMD. Although existing work shows many techniques and methodologies [3], [6],[11],[14] this articles focuses on the segmentation of DR with an unpretentious approach.

The retinal image is enhanced in the pre-processing stage by applying binarization techniques. The segmented image clearly shows the various diseases such as Micro-aneurysms, hemorrhages, hard exudates and cotton wool spots. The stages of DR extraction are shown in Fig.4.

![Fig.4. Steps of DR processing](image)
IV. RETINA PROCESSING

V. SEGMENTATION

A. Binarization

A Binary image has only two possible values, zero’s and one’s which are normally displayed as black and white. The retinal image is binarized where the 8 bit gray image is transformed into a 1 bit image. The image is transformed into black and white colour, where the darker regions become black and the rest of the region with white colour. The binarized image is shown in Fig 5(b)[1][2][5].

![Binary image](image1)

Fig.5(a). Original images 5(b). binarized image

VI. RETINA POST-PROCESSING

The fundus image is segmented and analyzed for further studies. The segmented retinal image shows various disorders such as cotton wool spots, Micro-aneurysms, hemorrhages, hard exudates. Fig.6(a). clearly depicts the presence of cotton wool spots and Fig.6(b) shows the segmented cotton wool spots from its original image.

![org Image](image2)

Fig.6(a). Fundus image with cotton wool spots
Fig. 6(b). Cotton wool spots extracted after thresholding

**VII. SIMULATION RESULTS**

Table I represents a sample of five retinal images taken from the DRIVE database, representing the abnormal human retina. About twenty five sample images were tested and the results were satisfactory where few examples are shown in Table I.

Table I shows the original image and its binarized image with its corresponding threshold values are also shown in Table II.

<table>
<thead>
<tr>
<th>Image Name</th>
<th>Original Image</th>
<th>Binarized image</th>
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<td><img src="image2.png" alt="thresholded" /></td>
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<tr>
<td>Disease e5</td>
<td><img src="image3.png" alt="org image" /></td>
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CONCLUSION

The results clearly show that the severity of DR can be diagnosed using the results obtained from the images. So it’s concluded that the various retinal disorders can be identified which can be considered as the initial step. This can be further used for screening processes in eye clinics. The images can be explored further to study various abnormalities caused by DR.

REFERENCES:


Table II

<table>
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<td>150</td>
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[14] Dhariti deka et.al " Detection of Macula and Fovea for disease Analysis in color fundus images” IEEE 2015