Detection of Hemorrhage from Retinal Images Using Digital Image Processing Techniques

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***Abstract*— Hemorrhage is a disorder of the eye, in this bleeding befalls into the back wall of the eye. It can be caused by hypertension, retinal vein occlusion and diabetes mellitus. In this paper, we design new algorithm for detection of retinal hemorrhages using digital image processing techniques. This algorithm is tested on DIARETDB0 and DIARETDB1 total 219 images. This algorithm is correctly classify the 197 images and remaining 22 images are misclassified.**

***Index Terms*—Hemorrhages, DIARETDB0, DIARETDB1, Green Channel.**

I. INTRODUCTION

Diabetic Retinopathy is disorder in which the eye retina gets injured due to leakage of blood. Consequence of this may be the loss of vision. Hemorrhages detection in the retina is the first sign of diabetic retinopathy so earlier detection of hemorrhage can help to reduce the blindness. The authors introduced new method for detection of hemorrhage by using three steps, removing noise from fundus image, vessel removal, removing the fovea and detection shape, area, aspect ratio, density and mean intensity [1]. Author tries to deal with two problems in detecting red lesions from retinal fundus images. To deal with false detections on blood vessels, new filter is proposed which distinguish between red lesions and blood vessels [2]. Diabetic Retinopathy is the Leading cause of blindness. It is the major problem in worldwide. Recent health studies estimates that 54 million American have diabetes and most of them don't know it. WHO reveal that 347 million people have this diabetes worldwide? As many as 25,000 people have lose their vision because of diabetic retinopathy every year [3]. Diabetic retinopathy is produced by the retinal micro vasculature. Blindness may look as a result of unchecked and severe cases of diabetic retinopathy. Manual examination of fundus images to check morphological changes in microaneurysms, exudates, blood vessels, hemorrhages, and macula is a very time-consuming and monotonous work [4]. This paper is tested on DRIVE and DIARETDB1 databases and is compared with the other approaches. The segmentation approach accomplished the average accuracy of 98.7% whereas the diseased image was detected with 99% accuracy [5]. This paper developed an automated method for detection of hemorrhage. They used template matching technique for the detection of hemorrhage. For detection of proper size of hemorrhage region growing segmentation used. This study is improving automated hemorrhage detection method to assistance diagnosis of diabetic retinopathy. The sensitivity for the detection of abnormal cases were 80% and 90% respectively [6]. Following table shows the fundus image database.

Table 1 Fundus Image Database

Sr. No.	*Name of Database*	*Total Images*	*Reference No.*
1	DIARETDB0	130	[7]
2	DIARETDB1	89	[8]

II. METHODOLOGY

For the detection of retinal hemorrhages, digital image processing techniques were used. Following are the mathematical equations for the extraction of retinal hemorrhages.

1. **Green Channel: -**

$$g = \frac{G}{(R + G + B)} \qquad (1)$$

Here g is a Green channel and R, G and B are Red, Green and Blue respectively. Because green channel shows the high intensity as compare to red and blue respectively.

2. Histogram Equalization:

$$h(v) = \text{round}\left(\frac{cdf(v)-cdf_{min}}{(M\times N)-cdf_{min}} \times (L-1)\right) \qquad (2)$$

Here cdf_{min} is the minimum value of the cumulative distribution function, M × N gives the image's number of pixels and L is the number of grey levels. Histogram equalization is used for enhancement of a green channeled image for extracting more fine details of fundus image.

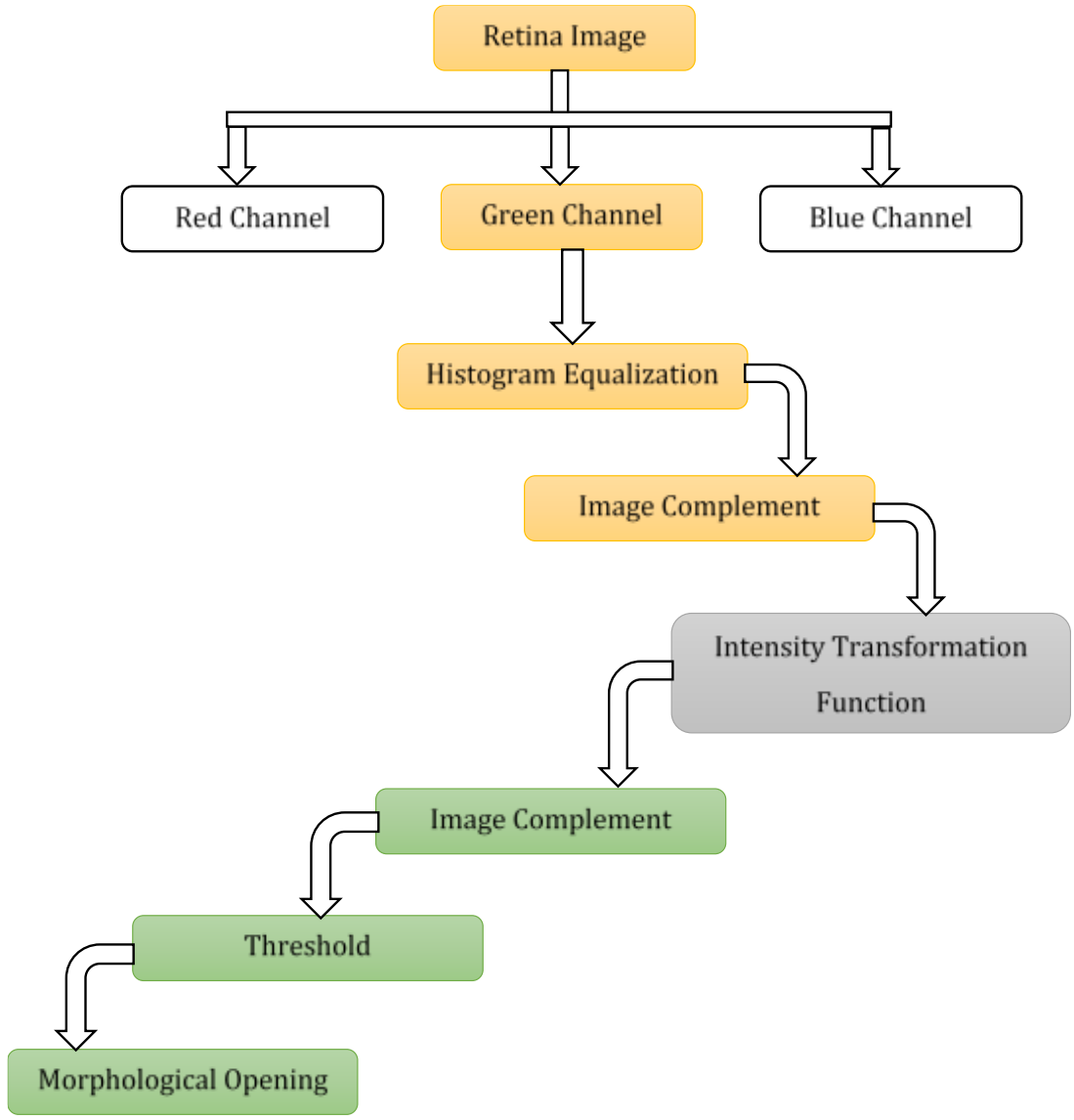

Figure 1: Flow for Detection of Hemorrhage

3. Complement: -

$$A^c = \{\omega \mid \omega \notin A\} \qquad (3)$$

Here A^c is a complement ω is the element of A, ∉ stands for not an element of A and A is set. Complement function is used on histogram equalization for enhancement.

4. Intensity Transformation Function: -

$$s = T(r) \qquad (4)$$

Where T is Transformation and r is Intensity. Intensity transformation function is used on complement image for extracting the Microaneurysms.

5. **Threshold: -**

$$T = \frac{1}{2}(m1 + m2) \qquad (5)$$

Here m1 & m2 are the Intensity Values. Threshold function is used for feature extraction of the fundus image.

6. **Morphological Opening: -**

$$A \circ B = (A \ominus B) \oplus B \qquad (6)$$

The opening of A by B is obtained by the erosion of A by B, followed by dilation of the resulting image by B

III. RESULT

For the detection of retinal hemorrhages we used digital image processing techniques and MATLAB 2012a, first of all we have extracted the green channel from fundus image. Afterwards apply histogram equalization for image enhancement, then image complement, intensity transformation, threshold and morphological opening for the detection of hemorrhages. After extraction of retinal hemorrhages we calculated the area of hemorrhages. Following table show the area of extracted hemorrhages.

Table 2 Area of Retinal Hemorrhages

Sr. No.	*Image Name*	*Area*
1	image007	8580.50000000000
2	image008	9940.87500000000
3	image009	8993.50000000000
4	image010	10236.3750000000
5	image021	11034.8750000000
6	image023	3160.37500000000
7	image025	20650.6250000000
8	image037	12534.3750000000
9	image040	21217.6250000000
10	image041	21419.2500000000
11	image046	26486.6250000000
12	image047	11634
13	image048	33144
14	image049	21091
15	image050	20662.8750000000
16	image051	21312.7500000000
17	image055	24151.2500000000
18	image060	18758.6250000000
19	image062	20293.1250000000
20	image068	21509.6250000000

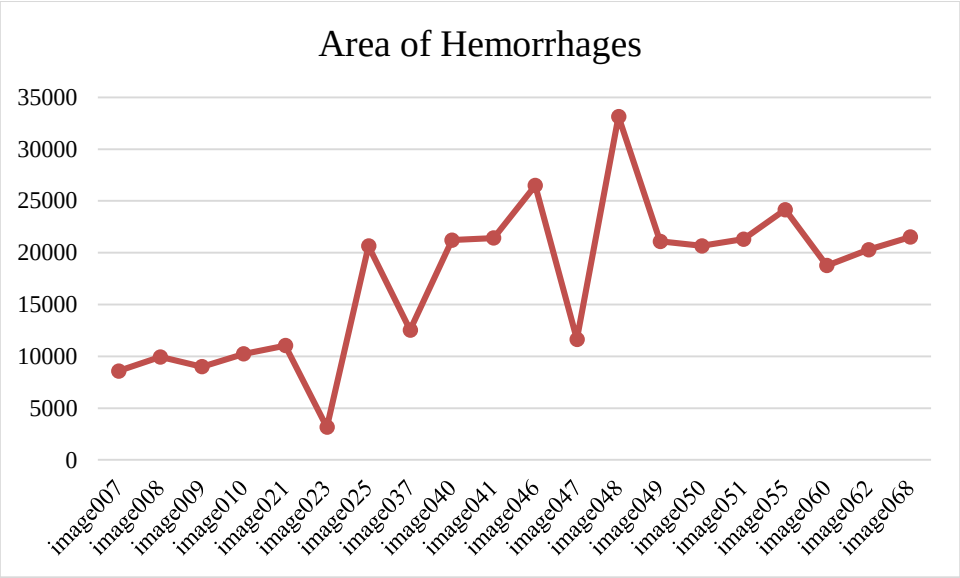

Figure 2: Area of Hemorrhages

IV. CONCLUSION

Medical imaging is training field with the help of digital image processing. It provides support in medical disease analysis. The propose algorithm is design for detection of hemorrhage at early stage. If it is not detected at early stages then it may causes the permanent loss of vision of a person. Ophthalmologists evaluate retinal images for various types of lesions like hemorrhages, exudates etc. The proposed algorithm is tested on DIARETDB0 and DIARETDB1 total 219 images. 197 images are correctly classified whereas 22 images are misclassified.

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REFERENCES

[1] Dolly Sahu, Sachin Meshram, "Automatic Detection of Hemorrhages Using Image Processing Technique", International Journal of Engineering Sciences & Research Technology, ISSN: 2277-9655, 2016.

[2] Ruchir Srivastava, Lixin Duan, Damon W. K. Wong, Jiang Liu, Tien Yin Wong, "Detecting retinal microaneurysms and hemorrhages with robustness to the presence of blood vessels", Elsevier, computer methods and programs in biomedicine 138, 2017.

[3] Falguni Thakkar, Rajvi Parikh, "A Survey on Automatic Detection of Diabetic Retinopathy Exudates from Retinal Fundus Images", International Journal of Advanced Research in Computer and Communication Engineering, ISSN (Online) 2278-1021, Vol. 5, Issue 5, 2016.

[4] Javeria Amin, Muhammad Sharif, and Mussarat Yasmin, "A Review on Recent Developments for Detection of Diabetic Retinopathy", Hindawi Publishing Corporation Scientifica Volume 2016, 6838976, 2016.

[5] Ishmeet Kaur & Lalit Mann Singh, "A Method of Disease Detection and Segmentation of Retinal Blood Vessels using Fuzzy C-Means and Neutrosophic Approach", Imperial Journal of Interdisciplinary Research (IJIR), ISSN: 2454-1362, Vol-2, Issue-6, 2016.

[6] Reshma M. M., Chavan M. S, "Detection of Hemorrhage from Fundus Images using Hybrid Method", International Journal of Computer Applications (0975 – 8887), Volume 107 – No 12, 2014.

[7] (DIARETDB0) http://www.it.lut.fi/project/imageret/diaretdb0/index.html.

[8] (DIARETDB1) http://www.it.lut.fi/project/imageret/diaretdb1/index.html.