Extraction of Exudates from Fundus Images Using Digital Image Processing Techniques

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Abstract- *Diabetic Retinopathy is an eye disease which occurred by impediment of diabetes that causes anomalies in the retina. Early detection is very important for saving the vision and for operative treatment. Exudates are the symptoms of diabetic retinopathy. In this paper we proposes a new algorithm for extraction of exudates. For extraction of exudates, digital image processing were used. And DIARECT DB0 and DIARECT DB1 fundus image database is used (total 219 fundus images). Proposed algorithm achieved 96% accuracy for the extraction of exudates.*

Keywords- Exudates, Fundus Images, Digital Image Processing Techniques.

I. INTRODUCTION

Diabetic retinopathy is a health issues which sources blindness in middle and old age group. Author proposes an algorithm for automatic identification of exudates in retinal images for early detection of diabetic retinopathy. This paper has shown the segmentation technique for detection of disease [1].The presence of exudates can characterized by the presence of fundus image in yellowish color with changeable size and shape. The snags in exudates detection are due to the alike color intensity with optic disc, but with smaller size compare to optic disc. This paper proposes color space approach where the object of interest area is used as exudates color references for retinal segmentation [2].Author proposes to program ID of exudates pathologies in retinopathy fundus pictures a new strategy is computational understanding method. To quintessence components of fundus picture like blood vessels, optical nerve, red sores and white sores together with surface element examination operates the remarkable execution of morphological administrators [3].Diabetic retinopathy is produced by the sensitive tissue in the retina because of the damaged blood vessels. Early detection of diabetic retinopathy can be a potentially reduce the risk of blindness and it could be prevented with an early screening process .In this paper authors have attempt to develop an automated exudates detection system for the classification of retinal image into exudates and non-exudates using PNN classifier [4].Diabetic Retinopathy is the leading basis of vision loss. Early symptoms of this disease are exudates, early diagnosis and treatment at right time is very essential to stop blindness.Author proposed an algorithm for automatically detecting optic disk and exudates in the retinal images. The algorithm was developed based on fundus images. The type of diabetic retinopathy presented in the images was exudates. [5]. Following table shows the fundus image database. Proposed algorithm is tested on DIARECT DB0 and DIARECT DB1.

Table 1. Fundus Image Database

Sr. No.	Name of Database	Total Images	Reference No.
1	DIARETDB0	130	[6]
2	DIARETDB1	89	[7]
Total: 219			

II. METHODOLOGY

For extraction of exudate, digital image processing techniques is used. Following are the mathematical representation for the extraction of disease.

a) Green Channel: -

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

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.

b) Histogram Equalization: -

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

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.

c) Complement: -

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

Here A^c is a complement ω is the element of A, $\notin$ stands for not an element of A and A is set.

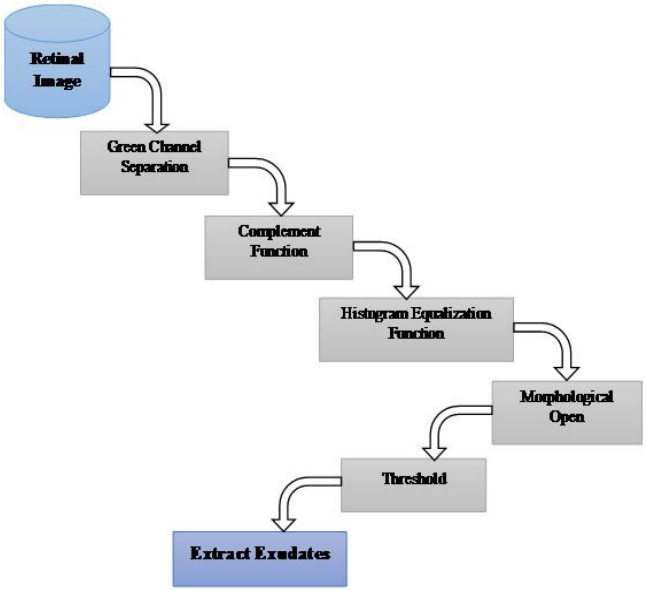


Figure 1: Flow forextraction of exudates from fundus image histogram equalization for enhancement.

d) 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.

e) Threshold: -

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

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

f) Morphological Opening: -

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

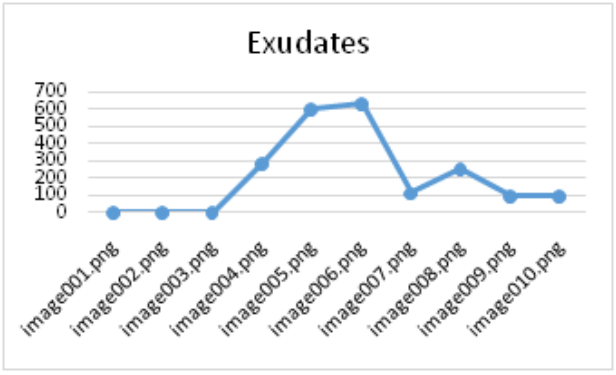
The opening of A by B is obtained by the erosion of A by B, followed by dilation of the resulting image by B.

Above techniques is used for extraction retinal exudates.

III. RESULT

For extraction of exudates digital image processing techniques is used. First of all we read original image, afterward extract green channel. Then apply complement function, histogram equalization, morphological opening and threshold respectively. For result analysis MATLAB 2012a were used. Following tables shows the area of exudates.

Sr. No.	Image Name	Exudates
1	image001.png	0
2	image002.png	0
3	image003.png	0
4	image004.png	287
5	image005.png	603
6	image006.png	634
7	image007.png	113
8	image008.png	252
9	image009.png	97
10	image010.png	97
11	image011.png	31
12	image012.png	0
13	image013.png	90
14	image014.png	0
15	image015.png	12
16	image016.png	19
17	image017.png	75
18	image018.png	0
19	image019.png	32
20	image020.png	35
21	image021.png	30
22	image022.png	54
23	image023.png	57
24	image024.png	0
25	image025.png	46
26	image026.png	0
27	image027.png	13
28	image028.png	0
29	image029.png	0



IV. CONCLUSION

In this paper, comparative studies of different In this paper we proposed new algorithm for extraction of exudates. Digital image processing were used. Like, green channel separation, histogram equalization, complement function and threshold. DIARECT DB0 and DIARECT DB1 fundus image database is used. We got 96% accuracy for extraction of exudates from fundus images.

V. ACKNOWLEDGMENT

Sincere thanks to Tomi Kauppi, Valentina Kalesnykiene, Joni-Kristian Kamarainen, Lasse Lensu, Iiris Sorri, Juhani Pietilä, Heikki Kälviäinen, and Hannu Uusitalo for providing. DIARETDB0 and DIARETDB1 fundus image database.

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

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