Volume-4, Issue-5, May Special Issue-2015 • ISSN No 2277 - 8160

Research Paper Engineering

# MORPHOLOGICAL PROCESS FOR DETECTION OF EXUDATES IN DIGITAL RETINAL IMAGES

**K. Jaya Raju** Department of Electronics and Communication Engineering Narayana Engineering College,Nellore-524003, A.P, India

**Syed Athika sultana** Department of Electronics and Communication Engineering Narayana Engineering College,Nellore-524003, A.P, India

**ABSTRACT**

*In diabetic mellitus patients diabetic retinography isthe main causes of blindness. In diabetic retinopathy blood ves sels of the retina gets rupture and lipoprotein substances getseep out by vessel damage and are deposit in the intra retinal space. The element of optic nerve below these substances is disqualified from being excited by light rays and unsuccessful to produce any nerve impulse to the brain. Therefore itleads to partial loss of vision.Here we are using Morphology operators using multi structure elements are applied for the enhanced image to produce the retinal image ridges. After enhancement reconstruction of morphological operators eliminate the vessel tree ridges not belonging to that tree by trying to keep the thin vessels unaffected, In order to increase the morphological operatorscompetence by reconstruction, we applied multi structure elements. A simple morphological method along opening and closing indicates the remained ridges belonging to vessels. Along with this approach the system introduces the Macula Boundary Tracing. The damage to the macula will result in loss of central vision system in the eye. Simulated results shows that the blood vessels and Optic disk can be effectively detected from retina images with parametric valuation to measure the algorithm performance*

*metrics include sensitivity with 99.25%, specificity with 77.29%, accuracy 97%*

**KEYWORDS : Diabetic retinopathy, Exudates, morphological process, Thresholding, sensitivity, specificity, accuracy**

## I. INTRODUCTION

Medical images computerized analysis is gaining importance day by day, it produceshigher sensitivity irrespective of experience of the forecaster. Therefore, we are using several image analysis techniques for usual detection of various diseases. In this technique after the damage of blood vessel protein and fat based particles get leaked out from the spoiled blood vessels. So that retinal blood flow decreases. These particles are termed as exudates. Various methods are developed for detection of exudates. These consist of techniques of thresholding and edge detection[1], An approach of FCM based[2],A technique of gray level variation based[3],An approach of multilayer preceptor based[4].In this technique detection and segmentationof Optic disk must be early in the process, because Optic disk has optic disk has same contrast and brightness as the exudates [5,6,7]. In this paper we have proposed a method which is used to detect exudates in digital retinal images.

### Image SegmentationOverview

Segmentation harms are difficult to get object mining, object specific measurements, and fast object representationof multi-dimensional image data. General segmentation techniques are depends on local pixel-neighborhood classification. Thereason is that the "logic" of an object does not follow that itsconfined image representation Local properties such as textures, nervousness, and ridges etc.

## II. Literature survey

### A. Clustering

Clustering is the most important invalid learning problem, clustering is useful for structure finding in a collection of unlabeled data.Clustering algorithms are classified differently.

In the first case grouping of data is done with an exclusive way, so that if a definite datum belongs to a definite cluster include in that cluster not be included in another cluster. Next type of clustering is the overlap clustering, uses fuzzy sets of cluster data [8]. A hierarchical clustering algorithm is depends on the grouping two nearest clusters grouping. The condition for beginning is realized by making every datum as a cluster.It required few iterations to reach the final cluster.

### B. Neural network segmentation

Image segmentation using neural networks depends on giving out small areas of an image usingset of neural networks or Artificial neural networks. These are usefulFor high-performance biometric image processing we are using Pulse-Coupled Neural Networks .These neural networks are two-dimensional neural networks. In this network each neuron is corresponds to each pixel in an input image,because it receives color information of corresponding pixel's color as an external motivation. [9]

### C. Edge detection

Edge detection is a well-suited field on its own with,in image processing. Region boundaries of an image and edges of that image are closely related, since there is often sharp adjustments in the intensity of the region boundaries. The edges those are identified are often disconnected[10,11]

### D. Thresholding

The easiest method of image segmentation is thresholding method. In This method we are using a level clipping (or a threshold value) to get binary image from a grayscale image into a binary image.Threshold value selection is basic key in this method Several popular methods used are method of including the method of maximum entropy, method of otsu's,and k-means clustering.

### E. Steps to design

(1) Set the initial threshold T= (the maximum image brightness value+ the minimum image brightness value) /2.

(2) Using the segment of Twe can get two sets of pixels, B ( Pixel values are less than T) and N ( pixel values are greater than T);

### F. Drawbacks

In this method detection of blood vessels is a difficult process because it depends on the intrensic characteristics of retinal images .Poor Edge detection. [12]

## III. PROPOSED METHOD

### MORPHOLOGICAL PROCESS

Morphological image processing is the non-linear operations set. Those operations arerelated to the shape or morphological features of the image.Operations of morphology depends only on the pixel's relative orderingvalue, not on their numerical values, and therefore they are especially suited for the processing of binary images Light transfer functions of

the grayscale images are unknown,so Morphological operations are also applicable forgrayscale images and their absolute pixel values are also have less or minor importance.

The structuring element in Morphological processchecks the image it is a small contour or template in its size. The input image is checked by the all possible locations by placing structuring element possible positions in the binary image and it is compared with the neighbourhood of the corresponding of pixels. Some operations test results the element is" fitted" within the neighbourhood, while other test results it "hits" or overlap the neighbourhood.

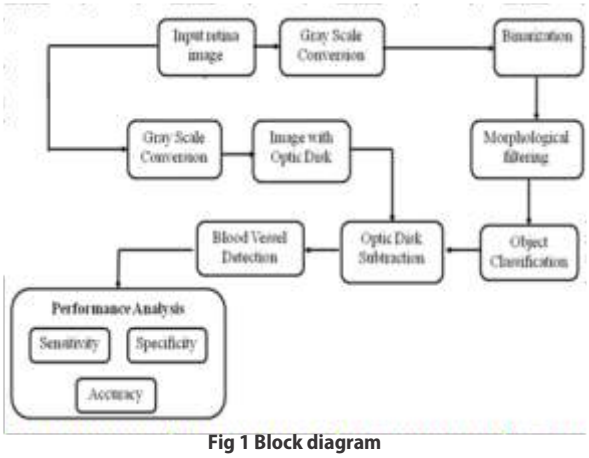


**Fig 1 Block diagram**

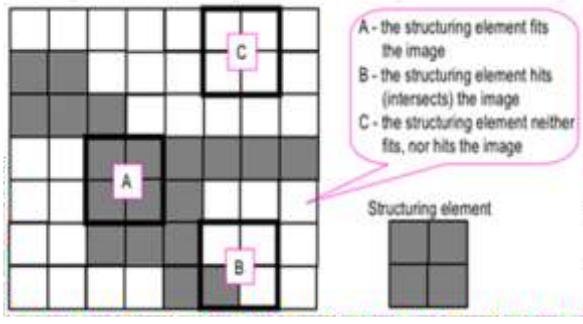


**fig 2structuring element fitting or hitting binary image**

Operation of a morphology on a binary image results a new binary image in this pixel valuecontains the non-zero, when we get the successful test at that position in the input image.

The element of structuring is a binary image with a small matrix of pixels, with the values of binary digits.Thesize of the structuring element is denoted by dimensions of the matrix. The structuring element's shape depends on the pattern of ones and zeros.Thestructuring element's origin is one of its pixel, although sometimes theorigin can be lies outside the structuring element.

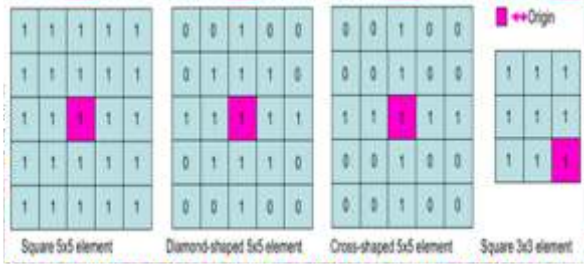


**fig:3 different types of structuring elements**

Examples of simple structuring elements. A most general thing is to have the structuring matrix odd dimensions and the centre of the matrix is the origin. when we placed a structuring element in a binary image, each pixel inthe binary image mapped with the corresponding pixel under the region of the structuring element. The structuring element fit is done in the image , for each of its pixels set to 1, the equivalent image pixel is also 1. Likewise, structuring element hitting is done ,if at least for one of its pixels to 1 coincide the related image pixel value also 1.

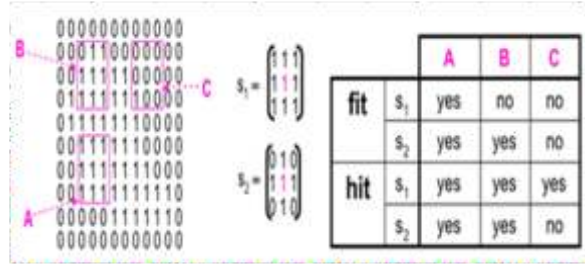


**fig 4:process stream**

figure above showsFitting and hitting of a structuringelements s1 and s2.Structuring elementzero pixel values are ignored are ignored, i.e. indicating of points where the corresponding image value makes no difference.

**Opening**

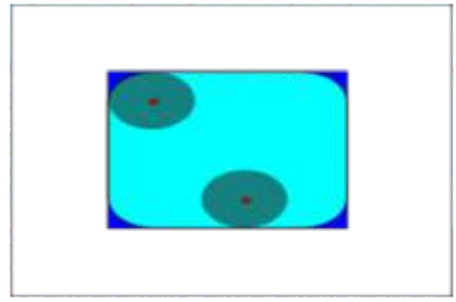

**fig:5 opening process**

The dark-blue square's opening by a disk, produces the round cornered squares with light blue color. TheA by B opening is obtained by the A by B erosion, which follows the dilation of the resulting image with B: .

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

$$A \circ B = \bigcup_{B_x \subseteq A} B_x$$

**Closing**

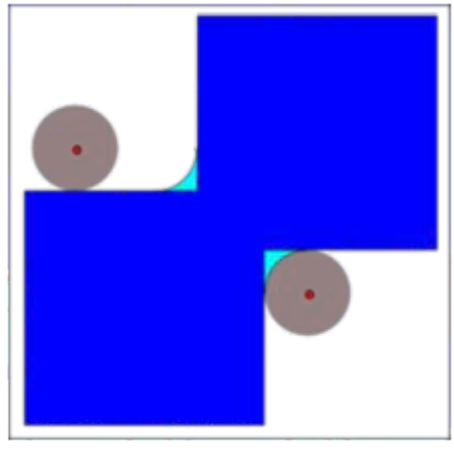

**fig 6: morphological closing process**

The closing of dark-blue shape produces the unionshape of dark blue and the light-blue areas.Also we can get A by B closing by A by B dilation, which follows erosion of the consequential structure by B:

$$A \bullet B = (A \oplus B) \ominus B$$ .[13]

***Properties of the basic operators (erosion, dilation)***
***They are translation invariant***

- Morphological operators are in increasing order, that is, $A \subseteq C$ if then, $A \oplus B \subseteq C \oplus B$ an, etc.
- The morphological dilation satisfies the commutative property.
- IfE the origin belongs to the structuring element B, then.

$$A \ominus B \subseteq A \circ B \subseteq A \subseteq A \bullet B \subseteq A \oplus B$$

**Morphology-based Operations**

From this process we can define image as a (amplitude) function of two, real variables a (x, y) or it also denoted as two discrete variables a [m, n]. An image can also be defined based on idea that an image is either continuous or discrete coordinates set.That is set corresponds to the points or pixels that belong to the objects in the image. This is shown in Figure below contains two sets or objectsA and B.

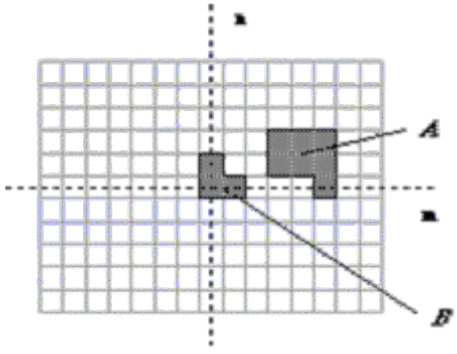


**Figure 7 : Containing two object sets A and B in binary image.**

The object A consists of those pixels that satisfies some general property:

Object - $A = \{\alpha | property(\alpha) == TRUE\}$

The background of A is obtained by Ac (the complement of A) it can be defined as
those elements that are not in A:
Background - . $A^c = \{\alpha | \alpha \notin A\}$ [14]

Dilation - setting of binary object pixel (with value "1") and all background pixels (with value "0") change pixels that are C-connected to that object pixel to the value "1". Erosion - setting of binary object pixel (with value "1")and all object pixels that areC-connected to a background pixel value to "0"[15]

**V. Results**

The input retinal images with optic disc detection &segmentation of exudates with performance metrics are shown below.

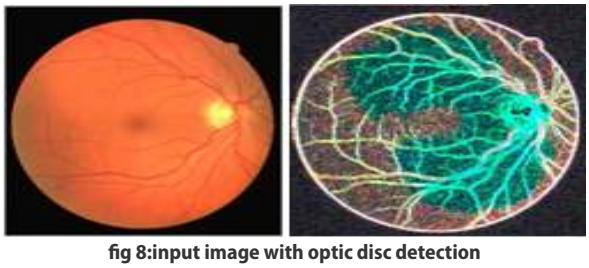

**fig 8:input image with optic disc detection**

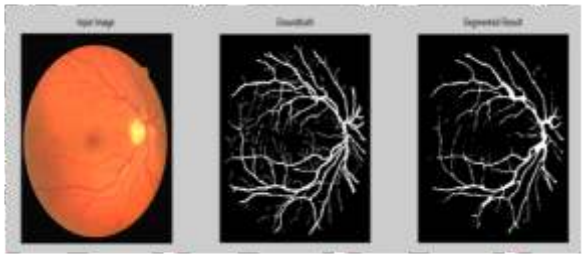

**fig 9:exudates segmentation**

| | Sensitivity | Specificity | Accuracy |
|---|---|---|---|
| Second human observer | 77.61 | 69.7891 | 94.73 |
| Mendonca (gray scale) | 73.15 | 72.6894 | 94.63 |
| Mendonca (green-channel) | 73.44 | 73.6981 | 9452 |
| Staal | 71.94 | 73.9874 | 0.9442 |
| Niemeijer | 68.98 | 75.0001 | 0.9417 |
| RGB-Q | 77.04 | 75.8974 | 0.9518 |
| G-Q | 75 | 76.8974 | 0.9587 |
| H-maxima | 84.31 | 77.1592 | 0.9687 |
| Proposed algorithm | 99.09 | 77.5894 | 97.9261 |

**Table:1**

```
Performance Parameters :

Specificity :
   77.1000

Sensitivity :
   99.0911

Accuracy :
   97.9261


Correlation Coefficient :
    0.7386

Root Mean Square Error :
    0.1901

Peak Signal to Noise Ratio :
   55.3411
```

**VI. conclusion**

In this proposed method we proposed method called morphology process for segmentation of exudates. Morphological opening and closing with structuring element performs operation on binary image Finally output of the proposed system gives better values of accuracy, sensitivity, specificity values compared to previous techniques ,and also we calculated values of peak signal to noise ratio,root mean square error, correlation coefficient.

## REFERENCES

[1]AvSagar,BBalasubramaniam,V.Chandrasekhara,“ A Novel Intergrated Approach Using Dynamic Thresholding and Edge Detection for Automatic Detection of Exudates in Digital Fundus Retinal images”,IEEE International Conference on Computing, 2007, Page 286-292. | [2] Hli, Ochutatape, “A Model Based Approach for Automated Feature Extraction in fundus Images’, IEEE International conference on Computer Vision, 2003, Page 127-133 | [3]. AOsrach, BShadgar, RMarkmham, “A Computational Intelligence Based Approach for Detection of Exudates in Diabetic Retinopathy”, IEEE 2009 | [4] LiH.And ChutatapeO. ‘ Fundus image features extraction ’, Proceedings of the 22nd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Vol.4, pp.3071-3073,2000. | [5] Wang, HWynneHsu,kheng Guan Goh,MonngLiLee,’ An Effective Approach to Detect lesions in Color Retinal Images’, IEEE Conference on Computer Vision and Pattern Recognition, vol.2,pp.181-186,Jan 2000.0 | [6] Clara ISánchez,R.Hornero, Marial. Lopez, JPoza, ‘Retinal Image Analysis to Detect and Quantify Lesions Associated with Diabetic Retinopathy’, Proceedings of the 26th Annual International Conference of the IEEE EMBS, San Fracisco,CA,USA,September1-5,2004. | [7] Giri BabuKande, PVenkata Subbaiah, T.Satya Savithri, "Segmentation of Exudates and Optic Disk in Retinal Images," icvgip, pp.535-542, 2008 Sixth Indian Conference on Computer Vision, Graphics & Image Processing, 200 | [8]. TWalter, J.cKlein, PMassin, A. Erginay, “A contribution of Image Processing To the Diagnosis of Diabetic Retinopathy – Detection of Exudates in Color Fundus Image of Human Retina”, IEEE Transaction on Medical Imaging, Vol 21, No 10, October 2002, Page 256-264 | [9] AOsareh, MMirmehdi, BThomas, and RMarkham, Comparative Exudate Classification using Support Vector Machines and Neural Networks, The 5th International Conf. on Medical Image Computing and Computer-Assisted Intervention, 2002, 413-420 | [10] ZLiu, OChutatape and SMKrishnan, “Automatic image analysis of fundus photograph”, Proceedings of the International Conference of the IEEE Engineering in Medicine and Biology Society, Vol. 2, 1997, pp. 524-525. | [11] R.Phillips, J.Forrester, PSharp, “Automated detection and quantification of retinal exudates”, Graefe’s Archive for Clinical and Experimental Ophthalmology, Vol. 231, 1993. | [12] KAkita and HKuga, “A computer method of understanding ocular fundus images”, Pattern Recognition, Vol.15, No. 6, 1982. | [13]RPhillips,JForrester,PSharp,“Automated detection and quantification of retinal exudates”, Graefe’s Archive for retinal images | [14] AJain, Fundamentals of Digital Image Processing. Prentice-Hall, 1986, pp. 384. | [15]Gonzalez RC, Woods RE, Eddins SL: Digital image processing using MATLAB. Prentice Hall, Upper Saddle River, 2004