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EXUDATE SEGMENTATION USING EDGE WEAKNING GUIDED IMAGE FILTER

RenuBala
M.Tech. CSE Student,
I.K. G PunjabTechnicalUniversity,
Kapurthala

R. C. Gangwar
Associate Professor Computer Sc and Engg, *Beant college of Engg. and Technology,GuradspurPunjab*

Abstract
Exudates image segmentation performs a major role in medical image processing. An efficient detection of exudates helps in recognition of diabetic retinopathy wounds. It helps doctor to monitor and recognize certain diseases. It has been found that theneighborhood estimator before filling filter provides significant results over available techniques. However, it has poor computational speed and not so effective against noisy images. Therefore, to improve the accuracy of exudates extraction further an integrated neighborhood estimator before filling filter with edge weakening filter technique is proposed in this paper. The integrated neighborhood estimator before filling filter with edge weakening filter will use improved edge weakening filter, which enables to detect exudates even in highly corrupted noisy images. Experimental results shown that the proposed technique is better as compared to other techniques.

KEYWORDS: Segmentation, Edge Based Segmentation, Threshold, Region Based

1. INTRODUCTION

Today numerous fields involve the use of image processing for their daily applications since it plays vital role in order to satisfy the real world situations. Image processing incorporates segmentation as a vital step as it forms the essence and foundation for eventual processing like object extraction and recognition. Image segmentation is a vital stage to analyse an image where its outcome eventually has an impact over the entire process The process of segregating image into distinct regions with the objective to obtain object of interest from background is known as segmentation. Obtaining vital information from the image can be accomplished by segregating the foreground from the background. Agriculture, medical and forensic all makes good use of segmentation. The central objective of segmentation is to separate an image into numerous pieces that have similar attributes (color, texture etc) and at the same time aggregate these pieces together for easy perceiving.

1.1 APPLICATIONS OF SEGMENTATION

Image segmentation is employed in numerous applications. Some of them are listed below:
a). Medical imaging– medical imaging makes use of digital image processing to identify tumors, evaluate tissue volumes,diagnosis, examination of anatomical framework, surgery planning, virtual surgery simulation and intra-surgery navigation.
b). Object detection- Digital image processing is used for pedestrian recognition, Face detection and to identify objects in satellite images (roads, forests, crops, etc.)
c). Recognition Tasks- Digital image processing is employed for Face recognition, Fingerprint recognition andIris recognition

1.2 EDGE BASED SEGMENTATION

Essential details and properties of an image can be interpreted using edge detection which captures the sharp changes in intensity. Boundaries of the object can be easily determined using edge segmentation. This technique is usually preferred whenever there are sharp transitions in the intensity. It actually aims to decrease the amount of data that need to be processed for an image and at a same time hold on the structural properties that will contribute to further processing of an image.
Advantages of using edge segmentation are:
a. Computationally inexpensive.
b. Implementation is relatively fast and simple c. Provides better results when images have good contrast between objects and background.

Edge segmentation do faces certain limitations:
a. Spatial information between pixels is ignored.
b. Sensitivity to noise.
c. May lead to pseudo or missing edges.
d. Does not produces efficient segmentation results if contrast of an image is low.

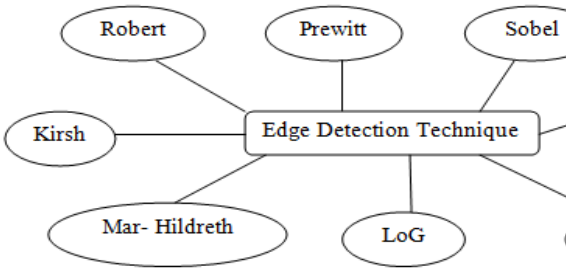


Fig. 1.6: Various Edge Detection Technique

1.3 THRESHOLD BASED SEGMENTATION

Another but much simple and efficient technique to segment an image is by using the concept of threshold. For such methodology, image is usually segmented by choosing an adequate value of threshold labelled 'T'. The underlined idea behind this technique is that gray level values that are less than or equal to determined threshold 'T' will be regarded as background or black and those gray level values that are above 'T' will be assumed as foreground object. Lot many options are available to select the threshold value 'T' for e.g. using histogram, mean method, p-tile method, HDT(Histogram Dependent Technique) and edge maximization technique. The distinction between the regions for the threshold based segmentation is done on the basis of intensity value difference between the pixels.

GLOBAL THRESHOLDING

In global thresholding, histogram is selected to choose the threshold value. Depending upon whether the histogram is bimodal or multimodal, the value of threshold can be single or multiple. In case the image has poor contrast, noise and is exposed to lighting, determination of global threshold becomes slightly difficult to evaluate.

1.4 REGION BASED SEGMENTATION

The main idea behind region based segmentation is that the pixels that are neighbours and have same values are combined together whereas the pixel values that are not similar are segregated. It basically specifies those gray level pixels that are similar as a region in an image. Region growing utilizes split and merge algorithm. This algorithm is accomplished by splitting an input image into numerous small regions until then when no further splitting is possible. Once the splitting has been done, merging of gray level pixels that are similar is done so as to obtain larger coherent regions. Determination of initial seed point plays a vital role in region based segmentation. Segmentation can be errornous, if incorrect seed is opted otherwise segmentation acquired using region based technique is very precise with clear edge boundaries.

Various advantages offered by region based segmentation are:
a. Better segmentation results as compared to other segmentation methods.
b. Clear boundaries of the objects can be obtained

2 . LITERATURE SURVEY

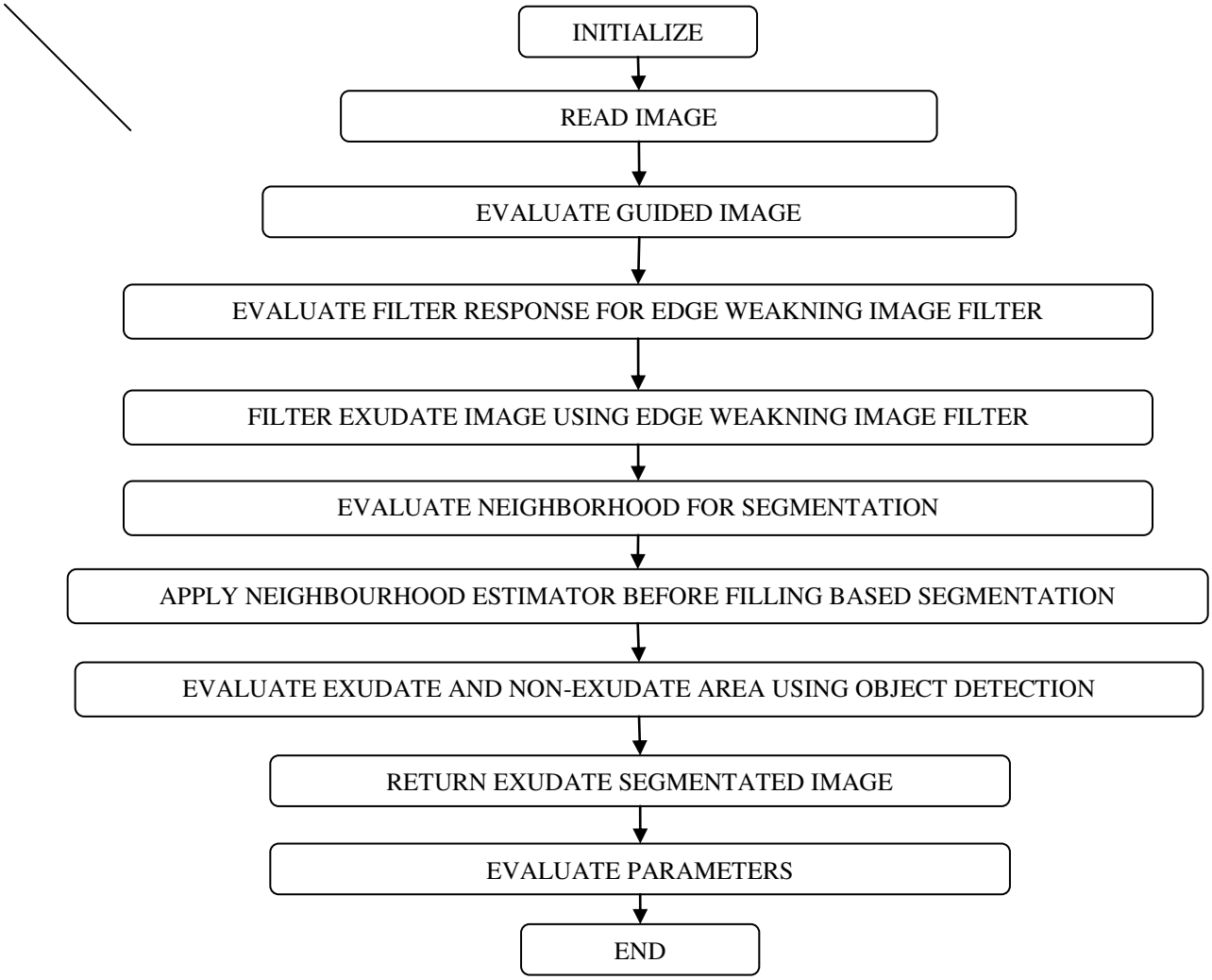
Kaur Amanjot et al.[1] discussed that diabetic retinopathy (DR) is really a wellness issue which in turn causes loss in vision. Automated recognition of exudates in retinal pictures may subscribe to early examination of DR. Several techniques in studies are mentioned to segment the exudates. They have indicated various practices to segment the exudates along with their advantages and disadvantages. All mentioned practices have increased the efficiency with regards to various parameters as precision, sensitivity and specificity. **Kaur et al.[2]** has shown that to be able to depict numerous disorders, it is very essential to segment the blood vessels. Diabetic Retinopathy is one of the problems which accidents the retina and also effects in blindness. They have shown a fresh computerized alternative to be able to obtain the blood vessels with higher rate of accuracy. The newest approach shown was made up of a modified Gabor filtration with local entropy thresholding below specific regular situations. The amount and positioning of Gabor filtration was to match a built-in element of blood vessels such that it could might be improved in the natural part of the image. **Justin Judith et al.[3]** discussed that diabetic retinopathy is among the crucial difficulties of the diabetes mellitus, which in turn causes critical harm to the retina ultimately causing anaesthetic damage. Retinal vessel segmentation represents an essential position in intelligent retinal illness assessment systems. An exact segmentation is necessary for pathological diagnosis. To guide that, many computerized methods were developed in the previous years. They have analyzed five various segmentation techniques that occur in the literature.**Yan Xin et al. [4]**discussed that applying a normal data design includes an excellent impact on getting the area of interest. Nevertheless, it really has constraints such as for example inadequate picture distinction, failure to manage with regional data and

therefore on. To be able to overcome these difficulties, a better algorithm on the basis of two dimensional Gabor filtration and route shades was proposed.**Zhang et al. [5]** planned an approach for segmenting retinal vessels that has been inspired by specific apparent method and operates on a Gabor filtration bank. To be able to improve the different filtration variables unit understanding was utilized. The filtration responses were exhibited as textons and that permits the same account characteristics to be properly used as software for knowledge vessel and non-vessel classes. Then by the end to make segmentation effects those vessel textons were employed. **HouYanli[6]**discussed the looks of retinal vessels is a significant diagnostic signal of critical illness. Computerized segmentation of vessels is really a principal stage towards automated evaluation of characteristics of retinal vessels. They have suggested a computerized technique for the advancement and segmentation of vessels in retina images. To reduce the effect of optic drive and highlight the vessels for every single retinal picture, a three dimensional morphological top-hat convert with twisting design components is initially placed on the backdrop and then a multi-scale point was created. **Devi Renuka et al. [7]** discussed that analysis of vessels present in the eye enables earlier in the day recognition of vision disorders such as for example glaucoma and diabetic retinopathy. Electronic picture handling practices perform an essential position in retinal blood vessel recognition. Many image handling strategies and filters have been in use to identify and acquire the features of retinal blood vessels such as for instance size, thickness, design and angles. Automatic electronic image handling practices and strategies needs to undergo some more improvement to accomplish accurate reliability to examine the situation of retinal vessels particularly in instances of glaucoma and retinopathy. They have described different themes centred coordinated filters, thresholding techniques, segmentation practices and practical methods to separate the vessels present in blood.**Kulkarni et al. [8]** discussed that median filtration is just a non-linear filtration utilized in image handling for intuition sound removal. It sees their normal requests in the conditions wherever ends can be maintained for larger state procedures such as segmentation, subject acceptance etc. They have suggested an appropriate and successful sound recognition and selection algorithm for impulse sound removal. The algorithm involves two phases, sound recognition accompanied by sound filtering. The planned algorithm changes the loud pixel by trimming the median value when the different values of other pixels 0 and 255 exist in the picked screen and when most of the pixel values are 0 and 255 the a sound pixel is changed by suggest value of all the components contained within the picked window. The VHDL was applied to create the aforementioned 2-D median filtration applying ISE instrument, and tried and compared for various grayscale images.**Wei Yanyan et al.[9]** discussed a better median filter algorithm for repairing of pictures, which are extremely damaged by sodium and pepper noise. The planned algorithm changes the loud pixel with the median of the previously refined pixel price of the picked screen by which all of the pixels were loud, by contemplating two complementary running directions. As it happens that planned algorithm may effortlessly take away the sodium and pepper sound once the sound stage is greater than 60%. **Saini Sujata et al. [10]** discussed that picture segmentation is an essential image running stage and it is applied everywhere to examine within the image. Image segmentation generally supplies the significant items of the image. They have shown different image segmentation practices that might be applied to segment the images. Once we assist the picture in just about any software, preliminary stage would be to part the picture to be able to resolve their complexity. The two main classes of segmentation are highlighted in this i.e. the end based and region based segmentation.**Odstrcilik Jan et al. [11]** presented that computerized analysis of retina vessels represents a significant position in the examination of numerous vision along with endemic diseases. A community assessment is extremely desired for immediate and powerful therapy because such disorders must be identified at the initial stage. Automatic and correct segmentation of the blood vessels is among the complicated jobs in the computer-aided examination of fundus photographs. We increase the idea of coordinated filter and propose an exact approach to segment the retinal vessels. The main purpose was always to manage to section the vessels with various vessel diameters in coloured fundus images. They gave a new freely accessible fundus image repository of balanced retinas. The efficiency evaluation demonstrated that planned vessel segmentation method was at the least very equivalent with other new methods.**Nazari Pouya et al. [12]** discussed an approach to acquire the vessels present in blood in the eye. They also provide a fresh powerful initial processing to lessen the after effect of non-uniform light applying red and natural routes of the pictures. The vessels eventually have already been produced applying 2D Gabor filtration bank accompanied by thresholding on black and white and thresholding centred on architectural attributes of marked vessel individuals to get big and slim vessels. The planned algorithm was examined

on DRIVE repository which can be publically available. The outcomes reveal that shown algorithm accomplished improved reliability and other variables.

3. PROPOSED METHODOLOGY

This section explains the working of proposed algorithm. Steps of proposed approach are as follows:
Step 1: Read the input retinal image
Step 2: Apply Guided Image
Step 3: Apply Filter Response For Edge Weakning Image Filter
Step 4: apply Filter Exudate Image Using Edge Weakning Image Filter
Step 5: apply the Neighborhood For Segmentation
Step 6: Apply Neighbourhood Estimator Before Filling Based Segmentation
Step 7: Evaluate Exudate And Non-Exudate Area Using Object Detection
Step 8: Image Segmented image is obtained.
Step 9:Evaluate Parameters To Compare Existing And Proposed Technique.



4. PERFORMANCE ANALYSIS

In order to implement the proposed algorithm, design and implementation has been performed in MATLAB-2013 using image processing toolbox. The Proposed approach is hybrid Neighbourhood Estimator Before Filling with ant colony based segmentation will be used for retinal vessel segmentation. Results show that our proposed approach gives better results than the existing techniques.

1. Sensitivity (SN)

Sensitivity basically describes the ability of the algorithm to detect the vessel pixels. Moreover, it is the other name for Recall. More the value of sensitivity more is the ability to detect the pixels correctly. Table 1 and Fig. 1 shown below clearly indicates that as the value of sensitivity for the proposed method is high in each case, so the proposed method gives improved results.

Table 1: Sensitivity (SN)

Image No.	Existing Technique	Proposed Technique
1	0.9713	0.9834
2	0.9647	0.9777
3	0.9611	0.9750
4	0.9554	0.9706
5	0.9624	0.9759
6	0.9513	0.9657
7	0.9679	0.9788
8	0.9629	0.9746
9	0.9643	0.9755
10	0.9641	0.9776

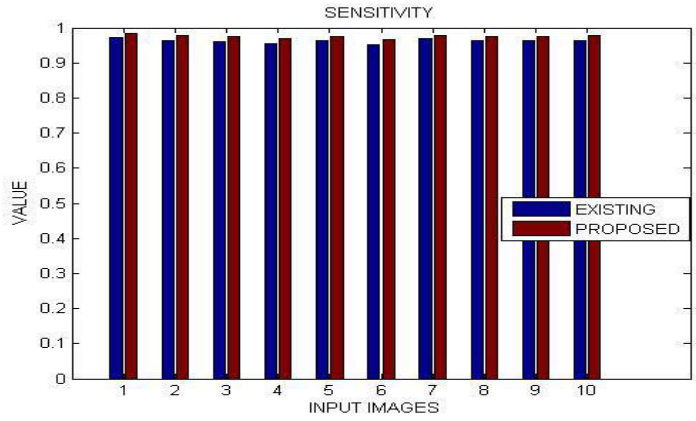


Fig 1 : **Sensitivity (SN)**

2. Specificity (SP)

Specificity describes the ability of the algorithm to detect the non-vessel pixels. More the value for specificity more is the improvement in results. Table 2 and Fig. 2 shown below indicate that value of SP is high using the proposed method.

Table 2: Specificity

Image No.	Existing Value	Proposed Technique
1	0.9574	0.99981
2	0.84112	0.99739
3	0.84296	0.99712
4	0.83569	0.99773
5	0.83798	0.99022
6	0.8143	0.99774
7	0.8342	0.99780
8	0.8197	0.99725
9	0.80872	0.99886
10	0.81978	0.99645

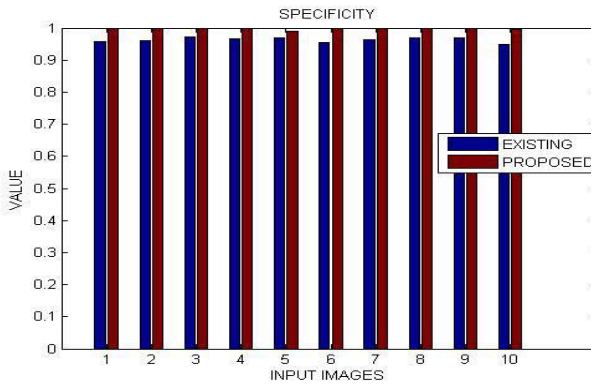


Fig.2: Specificity Evaluation

Conclusion

The review has shown that the Neighborhood Estimator Before Filling filter is rich in preserving the edges. However, it is not so efficient for high density of multiple noises. Thus, integrated neighborhood estimator before filling filter with edge weakening filter techniques is presented in this paper. The performance of proposed technique has been compared by using various parameters such as true positive rate, true negative rate, and F1-score have been evaluated. From performance evaluation, it has been concluded that the proposed technique outperforms over existing techniques. ACO based exudates segmentation technique does not guarantee the lowest error rate because ACO is limited to initial set of random ants only. Therefore, in near future other meta-heuristic techniques such as Gray wolf optimization, artificial bee colony etc. approaches are to be considered to enhance the results further.

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