

Detection of Diabetic Retinopathy Using Sobel edge detection method in DIP

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Abstract— Diabetic retinopathy, a complication of diabetes that occurs as a result of vascular changes in the retina, It is a major cause of loss of vision. Automated image processing has the potential to assist in the early detection of diabetes, by detecting changes in blood vessel patterns in the retina. Image processing techniques can reduce the work of ophthalmologists and the tools used automatically locate the exudates. In this paper the process and knowledge of Digital Image Processing (DIP) is used. Automated analysis techniques for retinal images have been an important area of research for developing screening programmers. By using MATLAB for programming to develop the DIP tool for diagnosis of eye infection. Sobel edge detection algorithm is a method to find the edge pixels in an image. Edges are pixels which carry important information in an image. Thus sobel method is best technique for features are extended & used to classify the pixels in the patch into vessel and non vessel.

Keywords— Diabetic Retinopathy, DIP, MATLAB,

1. INTRODUCTION

Diabetic retinopathy (DR) is a severe eye disease that affects many diabetic patients. Diabetic retinopathy is the most common cause of blindness which a complication of diabetes mellitus, so it is necessary to diagnosed early. The eye, a vital organ of the human body, gives us the sense of color, shape and state of physical objects. But if Abnormalities occurs in the eye because of diseases such as Conjunctivitis, Fungal Keratitis, glaucoma, diabetic retinopathy, fungal infection, diabetes then eye may be damaged [1].

The complicated images obtained from infected eye will be processed using digital Image Processing (DIP) technique, which manipulates the image for the purpose of either extracting information from the image or produces an alternative representation of the image. Thus screening is the most effective method to detect early signs of diabetic retinopathy [2-3]. Using screening method big blood clots called hemorrhages, Hard exudates, The bright circular region from the blood vessels called optic disk, The fovea defines the center of the retina, and is the region of highest visual acuity, exudates and microaneurysms, irregular shaped, and found in the posterior pole of the fundus can be detected.

Ma et al. [3] defined a quality descriptor according to three classes, namely, out-of-focus images, motion blurred images and severely occluded images of eyelids and eyelashes. Zhu et al. [4] proposed a quantitative quality measure using discrete wavelet decomposition.

Analyzing and interpreting retinal images have become a necessary and important diagnostic procedure in ophthalmology. We are interested in vessel segmentation in color images for screening of diabetic

retinopathy. Thus to remove noise, enhance objects of interest - blood vessels, damaged areas, Changes in the

blood Vessel Structure we can use Sobel algorithm, and Laplacian of Gaussian operator, which detects the edges of blood vessels [5]. Micro aneurysms [tiny dilations of the blood vessels] are the first apparent sign of diabetic retinopathy so that their detection in fundus images through photography might be detect the disease in an early stage.

2. METHODS OF DETECTION

SOBEL EDGE DETECTION METHOD

Detection of vessels, exudates, and hemorrhages, blood clots, Hard exudates, optic disk is possible using Sobel method. Edge detection is the process of localizing pixel intensity transitions. The Sobel operator is an algorithm for edge detection in images discovers the boundaries between regions also it determine and separate objects from background in an image. It's an important part of detecting features and objects in an image [6].

The Sobel method finds edges using the Sobel approximation to the derivative. It returns edges at those points where the gradient of I is maximum. Where the gradient of the considered image is maximum. The horizontal and vertical gradient matrices whose dimensions are 3×3 for the Sobel method has been generally used in the edge detection operations [7]. If we define A as the source image, and Gx and Gy are two images which at each point contain the horizontal and vertical derivative approximations, the computations are as follows.

$$G_x = \begin{bmatrix} -1 & 0 & +1 \\ -2 & 0 & +2 \\ -1 & 0 & +1 \end{bmatrix} * A \quad \text{and} \quad G_y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ +1 & +2 & +1 \end{bmatrix} * A$$

$$G = \sqrt{G_x^2 + G_y^2}; \quad \text{Where, } |G| = |G_x| + |G_y| \quad \&$$

$$G_x = (W_7 + 2W_8 + W_9) - (W_1 + 2W_2 + W_3)$$

$$G_y = (W_3 + 2W_6 + W_9) - (W_1 + 2W_4 + W_7)$$

Where, W_1 to W_9 are pixels values in a sub image

[7].

These filters estimate the gradients in the horizontal (x) and vertical (y) directions and the magnitude of the gradient is simply the sum of these 2 gradients. Using this information, we can also calculate the gradient's direction [8]. Where, for example, Θ is 0 for a vertical edge which is darker on the right side.

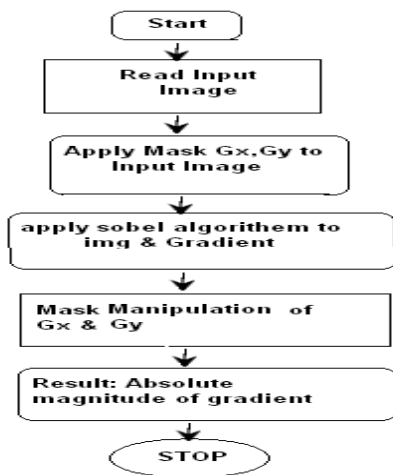


Fig. 1 Flowchart for Sobel Method

3. RESULT & DISCUSSION

The Sobel method finds edges using the Sobel approximation to the derivative. The Sobel operator calculates the approximate image gradient of each pixel by convolving the image with a pair of 3x3 filters. Thus fig.2) a) is a original infected image of in which red spot shoes clotting of blood also yellowish spots shows hemorrhages, Hard exudates. This is then converted in to grayscale image [9].



Fig.2. a) Pink Eye b) Gray Scale Imag

Further gray scale image is processed, sobel method is applied to find out derivative of grayscale image therefore Marr Edges, sigma=1, Marr Edges, sigma=2 is applied. in Fig.3.A) & B) we can clearly observe separate edges of nerve fibers, clotted spots, hemorrhages, Hard Exudates.

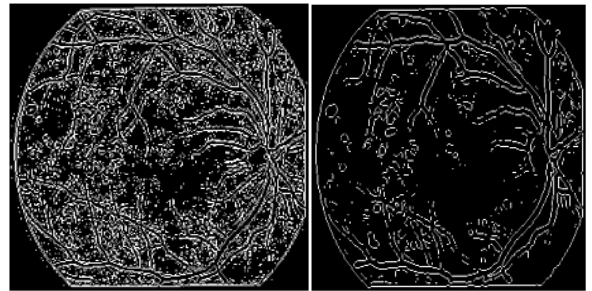
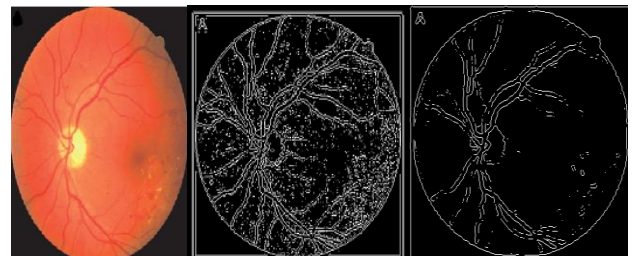


Fig. 3 A) Marr Edges, sigma=1 B) Marr Edges, sigma=2

Sobel method is able to detect exact location of optic disk with damaged blood vassals. We can observe yellowish part of optic disc in fig 3 a) which is damaged due to increase in pressure in eye due to Diabetic retinopathy which causes in blindness .So if it is possible to detect in early stage with the help of sobel function consist Marr Filter we can observe damaged part of optic disc, with damaged blood vassals, also we can observe yellowish blood spot due to pressure in eye. In Fig.b) & C).



A) Original Diabetic image, B) Detected edges, C) Detection of optic disc. Effect application of Edge detection algorithms of sobal edge detection method on diabetic images using function of Marr Filter.

4. Conclusions

We proposed an efficient method based on Sobel method which differentiates between original diabetic image & processed image. Sobel method can show separates parts of the edges of nerves from whole image. This paper has demonstrated an automated system which is able to distinguish normal and abnormal vasculature on the optic disc. The main focus of this work is on segmenting the diabetic retinopathy image and classifies the Exudates, micro aneurysms and hemorrhages. These methods give almost good results. Thus Image processing techniques can reduce the work of ophthalmologists and the tools used automatically locate the exudates.

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