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Skin Disease Identification using Image Segmentation

M.Ganeshkumar, J.Jebakumari Beulah Vasanthi

Research Scholar, Department of Computer Science, Ayya Nadar Janaki Ammal College, Sivakasi, Tamil Nadu, India

Head of Department, Department of CS & IT, Ayya Nadar Janaki Ammal College, Sivakasi, Tamil Nadu, India

***ABSTRACT*:** Melanoma is one type of skin disease and is much more dangerous than the other type of skin cancer. Skin disease is mostly found in animals, humans and plants and it is a particular kind of illness caused by bacteria or an infection. The diseases include ringworm, yeast infection, brown sport, allergies, etc. These diseases are identified by using many technologies. The Skin disease identification system has many techniques like preprocessing and edge detection, etc. Preprocessing is the main stage of discovery to improve the quality of images, removing the irrelevant noises and unwanted parts in the background of the skin images. Edge detection is the technique for finding the boundaries of objects within images. This paper presents a preprocessing technique such as morphological operations for removing the hair. The edge detection techniques such as Prewitt and Sobel filter are to detect affected area. These methods have been tested on online skin disease datasets. This proposed work removes the hair correctly and results in better PSNR and MSE values and detected the edges in the affected area.

KEYWORDS: Skin disease; Image processing; Preprocessing; Morphological operation; Edge detection*;*

I. INRODUCTION

Digital image processing deals with system that perform various operations on digital image to improve the quality of the image by removing noise and unwanted pixels and to obtain intentional information from an image [8]. An image is basically two dimensional signal defined by a mathematical function, F(x, y) where x and y gives value of horizontal and vertical co-ordinates [9]. Melanoma, a type of skin cancer must be diagnosed at an early stage. Early diagnosis makes treatment effective and life of the patient can be saved [11]. Dermoscopy has become an important technique in the early diagnosis of melanoma. In this technique, oil is applied on the skin surface where the lesion is present and polarized light is made incident on the skin. Then the image is acquired with a digital camera attached to dermatoscope. This process reveals the morphological structures which are present in deeper layers of skin [7].

Preprocessing is the process to improve the quality of an image by removing the unwanted parts in the image. Skin image contains skin lines, air bubbles and hairs around the lesion. These might reduce the accuracy of the border detection and increase the computational time, so the preprocessing step is essential. These steps are to detect in order to remove noise and enhance the quality of the original image. It required being applied to limit the search of abnormalities in the background influence on the result. The main purpose of this step is to improve the quality of the melanoma image by removing unrelated and surplus parts in the background of an image for further processing. Good selection of preprocessing techniques can greatly improve the accuracy of the system [3].

Edge detection is a part of image segmentation. The effectiveness of many image processing also computer vision tasks depend on the perfection of detecting meaningful edges. It is one of the techniques for detecting intensity discontinuities in a digital image [4]. The process of classifying and placing sharp discontinuities in an image is called the edge detection. The discontinuities are immediate changes in pixel concentration which distinguish the

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boundaries of objects in a scene. Operators can be optimized to look for vertical, horizontal, or diagonal edges. Edge detection is a difficult task in noisy images, since both the edges and noise hold high- frequency content [5].

This Paper is organized as follows. Section II describes some literature review and the Section III discusses the methodology with preprocessing steps and edge detection. Section IV discusses the experimental results. In section V conclusion of the paper is discussed.

II. LITERATURE REVIEW

Literature survey gains an understanding of the fundamentals and learning the definitions of the concepts. The aim of the literature survey is accessing latest approaches, methods, theories and discovering a new research based on the existing research.

Peter *et al.* have proposed morphology image preprocessing for thinning algorithms to briefly describe the binary morphological operation. This work proposes the use of binary morphology because of its versatility and relatively fast execution [7].

Raid *et al.* have described the morphological operations such as erosion, dilation, opening, closing, boundary extraction and region filling [10].

Zahhad *et al.* have exposed the Edge detection with a preprocessing approach. The proposed preprocessing approach involves computation of the histogram, finding out the total number of peaks and suppressing irrelevant peaks [12].

Bartunek *et al.* have described the adaptive fingerprint image enhancement with emphasis on the preprocessing of data. The four updated processing blocks are preprocessing, global analysis, local analysis and matched filtering. The preprocessing yields an improved and new adaptive fingerprint image processing method [1].

Muthukrishnan *et al.* have described the edge detection techniques such as Sobel Edge detection, Prewitt Edge detection, Canny Edge detection and so on [5].

This literature review provides a flexible study about preprocessing techniques, Edge detection techniques. Based on this survey, this research comprises of two stages.

First stage includes preprocessing like,

- Removal of hair in the Skin disease dataset image

Second stage includes Edge detection such as,

- Prewitt Edge detection
- Sobel Edge detection

III. METHODOLOGY

The methodology of this research work is described in this section. It has two stages. In the first stage, the irrelevant parts are removed from the image by using the morphological operations. In the second stage, the edges are detected by using the Prewitt and Sobel operators. The block diagram of the proposed work is shown in fig. 1.

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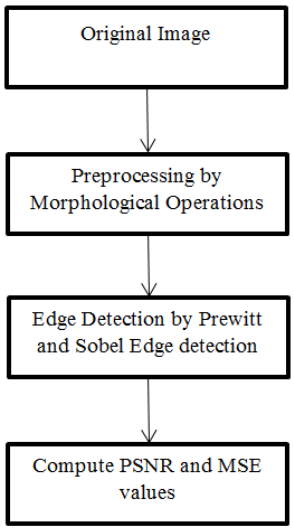

Fig. 1. Block diagram of proposed work

The morphological operations have two operations such as closing and opening.

After finishing the preprocessing work the resultant image is applied as the input for second stage. In this stage, the Edge detection methods are used to detect the edges of the affected area in skin disease image. Edge detection is used for object detection. It is a fundamental process detects and outlines of an object and boundaries among objects and the background in the image. Edge detection is the most familiar approach for detecting significant discontinuities in intensity values [5]. In Edge detection, the Prewitt edge detection and Sobel edge detection are used. In this proposed work, to detect the edges in an affected area in an image using the Prewitt edge detection and Sobel edge detection.

3.1 Morphological Operations

Binary image may contains countless defects. Morphology is the image processing operations that modifies the images and shapes. It has many applications. It follows the goal of eliminating all these defects and maintaining the structure of the image. Morphological operations are assured only on the associated ordering of pixel values, rather than their numerical values, so they focused more on binary image, but it can also be applied to grayscale images such that their light transfer functions are unknown and thus their absolute pixel values are not taken into consideration [9].

The morphological operation explores an image with small form or template. This template is called structuring element. The structuring element applies to all potential locations of the input image and generates the same size output. The output image pixel is based on like input image with neighbors [10].

3.1.1 Opening

The mathematical morphological opening is the important operator. It is derived from the fundamental operations such as erosion and dilation. Then it is applied to the normal binary images and also gray level images. The opening operation is like as erosion and it tends to remove the foreground (bright) pixel from the edges of regions of foreground pixels [6].

The opening of the set A by structuring element B, denoted A ◦ B

$$A \circ B = (A \ominus B) \oplus B \quad (1)$$

Thus, the opening A by B is the erosion of A by B, followed by a dilation of the result by B [9].

3.1.2 Closing

Closing is the one of the most important operators in mathematical morphology. It is similar to dilation. It tends to enlarge the boundaries of foreground regions in an image, but it is less destructive of the original boundary shape.

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Closing operator is an effort to preserve background regions that have a similar shape to this structuring element, while eliminating all other regions of background pixels [2].

The closing of the set A by structuring element B, denoted A●B is defined as

$$A \bullet B = (A \oplus B) \ominus B \qquad (2)$$

Which say that the closing of A by B is simply the dilation of A by B, followed by the erosion of the result by B [9].

In this proposed work, hairs are removed from the original skin image by using the morphological operations such as opening and closing. The PSNR and MSE values are computed.

3.2 Edge Detection

Edge Detection is a problem of fundamental importance in image analysis and computer vision. Edges occur at various resolutions or scales and represent transitions of different degrees or gradient levels. Fine edges comprise macroscopic images which make image processing more sensitive to the edge detectors. Edges reflect the basic characteristic of images. Within an image, edges correspond to the intensity discontinuities that result from the different surface reflectance of objects, various illumination or varying distance and orientation. Edges can be detected as rapid change in the gradient value within a small area. Algorithms in this area are based on either. The former relies on portioning the image based on abrupt changes, and deals with the detection of isolated points, lines, and edges in an image discontinuities or similarities [4].

3.2.1 Prewitt Edge Detection

The Prewitt edge detection is proposed by Prewitt in 1970. To estimate the magnitude and orientation of an edge Prewitt is a correct way. Even though different gradient edge detection wants a quiet time consuming calculation to estimate the direction from the magnitudes in the x and y-directions, the compass edge detection obtains the direction directly from the kernel with the highest response. It is limited to 8 possible directions; however knowledge shows that most direct direction estimates are not much more perfect. This gradient based edge detector is estimated in the 3x3 neighborhood for eight directions. All the eight convolution masks are calculated. One complication mask is then selected, namely with the purpose of the larger module. Prewitt detection is slightly simpler to implement computationally than the Sobel detection [5].

-1	-1	-1
0	0	0
+1	+1	+1

G_x

-1	0	+1
-1	0	+1
-1	0	+1

G_y

3.2.2 Sobel Edge Detection

The Sobel edge detection method is introduced by Sobel in 1970. The Sobel method of edge detection for image segmentation finds edges using the Sobel approximation to the derivative. It precedes the edges at those points where the gradient is highest. The Sobel technique performs a 2-D spatial gradient quantity on an image and so highlights regions of high spatial frequency that correspond to edges. In general, it is used to find the estimated absolute gradient magnitude at each point in n input grayscale image. In conjecture at least the operator consists of a pair of 3x3 complication kernel as given away in under table. One kernel is simply the other rotated by 90^o. This is very alike to the Roberts Cross operator [5].

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-1	-2	-1
0	0	0
+1	+2	+1

G_x

-1	0	-1
-2	0	+2
-1	0	+1

G_y

The proposed work is summarized as follows.

Step1: *Input skin disease image*
Step2: *Preprocessing the image for removal of hair*
Step3: *Detecting the edges of preproceesed image*
Step4: *Compute the PSNR and MSE values*

IV. RESULTS AND DISCUSSIONS

The experiments have been done on online skin disease datasets and implemented in MATLAB. The Fig. 2 describes the original skin disease image with hair.

Fig. 2. Original Image

The Opening morphological operation has been performed and the result is in Fig. 3

Fig. 3. Result of the Opening Operation

The Fig. 4 exposed the result of the closing operation. The hairs in the original skin disease image are removed after opening and closing operations.

Fig. 4. Result of Closing Operation

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The preprocessed images are applied to Prewitt and Sobel operators. Fig. 5 represents the Prewitt edge detection result.

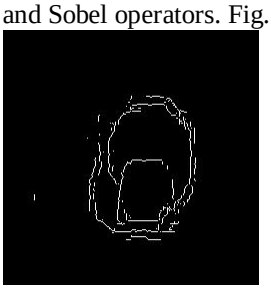

Fig. 5. Result of the Prewitt Edge detection

The Sobel Edge detection result is shown in the Fig. 6

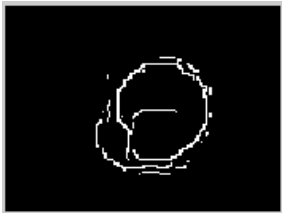

Fig. 6. Result of Sobel Edge detection

Table 1 compute the PSNR and MSE values of different skin disease images.

TABLE 1. PSNR and MSE values

S.NO	IMAGES	PSNR	MSE
1	Skin Image 1	31.60	42.65
2	Skin Image 2	32.42	37.48
3	Skin Image 3	28.10	80.23
4	Skin Image 4	36.68	14.07
5	Skin Image 5	31.78	43.47

PSNR value for edge detected images after applying Prewitt and Sobel edge detection techniques are tabulated in Table 2.

TABLE 2. PSNR value

RGB IMAGE	GRAY IMAGE	EDGE DETECTOR	PSNR
		Prewitt	14.75
		Sobel	13.69

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V. CONCLUSION

This paper has implemented the morphological operations for removal of hair. The foreground is removed in the first phase using Opening operation whereas in second phase, Closing operation removes the background. Morphological operation has given the hair removed image that helped in further processing . Finally, Edges are detected by using Prewitt edge detection and Sobel edge detection techniques. As this paper proved that morphological operation gives better PSNR and MSE values, Prewitt edge detection is better than Sobel edge detection based on the PSNR value.

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