ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Classification of Melanoma and Non Melanoma Skin Lesions in Dermoscopy Images using Asymmetry Feature

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ABSTRACT: The study presents a methodology to diagnose skin lesions. There are many clinical diagnose is available,but the exact and accurate result of diagnosis of skin lesion is acquired by using emerging image processing techniques. The study proposes two major components of diagnosis that are feature extraction and classification. The experiments use CVonline image database which contains dermoscopy images of benign, atypical and melanoma skin lesions.

KEYWORDS: Melanoma, Non-melanoma, Dermoscopy images, Asymmetry

I. INTRODUCTION

Human skin is multiple layers of ectodermal tissues with two general type hairy and glabrous. The skin can be easily scrutinized with eyes. However, in matters of skin lesion specific features of the skin are better appraised by noninvasive imaging methods[5] Dermoscopy is widely acknowledged technique, for an observation of pigmented skin lesions.Skin lesion is any abnormality in the tissues of an organism, caused by trauma. The class of skin lesions is presented in very great extent. Among these many, some skin lesions could lead to skin cancer. In 2013 at Cancer Research Center UK [www.cancerresearchuk.org] estimated 7200 and 7400 cases of malignant melanoma diagnosed in males and females respectively. Whereas 72,100 new cases of non-melanoma was diagnosed too. Earlier and more accurate examination of skin lesion could help out with making this ration down.Our key endeavor is to zoom in on 2 classes of skin lesions, that are melanoma and non-melanoma. Atypical and Benign skin lesion we can take under consideration of non-melanoma. General clinical features of skin lesions connotative of classes of skin lesions are ABCD: [1][2] Asymmetry, Border irregularity, Color diversification, Diameter. Using these symptoms expert can recognize the type of skin lesion. Extraction of these features have 59-74% [1] accuracy. But more precise diagnosis is needed .Besides these, other features like shape, color, pattern and pigment network [3] could be helpfull to determine better results in terms of accuracy. The contribution of all these features to categorize skin lesions can be studied in CVonline database[4]

II. RELATED WORK

Here we particularize the hired techniques used for procedure of diagnosis of skin lesions:

processing

Preprocessing is govern for better evaluation and also for erasing interruption, presented in the suspected skin lesion. This will make ease in the process of image segmentation.

Image Enhancement

Subtraction in image is generally carried out by temporal averaging techniques. Such idea is useful to improve a result, in later processing. Use of median filter is very convenient due to its feature edge preservation and moreover, it is just

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not simply replaces the pixel intensity with mean of neighboring pixel's intensity but it replaces it with the median of neighboring pixel's intensity. Doing this will give only that pixels which are representative enough for the image[2]

$$Y[m,n] = median\{x[i,j],(i,j)\in w\}$$
[1]

Where w represents a neighborhood throating around the location [m,n] in the image [2] This filter truncates the outcome of small objects like hair, lines on further results.

Hair removal

The methodology involves operations of edge detection, and morphological operations like dilation. Closing and filling. Edge detector will only preserve the strong and connected edges, it will suppress weak edges of the lesion. Morphological operation performs addition of exterior intensity pixels to the founded edges by edge detector. Closing morphological operation performs enlarging the boundary of the foreground and shrink the background of a lesion. Hairs presented in the image will be eliminated by morphological operations, So the pixels of hairs will be converted as holes, the work to fill that hole by neighboring pixel intensity values is done by filling morphological operation.

Lesion segmentation

The main motive of this process is for separating the skin lesion from its surrounding skin. So, that feature of that skin lesion could be finely achieve in feature extraction step.

This is achieved by an Otsu's thresholding method. This method consist of following an approach of finding the threshold that minimizes the weighted within-class variance. This turns out to be the same as maximizing the between-class variance.
The weighted within-class variance is:

$$\sigma_w^2(t) = q_1(t)\sigma_1^2(t) + q_2(t)\sigma_2^2(t) \qquad [2]$$

Where the class probabilities are estimated as:

$$q_1(t) = \sum_{i=1}^{t} P(i) \quad [3] \qquad q_2(t) = \sum_{i=t+1}^{I} P(i) \quad [4]$$

And the class means are given by :

$$\mu_1(t) = \sum_{i=1}^{t} \frac{iP(i)}{q_1(t)} \quad [5] \qquad \mu_2(t) = \sum_{i=t+1}^{I} \frac{iP(i)}{q_2(t)} \quad [6]$$

Finally, the individual class variances are:

$$\sigma_1^2(t) = \sum_{i=1}^{t} [i-\mu_1(t)]^2 \frac{P(i)}{q_1(t)} \qquad [7]$$

I ... $P(i)$

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$$\sigma_2^2(t) = \sum_{i=t+1} [i - \mu_2(t)] \quad \overline{q_2} \quad (t) \qquad [8]$$

Where, t is the threshold; P(*i*) where (*i*=0,1….n-1) is the stastical probability of pixels with gray level *i* in the image. [6]After some algebra, we can express the total variance as..

$$\sigma^2 = \sigma_w^2(t) + q_1(t)[1 - q_1(t)][\mu_1(t) - \mu_2(t)]^2 \qquad [9]$$

Since the total is constant and independent of *t*, the effect of changing the threshold is merely to move the contributions of the two terms back and forth. So, minimizing the within-class variance is the same as maximizing the between-class variance. The nice thing about this is that we can compute the quantities in recursively as we run through the range of *t* values. [7]

2.3 Feature Extraction

The remarkable problem in melanoma skin lesion detection is to find applicable characteristics describing malignant lesions in order to ensure the categorize between melanoma, Atypical and benign lesions. Generally, benign lesions that may be clinically mistaken for melanoma. ABCD rules are used to have an accurate system in recognition part; if the lesions have one or more of the ABCD, it should be in melanoma skin lesion.[2]

ABCD rule is summarized as below:

1. Asymmetry:

This feature belongs to irregularity in the lesion. In other words, asymmetry can be judged by comparing the distance of centroids to edge pixels. Fulfillment of this property will classify the segmented skin lesion into melanoma.

2. Border irregularity:

The edges of the lesions are irregular, uneven or blurred. If the lesion's border is rumple than it is more suspicious to be in category of melanoma.

3. Color:

This feature belongs to diversification of color in different type of skin lesion. The significant color range could compare with achieving color and classification can be done by predefined falling class of skin lesion with respect to color.

4. Diameter:

This feature belongs to the area of skin lesion > 6 mm of diameter of skin lesion will categorize a lesion in melanoma otherwise non-melanoma skin lesions.

Accurate extraction of these features would help in better classification of skin lesions.

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III. PROPOSED ALGORITHM

Proposed system has aims to accurately classify 6 classes of skin lesions. In respect of this objective different features of these types are examined as well. The denoting problem in detection of skin lesion is to find applicable and proper features representing the lesion in order to classify them in an accurate type of lesion among our scope. Key features described below are used to have an accurate classification.

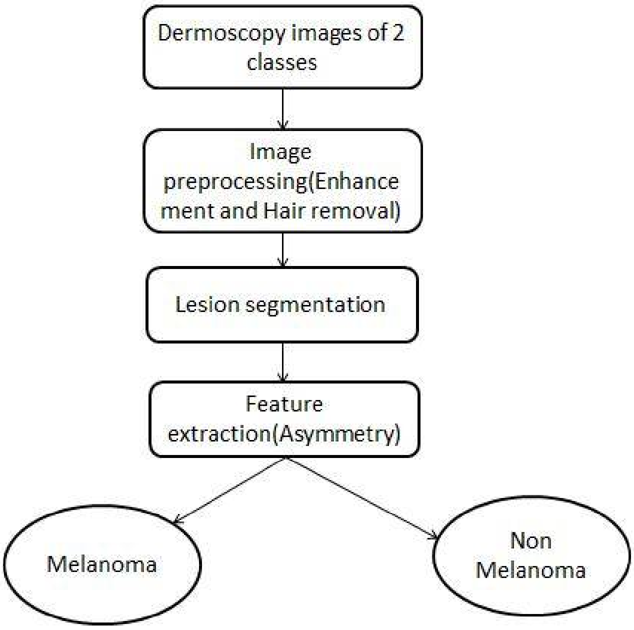

Fig 2 : Flowchart of proposed scheme

Asymmetry feature extraction and classification ***algorithm***

input *= images of melanoma and non-melanoma skin lesion* ***output*** *= classified skin lesions*

c=centroid

find ds,xend,yend

xc = pixels presented on x-axes yc = pixels presented on y-axes **for** *theta = 0<15<180*

if *theta = 90*

do *ds(theta+1)=sum(image(xc,imagesize))* ***else***
for *j=xc:-1 to1*

do *ypoint=(yc+tan(theta*pi/180)(xc-j))theta= theta++*

end
for *j=xc:1:size(image,1)*

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do *ypoint=(yc+tan(theta*pi/180)(xc-j))theta= theta++*

end
[a,b]=max(ds) *[where a=pixel value ,b=angle]*

thetamax=b-1

asm= ∅

for i=1<15<180 asm=[asm,sqrt(xc-xend(1,i)^2+yc-yend(1,i)^2)] s=[asm,0]

t=[0,asm]

asymmetry=sum(abs(s-t)) define thrreshcounter,

if *counter>=threshcounterlesion is melanoma*

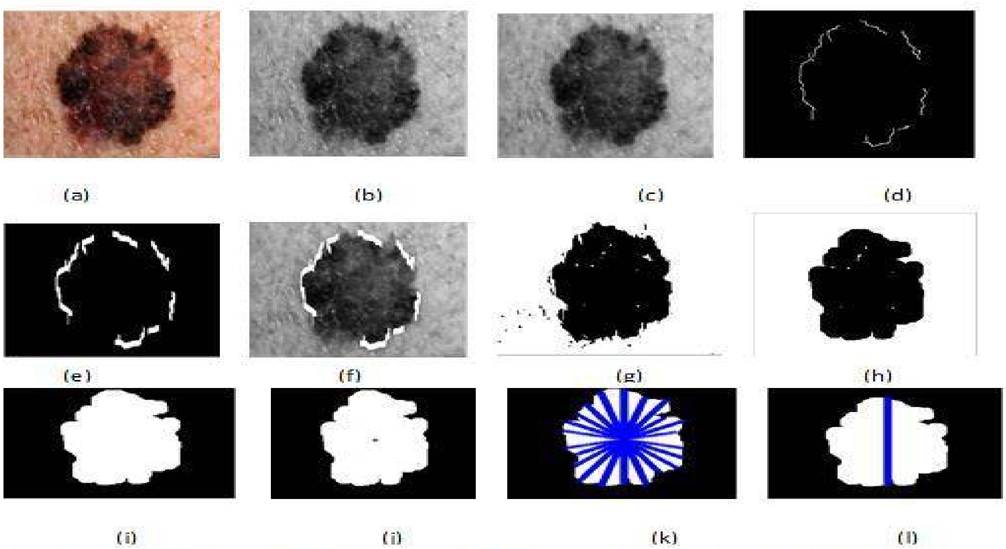
else

lesion is non-melanoma ***end***

Proposed algorithm foe asymmetry classifies the lesion images in 2 major classes that are melanoma and non-melanoma. In order to classify the skin lesions interval of theta is taken as 15 degrees and threshold for threshcounter is taken as 1.

IV. RESULTS

Experiment is done on 40 iamges for checking of asymmetry feature to classify non-melanoma from melanoma skin lesions



(a)original image (b)gray image (c)enhanced image (d)edge detection (e)dilation operation (f)addition operation (g)closing operation (h)hair removal (i)lesion segmentation (j)centroid (k)asymmetry (l)maximum diameter

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V. CONCLUSION AND FUTURE WORK

After getting the detection result with single feature asymmetry we achieve 77 % accuracy, 83% sensitivity and 73 % specificity which classify melanoma and non-melanoma skin lesions class. In order to achieve more accuracy we will proceed towards analyzing of focal length, image size , calculation from pixel to mm so that, we can incorporate the diameter feature in feature extraction and further in the classification.

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BIOGRAPHY

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