Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2015, 7(2):148-153

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Detection of skin cancer by image processing techniques

Pauline J., Sheeba Abraham* and Bethanney Janney J.

Department of Biomedical Engineering, Sathyabama University, Chennai, India

---

ABSTRACT

Half of all men and one-third of all women in the US develop cancer during their lifetimes. Today, millions of people are living with cancer or have had cancer. The risk of developing many types of cancer can be reduced by changes in a person's lifestyle, for example, by staying away from tobacco, limiting time in the sun, being physically active and healthy eating. Our aim is to find the types of skin cancer by various techniques of image processing. This paper presents a new approach for skin cancer detection and analysis from given photograph of patient's cancer affected area, which can be used to automate the diagnosis of skin cancer. The proposed scheme uses two methods for classification of skin cancer- ABCD rule with good diagnostic accuracy worldwide is used in diagnostic system as a base and finally the feature extraction is done using principal component analysis. These methods are compared for their effectiveness.

Keywords: Skin cancer, Feature extraction, Segmentation, Principal Component Analysis, ABCD.

INTRODUCTION

Skin cancer can be defined as skin growths with differing causes and various degrees of malignancy. Skin cancer can also be referred to as Skin Neoplasm's. Skin cancer develops on skin and so can be seen. The main cause of Skin cancer all over the world is UV radiations coming from the sun and it is estimated that Americans are greatly affected by skin cancers than the Africans and Asians. This is due to the fair complexion of their skin and so less melanin. Whereas Africans and Asians due to the high melanin content in the skin is far resistant to skin cancer [1]. It has been statistically proven that fairer skin toned people are much prone to tanning and so is prone to skin cancer. Cancer is the general name for a group of more than 100 diseases. Although there are different kinds of cancer, all cancers occur because abnormal cells grow out of control. Untreated cancers can cause serious illness and death.

Classification of Skin Cancer

Skin cancer is the most commonly occurring cancer. Skin cancer develops on skin and therefore from skin cells.Based on the type of skin cells, from which cancer arise, is classified into;Basal cell cancer [BCC], Squamous cell cancer [SCC], Melanoma

Basal cell cancer

Basl cell cancer is the most common skin cancer occurs in sun exposed areas. It rarely causes death as it rarely spreads. It is easily treated with surgery or radiation. Symptoms for basal cell cancer are:

Raised, smooth, pearly bump on sun exposed skin (head, neck or shoulders).Small blood vessels are seen sometimes. Crusting and bleeding in the centre of the tumour.

Squamous cell cancer

It is less common than Basal cell cancer. It spreads more frequently and is caused by UV-B radiation via direct DNA damage and often is a very rapid growing tumour. Symptoms for Squamous cell cancer are red, scaling, thickened patch, ulceration and bleeding may occur and it develops into large mass if not treated.

Melanoma

Least frequent than Basal and Squamous cell cancer, Melanoma spreads very frequently and once spread causes death. Melanoma is more dangerous skin cancer than other types of skin cancers. It is caused by UV-A radiation via indirect DNA damage and survival rates of the person affected is poor. Symptoms caused for Melanoma are brown to black looking lesions, few might be pink, red or fleshy in colour and these will be the most aggressive ones. Any change in size, shape, colour or elevation of a mole, appearance of a new mole or new pain or itching, ulceration or bleeding are the main symptoms.

EXPERIMENTAL SECTION

PREPROSSING

Preprocessing is an image enhancement technique to improve the quality of an image before analysing the signal.

Different methods involved in pre-processing are discussed below:

Edge detection:

Edge detection is identifying points in a digital image at which the image brightness changes sharply or more formally has discontinuities [1]. It is one of the pre-processing steps. Edge detection method is done by the method of canny and sobel method.[2] Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene. Classical methods of edge detection involve convolving the image with an operator (a 2-D filter), which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions. There are extremely large numbers of edge detection operators available, each designed to be sensitive to certain types of edges.

Canny method

The Canny edge detection algorithm is known to many as the optimal edge detector. The canny edge detector first smoothes the image to eliminate noise. It then finds the image gradient to highlight regions with high spatial derivatives.

Sobel edge detection Filter:

Sobel is an edge detection technique. But before it does Edge detection it smoothes/ filters the image and thus it has been mentioned under filters. The Sobel operator performs a 2-D spatial gradient measurement on an image and emphasizes regions of high spatial frequency that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input gray scale image. It has two convolution kernels

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

Gx

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

Gy

This figure represents the convolution kernels of Sobel edge detection filter. The convolution kernels smoothes the input image to a greater extend and so makes the operator less sensitive to noise. The operator also generally produces considerably higher output values for similar edges.

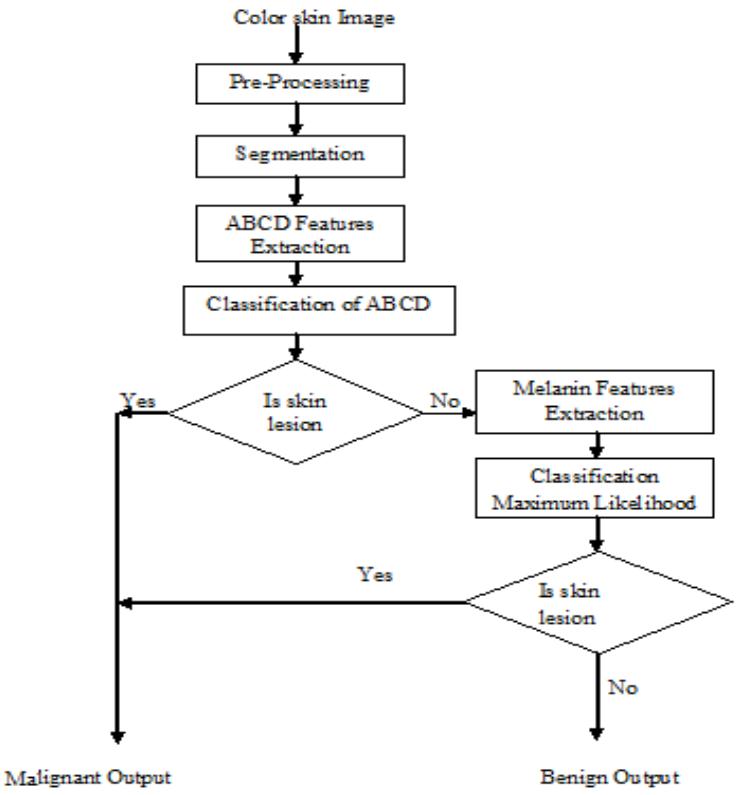

Fig1. Classification by ABCD/PCA Method

Segmentation

It partitions an image containing each pixel into distinct regions. It analysis the image and extract the area of interest of defected area. Segmentation accuracy determines the success or failure of computerised analysis procedures. In segmentation isolation of parts of the image that constitute objects or areas of interest is done. Thresholding is done to separate out the regions of the image corresponding to objects in which we are interested, from the regions of the image that corresponds to the background [1]. It uses watershed method [14].

Watershed Method

A watershed is a basin-like landform defined by highpoints and ridgelines that descend into lower elevations and stream valleys. A grey-level image may be seen as a topographic relief, where the grey level of a pixel is interpreted as its altitude in the relief. A drop of water falling on a topographic relief flows along a path to finally reach a local minimum [8]. Intuitively, the watershed of a relief corresponds to the limits of the adjacent catchment basins of the drop of water.

Concept of watershed is based on visualizing an image in 3-D- 2 spatial coordinates versus intensity. In such a topographic interpretation, we consider three types of points:

a) Points belonging to regional minimum
b) Points at which a drop of water, if placed at the location of any of those points, would fall with certainty to a single minimum; and
c) Points at which water should be equally likely to fall to more than one such minimum.

For a particular regional minimum, the set of points satisfying condition (b) is called catchment basin or watershed of that minimum. The points satisfying condition (c) form crest lines on the topographic surface and are termed divide lines or watershed lines.

Classification Using ABCD:

A=Asymmetry (0-2 points), the dermoscopic image is divided by 2 perpendicular axes positioned to produce the lowest possible asymmetry score.

B=Border (0-8points),the image of the lesions are divided in to eighths and a sharp,abrupt cutoff of pigment pattern at the periphery within one eighth has a score 1,in contrast, gradual, indistinct cutoff within one eighth has a score of 0,so the maximum border score is 8,and the minimum score is 0.

C=Color (0-6 points), six different colours white,red,light brown, dark brown, blue-gray and black are counted for determining the colour score.

D=Diameter (or) Differential structure (0-5 points).-Stolz proposed five features for evaluation called differential structures. pigment network, structure-less(or)homogeneous areas,streaks,dots and globules.

By the ABCD method the feature extracted is done. The segmented image is given to the ABCD. The image has been classified.

Total Dermatoscope Score (TDS):
TDS is calculated as TDS=A*1.3+B*0.1+C*0.5+D*0.5
The score value obtained from ABCD is used to calculate TDS.TDS is used to classify the cell as:

- TDS>5.45- Malignant Melanoma.
- <4.75-Benign
- >4.75<5.45- Suspicious case.

If TDS is greater than 5.45 it is called Malignant Melanoma.
TDS is less than 4.75 is called Benign.
TDS **is** greater than 4.75 and less than 5.45 called suspicious case.

PRINCIPAL COMPONENT ANALYSIS:
PCA is often referred to as technique for reducing the number of variables in a data set without loss of information and as a possible process for identifying new variables in to another smaller set the newly created variables are not usually easy to interpret. PCA has been most successful in applications such as image compression where data reduction and not interpretation is of primary importance. PCA allows one to identify the uncorrelated components of an ensemble of data. PCA is used for classification, to classify the skin cancer [10 &12] . PCA uses a method of analysis which involves finding the linear combination of a set of variables that has maximum variance and removing its effect and then testing and training is done. With the results of testing and training, PCA will find whether the given values are benign or malignant. If the values are below 1 then it is benign. In case, the values are above 1, it's a malignant.

RESULTS AND DISCUSSION

The experiments and results obtained by the techniques of image processing .The final results will be the classify of skin cancer and it shows that whether it is benign or malignant.1st method by ABCD method of classification[8].In that image has been segmented and edge detection has been done by using canny and sobel method. Then with that image graph has been plotted as fractal dimension.[9]

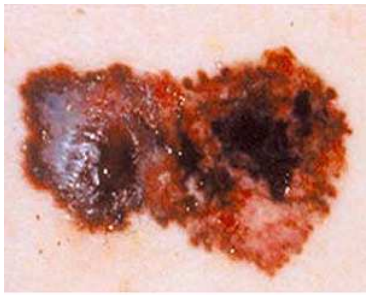

Fig 2. Input Image

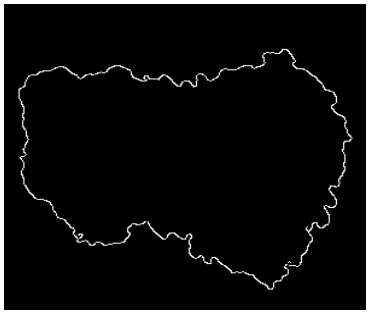

Fig 3. Edge Detection of Input Image

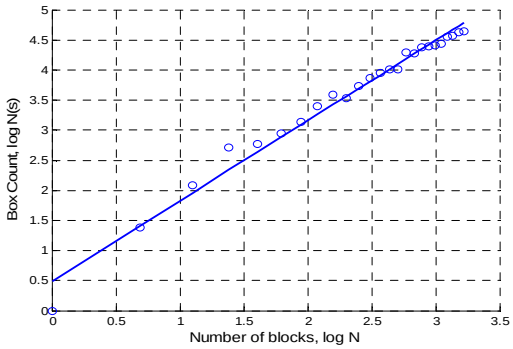

Fig 4. Fractal dimensions of the original image

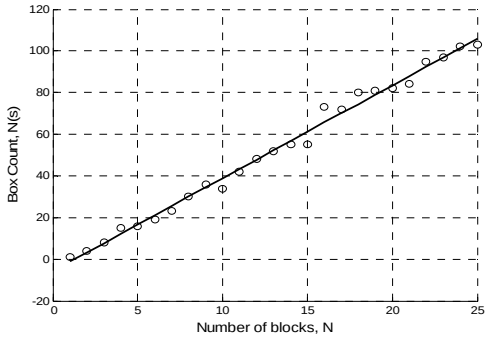

Fig 5. Fractal dimensions of the edge detection image

Table 1. Results of Benign

	1	2	3	4	5
A	0.0556	0.158	0.0867	0.3679	0.2071
B	0.3727	0.4134	0.3326	0.713	0.9031
C	2	2	1.5	1.5	1.5
D	2.5	2.5	2.5	2.5	2.5
TDS	4.928	5.0204	4.4193	5.081	5.1102

Table 2 Results of Malignant

	1	2	3	4	5
A	0.2321	0.1305	0.1653	0.2071	0.1904
B	1.6255	0.4154	0.521	2.6387	1.7511
C	3	3	3	2.5	2
D	2.5	2.5	2.5	2.5	2.5
TDS	7.3576	6.0458	6.1864	8.3073	6.4415

Input image is a dermatoscopic image, Fig. 3.1 represents an input image of a skin cancer, and the skin cancer image is segmented by using watershed method, then edge detection was carried out. Edge detection was done by Canny method, and filtering is done for removing noises from the given image using Sobel filter to get the clear edges (Fig. 3.2). Fig. 3.3 represents the fractal dimensions of the original image and Fig.3.4 represents the fractal dimensions of the edge detection image, after that classification is done using ABCD method. Many images are classified but only 5 images values are tabulated. Table3.1 represents benign images and suspicious by extracting the features of ABCD and TDS score. Table3.2 represents Malignant images values for the given input images.Second classification uses Principal component Analysis method. In that A,B,C,D values are given for training, and testing is done. By using MATLAB tool the result of PCA was compared. If the value is 1 then it is malignant, if in case it is less than 1, then it is benign.

CONCLUSION

In this paper, we presented two techniques for classification of skin cancer image into benign and malignant. We have taken the dermatoscopic image which was segmented by using watershed method and edge detection was applied using canny method. To remove various noises present in the image we used Sobel filtering before classification. First classification was done by ABCD method where feature extraction was done and we calculated TDS (Total dermatoscopy score) for different input images. Based on the TDS score, we classified the images as benign or malignant. Second classification was done by PCA (Principal Component Analysis) to analyse the values of ABCD. Then testing and training of the values of an image was carried out. If the PCA value is 1 then it is called malignant and if suppose the PCA value is less than 1 then it is classified as benign.. By comparing the first two techniques it is found that PCA gives an accuracy of 92% and takes less processing time, whereas ABCD method gives an accuracy of 90%. Third classification technique is the method called AIS (Artificial Immune System) using clonal selection method which is the future work.

Acknowledgement
We would like to thank management of Sathyabama University, Faculty of Bio and Chemical Engineering and Department of Biomedical Engineering for their guidance and support to complete the research successfully.

REFERENCES

[1] S Aksoy; RM Haralick, *IEEE Conference On Computer Vision And Pattern Recognition* ,**2000,** 2, 357–362.
[2] JF Alcon; C Ciuhu; W Ten Kate Heinrich; A Uzunbajakava; N Krekels, *IEEE Journal Of Selected Topics in Signal Processing*, **2009,** 3,14–25.
[3] E Alpaydin;"Introduction To Machine Learning (Adaptive Computation And Machine Learning). The MIT press."**2004**, ISBN:0262012111.
[4] G Argenziano; I Zalaudek; H Soyer**,** *British Journal of Dermatology*, **2004,** 151(2),512-513.
[5] L Ballerini; RB Fisher; B Aldridge; J Rees, *In ISBI British Journal Of Dermatology*, **2012,** 151, 512– 513,358–361.
[6] G Grammatikopoulos; A Hatzigaidas; P Papastergiou; Z Lazaridis; D Zaharis; G Kampitaki;
Proceedings of 5th Internatinal Conference Data Networks, Communications and Computers, Bucharest, Romania, **2006,** 91-94.
[8] S Krishnakumar; J Bethanney Janney; J Jerisha; P Nayaki Ashmi1; V Dooslin Mercy Bai; *Journal of Chemical and Pharmaceutical Research*, **2014**, 6(12), 456-463.
[9] Mahammed Messadi; Hocine Cherifi; Abdelhafid Bessaid; *Jourrnal of Convergence Information Technology*, **2014** , 9(2),21 -34,
[10] B Kusumoputro; A Ariyanto; *IEEE Conference Proceeding*; 2002,vol.2, 47 – 51.
[11] S Nilkamal; Ramteke; V Shweta; Jain; *International Journal of Engineering Trends and Technology*,**2013,**4 (6), 2555-2566.
[12] Francisco Castells; Pablo Laguna; Le Ifsornomo; Sndreas Bollmann; Jose Milletkoig; *EURASIP Journal on Advances in Signal Processing*, **2007**:074580.
[13] Philippe Schmid; *Medical Image Analysis*, **2000**, 4 (3), 269-282.
[14] Mahmoud Elgamal; *International Journal of Advanced Computer Science and Applications*, **2013,** 4(3), 287-294.
[15] JR Al-Enezi; MF Abbod; S Alsharhan; *International Journal of Research and Reviews in Applied Sciences* **,2010,** 3(2).