



## A Method for Automatic Skin Cancer Detection

Reshu Bansal\*  
ECE (K.U)  
India

Meenu Saini  
ECE (K.U)  
India

*Abstract Image processing is playing a great role in diagnostic purposes using image analysis in MATLAB. This feature of image analysis can also be used in medical application for early diagnosis of any disease using image processing. Now a days, skin cancer is a common disease. Its early detection and cure is very important. It can be done by using feature extraction and segmentation methods. This technique is cost effective as it does not use any costly instruments and hence can be used by every person. Its also time saving approach. Currently great interest is there in the prospects of automatic image analysis method for image processing, to provide quantitative information about a lesion, which is relevant for the clinical, as well as a tool for its early warning. It is well-known that early finding and treatment of skin cancer can reduce the mortality and morbidity of patients. The features should provide distinguishing quantitative measures to automatically diagnose the cancer. The most important challenge is the system evaluation before the task of diagnosis. Because of the limited amount of available data there might be a considerable amount of bias if the system evaluation is not conducted properly.*

*This thesis work provides a survey on the steps required to automatically diagnose skin cancer by using various images of different risks. In this we have used ABCD feature extraction method and Otsu segmentation method. In this paper we have improved the understanding of otsu segmentation method by adding some of the intermediate steps like filtering, masking the centre of image. So it is a better approach to detect the cancer at an early stage.*

**Keywords:** GVF, TEM, ELM

### I. INTRODUCTION

This document is a template. An electronic copy can be downloaded from the conference website. For questions on paper guidelines, please contact the conference publications committee as indicated on the conference website. Information about final paper submission is available from the conference website.

### II. IMAGE

An image is an array, or a matrix, of square pixels (picture elements) arranged in columns and rows.

Image processing is any form of signal processing for which the input is an image, such as a photographer video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most techniques of image processing involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.

Image processing are computer graphics and computer vision. In computer graphics, images are made manually from physical models of objects, environments, and lighting, from natural scenes. Image Processing forms core research area within engineering and computer science disciplines too.

### III. HUMAN CANCER

Human Cancer is a complex disease caused primarily by genetic instability and accumulation of multiple molecular alternations. Among many types of cancer, Skin cancers are the most common form of cancers in human. Skin cancer is a major public health problem in the light skinned population.

There are two major types of skin cancer,

- a. Alignant melanoma
- b. non-melanoma

Melanoma is more dangerous and can be fatal if not treated. If melanoma is detected in its early stages, it is highly curable, yet advanced melanoma is lethal.

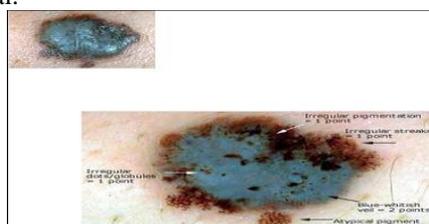
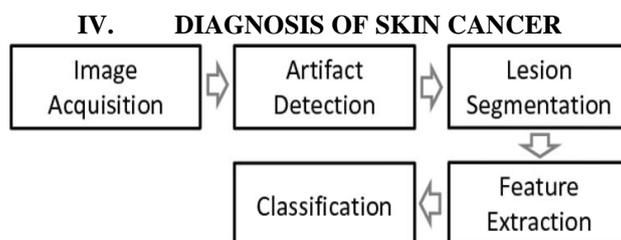


Figure: Various parts of infected skin



### A. IMAGE ACQUISITION

The first step in expert systems used for skin inspection involves the acquisition of the tissue digital image. The main techniques used for this purpose are the epiluminescence microscopy (ELM, or dermoscopy), transmission electron microscopy (TEM), and the image acquisition using still or video cameras.

### B. ARTIFACT DETECTION

Basically an artifact is something observed in a scientific investigation or experiment that is not naturally present but occurs as a result of the preparative or investigative procedure. The main aim of the this step is to refine the dermoscopy image, so that the border, color and local features become easier to be detected by the image analysis system. In other words, we reduce the image noise and increase the contrast of structures of interest (skin lesion, dots and globules).

### C. SEGMENTATION

The segmentation is the most important stage for analyzing image properly since it affects the accuracy of the subsequent steps. However, proper segmentation is difficult because of the great varieties of the lesion shapes, sizes, and colors along with different skin types and textures. In addition, some lesions have irregular boundaries and in some cases there is smooth transition between the lesion and the skin. To address this problem, several algorithms have been proposed. They can be broadly classified as thresholding, edge-based or region-based methods. In this thesis, three methods of segmentation have been discussed. The methods are:

- i. Otsu's method.
- ii. Gradient Vector Flow (GVF)
- iii. Color Based Image Segmentation Using K-mean Clustering.

Although fully unsupervised segmentation would be desirable, GVF method requires some degree of user interaction in order to achieve good performance. The following sections describe each of the methods in details.

#### i. Otsu's Method

Otsu's method is optimal for thresholding objects from the background. This technique is based on a discriminate analysis which partitions the image into two classes. Given an image represented in  $L$  gray levels  $\{0,1,2,\dots,L\}$ , Otsu's thresholding method partitions the image pixels into two classes  $C_0=\{0,1,2,\dots,t\}$  &  $C_1=\{t+1,t+2,\dots,L-1\}$ . Let the number of pixels in the  $i$ th gray level be  $p_i$ , and  $n$  be the total number pixels in a given image. The probability of occurrence of gray level  $i$  is defined as

$$P_i = n_i/n$$

$C_0$  and  $C_1$  are normally corresponding to the object of interest and the background, the probabilities of the classes are  $W_0$  and  $W_1$ ,

$$W_0 = \sum_{i=0}^t p_i \quad \text{and} \quad W_1 = \sum_{i=t+1}^{L-1} p_i$$

These means are further used to calculate variance and argument. Otsu's method of thresholding gray level images is efficient for separating an image into two classes where two types of fairly distinct classes exists in the image.

#### ii. Gradient Vector Flow (GVF)

The GVF snake is well-known algorithm proposed in which has been successfully used in many medical imaging problems. The object boundary is approximated by an elastic contour  $X(s) = (X(s), Y(s))$ ,  $S \in [0,1]$  which is initialized in the image domain by the user or the heuristic criteria.

#### iii. Color Based Image Segmentation Using K-mean Clustering

Image segmentation techniques can be differentiated into the following basic concepts: pixel oriented, contour-oriented, region-oriented, model-oriented, and color-oriented and hybrid. Color segmentation of image is a crucial operation in image analysis and in many computer vision, image interpolation, and pattern recognition system. The performance of color segmentation may significantly affect the quality of an image understanding system. This segmentation process is divided into two stages. First enhancing color separation of medical image using decorrelation stretching is carried out and then the regions are grouped into set of three classes using  $k$  mean clustering algorithm. Using this two step process, it is possible to reduce the computational cost avoiding feature calculation for every pixel in the image. Although the color is not frequently used for image segmentation, it gives a high discrimination power regions present in the image.

#### D. FEATURE EXTRACTION

In automated diagnosis of skin lesions, feature extraction is based on the so-called ABCD-rule of dermatoscopy. ABCD represent the asymmetry, border structure, color variation, and dermatoscopic structure so called diameter of the lesion and define the basis for a diagnosis by a dermatologist.

#### V. RELATED WORK

A number of journals and research papers published during the above span 2014-2013 have been studied. The various aspects of the problem were studied.

**i. Nadia Smaoui, Souhir Bessassi,** In this paper, the proposed work is based on a combination of a segmentation method and an analytical method and aims to improve these two methods in order to develop an interface that can assist dermatologists in the diagnostic phase. As a first step, a sequence of preprocessing is implemented to remove noise and unwanted structures from the image. Then, an automatic segmentation approach locates the skin lesion. The next step is feature extraction followed by the ABCD rule to make the diagnosis through the calculation of the TDV score. In this research, three diagnosis are used which are melanoma, suspicious, and benign skin lesion. The experiment uses 40 images containing suspicious melanoma skin cancer. Based on the experiment, the accuracy of the system is 92% which reflects its viability.

**ii. Rajvi Parikh, Dr Hitesh shah,** In this paper, computer diagnostic tools enable objective judgments by making use of quantitative measures. The basic three steps are there to achieve the results i.e. 1) image processing 2) Feature extraction 3) Classification. Step 1 deal with noise reduction artifacts removing, step 2 deals with extracting variety of information fro the processes image for accurate detection and step 3 deals with results that say various types of skin lesions. In this paper we are showing the process of it and also discussed some clinical diagnosis methods which is being incorporated with the tool for detecting the type of lesion.

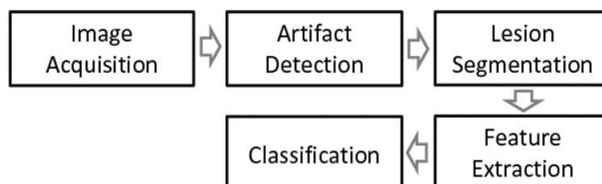
**iii. Paul Wighton, Tim K. Lee, Harvey Lui, David I. McLean, and M. Stella Atkins,** In this paper a general model using supervised learning and MAP estimation that is capable of performing many common tasks in automated skin lesion diagnosis. We apply our model to segment skin lesions, detect occluding hair, and identify the dermoscopic structure *pigment network*. Quantitative results are presented for segmentation and hair detection and are competitive when compared to other specialized methods. Additionally, we leverage the probabilistic nature of the model to produce receiver operating characteristic curves, show compelling visualizations of *pigment networks*, and provide confidence intervals on segmentations.

**iv. Margarida Silveira,** In this paper, we propose and evaluate six methods for the segmentation of skin lesions in dermoscopic images. This set includes some state of the art techniques which have been successfully used in many medical imaging problems (gradient vector flow (GVF) and the level set method of Chan *et al.* [(C-LS)]. It also includes a set of methods developed by the authors which were tailored to this particular application (adaptive thresholding (AT), adaptive snake (AS), EMlevel set [(EM-LS), and fuzzy-based splitand- merge algorithm (FBSM)]. The segmentation methods were applied to 100 dermoscopic images and evaluated with four different metrics, using the segmentation result obtained by an experienced dermatologist as the ground truth. The best results were obtained by the AS and EM-LS methods, which are semi-supervised methods. The best fully automatic method was FBSM, with results only slightly worse than AS and EM-LS.

**v. Md.Amran Hossen Bhuiyan, Ibrahim Azad, Md.Kamal Uddin,** In this paper, different digital images have been analyzed based on unsupervised segmentation techniques. Feature extraction techniques are then applied on these segmented images. After this, a comprehensive discussion has been explored based on the obtained results. To achieve this goal, feature extraction is considered as an essential-weapon to analyze an image appropriately. In this paper, different digital images have been analyzed based on unsupervised segmentation techniques.

#### VI. PROPOSED WORK

##### Diagnosis of skin cancer



##### Principal Component Analysis

Technique quite old: Pearson (1901) and Hotelling (1933), but still one of the most used multivariate techniques today[7].

Start with variables  $X_1, \dots, X_p$

Find a rotation of these variables, say  $Y_1, \dots, Y_p$  (called principal components), so that:

$Y_1, \dots, Y_p$  are uncorrelated. Idea: they measure different dimensions of the data.

$\text{Var}(Y_1) \geq \text{Var}(Y_2) \geq \dots \text{Var}(Y_p)$ . Idea:  $Y_1$  is most important, then  $Y_2$ , etc.

Possible uses of PCA When all measurements are positively correlated, the first principal component is often some kind of average of the measurements (e.g., size of birds, severity index of psychiatric symptoms). Then the other principal components give important information about the remaining pattern (e.g., shape of birds, pattern of psychiatric symptoms).

## Image processing using MATLAB

Digital image processing is the use of computer algorithm to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

## VII. RESULTS AND DISCUSSION

For finding the performance & result analysis, we have taken 2 images each of different risks(Low and High).The results are tabulated in table for low risk type of skin and table 5.2 for high risk type of skin.

S.No.	Image	Name of Image	Probability of Risk
1		Low Risk	0.2172
2		High Risk	0.44214

Following figure shows the screenshots of result for above images

- Low Risk

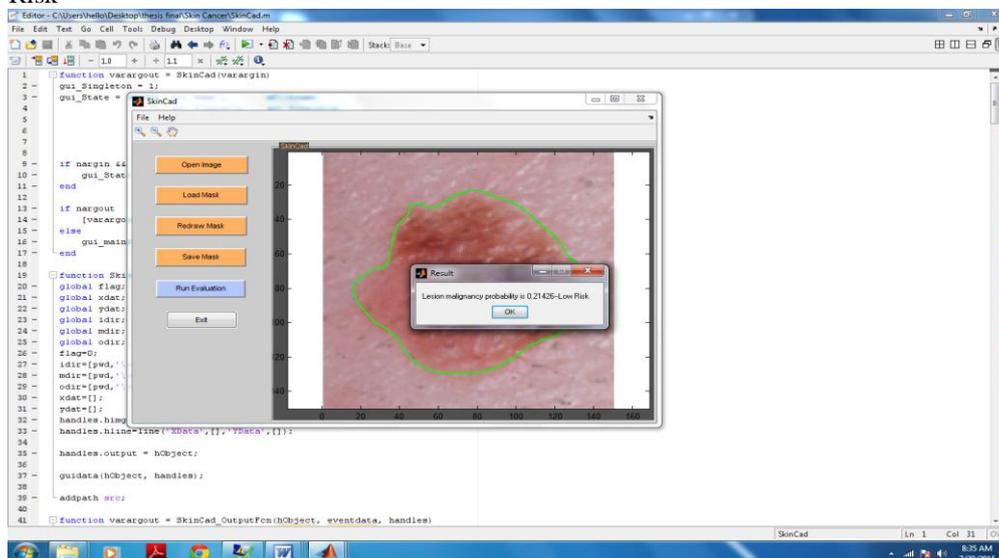


Figure: Result of a skin of low risk type(Low Risk 1)

- High Risk

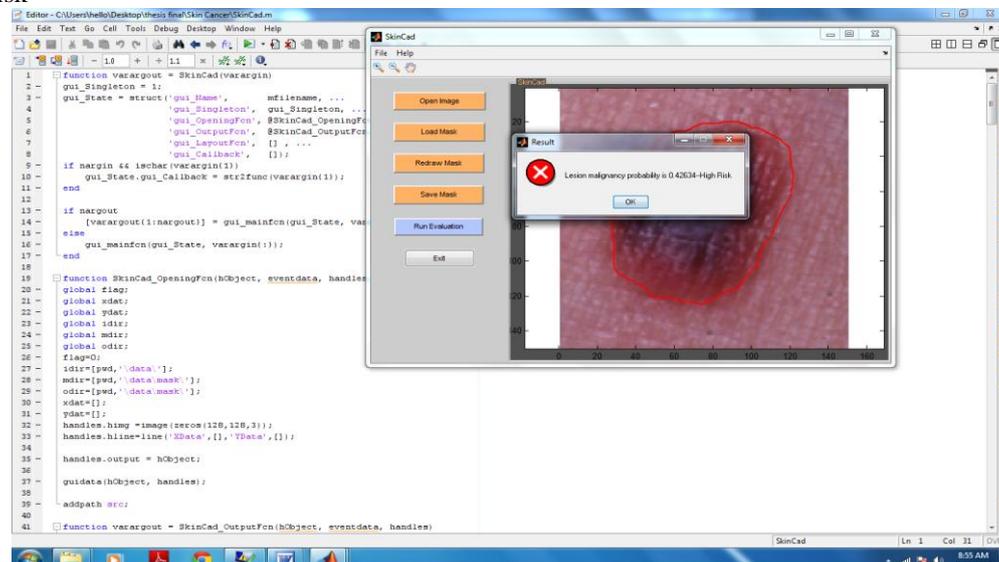


Figure: Result of a skin of high risk type

In this thesis the image is segmented using Otsu Segmentation. Firstly the original image is taken. Then second step is filtering, the desired part of the image is separated from the rest of the area as shown in (b). Then the image boundary is marked using the centre of the image. In (d) part the image is masked and hence it is segmented using Otsu Segmentation method as shown in (e).



Figure: (a) Original RGB image (b) Filtered image (c) boundary marking of desired area by using centre of the image (d) masked image in black and white format (e) segmented image

### VIII. CONCLUSION

The dissertation includes the skin cancer detection by using ABCD method of feature extraction and Otsu segmentation method. Different types of images have been taken having different types of risk probabilities (low, medium and high). These images are then segmented and extracted using MATLAB and hence their risk probability is calculated. It proposes an improved method of image segmentation by using Otsu segmentation method where similarity measure is taken from Md. Amran Hossen Bhuiyan in which the image is segmented using Otsu as well as GVF method. The steps involved in segmentation of image- the filtering of the image, marking of boundary using the centre of the image and hence masking are shown separately in this thesis. Hence it is a better approach to understand the Otsu segmentation method.

In future clustering method of segmentation can also be used with Otsu's method to get better results. Also image characteristics can also be explored to find how its various characteristics effect segmentation.

### REFERENCES

- [1] Nadia Smaoui, "A developed system for melanoma diagnosis" International Journal of Computer Vision and Signal Processing, 3(1), 10-17(2013).
- [2] Rajiv Parikh, "A Survey on Computer Vision Based Diagnosis for Skin Lesion Detection" International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 2, Issue 2, March 2013
- [3] Paul Wighton, "Generalizing Common Tasks in Automated Skin Lesion Diagnosis" IEEE, VOL. 15, NO. 4, JULY 2011..
- [4] Margarida Silveira, "Comparison of segmentation Methods for Melanomas Diagnosis in Dermoscopy Images" IEEE, Vol.3, No. 1, February 2009
- [5] Md. Amran Hossen Bhuiyan, "Image Processing for Skin Cancer Features Extraction" International Journal of Scientific & Engineering Research Volume 4, Issue 2, February-2013