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# A Brief Review of Classification and Segmentation Methods for Skin Cancer Images

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***Abstract*— early detection of cancer is a very critical issue in today's dermatologic practice. Skin Cancer is the most commonly diagnosed type of cancer in all people irrespective of age gender or race. One of the most common skin cancer melanoma. In this paper as evaluate different methods for the segmentation of skin losions in dermoscopic images. It includes some techniques which have been efficiently used in many medical imaging problems. This methods are Otsu's method, Gradient vector flow (Guf) and color based image Segmentation using K- mean clustering. Otsu's method of thr-esholding gray level images is efficient for dividing an image into two classes where two types of fairly distinct classes exists in the image. The Guf snake is a well-Known algorithm which has been successfully used in many medical imagining problems. Color based image segmentation using K-mean clustering can be differentiated in to pixel oriented region oriented, Modal oriented and color oriented .**

***Index Terms*— segmentation K-mean clustering, Otsu's method, Gradient vector flow (GUF), Lesion recognition**

## I. INTRODUCTION

### 1. Skin cancer:

Human Cancer is a complex disease caused primarily by Genetic uncertainty and accumulation of multiple molecular variation [1]. Skin cancer is the most commonly diagnosed type of cancer in all people, irrespective of age, gender, or race [2]. The skin properties like skin dryness, fungus and allergic symptoms of skin layer may lead to starting symptoms of skin cancer. The correct identification of skin spots based on certain features is the key steps in diagnosing the skin cancer disease in advance [3]. Cancer is often diagnosed and treated very late, when the cancer cells have already filled and metastasized into other parts of the body. At the time of clinical presentation, a huge percentage of patients with breast, lung, colon, prostate, and ovarian cancer have hidden and over metastatic colonies .At this stage, therapeutic modalities are restricted in their effectiveness. Due to these problems, cancer has surpassed heart disease as the leading cause death for any age in all over the world [1]. There are two major types of skin cancer, called malignant melanoma and non-melanoma (basal cell, squamous cell, and Markel cell carcinomas, etc.) [7].Melanoma is more threatening and can be fatal if not treated. If melanoma is detected in its early stages, it is highly curable, still advanced melanoma is lethal[1]. Melanoma – a lesion in the pigment-bearing basal layers of the skin – is now a days one of the leading cancer causes among many white-skinned populations [4].

### 1.1Types of skin cancers:

Skin cancer is divided into non melanoma skin cancer (NMSC) and MSC (melanoma skin cancer) figure (1.1). Non melanoma skin cancer (MMSC) is the

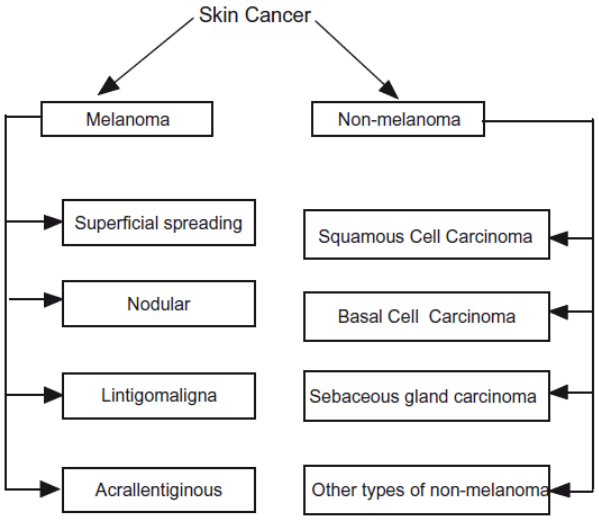


Fig. 1.1. Types of skin cancer.

Most prevalent cancer among light-skinned population [5]. A melanoma is a cancer that begins in skin cells called melanocytes which are normally responsible for producing the skin pigment melanin [1]. If left untreated, a melanoma can spread resulting in cancers in different organs of the body [6]. The American Cancer Society (ACS) recommends use of the so-called "ABCD rule" for distinguishing between a normal mole and a potential melanoma as follows:

• A – Asymmetry: One half of the lesion does not Match the other.

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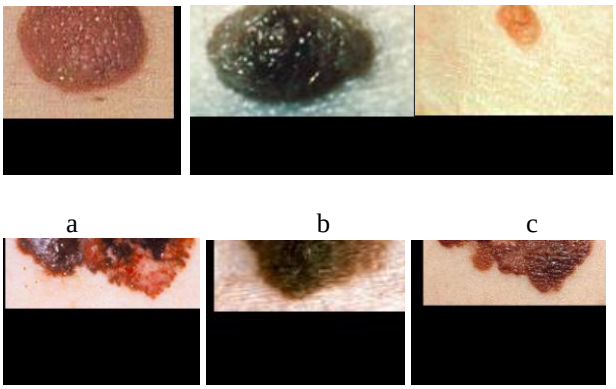

a b c

d e f

Figure1.2 Examples of (a)-(c) Benign and (d)-(f) Malignant Lesions.

B – Border: The edges of the lesion are irregular, Ragged, notched or unclear.

- C – Color: The color is not uniform. May include Shades of brown or black Or spots of pink, red, White or blue (variegated).
- D – Diameter: the spot is greater than quarter of an Inch [6].

**1.2 stages in automatic dermoscopy image analysis system:**

An automatic dermoscopy image analysis system has usually three phases: 1. Proper Segmentation
2. Feature extraction and selection, and
3. Lesion recognition [1].

**1.2.1 Segmentation:**

The segmentation is the most important phase for analyzing image properly since it affects the accuracy of the subsequent Steps. They can be broadly classified as thresholding, edge-based or region-based methods. There are three methods of segmentation have been described.. The methods are:

1. Otsu's method.
2. Gradient Vector Flow (GVF)
3. Color Based Image Segmentation Using K-mean Clustering [1].

**1.2.1.1 Otsu's method:**

Otsu's method is optimal for thresholding objects from the background. This method is based on a differentiate analysis which partitions the image into two classes**.** Otsu's method of thresholding gray level images is effective for separating an image into two classes where two types of fairly different classes exists in the image[1].

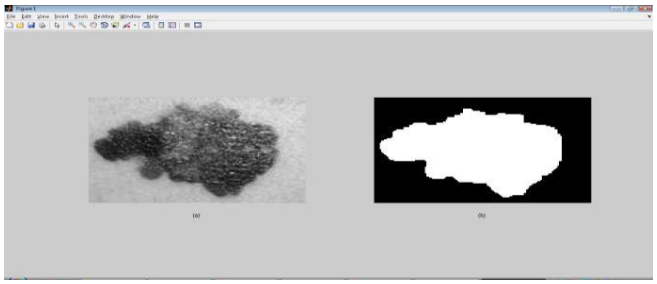

Fig.2: (a) Grayscale version of RGB image; (b) Segmented image after applying Otsu's method.

**1.2.1.2 Gradient Vector Flow (GVF):**

The GVF snake is a well-known algorithm suggested in which has been successfully used in various medical imaging problems.

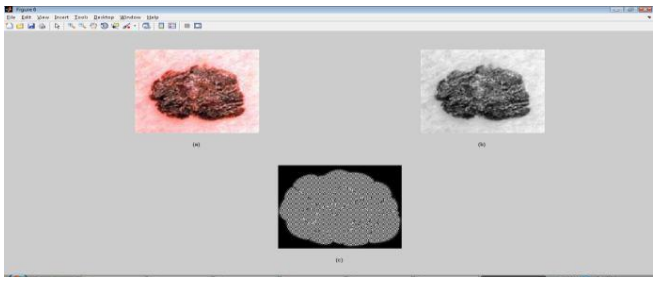

Fig.3: (a) Original RGB image; (b) Grayscale version of the RGB image; (c) Segmented image after applying GVF method.

The initialization of the GVF snake is automatic. circle with a given radius is placed on the image. The circle center is define by the center of the segmented region produced thru the Adaptive Threshold method. The circle radius is like that the model units are far away from the features of interest [7].

**1.2.1.3 Color Based Image Segmentation applying K-mean Clustering:**

Image segmentation methods can be differentiated into the following basic notions: pixel oriented, contour-oriented, region-oriented, model-oriented, and color-oriented and hybrid [1].

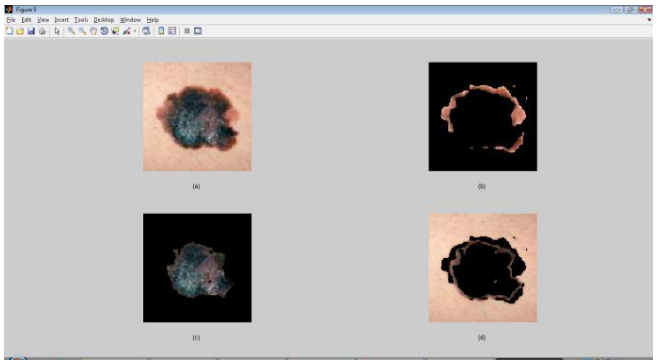

Fig.4: (a) RGB image (b) objects in cluster 1 (c) objects in Cluster 2 (d) objects in cluster 3 [1].

**1.2.2 Feature Extraction:**

This module calculates the feature values of a lesion that is used by a classifier to assign a class label to the lesion.

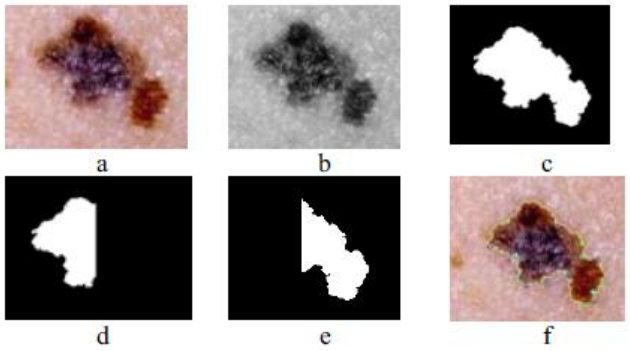


Figure 5. An example of the image processing and feature extraction action: (a) Source image; (b) Greyscale image; (c)-(e) Various masks; (f) Output image with lesion contour outlined in yellow and significant defects marked by light blue circles [6].

**1.2.3Lesion recognition:**

The noticed segmentation algorithm for the skin lesion border extraction consists of:

- ☐ Color to monochrome image conversion;
- ☐ Image binarization using an adaptive threshold
- ☐ Border identification

**1.2.3.1. Color to monochrome image conversion:**

In the first step of the segmentation algorithm 3different monochrome images (8 bits per pixel) from the source image (RGB standard color, 24 bits per pixel) correlated to the red, green and blue color components, respectively. For every component, two modes are typically evident in the pixel intensity histogram corresponding respectively to the pigmented lesion and the surrounding skin.

**1.2.3.2. Image binarization**

The binarization (i.e. a conversion to a1 format) of every monochrome image is carried out by thresholding the corresponding intensity histogram through a suitable value. Then the image pixels with gray level less than the threshold become black whilst the pixels greater than The threshold are set to white. More precisely, instead of Choosing a fixed threshold at this point, an adaptive threshold is obtained for every monochrome image by adopting the Otsu algorithm.

**1.2.3.3 Border Identification**

Finally, in order to separate the contour of the lesion, a simple blob-finding algorithm [10] is adopted for the binary image previously obtained the tracking algorithm gather and sorts out the edges of the black and white image into an ordered list. At this point, the border is overlying on the color ELM image and displayed for visible inspection to the diagnostician. The binary image is also used in obtaining the lesion dimension (number of white *Ntot*) that will be used in the lesion analysis.

**LITERATURE SURVEY**

**Md.Amran Hossen Bhuiyan et al. (2013**) In order to achieve an effective way to recognize skin cancer at an early stage without performing any not requiring skin biopsies, digital images of melanoma skin lesions have been examined. To achieve this goal, feature extraction is considered as an essential-weapon to analyze an image properly. In this paper, various digital images have been studied based on unsupervised segmentation methods. Feature extraction methods are then applied on these segmented images. After this, a comprehensive discussion has been browsed based on the obtained results.

**Joanna Jaworek-Korjakowska et al.(2013)** In this paper author proposed a new approach to the assessment of dots and globules asymmetry of the pigmented skin lesion. We describe a typical algorithm containing following phases: image improvement, hair removal, lesion segmentation, dots and globules detection as well as asymmetry calculation. The algorithm has been verified on a database of 100 dermoscopic images. Compared to state-of-the-art, we find out improved detection and classification accuracy.

**Rashi Goel et al.(2015)** The presented work here is stressed on extraction of features including of contrast, correlation, homogeneity, entropy, radius, standard deviation and perimeter etc for exact diagnosis of the cancer phase and the post treatment progress could be estimated by the direction and dimensional study of parameters. A statistical method of inspecting texture that considers the spatial connection of pixels is the gray-level co-occurrence matrix (GLCM), also called as the gray-level spatial dependence matrix. The GLCM functions categorize the texture of an image by calculating how often pairs of pixel with certain values and in a stated spatial relationship occur in an image, creating a GLCM, and then separating statistical measures from that matrix. A back propagation neural network is proposed for classification of different class of skin cancer by supplying sufficient no. of training images to the classifier.

**G. Di Leo et al.(2008)** The paper is devoted to the detection of an important dermatologic structure: the unusual pigmented network. A proposal is described for the application of decision-tree classification methods to the results of particular image processing algorithms for the estimation of chromatic and structural parameters.

**Mahmoud Elgamal (2013)** This paper presents two hybrid techniques for the classification of the skin images to guess it if exists. The suggested hybrid techniques consists of three stages that is feature extraction, dimensionality reduction, and classification. In the first phase, we have obtained the features correlated with images using discrete wavelet transformation. In the second phase, the features of skin images have been minimized using principle component analysis to the more essential features. In the classification phase, two classifiers based on organized machine learning have been developed. The first classifier ground on feed forward back-propagation artificial neural network and the

second classifier relied on k-nearest neighbor. The classifiers have been used to categrize subjects as normal or abnormal skin cancer images. A classification with a success rate of 95% and 97.5% has been obtained by the two proposed classifiers separatly. This result shows that the suggested hybrid techniques are robust and effective**.**

**Kiran Ramlakhan et al.(2011)** This paper suggest a prototype of an image-based automated melanoma recognition system on Android smart phones. The system consists three prime components: image segmentation, feature calculation, and classification. It is outlined to run on a mobile device with a camera, namely a smart phone or a tablet PC. A skin lesion image is converted to a monochrome image for underline contour diagnosis. Color and shape properties of the lesion are separated and used as input to a kNN classifier. Initial experimental result shows that the system is efficient and works well on well-lighted test images, achieving an average accuracy of 66.7%, with average malignant class recall or sensitivity of 60.7% and specificity of 80.5%.

| Ref No. | Author Name | Year | Tech/Method Used | findings |
|---|---|---|---|---|
| 1 | Md.Amran Hossen Bhuiyan | 2013 | Feature extraction techn.to find digital images of melanoma skin lesions | All the four measures have to be considered to decide whether a skin lesions is melanoma or not |
| 2 | Joanna Jaworek-Korjakowska | 2013 | algorithm for the diagnosis of asymmetry of the pigmented skin lesion, For the evaluation of correct border detection we use the Border Error (BE)measure, which is also called XOR measure. | The results of the preliminary tests show that computer-based image processing has the potential of better evaluation of changes |
| 3 | Rashi Goel | 2015 | Skin Cancer Detection using GLCM Matrix Analysis and Back Propagation Neural Network Classifier | Once the ranges are confirmed, the algorithm may be developed on a real time embedded machine e.g. dermetoscope that can itself suggest the skin disorder level. |
| 4 | G. Di Leo | 2008 | An improved procedure for the automatic detection of dermoscopic structures in digital ELM images of skin lesions | The good results achieved both for sensibility and specificity with respect to a quite large dataset |
| 5 | Mahmoud Elgamal | 2013 | hybrid techniques based on the following techniques, discrete wavelet transforms DWT, the principle components analysis PCA, FP-ANN, and k-NN. | The results of the deployed techniques were promising as, we got 100% for sensitivity, 95% for specificity , and 97.5% for accuracy. |
| 6 | Kiran Ramlakhan | 2011 | A Mobile Automated Skin Lesion Classification System | Implementation of a measure of shape asymmetry as a feature would improve the performance of the classifier. |
| 7 | Margarida Silveira | 2009 | Comparison ofsegmentation Methods for Melanoma Diagnosis in Dermoscopy Images | AS and EM-LS methods are robust anduseful for the lesion segmentation in a computer aided diagnosis system to assist the clinical diagnosis of dermatologists |
| 8 | Apoorva Raikar | 2013 | Check-list method to diagnose melanomas | Because diagnosis accuracy with dermoscopy depends on experience of the dermatologists, the automated system might help less experienced dermatologists in |

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| | | | | future. |
| 9 | Paul Wighton | 2011 | model based on supervised learning and MAP estimation on a variety of common tasks in ASLD | the model employs supervised learning, it can quickly be applied to a variety of tasks and the resulting model parameters are guaranteed to be optimal. |
| 10 | Fadzil Ahmad | 2010 | Artificial Neural Network (GA-ANN) Hybrid Intelligence for Cancer Diagnosis | approach that is based on GA-ANN hybrid intelligence assisted with LM training capable to obtain high generalization ability ANN for cancer dataset. |

## Conclusion

Skin cancer has been rising since last two decades. So, early, fast and effective detection of skin cancer has lots of importance. If detected at an early stage, skin has one of the highest cure rates, and the most cases, the treatment is totally simple and involves excision of the lesion. Moreover, at an early stage, skin cancer is very economical to treat, while at a later stage, cancerous lesions generally result in near fatal consequences and extremely high costs associated with the necessary treatments. From study of various papers we concluded few points that are: When a skin lesion is surmised as melanoma, it must go through all four analyses. If the suspected skin lesion go through only the three of these, it might show incorrect results about its being melanoma or not. For this reason, all the four measures have to be supposed to decide whether a skin lesion is melanoma or not. According to these studies skin cancer detection is the most important task and for this various automated medical decision support system for skin cancer developed with normal and abnormal classes and the results of the deployed techniques were promising as, gives 100% for sensitivity, 95% for specificity, and 97.5% for accuracy. Also methods for the segmentation of skin lesions in dermoscopic images are proposed. This set consists some state of the art techniques which have been successfully used in many medical imaging problems (Gradient Vector Flow), Otsu's and color based segmentation applying k-means clustering. These methods are robust and helpful for the lesion segmentation in a computer aided diagnosis system to assist the clinical diagnosis of dermatologists.

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