

# Software Approach for Skin Cancer Analysis and Melanoma detection

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**Abstract**—The proposed paper reviews diverse strategies of automated non-invasive analytic framework utilized for investigating skin growth. Melanoma is the other name for skin tumor. It is one of the infections which influences the skin layer and prompts to lethal, if not analyzed at an early stage. Skin growth is partitioned into two sorts-benign kind and threatening melanoma. Melanoma is the deadliest skin tumor. Early recognition of melanoma can be cured totally. Thus, dermatologists utilize a tool "Dermoscope" to investigation the skin disease. Because of the examination of different patients and diagnosing each of them with cautious visual interpretation is tedious and prompts to misdiagnosis. In this manner to limit such complexities, Computer Aided Diagnostic (CAD) strategy was presented which give precise outcomes than prior technique. This paper concentrates on different CAD framework procedures which play out a fundamental task on the dermoscopic images, for example, preprocessing, segmentation, feature extraction, and classification.

**Keywords**—Melanoma, Skin Cancer, Dermoscopy;

## 1. INTRODUCTION

Skin is the crucial part of human body. Figure 1 demonstrates the layers of skin. The skin gets influenced by different elements, lifetime exposure to sun (UV radiation), sunlamps and tanning corners, medicines (a few anti-toxins, hormones, or antidepressants that make skin more delicate to the sun) which increment the chances of skin cancer [2]. Skin cancer is a type of cancer which is very common nowadays and it usually develops in the epidermis layer of skin. This happens in all people regardless of gender, age, or race. These incidence of skin cancers increases every year. There are mainly three fundamental types of skin cancers viz, basal cell carcinoma (BCC), melanoma and Squamous cell carcinoma (SCC). Malign melanoma is mainly dangerous type of skin cancer and is increasing in the world. An estimate of 161,790 new cases of melanoma, 87,110 invasive and 74,680 noninvasive is being diagnosed in the U.S. in 2017 [3]. Invasive melanoma is predicted to be the sixth most common cancer for women (34,940 cases) and the fifth most common cancer for men (52,170 cases) in the year 2017 [3]. Malignant melanoma happens due to improper synthesis of melanin in melanocytic cells show in the basal cell of epidermis layer of the skin [4]. Skin cancer is of two types-

non-melanoma and melanoma. Melanoma is the most widely recognized and deadly infection kind of skin tumor. Despite the fact that the curing of melanoma happens at a higher rate, yet survivors of melanoma disease is low than that of non-melanoma [5]. As instances of the skin tumor patient are expanding, there is a great demand for system to recognize and analyze skin cancer. Melanoma is treatable at an early stage.

Since 1997, image processing techniques are used for analysis of melanocytic lesions, with the goal of developing computer-aided detection (CAD) system equipped with digital dermoscopy device for the recognition of atypical melanocytic lesions. This helps in clinical diagnosis and even the practitioners for prognosis of melanoma and for accurate diagnosis of disease. Dermoscopy tool is used for the analysis and diagnosis of skin lesions. Dermoscopy identifies the morphological features viz, air bubbles, pigment networks, streaks, and blotches [6]. Once the disease is identified, surgery is done to remove the lesion. This requires the accurate diagnoses of disease. Image processing is an important part of dermoscopy. It helps in diagnoses of benign, atypical, melanoma and determines the probability of melanoma. The proposed method uses the dermoscopy images from Pedro Hispano Hospital, PH2 Dermoscopy image database.

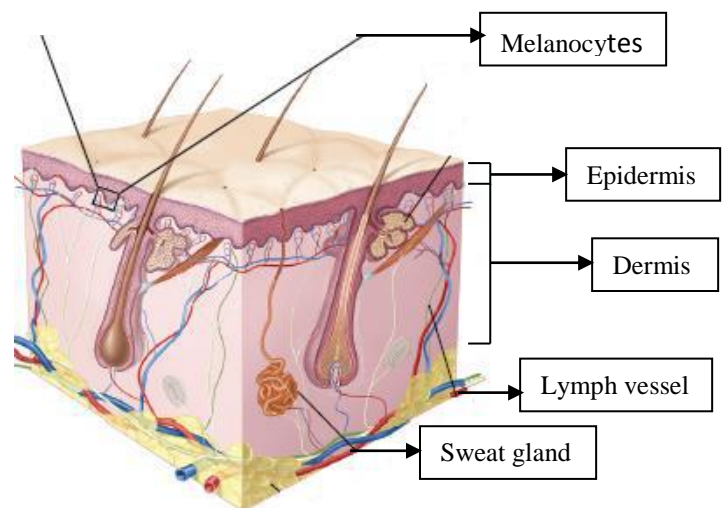


Figure 1: Layers of Skin

Dermatologists utilize "Dermatoscope" to analyze any skin ailments [7]. Prior indications of melanoma are broke down by "ABCDE" rule: Asymmetry, Borders, Color, Diameter (greater than 6 mm), and Evolving after some time as appeared in Figure 2.

- A-Asymmetry: Half of the lesion does not match other lesion
- B-Border: The borders of lesion are notched, irregular, ragged.
- C-Color: The color variations is not uniform, It includes shades of black or brown or red, pink.
- D-Diameter: The lesion or mole will be greater than the quarter inch.
- E-Evolve: The moles evolve over time.

Because of the examination of different patients and diagnosing each of them with watchful visual interpretation gets to be distinctly troublesome and prompt complexity in diagnosis. Therefore Computer aided diagnostic system is introduced for dermoscopic images which give an exact result of the patient at an early phase of skin cancer [8]. CAD System has following steps: Preprocessing, image segmentation, feature extraction and classification.

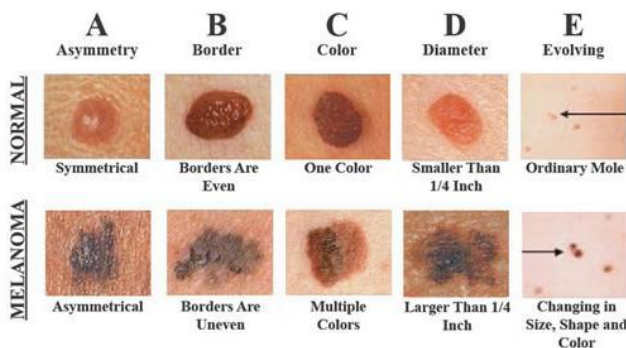


Figure 2: ABCDEs of detecting Melanoma

## 2.MOTIVATION

Melanoma is the most hazardous type of skin cancer. It is developed from the malignant transformation of melanocytes. Its survival rates when compared to non-melanoma skin cancer types are low. An automated system to diagnose this type of disease is very much required and is very much in demand since more new cases of skin cancer is increasing each year.

## 3.RELATED WORK

Chen Lu et al [9] presented another technique for epidermal region segmentation in skin whole side image (WSI). To accomplish successful segmentation, the monochromatic color ought to be resolved first. Thus, the red channel of the RGB image is resolved. First, this technique using Otsu thresholding performs initial segmentation and removes the undesirable region utilizing shape analysis on the binary image. Next, the Template matching (TM) technique is done relying on the result consequence of initial segmentation. A circle shape template is made for TM strategy. This template is associated with the red channel to increase the intensity of the melanocytic epidermal area. This

strategy gives a melanocytic region with high response value and the rest of the region with lower response value. At last, for effective epidermal segmentation, by calculating the threshold value analysis of Probability Density Function (PDF) is done. The final threshold value is computed by obtaining the average between higher response values obtain by TM method and the threshold value for effective epidermal segmentation.

The proposed method for 105 skins WSI, achieved segmentation result of 95.68% sensitivity and precision rate of 93.13% show in Table 1 along with other methods used.

Table 1: Proposed system performance evaluation of the epidermis segmentation

Technique	ASEN%	ASPE %	APRE %
EMBS	91.68	99.76	56.05
CLAHE	93.93	96.94	53.80
the proposed	95.68	99.41	93.13

Aswin et al [10] this paper presented another framework for identifying the skin cancer at early stage. In this method, the initial phase is to remove the noise and refine the outskirts of the dermoscopic image. Next by using the DullRazor software the hair pixels are removed and by filtering, the noise is removed as shown in Figure 3.

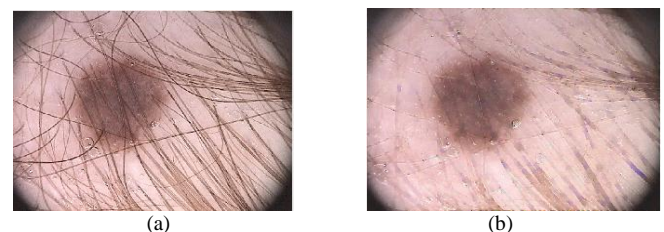


Figure 3: (a) Image Containing hairs (b) Image after hair removal

Next step is to do the segmentation. This step is done by using the Otsu's thresholding method. By applying threshold to the previously obtained image, it isolates the background lesion region of the skin for the next process this is illustrated in the Figure 4. Finally in the last step feature extraction, the lesion is identified. The Gray Local Co-occurrence Matrix (GLCM) and Normalized Green, Red, Blue methods are used. The Melanoma is usually identified by the high contrast value and has the combination of red, blue, green colors whereas benign melanoma is identified using low contrast value and of uniform color.

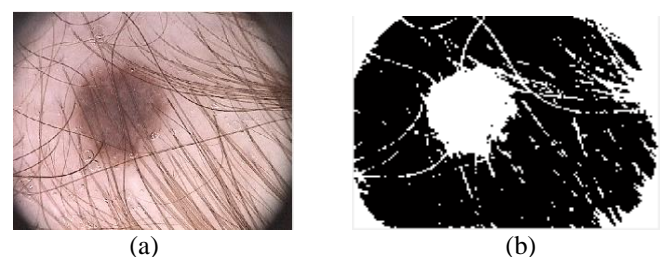


Figure 4: (a) Original Image (b) Lesion Region

This method finally classifies the extracted feature as non-cancer lesion and cancer lesion. The classification method used here is Artificial Neural Network using Hybrid Genetic Algorithm (HGA). This method gives the precise and optimized result. The above framework is tested for 30 datasets of melanoma producing an accuracy of 88%.

Mariam Ahmed et al [11] have composed a computerized framework for diagnosis of the pigmented lesions. In this method, both of the images clinical images, taken from standard camera and dermoscopic images, taken from the dermoscope is used in this system. The actual image size of the image is 470x640 pixels and later it is enhanced for the lesion border detection. The enhancement is done by applying the median filter for two times and then converting the RGB image to Grayscale image. In the next step, the contrast adjustment and the segmentation are done. By using the Otsu threshold the lesion area and the background region is segmented. This has been shown in the Figure 4.

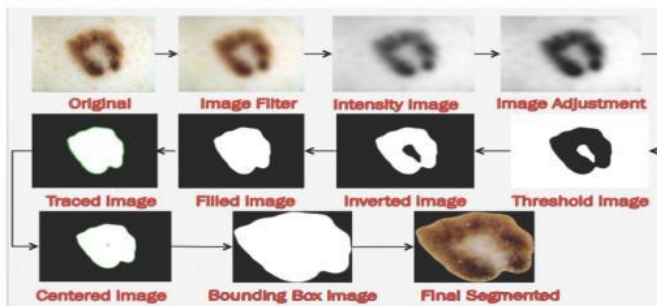


Figure 4: Image Segmentation steps

In this method two features sets geometric features (shape) and chromatic features (color) are extracted. Features are calculated by using Feature selection t-test. Then by using the classifiers Artificial Neural Network and the support Vector Machine classification is done. In this method totally 320 dermoscopic images are used for training the system. This method produces an accuracy of 95% for dermoscopic images form SVM machine and produces an accuracy of 93.75% for clinical images using Artificial Neural Networks.

#### 4. METHODOLOGY

Figure 5 shows the block diagram of our proposed algorithm. The proposed algorithm is tested with PH2 dermoscopy image database. The images are acquired using the dermoscope. The proposed algorithm has 5 major steps: First, Image Acquisition, Pre-processing of dermoscope image, Segmentation, Feature Extraction, Classification using the SVM classifier.

##### A. Image Acquisition

The first phase is collection of images which is essential for the rest of the stages, hair detection, segmentation, feature extraction and classification; hence images have to be acquired satisfactorily. The iPhone camera is used for capturing of images to which dermoscope is attached. The dermoscope provides quality images of skin lesion. It provides auto-focus ability with magnification of 20x.

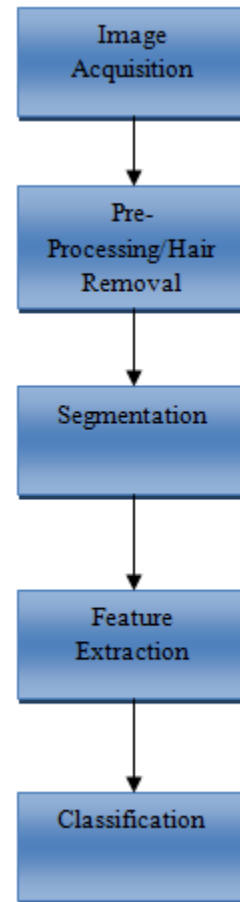


Figure 5: Block diagram of proposed method

##### B. Pre-processing

The clinical images or dermoscopic images have hair and the noise. This removal of hair and noise is done using the filtering techniques. The detection of lesion with hair in it takes more time for calculation and may leads in less accurate result. Median filter is used for performing this task. It preserves the cancer image and does the pre-processing. First the RGB image is converted into the grayscale using the formulae.

$$X=0.299R+0.587G+0.114B \quad (1)$$

Next, Median filter is used for pre-processing of image. Then the image is resized and the contrast is enhanced.

##### C. Segmentation

Segmentation is another important step. In this process the region of interest (ROI) is segmented from the dermoscope image. The Segmentation is achieved using the image properties such as, edges, texture. It is defined as the process of classifying the group of pixels which are homogenous. It is based on basic methods thresholding, region based, edge based. Thus after segmentation the output will be lesion region and the background region.

##### D. Feature Extraction

In this module, from the segmented image the features are extracted such as texture, color, shape. The features include shape, smoothness, aspect ratio, location parameters, and compactness.



### E. Classification

For Classification, Support Vector Machines (SVM) Classifiers is used. SVMs are used to classify the data. The framework is illustrated in the Figure 6. The framework has used two types of classifiers, one level and two-level classifiers. The first phase is of removing the noise, finding the lesion area and by using the classifiers the diagnosis of cancer is done. The Classifiers, Classifier A and Classifier B & C classifies the image as melanoma, atypical, benign.

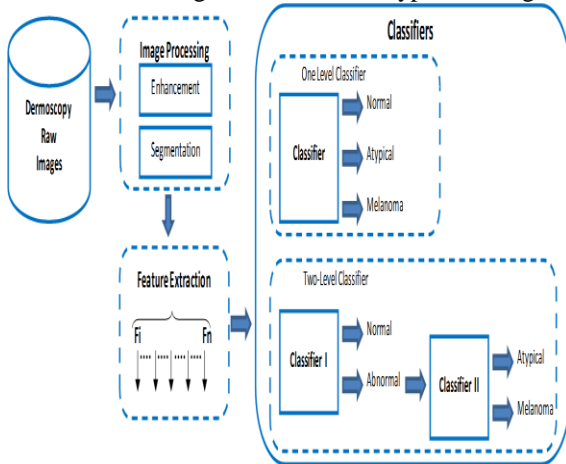


Figure 6: Proposed method framework for dermoscopy image classification.

The SVM are the supervised learning methods. It finds the hyper plane to separate the data sets. The process of SVM with the support vectors are shown in Figure 7.

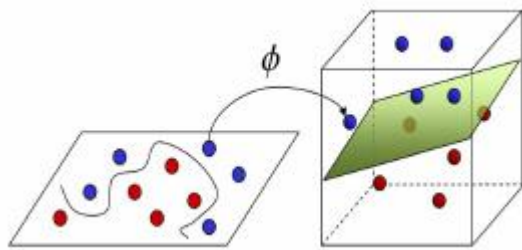


Figure 7: SVM Process

## 5. RESULTS AND ANALYSIS

The proposed method uses the PH2 dermoscopy database. It includes dermoscopy images of total 200 containing 80 atypical, 80 benign and 40 melanoma images. In this experiment among the total images 75% of images are utilized for the training of machine and rest of 25% of images are used for the testing purpose. The proposed framework is having the two classifiers; Classifier A gives an accuracy of 90.4%, 93.5% and 94.3% to classify the atypical, benign and melanoma. Similarly Classifier B gives an accuracy of 97.5%, 95.7% and 96.3% to classify the melanoma, atypical and benign. The tables 2 and 3 below shows the Classifier A's and Classifier B's confusion matrix respectively.

Table 2: Classifier A's Confusion Matrix

		Predicted class (%)		
		Benign	Atypical	Melanoma
Actual Class	Benign	93.5	6.5	0
	Atypical	9.6	90.4	0
	Melanoma	0	5.7	94.3

Table 3: Classifier B's Confusion Matrix

		Predicted class (%)	
		Normal	abnormal
Actual Class	Normal	90.6	9.4
	Abnormal	7	93

## 5. CONCLUSION AND FUTURE ENHANCEMENT

In the proposed paper the system that helps in early detection and prevention of melanoma. It classifies the skin cancer into benign, atypical, and melanoma. The framework proposed the classifiers. The Classifier A and Classifier B compares and produces the confusion matrix giving its accuracy measure of predicting the cancer disease. In this proposed method MATLAB software is used for developing the GUI

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