Support Vector Machine Based Melanoma Skin Cancer Detection

H.D.Praveena [1*], K. Sudha[2] , P.Geetha[3]

[1,2] *Assistant Professor, Department of Electronics and Communication Engineering,*
Center for Communication and Signal Processing
Sree Vidyanikethan Engineering College, Tirupati-517102, India

[3] *Associate Professor, Department of Electronics and Communication Engineering,*
Center for Communication and Signal Processing
Sree Vidyanikethan Engineering College, Tirupati-517102, India

Abstract: *In Present Scenario, one of the life threatening disease which causes human death is Skin cancer. The cause of skin cancer is due to the abnormal growth in melanocytic cells. Due to genetic factors and exposure of ultraviolet radiation , Melanoma appears on the skin as brown or black in colour. Early diagnosis can cure this skin cancer completely. The traditional method to detect the skin cancer is Biopsy which is invasive and painful. This method of laboratory testing consumes more time. To resolve the above issues, diagnosis of skin cancer is developed based on computer aided. The proposed system uses four phases to detect the skin cancer. First, it uses Dermoscopy to capture the skin image. Next step is to pre-process the image . After the step of pre-processing, it is segmented which is followed by feature extraction with unique features from the segmented lesion. A last, these features were given to a supervised classifier named support vector machine (SVM) to classify whether the given image is as normal image or melanoma diseased skin image . The experimental result shows SVM classifier offers more accuracy compared to existing technique.*

Keywords: Melanoma Skin Cancer, Segmentation, Feature Extraction, Artificial Neural Networks, SVM Classifier.

1.INTRODUCTION

Humans are suffering with Hazardous forms of the Cancer. Melanoma, Squamous Cell Carcinoma and Basal are the types of Skin cancer [1]. Among these, most unpredictable and hazardous type of skin cancer is Melanoma. For the diagnosis of skin cancer, skilled dermatologists uses the instrument dermoscopy and predicted the accuracy around 75-84% [3]. This computer method of diagnosis is supportive to improve the accuracy and also increases the speed. The Computer is capable of extracting information like asymmetry, color and texture features, which is difficult by human eyes accurately. Numerous proposed algorithms and systems are available like ABCD rule, seven-point check list and Menzies techniques [2] to diagnosis the melanoma skin cancer. Four important steps to diagnosis of melanoma on computer based are: Collecting skin lesion image, then segment the image and extract the features from the lesion area and finally classification.

Based on ABCD rule of dermoscopy, Extraction of features for melanoma lesion detection can be performed , because of its effectiveness, ease of execution and adaption. In feature extraction process , the features like asymmetry, color , border irregularity and diameter are extracted from the given image. Apart from Artificial Neural Network, a computer based melanoma cancer detection using Support Vector Machine classification is used which is more efficient than the conventional one.

This research work is structured as follows. Section 2 denotes a broad review of papers in skin cancer detection. Section 3 deals with Existing technique with Artificial neural networks. In section 4, an effective supervised system Support Vector Machine is developed to detect skin cancer. Explanation of results in the section 5. To end with, the conclusion is done in the last section .

2.Literature Review

The researchers are developed a number of new methodologies in skin cancer detection. In this segment, the evaluations of some significant contributions to the existing literature papers are presented.
Computer based approach is now a days very popular to detect the skin cancer. Melanoma is recognized as the most dangerous and unpredictable category of skin cancer caused in human beings Skin lesion presented in the input image Segmented either manually, semi-automatic or fully automatic border detection methods. Some methods are reported in literature like global, histogram and Hybrid thresholding, followed by morphological operations. In this work, threshold based segmentation and fully automatic border detection method is applied. In [4], Various methodologies have been developed like analysis of color-space and global histogram thresholding [6] have been developed to improve the detection accuracy. In [5] the author has reported that border-detection method shows high performance in estimation of melanoma skin lesion borders.
The accuracy can be increased by developing algorithms which gives information about parameters like colour variation, texture features and asymmetry. In [8], authors described about Euclidean distance transform for division of input image into various regions. Few methods use calculation of parameters like symmetric distance and circularity. Other methods are based on estimation of parameters like circularity index from skin cancer images. In [10] the author compared performance improvement using various classifiers for diagnostics of skin lesion.
To overcome the problems mentioned in the literature, the detecting performance of skin cancer can be improved by implementing a new system.

3. Classification using Artificial Neural Networks

The Methodology of existing work to detect the Skin Cancer is shown in the Fig. 1.The skin lesion image is considered as input and the image quality is improved using pre-processing techniques. After that for image segmentation Background subtraction and edge detection mehods can be performed. Then features are extracted after segmentation process . Finally, Using Artificial Neural network [7,9], classifies the given image is as cancerous or normal.

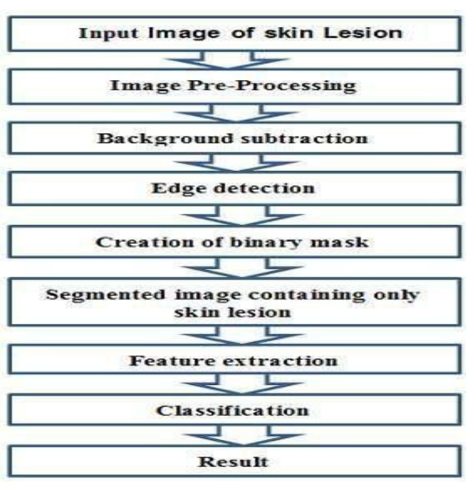

Figure 1. Work flow of existing system

4. Classification using Support Vector Machine

Methodology that is proposed for identification of Melanoma Skin Cancer is depicted in Fig. 2. Image quality can be upgraded after pre-processing step. The image which is segmented is applied for feature extraction to extract the features. After applying the extracted features to the stage of classification, it classifies the skin lesion as normal or cancerous by Support Vector Machine Classifier.

4.1 Image Pre Processing

Image preprocessing involves scaling or resizing, improvement of contrast & brightness is performed to compensate the non-uniform illumination in the image .

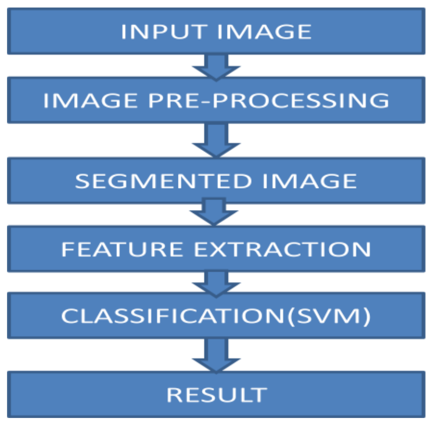

Figure 2. Work flow of proposed technique

1. Resizing

First the image size is either increased or decreased such that image is clearly visible

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Figure 3. Resized image

2.Converting RGB to Gray Scale image

The “rgb 2 gray ” MATLAB syntax is used for conversion of RGB image to gray scale image **.**

Figure 4. Gray Scale image

3.Converting Gray Scale image to Binary image

The "Im2bw" MATLAB function is used for conversion of gray scale to a binary image. This function replaces all the pixels which is present in the image with luminance beyond the level with the value 1 as white & substitutes remaining pixels value 0 as black. In case, if no level is defined, then im2bw command assigns with the value 0.5.

Figure 5. Binary image

4.2 Segmentation

Segmentation is a process of segregating an image into many parts. Then using these parts objects and other relevant information about images are identified.

1. Back Ground Subtraction

Background subtraction is otherwise termed as blob detection, which is a promising method in the area of image processing. In this method foreground information of an image is extracted to process it further.

2. Edge Detection

Edge detection is the significant method of in which boundaries of objects are detected. This method is based on detection of discontinuities in brightness.

3.Masking

Masking is a process of separation of lesions from skin image. Finally the masked image retains with only the skin lesion.

Figure 6. masked image

4.3 Feature Extraction

The geometric attributes extracted from skin Lesion are Area, CircularityIndex, Greatest Diameter, Perimeter and Irregularity Index) [8]. The explanation of those Features are as follows.

Area (A): Number of pixels of the lesion

Perimeter (P): Number of contour pixel.

Major Axis Length (Ma L): It is the length of the line passing through lesion centroid and the two farthest boundary points.

Minor Axis Length (Mi L): It is the length of the line passing through centroid of the lesion and joining the two neighboring boundary points. Circularity Index(CI): It gives the shape uniformity. CI =4*PI*A/P2

The mathematical equations of irregularity index A,B,C and D are represented in the equations (1),(2),(3) and (4) respectively.

Irregularity Index A (IrA)=P/A (1)
Irregularity Index B (IrB)=P/Ma L (2)
Irregularity Index C (IrC)=P((1/Mi L)-(1/Ma L)) (3)
Irregularity Index D (IrD)=MaL-Mi L (4)

4.4 Classification

In addition to the linear classification , SVM can effectively executes a non-linear classification, through mapping the inputs into high-dimensional feature spaces. Supervised SVM classifier sort out all the data points of one class from the other class data points using hyperplane. The optimum hyper plane in SVM is the one with the leading margin between the two classes. Margin is the maximam distance across the slab which is parallel to the hyper plane that has no data points inside. The data points which are closer to the hyper plane are called the support vectors , that lies on the boundary of the slab. The figure 7 shows that, + representing data points of type-one, and – representing data points of type –two.

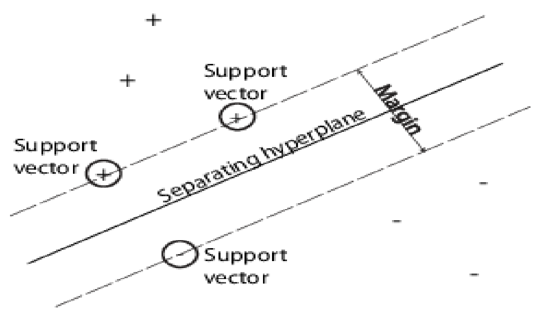

Figure 7:Hyperplane

5.Results

Initially, 40 skin cancerous and normal images are collected from dissimilar sources & pre processed with the subsequent steps like image scaling operation, RGB image to gray scale image, gray scale to binary image conversion and then segmentation operation is performed. Here for training 80 percent and for testing 20 percent of images are considered for the experimentation. The ANN is trained with the known target values depicted in the figure 8. Later, masking of the image can be obtained from the preprocessing step that contains only the skin lesion. The extracted features like Area, Greatest Diameter, Shortest Diameter, Perimeter, Circularity Index and Irregularity Index were given to SVM Classifier. At last, SVM Classifies melanoma skin cancer more accurately. The performance evaluation of ANN and SVM Classifiers is shown in table 1 in light of Accuracy.

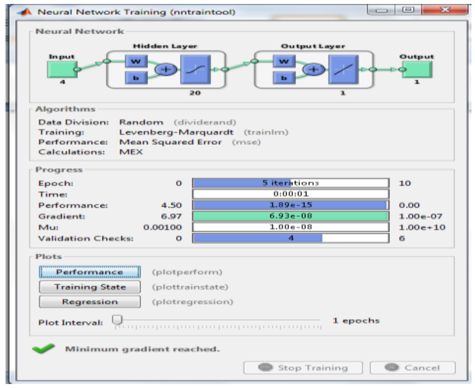

Figure 8 .Training in Artificial Neural Networks

Table 1.Comparison of Accuracy values of ANN and SVM

S.N0	**Skin Cancer Detection Classifier**	**Accuracy(%)**
1.	Artificial Neural Networks	96.2
2.	Support Vector Machine	97

6 . Conclusion

In this Article, computer based diagnosis for melanoma skin cancer is developed with supervised Support Vector Machine classifier. The algorithm which is proposed here is fast & accurate when compared to other existing machine learning algorithms. This Support Vector Machine is helpful for the people in the areas where the experts may not be present to diagnosis and they can check with the help of this tool to know whether they have cancer or not. Since this tool is made more robust and feasible, it can recognize the Melanoma skin cancer automatically.

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