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Skin Cancer Detection And Classification in Humans

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Abstract

Skin cancer has become one of the major health issue. Skin cancer is of two types. They are malignant melanoma and Benign melanoma. Benign melanoma is not a deadly skin disease to humans where as malignant melanoma is a deadly skin disease to humans. The input to the proposed system is the skin lesion image and then apply median filter to extract the skin lesion image from the healthy skin. Some differenciable factors of malignant(cancerous) melanoma and benign melanoma were extracted using Gray Level Co-occurance Matrix (GLCM) procedure. The extracted features were submitted as input to Artificial Neural Network (ANN) classifier. This classifier classifies the infected skin region and produces the output as Normal skin or Melanoma cancer. The image database contains total number of 90 different dermoscopy lesion images including normal, atypical, and melanoma cases. The tested results shows that the proposed system is efficient and can achieve the classification of the normal, atypical and melanoma images with accuracy of 97.3%, 96.7% and 98.5%, respectively. Hence, the computer based diagnosis(identification of a disease) system can enhance the speed of diagnosis.

Keywords- Gray Level Co-occurance Matrix, Gabor method,Median filtering.

1. INTRODUCTION

Skin cancer will be considered as the major causes of deaths in the next few generations. There are two main skin cancer types [1]. They are Malignant Melanoma and Benign Melanoma. Malignant Melanoma type is a deadly disease. Benign Melanoma(Non-cancerous) is not a fatal disease. Malignant(cancerous) melanoma has divided into Superficial Malignant Melanoma, Nodular Malignant Melanoma, Lentigo Malignant Melanoma and Acral Malignant Melanoma. Melanocytes present in any parts of the body are the causes of melanoma. When the human skin is very much exposed to ultraviolet radiations and the abnormal growths of melanocytes are the main reasons of the Malignant Melanoma. When melanocytes produces more pigments then skin becomes dark resulting as Malignant Melanoma. The unique symptoms of skin cancer are Asymmetry, irregularities in Border, variation in Color, Diameter and Evolving. These symptoms are commonly called as ABCDE features.

Some of the skin cancer images can be seen in the figure 1.

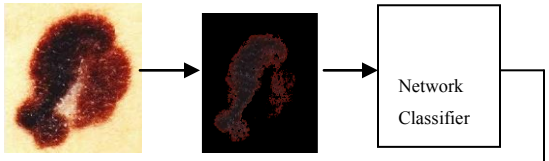
(a)  (b) 

(c)  (d) 

(e)  (f) 

2. Architecture of the proposed system.

Initially, the segmentation of input image is done for removing the background region and to obtain the infected region. In the next level, features are extracted using feature extraction procedures such as Gabor procedure and GLCM procedure. In the final, using artificial neural network classifier, the skin diseases are classified. The complete process is depicted in Figure 1.1



Input image Median Filter, GLCM and Gabor

Output

1. Acral melanoma
2. Lentigo melanoma
3. Nodular melanoma

Cancerous or Non-cancerous

Figure 1.1 : Flow diagram of classification of skin disease

A. Image Segmentation

The concept of median filter was introduced by Tukey in 1997. Median filters can be defined as statistical non-linear filters. Median filter perform the below mentioned steps to each pixel value in the processed image[2].

Median Filter Algorithm

Step 1 : All pixels of surrounding region in the original image which were recognized by the mask were arranged in increasing order or decreasing order.

Step 2 : The median of sorted value was calculated and was selected as pixel value of the processed picture.

Step 3: When median filters were applied to an image, the pixel values which were very distinguishable from surrounding pixels will be eradicated.

Step 4: By eradicating the impression of such odd pixels, the values were alloted to those pixels that were representative of values of typical surrounding pixels in the original image.

Figure 2.1: Input images before segmentation and feature extraction

B. Performance evaluation of segmentation

It is applied by measuring the parameters such as Mean, Contrast, Correlation, Energy, Homogeneity and below values were tabulated[3].

Contrast	Mean	Correlation	Homogeneity	Energy	Diagnosis	Output
0.123	234.57	0.978	0.986	0.757	Benign	No
0.230	243.77	0.918	0.983	0.855	Benign	No
0.165	192.15	0.983	0.972	0.458	Malignant	Yes
0.139	216.03	0.980	0.986	0.612	Benign	No
0.074	221.48	0.987	0.987	0.627	Malignant	Yes
0.196	236.96	0.941	0.982	0.768	Malignant	Yes
0.529	213.59	0.903	0.932	0.453	Benign	No
0.068	241.37	0.981	0.990	0.845	Benign	No
0.080	228.62	0.984	0.978	0.706	Benign	No
0.359	231.50	0.898	0.949	0.664	Benign	No
0.181	241.57	0.955	0.664	0.949	Benign	No
0.106	237.49	0.978	0.993	0.839	Benign	No
0.172	191.54	0.986	0.981	0.490	Benign	No
0.177	222.74	0.784	0.915	0.309	Malignant	Yes
0.137	188.80	0.987	0.973	0.398	Benign	No
0.090	236.31	0.975	0.984	0.760	Malignant	Yes
0.150	206.97	0.913	0.986	0.635	Benign	No
0.171	204.07	0.979	0.970	0.638	Malignant	Yes
0.369	203.78	0.977	0.922	0.337	Benign	No

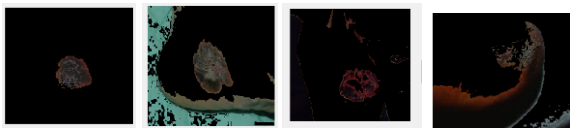


Figure 2.2: Output images after segmentation and feature extraction

C. Gray Level Co-occurrence Matrix (GLCM)

GLCM is a powerful tool for feature extraction. GLCM can be defined as a matrix where the number of rows and number of columns are equal to the number of gray levels. The features were taken out based on GLCM were: Contrast, skewness, kurtosis, standard deviation, Correlation, Energy, Mean, and Homogeneity[4].
Contrast can be defined as the measurement of local intensity variation. It can be computed as,

$$\text{Contrast} = \sum_{i=1 \text{ to } a} \sum_{j=b} (i-j)^2 R(i,j)$$

Correlation can be defined as a measurement of gray level linear dependence between the pixels at the specified positions relative to each other. It can be computed as,

$$\text{Correlation} = \{\sum_{i \text{ to } a} \sum_{j=b} (i,j)R(i,j) \}- \mu_x\mu_y / (\sigma_x\sigma_y)$$

Energy can be defined as the parameter which is used to measure the texture uniformity in a picture. It can be computed as,

$$\text{Energy}= \sum_{i \text{ to } a} \sum_{j \text{ to } b} R(i,j)^2$$

Homogeneity can be defined as the parameter which is used to measure the amount of local uniformity within the picture. It can be computed as,

$$\text{Homogeneity} = \sum_{i \text{ to } a}\sum_{j \text{ to } b} R(i,j) / (1+|i-j|)$$

Mean value provides a measure of distribution. It is calculates as,

$$\text{Mean}= 1/ab \sum_{i \text{ to } a} \sum_{j \text{ to } b} R(i,j)$$

3. EXPERIMENTAL RESULT

A. Dataset preparation

The images in the dataset will determine how realistic the analysis will be. The database collection contains 90 different pictures of 3 types of skin cancer. Some of them can be seen below.

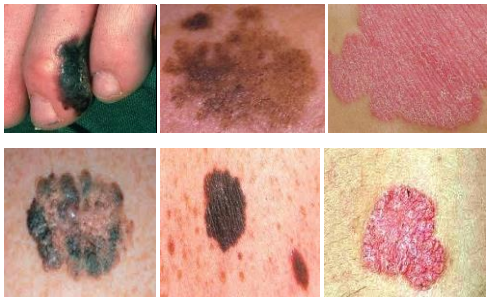


Figure 3.1: Sample images from the dataset

B. Result discussion

The database consists of 3 classes containing 90 images. The images are segmented and features are extracted using GLCM [5].These extracted features are classified in to different fruit diseases using classifier. The result of classification has relatively higher accuracy in all cases when segmented using K – Means.

4. Conclusion

In this paper, an image processing based solution is proposed and evaluated for the skin cancer disease detection and classification in humans. The first step of image segmentation is performed using

Median filtering. In second step features of interest are extracted. In the third step classification is performed using ANN classifier. Our experimental results shows that the proposed system can detect and classify the skin diseases. The result of classification has relatively higher accuracy in all cases. Further work includes consideration of more dataset to improve the output of the proposed method

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