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Different Techniques for Skin Cancer Detection Using Dermoscopy Images

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Abstract— Now a days, most dangerous form of disease is melanoma. Melanoma is type of skin cancer that develops from melanocytic cells. Due to malignancy feature melanoma skin cancer is also known as malignant melanoma. Melanoma cancers have various stages which will increase the death rate of patients. So early detection and treatment of melanoma implicate higher chances of cure. Traditional methods for detecting skin cancer are painful, invasive and time consuming. Therefore, in order to overcome the above stated issues different techniques used for skin cancer detection. These techniques works on image so there is no physical contact with skin, so this is non-invasive. These techniques use Image Processing tools for the detection of Melanoma Skin Cancer. These techniques first pre-process the skin image which is followed by image segmentation. Feature extraction is performed on segmented lesion. The extracted features are used to classify the image as normal skin and melanoma cancer lesion.

***Keywords*—** Image Pre-processing, Segmentation, Feature Extraction, Classification, Melanoma Skin Cancer

I. INTRODUCTION

Now days, cancer is one of the wide spread cause of death. Research elaborated that effect rate in asian countries is far higher than others. Rate of people anticipated to death due to cancer is increasing each day. Among different types of cancer, skin cancer has got a wide number of patients. It happens due to rapid growth of skin cells, sometimes causing skin tumours [1].

Melanoma skin cancer has been increasingly identified as the major cause of deaths. It is a condition or a disorder that develops from the melanocytes, which produce a pigment known as melanin**.** So melanoma regions appear as black or brown in colour. But some of them doesn't produce melanin; they appear as pink, tan or white colour [2]. Most dangerous form of disease is the malignant melanoma. Malignant melanoma can easily affect the other parts of the body. In initial stage malignant melanoma begins on the skin surface where it is easy to see and treat. Then it grows deep in to the skin and reaches at the blood vessels. Finally, it will spread to different parts of the body and influence different organs.

Melanoma skin cancers have different stages which are stage 0, stage I, stage II, and stage III [3]. In stage 0, tumours only begins on the surface of skin. In stage I, tumours invade the skin but are unulcerated and grow at a slow mitotic rate. Stage II is considered as intermediate melanoma and has different classifications. In stage IIA, tumour is 1- 2mm thick, in stage IIB, it is 2-4mm thick and in stage IIC, the thickness is above 4 mm. stage III is the most advanced stage of melanoma which affects various organs and the treatment becomes difficult. So early detection of melanoma is very essential [4].

Traditional method for detecting skin cancer is invasive method such as biopsy of the lesion is widely used for the diagnosis purposes. Analyzing the skin lesion with the naked eye is a challenging task for the clinicians [5]. This method is painful and time consuming. Therefore, in order to overcome the above stated issues different techniques are used for skin cancer detection. This paper describes the five different techniques for skin cancer detection. Reviewing these techniques is the contribution of this paper. These techniques uses computer aided diagnosis for skin cancer detection. These techniques works on image so there is no physical contact with skin, so this is non-invasive. These techniques use image processing tools for the detection of melanoma skin cancer. These techniques first pre-process the skin image which is followed by image segmentation which is followed by feature extraction. The extracted features are used to classify the image as normal skin and melanoma cancer lesion.

Paper is organized as follows; Section II gives different techniques used for the skin cancer detection. Section III provides the comparative analysis among different techniques. Section IV concludes the paper.

II. TECHNIQUES USED

Following are some techniques used for skin cancer detection:

1. An Efficient Machine Learning Approach for the Detection of Melanoma using Dermoscopic Images.

The paper [1] first pre-processes the skin image by using mean filter. Otsu Thresholding is applied for lesion segmentation. Feature extraction is done by using gray level co-occurrence matrix (GLCM). After feature extraction support vector machine (SVM) classifier is used for classification.

a) Image Pre-Processing

Image pre-processing is the first step. Digital image of skin contains some background noise so it will affect the accuracy. Mean filter is used for removing such type of noise.

b) Image Segmentation

Image segmentation is the important step of image processing. In this step lesion part is segmented from skin for improving the results. Image segmentation is done by using otsu thresholding .

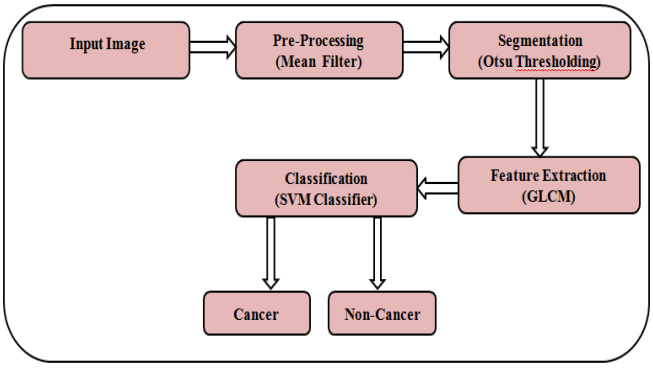

Figure.1. Flowchart for Detection Of skin cancer using machine learning approach

c) Feature Extraction

In feature extraction Colour and Texture features are extracted. Figure 1 shows the overview of machine learning approach.

a) Colour Features

In colour features nine different features extracted by using HSV colour space which include; Hue(mean), Saturation(mean), Value(mean), Hue(max), Saturation(max), Value(max), Hue(Standard Deviation), Saturation (Standard Deviation) and Value (Standard Deviation) [1].

b) Texture Features

In texture features four different features are extracted which include; Contrast, Energy, Homogeneity and Correlation. 13-D feature vector is formed by using nine colour features and four texture features. This feature vector is saved into database along with class labels.

d) Classification

After feature extraction selection of classifier is important. So SVM classifier is chosen to classify the image as normal skin and melanoma cancer lesion.

2. Advanced Earlier Melanoma Detection Algorithm Using Colour Correlogram.

The paper [4] first preprocesses the skin image by using 84 directional filter. Active contour based segmentation is applied for lesion segmentation. Feature extraction is done by using colour correlogram. It uses Bayesian classifier for classification. All these steps are shown below in Figure 2.

a) Image Pre-Processing

Input image is pre-processed by using image processing technique. Skin image contains some hairs, so it will reduce the accuracy of classification. 84 directional filters are used for hair detection and removal. This is shown in below Figure. 2

b) Image Segmentation

Input image contains healthy as well lesion part. So it will give less accurate result. Segmentation of lesion part is very important for further processing. Active contour based segmentation is applied to obtain satisfactory results. To perform active contour based segmentation, a mask is needed to specify the initial location of the active contour [4].

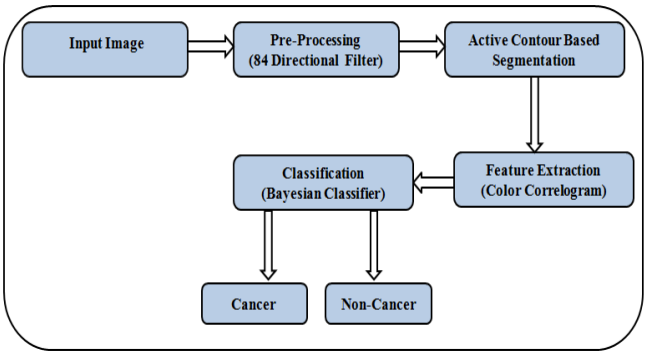

Figure.2. Flowchart for skin cancer detection using colour correlogram

c) Feature Extraction

Feature extraction is the technique in which unique features are extracted from segmented lesion. This step is very important. In this, colour correlogram and texture analysis is used for extracting features.

d) Classification

Feature extraction is followed by classification. In this, Bayesian classifier is applied for classifying melanoma from benign lesion.

3. An Automated Computer Aided Diagnosis of Skin Lesions Detection and Classification for Dermoscopy Images

The paper [6] uses median filter for pre-processing, K-means clustering for segmentation and GLCM for feature extraction. Feature selection is done by using wikis Lambda. It uses SVM classifier for classification. All these steps are shown in Figure 3.

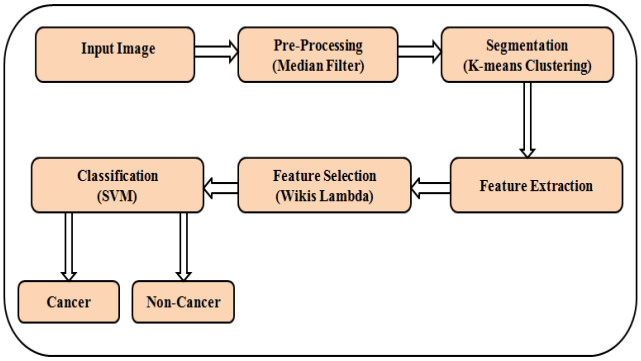

Figure.3. Flowchart for Skin Cancer Detection using Automated Computer aided diagnosis

a) Image Pre-Processing

Processing the input image is the first step of image processing which is shown in Figure 3. The skin cancer image contains some hairs which obstructs the classification result. In this, median filter is applied for hair removal.

b) Image Segmentation

After preprocessing, convert the RGB image to grayscale image and identify the pixels whose intensities are less than 200 of an image. To segment out the lesion part, K-means clustering is used [6].

c) Feature Extraction

Color, sub-region and texture related features extracted for the classification. After feature extraction, feature selection is performed using Wikis lambda method.

d) Classification

Classification is the last step in image processing. Classification classifies the melanoma images from benign images. So selection of the classifier is an important step. SVM classifier is applied for classification of melanoma from benign lesion.

4. Automatic Non-Invasive Recognition of Melanoma Using Support Vector Machines.

The paper [7] first pre-process the skin image by using median filter. K-means clustering and region of interest (ROI) segmentation is applied for lesion segmentation. Feature extraction is done by using GLCM. SVM classifier is used to classify the image as normal skin and melanoma cancer lesion.

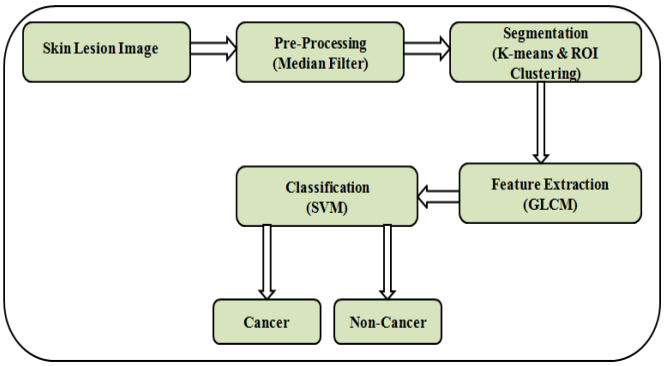

Figure.4. Flowchart for Skin Cancer Detection

a) Image Pre-Processing

Skin lesion image contains some background noise, hairs and air bubbles. This noise will affect on segmentation and classification. Median filter used for noise elimination as shown in Figure 4.

b) Image Segmentation

Image segmentation is the process of separating lesion part from the skin image. In this, K means clustering and ROI segmentation methods are used.

c) Feature Extraction

Image segmentation is followed by feature extraction. In this method GLCM (Gray level Co-occurrence Matrix) is used for extracting features from segmented lesion. Contrast, correlation, Energy, Homogeneity features were extracted using this method.

d) Classification

The Classification is the final stage that is in charge of taking decisions about the extracted information in order to diagnose the input image. In this project Support Vector Machines classifier was used. SVMs are supervised learning classifiers [7].

5. Computer aided Melanoma skin cancer detection using Image Processing.

The paper [8] uses Gamma Correction method for pre-processing, Automatic Thresholding method for the segmentation process and Geometric Feature Extraction for extracting Features. Finally it uses Predefined Thresholding for classifying melanoma. All these steps are shown in Figure 5.

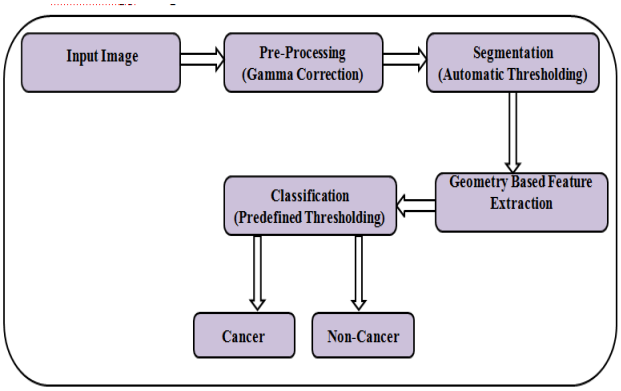

Figure.5. Flowchart for skin cancer detection using image processing

a) Image Pre-Processing

The input image given to the system can be obtained in any lighting condition or by using any camera such as mobile camera. Hence it needs to be pre-processed. Here, the pre-processing includes the image resizing and contrast and brightness adjustment. This is done in order to compensate the non-uniform illumination in the image. These processes are done by using image processing techniques like gamma correction [8].

b) Image Segmentation

Image segmentation is a technique to determine the shape and size of the border, and to separate the object from its background based on different features extracted from the image [9]. Automatic thresholding is performed for lesion segmentation.

c) Feature Extraction

Feature extraction extracts the unique features from the image. In this, geometric based features were extracted such as Area, Perimeter, Greatest Diameter, Circularity Index, and Irregularity Index.

d) Classification

Feature extraction is followed by classification. Geometry based features are given input to classifier. In this, Predefined Thresholding is applied for the classification.

III. COMPARATIVE ANALYSIS

Table 1 shows the comparative analysis of different five approaches used for skin cancer detection. Each paper contains image pre-processing, image segmentation, feature extraction and classification steps. Paper [1] contains mean filter for pre-processing, Otsu thresholding for segmentation and SVM classifier for classification. In paper [4] 84 directional filter for pre-processing, active contour is used for segmentation and Bayesian classifier used for classification. Paper [6] contains Image pre-processing, k-means clustering based segmentation, Feature extraction and SVM classifier for classification. Paper [7] contains Image pre-processing, k-means clustering based segmentation, Feature extraction using GLCM and SVM classifier for classification. Paper [8] contains automatic thresholding based segmentation, geometry based Feature extraction and predefined thresholding used for classification.

TABLE 1. COMPARATIVE ANALYSIS OF DIFFERENT TECHNIQUES USED FOR SKIN CANCER DETECTION

Parameters	Paper[1]	Paper[4]	Paper[6]	Paper[7]	Paper[8]
Pre-processing	Mean Filter	84 Directional Filter	Median Filter	Median Filter	Gamma Correction
Segmentation	Otsu Thresholding	Active Contour Based Segmentation	K-means Clustering	K-means Clustering & ROI Segmentation	Automatic Thresholding
Feature Extraction	GLCM	Colour Correlogram	Wikis Lambda	GLCM	Geometry Based Feature Extraction
Classification	SVM Classifier	Bayesian Classifier	SVM Classifier	SVM Classifier	Predefined Thresholding

IV. CONCLUSION

In this paper, we have studied different techniques for detection of skin cancer. The manual detection of skin cancer is not only tedious but also time consuming task. Traditional method for detecting skin cancer are painful, invasive and time consuming. Therefore, in order to overcome the above stated issues these techniques effectively and efficiently used. Each technique contains image pre-processing, segmentation, feature extraction and classification steps. First technique contains mean filter for pre-processing, otsu thresholding for segmentation and SVM classifier for

classification. Second technique uses 84 directional filter for pre-processing, active contour is used for segmentation and Bayesian classifier used for classification. Third technique contains Image pre-processing, k-means clustering based segmentation, Feature extraction and SVM classifier for classification. Fourth technique contains Image pre-processing, k-means clustering based segmentation, Feature extraction using GLCM and SVM classifier for classification. Fifth technique contains automatic thresholding based segmentation, geometry based Feature extraction and predefined thresholding used for classification.These techniques works on image so there is no physical contact with any part of body, so this is non-invasive.

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