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# Developed A System To Recognize And Identify The Type Of Skin Disease Using Stolz's Method

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**ABSTARCT-** Dermatological diseases also called as skin diseases are more common in human due to various conditions. These are caused by many bacterial and fungal infectionsand also by some of the environmental changes. The advancement in medical technology has developed many systems and procedures to diagnose those skin diseases effectively. But the cost requirement for such diagnosis process is very expensive. For that, an automated screening system is proposed todiagnose dermatology diseases at an initial stage with the support of image processing techniques. The proposed system works on a color image of the affected skin and pre-processes the image to segment the lesion using Otsu's thresholding method. And the diagnosis is carried out by extracting four geometric
characteristics: Asymmetric Index (A), Border Irregularity (B), Color (C) and Diameter (D) from the lesion area using Stolz's algorithm (ABCD rule). From the measure of ABCD parameters, the six different type of skin disease are classified using Multi class SVM classifier. Such diseases are Melanoma, Basal cell carcinoma, Squamous cell carcinoma, Melanocytic nevi, Seborrhoeic keratosis and Acrochordon (Skin tags). The system performance is evaluated by sensitivity, specificity and accuracy. This idea can be helpful for detecting skin cancer at an earlier stage.

**Keywords** –Image processing, De-noising, mean square error (MSE), Melanoma, peak signal to noise ratio (PSNR), Otsu's thresholding, Skin disease, STOLZ's algorithm, dermnet, dermquest.

## I. 1.INTRODUCTION

Our human body is made up of several organs. The largest organ by its surface area is skin. It protects our human body from various disease caused by bacteria and viruses. But there are various skin diseases that affects human body. Early detection of this diseases can help to reduce great loses. For that we created a project based on MATLAB software program. This detects and recognizes the skin disease with just an image of the affected area. It involves filtering, segmentation and feature extraction. This paper proposed the diagnosisof 6 types of diseases. They are Melanoma,Basal cell carcinoma, Squamous cell carcinoma, Melanocytic nevi, Seborrhoeic keratosis and Acrochordon (Skin tags).We just need a mobile camera and computer with MATLAB software to diagnose these disease.

### 1.1 IMAGE PRE-PROCESSING STEPS

Image Conversion – It is the process of converting the image from one form to another form like RGB to Grey or RGB to Binary etc., to convert the image to more suitable form for further processing. Function used for rgb to gray conversion is rgb2gray() and for gray to binary conversion is imbinarize().

Image Enhancement – It is the process of enhancing the quality of an image for better understanding. It includes various methods such as filtering, smoothening, sharpening etc.,

Image filtering – It is the process of denoising the image by removing unwanted noise while preserving edges. Mostly used image filters are median filter ,Gaussian and butterworth filter.

Image Segmentation – It is the process of dividing the image into several segments for further minute analysis and understanding fine details about an image.

Edge Detection –It is the process of finding the boundaries of the objects within the image. It is used to extract theparticular information from the image.

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1.2 PRE-PROCESSING TECHNIQUES USED

Using RGB to Gray scale and gray scale to binary conversion, the image is initially pre-processed. The image enhancement process is done by removing the unwanted pixels and noise present in image using Butterworth Highpass Filter and Median Filter.

Otsu thresholding is a segmentation algorithm used in the proposed model through which we can segment an image into two or more than two regions followed by edge detection.

Edge detection - It is also a segmentation process to detect strong and weak edges.Here we use canny edge detection because of its effectiveness.

1.3. DATA SET DESCRIPTION

We compiled our dataset by collecting images from DERMNET and KAGGLE.

DERMNET DATASET: It is an online medical datasets for skin disease. There are thousand of images in the DermNet dataset with various skin disease. For our experiment, we have chosen 200 images for training and also 60 images for testing operation.

KAGGLE DATASET: The Kaggle dataset consists of almost eleven thousands and above skin disease images with multiple types of lesions. We have selected 260 images for training and 80 images for testing.

1.4 RELATED WORK

Arifin S [1] developed a system for Diagnosingdermatological disease using Color-Skin Images. In this, the system is proposed for the dissection of skin diseases using color images without the need for doctor intervention but the accuracy is decreased from first stage to second stage.

Yasir, R [2] developed a method for dermatological disease detection using Image processing and Artificial Neural Network but artificial neural network increases the complexity.

Joseph, R [3] explained the Segmentation methods for computer aided melanoma detection but this type was restricted to only for one type of cancer detection.

Alam, N [4] proposed Automatic Detection and severity measurement of eczema using Image processing but this was restricted to detection of only one disease.

Zeljkovic, V [5] developed Supplemental melanoma diagnosis for darker skin complexion gradients but it was applicable for only darker skin.

Kumar, V [6] used computer vision to extract the features from the image and machine learning to detect skin diseases. This was limited to certain skin diseases alone.

Shamsul Arifin, M [7] proposed a model which works on two different steps : Disease detection and Identifying the type of disorder using various techniques such as k-means clustering, colour image processing etc., But the working procedure used here is complex .

MdNafiulAlam [8]proposed an automated method of detecting the skin disease like eczema using computer algorithms and image processing. This by itself computes the required features and factors as well as various skin attributes. But it requires more time as well as expensive.

Md. Ariful Islam [9] work only focus on Arsenic proved to be highly toxic substance to human skin. He proposed a model that uses image processing to analyse, create and find features to process the information and to detect the disease.

## II. SKIN LESIONS DETECTION SYSTEM

Skin is one of the sensitive parts of our body. It protects our human body from various disease caused by bacteria and viruses.

2.1 METHODOLOGY

Initially, the images in the datasets are trained and all features are stored in data base by using Stolz'sfeature extraction techniques and MSVM classifier for database creation.

Then theGUI is created within Matlab for ease access to the user and to visualize the process flow and outcome of diagnosis.

Fig 2.1 shows the Block diagram of Proposed Technique. Then Image pre-processing techniques are performed to pre-process the image and enhances quality. It aims at converting a image into a more suitable and usable form.

Here median filter is used to remove noise while preserving edges. Then image segmentation is performed to convert the image into a form which clearly identifies and marks the region of interest.The image is converted into a binary image.

Then otsu'sthresholding is carried out to minimize the within class variant and maximize the between class variant.

The image components that are useful in representation and description of region. The shapes are extracted using morphological operations.

After that, edge detection is used for image segmentation and data extraction by finding the boundary of objects within images.

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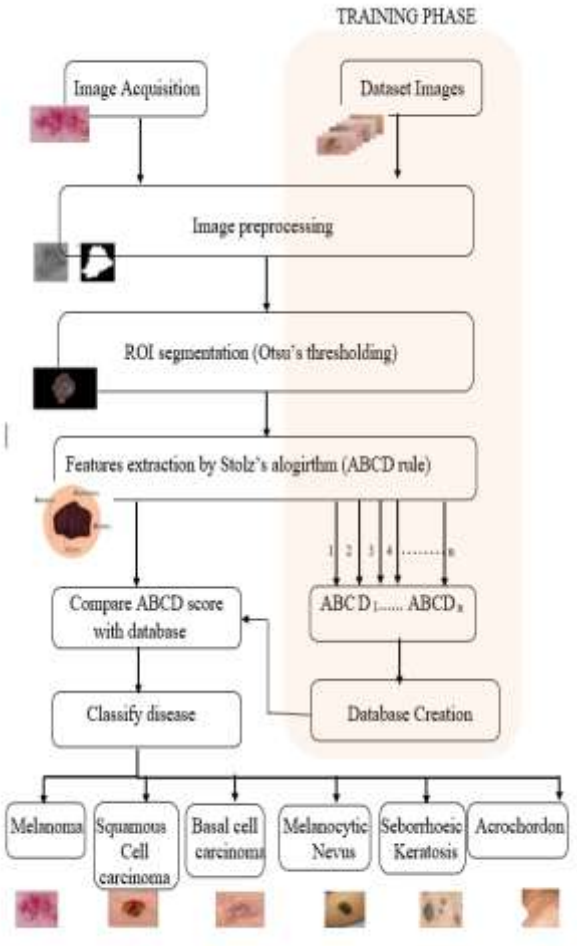


Fig 2.1

In this canny edge detection is used for better accuracy and effectiveness. The segmented lesion from the healthy skin is displayed and further used for feature extraction. In feature extraction, STOLZ's algorithmis used to extract unique features of lesions with the help of ABCD rule.ABCD extracts some of the major attributes to distinguish skin lesions. Those attributes are

1. **Asymmetry** is an essential parameter in differentiating malignant tumour from benign lesions.

Asymmetry Index (AI) = $\Delta A/A$,
where $\Delta A$ =lowest absolute value difference between subregions,
A = Total pixel count of lesion.

2.**Border Irregularity/Compact Index** is used for the measurement of the most popular form of barrier which estimates unanimous 2D objects. This measure is very sensitive to noise along the boundary.

Compactness Index (CI) = $P^2/4\pi A$ where P = Perimeter of the Lesion,
A = Area of the Lesion.

3.**Colour Score**of an image may range from 1 to 6 as per the colour of the image. The six suspicious colours are white, red, light-brown, dark-brown, blue-gray, black.

C = W+R+LB+DB+BG+B

Where W – white ,its value may 0 or 1
R – Red , LB – light Brown, DB –Dark Brown, BG –Blue Gray, B- Black

4.**Diameter** is also a lesion determining factor. The diameter greater than 6mm or growing is considered as melanoma.

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**Table 3.1:**ABCD rule algorithm score

| Attribute | Score | Multipli -cation factor | Description |
|---|---|---|---|
| Asymmetry | 0-2 | 1.3 | 0- Biaxial Symmetry, 1- Monaxial Symmetry, 2- Biaxial Asymmetry |
| Border | 0-8 | 0.1 | Abrupt ending of pigment pattern at the periphery in 0-8 segments |
| Colour | 1-6 | 0.5 | Presence of up to six colours 1-6 (white, red, light-brown, dark-brown, blue-gray, black) |
| Diameter | 1-5 | 0.5 | Diameter greater than 6mm |

After feature extraction, the detection of disease is performed. The segmented image and the ABCD score are then compared to trained database created earlier for similarities.From the similarities obtained the type of disease is declared from the sixtype skin lesions using Multi class SVM classifier.

## III. RESULT AND DISCUSSION

Graphical User Interface(Fig 3.1) is created for ease access for users by adding the essential components(Fig 3.2) for visualizing the process.

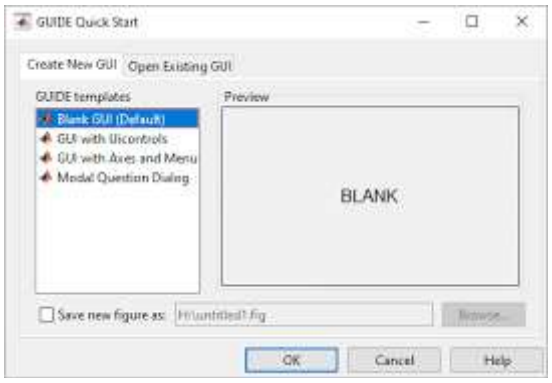


Fig 3.1

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Fig 3.2

The image(Fig 3.3) captured for diagnosis is loaded onto the GUI for color conversion (Fig 3.4) .


Fig 3.3


Fig 3.4

And in the backend the image is denoised and enhanced (Fig 3.5) using butterworth and median filter.


Fig 3.5

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The lesion/disease affected region is segmented from the background(Fig 3.6) by using Otsu's thresholding method followed by canny edge detection.


Fig 3.6

The unique features(Fig 3.7) of skin lesions (Assymetric Index, Compactness Index, Color factor, Diameter) are extracted by applying Stolz's algorithm and ABCD rule.


Fig 3.7

The system declare the disease(Fig 3.8) by comparing features of input image to the features of image in database.

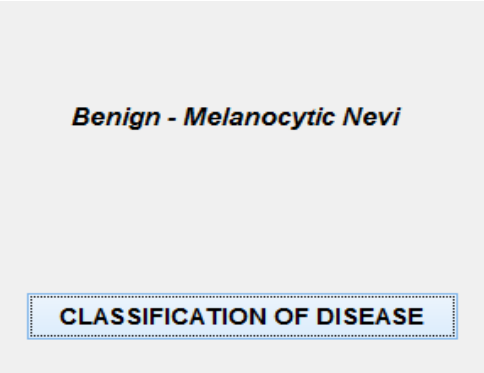


Fig 3.8

The outcome (Fig 3.9) of the proposed method is analyzed on the statistical performance and gives expected output with cross validation accuracy of 94%.

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Fig 3.9

3.1.PERFORMANCE ANALYSIS

The value of sensitivity and selectivity are calculated by True Positive(TP),True Negative(TN), False Positive(FP), False Negative(FN).The classification accuracy focuses on the specificity and sensitivity. The accuracy is calculated as follows:

Accuracy = (TP+TN)/(TP+TN+FP+FN)
The sensitivity is calculated as follows:
Sensitivity = TP/(TP+FN)
The specificity is calculated as follows:
Specificity = TN/(TN+FP)

| **Dataset** | **Dataset 1 (Malignant)** | | **Dataset 2 (Bening)** | |
|---|---|---|---|---|
| | **DermNet** | **Kaggle** | **DermNet** | **Kaggle** |
| **Sensitivity** | 95.12% | 97.37% | 94% | 96.68% |
| **Specificity** | 80% | 83.33% | 90% | 95% |
| **Accuracy** | 94% | 94% | 92.86% | 96.68% |

Table 3.2

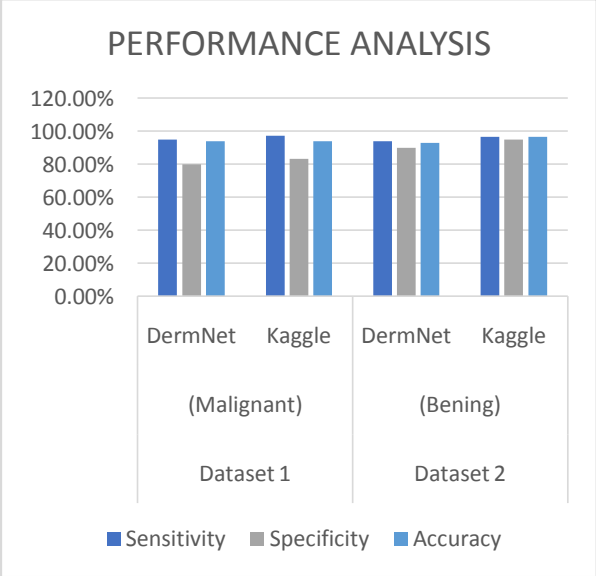


Fig 3.10 Graphical Result

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| Overall Result | |
|---|---|
| Accuracy | 94.28% |
| Sensitivity | 95.79% |
| Specificity | 87% |

Table 3.3

## IV. CONCLUSION AND FUTURE WORK

In this paper, skin lesion detection model is proposed. It concludes that the detection is carried out through various image processing technique. This gives solution for detecting six types of skin lesions such as Melanoma, Basal cell carcinoma, Squamous cell carcinoma, Melanocytic nevi, seborrhoeic keratosis and Acrochordon(Skin tags). The outcome of this model is relatively good when compared with other works.After, the system performance are analysed by accuracy, sensitivity and specificity of 94.28%, 95.79%and 87% respectively. The future enhancement would be a common model to identify all type of skin disease as a mobile application and it will work on a large dataset for more accuracy.

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