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Skin Disease Recognition using Texture Analysis

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***Abstract* — There are many skin diseases that have the similar symptoms which can be recognized using neural network which is based on the texture analysis. The many diseases like Measles, German measles and Chickenpox etc. shares the similar pattern of infection and symptoms such as redness and rashes. Diagnosis and recognition of the skin disease is the very difficult job since it requires the details of patient's history, physical examination and the laboratory results. Since many skin diseases share the similar symptoms it is very difficult to diagnosis and recognize the skin disease. Hence, a computer aided diagnosis and recognition of skin disease system is introduced. Image processing, image feature extraction and classification are the few steps involved in computer aided algorithm. Classification of the data has been done with the help of the classifier such as artificial neural network (ANN). The ANN can learn patterns of symptoms of particular diseases and provides faster diagnosis and recognition than a human physician. Hence based on the symptoms detected the patients can be treated immediately using skin disease recognition by texture analysis.**

Keywords — Skin disease; classification by NN; segmentation; GLCM features;

I. INTRODUCTION

Composed of epidermis, dermis and subcutaneous tissues, skin is the largest organ of the human body, containing blood vessels, lymphatic vessels, nerves and muscles, which can perspire and perceive the external temperature and protect the body. Covering the entire body, the skin can protect multiple tissues and organs in the body from external invasions including artificial skin damage, chemical damage, adventitious viruses and individual's immune system. Besides, skin can also avoid the loss of lipids together with water within epidermis and dermis so that skin barrier function can be sterilized. In spite of defense and barrier system, skin is not indestructible in that skin tends to be constantly influenced by a variety of external and genetic factors. The skin itself can be separated into three different layers which are epidermis, dermis and subcutaneous. The two layers that make up the human skin is known as epidermis. Meanwhile, dermis is the thick layer of living tissues below the epidermis that forms the true skin and contains a lot of important structures such as blood capillaries, nerve endings, sweat glands, hair follicles and other structures.

Recognition of human skin is an important task for both computer vision and graphics. For computer vision, accurate recognition of skin texture can greatly assist algorithms for human face recognition or facial feature tracking. In computer graphics, facial animation is an important problem which necessitates reliable skin texture recognition. In addition to computer vision and graphics, skin recognition is useful in dermatology and several industrial fields. In dermatology, the skin recognition can be used to develop methods for computer-assisted diagnosis of skin disorders, while in the pharmaceutical industry; quantification is useful when applied to measuring healing progress.

A lot of research also has been made and there are plenty methodologies have been propose in order to analyze and recognize textures of the skin disease. A scheme for automated detection of three classes of skin diseases by analyzing textures and obtained from a collection of medical images based on Gray Level Co-occurrence Matrix (GLCM). In order to give more efficient recognition accuracy of the skin disease an approach relied on both skin color and texture features (features derived from the GLCM). Texture analysis is one of the most important aspects of human vision which can classify between surfaces and objects. In the computer vision techniques provided surface texture to distinguish and recognize objects based on visual patterns of objects. A GLCM is a popular statistical method for texture analysis and it indicates the probability of object's patterns.

II. PROBLEM STATEMENT

The doctors typically have assumed diagnosis opinion, which most likely begin by searching for further

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evidence that their assumption can be validated and in cases where it is not validated, they will have missed other potential diagnosis. Additionally, if a doctor begins searching by symptoms, while this may be accurate, the order or weight given to any of the symptoms would most likely give a bias towards related diagnosis when in fact, there may be a symptom that is not given any credit and thus not included in the search or considered in timely fashion. For the regions where expert might not be readily available, dependencies on medical expert for image diagnosis are a serious challenge where expert might not be readily available, inadequate or non-responsive to an urgent medical need. The before mentioned problems suggest that a better and manageable solution is needed urgently with the view to minimize these dependencies and human bias, thus leading to our research question.

III. LITERATURE SURVEY

Human skin is a standout amongst the most troublesome surface to analyze because of its unpredictability of uneven edge, tone, presence of hair and other mitigating feature. Skin is the surface of the body having some texture; unhealthy skin has variety in the texture from healthy skin malignant melanoma at present records for a third most frequency type of skin disease and 79% of skin cancer death. The rate of harmful melanoma in fair-skinned patients has increased histrionically in most parts of the world in the course of recent decades.

In Europe, it's been reported that harmful melanoma frequency is increase by 5% consistently and it is responsible for 91% of skin tumor death. In an offered to enhancing early identification, various symptomatic agendas and principles have been proposed, for example, Seven Point Checklist and ABCDE: Asymmetry, Border, Color, Diameter, Evolution agenda. These standards and agendas indicate visual elements related with dangerous injury manifestations [2]. This paper, built up a diagnosis scheme for dermoscopic pictures, getting to the Asymmetry (A), Border (B), Color (C), and Diameter (D) of various picture structures. This ABCD run turned into the standard in dermoscopy for arranging PSL into generous, suspicious or harmful moles (melanoma). Likewise, visual understandings of these components by dermatologist have so far proven to be difficult task [1].

Priyanka et al [3] developed a system which utilizes for the classification of Malignant Melanoma from other different skin disease are Digital Image Processing Techniques and Artificial Neural Networks. Dermoscopic pictures were gathered and different Image processing methods were applied. With the help of segmentation the cancerous region is isolated from healthy skin. 2-D Wavelet Transform is utilized for feature extraction from segmented pictures. In light of the feature, the pictures were named Cancerous and Noncancerous.

Y. P. Gowramma et al. [4] insisted to investigate and recognize textures in a computerized form and a computational approach for analyzing visible texture by localizing spatial changes in the frequency, orientation, or phase of the texture using 2-D. Data extract from the Curve lets responds are used to recognize phase discontinuities inside a texture. A statistical and structural technique to model texture construct designs based on the symmetric Gray Level Co-occurrence Matrix (GLCM). Coarseness is the measure of granularity of a photo, or typical size of area that have a comparative force, complexity is the measure of clarity of the surfaces influenced by the utilization of confirming highly contrasting powers, directionality is the measure of headings of the dark esteems inside the photo. The standard focal point on surface based arrangement has been decided the interior pixel structure of picture district since overall these methods neglect to recognize convoluted edges and minimal restricted component.

A framework proposed by author which melanin and hemoglobin shade substance is extricated from a solitary skin shading picture by free part investigation [5]. There are numerous systems that were planned to examine ailments as by and large however a couple for skin sicknesses determination; MYCIN is a decent framework for diagnosing bacterial maladies.

IV. PROPOSED METHODOLOGY

Image Processing and classification are the two major steps involved in the Skin Disease Classification System. This method involves five major steps, i.e. Image acquisition, Pre-Processing, Segmentation, Feature Extraction and Classification using neural network. Once all the five steps are completed finally decision phase is used to evaluate whether the skin is affected with disease or not.

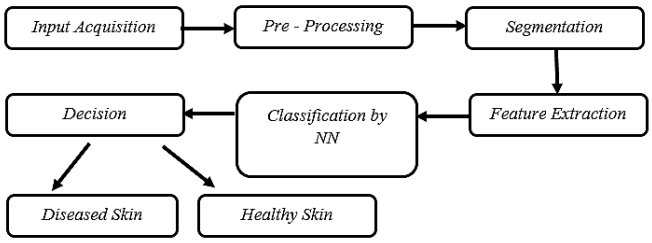

Fig. 1: Block diagram of Skin Disease Classification System

A. *Input acquisition*

Image acquisition in image processing is the first step in the workflow sequence where the input images are obtained either by capturing the image through camera or collecting the image directly from the database. Further processing is not possible if there is a no image.

B. *Pre-processing*

The unwanted distortion is eliminated from the image data using Pre-processing method. In order to get the accurate feature classification results the image is resized to a uniform scale of 360X360. The image then converted from RGB to grey scale image. Segmentation and contrast enhancement are applied to obtain the better-quality image. The hairs and other pigments present in the sample are eliminated by median filtering.

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C. Segmentation

The process of subdividing a digital image into a multiple segment is known as segmentation. This process is important in order to simplify the image and make the process easier to understand and analyze. Here segmentation process is mainly concentrated on affected skin. For segmentation Maximum Entropy Thresholding method is used.

D. Feature Extraction

Feature extraction is used to differentiate between input patterns. It is a very difficult step which mainly depends on the performance of the classifier. The Grey Level Co-occurrence Matrix (GLCM) is used for feature extraction in texture analysis. GLCM is a powerful tool for image feature extraction that maps the grey level co-occurrence probabilities based on spatial relations of pixels in different angular directions. The feature extracted GLCM consist of four features i.e.

1) Energy: It returns the sum of the squared elements in the GLCM and it ranges from 0 to 1. For constant image energy is equal to 1.
2) Correlation: it ranges from -1 to 1 for a perfectly positively or negatively correlated image.
3) Contrast: Returns a measure of the intensity contrast between a pixel and its neighbor over the whole image
4) Homogeneity: it measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal. Here the values range from 0 to 1. Homogeneity is 1 for the diagonal GLCM.

E. Classification

Using neural network classifier, the segmented images are classified. In this system it mainly consists of three layers Input layer, hidden layer and Output layer. Here training is done using Black Propagation Algorithm (BPN) for the classifier. The hidden layer and output layer work in adjusting weights value based on the error output in classification of different features. The signal flow is in the forward direction in BPN algorithm. An error signal is generated when the output does not match with output generated by the network each time which has been compared with desired output. The error signal is propagated backward to the input layer and the weights in the hidden layer are adjusted hence the error signal is reduced. In the beginning of the training the input and the hidden layers are randomly initialized during BPN algorithm. The process will be continued until the error reaches zero.

V. EXPERIMENTAL RESULT

Images from the database of Dermnet Skin disease atlas were retrieved and used as input images. Three common skin diseases: Eczema, Impetigo and Psoriasis were considered for the skin disease classification system. Fig. 2 shows the sample images used as input images.

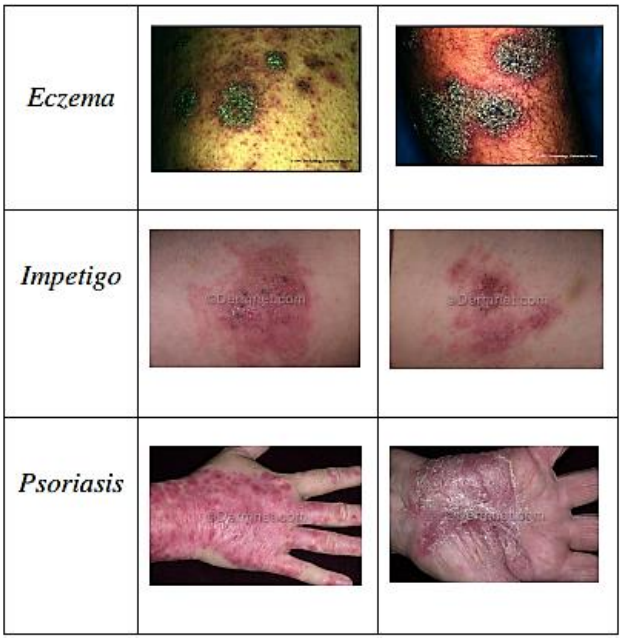

Fig. 2: Sample of Skin Disease Images

The converted gray scale, contrast enhanced and median filtered sample images are presented in Fig. 3. Then, suspicious regions of the pre-processed skin images are segmented using Maximum Entropy Thresholding to separate the diseased skin from healthy skin. Fig. 4 represents the sample of diseased and healthy skin segmented images respectively.

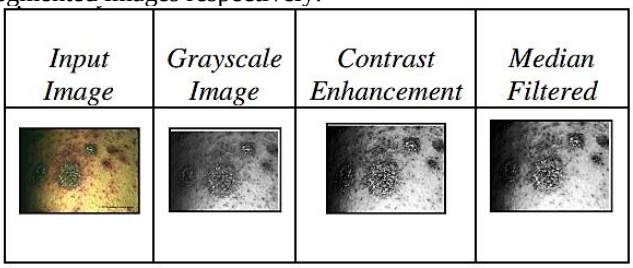

Fig. 3: Pre-Processed Sample Images

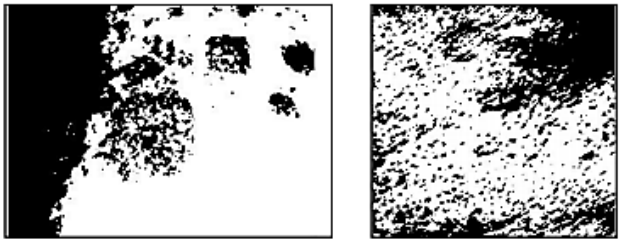

Fig. 4: Sample of Segmented Images

GLCM features were used for feature extraction and neural network for classification. After segmentation, GLCM features are extracted for each sample image as given in Table 1. Contrast, Correlation, Energy and Homogeneity are the features selected as input fed for the input layer of neural network.

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Table 1: Extracted Features of Sample Images

Features	Affected Skin	Healthy Skin
Contrast	4.1819	7.7104
Correlation	0.8829	0.6676
Energy	0.4400	0.3940
Homogeneity	0.9253	0.8623

The extracted features are divided into training and testing dataset, where 50% of the images from each group are used to train the system and rest of the images serves as the testing set. The output '0' represent healthy skin and '1' represent skin that affected by disease. The classification of the skin disease is represented in confusion matrix as given in Fig. 5 whereby 12 sample images were correctly classified and 3 sample of images were misclassified. The overall performance of the system is calculated in terms of 80% accuracy, 71.4% of sensitivity and 87.5% of specificity.

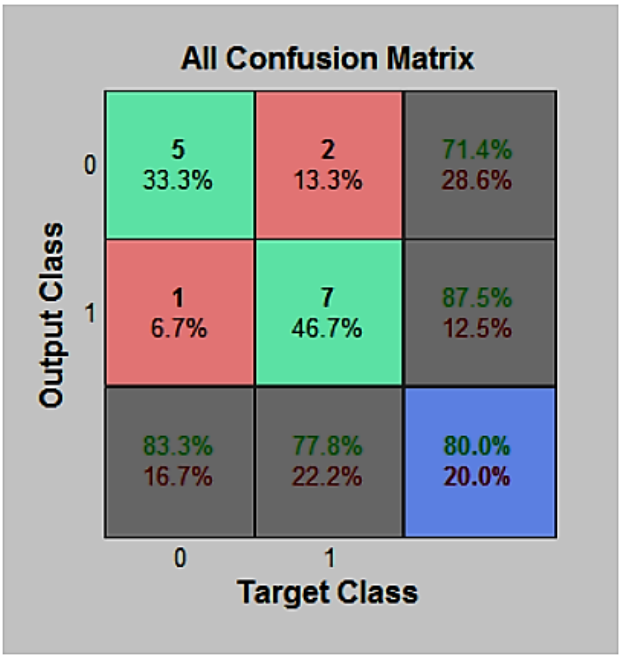

Fig. 5: All Confusion Matrix

VI. CONCLUSION

The skin disease recognition using texture analyses can be determined using neural system determination of skin illness and can be achieved through the various steps like image acquisition, feature extraction, classification, very much characterized division and arrangement method. Using back propagation algorithm, we can diagnosis the multiple skin diseases as well as classify skin disease. The numerous images are recorded and determination of skin diseases is using texture analysis. The collected skin disease images are set together gives practical, less demanding and quicker finding for understandable ranges. These helps in identifying the disease earlier and patient can be treated immediately. This also enhance the general productivity and also reduces the computational time.

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