Skin Disease Recognition Using Texture Analysis

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ABSTRACT —This paper describes skin disease recognition by using neural network which is based on the texture analysis. There are many skin diseases which have a lot of similarities in their symptoms, such as tinea corporis, ringworm, psoriasis and ezchema etc. In general, these diseases have similarities in pattern of infection and symptoms such as redness and rash. Diagnosis and recognition of skin disease take a very long-term process because it requires patient's history, physical examination and proper laboratory diagnostic tests. Not only that, it also requires large number of features clinical as well as histopathological for analysis and to provide further treatment. The disease diagnosis and recognition become difficult as the complexity and number of features of the disease increases. Hence, a computer aided diagnosis and recognition system is introduced. Computer algorithm which contains few steps that involves image processing, image feature extraction and classification of data have been implemented with the help of classifier such as support vector machine (SVM). The SVM can learn patterns of symptoms of particular diseases and provides faster diagnosis and recognition to assist the physician in patient treatment.

INTRODUCTION

Biggest organ of human is a skin, mass of it is approximately around 4 kg to 5 kg. The skin have the surface area of about 1.2 $m^2$to 2.2 m^2. It has many functions and especiallyitisoneofthemostessentialorganforhumanbeing.
Among the uses and functions of the skin are protecting the body, adjusting the temperature of the body and used for the sense of touch as well. 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.

The appearance of human skin is hard to be model and analyze due to its complex surface with fine scale geometry. The complexity of the uneven edge, tone, presence of the hair and other mitigating features caused the skin difficult to be analyze. Its structure consists of Melanin and hemoglobin pigments in the structure. Thus, slight variation of pigment structure will cause the color of the skin change. Human skin have some different kinds of textures which diseased skin can be differentiate between the textures of the healthy skin. It is very important to take a really good care of the skin care. This is because, if the skin diseases are not treated earlier, it might leads to the spreading of the infection from one part of the body to the other parts of the body. Not only that, it might also leads to the spreading of the infection to the people surrounding. A lot of observations can be made regarding the nature of the skin just by analyzing the skin texture and the color of the skin. In order to design the system for the recognition of the skin disease, there are a few steps that must be taken which are including image processing, segmentation of the image, image feature extraction and data classification using neural network. The most difficult part in designing the skin disease recognition system is to identify the disease itself. This difficulty is due to the huge similarities between different classes.

In addition, the common symptoms shared by these skin disease leads to the confusion in detecting and recognizing the exacttypeofskindiseasefacedbythepatients.Therearemany papersthatdescribetheapplicationsofartificialneuralnetwork in medical decision making. 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 methodfor texture analysis and it indicates the probability of object'spatterns.

CLASSIFYING METHODS

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 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. 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). Be that as it may, dermoscopic diagnosis is regularly complex and subjective, in this manner related with poor reproducibility and low precision particularly among dermatologist, as the exactness of specialists is 65-84%. Likewise, visual understandings of these components by dermatologist have so far proven to be difficulttask. Priyanka et al 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 Non-cancerous. In diagnosis of skin disease using image processing the important task is to identify the skin based on the histogram and mixture Gaussian models in skin detection and it is proved histogram models are predominant as far as accuracy and computational cost. Alongside color, texture feature are likewise assume imperative part in grouping of skin disease. Authors [5] proposed system to detect disease states of human skin by examining skin surface pictures using a set of normalized symmetrical Grey Level Co-occurrence Matrices. There was system developed for psoriasisdetection using color and texture feature. To classify different disease from erythemato-squamouss class a system will be design**e**dby using artificial neural network and in which melanin and hemoglobin pigment content are extractedfrom a single skin color picture by independent component analysis (ICA). In this system, the scattering in the skin is demonstrated in a simple linear form in the optical area in which reverse optical scattering is performed by simple inverse matrix operation. There was a plan for automatic recognition of three classes of skin disease by analyses texture acquired froman accumulation of medicinal pictures, using feature based on Gray Level Co-occurrence Matrix (GLCM) and using neural network as classifiers.Another method in which the spatial distribution of pigment in foliage which lead to color variety are isolated by independent component analysis (ICA) from a single leaf color picture. Texture analysis and estimations in light of a measurable way to deal with the example acknowledgment are proposed and contrasts in color and coarseness of skin are quantitatively. This approach depended on both skin color and texture feature (highlights gotten from the GLCM) to give a more efficient recognition accuracy of skin maladies. Feed forward neural network were used to classify input pictures to be psoriasis infected or non-psoriasis infected. A fast fixed-point type algorithm that is capable for isolating complex valued, linearly mixed source signals is exhibited and it is guaranteed to be robust against outlier and computationally simple. There are a way to deal with feature extraction which contain picture textural qualities, for example, homogeneity, grey tone linear conditions, contrast, number and nature of boundaries present and the complexity of the picture. The Run Length feature to classify the focal lesion in ultrasound live pictures. The general classification ccuracy using neural networks was observed to be 83%. Eduardo et al review the non-linear Independent Component Analysis and its applications to visually impaired source separation. Y. P. Gowramma et al. suggested to investigate and recognize textures in a computerized form and a computational approach for analyzingvisible 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.

TYPE OF SKINDISEASE

There are a couple kind of sickness that can be describedas skininfectionatfirstisTinea Corporis.Tinea corporis is a superficial fungal infection. It may have a variety of appearances, most easily identifiable are the enlarging raised red rings with a central area of clearing. The same appearances of ringworm may also occur on the scalp, beard area or the groin. Other classic features of tinea corporis include:

- The edge of the rash appears elevated and is scaly to touch.
- Sometimes the skin surrounding the rash may be dry and flaky.
- Almost invariably, there will be hair loss in areas of the infection.

Second skin malady is Ringworm.Ringworm occurs in people of all ages, but it is particularly common in children. It occurs most often in warm, moist climates. Ringworm is a contagious disease and can be passed from person to person by contact with infected skin areas or by sharing combs and brushes, other personal care items, or clothing. It is also possible to become infected with ringworm after coming in contact with locker room or pool surfaces. The infection can also affect dogs and cats, and pets may transmit the infection to humans. It is common to have several areas of ringworm at once in different body areas.

The third type is Psoriasis**.** Psoriasis is a long-lasting autoimmune disease characterized by patches of abnormal skin. These skin patches are typically red, itchy, and scaly. There are five main types of psoriasis: plaque, guttate, inverse, pustular, and erythrodermic. Plaque

psoriasis, also known as psoriasis vulgaris, makes up about 90 percent of cases. It typically presents as red patches with white scales on top. Areas of the body most commonly affected are the back of the forearms, shins, navel area, and scalp. Guttate psoriasis has drop-shaped lesions. Pustular psoriasis presents as small non-infectious pus-filled blisters. Inverse psoriasis forms red patches in skin folds. Erythrodermic psoriasis occurs when the rash becomes very widespread, and can develop from any of the other types. Fingernails and toenails are affected in most people with psoriasis at some point in time. This may include pits in the nails or changes in nail color.

PROPOSEDMETHODOLOGY

The proposed methodology involves two sections: Image ProcessingandClassification.Figure1representstheoverview of the system in block diagram. The method involves the following steps: Image acquisition, Pre-Processing, Segmentation,Feature Extraction Classification using neural networkandfinallydecisionphasetoevaluatetheskindisease.

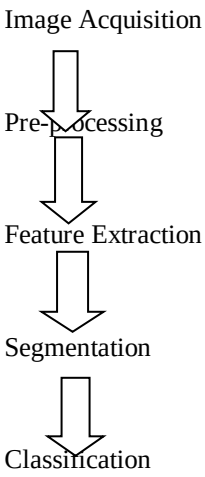

Fig1. Block Diagram of Skin Disease Classification System.

A. InputImage

Input image is obtained through the process of image acquisition. The process involves either capturing an image from a camera or retrieving images directly from image database. Image acquisition in image processing is the beginning step in the workflow sequence thus, without an image, no further process is possible.

B. Pre-processing

The pre-processing is a modification of the image data that eliminates unwanted distortions or enhances image features to ease further processing. First, the image is resized to a uniform scale of 360x360 so that it supports feature classification withaccuracy. The images are then converted from RGB to grayscale. To improve the image quality for better performance during segmentation, contrast enhancement is being applied. Sometimes, hairs and pigments which existed in some of the images to be used would confuse the analysis. Therefore, all of the unwanted elements or noise would be eliminated by median filtering.

C. Segmentation

Segmentation of image is the process of subdividing a digital image into its constituent parts or multiple segments (sets of different pixels). This process is important in order to simplify an image into something that is more meaningful and easier to analyze. In terms of skin disease classification, the affected region in the image is being segmented. In another word, image segmentation is the process of assigning a labelto every pixel in an image such that each pixel with the same label share certain visual characteristics, this process used Maximum Entropy Thresholding method forsegmentation.

D. FeatureExtraction

To differentiate between each input patterns, feature extraction is used. It is a very crucial step that greatly influences the performance of the classifier. The features selection is based on texture analysis using Grey Level Co-occurrence Matrix (GLCM). GLCM is a powerful tool for imagefeatureextractionthatmapsthegreylevelco-occurrence probabilities based on spatial relations of pixels in different angular directions. The features extracted from GLCM consist of Energy, Correlation, Homogeneity andContrast:

Energy: Ranges from 0 and 1. It returns the sum of squared elements in the GLCM. For a constant image, energy is1.

Correlation: 1 or -1 for a perfectly positively or negatively correlatedimage.

Contrast: Returns a measure of the intensity contrast betweenapixelanditsneighboroverthewholeimage.

Homogeneity: The values range from 0 to 1. Returns a value that measures the closeness of the distribution of elements in the GLCM to the GLCM diagonal. Homogeneity is 1 for a diagonalGLCM. After segmentation, GLCM features are extracted for each sample image as given inTable1.

Fig 2. Sample of Skin Disease Images.

EXPERIMENTALRESULTS

ImagesfromthedatabaseofDermnetSkindiseaseatlaswere retrieved and used as input images. Three common skin diseases:Eczema, Ringworm, Tinea CorporisandPsoriasiswereconsideredfor the skin disease classification system. Fig. 2 shows the sample images used as inputimages.

Original image Gray scale image

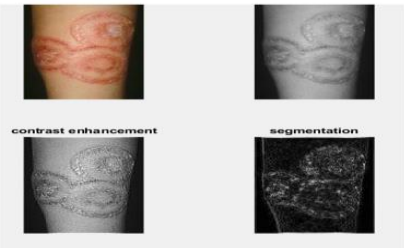

Fig 3. Image Processing:The converted gray scale, contrast enhanced and Median filtered images. Then, suspicious regions of the pre-processed skin images are segmented usingWatershed algorithm.

Diseases	Contrast	Correlation	Energy	Homogeneity
Tinea	4.266	-0.00956	0.00464	0.0507
Ringworm	1.0542	0.0079	0.00211	0.0354
Psoriasis	3.550	0.0025	0.00549	0.0054
Ezchema	6.889	0.0033	0.00131	0.0301

Table1. GLCM Features extracted after segmentation.

CONCLUSION

This work describes skin disease recognition by using neural network which is based on the texture analysis. There are many skin diseases which have a lot of similarities in their symptoms, such as tinea corporis, ringworm, psoriasis and eczema etc. Diagnosis and recognition of skin disease take a very long-term process because it requires patient's history, physical examination and proper laboratory diagnostic tests. Not only that, it also requires large number of features clinical as well as histopathological for analysis and to provide further treatment. The disease diagnosis and recognition become difficult as the complexity and number of features of the disease increases. Hence, a computer aided diagnosis and recognition system is introduced. Computer algorithm which contains few steps that involves image processing, image feature extraction and classification of data have been implemented with the help of classifier such as support vector machine (SVM). The SVM can learn patterns of symptoms of particular diseases and provides faster diagnosis and recognition than a human physician. The speed and efficiency of the system can further be improved by using the other segmentation and classification methods.

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