Image Analysis Model For Skin Disease Detection: Framework

Alaa Haddad
department of electrical and computer engineering, IIUM university
KL, Malaysia
haddad.alaa@live.iium.edu.my

Shihab A. Hameed
department of electrical and computer engineering, IIUM university
KL, Malaysia
shihab@iium.edu.my

***Abstract* — Skin disease is the most common disease in the world. The diagnosis of the skin disease requires a high level of expertise and accuracy for dermatologist, so computer aided skin disease diagnosis model is proposed to provide more objective and reliable solution.**
Many researches were done to help detect skin diseases like skin cancer and tumor skin. But the accurate recognition of the disease is extremely challenging due to the following reasons: low contrast between lesions and skin, visual similarity between Disease and non-Disease area, etc.
This paper aims to detect skin disease from the skin image and to analyze this image by applying filter to remove noise or unwanted things, convert the image to grey to help in the processing and get the useful information. This help to give evidence for any type of skin disease and illustrate emergency orientation.
Analysis result of this study can support doctor to help in initial diagnoses and to know the type of disease. That is compatible with skin and to avoid side effects.

Keywords— skin disease detection, image classification, image segmentation.

I. INTRODUCTION

Skin is the largest organ in human body, which is important to cover human bone, and to protect human [1] from any harm, fight the bacteria and other kind of diseases, and may have numerous potential abnormalities.

Several factors may affect the skin directly or indirectly and cause diseases which can be treated with specific medicine and others require doctor's consultation.

This paper will help people to know what are the required procedures for treatment of skin disease [2] by analyzing the image and extract useful information that help to show the infected skin area and classification of image based on the kind of skin disease, and show emergency medical services if it is possible and normal to reassure people.

There are many skin diseases including skin cancer, eczema, allergies. The focus of this paper will be of four types of most common dermatological, where the image will be taken either directly from the mobile camera or choose it from database and then analyzes the image and isolate the skin area and extract the affected area. The most common skin diseases discussed in this paper are: Acne, Psoriasis, Melanoma, Heat Rash. In acne [3] condition it includes whiteheads, blackheads, red and inflamed patches and it occurs mainly on face and shoulders. Psoriasis is a harmful and hazardous [3] form of skin disease, with increasing rates and subjectivity in a different type of current clinical skin detection global methods, there is a need for skin disease detection decision support system in which feature extraction is a sharp critical and valuable step in skin disease decision support system. In this paper the percentage of validation and accuracy was 90.09% and it's achieved by using KNN (Neural Network) algorithm. Melanoma is the most dangerous form of skin cancer [4] if left untreated. the rates of melanoma have been increasing, especially among young adults, but survival rates are high if detected it early. Unfortunately, the time and costs required by dermatologists to check all patients for melanoma are very expensive. There is a need for an automated system to assess a patient's risk of melanoma using images of their skin diseases. The percentage of validation and accuracy in this paper was 82.5% by using MSIM algorithm to achieve better result. Dermatologists [4] could use the system to help to diagnose without the need for special or expensive equipment. The last one is Heat Rash or Prickly Heat, caused by excess sweating and inadequate evaporation of the sweat. If this occurs at the surface of the skin, small vesicles (blister-like sacs containing fluid) which are not inflamed, occur on the skin surface (miliaria crystallina). These blisters last only a few hours and burst spontaneously.

While several research papers analyze Only one disease like Melanoma cancer scope [4] Depend on digital images to detect apart of lesion area easily and propose skin lesion segmentation algorithm to segment lesion area and extract features and classify the region if it is normal or lesion in terms of the risk of melanoma. Also analyze the skin disease using texture analysis of skin image [5] and by comparing the test image to a defined images or reference images. The matching of test and reference images compared that yields the percentage of skin diseases in the captured skin texture image. The analysis result of this research paper is not accurate and unreliable. So that is achieving the percentage of validation and accuracy about 78%. The research of automatic detection of eczema [6] using image processing, detects eczema regions and classify the identified region as mild or severe based on image color feature and texture feature. It is achieve good result of validation and accuracy about 92%.

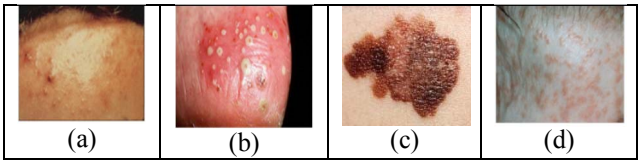

Figure 1. The skin diseases.

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In Figure 1, shows the most common skin diseases will discussed and processed in this paper, (a) Acne diseases, (b) Psoriasis, (c) Melanoma, (d) Heat Rash.
It is expected that our proposed system gives better results than the previous research mentioned because it uses two powerful algorithms K-means and Fuzzy C-means, which give better and accurate results than from others.

II. FRAMEWORK OR SKIN DISEASES MODEL: METHODOLOGY AND ARCHITECTURE

in this section, the methodology of the proposed image analysis model for skin diseases detection are discussed. the system architecture can be divided into several important steps which include: apply enhancement on the captured image, segmentation the image, feature extraction, classification, and the expected severity.

After that, need for two segmentation algorithm to be used in this model, firstly: apply the segmentation algorithm for skin detects to produce a mask for separate skin area in the picture. When the skin area is separated, then used the second segmentation algorithm to get the disease area in the skin area.

the result of this research paper proposed shown in Figure 2, we will notice these steps a,b,c below:

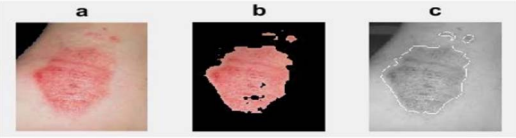


Figure 2. Diseases segmentation.

The model architecture can assume in several steps shown in Figure 3 that is flowchart show how analysis image and skin diseases detection.

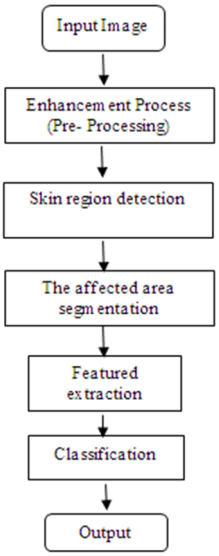


Figure 3. Image Analysis Model for Skin Disease Detection
In Figure 3 shows flowchart shows brief of several steps for the proposed skin diseases detection.

A. *Input Image:*

Input image is the first step in workflow to begin the model, so it's go through the process involves either to capture the image of the skin disease area from camera mobile or can choose image from database.
This is first and important step, because without the image, no further process is possible.

B. *Enhacement process (Pre-processing)*

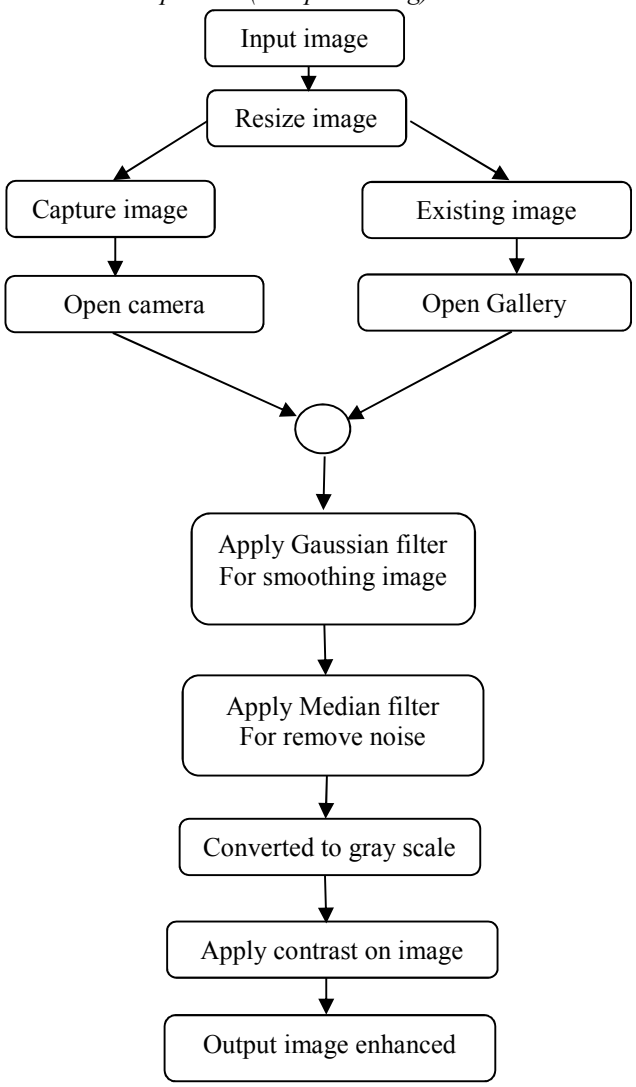


Figure 4. Enhancement process.

The enhancement process is to apply modification filter called Gaussian filter to smoothen the image either that is captured now or from database, to destroy from unwanted element in the image like noise by applying median filter. Firstly after choosing an image resizes the image to uniform scale 360x360. The image is then converted from RGB (Red Green Blue) to gray scale, then apply contrast enhancement to improve the image quality for better performance. Sometimes need to remove hair from the skin image, to analyze the image better for accurate result.

C. *Skin region detection*

For discarding non skin region pixels and make the image simpler for the next step in the processing, so will select skin regions only from the image.
To detect the skin region the image must be converted to (YCbCr) color space to different the skin image from others.

So, apply this converted state on image to convert it to blue difference and red difference and Chroma component, the skin area from all images were detected.
In some images, the diseases region colors are totally different from the skin color of the image.
Fig [5] show an example of a skin detects area. So after that we can move to the next step in analyzing process.

Figure 5. Skin region Detection.

In Figure 5, shows the output of proposed skin detection model. (a) Shows the original skin image. (b) Shows the detected skin area.

D. Segmentation

The aim of this process is to distinguish between diseases area and skin area. To detect the diseases area correctly, should apply segmentation method with high accuracy.
The best methods that give good result, the color-based segmentation method based on K-means clustering method.
Clustering is technique to divide the image into K group of cluster based on the Euclidean distance of an image pixel from a selected cluster centroid.
The algorithm firstly initialize give K for the centroid for each of k numbers of clusters by compute histogram of the image. Then add each pixel in image to this group, if the difference between pixel value and centroid value is minimum, then the clustering can be applied spatial or in color space. As the K-means algorithm the desired number of clusters C Has to be pre-defined and C initial seeds of clustering are required performing the Fuzzy C- means algorithm. Contrary to the K-means method the Fuzzy C-means is more flexible because it shows those objects that have some interface with more than one cluster in the partition. May be when apply two algorithms K-means clustering and fuzzy C-means and show the two of results and compare between them. That is lead to good accurate result with little chance of error.
The clustering algorithm is very sensitive for objects in the image, because the objects tend to have similar properties.
So, converted the RGB image into L*a*b color to describe more precisely and intensity for the color. Then segment the diseases area by using clustering algorithm. And repeat the clustering method may be three times, it's enough to reduce the local minima.
After that, will apply several image processing techniques, like erosion and dilation, were applied in the segmented eczema cluster. All the tiny holes were removed, and a continuous region of the affected area was separated
Figure 2. Shown the process of filtering the skin detect area then could process to next step.

E. Feature extraction

The aim of these steps is to extract meaningful features of the image diseases area that can help in identification and evaluation or diseases state.

- Color Features: it is the most common color features, which is the average value for color in several color channels. Color channels that is used for capture color differences were gray, Red, Green Blue (RGB), Hue and Value (from HSV color-space), Luminance and Chrominance (from YCbCr color space). In this paper, extract ten features for color features description for the diseases area.
- Texture Features: it is matrix called GLCM (Gray Level Co-occurrence Matrix) of gray scale image. It is depended texture analysis in one or more the most common method for select texture features. The texture features of image is described by tabulating how often combination of pixel with specific brightness level of skin image in specific spatial direction. The extraction features from (GLCM) matrix it is used to describe the area from contrast, energy, correlation, homogeneity.

F. Classification

Total images in database included around 100 images of healthy skin, and skin with mild diseases and with severe diseases. And the images are classified as healthy skin or mild diseases, or severe diseases images.
When different visual vocabularies are obtained then each image is described using these vocabularies, the histogram of each visual vocabulary is determined and stored in what is called feature vector, all vectors of all images represent the input to the classifier.
In this paper, classification Support Vector Machine (SVM) classifier is used; since the input data is complicated and nonlinearly then SVM with Radial Basis Function kernel is used. There are many types of radial basis functions such as Gaussian radial basis function, Multi-Quadric Functions and Thin Plate Spline Function, Gaussian function is the most commonly used.

Gaussian Function:

$$\varphi(r) = exp\left(-r^2/2\sigma^2\right)$$

III. SKIN DISEASES MODEL FUNCTIONALITY

The image analysis model for skin diseases detection mainly contains two component client and database.
Client use mobile to capture live image for the skin diseases area. Then after image captured send to database to do analysis and processing on this image.
Then will extract the output and show the result on the application and detect which skin diseases type and possibility to read more about these diseases, and know what the factors are cause this disease. And can read some advices about that. This results will help the specialist to adopt the application result as a starting point for medical diagnosis, it's could save the time in diagnosis for the patient.
When user installs the application in his phone, can easily use it when choose the photo and begin processing for 5- 10 seconds and show the result immediate. So the connect between application and database it is easy once the image

is taken, connecting to the database is created then give what is the desired.

Figure 6. Android application and database.

Mainly there are several steps for use the application and it is supposed to be implemented in the application:

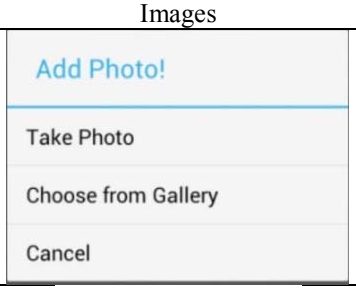
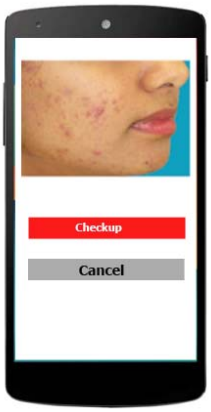
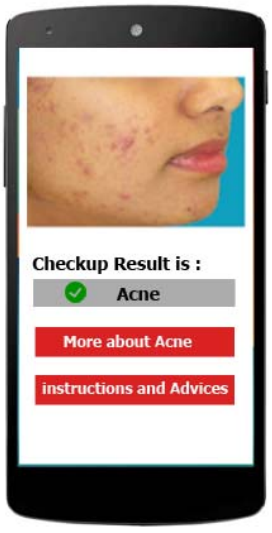
Steps	Images	Description
1		Firstly, the image can be taken from phone camera or choose exist image from gallery.
2		In this interface will display the selected image with two options: checkup to apply the algorithm to get the result of skin disease detection or cancel the process.
3		After click on checkup button will do the following : 1- Create connection between the application and database. 2- Process the image and apply enhancement and segmentation and classification to detect the skin disease accurately.
4		After detect the skin disease, will get two options - Read more: to get information about disease detected. -Recommend-ations: to give some advices how to treat this disease.

Table 2. Application interfaces.

In table 2, provides a simplified explanation of what the application has done to detect skin diseases.

IV. CONCLUSION

In this research paper can used as an effective, low cost solution for skin diseases detection by a computer aided system is proposed to resolve difficulties that's created from challenges faced from the dermatologist to recognize the different skin diseases easily.

Firstly applied enhancements to remove the noise, two noise reduction technologies were investigated. Gaussian filter and median filter were compared in the noise reduction and compared four color spaces (RGB, YUV, HSV and YCbCr) for skin lesion extraction and feature extraction and to improve computation efficiency.

This model is built in mobile application with user friendly interfaces and clearly steps.

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