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Online Prescription for Skin Diseases

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ABSTRACT

Acne vulgaris is a common skin disease that is found in all humans. There are various types of acnes according to their severity. In this research, an application was developed to segment and find out the acne on patients image. In this paper an acne detection method based on image processing techniques were processed. It is mobile based and hence very accessible even in remote areas and it is completely noninvasive to patient's skin. An image of the infected area of the skin is provided as an input to prototype by patient. Different Image processing techniques are performed on this image and corresponding disease detected is displayed at the output. This proposed system is highly beneficial in rural areas where access to dermatologists is limited.

Key words: CIELAB, Image Processing, Image segmentation, KMeans Clustering

1.INTRODUCTION

Beauty industry has become one of the largest growth industries because people care about their skins . Acne is a common skin disease occurring from blockage and/or inflammation of pilosebaceous units, which are hair follicles and their accompanying sebaceous gland (fatty gland) . In acne treatment, the first process is acne counting and classification into skin lesions including comedo, reddish papule, pustule and scar. Dermatologist has to count the acne manually and marks the spot of acne on the sheet corresponding a location of acnes seen. This method results in unreliability, inaccuracy, requires doctor's excessive effort and time wasting . Therefore, an Automatic Acne Detection System has been proposed by using computer aided detection program in recent years [3]

Many of the previous works detected the skin lesion that is taken from very close view with high resolution, in which there is only a particular acne lesion in each image. However, for this application the more challenging problem was that the images used are from different parts of the body with low resolution and contain more than one acne lesion . The main motive behind the research is to find a proper computational imaging method for automatic detection of acne using images that are taken by cell phone and then the classification of the different type of acne lesions from each other.[1,2].

2. LITERATURE SURVEY

WHO (World Health Organization) has emphasized the severity of skin diseases in India which accounts for 10 to 12 percent of India's population. There are only 6000 dermatologists present to cater to a population of 121 crore people and most of these dermatologists are concentrated in the cities. Due to this, rural areas are lacking dermatologists. So we thought of developing our model.

From the first paper we studied how to convert RGB to CIELAB color space and what was the need for the conversion. It expresses color as 3 numerical values. The L*a*b* space indicates about luminosity layer L*, chromaticity layer a* indicating where color falls along the red green axis and chromaticity layer b* indicating about where color falls along blue yellow axis [10].

In the next paper, an automatic acne detection system was proposed. The facial image was captured via a high definition web camera. The system converted acquired image to a suitable color model, which were RGB, Gray scale and Hue Saturation Value (HSV). The system did face detection then removed the background using Grab Cut image segmentation method and marked the area as the ROI. The system performed Adaptive Thresholding, BLOB detection [3].

In the next paper, we learned about the k-means algorithm , what was the need and why we choose k-means algorithm. Various clustering algorithms were compared and finally we came to a conclusion to choose k-means algorithm as it is more efficient [1].

Given paper proposes a skin disease detection method based on image processing techniques. Image processing techniques was performed on the image and the detected disease is displayed at the output. The proposed system is highly beneficial in rural areas where access to dermatologists is limited [9].

In this paper a model application for programmed skin break out discovery, sore checking and revealing through the preparing of separation picture taken by cell phones is created. The pipeline of the application is made out of body part location, skin segmentation, heat mapping, acne extraction, skin break out extraction and mass discovery. Body part discovery is practiced utilizing diverse Haar-Cascade classifiers; frontal face, right profile, left profile and middle are discriminated. [10].

3. KMEANS CLUSTERING

The main aim of K-means is to partition N observation to k clusters. The value of K can be given. Suppose there is a data set {x1,. . .,xN} containing of N examples (observation) of a random D- dimensional Euclidean variable x. The process behind it is that this method clusters the data in which inter-point distances of a group of data points are smaller compared with the distances to points outside of the cluster. To formalize this notion, we assume a prototype, μ_k, associated with the *Kth* cluster. These prototypes are representing the centers of the clusters [1] Then the goal is to find the center of each cluster such that the sum of the squares of the distances of each data point is a minimum to its closest cluster center μ_k[7].

The objective function, which is also called as *distortion measure*, is given by

$$J = \sum_{n=1}^{N} \sum^{K} r_{nk} \, \| x_n - \boldsymbol{\mu}_k \|^2$$

that characterizes the summation of the squares of the distances of each data point to its center.

The aim of segmentation using this method is to divide an image into regions, each of which has a rationally similar visual appearance or that matches objects or parts of objects. Every pixel of the image is a point in a 3-dimensional space comprising the intensities of the RGB components, blue, red, and green, and the segmentation procedure simply considers every pixel of the image as a distinct data point [7].

In our work, we took advantage of two-level k-means clustering which is a modified version of "Color-Based Segmentation Using K-Means Clustering" code. Before k-means clustering was applied, first the RGB image was converted to the L*a*b* color space. In the first level clustering, two classes or regions were assigned: skin and acne lesions. For the second level k-means clustering, three categories were assigned; from these three categories, our desired class is acne. In this method, after performing the first level of clustering, the user chooses the desired cluster for executing the second level [4].

4. METHODOLOGY

The following is the methodology adopted for the implementation of the system (Figure 1).

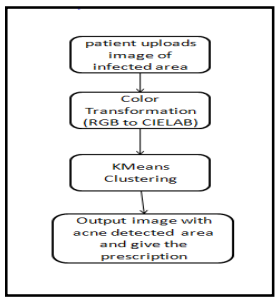

Figure 1: Methodology

The patient first needs to take the picture of infected area. Patient then takes the suggestion from system. The system first converts image to CIELAB color space. The CIELAB space contains L*, a* and b* component. The L* component tells us the brightness of the image. The a* component tells us the red to green variation. The b* component tells us the blue to yellow variation. Hence to detect acne in the image this conversion is necessary [9].

Then KMeans clustering is applied on the image which gives the clusters of acne affected area. If the acne is found then prescription is suggested to the user.

5. IMAGE PROCESSING DETAILS

After the patient uploads image, major part is K-Means clustering process. We have performed color based segmentation using K-Means clustering to identify the acne on the affected area of the human body (Figure 2) . The steps are as follows:

Step 1: Reading the image

First we read the picture utilizing imread direction utilized in MATLAB

Figure 2: Original image

*Step 2: Converting the image from RGB color space to L*a*b* color space*

The L*a*b* color space is gotten from CIE XYZ tristimulus values. The L*a*b* in figure 3 space demonstrates radiance layer L*, chromaticity layer a* showing where shading falls along the red green axis and chromaticity layer b* showing where color falls along blue yellow axis [10]. The methods makecform and applycform is utilized to change over the picture to L*a*b* color space.

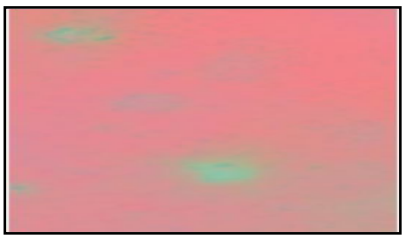

Figure 3: Image Converted to L*a*b* color space

*Step 3: Classifying the colors in a*b* space using K-Means clustering*

Clustering is an approach to isolate gathering of objects in separate groups. In K-Means clustering it is required to determine the quantity of groups to be apportioned and a distance metric to evaluate how two objects are near one another. Since the color information exists in a*b* values, objects are pixels with a* b* values.

Step 4: Labelling every pixel in the image using the results from kmeans

For every object in the image, kmeans returns an index corresponding to the cluster. Every pixel in the image can be labelled (figure 4) with its *cluster index.*

Figure 4: Image labelled according to cluster index

Step 5: Create images that can easily segment the H&E image by color

Using *pixels labels* , objects in the original image can be separated by color resulting into two images. Here two clusters (figure 5) were created . In first cluster red spot was spotted in second cluster background skin color was separated (figure 6).

Figure 5: Objects detected in cluster1

Figure 6: Objects detected in cluster 2

Step 6: Segmenting nuclei into different image

Notice that there are dark red and background color present in the clusters. It tends to be isolated utilizing L* layer in L*a*b* space as L* means the brightness value of each color. The brightness values of the pixels in each cluster can be extracted and threshold can be applied with a global threshold using *imbinarize.*

Index of the cluster containing the red objects can be determined programmatically because kmeans will not return same cluster index value each and every time. This can be done using *cluster centre* value which contains mean a* and b* values for each cluster. Finally the output image can be displayed which separates red spots from skin colour (figure 7).

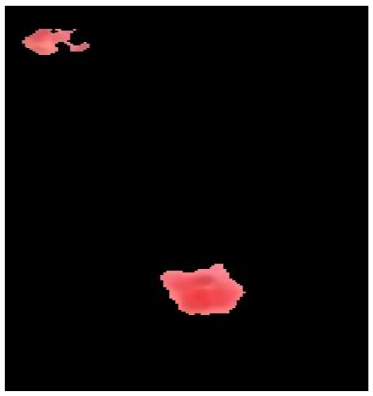

Figure 7: Final output image with acne marked

6. IMPLEMENTATION

6.1 Patient Module: The Patient Module is used by the patient to get the suggestions about the acne disease and about the causes and some primary remedies; the patients can also consult the doctors for getting an opinion and getting a online prescription.

6.1.1: Create a Patient Profile

The signup option enables to create a new profile (figure 8) for the patient, if the patient has an existing profile or an account then login using the valid credentials is required.

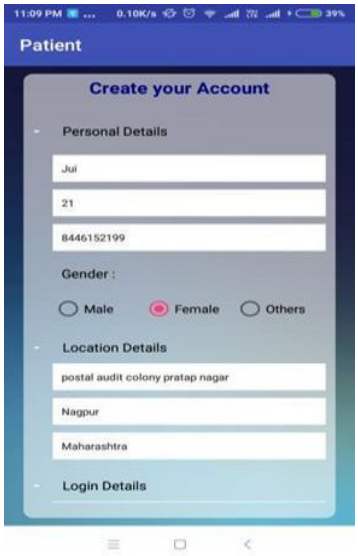

Figure 8: Create Patient Profile.

6.1.2: Selecting the Doctor

The patients can select doctor according to their preferences from the list of doctors (figure 9) that is provided and then requests for the prescription and opinion of doctor.

Figure 9: .List of Doctors.

6.1.3: Upload Image

The patient has to take an image of the affected region on the skin and by providing the name of the patient upload (figure 10) the image and this will send a notification to the chosen doctor and a case record is created and presented to the doctor.

Figure 10: Image Upload.

6.1.4: Receiving Notification

On completion of the analysis by the doctor, a prescription (figure 11) along with the summary of analysis is sent to the patient and in serious or severe cases the patient is advised to visit the doctor, the doctor sends the online prescription and a notification is sent to the patient.

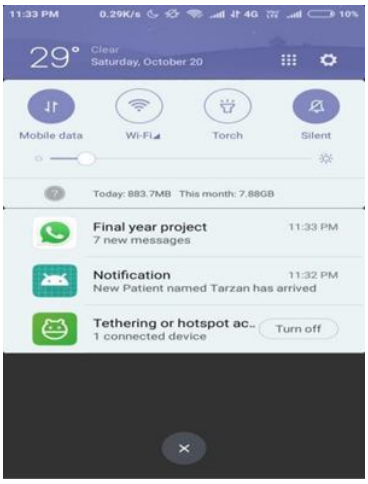

Figure 11: Prescription Notification

6.2 Doctor Module: The Doctor Module is used by the registered doctors who receive the request from the patient and analyse the images uploaded by the users by applying image processing on them and after extracting features, prescribe the medicines and send the reports and prescription back to the patient.

6.2.1: Create a Doctor Profile

The signup option enables to create a new profile (figure 12) for the doctor, if the doctor has an existing profile or an account then login using the valid credentials is required. The doctor after this step is eligible for sending prescriptions to the users. The authentication of the doctors can be done by using the registration number allotted to them by the IMA.

Figure 12: Create Doctor Profile.

6.2.2: Receiving Case

The doctors receive the patient's case (figure 13) when selected from the list of doctor and then the complete information about the case is presented to the doctor and by applying the image processing algorithm, extracts features and identifies the disease and prescribes medicines.

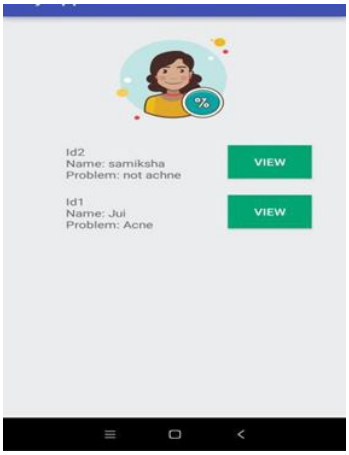

Figure 13: .New Cases

6.2.3: Upload Prescription

After the analysis and identification of the disease the doctor prescribes the medicines and also the entire analysis is stored at the backend (figure 14) and the notification about the case completion and the analysis of the case along with the entire report is presented to the user(figure 15).

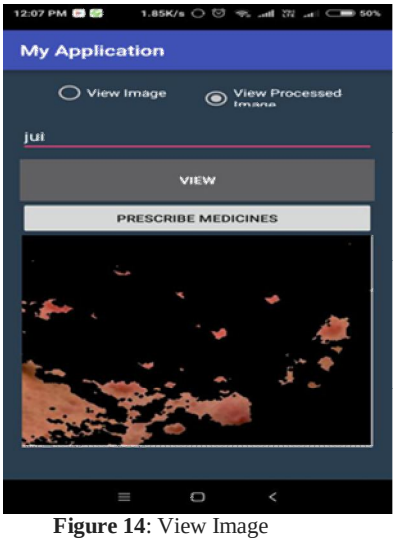

Figure 14: View Image

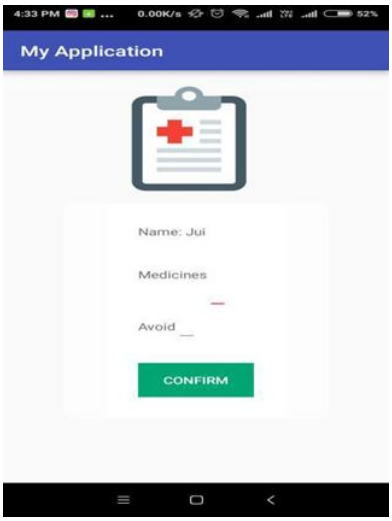

Figure 15: Send Prescription

7. CONCLUSION

This paper addresses the segmentation of acne with the help of color based segmentation using k-means clustering. The knowledge about various algorithms were gathered by surfing various IEEE papers. We were successful in separating the red spots from the background skin colour and detecting the acne out of it.

Further studies are being carried out to detect the type of acne lesion and to provide the grading. This work can aid dermatologists give the acne grading automatically and hence help in monitoring the growth of acne lesions.

8. ACKNOWLEDMENT

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