AUTOMATIC ACNE QUANTIFICATION AND LOCALISATION FOR MEDICAL TREATMENT

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ABSTRACT

Abstract— Acne quantification and localisation is the vital process for acne treatment. Dermatologist normally count the number of acne manually and mark them on a facial shape on paper. This process is tedious and prone to error. In this paper, we applied effective image processing techniques for automatic acne detection and quantification. An input image is first converted into gray and special color model from regular red-green-blue version. This is for comparison and revelation of region of interest. The technique focuses on binary thresholding applied to facial images with various types, shapes or amounts of acne. A typical image on a cheek has been used and results are markings on acne automatically. A box shape is constructed to mark the final result of acne detection. The results are then compared with expert hand drawn ground truth for a system efficiency which are summarised into accuracy, precision and sensitivity. This method is more effective than manual counting by a typical dermatologist even in various lighting conditions.

Keywords— image processing, acne, detection, binary thresholding, facial

1. INTRODUCTION

Beauty business is a huge business in most of the countries. That is because people care about their look, their face and body more than ever before. However, acne has been the problem for facial treatment for decades. The first step in facial treatment is the acne counting and quantification. The dermatologist count the number of acne before and after the treatment to see whether the patients respond well to the treatment or not. The counting is the vital process in the acne treatment. However, dermatologist normally count the number of acne manually and mark them on a facial shape on paper (as shown in Fig.1). There were many publication proposed to tackle this problem.

All the automatic processes used the process and the basic steps from image processing and detection system[1-3]. In this publication, it is involved with face detection[4], blob detection[5], and color segmentation[6]. We develop a program to automatically count the number of acne which is also useful to help in the medical treatment. It will count the number of detected acne that helps the doctor see the development of acne of each patient or the response to the treatment. The doctor can also compared the weekly result very clearly that acne on the patient's face is getting better or worse. So, the doctor can perform analysis and select appropriate approach to treatment.

Figure1. Images of doctor write down the disease information of patients by hand written.

The developing algorithms of acne detection worked on the collection of data taken locally (as shown in Fig 2). Those pictures were taken into Photoshop by expert and then the experts mark them on a different Photoshop layer (Fig 3) and we used that layer (Fig 4) as our gold standard or ground-truth that we use to compare our result to. Only for cheek area that is under consideration. The ground truth images are shown in Fig 4.
2. THE PROPOSED SYSTEM

To developing algorithms of detect facial acne, we use Adobe Photoshop to simulate the expected result of acne images for compared with the results of experiment of program and Matlab to write a program with a basic function of image processing command, we started to collect face images of patient. Then our algorithm starts with two main techniques that include the face detection and the statistical methods to detect the acne. After the detection, we compare the result images with ground truth for results evaluation both by qualitative and quantitative data. The overall process flow of the algorithm is shown in Fig 5.

3. METHODOLOGY

3.1 Face Detection

Face detection technology is a process that is developed continuously. The result of the development also accurate and has basic method that used to detecting the key
points on the face such as eyes, nose and mouth to find out where to catch up with where you want to. In addition, we have been studying about Connected Component Analysis as a way to define an object with a specific value and analyzed by specific values eliminate the specification of an object that does not want to ignore. These methods are applied in algorithm of acne detection, program will uses the detection of key points on the face to ignore those key points, such as hair, eyes, or mouth by the program to store these specific values to process and get rid of the parts that are out of focus. So, the area is detected will be ignored to display. The results will display only part of the acne. This method reduces the error acne detection problems on the face and causes of greater accuracy.

3.2 ACNE QUANTIFICATION

To developing algorithms of detect facial acne, we started to collect a face acne images of patient. Those images used to simulate the detection point acne in the Photoshop program. We imported the image to first layer, and created the second layer to spot a specific area of acne. Then exported only the paint of spot acne to be a result of the simulation (Ground truth) that obtained in this process, using it compared with the results of the testing algorithm in computer processing. Ground truth represents ability of the human detecting.

To processing the algorithm, import the images into the program and it will automatic detection the acne.

1. Convert the RGB color images to the Grey scale images
2. Find the maximum value of intensity images with X and Y coordinates on the Grey scale images.
3. Calculate normalized grey-scale image by divide the value of intensity to 0 or 1 with X and Y coordinates, to compare with HSV images.
4. Retrieve HSV color images to define the value of H(Hue) = 0 for drop a red color
5. To extract the brightness area (V) from HSV model and define Dark color = 0 and White color = 1.
6. To subtract by V-Grey scale, the result show the region of maximum lightness
7. Define the value of threshold background is white color otherwise will be a black color. The images convert to negative binary color
8. To analyse the images for eliminate a tiny spot area.
9. From the result of step 8, divided the area less than 7000.
10. The results from step 7, 8 and 9 will represent the appropriated size of specific object.

11. Create the square to cover the area of detection
12. Detect the input images and calculate the amount of acne.

![Figure 6. The step of algorithm processing](image)

The result image will show the rectangle and amount of detected acne as output.

4. EVALUATION

The structure working process of the program consists of two main techniques, there are Statistic Methods and Face Detection by way of starting are the same, but the results in term of accuracy will be difference by can compare the image from the results of the program (Evaluation Accuracy). As the result image shows that the amount of acne on the patient's face from the treatment of each time. Using basic manually method to checking each frame of acne that program detected is correct or not. By the way called Qualitative and Quantitative and each method are different, as follows.

- Qualitative: evaluation of qualitative data is considered on the details of the images, the result is information that can be seen with the naked eye. Evaluation from the result images by comparing each image and determine of each frame of acne that program detected is the actual acne including areas where error of program detection.

- Quantitative: evaluation of quantitative data is a consideration about numbers or data that can be measured as the number of digits. From each image results can be
 evaluated by calculating the quantity of acne on the patient's face and determine whether the average of the frames of acne that program detected is the actual acne including areas where error of program detection.

From the analysis of Quantitative and Quantitative, each result images will have different accuracy. The result of analysis will be classified into 4 types (Confusion Matrix);

1. True Positive (TP) is what the program predicted, and says it is true.
2. True Negative (TN) is what the program to predict that's not true, and says it is false.
3. False Positive (FP) is what the program predicted, but says it is false.
4. False Negative (FN) is what the program predicted that's not true, but says it is true.

- Sensitivity[7] is the rate of what the program actually predict and people say that it is true, can be calculated as a percentage by TP/TP+FN
- Specificity[7] is the rate of what the program actually does predict and say it's not true, can be calculated as a percentage by TN/TN+FP

5. RESULT

The results are displayed in Table 1.

Table 1. results

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6. CONCLUSIONS

This paper proposed to use image processing techniques to improve acne detection and localisation particularly for medical dermatologists. The doctor will be able to use the results of both area and amount of acne from a program to track changes or development the acne diseases on the face of patients effectively. The program reads an image of patient's face and detected only the acne areas based on color or texture. After the acne detection, the program will be compare the result and analyze the areas or amount of acne coming out as a percentage to compare the changes or the development of acne on the face. The results are very promising.

Not only that the algorithms will help with the medical treatment, but also the algorithm can be extended to App industry too. There are many mobile phone applications that use to beautify the photo automatically. When detecting the acne accurately and then blur only where a point of acne. Localisation of the acne can lead to acne removal or smoothening for more natural outcome of the results.

7. ACKNOWLEDGMENT

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8. REFERENCES


