Performance of Acne Type Identification Using GLCM and SVM

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***Abstract*—Acne is a common skin disease in teenage to adult populations. Acne is caused by intrinsic factors, such as genetics, race and hormonal, as well as extrinsic factors such as stress, diet, cosmetics and drugs. Treatment by the doctor is generally determined by the type and severity of the patients. The identification process begins with image acquisition and acne segmentation process using Multi-Level Thresholding. The feature extraction using GLCM is applied to the image of the segmentation result to get the value of contrast, correlation, energy and homogeneity. Classification is based on previously extracted features. The best result of accuracy level for testing data is 89% of the total 18 acne images. Meanwhile, for two images non-acne, the accuracy of the testing data reached 50%.**

Keywords—Acne, Gray Level Co-occurrence Matrix, Support Vector Machine

I. INTRODUCTION

Self-confidence is an important thing for someone to be able to behave as expected and desired. One that affects confidence is from internal factors such as a person's physical condition. Acne-prone faces will also affect psychosocial development, including self-confidence [1].

According to data released by IDAI in 2013 showed that the number of acne sufferers in teenagers is quite high, it is known that 80% of acne can occur at the adolescent level. Acne is found as much as 30-60% occur at the age of 14-17 years of girls and 16-19 years of men [2].

Treatment of acne cannot be done with carelessly if handled with improperly it will aggravate the condition of acne. Type or category should be known to get the proper treatment to be given. Acne classification itself can be categorized by type and severity [3].

This paper build application that can identify the types of acne using GLCM for feature extraction and SVM as a method of classifying acne.

II. METHODOLOGY

A. Acne Vulgaris

Acne vulgaris is a skin disease in the form of chronic inflammation of pilosebasea follicles with increased sebum production, ductal hyper-cornification, symbiosis with commensal microorganisms and skin inflammation. Increased sebum production is a fundamental anomaly in the pathogenesis of this disease [4].

Acne is very common and can be found in all demographics of gender and age. Classification of acne is [5]:

- Blackheads are pores covered by oil, dead skin cells and bacteria.
- Papules are pores that are suffering from severe irritation, causing the appearance of reddish-pink skin bulge. Usually, this type of acne there is no fluid in it.
- Pustules are Papules but with a yellowish pussidy in the middle.
- Nodules and cysts that are already inflamed acne are too severe to cause the appearance of the large bulge and cause pain.

B. Sharpening

The principle in sharpening the image is to highlight an image intensity. One of the filters used is a spatial linear filter. Linear spatial filters use the "fspecial" function by creating two-dimensional filters of the specified type [6]. One type used is unsharp, with the syntax:

filter = **fspecial**('unsharp')

C. Segmentation Image

Segmentation image is the process shown to get the objects contained in the image or divide the image into several areas with each object that has similarity attributes. The image segmentation used is Multi-Level Thresholding.

In multi-level thresholding, the image is divided into several sections by using some threshold values. The threshold value is given in the YcbCr colour space [7].

The popular colour space in digital image processing is RGB. But if for the recognition of RGB colour space skin, the result is often not good then often used is the colour space perceptional the colour space YcbCr [8]. Here is the conversion of the RGB image to Y, Cb, and Cr components.

$$Y = 0.257 * R + 0.504 * G + 0.098 * B + 16 \quad (1)$$

$$Cb = 0.148 * R - 0.291 * G + 0.439 * B + 128 \quad (2)$$

$$Cr = 0.439 * R - 0.368 * G - 0.071 * B + 128 \quad (3)$$

D. Gray Level Co-Occurrence Matrix

GLCM uses second-order calculations. GLCM is formed by considering the location of adjacent pixels (d) and the angle between adjacent pixel locations (θ). GLCM calculation results can then be used to calculate the value of features as representations of object texture.

The features that can be used to obtain the texture characteristics of an object include:

1) Angular Second Moment (Energy), serves to measure the uniformity of pixels in an image

$$Energy/ASM = \sum_i \sum_j \{p(i,j)\}^2 \quad (4)$$

2) Contrast, serves to measure the level of variation of the grey level between the reference pixel and its neighbour

$$Contrast = \sum_x \sum_y |x-y|^2 . p(x,y) \quad (5)$$

3) Correlation, this feature illustrates the luck in a linear fashion from a grey reference matrix-matrix to neighbouring pixels.

$$Correlation \ \frac{\sum_i \sum_j (i-\mu_i).(j-\mu_j).p(i,j)}{\sigma_i \sigma_j} \quad (6)$$

4) Inverse Different Moment (IDM), this feature is used to measure the local homogeneity level of the image.

$$IDM/Homogeneity = \sum_i \sum_j \frac{p(i,j)}{1+(i-j)} \quad (7)$$

E. Support Vector Machine

Support Vector Machine (SVM) is a method of supervised type classification because, during the training process, certain learning targets are required. The concept of classification with SVM can be explained simply as an attempt to find the best hyperplane that serves as a separator of two classes of data in the input space [9][10].

F. SVM Multiclass

SVM is basically designed for binary classification (two classes). However, further research to develop SVM so that it can classify data that has more than two classes continues to be done.

In this research, the SVM multiclass approach that uses is a "one-against-all" classification method. In this method, k built binary model SVM binary, with k is many classes. Each i-class model is trained using the entire data, to find the solution to the problem. SVM classifies two classes between one class and the other classes seen as a class. The classes for a sample of data can be directly determined by this method. When a sample of data is not entered into a group containing a set of classes, but into a specific class, then the class is the class of the corresponding data sample.

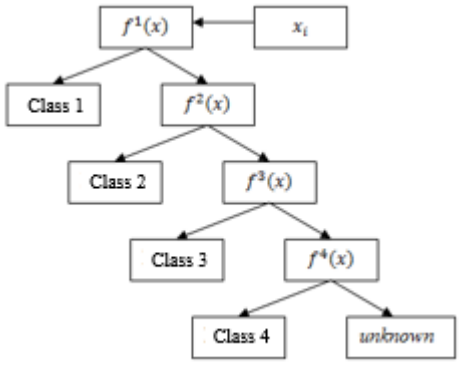

Fig. 1. One-against-all methods

III. Result Method

The problem was found after the writer conducted a literature study on acne and an interview with a doctor. From the journal, it is concluded that the handling of acne cannot be done with the same treatment on each type of acne. For the treatment of acne is required special consideration based on the severity and type of lesions of acne sufferers.

Through a series of interviews, the writer gets the fact that was checking the types of acne from patients who come still done manually. Manual examination poses a risk of inconsistency to any acne lesions that have similar colour and shape. Therefore, it becomes important whether the drug to be administered to each patient is appropriate or not in each of its acne

To overcome the above problems, needed a solution for the examination of acne types are more efficient and targeted. So the solution is considered appropriate by applying computer technology. Computer technology using the Gray Level Co-occurrence Matrix (GLCM) and Support Vector Machine (SVM) method, can be applied so that it can automatically detect faces that infect acne and classify them into three types: papules, pustules, and nodules or cysts.

It will perform a graphical application design (interface) that aims to facilitate the user when the application is used. Ease of use is necessary for system users to understand each function of the system when running it.

The flow of the identification system of acne types to be created as well as the algorithm used. Fig 2 is a system algorithm flow that will be made in this research.

Informing the pattern of training data, the first thing to do is to prepare the input data to be used in this study. The input data used has been through the cropping stage first, which is done outside the system. Furthermore, input data is processed into a system with the following stages:

- Image acquisition
- Resize Image
- Image Processing
- Search GLCM value
- Creating an acne group and save them in a format .mat
- Creating a group of GLCM value and save them in a format .mat

The writer performs the encoding stage of a predefined design result to be an application. This application was created using MATLAB R2015b as the platform used for acne type identification program. At this stage, it is testing each unit of the program, whether in accordance with its function.

Fig. 2. Interface cropping image

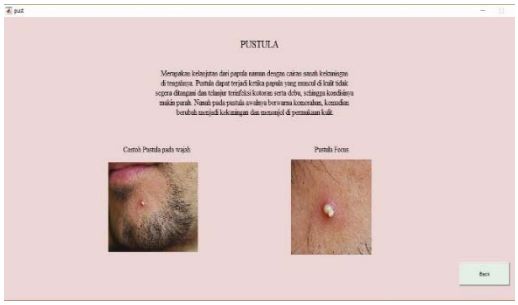

Fig. 3. Interface Info

1. Scenario 1

From the results of the experiments conducted for the identification of 18 samples of acne image with 192x192 pixel image size using GLCM characteristic extraction and SVM algorithm obtained accuracy for 100% papular acne, 50% pustular type and 50% nodule type. As for the identification of the overall type of acne, we obtained an accuracy of 66.7% with an average test time of 10.72 seconds.

TABLE I. CONFUSION MATRIX TESTING RESULT SVM

		Prediction			Accuracy (%)
		Papule	Pustules	Nodules	
Ori	Papule	6	0	0	100%
	Pustules	3	3	0	50%
	Nodules	0	3	3	50%

2. Scenario 2

From the experimental results for the identification of 18 samples of acne image with 256x256 pixel image size, the accuracy of papular acne is 83.3%, 100% pustules and 83.3% nodules as for the overall identification of the results obtained accuracy of 89% of the eyes with an average test time of 10.51 seconds.

TABLE II. CONFUSION MATRIX TESTING RESULT SVM

		Prediction			Accuracy (%)
		Papule	Pustules	Nodules	
Ori	Papule	5	1	0	83.3%
	Pustules	0	6	0	100%
	Nodules	0	1	5	83.3%

3. Scenario 3

The 2 (two) non-acne imagery samples in scenario 3, one image was identified as acne, and one was identified as non-acne. Image identified as acne occurs in the image of mosquito bites and images identified as not acne occurs on the image of the baby rash.

A. Difference Between Acne Image and Non-Acne Image

Table.3 shows the difference between acne image and non-acne image based on the GLCM characteristic values. It is known that the value of the contrast feature on non-acne imagery produces the greatest value among the identified images as acne. Then the higher the contrast value, the more likely the image is identified as non-acne. From the correlation value in can be that the number of the non-acne image is the smallest among the image values identified as acne. Then the lower the correlation value, the more likely the image is identified as non-acne.

TABLE III. DIFFERENCE BETWEEN ACNE AND NON ACNE IMAGE

Feature	Average Value Acne Image			Non-acne image
	Papula	Pustules	Nodules	
Contrast	0.09662	0.27859	0.39441	0.58511
Correlation	0.90266	0.88088	0.90623	0.80973
Energy	0.91428	0.78884	0.59465	0.74657
Homogeneity	0.98875	0.96362	0.93874	0.95139

IV. CONCLUSION

Based on the results of research discussions for the identification of acne type using GLCM method and Support Vector Machine algorithm, then the conclusion that can be taken is the result of image segmentation of acne can be affected by the lighting at the time of the shooting. The shape and colour of the acne image segmentation results affect the value of the GLCM characteristics to be generated. The result showed that the identification of the type of acne using GLCM feature extraction and SVM algorithm on a 256x256 pixel image size produces an accuracy of 89%, better than the image size of 192x192 pixels which only produces an accuracy of 66.7%. As for testing on the non-acne image obtained an accuracy of 50%.

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