SHORT FCC AND CCC TO DETECT EYES AND MOUTH IN DIFFERENT IMAGE SIZE

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ABSTRACT

The face parts that can uses for recognition e.g eyes, mouth, nose, etc. Most of the face recognition did resampling the image to the same size. This research aim to regconize the eyes and mouth in the image with different size. For the features extraction algorithm that use is short Freman Chain Code and for the recognition use Consecutive Changing Characters algorithm. Data that use to be data training is the images that have the different size. The result of experiment shows that using adaptive Freeman Chain Code algorithm and adaptive Consecutive Changing Characters algorithm, the percentage of success rate is 60% for eyes and 75% for mouth.

Keywords: pattern, freeman chain code, consecutive changing character, eyes detection, mouth detection

INTRODUCTION

There are many phases for recognize the image. Before feature extraction images need some proprocceing such as filtering, edge detection and etc. One of the processes used for early detection of faces is determining the ROI of an object [4]. One way to detect ROI is skin detection. Skin detection is used to detect skin from human objects, one of the goals is to separate the skin color and the color of the clothes from the image [6]. The percentage of successful image recognition with the skin detection method is 95% [4]. The next step is to thicken the non-skin area inside the face, such as the mouth and eyes using one of the morphological image processing methods namely erosion [2]. The purpose of this method is to get an object more clearly. The next step to get the chaincode results is an edge detection process. 2-dimensional shape can be detected using the results of the chaincode and produce 85% of accuracy [9]. Other research also states that the Freeman Chain Code algorithm using skin detection and contour detection results in 95% accuracy [3]. All of the above steps are carried out on training data and testing data in order to get 2 results of chaincode, where the 2 patterns will be compared similarity using the fast-matching algorithm namely Changing Consecutive Characters algorithm [7].

RESEARCH METHOD

Reseach method is divide to 4 steps, first, collecting the dataset. The data set is taken from Google with 20 images. Second, skin detection sd as initial preprocessing to separate skin color and not skin. Third, image erosion to thicken the object being studied. Fourth, edge detection to determine the edge of an object in the image.

Data Sets

Wedding photos are taken from Google images with different sizes. For testing images are 20 wedding photo images consisting of 2 faces with a solid background. For trainning image

consists of various eye and mouth models of various size and created by manually cropping from testing images. Then the trainning data is resized by two-thirds and one-third from the original size. So, there are 20 x 3 = 60 (original size, 2/3 size and 1/3 size) for eyes data training and 60 for mouth data training

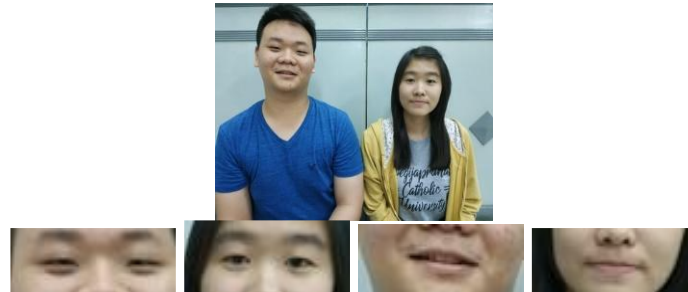**Figure 1.** Example Data

Table 1. The Provision of RGB, Normalize RGB, HSV, YCbCr color space

No	Input Image	Name	Source
1		Image 1	https://nyonyamalas.com/blog/2015/09/22/12-dokumen-syarat-administrasi-catatan-sipil-pernikahan-file-doc-available/
2		Image 2	https://kisahmuslimin.com/
3		Image 3	http://www.cemerlangradio.com/pas-foto-foto-haji/
4		Image 4	http://hijaudyasku.blogspot.com/2013/08/pernikahan-hijauku.html
5		Image 5	http://fransiscarahman.blogspot.com/2010/08/pas-potoh.html
6		Image 6	http://evyandiryanias.blogspot.com/2015/04/allamdulillah-sudah-sah-nikah-kantor.html
7		Image 7	https://www.websta.org/tag/persittniad
8		Image 8	http://devifitris.blogspot.com/2017/01/bridetobe06-sidang-pranikah-anggota.html

| 9		Image 9	https://gomversusjos.wordpress.com/2016/08/04/foto-fenomenal-foto-gandeng/
10		Image 10	http://www.kerenbgt.com/foto/foto-buku-nikah-pakai-jilbab.html
11		Image 11	https://gambardesain.online/detail/persyaratan-pengajuan-nikah-tni-ad-tahap-sampul-d
12		Image 12	http://free-book-0.blogspot.com/2018/06/37-info-download-warna-buku-nikah-2017.html
13		Image 13	http://widya-sandy.blogspot.com/2006/03/our-strange-face.html
14		Image 14	https://gambardesain.online/detail/persyaratan-pengajuan-nikah-tni-ad-tahap-sampul-d
15		Image 15	http://www.natashadesiree.com/2012/01/foto-berdampingan.html
16		Image 16	http://ceritasumi.blogspot.com/2012/02/foto-gandeng.html
17		Image 17	https://nikeitok.wordpress.com/2010/08/17/pas-photo-untuk-catatan-sipil/
18		Image 18	http://frediedesi.blogspot.com/2012/06/buku-nikah.html
19		Image 19	http://keluargaadianjaya.blogspot.com/2012/06/pas-foto-berdampingan.html
20		Image 20	https://fangfangin30s.wordpress.com/tag/beda-agama-nikah-beda-agama-kawin-beda-agama-nikah-di-hong-kong-kawin-di-hong-kong-hong-kong-kawin-perkawinan-beda-agama/

Pre-Processing
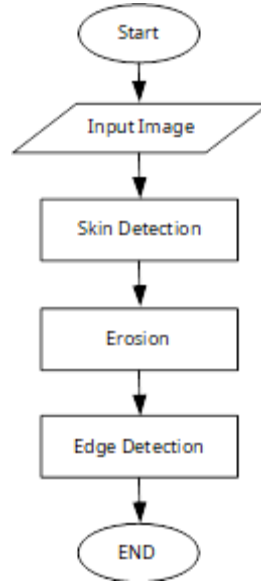
Figure 2. Flowchart of Preprocessing

Figure 2 is the flowchart from the preprocessing image. It starts with the detection of the skin and then thickens the image and ends with edge detection.

<u>*Skin Detection*</u>

To classify pixels from RGB images to two classes (skin and non-skin) can use 4 kinds of space colors, namely RGB color space, Normalize RGB color space, HSV color space, and YcbCr color space [2]. The result of this step is a binary image. In this research using the Normalize RGB Eye color space because the resulting binary image shows the shape of the eyes and mouth (figure 3). This shows that the color level of the skin pixels must satisfy the following rules (R: red, G: green, B: blue):

$$R > 95 \ and \ G > 40 \ and \ B > 20$$
$$\max(R, G, B) - \min(R, G, B) > 15$$
$$|R - G| > 15$$
$$R > G$$
$$R > B$$
$$0.36 \leq r \leq 0.465$$
$$0.28 \leq g \leq 0.363$$

(1)

with:

$$r = \frac{R}{R + G + B}$$
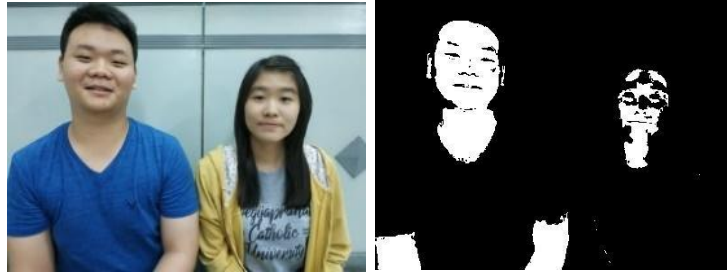
(2)

and

$$g = \frac{G}{R + G + B} \tag{3}$$

Figure 3. (a) Original Image (left) (b) Normalize RGB Color Space Image (right)

Image Erosion

Image erosion is used to thinning the object image, in this research the object is facial skin (white color), so if an erosion process is carried out, the facial skin becomes thinner and black objects (eyes and mouth) become thicker. In mathematics is intended as follows:

The erosion of A by B is defined by:

$$A \ominus B = \bigcap_{b \in B} A_{-b} \, , \text{Where } A_{-b} \text{ denotes the translation of } A \text{ by} - b \tag{4}$$

Edge Detection

Edge detection in this research uses the 3x3 matrix kernel as follows:

-1	-1	-1
-1	8	-1
-1	-1	-1

Figure 4. 3x3 Outline Matrix (Edge Detection)[1]

RESULTS AND ANALYSIS

To obtain optimal results of research using 2 algorithms that are modified, namely Adaptive Freeman Chain Code and Adaptive Consecutive Changing Characters.

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[1] The kernel outline is sourced from http://setosa.io/ev/image-kernels/.

Determine Object Pattern Using Adaptive Freeman Chain Code

Freeman Chain Code consists of 2 types, the first is the 4-way chain code and the second is the 8-way chain code. In this research 8 chaincode directions were used. In this research Freeman Chain Code is used to determine the length and width of objects, the position of objects and the pattern of objects in the image resulting from edge detection. Besides that Freeman Chain Code is used to determine a pattern from the results of the chaincode that has been obtained based on each change in direction on the object. To determine the pattern of objects described as follows.

8 direction chaincode result:

<u>0 0 0 0 0 0 0 1 1 1 2 2 2 3 3 3 4 4 4 4 5 5 5 5 4 4 4 5 5 5 5 6 6 6 6 6 7 7 7 7 7 7 6 6 6 7 7 7</u>

Combine sequential numbers and rewrite them into arrays become short chaincode.

0 1 2 3 4 5 4 5 6 7 6 7

Pattern Matching Using Adaptive Consecutive Changing Characters

This research using Changing Consecutive Characters Algorithm algorithms that have been modified by shifting and rotating patterns.

Example: Input : 0 1 2 1 3 4 5 6 7   Database : 0 1 3 4 5 6 7

To detect the similarity of patterns used 2 methods:

<u>Shifting</u>

From the input pattern, (the length of input pattern - 1) will be shifted, for example:

1. 1 2 1 3 4 5 6 7 0
2. 2 1 3 4 5 6 7 0 1
3. 1 3 4 5 6 7 0 1 2
...
8. 7 0 1 2 1 3 4 5 6

<u>Rotating</u>

By adding 1 value for each individual pattern from the input pattern above, rotating data will be obtained in accordance with the direction of the chaincode as follows:

a. First rotated pattern : 1 2 3 2 4 5 6 7 0

b. Then do shifting like step 1.

c. Then rotating again becomes 2 3 4 3 5 6 7 0 1

d. Do shifting like step 1

e. Repeat steps a, b as much 4 times (total rotating is 7 times)

from steps 1 and 2 the pattern will be compared to the pattern in the database with a maximum pattern length of 1.5 from the length of the input pattern. Then the percentage of similarity between each change in input pattern and database pattern is calculated.

RESULT

This testing is about the program in detecting eyes and mouth in marriage photos with constraints, if the marriage photo is detected by an eye or mouth it will be considered successful and ignoring the number of eyes and mouth in the picture.

There are 4 Categories of this testing :

1) Testing of program using Freeman Chain Code and using Consecutive Changing Characters.
2) Testing of program using **Adaptive** Freeman Chain Code and using Consecutive Changing Characters.
3) Testing of program using Freeman Chain Code and using **Adaptive** Consecutive Changing Characters.
4) Testing of program using **Adaptive** Freeman Chain Code and using **Adaptive** Consecutive Changing Characters.

Table 2. The Provision of RGB, Normalize RGB, HSV, YCbCr color space

No	Input Image Name	Category 1	Category 2	Category 3	Category 4
1	Image 1	3 eyes, 2 mouths	3 eyes, 2 mouths	3 eyes, 2 mouths	3 eyes, 2 mouths
2	Image 2	2 eyes, 1 mouth	2 eyes, 1 mouth	2 eyes, 1 mouth	2 eyes, 1 mouth
3	Image 3	2 eyes, 2 mouths	2 eyes, 1 mouths	2 eyes, 2 mouths	2 eyes, 2 mouths
4	Image 4	0 eye, 2 mouths	0 eye, 2 mouths	0 eye, 2 mouths	0 eye, 2 mouths
5	Image 5	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth
6	Image 6	0 eye, 1 mouth	0 eye, 1 mouth	0 eye, 1 mouth	0 eye, 1 mouth
7	Image 7	1 eye, 1 mouth	0 eye, 1 mouth	0 eye, 2 mouths	1 eye, 1 mouth
8	Image 8	3 eyes, 2 mouths	3 eyes, 2 mouths	4 eyes, 2 mouths	3 eyes, 2 mouths

9	Image 9	0 eye, 2 mouths	0 eye, 1 mouth	0 eye, 2 mouths	0 eye, 2 mouths
10	Image 10	0 eye, 1 mouth	0 eye, 0 mouth	1 eye, 2 mouths	0 eye, 1 mouth
11	Image 11	3 eyes, 1 mouth	1 eye, 1 mouth	3 eyes, 1 mouth	3 eyes, 1 mouth
12	Image 12	0 eye 0 mouth	0 eye 0 mouth	0 eye 0 mouth	0 eye 0 mouth
13	Image 13	1 eye, 2 mouths	1 eye, 1 mouth	1 eye, 2 mouths	1 eye, 2 mouths
14	Image 14	0 eye, 2 mouths	0 eye, 2 mouths	0 eye, 2 mouths	0 eye, 2 mouths
15	Image 15	1 eye, 1 mouth	0 eye 0 mouth	1 eye, 1 mouth	1 eye, 1 mouth
16	Image 16	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth
17	Image 17	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth	0 eye, 0 mouth
18	Image 18	1 eye, 1 mouth	1 eye, 1 mouth	1 eye, 1 mouth	1 eye, 1 mouth
19	Image 19	2 eyes, 0 mouth	1 eye, 0 mouth	2 eyes, 0 mouth	2 eyes, 0 mouth
20	Image 20	2 eyes, 1 mouth	2 eyes, 0 mouth	2 eyes, 1 mouth	2 eyes, 1 mouth

From figure 5 and 6, it is known that the success rate of detecting eyes and mouth is based on 4 categories by ignoring the number of eyes or mouth that has been detected are showed in the below.
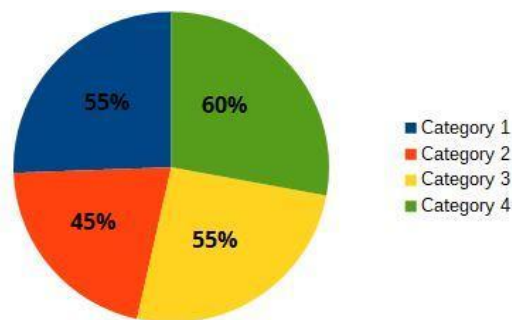

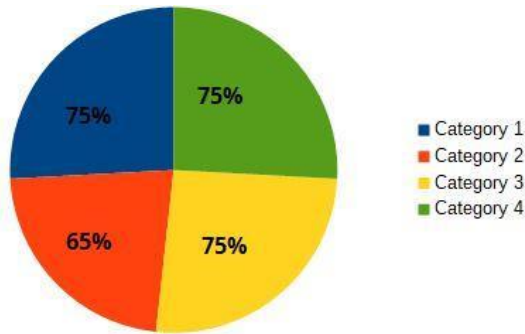**Figure 5.** Pie Chart for the Success of Eye Detection

Figure 6. Pie Chart for the Success of Mouth Detection

From the results table above, it is known that the optimal results for detecting eyes and mouth in marriage images are using the 4th method, namely Adaptive Freeman Chain Code and using Adaptive Consecutive Changing Characters with a success rate of 60% for the eyes detection and 75% for the mouth detection.

Testing rotation data is also done to find out whether the modification of Changing Consecutive Characters algorithm can resolve the rotated trainning image or not. The image used for this testing is a picture of program testing that was successfully detected. Rotated training images are pictures of the test image's eyes and mouth.


Figure 7. Rotation Testing Image[2]

Table 3. Rotated Training Image 90º,180º,270º

No	Rotated Trainning Image	Output Image	Result
1			√

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[2] Image source : http://devifitris.blogspot.com/2017/01/bridetobe06-sidang-pranikah-anggota.html

No	Rotated Trainning Image	Output Image	Result
	90°		
2	270°		√
3	90°		√
4	180°		√

From testing figure 7, it is known that the results of trainning image rotation with multiples of 90 degrees have a success percentage of 100% (table 3).

CONCLUSION

The implementation of using Adaptive Freeman Chain Code algorithm and Adaptive Change Consecutive Characters algorithm can recognize part of eye with 60% success rate and mouth with 75% success rate. The first step taken in this research is determine skin detection then image erosion and edge detection. After that the Adaptive Freeman Chain Code algorithm process is done to get a short pattern on the object, then Area of Interest to determine the object to be studied next. Then the possible face process is done to determine the position of the eyes and mouth so that it can be detected through the pattern matching using the Adaptive Change Consecutive Characters. Modifications at Change Consecutive Characters algorithm is to overcome detection the similarity of patterns in the eyes and mouth with different degrees of multiples of 90 degrees.

The suggestion for further research is change the composition in the skin detection process in order to resolve color differences in people or users can specify variants of skin composition.

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