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Use human facial features to recognition person

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Abstract - This research aimed to apply the usage of distance between two facial features to facial recognition. To gather the need information, the researcher first used a camera to capture facial images, then use image processing to adjust the size; locate the facial position through skin colour detection and image projection, capture the result and use it to find the feature on the face according to the proportion and image projection. After that, by using Threshold Method, Edge Detection, and image projection to do coordinate positioning, gather the information of width and height of every facial features, in order to use the Euclidean Distance to do the recognition. The finding reveled that the best recognition rate is 99.5%.

Key Words: **Human Face, Skin Colour Detection, Image Processing, Euclidean Distance, image projection**

1. INTRODUCTION

During the development of the biometrics, lots of authentication technology has been applied, including fingerprints, iris identification, facial recognition, and voiceprint recognition. So far, iris identification is well-known the most effective one; yet it may cause sampling difficulties due to mental disturb. Fingerprints and voiceprints have sample quality and safety issues. In contrast, Facial recognition only needs a camera to gather samples, and can do lots of comparison from the large quantity of the gathered features.

Apart from that, facial recognition also has the benefits of more nature and low awareness by the subjects. Low awareness means less chance to get pretended or faked samples. Yet facial identification may sometimes occur recognition errors due to similarity of the facial structure and features.

So far, most of the facial identification technology uses the whole face as a recognizing sample. Yet in this research, researcher captures particular features and measures the width or height, in order to achieve higher identification success rate. The facial recognition process can be categorized into training and testing, please see the graph below Fig 1(a) and (b):

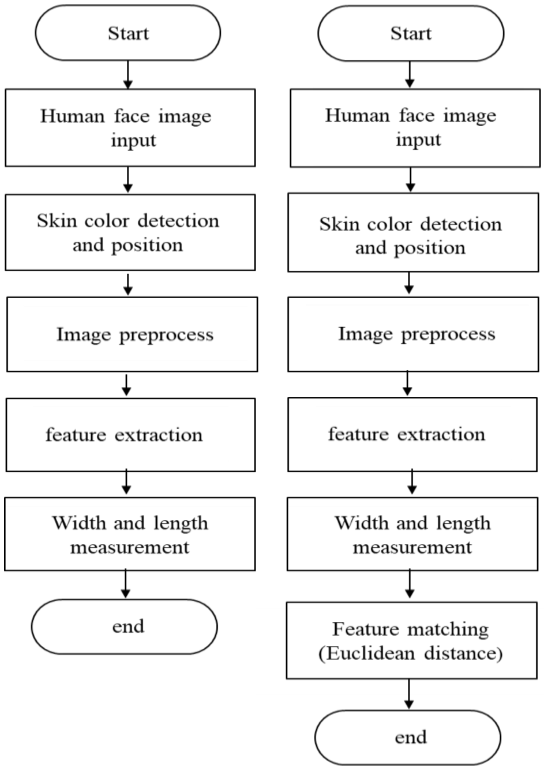

Fig -1: (a) Human facial recognition training process, (b) Human facial recognition testing process.

2. LITERATURE REVIEW

There are many researches been done in the field of facial recognition. The common practice in non-interference situations is to reduce the dimension of the original data through PCA (Principal Components Analysis), in order to retain the features that are suitable in the data set and have a large contribution from the variance. Or use SVM (Support Vector Machine) for classification and regression analysis and convert the image into a set of numerical values for comparison directly or in a categorical manner. Even in different situations, different series of methods for this identification, such as KPCA (Kernel Principal Component Analysis) introduce nonlinear mapping functions during PCA calculus so that the data can be mapped into high-dimensional space for analysis and processing, and the non-linear part of the data can be processed more effectively.

According to the methods commonly used in face recognition mentioned in the previous paragraph, the method of PCA has been raised in Lin et al.'s paper "Principal Component Analysis for Face Recognition" to add facial features, through adding different weights are used to identify and successfully obtain a correct rate of up to 94.14% [2], and the use of KPCA in the PCA series is also in Meng et al.'s paper "An Application of KPCA in the Human Face Recognition". Applying KPCA to deal with facial nonlinearity and SVM for face recognition can also achieve good recognition effects [3]. Finally, SVM's method has also been used in Zeng et al.'s "neural networks applied to pattern recognition". This paper mentions that the accuracy rate can reach 96% when using SVM for face recognition[4].

3. CONCEPTUAI FRAMEWORK

3.1 Database of Institutions

Face image input uses a digital camera with full-pixel resolution of 4000x3000 to take face images and shoot without any interference or complex background conditions. The number of volunteers in this research is 40, each taking 20 pictures, a total of 800 face images data were taken from the face database, as shown in Fig 2, and then take 10 from each to establish 10 training databases to establish a test database to produce 400 face images each Training database and test database.

Fig -2:. Self-made face database

3.2 Preprocess of the image

In the preprocessing part after the input of the face image, the size of the input image is first reduced to 600x400, as shown in Fig. 3(a), and then the skin colour detection is performed through the HSV to exclude part of the image background. Under the face, the binarization process and image projection are used to find the position of the human face, and the position of the face in the grayscale original image and the skin color detection image is captured and the face image is captured. Resize again to 180x192, as shown in Fig 3(b) and (c).

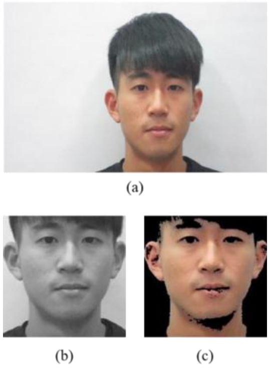

Fig -3: Image Size Adjustment: (a) Input image (b) Grayscale original image size adjustment result (c) Skin color detection image size adjustment result.

In order to achieve the time without affecting the subsequent feature extraction and reducing the entire identification process.

Before performing the feature extraction process, the features of the person's face will be extracted first and the features will be captured. The features of the captured face are the eyes, nose, mouth and ears, and 3(c) is taken as an example to represent the face. The proportions and image projections are used to look for these features. As shown in Figure 3, the x-axis coordinate points between the left and right sides of Fig 4(a) are taken first.

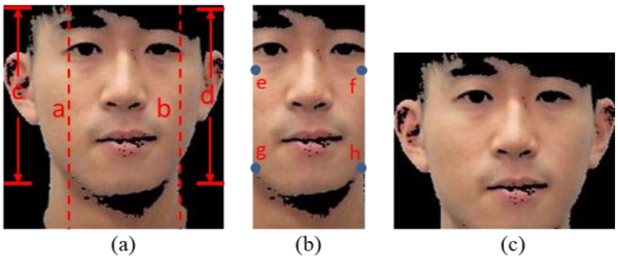

Fig-4: Human face ratio: (a) Capture the facial features and the predetermined area of the ears (b) Capture the facial area of the facial features (c) Capture the facial area of both ears

Take the X-axis coordinate points between the left and right sides to find the coordinate range of the two dotted lines in a and b of Fig 4(a), and then take the two dashed lines between a and b in Fig 4(b). The y-axis coordinate points between the upper and lower sides of the left and right sides of the face region, and through the ratio calculation, the four points e, f, g, and h in FIG. 4(b) are obtained, and then the four points are Use horizontal and vertical projections to find out the distribution of facial features (eyes, mouth, and nose).

Then, when starting from the position of the eye, the first step would be to look at the appearance of the eye as shown in Fig 4(c) through skin color detection, and to find the eye's range of distribution based on the previous paragraph to capture the eye, as shown in Fig 5(a). As shown in Fig. 5(b), the Sobel algorithm performs edge detection to find the edge of the eye, and the grayscale processing before binarization preserves the edge of the eye by setting the threshold value. The critical value method will be converted from Fig 5 (b) to a grayscale image, and then the grayscale value that is added to the number of 25% grayscale values from the number of grayscale values of 0 is used as the threshold value. After the binarization results are shown in Fig 5(c), the edge breaks and the isolated black dots in the edge are connected or filled through the closing operation, as shown in Fig 5(d), but in Fig 5(d) It is found that there are still some small white spots or blocks on the periphery of the eye. At this time, the study removes these points or blocks by retaining the largest block and removes the minimum block. After removal, it is shown in Fig 5(e) [8] Finally, in order to avoid jaggies in the corners of the eyes, a four-connected method is used to fill in the jagged portions of the corners of the eyes and fill them up. However, even the part between the eyes also followed from the end of eye filled, but also to achieve the effect is more prominent appearance of the eyes, filled with complete results shown in Fig 5 (f).

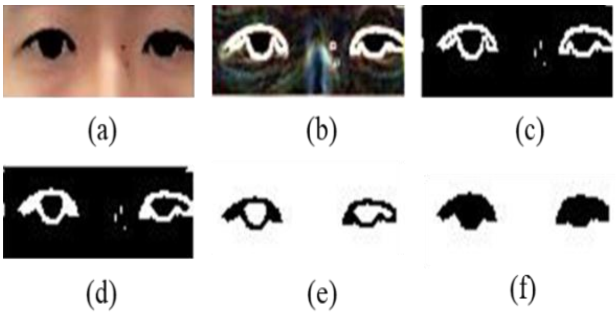

Fig -5:. Eye capture process: (a) Eye detection of face skin color detection image (b) Eye soble edge detection image (c) Eye binarization image (d) Closing operation and maximum and minimum block method results (e) Image inversion (f) Quadruple connectivity method results

The part of the nose will be based on the proportion and image projection to find the distribution of this feature and extract it. After grayscale processing, as shown in Fig 6(a), the threshold value is set for the critical value method of Fig 6(a). This feature is retained. The part that can be highlighted more stably, and observe that the number of gray level values that are set in the cumulative road at the same time when the threshold is set in the eye can stably highlight the outer shape of each person's nose, and the results after binarization are as follows. Fig. 6(b) shows that the appearance of the bottom of the nose is also different from the appearance of the nose, and then the residual black spot or smaller block is removed by the maximum and minimum block method. After removal, it is shown in Fig 6(c)[8].

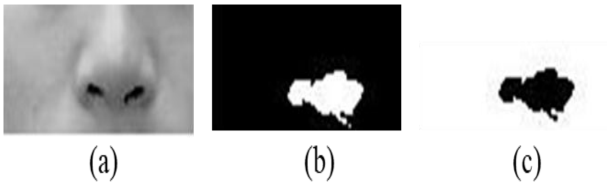

Fig -6:.Nose extraction process: (a) nose capture of grayscale image of face (b) binarized image of nose (c) maximum and minimum blocks and inversion results

In the following part of the mouth, due to the morphological relationship, it was found that during the process of thresholding, it was found that the general grayscale image was more stable than the grayscale image after the detection of the mouth color. Therefore, the general greyscale image was changed from the grayscale image. The mouth is shown in Fig. 7(a), and the number of gray values added to the first 10% during the setting of the threshold value according to the nose, and the results after binarization are shown in Fig. 7(b). The maximum and minimum block method removes the leftover white spots or smaller blocks from the image, removes them and then reverts them to white, as shown in Fig. 7(c)[8]. Finally, the expansion and four-connected method is used to stabilize the appearance after the mouth is treated. The result of the processing is shown in Fig 7(d).

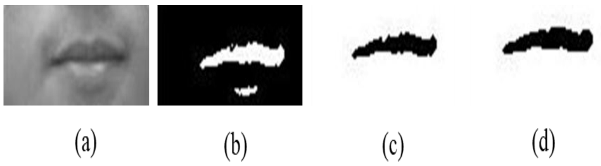

Fig -7: Nose extraction process: (a) nose capture of grayscale images of the face (b) binarized image of the nose (c) maximum and minimum blocks and inverted white results (d) expansion and four-connected results

In both ears, the coordinates of c and d are calculated using the same proportion as in Fig 4(a) on the face of the person, and the face region between the two coordinates of Fig 4(c) is searched for with horizontal projection. After the position of both ears, the captured results are shown in Fig. 8(a). Sobel operation is also used in the same manner of using the eye to retain two ear contours as shown in Fig. 8(b), and then grayscales and adds to the 27% gray. The gray value of the number of degrees is used as the threshold value. After setting, the result of binarization is shown in Fig. 8(c). Finally, the characteristics of both ears are stably highlighted by the closed operation and the maximum and minimum block method. The result is shown in Fig 8(d)[8].

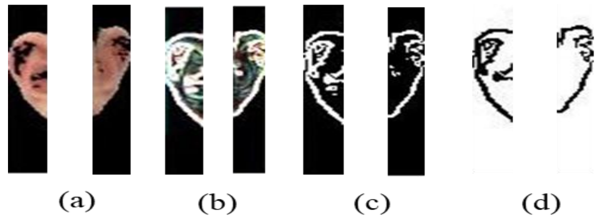

Fig-8: Two-ear extraction process: (a) Two-ear capture of face color detection image (b) Two-sided soble edge detection image (c) Two-head binarized image (d) Closing operation and maximum and minimum areas Block method results.

3.3 Feature Extraction

After the pre-processing, the facial features and the two ears are removed, and then horizontal and vertical projections are taken as feature features, respectively. In order to avoid eye and mouth opening or closing, the height measurement is affected. , choose to use the measurement width as a feature in addition to both ears, and measure the widths of the two eyes, left and right eyes, eyes, nose and eyes, and ears, as shown in Fig 9 below. Each width or height measurement range,

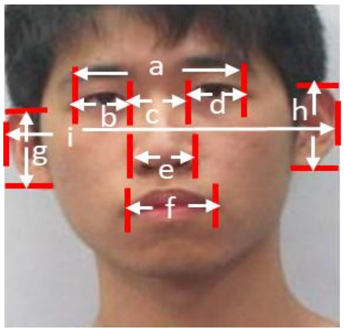

Fig -9: Each feature of width or length measurement range

In the process of measuring the width, horizontal projection is used to find the value of 0 in the binarized image, and it is displayed on the horizontal axis so that the value of 0 is found on the horizontal axis, and the starting coordinate in the range is taken. The width of the axis is measured by the X-axis point and the end point. Take the horizontal projection of the image in Fig 5(f) as an example. The system statistically displays the number of zeros at the point 9 or 10 on the X-axis. And statistics show that the point at the end 102 of Fig. 5(f) still has the number of times that the value is 0, so it can also indicate that the captured eye's distribution range is from 9 to 102 points, as shown in Fig 9. Then, take the X-axis 9 and 102 as the starting and ending coordinates to find the width of both eyes.

The vertical projection used in the final height measurement is also the area where the value 0 is found and displayed on the vertical axis to know the range where the value 0 is found on the vertical axis, and then the point on the Y-axis of the start coordinate in the range. The coordinates of the Y-axis of the end point are used for height measurement. Take the left ear of Fig 8(d) as an example. After passing through the vertical projection, the system statistically shows the number of times that the value at the 31 or 32 points on the Y-axis starts to appear as 0. And statistics are displayed up to 144 points, so it can also indicate that the height distribution of the left ear captured is in the range of 31~144, as shown in the distance g in Fig 9, and then take the Y axis 31 and 144 as the start and end point. Coordinates are used to find the height of the left ear, and the height of the right ear is also measured in this way.

3.4 Feature Match

During the training phase, the face image in the training database is pre-processed, and the features are captured to measure the width and height of the face image in the front position and are captured by each of them. A database is established based on the measured width and height of the feature. Finally, the verification of the identity and results is performed through the Euclidean distance (Euclidean distance) and the test data to complete the feature comparison at the recognition stage.

A set of numerical values measured for the training and test data can be represented as two sets of feature vectors. When the two sets of feature vectors are compared with Euclidean distances, this study is to accurately identify and set the comparisons. The resulting set of distance values between 0 or 1 can be represented as the same image.

6. EXPERIMENTAI RESUIT

In addition to explaining the experimental results in this section, the performance of the experiment will be compared with that of other similar experiments. The results of the training and test sheets and the identified experimental results are shown in Table 1 below.

Table -1: The results of performance evaluation table

Work	Propose
Face sample	800
Training sample	400
Test sample	400
Feature extraction	Image projection
Feature matching	Euclidean distance
recognition accuracy rate	99.5%
identification error rate	0.5%

In Table 1, in this study, with 20 photographs of 40 people and a total of 800 face samples, 10 trainings and 10 tests are performed for 20 each. Therefore, the number of training sessions will be increased. There are 400, and the relative number of test sheets is also 400. In the identification, the correct number of sheets is 398, and the number of sheets is 2 and the recognition accuracy rate is 99.5% and the identification error rate is 0.5%.

According to the literature review, "Principal Component Analysis for Face Recognition" and "Neural Networks Applied to Pattern Recognition", compared the recognition rates of 96% and 94.14% of the two papers' identification methods and the present study's recognition rate, we can find that the identification method of this study cannot affect the recognition result without parameters or values close to each other, and generate unique values and values by enhancing the image stability and feature width and height measurement. Combine to identify and increase the recognition rate.

7. CONCIUSION

By using the research method in this paper to enhance the stability and uniqueness of image combination of numerical values and numerical values, the high image recognition rate is improved to achieve higher recognition rate in the entire image recognition process. But the eyes may be shaded by hair during the research process. The resulting inconsistency identification results show that the research method is susceptible to blinding and lead to errors in recognition. Although the time spent on identification only takes 0.07ms, it takes 4.30 during the training process. In in the follow-up study will be based on these two issues to improve to further enhance the recognition rate under different conditions, as well as the time spent on the entire system operation.

In the future studies, according to the conclusion of the issue of masking in this paper, the study will take more pictures of people wearing glasses, sunglasses, and facial masks to identify, and consider to the ear as a way to detect the masking of facial features. Last but not least, instead of comparing the features that cannot be compared due to shadowing, the overall speed of the entire system is to try to execute on other platforms and observe whether it can reduce the time required for the entire operation.

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