Hybrid Method of Face Recognition in Frontal View

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***Abstract*— Face Recognition(FR) is an active research area that has many real-life applications such as airport security, bank/store security , access control and so on. Each application has each own criteria and so on. In terms of background faces and application, the numerous presented systems show different capabilities and strengths in each aspects of recognition performance. In this paper, we proposed recognitions of real time face images in frontal view using a hybrid methods of geometric features and template matching. The facial features is extracted from the face in frontal view. The silent feature region also extract from the two eyes and the mouth. After passing the feature based method, the new face image is projecting into face space and then comparing its position in the face space with those of known face . After that we find the best match in a face database.**

***Keywords*— Face Recognition (FR), Facial Feature, Frontal View, Euclidean Distance**

I. INTRODUCTION

Face Recognition is an interesting problem in the computer vision with many commercial and law enforcement applications. While research into this area dates back to the 1960's, it is only very recently that acceptable results have been obtained. However , face recognition is still an area of active research since a completely successful approach or model has not been prpoposed to solve the face recognition problem. Though people are good at face identification, recognition human face by computer is very difficult. So face recognition(FR) is a very challenging problem and up to date, there is no techniques that provides a robust face solutions to all situations and applications that face recognition may encounter. Approaches for face recognition are generally classified as static (processing still images) and dynamic (processing video image sequences).

II. RELATED WORKS

There are some reports have already been proposed related to the face recognition works[1]. B.S. Manjunath, R. Chellappa, C.V.D. Malsburg proposed biologically motivated the features extraction model and the locations of the feature often correspond to silent facial features such as eyes, nose, etc. [2]. Topological graphs were used to represent relations between features, and a simple deterministic recognize familiar faces from a face database. V. Starovoitov and D. Samal proposed two algorithms for computer recognition of human faces, one based on the computation of a set of geometrical features, such as nose width and length and mouth position and chin shape, and the second based on gray level template matching[3].

III. SYSTEM DESIGN OF APPROACH TO FACE RECOGNITION

The first step in face recognition is input the face image and then preprocesses the face image such as normilization. Preprocessing steps are physically motivated and supply the purpose of data reduction, removal of redundancies, and speed up of parameter searches. The key to recognition is feature extraction and it reduces redundant information, which is not concern as the attributes of the face. The input face images pass the preprocessing steps, such as cropping, resizing, normalization and so on. The system gets the small memory requirements and a higher recognition speed after passing the pre-processing step. After that the system classify the features. Decision maker decide whether the face is recognize is or not and displaying the output results. The system design for the approach to face recognition is illustrated in Figure 1.

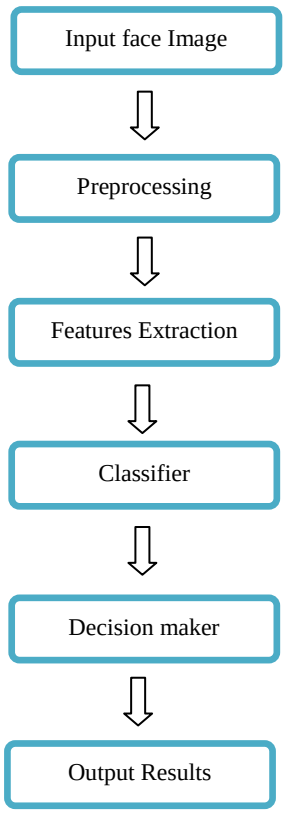

Figure 1. System Design of Approach to Face Recognition System

IV. HEAD POSE DEFINITION

There are 3 head pose classes in face recognition. They are

- **Frontal or near Frontal view**

In this view, both eyes and lip corners are visible.

- **Side View of Profile View**

In this view, at least one eye or one corner of the mouth is visible because of the head turn.

- **Others**

All other reasons cause more facial features , not to be detected such as the back of the head, occluded face and face with extreme tilt angles.

This paper extract the facial features from the face in frontal view or near frontal view because face recognition system can get high recognition rate for good qualtity in frontal view, steady lighting and only slight expression or expressional face images.

V. THE FEATURE POINTS ON HUMAN FACE

(i) Feature of the Human Face

Human face is made up of eyes, nose, chin and mouth. These are differences in size, shape and structure of the organs, so the face differ in thousands of ways. One comman method is to extract the shape of the eyes, nose, and mouth and then distinguish the faces by distance and scale of those organs. By normalizing the characteristics of the face image which have the properties of scale, translation and rotation invariance of the face image database.

In FR system, its needs to extract the features points, which represent the most important characteristics on the face. The number of features points should take enough information and not be too many.

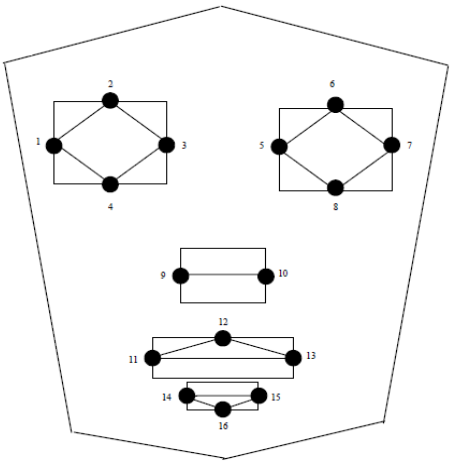

Figure 2. Example of Feature Points Use in Face Recognition

(ii) Features Extraction and Classification of the Face

In this paper, after estimating the head pose, the facial features are extracted only for the face in frontal view. The most facial feature changes that are caused by expression are in the area of eyes, eyes brow and mouth. This paper used the silent facial features from the two eyes and mouth as shown in Figure (3).

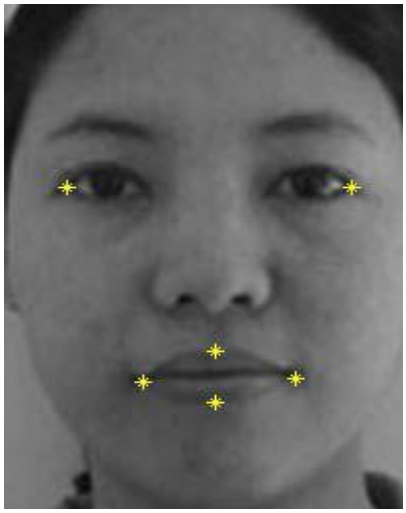

Figure 3. Locating of Features in Face Image

In this paper, as for facial features, the six feature points are selected from the gray-scale face image, two feature point from the corners of the two eyes and four features points from the mouth. Fig. 3 shows features locations.

After locating the feature points, first it need to find the distance between the distance between the two points of the mouth corners and the height of the mouth by using line equation and after that the system need to find the center point of the mouth by taking the intersection point of the two lines. After that connect the features points of the two eyes corners and also connect each of the eye corner with the center point of the mouth as shown in Figure 4.

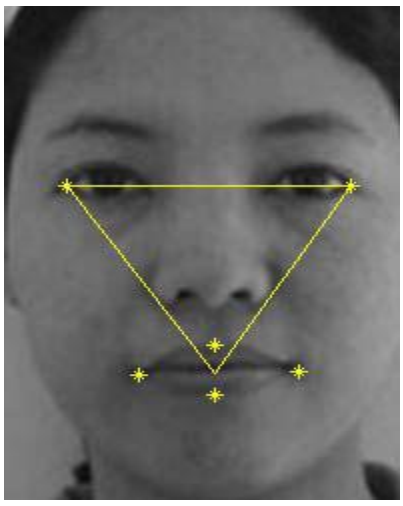

Figure 4. Distance between Feature Points

In face classification stage, the two faces as shown in Figure 5 and Figure 6 are match or not by using the distance between the two eyes corner and the width of the angle appearing at the center points of the mouth. The matching process can be seen as in Figure 8. The preliminary experiments are test with the distance between the two eyes corners and the width of the mouth.

Finally because of Hybrid system is used the matching image is matching agin with the template matching methods.

VI. Modeling FR System using Statistical Computation

(i) Center Point

Consider P_1,P_2,P_3,….., P_6 be six feature points from face image. Then we can find the center point (C) between the two features by the following equation

$$C = \frac{P_1 + P_2}{2}$$

(ii) Translation

Translation is to change a point with co-ordinates (P1,P2,P3, …..,P6) to a new location. We can compute the new positions of the six feature points from the new center point (C) as the following

$$P_i' = P_i - C \text{ , where } i = 1,2,3,\ldots,6$$

(iii) Euclidean Distance

Let us consider feature point P1 is in (x_1,y_1) and P_2 in (x_2,y_2). We can get the Euclidean distance D_{12} from the following equation

$$D_{12} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

VII. Experimental Results

To construct the face recognition system , we construct our own face database. Slight face rotation is allowed.

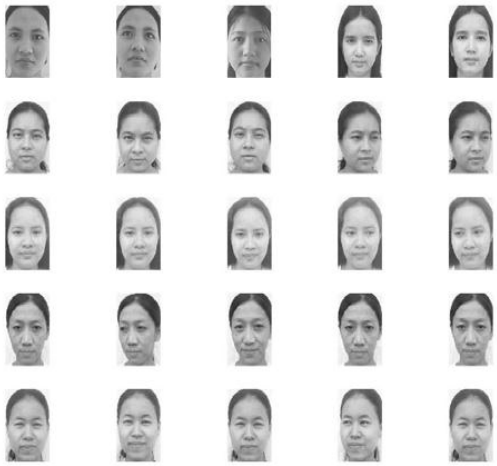

Figure 5. Some Images in Our Face Database

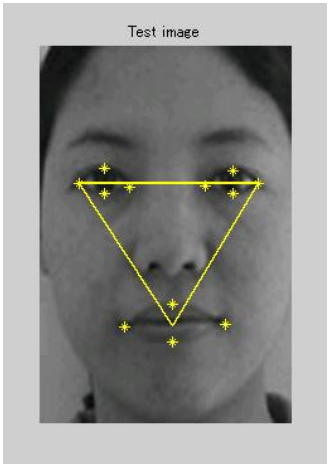

Figure 6. Feature points of Test Image

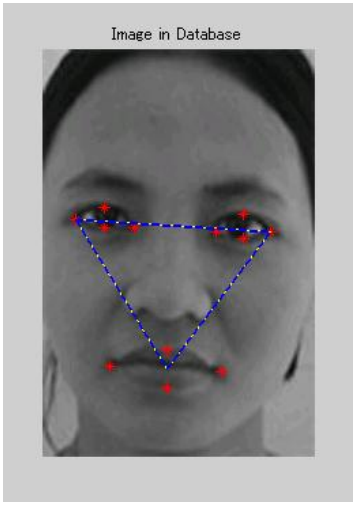

Figure 7. Feature points of Image in Database

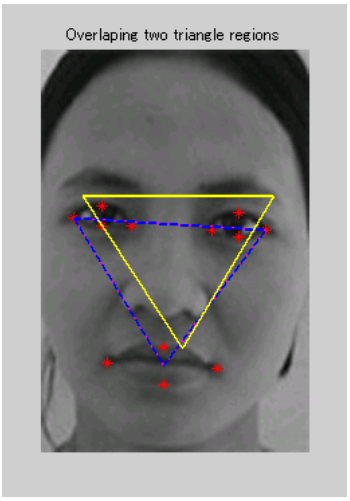

Figure 8. Overlapped Two Triangle Regions

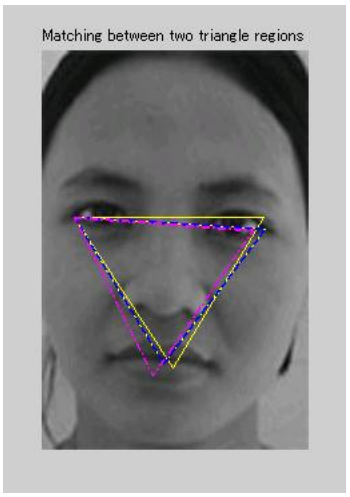

Figure 9. Matching Between Two Triangles

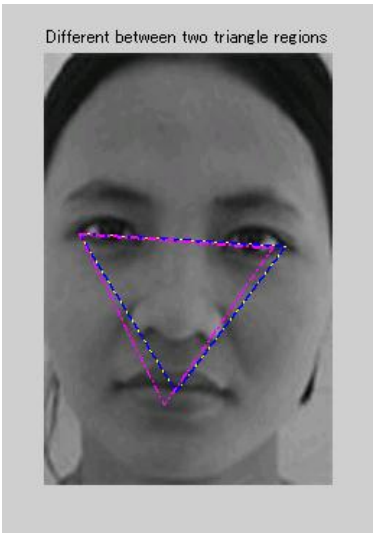

Figure 10. Different between Two Triangles Region

The FR system needs some limited constraint such as not wearing glasses, without beards, etc. The images size will be 300x400 pixels. There

are 500 training face images use in the preliminary experiment. Fig. 5 show some face images in the face database. The feature points of the corner of the eyes and lip are preconnected. Figure 5 and Figure 6 show the feature points and drawing triangles of the training and testing face image respectively.

The overlapped triangles on the training image are illustrated as in Figure 7. Translation of a triangle of testing image is shown in Figure 8. After that rotating the edges of the triangle, and the difference between two triangles can be measured as shown in Figure 9. Several experiments have been done using the multi face images to confirm the effectiveness of our proposed method.

Finally the experiment be done again by matching the average value of the pixels value of the testing face image and training face image because we used a hybrid method for matching process. The accuracy rate of the system is getting around ninety percent when using face in frontal view. The recognition errors about ten percents were caused due to the variation of poses.

Table 1. Accuracy Rate of Face Recognition in Preliminary Experiment

Person	Accuracy Rate(Percentage)
Person 1	91.25
Person 2	92
Person 3	85.33
Person 4	87.5
Person 5	90.01

VIII. Conclusion and Future Works

Face recognition is a very attractive research area. This paper includes translation, small rotation and small illumination changes. The experiment showed that the hybrid method of geometric features and template matching provides an excellent results. Some erroe were caused due to the pose change.

In Future works, we will use not only two methods were hybrid, we can hybrid more than two methods or to hybrid with other method to improve the accuracy rate.

References

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