

A novel approach for performance parameter estimation of face recognition based on clustering, shape and corner detection

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ABSTRACT: The aim of this research is to solve face recognition problem in area of biometric by using CSC hybrid method. In our work first we make the cluster of face key points and parallelly apply shape and corner method for detection boundary of face and the corner of face objects. Our work is performing both face identification and recognition on large face database. It is better than other previous work because our FAR, FRR and EER less than. Also we calculate the recognition time in our work.

Keywords: Face Recognition, Clustering, Shape Descriptor, Corner Detection, RGB Image, Image Processing, Color Model, Binary Image, 4-Connected Component.

I. INTRODUCTION

Image of outdoor scenes are Now a day's face recognition is play very crucial role in recent technology like mostly companies are adopting the biometric identification for login but when images are degraded than the performance of our system is reduced. This study gives some idea about steps by steps face recognition algorithm how face is recognized but when quality of an image is degrade due to some noise or any external reason than matching process will not give accurate result for this reason we adopt some restoration and enhancement techniques like retinex theory for degrade image to improve quality for better performance in next part of my work.

Pattern recognition is the scientific discipline whose goal is the classification of *objects* into a number of categories or classes [1]. Depending on the application, these objects can be images or signal waveforms or any type of measurements that need to be classified. We will refer to these objects using the generic term *patterns*. Pattern recognition has a long history, but before the 1960s it was mostly the output of theoretical research in the area of statistics [6].

We have studied a face recognition system using the Principal Component Analysis (PCA) algorithm with Euclidean distance as a classifier and secondly Linear Discriminant Analysis (LDA) with Euclidean distance as a classifier. Face recognition systems try to find the identity of a given face image according to their memory. The memory of a face recognizer is generally simulated by a training set. Independent Component Analysis (ICA) is similar to PCA except that the distribution of the components is designed to be non-Gaussian. Maximizing non-Gaussianity promotes statistical independence.

The problem of face recognition can be stated as follows: Given still images or video of a scene, identifying one or more persons in the scene by using a stored database of faces [3]. The problem is mainly a classification problem. Training the face recognition system with images from the known individuals and classifying the newly coming test images into one of the classes is the main aspect of the face recognition systems.

II. FACE RECOGNITION

The face plays a major role in our social intercourse in conveying identity and emotion. Face Recognition (FR) [1,3] is a challenging task and has been one of the most successful applications of image analysis and understanding in many fields such as computer vision, pattern recognition. Image-based face recognition techniques can be divided into two groups according to the face representation which they use, which being the appearance-based approach and the feature-based approach, among which the appearance-based is more popular, that use holistic texture features [2,7]. With automatic face recognition there are many applications in human computer interaction, biometrics and security, etc. Over the decades, many computer systems that can recognize faces have been developed, some of which have been in commercial use. Generally, appearance-based face recognition techniques are finished with image matching in the space of compressed image. If image matching done in the original space, it will result in the curse of dimensionality in addition to the problems of large computational complexity and memory Face recognition has received considerable interest as a widely accepted biometric, because of the ease of collecting samples of a person, with or without subject's intension . Face recognition [10,11] refers to an automated or semi automated process of matching facial images. This type of technology constitutes a wide group of technologies which all work with face but use different Scanning techniques. Most common by far is 2D face recognition which is easier and less expensive compared to the other approaches.

There are four steps in face recognition process as shown in flow chart:

1. Acquiring a sample: In a complete, full implemented biometric system, a sensor takes an observation. The sensor might be a camera and the observation is a snapshot picture. In our system, a sensor will be ignored, and a 2D face picture [8, 11] “observation” will supplied manually.

2. Extracting Features: For this step, the relevant data is extracted from the predefined captured sample. This is can be done by the use of software where many algorithms are available. The outcome of this step is a biometric template which is a reduced set of data that represents the unique features of the enrolled user's face.

3. Comparison Templates: This depends on the application at hand. For identification purposes, this step will be a comparison between a given picture for the subject and all the biometric templates stored on a database. For verification, the biometric template of the claimed identity will be retrieved (either from a database or a storage medium presented by the subject) and this will be compared to a given picture.

4. Declaring a Match: The face recognition system will return a candidate match list of potential matches. In this case, the intervention of a human operator will be required in order to select the best fit from the candidate list. An illustrative analogy is that of a walk-through metal detector, where if a person causes the detector to beep, a human operator steps in and checks the person manually or with a hand-held detector.

III. PREVIOUS WORK

A. Facial-Image Acquisition

In our research, original images were obtained using a charge coupled devices (CCD) camera with image dimensions of 384×243 pixels encoded using 256 gray-scale levels.

In image acquisition, the subject sits 2.5 m away from a CCD camera. On each side of the camera, two 200-W lamps are placed at 30° angles to the camera horizontally. The original images are shown in Fig. 1.

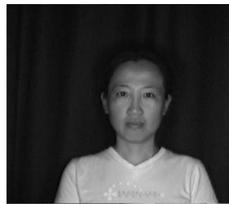


Fig. 1. Original face image.

B. Lighting Compensation

We adjusted the locations of the lamps to change the lighting conditions. The total energy of an image is the sum of the squares of the intensity values. The average energy of all the face images in the database is calculated. Then, each face image is normalized to have energy equal to the average energy

$$\text{Energy} = \sum (\text{Intensity})^2. \quad (1)$$

C. Facial-Region Extraction

We adopt the face-detection method presented in the method of detecting and extracting the facial features in a gray-scale image is divided into two stages. First, the possible human eye regions are detected by testing all the valley regions in an image. A pair of eye candidates is selected by means of the genetic algorithm to form a possible face candidate. In our method, a square block is used to represent the detected face region. Fig. 2 shows an example of a selected face region based on the location of an eye pair. The relationships between the eye pair and the face size are defined as follows:

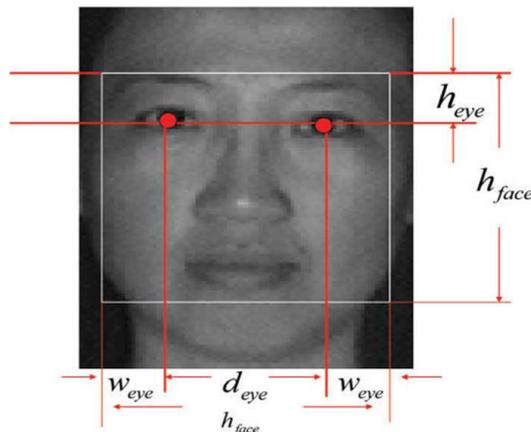


Fig. 2. Geometry of our head model.

$$\begin{aligned}
 h_{\text{face}} &= 1.8d_{\text{eye}} \\
 h_{\text{eye}} &= \frac{1}{5}h_{\text{face}} \\
 w_{\text{eye}} &= 0.225h_{\text{face}}.
 \end{aligned}$$

Then, the symmetrical measure of the face is calculated. The nose centerline (the perpendicular bisector of the line linking the two eyes) in each facial image is calculated. The difference between the left half and right half from the nose centerline of a face region should be small due to its symmetry. the symmetrical measure is less than a threshold value, the face candidate will be selected for further verification.

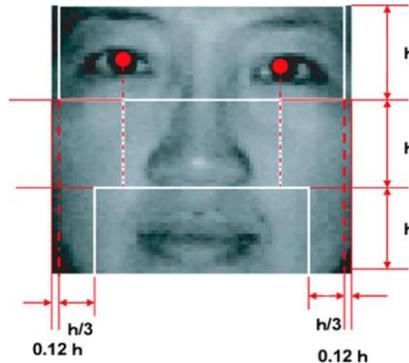


Fig.3. Windows for facial feature extraction

After measuring the symmetry of a face candidate, the existences of the different facial features are also verified. The positions of the facial features are verified by analyzing the projection of the face candidate region. The facial feature regions will exhibit a low value on the projection. A face region is divided into three parts, each of which contains the respective facial features. The y -projection is the average of gray-level intensities along each row of pixels in a window. In order to reduce the effect of the background in a face region, only the white windows, as shown in Fig. 3, are considered in computing the projections. The top window should contain the eyebrows and the eyes, the middle window should contain the nose, and the bottom window should contain the mouth. When a face candidate satisfies the aforementioned constraints, it will be extracted as a face region. The extracted face image is shown in Fig. 4.

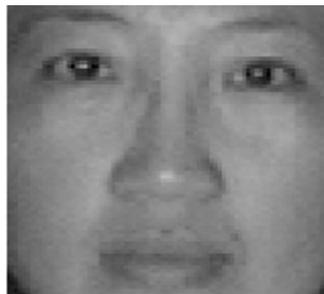


Fig. 4. Extracted face image.

D. Principal Component Analysis (PCA)

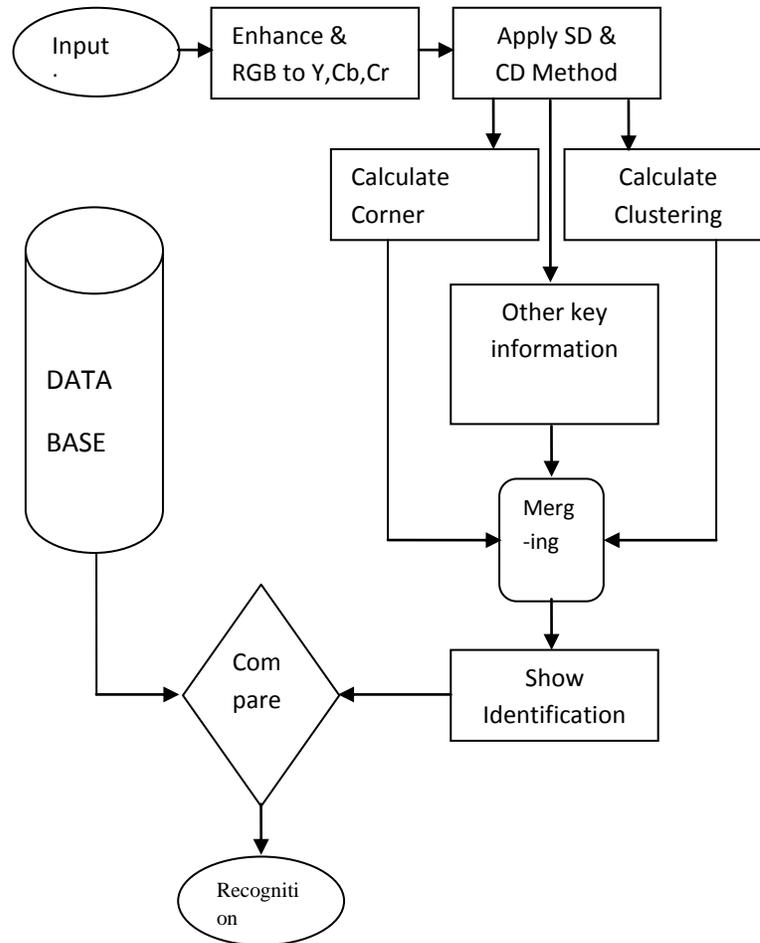
Let a pattern Z_i be a two-dimensional (2-D) $m \times m$ array of intensity values. A pattern may also be considered as a vector of dimension m^2 . Denote the database of n patterns by $Z = (Z_1 Z_2 \dots Z_n) \in \mathfrak{R}^{m \times n}$. Define the covariance matrix as follows [4].

$$\Gamma = \frac{1}{n} \sum_{i=1}^n (Z_i - \bar{Z})(Z_i - \bar{Z})^T = \phi\phi^T$$

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Proposed Work

We present the model of the our work is given below

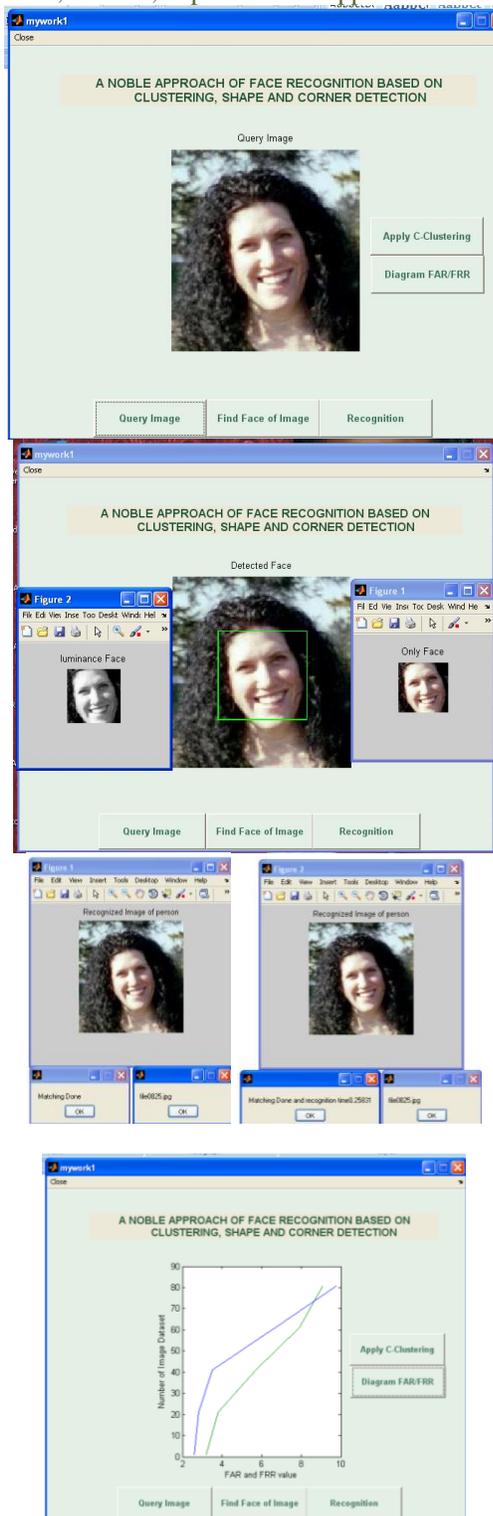


Algorithm

- Step1. we take query image.
- Step2. Image enhancement (Filtering)
- Step3. Convert into Y, Cb, Cr model.
- Step4. By this process (step 3), we get three picture of this query image (luminance, chrome blue & chrome red)
- Step5. Then we apply shape discripiter on luminance image.
- Step6. Now we apply colour discripiter on Cb(chrome blue) &Cr.
- Step7. Merging of result no.5&6 steps.
- Step7. By step 7 we detect the face.
- Step8. Now we save the detected shape in variables (For subsequent analysis) c o m p l e t e
- Step9. Prepare predefind database of 40 image.
- Step10. Now we apply step 2-9 on prepare database image.
- Step11. Now we apply C-Means clustering on step 9& step 10 (parallely)
- Step12. If no. of clusters, clusters position, cluster size are same then show recognition done and also show recognize person name.
- Step13. Determine no. of detected & no. of non face.Image will be count & then calculate FAR,FRR & EER.

IV. EXPERIMENTAL RESULT

Below figure show the GUI of our work, that getting the face image for analysis. Next figure calculate the only face of the face image. After that we apply our methodology on this query image and finally archive the matching face image, name of image person, clustering on face image and diagram of FAR,FRR.



V. CONCLUSION

In this paper, we have developed a hybrid method that is very effectively work on face image. It selects a face image then find the only face image and matching with respect to database. It reduces the deficiency of existing methods like PCA, correlation based etc. This hybrid method gives better result than all the other individual method. In this work we calculate FAR and FRR. In future we add some other concept like 2D cross correlation and moment invariants of face, with this approach and get a very good result for fingerprint matching.

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