

FACE RECOGNITION SYSTEM: A REVIEW

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ABSTRACT

A face recognition system is capable of *verifying* the human from a *scanned image* or frames from video. Face recognition systems select the face features and compare with the features of scanned image stored in database. It is a technology designed to verify the identity of the person using physical or behavioural characteristics and has been widely used in authentication systems. Due to increasing applications which need security, physical features like finger prints, face, hand geometry, iris, palm prints retina and the behavioural features like voice, typing rhythm and gait are used to recognize a person in today's authentication system. As compared to all other Recognition system, face is the most natural way to recognize the person because it solves the problem of non-universality. This paper presents functionality, literature survey and application of face recognition system.

Keywords: Face recognition process, facial feature acquisition technique, facial feature extraction technique, applications,

INTRODUCTION

Face Recognition is a technology designed to verify the identity of the person using physical or behavioural characteristics and has been widely used in authentication systems [1]. Generally, all the recognition system operates in two phases: Enrolment and Verification (Adaptation is optional) [2]:

1. Enrolment: - In this step user recognizing data is scanned by a sensor like thermal camera and stored in the data base.
2. Verification: - In Verification, some technique is used to identify or verify the requested user.
3. Adaptation- This step is used to increase and maintain the performance of system with changing data over time.

1.1 Functionality of Face Recognition System

Functionality of Face Recognition System as shown in figure 1 is described as follows:

- **Face Data Acquisition:** - In this step, face image is collected using some device like camera or video camera.
- **Pre- Processing:** - In this step, collected data is pre-processed by discarding the noise and image quality is improved for further processing.
- **Feature Extraction:** - In this step, desirable features are extracted from collected data by using some technique of feature extraction.
- **Template Generation:** - Extracted features are transformed into template so that it can easily readable and comparable in matching process.
- **Matching:** - In this step, input image template for testing is matched with the stored template in database, and a matching score is generated on the basis of similarity between live and stored template.
- **Decision:** - Finally Decision as live or fake is taken on the basis of matching score generated in previous step.

II FACE RECOGNITION TECHNIQUES

This section gives an overview on the major human face recognition techniques that apply mostly to frontal faces, advantages and disadvantages of each method are also given. The methods considered are eigenfaces (eigenfeatures), neural networks, dynamic link architecture, hidden Markov model, geometrical feature matching, and template matching. The approaches are analyzed in terms of the facial representations they used.

• **Eignfaces**

The eigenface technique using the Principal Components Analysis (PCA) method known as Karhunen-Loeve method is successfully used in order to perform dimensionality reduction. Turk et. al. al in [3], used principal component analysis to face detection and recognition. L. Sirovich et. al. in [4,5], to represent face images efficiently, principal component is used.

Fisherfaces

Fisherface i.e. Linear Discriminant Analysis (LDA) is developed by R. A. Fisher in 1930 [6]. Belhumeur et. al.[7] suggested that it is based on appearance and shows the good and satisfactory results.

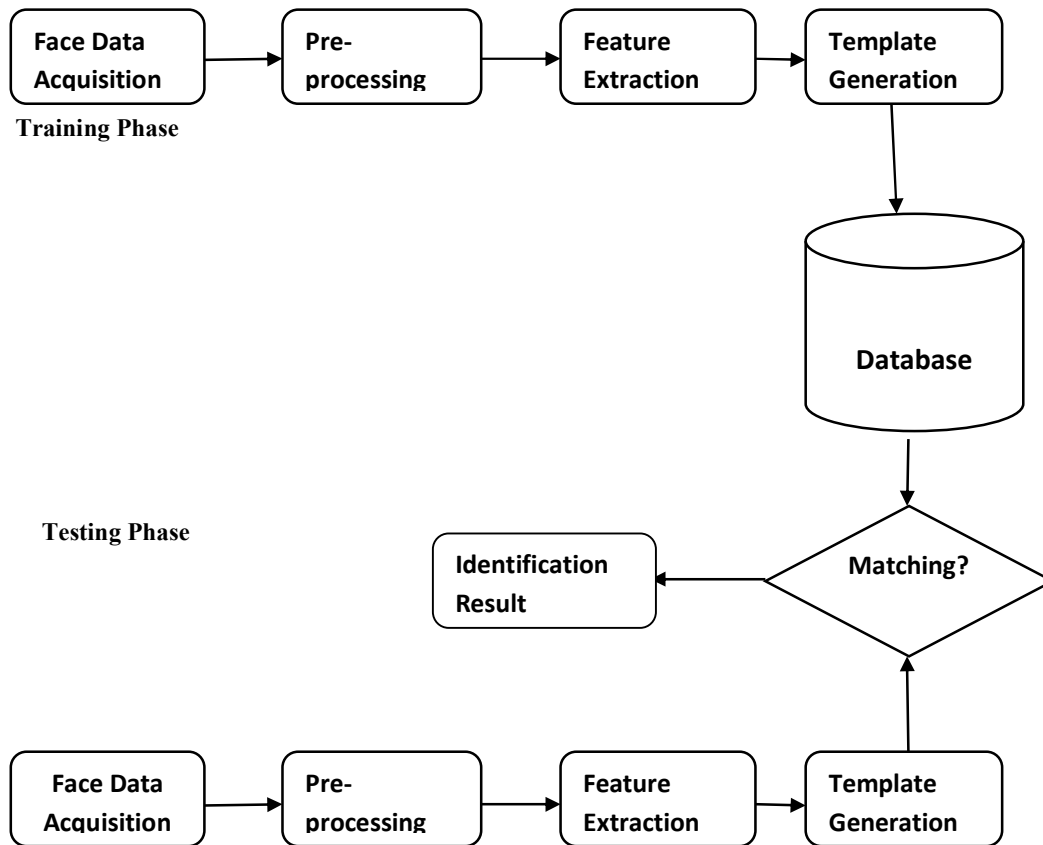


Figure 1: Verification process of Face recognition

- **Neural network**

Mostly pattern recognition problems like object, text, and sound image recognition solved using neural network. In face recognition, it gives feasible results for training, feature extraction, and feature selection.

Neural network can be tuned to get better performance [8]. Feature extraction using neural network gives efficient results than linear Karhunen-Loève methods [9].

- **Graph matching**

In graph matching, correspondence between the nodes of graphs is find using patterns of modelled as pattern and graph [10]. In graph matching, a relational distance metric is used to match the graphs by comparing vertices and edges according to their contribution to a relational distance metric [11].

I. FACIAL FEATURE EXTRACTION TECHNIQUES

- **Appearance-based approaches**

In face recognition, eyes, iris, mouth, chin are some features used for extraction. Some techniques like principal component analysis (PCA), local binary pattern(LBP), and Gabor-wavelets [12] are used to extract the face features . These techniques trained from a set of training images

- **Template-based**

These methods are used for localization and face detection both. The correlation is find out between stored and input image. Yuille et al [13] gives the best result of template in face image.

- **Colour segmentation techniques**

As the skin color of all the faces is unique, this technique works on this principle. Like mouth or eyes are observed as non skin colour region. But this technique is limited for performance due to the ethnical backgrounds diversity [14].

- **4Geometry-based**

In this technique, relative size and position of features are extracted using geometry. Kanade [15] proposed this technique to localized eyes, mouth features using the vertical edge map.

II. APPLICATIONS OF FACE RECOGNITION

Face recognition system can be used in different area [16]. Some of them are discussed below:



- **General Verification:**

Face recognition is used in bank verifications, passport, Electoral Registration, employee Ids.

- **Security of Mobile Device**

In day to day life, all the important work done on mobiles. So security is a key issue in mobiles. Face recognition is very secure in mobile verification.

- **Criminal Recognition**

Face recognition is very helpful in criminal identification. Special cameras are to be installed on susceptible areas to identify criminals.

Figure 2: Thermal Camera used for capturing the data

- **Security on Airport**

Security on Airport is most important because all the criminals escape from airports. Face recognition is very helpful in airport security.

So, face recognition helps in security system of office which is used to secure the hours. Face recognition system also helps in door access control system, hardware access security etc.

IV CONCLUSION

This paper reviews the concept of face recognition and its techniques. How the face recognition system works discussed in this paper. This paper also revealed some features extraction techniques like PCA, LBP etc. And some important applications of face recognition is also discussed in this paper.

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