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# Face Recognition Method in Biometric Authentication

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**ABSTRACT**:

Face Recognition is used for real time application. So reliability is the more important matter for security. Facial Recognition is rapidly becoming area of interest. Face biometrics is useful for authentication that recognizes face. This paper represents review of face recognition methods and discusses their advantages and disadvantages. The purpose of this paper is to provide a survey of face recognition methods that appeared in the literature over the past decade which was not discussed in the previous survey and also categorize them into meaningful approaches

**Keywords** :Biometrics,Face recognition, Authentication,

## Biometric Authentication Methods

Biometric has been for long the target of future authentication that expected that biometric authentication will largely displace other means of our current authentication and access control. Biometric systems can be used in two distinct modes as follows.

- ***Verification*** : determining whether a person is who he claims to be. In the verification mode, the system validates the person's identity by comparing the captured biometric data with the template stored in the database.
- ***Identification*** determining who the person is. In the identification mode, the system identifies the person by searching the templates of all users in the database for a match.

A biometric system operates by firstly ***acquiring*** biometric data from an individual, then ***extracting*** feature set from the data, and finally ***comparing*** the feature set with the template in the database as shown in the below figure

**What are biometric techniques?**

The use of biometrics, or specifically unique human characteristics, has existed for hundreds of years in one form or another, whether it is a physical description of a person or perhaps more recently a photograph. Biometric authentication techniques are classified by the type of characteristics evaluated: physiological attributes or behavioral singularities.

**Physiological Biometrics**

Physiological biometrics are based on classifying a person according to data obtained as part of the human body such as his fingerprints, face, or eye iris.

**Fingerprint Recognition**The most popular biometric to date, fingerprint recognition, can utilize a number of approaches to classification, based on minutiae which are a reproduction of epidermal friction skin ridges found on the palm side of the fingers and thumbs, the palms, and soles of the feet. We can use them for authentication because there are basic principles as follows.

- A fingerprint will remain unchanged during an individual's lifetime.
- Fingerprints have general ridge patterns that permit them to be systematically classified.
- A fingerprint is an individual characteristic because no two fingers have yet been found to possess identical ridge characteristics.

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**Hand Geometry**

The second most widely deployed biometric is hand geometry. We use the geometric features of the hand such as the lengths of fingers and the width of the hand to identify an individual.

**Facial recognition**

The system record face images through a digital video camera and then analyze facial characteristics like the distance between the eyes, nose, mouth, and jaw edges.

**Retinal Identification**

Retina based identification is perceived as the most secure method of authenticating identity. Retinal identification provides true identification of the person by acquiring an internal body image, the retina/choroid of a willing person who must cooperate in a way that would be hard to counterfeit

**Behavioral Biometrics**

It consists of measurements taken from the user's actions, some of them indirectly measured from the human body.

**Voice Verification**

Voice verification systems are different from voice recognition systems although the two are often confused. Voice recognition is the process of recognizing what a person says, whereas voice verification is recognizing who is saying it.

Voice verification benefits from a high acceptance rate because of its high usability and costs. Similar to facial recognition, the results demonstrated low performance in non-standard environments. Thus, voice authentication technologies cannot be considered mature enough and again, they must be accompanied or combined with additional mechanisms.

Moreover, voice recognition algorithms must be tolerant of noise and should not be influenced by variations of the voice produced by sore throat or cold.

**Keystroke Dynamics**

The system measures and compares specific timing events also known as "typing signature". The way in which a person types on a keyboard has been shown to demonstrate some unique properties.

**Handwritten Signature**

Signature recognition systems attempt to authenticate people based on their handwritten signature

FACE RECOGNITION METHODS

**Knowledge-based:** methods Knowledge-based methods are encoding our knowledge of human faces. These are rule-based methods. They try to capture our knowledge of faces, and translate them into a set of rules. It"s easy to guess some simple rules. For example, a face usually has two symmetric eyes, and the eye area is darker than the cheeks. Facial features could be the distance between eyes or the color intensity difference between the eye area and the lower zone. The big problem with these methods is the difficulty in building an appropriate set of rules. There could be many false positives if the rules were too general. On the other hand, there could be many false negatives if the rules were too detailed. A solution is to build hierarchical knowledge-based methods to overcome these problems. These methods show themselves efficient with simple inputs. But, what happens if a man is wearing

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glasses? There are other features that can deal with that problem. For example, there are algorithms that detect face-like textures or the color of human skin.

**Feature-invariant methods:** Feature-invariant methods that try to find invariant features of a face despite its angle or position. Facial recognition utilizes distinctive features of the face – including: distinct micro elements like: Mouth, Nose, Eye, Cheekbones, Chin, Lips, Forehead, Ears, Upper outlines of the eye sockets, the areas surrounding the cheekbones, the sides of the mouth, and the location of the nose and eyes. The distance between the eyes, the length of the nose and the angle of the jaw.

**Template matching methods** These algorithms compare input images with stored patterns of faces or features. Template matching methods try to define a face as a function. One can try to find a standard template of all the faces. Different features can be defined independently. For example, a face can be divided into eyes, face contour, nose and mouth. Also a face model can be built by edges. But these methods are limited to faces that are frontal. A face can also be represented as a shape. Other templates use the relation between face regions in terms of brightness and darkness. These standard patterns are compared to the input images to detect faces. This approach is simple to implement, but it‟s insufficient for face detection. It cannot achieve good results with variations in pose, scale and shape. Appearance-based methods A template matching method whose pattern database is learnt from a set of training images. In general, appearance-based methods rely on techniques from statistical analysis and machine learning to find the relevant characteristics of face images Eigenface based Methods - PCA Algorithm Principal Component Analysis (PCA) is well-organized method for face recognition. It is one of the most usable methods for a face image. It is used to reduce the dimensionality of the image and also holds some of the variations in the image data. It is projecting face image data into a feature space that covers the significant variations among known facial images. Those significant features are known as “Eigen faces”, because they are the eigenvectors or Principal Component of the set of faces. That is not necessary to correspond to the features such as eyes, ears, and noses. The projection operation characterizes an individual face by a weighted sum of the Eigen faces features. So to recognize a particular face, it is necessary only to compare these weights to those individuals. The Eigen Object Recognizer class applies PCA on each image, the results of which will be an array of Eigen values. To perform PCA several steps are undertaken,

**Distribution based Methods** – LDA Algorithm LDA also known as Fisher‟s Discriminant Analysis, is another dimensionality reduction technique. It is an example of a class specific method i.e. LDA maximizes the between – class scattering matrix measure while minimizes the within – class scatter matrix measure, which make it more reliable for classification.[37][38]. Lih-Heng Chan proposed a framework of facial biometric was designed based on two subspace methods i.e., Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA). First, PCA is used for dimension reduction, where original face images are projected into lower-dimensional face representations. Second, LDA was proposed to provide a solution of better discriminant. Both PCA and LDA features were presented to Euclidean distance measurement which is conveniently used as a benchmark. LDA-based methods outperform PCA for both face identification and verification. Fisher faces are one the most successfully widely used method for face recognition. It is based on appearance method. In 1930 Fisher developed linear/fisher discriminant analysis for face

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recognition which shows successful result in face recognition process . The disadvantage of LDA is that within the class the scatter matrix is always single, since the number of pixels in images is larger than the number of images so it can increase detection of error rate if there is a variation in pose and lighting condition within same images. So to overcome this problem many algorithms has been proposed. Because the fisher faces technique uses the advantage of within-class information so it minimizes the variation within class, so the problem with variations in the same images such as lighting variations can be overcome

## Conclusions

Nowadays biometric data extraction can be easily achieved without the need for specific sensors; therefore, its implementation can be low cost when taking advantage of modern technologies, such as mobile devices equipped with embedded cameras for facial recognization or fingerprints.

Facial recognition benefits from high user acceptance because of its costs but nonetheless they get low performance in non-standard environments.

In addition to this method showed to be vulnerable, allowing authentication using “selfies”, which are not difficult to acquire. Therefore, it must be accompanied by additional methods such as liveness detection mechanisms.

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