

PCA BASED EFFICIENT FACE RECOGNITION TECHNIQUE

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Abstract: Face recognition has many important applications e.g. recognition of faces at security checkpoints and airports. Human beings have capability of recognizing a person or a face but machine is not able to perform the same. The main aim is to engineer a system which is able to function like mankind. In this paper face recognition approach is proposed using Principal Component Analysis in the combination of Euclidian, city block distance and Mahalanobis distance.

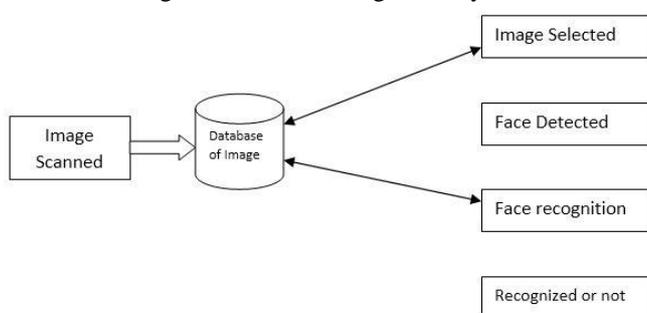
Keywords: Eigen faces, PCA, Euclidian distance, Manhattan distance, city block distance, Template based.

I. INTRODUCTION

Face recognition has been asked for drawback of biometric and it has a range of applications. If a face is recognized it is familiar for the system and system might be able to show the same face existing in stored database. If a face is not found in stored database or system is encountering the particular face for the first time then the face is stored in the database for further recognition. In closed-circuit television if an unknown face seems first time then it is hold on in the system database for further uses. This is very helpful in identification of criminals.

On the basis of face representation, face recognition technique is of two types 1. Appearance Based 2. Feature Based. A challenge in face recognition is illumination and viewing direction generates a large mathematical variation in image. On the basis of image representation face recognition is of two types, geometric and photometric. Geometric method is feature based. Although it is free from the drawback of illumination and viewpoint but it is fully dependent on facial feature extraction and measurement. Photometric or template based methods are more practical and easier to implement.

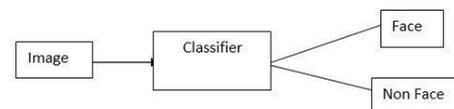
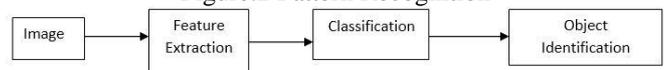
Figure.1 A Face Recognition System



A general face recognition system is shown in fig. 1. An image is first scanned and then it is stored in the database of image category for further uses. For face recognition a most matching image is selected from the database. Face of the

image is detected and recognition of face is performed. On the basis of particular threshold it is decided that face is recognized or not. For the recognition of pattern, firstly features are extracted from the image (fig.2). According to extracted features an image is classified using different methods e.g. Euclidian, city block and Manhattan distance.

Figure.2 Pattern Recognition



II. REVIEW OF LITERATURE

An approach for facial expression recognition based on neural network ensemble [2] proposes a novel method for facial expression recognition based on neural network ensemble. In this approach facial expression features are extracted primarily through multi-expression eigenspace analysis, and after that several neural networks are trained each having an eigenspace of different expressions respectively.

In the paper Local feature analysis for robust face recognition [7] an approach for face recognition using LFA is proposed. In this approach only those feature points which have highest deviations from the statistical expected face are extracted from the Images A pruning algorithm which is based on triangle-inequality was developed to increase the performance and speed up the matching between query features and the database of model features.

In A Multi-Algorithmic Face Recognition System automatic detection of the face is done. After gross scale correction of the image DCT and PCA signatures of the image are extracted. Extracted signatures and set of reference images are compared. After comparison the top five highly similar images are selected.

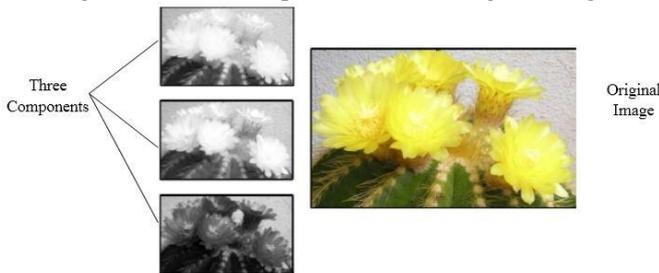
In Real Time Face Detection Using Neural Networks [4] uses the technique from computer vision, pattern recognition and image processing. It proposes use of neural networks in the generation of face detection.

III. PRINCIPAL COMPONENT ANALYSIS

The Principal Component Analysis (PCA) is one in every of the foremost eminent techniques that are utilized in image recognition and compression. Principal component Analysis

is that the general name for a way that uses subtle underlying mathematical principles to transform variety of possibly related to variables into a smaller range of variables known as principal elements [8]. PCA may be an applied math method beneath the broad title of correlation analysis. The aim of PCA is to cut back the massive dimensionality of the information house (observed variables) to the smaller intrinsic spatial property of feature house (independent variables), that square measure required to explain the information economically. This is the case once there's a robust correlation between ascertained variables. The jobs which PCA will do square measure prediction, redundancy removal, feature extraction, knowledge compression, etc. as a result of PCA may be a classical technique which might do one thing within the linear domain, applications having linear models square measure appropriate, like signal process, image process, system and management theory, communications, etc. Face recognition has several applicable areas [9]. Moreover, it may be classified into face identification, face classification, or sex determination [10].

Figure. 3 Three Components and its Original image



IV. CLASSIFICATION METHODS

A). MANHATTAN DISTANCE: It is also called city block distance. When distance between two points is measured at axes at right angles it is called city block distance. It is defined as

$$d(x, y) = |x - y| = \sum_{i=1}^{i=k} x_i - y_i$$

B). EUCLIDEAN DISTANCE: Ordinary distance between two points in Euclidean space is known as Euclidean distance.

$$d(x, y) = \|x - y\|^2 = \sum_{i=1}^k (x_i - y_i)^2$$

C). MAHALANOBIS DISTANCE: It is a measure of distance between a point P and a distribution. If there are two vectors x and y in the unscaled PCA space and corresponding vectors m and n in Mahalanobis space. First, we define $\lambda_i = \sigma_i^2$ where λ_i are the PCA eigenvalues, σ_i^2 is the variance along those dimensions and σ_i is the standard deviation.

$$m_i = \frac{x_i}{\sigma_i} \quad n_i = \frac{y_i}{\sigma_i}$$

$$d(x, y) = \sqrt{\sum_{i=1}^k (m_i - n_i)^2}$$

V. PROPOSED APPROACH

Proposed approach for face recognition is combination of Principal Component Analysis and Mahalanobis Distance. Given approach uses Eigen Face method for the compression or information reduction. Since the image has wide information and most of the data is redundant or repeated, so reduction is performed. In the proposed approach, extraction of feature is performed by Principal Component Analysis. Further, different distance measures are used for distance classifiers. Eigen Faces are generated and then training of data is projected into free space.

VI. RESULTS

Method	Detected	Not Detected	Accuracy
Euclidean with PCA	256	64	80%
City Block with PCA	254	66	79.37%
Mahalanobis with PCA	296	24	92.5%

Table.1 Comparison of Different Approaches of Face Recognition

In the proposed approach Principal Component Analysis is combined with different distance measures. Principal Component Analysis with Euclidean distance measure detects faces with an average of 80 percent accuracy. It detects approximate 256 faces out of 320 faces. Principal Component Analysis with City Block distance measure detects faces with an average of 79 percent accuracy. It detects 254 faces out of 320 faces. Principal Component Analysis with Mahalanobis distance measure detects faces with an average of 92.5 percent accuracy. It detects 296 faces out of 320 faces. Last combination gives the best results in comparison to others.

VII. CONCLUSION

This project on Face recognition had given us an opportunity to review regarding several common strategies used in the sector of face recognition. The flowery literary survey provided us with the pros and cons of the many recognition systems and therefore the trade-off related to them. We tend to additionally came to understand that combining 2 or a lot of techniques will improve the accuracy of system greatly. In this project we've developed a PCA primarily based face recognition system for feature extraction and matching using numerous distance classifiers. The space classifiers used area unit Euclidean distance, Manhattan Distance and Mahalanobis distance. The results for all three are bestowed. The results clearly shows that a recognition system supported Mahalanobis distance performs much better than the standard Euclidean distance primarily based classifier.

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