Review of Face Recognition Technology Using Feature Fusion Vector

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Abstract— *Facial recognition Technology has evolved into a successful technology. Recognition algorithm, have been reviewed in this paper. PCA, LDA, EBG Matching, Multi linear sub linear applying tensor representation and neural network based dynamic link matching are being used commonly*.

Keywords— *PCA, Viola-Jones, Edge Detection, Face Detection and Fusion Method.*

I. INTRODUCTION

Modern era is marked by latest advances in biometric recognition system. Face recognition is catching the attention of security systems by both security agencies and common people. Face recognition system consist of acquisition, normalization and recognition.

In this review paper we have thoroughly investigated the historical development up to current commercial application of the face recognition systems.

The common methods are:-
1. Geometrical methods
2. Pictorial methods.

The geometrical methodology consists of spatial configuration of salient facial characteristics. Nose, eyes and mouth like features are geometrically located.

The pictorial approach uses stored database of different pictures of the same person with different expression acquired for identification, Kohanen model based on the neural network is one of the first method. This system was able to identify the faces by approximating the Eigen vectors of the face geometry [1].

a) Knowledge-Based Methods
The human face can be classified using Top-Down approach and Bottom-up approach methods. These are the two methods to solve this problem.

- **Top-Down Methods:**
This approach involves recording facial features like eyes, nose, mouth, ears and hair style and their relative position. This method is little difficulty to implement in the real world.

- **Bottom-Up Methods**
In bottom up approach varying features can be recorded by presuming certain conditions like one pose, bright background etc. Different techniques are developed which

first detect the facial features and then compare them with the stored database.

There are certain limitations with the feature based algorithms like illumination shadows etc. Due to these problems grouping algorithms become useless.

The generic methods for the face detection are facial expression, texture, skin color, its size and shape. The world wide human face feature can be used to identify the faces of different color skin.

b) Template Matching Methods
These are ready made reference formats called as template for comparison of the input data with categorized image data base. The face is predicted on the basis of features such as eyes, nose, mouth, and other outlines of the face.

This is easy method but it is able to help with variation in posture, scale and shape. The scale and shape variation templates are proposed.

- **Predefined Templates**
Method is to find out the face out of the picture available and then focus is shifted to finding out the details about the desired face.

- **Deformable Templates**
The parametric technology is used to fix the facial feature based template. An entropy functions are defined to correlate peaks, edges, and valleys of the input image with the corresponding parameters defined in the templates [2] - [3].

c) Appearance Based Methods
These are the appearance based methods which rely upon statistical analysis and then calculate the features of facial and non-facial images. There are many approaches using the appearance based methods:

- **Inductive Learning:**
The inductive learning method involves the face detection by the decision tree represented by a vector having 30 characteristics. The leaves of the decision tree tell about the class and the node identifies the tests to perform on single attribute. It displays 96% accuracy in the FERET data set.

- **Eigen faces:**
Principal component analysis (PCA) detection method, the faces are pictured as points the 3D space called Eigen face.

It is difficult to assume images as points for the two reasons, its running is expensive and raw images contain the spurious information. Thus, PCA is used for projecting the raw face images onto the Eigen space of a representative set of normalized face images, for eliminating redundant and irrelevant information [4].

II.   REVIEW OF TECHNIQUES

Commonly used algorithms are principal component analysis using Eigen faces, linear discriminate analysis, elastic bunch graph matching using fisher face algorithm, the hidden markov model, the multi linear subspace learning based on tensor representation and neural network based dynamic link matching.

Rizoan Toufiq and Md. Rabiul Islam have used canny edge detection. The system is taught by train faces which are stored and later used to compare the acquired images for submitted for the recognition .Viola-Jones detection algorithm is used for this purpose. Finally the two characteristics of facial image are fused into a feature vector.The reduced feature is used as the input to the back propagation algorithm. The database is classified using BPNN algorithm and weighted matrix. The threshold values are predefined to reject the unknown faces. The 94% accuracy has been claimed by the authors [5].

Aamer et.al have explored the face detection technique using skin color by neural network. The proposed method is pre-processing, segmentation and feature extraction. The skin color can be quickly processed by cropping the skin part of the image. Different people have different skin color Cb and Cr color. Space forms the basis to extract DCT coefficient. For segmentation the image is converted from RGB to YCbCr format. This format is not sensitive to intensity. DCT is applied to achieve image compression. This extracted coefficient is used to detect the facial feature. Authors have used 2D-DCT for cropped skin. Further multilayer perception back propagation neural networks that could discriminate between face and non-face. This method will further improve the face detection technology [6].

Authors have worked out a methodology to improve canny edge detection. Scale multiplication method is applied on synthetic image and natural images. Large scale big enough to keep the false edge rate too, while achieving high edge location accuracy by multiplying a small scale. Edge maps are constructed as local maxima by thresholding the scale multiplication results. At a small loss in the detection and localization criterion [7].

Paul viola and Michael Jones have created a real time face detection technique which is recognized throughout the world. The high frame rates with the help of the data present in the single grey image. Internal image method allows faster feature evaluation. This image can be computed from an image with very little processing. The method for constructing a classifier on the basis of few features using Adaboost training. It is sensitive to noisy environment. This work has further improved the method of combining complex classifiers in a structure in tandem. It has 32 classifiers which lead to high speed detection system [8].

John Canny author has worked out a mathematical model for detection and localization. The multiple response measure is added to two criteria. The numerical optimization is used to find optimal operators for roof and ridge edges. The classes of operators are generated by 3D scaling. The detector is based on adaptive thresholding with hysteresis to remove streaking edges. Further, it is experimentally proved that the step edge detector performance improves considerably as the operator point spread function is extended along the edge [9].

Peter and David have made a deep study of face detection algorithms. The fisher face technique proves to be the best. This is based on extrapolating and interpolating in variable lighting environment. The linear subspace methodology is quite accepted. Eigen faces method use large number of principal components. It is found that the fisher face method is the best at handling variation in lighting and expression. Linear subspace gives the poor result [10].

Y. Lecun et.al have demonstrated in this research the application of constraints and its integration in back pro propagation network through the architecture of the network. The network was trained on low level representation of data. This needs lesser hardware resources. The data was redundant and the constraint on the network reduces the learning time. Scaling is improved. The weight obtained by back proportion learning was easily realized. The work signifier the importance of flexible network design [11]

P. Latha et.al have applied PCA algorithm for Principal Component analysis. It acquires the set of faces and then calculates the Eigen-Faces form the training set. The images are classified as known and unknown. After PCA back-propagation algorithm is used for learning the images (BPNN). This BPNN provides an efficient method for changing the weight in feed forward network. The authors have concluded that PCA with BPNN helps to improve the success rate by 90% and improves the efficiency [12].

Nazil et.al have proposed to use the fastest neural network technique to classify the expression is used which classify the face very efficiently. The effective back propagation network with 6 input neurons, 100 hidden neurons and 7 output neurons is used to train the network. Training results are 100% accurate [13].

Sujata G.Bhele and V.H.Mankar have reviewed the face recognition techniques. PCA, LDA, ICA, SVM, Gabor Wavelet soft computing tools like ANN for recognition techniques have been briefly reviewed. It is concluded new and best method will evolve by integrating all methods efficiently [14].

S.Thakur et.al has employed PCA and redials basis function (RBF) neural networks. The RBF neural network is faster and easy to train the system. The face features are extracted by PCA method which reduces the dimensionality of the input space. The proposed method is tested on the AT& T and UMIST face database by deploying random partitioning the database, n- folds and cross validation test and leave one – out method. The result obtained is trust work and encouraging [15].

Arvind kourav and Prashant Singh have studied the recognition accuracy using feature extraction algorithm. Curvelet Transform is specifically studied and ORL face dataset tested. It is found that the combination of LDA and curvelet proves to be better at reducing dimensionality and this can be applied to face recognition successfully [16].

Sachin Shende and Rahila Patel have proposed an efficient algorithm which makes the use of PCA and ANN methods. The fusions of both the techniques yield a new and efficient face detection system with high accuracy [17].

III.
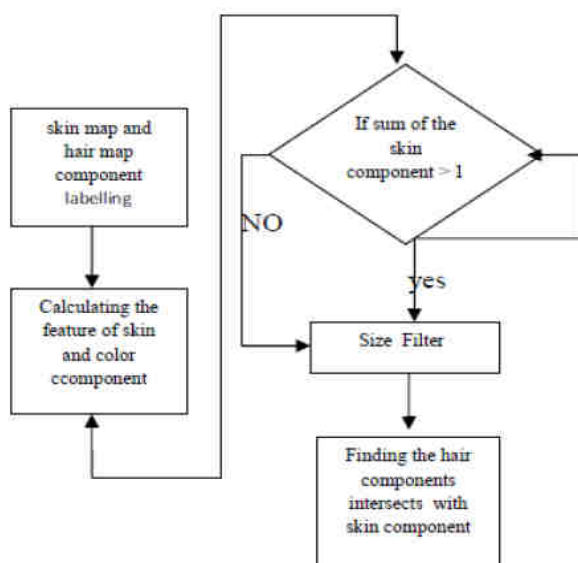

Fig. 1: General Face Detection Algorithm

Fig. 2: Flowchart of Single Human Face Detection

IV.   CONCLUSION

Face recognition is a mind boggling problem. This technology is making progress by leaps and bounds. We have briefly analyzed ample of research papers. It transpires from review that face recognition technology is evolving every day and very shortly it would be more efficient and useful.

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