Chapter 3

Modified Image Based Approach and Neural Networks for Face Recognition

Abstract- Recognition of people is a big challenging problem. Face recognition is one of them. Face recognition is a task which a human being performs in a routine manner in his/her daily life. Automatic processing of digital images has a number of applications, which include biometric authentication surveillance, human computer interaction, multimedia management etc.. The face recognition technique has several advantages over other biometric modalities such as fingerprint and photo of iris. The most important advantage of face is that it can be captured at a distance and in a covert manner. In this chapter we propose multilevel technique for human face recognition and we use the neural network technique to train the data. We compare the performance of proposed technique

with that of existing techniques. The proposed technique gives better result.

3.1 Introduction

There are four modules in face recognition system: detection, alignment, feature extraction and matching, where localization and normalization (face detection and alignment) are processing steps before face recognition (facial feature extraction and matching) is performed.

The detected faces may need to be tracked using a face tracking component in case of video. Aim of face alignment lies in achieving more accurate localization and normalizing faces. Whereas face detection provides coarse estimates of the location and scale of each detected face [4], face components such as eyes, noses, mouth and facial outlines, are located based on the location points, the input face image is normalized with respect to geometrical properties such as size and pose using geometrical transforms or morphing.

After a face is normalized geometrically and photometrically, feature extraction is performed to provide effective information that is useful for identifying different faces of persons and it is stable with respect to geometrical and photometrical variations.

The extracted feature vector of the input face is matched with enrolled faces in the database. When a match is found with sufficient confidence or indicates an unknown face otherwise, it produces outputs of the identity of the face [6].

Face recognition results depend on features that are extracted to represent the face pattern and classification methods used to distinguish between faces.

These difficulties may be analyzed from the viewpoint of face subspaces or manifolds as follows:

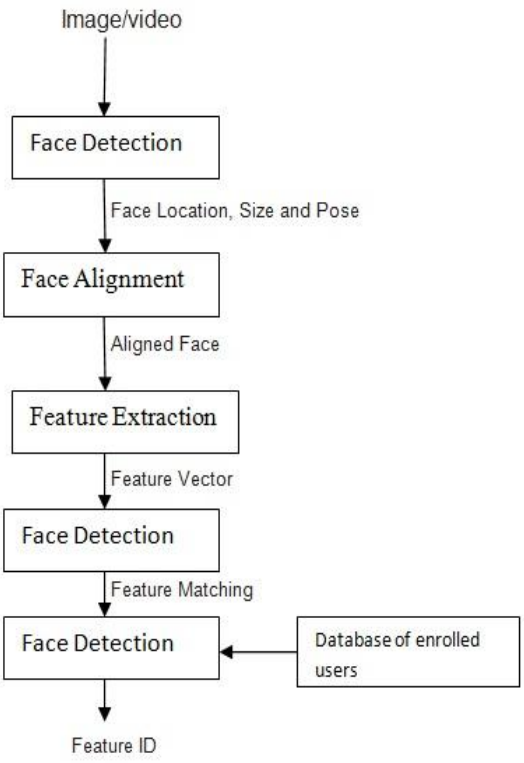

Fig 3.1: Face recognition processing flow

In the general case we use two approaches for face recognition. In the first approach, we use facial features like noses, mouth, eyes etc.. The second approach is a global face recognition system which

is implemented using various algorithms. Recent development of artificial neural network is very efficient tool for the face recognition.

3.2 Principal component analysis (PCA)

Principal component analysis (PCA) has brought out strong patterns in a dataset. It is often helpful for making data easy to explore and visualize. First, consider a dataset in only two dimensions like height, weight. This dataset can be plotted as points in a plane. But if we want to tease out variation, PCA finds a new coordinate system in which every point has a new (x, y) value. The axes don't actually mean anything physical; they are combinations of height and weight called "principal components" that are chosen to give one axis lot of variation [1]. PCA is also useful for eliminating dimensions. PCA is used to describe face images in terms of basic functions or “eigenfaces”.

3.3 Gabor filter

Gabor filter is a Gabor function changed into the linear filter form, that is, a signal or an image can be convolved with the filter to produce a “response image”. This process is similar to edge detection. Gabor features are formed by combining the responses of several filters from a single or multiple spatial locations. It is also called bandpass filters [5] which are used in image processing for feature extraction, texture analysis and disparity estimation.

3.4 Neural Network

We use neural network for recognizing the face. This technique uses support vector machines for face recognition. Proposed system uses a combination of PCA, linear discriminate analysis (LDA) and neural networks. First the dimensionality of face image is reduced by PCA and LDA. In the Last the recognition is done by Back propagation Neural Network [3].

3.5 Face Detection Approaches

Face detection approaches can be classified into two categories: feature–based approaches and image-based approaches. In the first category we use extraction of visual features (edges, brightness, color movement etc.) from pixel properties like position and color is used. It is used in knowledge of facial geometry. We use feature searching, constellation analysis and active shape model techniques for the feature based approach. Feature searching is based on face feature and its relative placement in order to detect a face. In the constellation analysis facial feature is grouped into face using more robust face models based on statistical analysis. The active shape model technique is based on face feature which are located with active shapes. In the image based approach, reformation of the face detection problem is done as a pattern recognition problem. Direct face knowledge is not given in this approach. In this approach we use linear subspace methods, statistical approach and neural Network techniques for face recognition [2].

3.6 Training methodology

For training the network we used classical feed forward algorithm. The neural network can be implemented in four main steps: (i). Creation of Database, (ii). Initialization of network, (iii). Training and (iv). Classification.

(i). Creation of database- Preprocessing technique is applied to a system with a set of one class "face" images. It includes original images, mirror images & left–right mirror images which dilate face information whereas non-face information is dilated by up-down mirror images.

(ii). Initialization of neural network- Neural network with weight and bias values is updated according to the network initialization function and many such properties are set to compose the number of network sub- objects (which include input layer, outputs, target biases & weights) and the way they are connected.

(iii). Training the neural network- After initialization of neural network face classes are ready to train the neural network with them to feed into the system, training occurs according to training parameters shown with their default rules.

(iv). Classification- For the checking of an image that it contains face or not, trained network is used in which the image is firstly modified into grey scale for classification of the image. A new image is offered to the network, this image is spitted into windows that are individually offered to the network to perform classification windows verdict to contain a face outlined with a red bounding box of size 256 X 256 & the images will be displayed on completion.

3.7 Proposed System

We use the image processing toolbox with neural network toolbox and face recognition systems. We add some photos in a database and use PCA and LDA methods in combination for face recognition in order to improve efficiency. Face images are collected into the

sets. Every set or class includes a number of images for each person with some variation in expression and in lighting. We have used a number of images with different expressions:

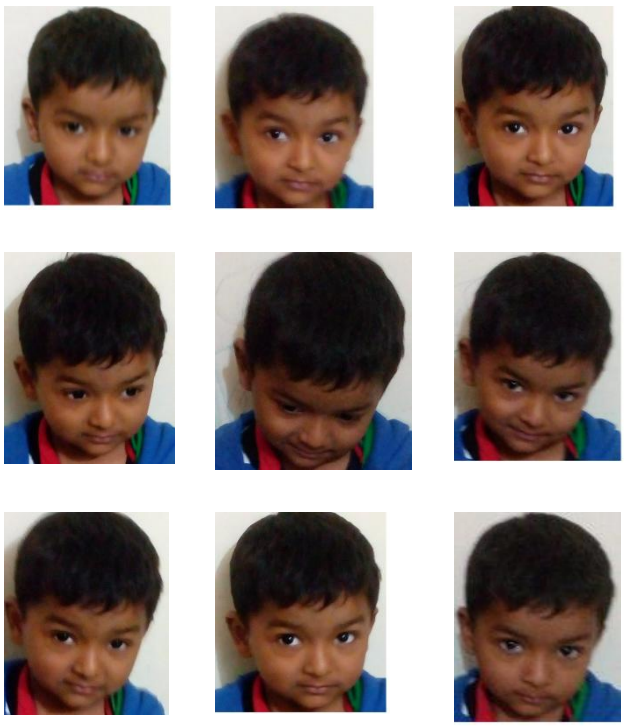

Fig 3.2: Images with different expressions

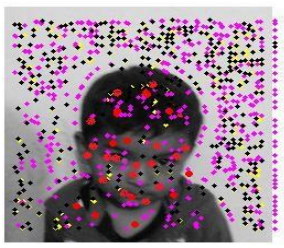

Fig 3.3: Training of neural networks

Following steps are used by the proposed procedure:

Step1. Create database

Step2. Initialize network

Step3.Train network

Step4. Apply proposed method

Step5. Test on the photo

Step6. Exit

A number of cases is required when we input new images in the training database. Before starting image recognition first we select the input image that is present in the database and matches with known faces. It needs to train the network to achieve the performance goal.

We compare our result with Principal Component Analysis (PCA) and Independent Component Analysis (ICA).

Performance rate evolution is given in the table below.

Table 3.1: Performance table of proposed method.

Test sets	ICA performance (%)	PCA performance (%)	Proposed performance (%)
1	82.1	81.1	83.1
2	74.2	73.9	74.1
3	76.7	75.2	79.2

3.8 Conclusion

In this process trained neural network is used. We have used only two algorithms for comparing the results. Other issues are ignored. MATLAB R2012a with Pentium-Core2Duo processor is used to implement the proposed technique. All images are taken by Camera. Further research is possible for performance measurement and comparison of other issues and algorithms.

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