FACE RECOGNITION BASED AUTOMATIC ATTENDANCE SYSTEM USING NEURAL NETWORK

LOKESH B S, CHANDRASHEKAR M PATIL

***Abstract*— Face detection has been one of the most studied topics in the computer vision literature. This technical report,reveals the recent advances in face detection for the past decade and implementation of new algorithm to detect faces in real time. The algorithm developed using PCA and BPN algorithm detects all the faces present in real time and name the faces accordingly using face feature extraction algorithm.**

***Index Terms*— Face Detection, PCA, BPN, Feature Extraction**

I. INTRODUCTION

With the rapid increase of computational powers and availability of modern sensing, analysis and rendering equipment and technologies, computers are becoming more and more intelligent. Many research projects and commercial products have demonstrated the capability for a computer to interact with human in a natural way by looking at people through cameras, listening to people through microphones, understanding these inputs, and reacting to people in a friendly manner. One of the fundamental techniques that enables such natural human-computer interaction is face detection. Face detection is the step stone to all facial analysis algorithms, including face alignment, face modeling, face relighting,facerecognition,faceverification/authentication,
read pose tracking, facial expression tracking/recognition, gender/age recognition, and many more. Only when computers can understand face well will they begin to truly understand people's thoughts and intentions.

Given an arbitrary image, the goal of face detection is to determine whether or not there are any faces in the image and, if present, return the image location and extent of each face.

The field of face detection has made significant progress in the past decade. In particular, the seminal work by Viola and Jones has made face detection practically feasible in real world applications such as digital cameras and photo organization software. In this report, we present a brief survey on the latest development in face detection techniques since the publication. More attention will be given to boosting-based face detection schemes, which have evolved as the de-facto standard of face detection in real-world applications since.

OVERVIEW OF FACE DETECTION & RECOGNITION

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Face recognition is a process of extracting the features of face in an image and detecting the entire face using principle component analyzer. Face detection and analysis can be done using various algorithms. The steps followed in detection and extracting face features are as shown in figure 1.

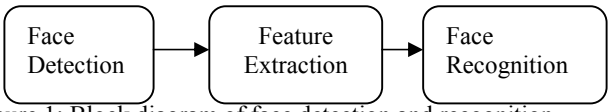


Figure 1: Block diagram of face detection and recognition

The input of a face recognition system is always an image or video stream. The output is an identification or verification of the subject or subjects that appear in the image or video. Face detection is defined as the process of extracting faces from scenes. So, the system positively identifies a certain image region as a face. This procedure has many applications like face tracking, pose estimation or compression.

The next step -feature extraction- involves obtaining relevant facial features from the data. These features could be certain face regions, variations, angles or measures, which can be human relevant (e.g. eyes spacing) or not. This phase has other applications like facial feature tracking or emotion recognition. Finally, the system does recognize the face. In an identification task, the system would report an identity from a database. This phase involves a comparison method, a classification algorithm and an accuracy measure. This phase uses methods common to many other areas which also do some classification process -sound engineering, data mining et al.These phases can be merged, or new ones could be added. Therefore, we could find many different engineering approaches to a face recognition problem. Face detection and recognition could be performed in tandem, or proceed to an expression analysis before normalizing the face.

II. FACE DETECTION

Face detection Nowadays some applications of Face Recognition don't require face detection. In some cases, face images stored in the data bases are already normalized. There is a standard image input format, so there is no need for a detection step. An example of this could be a criminal data base. There, the law enforcement agency stores faces of people with a criminal report. If there is new subject and the police has his or her passport photograph, face detection is not necessary. However, the conventional input image of computer vision systems are not that suitable. They can contain many items or faces. In these cases face detection is mandatory. It's also unavoidable if we want to develop an automated face tracking system. For example, video surveillance systems try to include face detection, tracking

and recognizing. So, it's reasonable toassume face detection as part of the more ample face recognition problem.

Face detection must deal with several well-known challenges. They are usually present in images captured in uncontrolled environments, such as surveillance video systems. These challenges can be attributed to some factors: .Pose variation. The ideal scenario for face detection would be one in which only frontal images were involved. But, as stated, this is very unlikely in general uncontrolled conditions. Moreover, the performance of face detection algorithms drops severely when there are large pose variations. It's a major research issue. Pose variation can happen due to subject's movements or camera's angle.

III. FEATURE EXTRACTION

Humans can recognize faces since we are 5 year old. It seems to be an automated and dedicated process in our brains, though it's a much debated issue. What it's clear is that we can recognize people we know, even when they are wearing glasses or hats. We can also recognize men who have grown a beard. It's not very difficult for us to see our grandma's wedding photo and recognize her, although she was 23 years old. All these processes seem trivial, but they represent a challenge to the computers. PCA algorithm performance recognition's core problem is to extract information from photographs.

This feature extraction process can be defined as the procedure of extracting relevant information from a face image. This information must be valuable to the later step of identifying the subject with an acceptable error rate. The feature extraction process must be efficient in terms of computing time and memory usage. The output should also be optimized for the classification step. Feature extraction involves several steps - dimensionality reduction, feature extraction and feature selection.

This steps may overlap, and dimensionality reduction could be seen as a consequence of the feature extraction and selection algorithms. Both algorithms could also be defined as cases of dimensionality reduction. Dimensionality reduction is an essential task in any pattern recognition system. The performance of a classifier depends on the amount of sample images, number of features and classifier complexity. One could think that the false positive ratio of a classifier does not increase as the number of features increases. However, added features may degrade the performance of a classification algorithm.

This may happen when the number of training samples is small relative to the number the features. This problem is called "curse of dimensionality" or "peaking phenomenon". The Face Recognition Problem ten times as many training samples per class as the number of features. This requirement should be satisfied when building a classifier. The more complex the classifier, the larger should be the mentioned ratio. This "curse" is one of the reasons why it's important to keep the number of features as small as possible. The other main reason is the speed. The classifier will be fasterand will use less memory. Moreover, a large set of features can result in a false positive when these features are redundant. Ultimately, the number of features must be carefully chosen. Too less or redundant features can lead to a loss of accuracy of the recognition system. We can make a distinction between feature extraction and feature selection. Both terms are usually used interchangeably. Nevertheless, it is recommendable to make a distinction.

A feature extraction algorithm extracts features from the data. It creates those new features based on transformations or combinations of the original data. In other words, it transforms or combines the data in order to select a proper subspace in the original feature space. On the other hand, a feature selection algorithm selects the best subset of the input feature set. It discards non-relevant features. Feature selection is often performed after feature extraction. So, features are extracted from the face images, then a optimum subset of these features is selected. The dimensionality reduction process can be embedded in some ofthese steps, or performed before them

IV. FACE RECOGNITION

Face recognition is an evolving area, changing and improving constantly. Many research areas affect face recognition - computer vision, optics, pattern recognition, neural networks, machine learning, psychology, etcetera. Previous sections explain the different steps of a face recognition process. However, these steps can overlap or change depending on the bibliography consulted. There is not a consensus on that regard. All these factors hinder the development of a unified face recognition algorithm classification scheme.

V. METHODOLOGY

The goal is to jointly detect and recognize of faces from the set of real time database using Face recognition is a process of extracting the features of face in an image and detecting the entire face using Back propagation neural Network. The overview of proposed technology is as shown in Figure 2

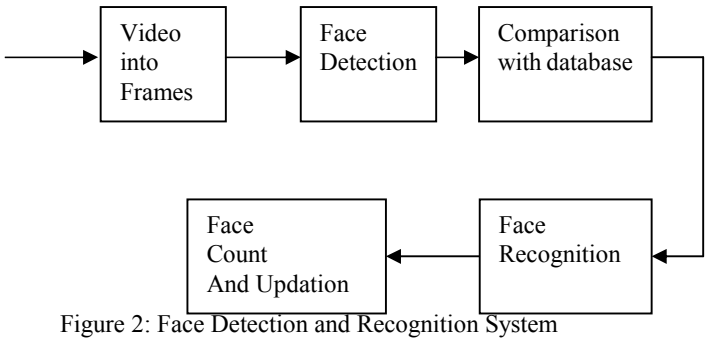


Figure 2: Face Detection and Recognition System

As shown in the above block diagram the videos are taken from the camera is converted into the frames, these frames are converted from RGB to Grayscale images and those frames are resized to N×N matrix dimensions. Face detection is done and face regions are marked by bounding box and these are cropped and stored for testing. By applying Back propagation Neural network database is trained and these stored images are tested.

Step1: Capture Video from camera.

First step in Face detection and recognition is to collect the database for training purpose. In order to achieve this videos are captured from standard camera inside the class room. Later videos are converted to frames for further processing

Step2: Converting the Extracted frames into Gray scale Images and labeling

Once the frames gets extracted from video captured, the frames are later converted to gray scale images to increase the performance of system and to reduce processing time and resized.

Step3: Face detection algorithm

Later the gray scale converted frames are passed through face detection algorithm one by one. PCA is the algorithm used to detect the faces in the extracted frame in this paper. One of the most used and cited statistical method is the Principal Component Analysis (PCA) . It is a mathematical procedure that performs a dimensionality reduction by extracting the principal components of the multi-dimensional data. The first principal component is the linear combination of the original dimensions that has the highest variability. The n-th principal component is the linear combination with the maximum variability, being orthogonal to the n-1 first principal components. The greatest variance of any projection of the data lies in the first coordinate. The n-st coordinate will be the direction of the n-th maximum variance - the n-th principal component.

Boundary is selected based on PCA output for each and every face present in an image. Later the detected faces are cropped resized and saved into a folder for training purpose.

Step4: Test and Training data

After the data is saved into the respective folder BPN algorithm is used to train the input images and to recognize the faces. In order to train input images we need at least 10 to 15 images of single detected face, hence we are taking all the video frame images for training purpose. The test and train images are as shown in Figure 3 and 4 respectively.

Figure 3: Test Images

Figure 4: Training Images

Step 5: Face Recognition

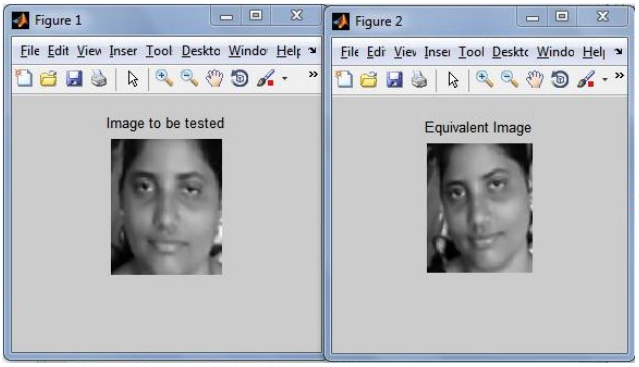
Face recognition is the final step in this paper, here we are using BPN algorithm for recognizing the test faces. In BPN, Back propogation algorithm the weight change is in a direction that is a combination of current gradient and the previous gradient. A small learning rate is used to avoid major disruption of the direction of learning when very unusual pair of training patterns is presented. Various parameters assumed for different Artificial Neural Networks are specified in subsequent sections. Main advantage of this back propagation algorithm is that it can identify the given image as a face image or non face image and then recognizes the given input image .Thus the back propagation neural network classifies the input image as recognized image.

Step 6: Face count and Updating

Finally the recognized faces in extracted frames are named individually and numbered based on detected faces.

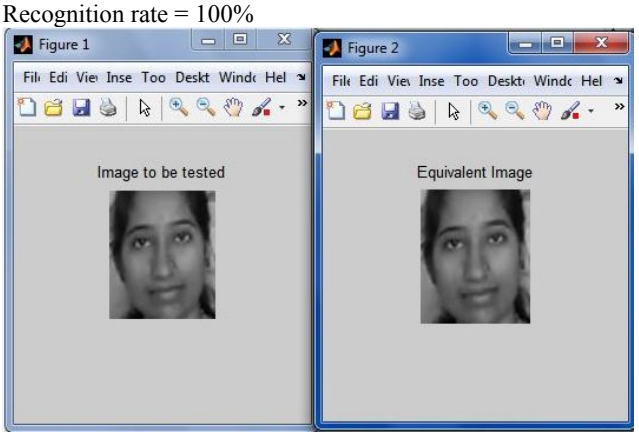
VI. RESULTS AND DISCUSSION

Performance of the proposed system is calculated using MSE and based on the calculated value face recognition rate is calculated. The face recognised output is as shown in Figure 5.



Elapsed time = 28.80 seconds

Recognition rate = 100%



Elapsed time = 25.62 seconds

Recognition rate = 100%

CONCLUSION

Face recognition based automatic attandance system is working efficiently and performance of the system is much better compared to other algorithms. Recognition time is under half a minute and recognition rate is 100 percent. From above result we can conclude that the developed algorithm is faster and more efficient.

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