A Novel Approach to Maintain Attendance Using Image Processing Techniques

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***Abstract*—Now-a-days, the research is growing towards the invention of new approaches. One such most attracted application is face recognition of image processing.There are several innovative technologies developed to take attendance such as biometric, thumb impressions, access card, fingerprints. The method proposed in this paper is to record attendance through image using face detection and face recognition.This algorithm mainly includes four steps such as face detection, creating the dataset, training the created dataset, face recognition. The database is constructed with the positive images and negative images from which haar cascade is generated. In the process, Training is done with number of negative images and number of positive images generating haar cascade file. In the second step, dataset has to be created which contains sample images of the persons followed by training the dataset. The final step is to take the attendance i.e, face recognition in which the input image is given and faces in it are detected along with their IDs. The proposed method can be used to take attendance of whole group of a unit saving considerable amount of time compared to the time taken by eigen face recognition, local binary pattern approaches.**

***Index Terms*—Eigen face detection, Fisher face recognition, Haar cascade.**

I. Introduction

Maintenance of attendance is an important issue of every school and colleges, because it is one of basic way to check the regularity of every student. But, the traditional method of taking attendance in schools and colleges is maintaining the attendance sheet which is a time taking process of every school and colleges. Since, attendance is manually recorded one can easily manipulate it and also it is difficult to verify each and very student in class. Hence, the mechanism of face detection and face recognition method is proposed for the validation and maintenance of attendance record which not only saves time but also prevents the students from giving the fake attendance. So, the topic of face recognition for images has gathered immense awareness for the students to attend classes daily because attendance is taken from the image based on face recognition. Face recognition system for the attendance and also security has attracted more attention from past few years. There are numerous methods in this field which are taken as a mile stone. There are many proposed algorithms that detects and recognizes the face of human being form the provided dataset.

Over the past few years many researches have been done on the field of face recognition which is the best method to find the human identity. Face recognition from images is a popular research in biometrics. One of the most useful application of face recognition is understanding the image analysis. Because of the some specific problems in the face recognition, which not only dragged computer vision researchers interest, but also psychologists and neuro-scientists because advancing the field of face recognition can provide an idea for psychologists and neuro-scientists to know the how human brain is functioning. Though there are many biometric methods like finger analysis and retinal scan for human identification. However, these methods works only with cooperation of human being, whereas human identification from image based on the facial features of human face does not need human cooperation. Hence, the method of face recognition plays an crucial role in finding the human being identity as it does not require the human cooperation which is the unique advantage of face recognition from other biometrics methods.

Though there exist many systems to detect the faces and recognizes from images. But these systems are not good enough in face recognition because of the conditions like poor light effects and so on. Many research works are going in order to better factors which increases the efficiency and accuracy. But there are many factors like pose, occlusion, illumination and so on are influencing the efficiency and high processing capacity for retrieving from the large image dataset. Hence, this leads to focus on large image dataset and also on new algorithms which increases the processing speed and accuracy. Efficient face recognition of human being from image dataset is main requirement. In the field of biometric face recognition is used to identify the individuals from image of group of people based on facial features of face. There are many Applications for the face recognition and are widely used in areas like security system and identification system. the sequence of this process is first image is taken by the camera, then the next goal is to identify the match in the dataset. Using dataset which has the collection of trained images one can identify and confirm the identifies of human being or reject in case if there is no match of identity in the dataset. The generally this face recognition system has three important blocks, they are face detection, training of detected faces and

face recognition.

Remaining part of this paper is structured as follows. Section II evaluates the several existing algorithms. Section III describes the proposed method. Section IV describes the results and observations. Section V concludes the work done and future work.

II. Literature Review

Image processing was one of the major areas for most of the researchers to work on. Face detection and recognition were popular parts of image processing. There were various algorithms used for detection and recognition of face as described below.

A. Eigen face detection

This algorithm was generally used for face recognition. [2] Eigen faces are the components divide the face into feature vectors. These vectors used for distinguishing various faces. Each face can be treated as a linear combination of linear vectors of highest eigen values i.e., a linear combination of eigen faces. Face images can be constructed using small amount of weights for each of the eigen faces. Because of it was a simple algorithm it was easy to implement, it was efficient in processing time and space. [2] Its accuracy depends on light intensity as it was pixel dependent.

This algorithm can be used in all conditions where lightening is good and effective. The limitation of this method is sensitive for lightening condition and position of head and time consuming for calculation of eigen vectors and values.

B. Fisherfaces

This algorithm was also used for face recognition. It used principal component analysis and linear discriminant analysis by which we get a subspace projection matrix. Alike eigenface construction process, the fisherface technique takes a matrix and converts it into a vector. It was similar to eigenface but it classifies better than eigenface into different classes. It would not change much to light intensity.[2]

It was difficult to find projection matrix. It requires more space for face storage and takes more processing time for recognition. It can be used where one needs better results with time compromised.[5]

C. Haar cascades

This was the most popular method used for face detection. [1] In this method rectangular haar features are generated and were used for the detection of various parts like white and black of a grey scale image. This process forms single rectangular like frame around the detected face. Before doing any computation the images are converted into respective grey scale images, the grey scale images will have black and white pixels. The pixels which were black were stored and they were subtracted from total number of white pixels. The output was compared with threshold and if the features are matched then the objective like face will be detected.[3]

Haar features are calculated as follows:

$$Feature = ie[1..N]wi.RecSum(x, y, w, h)$$

Where RecSum (x,y,w,h) was sum of intensities in rectangle(x,y,w,h) enclosed within a detection window. Haar Wavelets which were represented as a box classifier. Integral images and box classifier were used together to extract the face features. This method can be applied in all the fields where face detection needs to be done according to the situations and condition rather than universally. The main limitation of this process was the laborious process of generating haar cascade classifier based on the application.[31]

Out of all the above approaches Haar cascade was the fastest and the most popular one used for face detection.

III. Proposed Methodology

Generally, attendance is taken using biometric, retinal scan, access cards. The proposed method in the paper uses face recognition technique of image processing. The advantages of Haar cascades over these above mentioned methods are the use of integral images in Haar-like features, calculation speed of features in Haar cascades. Haar cascades also provide one to create his/her own Haar cascade files based on the applications. Here in this application in specific, one can collect negative images or background images (Images that does not contain face) and train them, then collect positive images or images containing faces and train the classifier to generate the Haar cascade files which can be used for face detection. Thus Haar cascades provide an opportunity to use them not only in face recognition but also in any object detection.

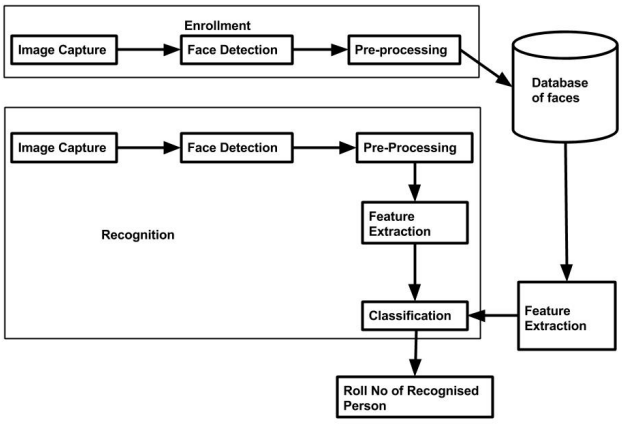

Fig. 1. Various stages in Evaluation

In our proposed method, we have four stages in our implementation. As shown in figure 1, in the first stage face is detected from the image or video input and convert it to grey scale image. In stage 2, this grey scale image is stored in the dataset so that these images are trained in the next step to generate the trained classifier file for face recognition. In the last stage, if a input image is given containing trained faces,

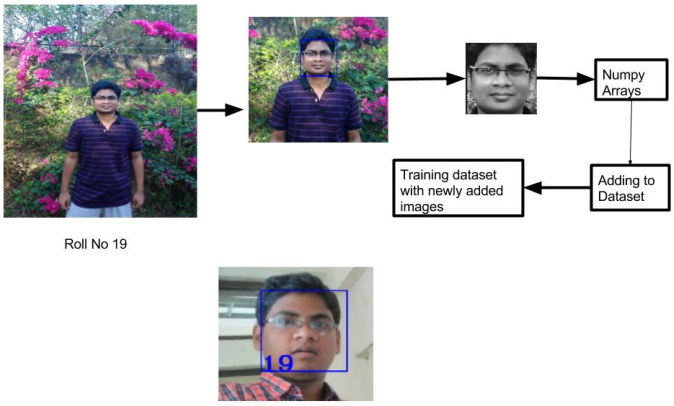

Fig. 2. Various stages in Evaluation

the the faces are recognized along with the id mentioned to the each particular face while creating the dataset.

A. Face Detection

The main Viola and Jones method proposed for face detection actually executes at 15 frames. But over the last few years, many developers and researchers have improved the original methods so as to suit the respective real time applications. An approach is made to decrease the computational complexity by applying the face detection algorithm only to the segmented region after background subtraction.

Fig. 3. Haar Features

The implementation of our face detection method is wavelet transform based. The objects shape is represented in wavelet coefficients subsets. In order to compute the Haar features, integral images are used. The rectangle features value can be calculated as the difference in variance values of black region and variance values of white region. Integral image and squared integral image is used to calculate these features.

The face detection is shown in first picture if the figure 1 mentioned above using extraction of Haar features.

B. Dataset Creation

In order to take the attendance of the group or unit, one who takes the attendance has to know the faces in advance. The same applies for this application also. The faces that need to be recognized has to be trained. So, the faces of all the required persons has to be taken from the various images using the first stage i.e face detection and stored in dataset as grey-scale image with dimensions of 152 X 152.

Suppose x is a member of unit, the several images containing x are given as input in this stage. Now since the first stage is face detection, the faces in the input images are detected and then converted as grey scale images. After conversion , with the filename as ID of x, they are stored in the dataset for creation.In order to get high accuracy of face recognition, all members faces images have to be trained under all conditions. For example, if X images are taken in the day and Y images are taken in night. If X image input given is taken in night mode, then it might be recognized as Y. To avoid such discrepancies, it is advised to train images of all members in all conditions such as day light, night time, different expressions, different angles of faces.

C. Training the Dataset

Now, faces of all members under different conditions are stored in dataset. 600 images of all persons under several conditions are taken. These images are to be trained in order to generate the classifier file which contains numpy arrays corresponding to each image in the dataset. The trained classifier file is the most important because this is the file which is used in the final stage to give the output with the faces recognized.

D. Face Recognition

The input image can be the image containing all the members of the group. Now, initially the face detection is done in the image using algorithm implemented in the first stage. After detecting the faces, each face is converted into grey-scale image, which can be viewed as a numpy array. Now this array is compared with the trained classifier that we generated in the second stage and third stage. The most matched array id is displayed along with face detected. This way, the ids of all detected faces are displayed.

A sample image containing group of students are displayed with their faces detected along with their Ids.(Figure 3)

Fig. 4. A Group of students

IV. Result and Observations

Experiments were carried out on videos as it is difficult to experiment on images individually. The following table shows the results obtained for a video of resolution 160 x 120 with single human face per frame.

A. *Following observations are made inorder to detect the face correctly using the haar face detector*

Haar cascades are well known for real-time applications. Faces should be clear to the normal human eye in order to get detected. Dataset should consist of every person images in various light intensities and various orientations in order to get recognized. Dataset should not contain any negative images which might be created during the detection stage. We recommend the threshold value to be in between 1.1-1.3 for appropriate face detection and recognition. Create the training recognition dataset in particular for every class separately because more images may mislead the trainer. Class strength we usually recommend should be between 120-130 members. Each person should be taken 30-40 images under different conditions with different light intensities, different distance between camera and the person. we recommend the distance between camera and the person to be in between 1-8 meters.

TABLE I
EVALUATION USING VARIOUS VIDEO INPUTS

Videos	Frames	Training Time(Sec.)	No. of Face Recogn. frames
1.	198	3	156
2.	339	4	190
3.	329	4	177
4.	237	3	174
5.	257	3	167
6.	388	4	259
7.	448	5	261
8.	346	4	208

In the above table, one can easily understand by the values presented there. Number of frames by different video devices for some particular training time, Number of faces recognized by our algorithm is mentioned.

TABLE II
COMPARISION OF VARIOUS ALGORITHMS

Conditions	Eigenface	Fisherface	Proposed method
Training Time	1081 ms	5023 ms	920 ms
Recognition%(static images)	85	89	93
Recognition%(Real time)	68	74	85
Occluded faces%	2	2.5	2

In the above table, one can easily understand by the values presented there. The training time for each algorithm is mentioned along with recognition of faces in both static images and real time video input.

V. CONCLUSION AND FUTURE WORK

The method proposed deals with face detection and face recognition using Haar features based on the Viola-Jones method for face detection. The method proposed is mainly implemented in four stages, namely face detection, dataset creation, training the created dataset, face recognition. In the first stage the faces in the input image are detected and the detected faces are added to the dataset in the second stage after converting to the grey scale images following which trained classifier file is formed from training the created dataset. The final stage is the most important stage where face recognition is done to the input image.

The further extension to this technique can be to find out the facial expression of the students in the class. Since face detection and face recognition is already done, the expression of each student while listening to the class can be found out.

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