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Making Attendance Management Easy with Haar Cascade Approach

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Abstract— Facial recognition technology (FRT) has a major solution to address many contemporary needs for identification and the verification of identity claims. The research is growing towards the invention of new approaches. One of the most attracted application is face recognition using image processing. There are several innovative technologies have been developed to take attendance. Some advanced ones are biometric, thumb impressions, access card, and fingerprints. The method proposed in this paper is to record the attendance through image using face detection and face recognition. The proposed approach has been implemented in four steps such as face detection, labelling the detected faces, training a classifier based on labelled dataset, and face recognition. The database has been structured with the positive images and negative images. The complete database has been divided into training and testing set and further, processed by a classifier to recognize the faces in a classroom. The final step is to take the attendance using face recognition technique in which the input image of a classroom is given, and faces of the given image will be detected along with their IDs. The frames of a video taken for a minute is taken into consideration to avoid the missed ones due to rotational issues.

Keywords— Haar cascade, Viola and Jones, Face Detection, Face Recognition, Dataset Creation.

I. INTRODUCTION

Attendance management is a daily concern in every school and colleges since it is a system which records the status of the student. Manual Attendance maintaining is difficult process, As is it is a time- consuming procedure. Same time can be utilized which may help the student to grab more information effectively from the teacher. As Attendance is marked manually one can easily manipulate the attendance which is recorded. With data being manipulated in abundance, there is a crucial need for high security. Also, keeping track of every student in the class is difficult. Hence, the mechanism of face detection and face recognition method is proposed to maintain the attendance. It not only saves the time but, also prevents the students from giving the fake attendance. Hence, it creates the awareness for the students to attend classes daily since the attendance is going to be monitored by an automated machine.

Over the past few years, extensive research has been done on the field of face recognition which is one of the best ways to find the human identity. One of the most useful applications of face recognition is to understand the image by analysis. Because of some specific problems in the face recognition, which not only dragged computer vision researchers' interest, but also psychologists, and neuro-scientists since advancing the field of face recognition can provide an idea to know how the human brain is functioning.

Though there are many biometric methods like finger analysis and retinal scan for human identification, which require human cooperation. Whereas, human identification from facial images do not need it. Hence, the method of face recognition plays an important role in finding unique human being as it does not require the human cooperation which is the unique advantage of face recognition from other biometrics methods. Many research works are going to find better factors that increase the

efficiency and accuracy. In general, the factors like pose, occlusion, illumination and so on are influencing the efficiency and needs high processing capacity for retrieving from the large image dataset. Efficient face recognition of human being from image dataset is an ultimate goal. In the field of biometric face recognition, research has been done to identify the individuals from a picture of the group of people based on facial features. There are many Applications for the face recognition and are widely used in security-based applications and biometric systems. In general, face recognition system has three important blocks namely face detection, training of detected faces, and face recognition.

II. LITERATURE REVIEW

Image processing was one of the major areas for most of the researchers to work on. Face detection and recognition are major process in image processing. Many algorithms are available in the literature that detects and recognizes the face of a human being. Three important methods are discussed here namely Eigen face detection, Fisher faces, and Haar cascades. Eigenfaces have advantages over other techniques available, such as the system's speed and efficiency. As Eigenface is primarily a dimension reduction method, a system can represent many subjects with a relatively small set of data. As a face-recognition system it is also fairly invariant to large reductions in image sizing; however, it begins to fail considerably when the variation between the seen images and probe image is large. To recognize faces, gallery images – those seen by the system – are saved as collections of weights describing the contribution each eigenface has to that image. When a new face is presented to the system for classification, its own weights are found by projecting the image onto the collection of Eigenfaces. This provides a set of weights describing the probe face. These weights are then classified against all weights in the gallery set to find the closest match. A nearest-neighbor method is a simple approach for finding the Euclidean distance between two vectors, where the minimum can be classified as the closest subject. The limitation of this method is sensitive for lighting conditions. This algorithm is also highly used for face recognition. It uses principal component analysis and linear discriminant analysis by which subspace projection matrix will be constructed. Unlike Eigen face construction process, the Fisherface technique takes the matrix and further converts into a vector. It is as similar as Eigenface but, found better results in the case of low light. The problem with this technique is the difficulty while constructing projection matrix. For that, it needs more storage space. Similarly, there are many algorithms developed to detect the face. The popular one amongst them is Haar cascades. The rectangular Haar features will be generated to detect various parts like white and black portions of a gray scale image. A rectangular frame will be produced as a border that helps to crop the face alone from the entire image. It is used to detect multiple faces in a single given image. The pixels which were black are stored, and they are subtracted from the total number of white pixels. The output was compared with a threshold and if the features are matched, then the objective like face will be detected.

III. PROPOSED METHODOLOGY

Generally, attendance process would be done using finger print, retinal scan, access cards and so on. The proposed method in the paper uses face recognition technique. Less time is required to detect the face by using Haar feature. For every user single Haar cascade will be created. Negative images or background images can be collected (Images that does not contain face) and then trained. Such that, the system will not detect any faces from empty spaces. Then, collect positive images or images containing faces and train the classifier which generates the Haar cascade files. The same files can be used for face detection. Thus, Haar cascades can be used in any object detection. Four stages of implementation have been proposed in this work. As shown in Fig. 1, the first stage concentrates on face detection images of video captured for two seconds. Then, all frames are converted to grey scale images. In stage two, the converted grey scale image is stored in the dataset to get trained in the next

step. Lastly, an input image is given that contains trained faces, the faces are recognized along with the student ID mentioned to a particular face while creating the dataset.

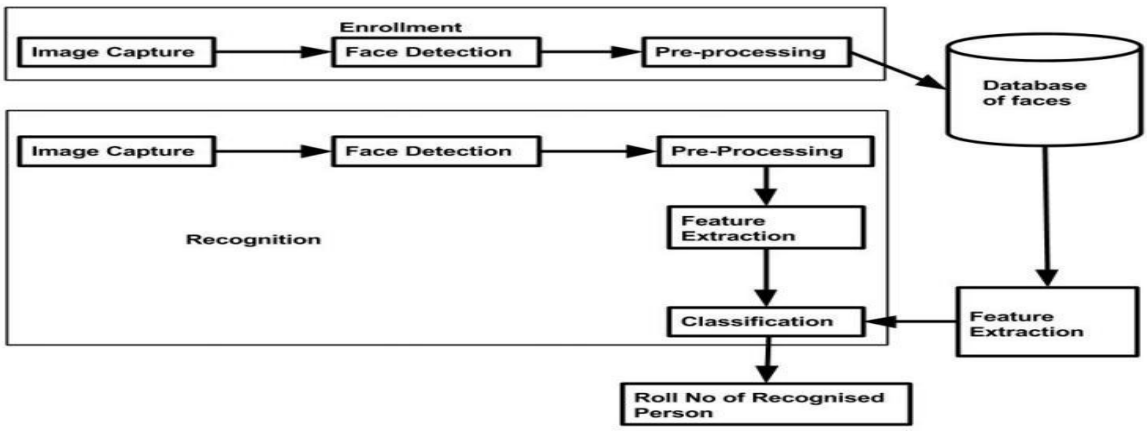

Fig.1: The proposed methodology for maintaining the attendance.

i. Face Detection

The main Viola and Jones method proposed for face detection executes at 15 frames. However, 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. The implementation of our face detection method is a wavelet transform based. The object shape is represented in wavelet coefficients subsets. In order to compute the Haar features, integral images have been used. The rectangle feature values have been constructed by computing the difference in the variance of black region and white region. The method of an integral image and squared integral image is used to compute these features. The steps used to detect the face. The steps used to detect the face are portrayed in Fig. 2.

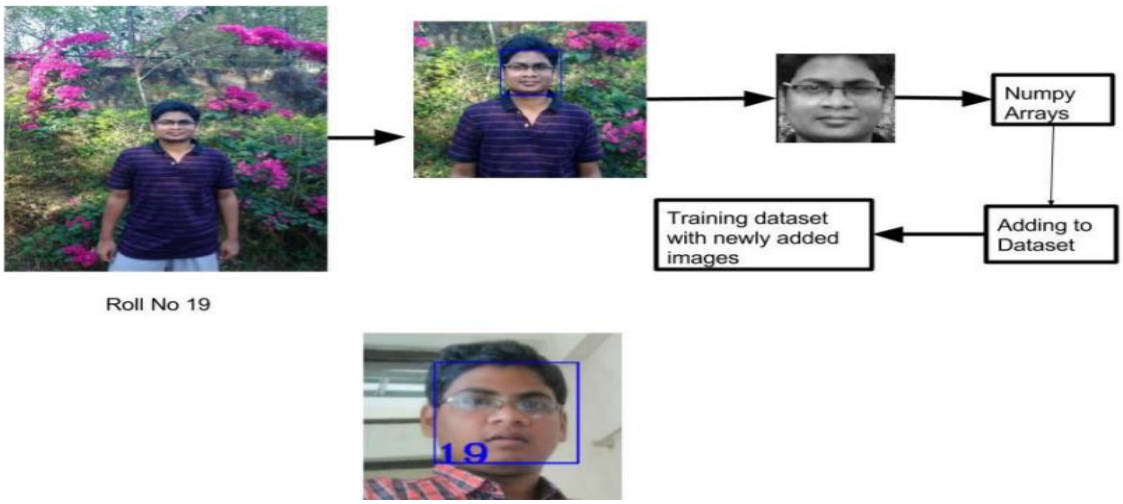

Fig.2: An example flow that demonstrates the process of face detection.

ii. Dataset Creation

The process of recording every student of a class would be the main step to manage the attendance using a computerized system. The faces that need to be recognized have to be properly trained. Hence, the faces of all the required person had to be taken from the various images using the first

stage, i.e., face detection and stored as a dataset as gray scale image with dimensions of 152x152. Suppose x is a member of unit, the variety of images containing x are given as input in this stage. Since the first stage is face detection, the faces in the input images are detected and then converted into gray scale images. After the conversion, each file is labelled with a unique ID to further recognize their identity. In order to improvise the accuracy of face recognition, the face of all members have to be trained with varity of conditions. For example, if x images are taken in the day and y images are taken in the night. If x image input given is taken in night mode, then it might be recognized as y. It is considered to train all the images with all conditions such as day light, night time, different expressions, and different angle of faces to avoid such conflicts.

iii. Face Recognition

In process, the faces of all students under various circumstances are stored in dataset. Numpy arrays have been created after training all these images. The trained classifier file has been saved which is needed to label the test dataset gathered from class. The input image will be the image containing all the students of a class. Initially, it detects all the faces using face detection algorithm. The detected faces are then converted to gray scale image. Then, the trained classifier is used to recognize the face. Each recognized face will be labelled with student ID which further aids to monitor the attendance. An example is outlined in Fig 3.

Fig.3: A sample photo taken from one camera in classroom.

IV. RESULT

Many experiments are carried out on videos as it is hard to consider all students information in a one image because students may move their body parts. Table I depicts that obtained result for the video of resolution 160x120 with a single human face per frame.

Faces should be distinct and clear to the human eye so as to get detected. Haar cascades are notable for real-time appliance. The dataset should be composed of every person image in various light intensities and orientation in order to get recognized. The threshold value of range 1.1 to 1.3 is suggested while detecting the face after examining.

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

130 students of a class have been considered with 30-40 distinct images that resulted database having 4550 images. Dataset was created with different angles and light intensities. 6 cameras have been used to cover the entire class with a proper resolution of every student. Upon performing various trails and errors with proposed algorithm, The in-detailed observation that the recognition rate and number of frames considered by the video clip with time is described in Table II.

TABLE II COMPARISON OF RESULTS OF FACE DETECTION USING DIFFERENT 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

V. CONCLUSION AND FUTURE WORK

The proposed method behaviour towards face detection and face recognition is found effective and further helps to manage attendance in an easy way. Clearly, the Haar cascade approach is employed to detect faces and recognise them verily in different conditions with minimized variations in training dataset. Yet, to conclude, further optimization can be done to achieve maximum performance by reducing the number of video clip needed, and the number of cameras required.

Furthermore, the increase in number of camera coverage footage can detect criminal activities with increased work in a group, providing exponential growth to security is sublime goal of this work.

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