An approach to maintain attendance using image processing techniques

Conference Paper · August 2017

DOI: 10.1109/IC3.2017.8284353

5 authors, including:

M. Srikanth
National Institute of Technology Karnataka
1 PUBLICATION **15** CITATIONS
SEE PROFILE

V. Santhosh Kumar
2 PUBLICATIONS **16** CITATIONS
SEE PROFILE

Y.V. Srinivasa Murthy
VIT University
40 PUBLICATIONS **290** CITATIONS
SEE PROFILE

Shashidhar Koolagudi
National Institute of Technology Karnataka
154 PUBLICATIONS **2,253** CITATIONS
SEE PROFILE

Proceedings of 2017 Tenth International Conference on Contemporary Computing (IC3), 10-12 August 2017, Noida, India

An Approach to Maintain Attendance using Image Processing Techniques

C.B.Yuvaraj, M.Srikanth, V.Santhosh Kumar, Y.V.Srinivasa Murthy, and Shashidhar G. Koolagudi
Department of Computer Science and Engineering
National Institute of Technology Karnataka, Surathkal, Mangalore, India - 575 025
Email IDs: {*yuvarajchinthapulusu22, mudili.srikanth, vsanthoshnayak15*}*@gmail.com,* {*yvsm, koolagudi*}*@nitk.ac.in*

***Abstract*—Nowadays, 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 have been developed to take attendance. Some prominent 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 constructed 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.**

***Index Terms*—Attendance Maintenance, Biometric System, Face Detection, Face Recognition, and Haar Cascades.**

I. Introduction

Maintenance of attendance is an important issue of every school and colleges since it is one of the primary ways to check the regularity of every student. As of now, attendance in schools and colleges is done by maintaining the attendance sheet which is a time-consuming procedure. Utilization of the same time may help the student to get some more information from the instructor. Moreover, one can easily manipulate the attendance since it is manually recorded. Also, verifying each 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 save 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. Face recognition from images is a popular research in biometrics. One of the most useful applications of face recognition is understanding the image 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 the how the human brain is functioning. Though there are many biometric methods like finger analysis and retinal scan for human identification, they need human cooperation. Whereas, human identification from facial images do not need it. Hence, the method of face recognition plays a 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 to recognize them from images. 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. It may lead to focus on large image dataset and also on new algorithms which reduce the computational issues and to increase the accuracy. 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.

The rest of the paper is structured as follows. Section II evaluates the several existing algorithms for face detection and recognition. Section III describes the proposed method including classification procedure. Section IV demonstrates the experimental setup and results obtained. Section V concludes the work with some future directions.

II. Literature Review

Image processing was one of the major areas for most of the researchers to work on. Face detection and recognition are popular sub-parts of image processing. There are several algorithms available in the literature that detects and recognizes the face of a human being. Three important methods are discussed here namely Eigen face detection, Fisherfaces, and Haar cascades.

Eigen face detection is one useful technique which detects and recognizes the face [1]. Eigen faces are the components that divide the face into feature vectors. These vectors are further used to distinguish various faces. Each face can be

978-1-5386-3077-8/17/$31.00 ©2017 IEEE

treated as a linear combination Eigen values. The face images can be reconstructed using a few weights for each of the Eigen faces. The processing speed of this algorithm is efficient and even in time consumption. The accuracy of Eigen face detection depends on light intensity as it was pixel dependent. It means that it can be highly used in the conditions where light is good enough. 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, it converts into a vector. It is as similar as Eigenface but, found better results in the case of low light [1]. The problem with this technique is the difficulty while constructing projection matrix. For that, it needs more storage space [2].

Similarly, there are many algorithms developed to detect the face as well. The popular one amongst them is Haar cascades [3]. 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 suitable to detect multiple faces in a given image. It is already mentioned that the preprocessing step converts the RGB image to gray scale image. The pixels which were black were stored, and they were 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 [4].

III. Proposed Methodology

In general, the process of taking attendance would be done by using finger print, retinal scan, access cards and so on. The proposed method in the paper uses face recognition technique. The concept of Haar cascades has been utilized to detect the faces of individuals in a given picture. The reason is to take the attendance in a classroom without an intervention of the instructor. The capability of detecting faces in less time is the advantage of Haar cascades over the existing methods. One single Haar cascade will be created for each user. Here, one can collect negative images or background images (Images that does not contain face) and train them. So that, the system will not detect any faces from empty spaces. Further, 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 provide an opportunity to use them not only in face recognition but also 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. Further, 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. Finally, if an input image is given containing trained faces, the faces are recognized along with

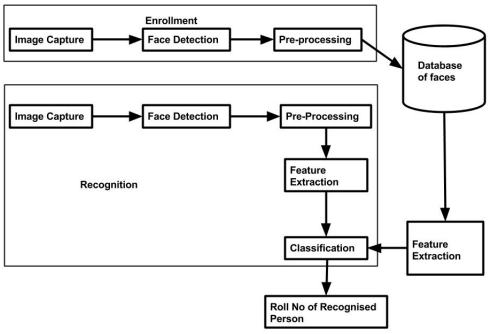

Fig. 1. The proposed methodology for maintaining the attendance.

the student ID mentioned to the each particular face while creating the dataset.

A. 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 objects 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 technique of an integral image and squared integral image is used to calculate these features. The steps used to detect the face are depicted in Fig. 2.

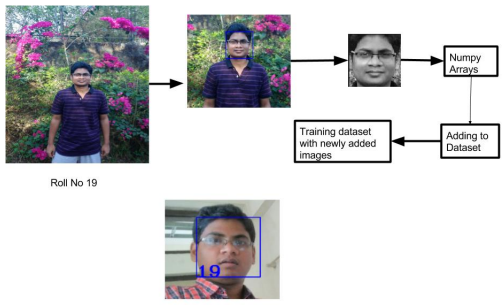

Fig. 2. An example flow that demostrates the process of face detection.

B. Dataset Creation

The process of registering every student of a class would be the basic step to maintain the attendance using an automated

system. The faces that need to be recognized have to be properly trained. Hence, the faces of all the required persons 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 an unique ID to further recognize their identity. In order to improve the accuracy of face recognition, the faces of all members have to be trained with different all 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 advised to train all the images with all conditions such as day light, night time, different expressions, different angles of faces to avoid such discrepancies.

C. Face Recognition

At present, the faces of all members under different conditions are stored in dataset. Numpy arrays have been generated after training all these images. The trained classifier file has been saved which is helpful to label the test dataset taken from class. The input image will be the image containing all the members of a class. First, it detects all the faces using face detection algorithm. The detected faces are then converted to gray scale image. Further, the trained classifier has been utilized to recognize the face. Each recognized face will be labelled with student ID which further helps to monitor the attendance. An example is depicted in 3.

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

IV. Result and Observations

Experiments are carried out on videos as it is difficult to consider all students information. It is done because the information in a single image is not sufficient since the students move their body parts. Table I shows the results obtained for a video of resolution 160x120 with a single human face per frame.

Haar cascades are well known for real-time applications. Faces should be clear to the normal human eye to get detected. The dataset should consist of every person images in various light intensities and various orientations in order to get recognized. The threshold value of range 1.1 to 1.3 is recommended while detecting the face after certain analysis. 130 students of a class have been considered with 30-40 individual images. It means that the database is having 4550 images. Various light conditions and different directions have been used to create the dataset. Six cameras have been used to cover the entire class room which gives proper resolution about every student. With the proposed algorithm, the number of frames considered from a video clip and the recognition rate is detailed in the Table II.

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

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 method proposed here deals with the face detection and face recognition that further helps to maintain the attendance. Haar features based on the Viola-Jones method have been used to detect the face. It is observed that the Haar cascades are highly useful to detect the faces with less variations in training image set. However, to generalize the system fine tuning has to be done in terms of the number of cameras needed and the length of the video clip.

As it is true that the number of CC footages has been increased, the work can be extended to detect the criminal activities in a group and to recognize their spots. A proper automated system to maintain the system using multi-modal approach is ultimate aim of the work.

References

[1] R. Patel and S. B. Yagnik, "A literature survey on face recognition techniques," *International Journal of Computer Trends and Technology (IJCTT)*, vol. 5, no. 4, pp. 189–194, 2013.

[2] L. Introna and H. Nissenbaum, "Facial recognition technology a survey of policy and implementation issues," 2010.

[3] P. Viola and M. Jones, "Rapid object detection using a boosted cascade of simple features," in *Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on*, vol. 1. IEEE, 2001, pp. I–I.

[4] W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, "Face recognition: A literature survey," *ACM computing surveys (CSUR)*, vol. 35, no. 4, pp. 399–458, 2003.