International Journal For Technological Research In Engineering
Volume 1, Issue 11, July-2014 *ISSN (Online): 2347 - 4718*

AUTOMATED ATTENDANCE SYSTEM USING FACE RECOGNITION THROUGH VIDEO SURVEILLANCE

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ABSTRACT: The objective of this system is to present an automated system for human face recognition in a real time background for an organization to mark the attendance of their employees or student. So automated attendance using real time face recognition is a real world solution which comes with day to day activities of handling employees or student. The task is very difficult as the real time background subtraction in an image is still a challenge. In the past two decades, face detection and recognition has proven to be very interesting research field of image processing. The work carried out describes an automated attendance system using video surveillance. The proposed algorithm is automatic and efficient in intelligent surveillance applications. Video surveillance is used to detect the object movement thereby the captured image undergoes face detection and recognition process and searches the student database and enters the attendance if it is valid in the list.

I. INTRODUCTION

In many institution and organization the attendance is a very important factor for various purposes and its one of the important criteria that is to follow for students and organization employees for checking the performance of students or employee. Every institute has its own method in this regard. Some are taking attendance manually using the old paper or file based approach and some have adopted methods of automatic attendance using some biometric techniques. The previous approach in which manually taking and maintains the attendance records was very inconvenient task. Traditionally, student's attendances are taken manually by using attendance sheet given by the faculty members in class, which is a time consuming event. Moreover, it is very difficult to verify one by one student in a large classroom environment with distributed branches whether the authenticated students are actually responding or not. The ability to compute the attendance percentage becomes a major task as manual computation produces errors, and also wastes a lot of time. This method could easily allow for impersonation and the attendance sheet could be stolen or lost. An automatic attendance management system using biometrics would provide the needed solution. The results showed improved performance over manual attendance management system. Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years since, instead of authenticating people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys and so forth, these methods examine an individual's physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. Biometric based technologies include identification based on physiological characteristics (such as face, fingerprints, finger geometry, hand geometry, hand veins, palm, iris, retina, ear and voice) and behavioral traits (such as gait, signature and keystroke dynamics). Face recognition appears to offer several advantages over other biometric methods, a few of which are outlined here: Almost all these technologies require some voluntary action by the user, i.e., the user needs to place his hand on a hand-rest for fingerprinting or hand geometry detection and has to stand in a fixed position in front of a camera for iris or retina identification. However, face recognition can be done passively without any explicit action or participation on the part of the user since face images can be acquired from a distance by a camera. This is particularly beneficial for security and surveillance purposes. Furthermore, data acquisition in general is fraught with problems for other biometrics: techniques that rely on hands and fingers can be rendered useless if the epidermis tissue is damaged in some way (i.e., bruised or cracked).

II. MOVING OBJECT DETECTION ALGORITHM FOR VIDEO SURVEILLANCE

Moving object detection is always the first step of a typical surveillance system. Moving object detection aims at extracting moving objects that are interesting out of a background which can be static or dynamic. Since subsequent processes are greatly dependent on the performance of this stage, it is important that the classified foreground pixels accurately correspond to the moving objects of interests. There are two types of methods that realize moving object detection. One detects changes at pixel level and the other is based on feature comparison. The first method is better because of very fast detection of any kind of changes in the analyzed scene and it is implemented. Considering the fact that the image frequency in video sequence is 25 frames per second, the real-time video processing demands simple and fast algorithms.

A. Binarization

Selection of threshold is a crucial step for binary process. The value of threshold is changeable with frames of video, and it will affect the efficiency of the whole proposed algorithm if it is too large or small. In order to obtain an

adaptive threshold automatically from frames, many people extract statistic characters such as mean, standard deviation. The noise pixels and shadow pixels in the frame difference image always have numerically small gray values while object pixels contain high gray values. Based on this concept, the frame difference image is separated into two parts by noise threshold. Pixels those have smaller gray values than noise threshold are set down to zero and the other pixels those have greater gray values than noise threshold are set up to one and then the image that contains only the object pixels can be obtained, etc .

B. Frame Difference Algorithm

Frame differences method is a technique for detecting the motion area by making the difference between the current frame and the background frame. An image is divided into foreground and background in this method. The background is modeled, and the current frame and the background model are compared pixel by pixel.

C. Moving Pixels

Frame difference is obtained by the absolute difference value of two frames. It can reflect the movements in the frames. Supposing the background of video is static, if the difference is below some value, it means there is no movement and it may be caused by noise. Otherwise, it caused by movement. This value is called threshold. So moving pixels and static background pixels can be distinguished by thresholding T. And we call this image mask. .

$$Z_{k,k-1}(i,j)=\begin{cases}1, & if\ FD_{k,k-1}(i,j) > T \\ 0, & else\end{cases} \quad (1)$$

III. FACE DETECTION

Voila and Jones algorithm is used for face detection. Where it is used in both creating database and face recognition process. Where in case creating database it takes input image through a web camera continuously. Captured image undergoes face detection. Detected face will be cropped and stored in database. Where in case of face recognition if there is any movement video surveillance will be used to detect the moving object. The captured image undergoes face detection and further processed later by face recognition.

IV. FACE RECOGNITION

A. Cross-Correlation

The use of cross-correlation for template matching is motivated by the distance measure (squared Euclidean distance)

$$d_{i,t}^2(u,v) = \sum_{x,y}[f(x,y) - t(x-u,y-v)]^2 \quad (1)$$

Where f is the target image and t is the feature, the sum is over x, y under the window containing the feature t positioned at (u, v). In the expansion of d^2.

$$d_{i,t}^2(u,v) = \sum_{x,y}[f^2(x,y) - 2f(x,y)\,t(x-u,y-v) + t^2(x-u,y-v)] \quad (2)$$

The term $\sum_{x,y} t^2(x-u,y-v)$ is constant. If the term $\sum f^2(x,y)$ is approximately constant, then the remaining cross-correlation term is a measure of the similarity between the image and the feature.

$$c(u,v) = \sum_{x,y}[f(x,y)t(x-u,y-u)] \quad (3)$$

B. Normalized Cross-Correlation

- If the image energy $\sum f^2(x,y)$ varies with position, matching using (3) can fail. For example, the correlation between the feature and an exactly matching region in the image may be less than the correlation between the feature and a bright spot.
- The range of c(u, v) is dependent on the size of the feature.
- Eq. (1) is not invariant to changes in image amplitude such as those caused by changing lighting conditions across the image sequence.

The correlation coefficient overcomes these difficulties by normalizing the image and feature vectors to unit length, yielding a cosine-like correlation coefficient.

$$\gamma(u,v) = \frac{\sum_{x,y}[f(x,y)-f_{u,v}][t(x-u,y-v)-t]}{(\sum_{x,y}[f(x,y)-\overline{f_{u,v}}]^2 \sum_{x,y}[t(x-u,y-v)-\bar{t}]^2)^{0.5}} \quad (4)$$

Where $\bar{t}$ is the mean of the feature and $\overline{f_{u,v}}$ is the mean of f(x,y) in the region under the feature. We refer to (4) as *N*ormalized Cross-Correlation.

C. Proposed Face Matching Technique

Face matching system involved 2 stages of operation (1): First stage is the model registration which is concerned with the storage of an image with computer memory. (2): Second stage is the process of searching for an extracted face in an image. This study is mainly focused on the latter process of template matching system. The following is the face matching algorithm for matching the extracted face with the different images of same person, which are taken at different times, from different viewpoints, or by different sensors.

Algorithm

- Read the source image, and Extract the ROI from the source face image. ROI will be the sub image.
- Do Normalized Cross-Correlation and find Coordinates of Peak with the ROI and Target images. Calculate the normalized cross-correlation. The peak of the cross-correlation matrix occurs where the sub images are best correlated.
- Find the total offset between the images. The total offset or translation between images depends on the location of the peak in the cross correlation matrix, and on the size and position of the sub images.
- Check if the face is extracted from the target Image. Figure out where face exactly matches inside of target image.

- Pad the face image to the size of the target image using the offset determined in step 3.

The above detailed algorithm is also shown pictorially as shown in the fig 4.1.

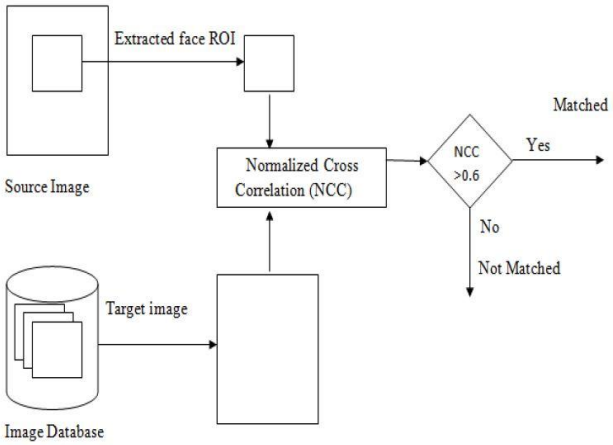

Figure 1: Different stages of face recognition algorithm for matching extracted face of the person from one image with different images of same person.

V. METHODOLOGY

This proposed system introduces a new automatic attendance marking system, which integrates video surveillance and face recognition algorithms into the process of attendance management. The system is implemented using a non intrusive web camera installed at the entrance of room, if there is any movement it capture the image. The captured image undergoes face detection and faces recognition, detects and extracts all faces from the acquired images. After faces have been extracted, they are compared with an existing database of student images and upon successful recognition a student attendance list is generated and saved on a database.

This work is being carried out in five stages:

Step 1: Generating Data for Training

Database will be created using web camera. Where captured image will undergoes face detection. After a face has been detected, the rectangle enclosing this face is cropped and processed later by the face recognition module. This rectangle represents a single face, and after being cropped as an image and it will be stored in database.

Step 2: Video Surveillance

Start monitoring the movements in the video. Video surveillance will be used detect moving object. Frame difference algorithm will be used to detect the moving object. Where frame difference algorithm gives absolute difference between two consecutive frames which reflects movement in frames.

Step 3: Face Detection

Violas and Jones algorithm is used for face detection. Face detection is used in both creating database and face recognition. If there is any movement video surveillance will be used to detect the moving object. The captured image undergoes face detection and further processed later by face recognition.

Step 4: Face Recognition

Correlation technique is used for face recognition. Where after face detection image undergoes face recognition process, where test image will be compared with training images in order to perform face recognition.

Step 5: Attendance Registry Updating

After face recognition process it searches the student database and enters the attendance if it valid in database. Where corresponding USN of recognized face and login time with date will be displayed.

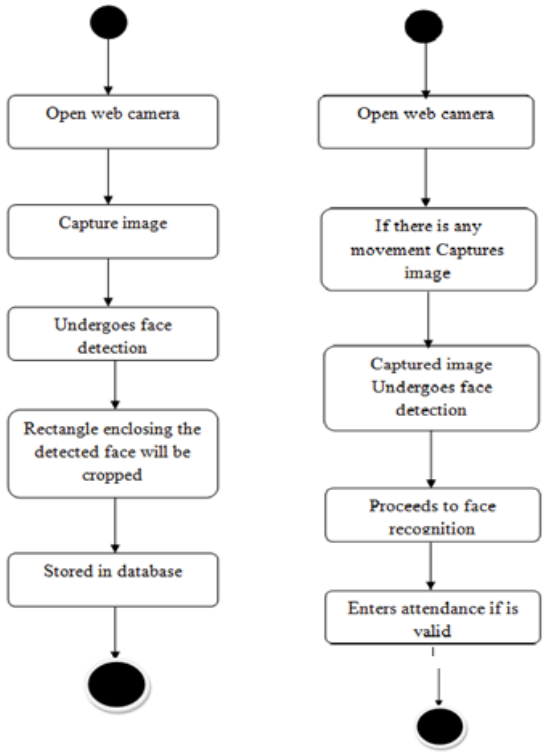

Figure 2: Face detection and recognition

VI. RESULT ANALYSIS AND DISCUSSION

We perform a set of experiments to demonstrate the efficiency of the proposed method. Images of different persons are used in training set. In order to obtain the efficiency of proposed methodology 10 training images are taken. Where each training image will be stored with corresponding USN and num. Where here we consider different scenarios in order to obtain experimental result. Video surveillance is used for detect object movement. If there is any movement captured image undergoes face detection and face recognition This can be achieved by cropping the first detected face from the image and compare it with the database. This is called the selection of region of interest. In this way faces of students are verified one by one with the face database using the correlation method and attendance is marked along with the login time and date. Increasing of face angle with respect to camera face recognition rate decreases. Here face recognition rate achieved by proposed methodology is 90%.

Table 1: Result Analysis

No	Test image	Training image	Results	Accuracy
1	Image with one person	10 training image	Recognized	100%
2	Image with two person	10 training image	Recognized	100%
3	Image with multiple person Same sequence	10 training image	Recognized two person correctly and one wrongly	100%
4	Image with multiple person different sequence	10 training image	Recognized front person correctly another one wrongly	50%
5	Image without face	10 training image	Failure case	100%

VII. CONCLUSION AND FUTURE ENHANCEMENT

It can be concluded from the above discussion that a reliable, secure, fast and an efficient system has been developed replacing a manual and unreliable system. This system can be implemented for better results regarding the management of attendance and leaves. This system will save time, reduce the amount of work the administration has to do and will replace the stationery material with electronic apparatus. Hence a system with expected results has been developed but there is still some room for improvement. For future enhancement same method can be implemented for logout. Where other face recognition technique can also be used for same proposed methodology in order obtains better accuracy.

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