Students Attendance and Security Assurance using Image Processing

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Abstract

In Maximum number of educational institutions we can see prevailing system of attendance where attendance of students are taken manually by the professors calling out the names of the students. In some universities we can find RFID system present for attendance. The manual system of attendance is very time consuming and may not be much efficient as well. Whereas RFID based attendance is also not much reliable as we don't know if the RFID card is actually used by the student whom it belongs or not. Both existing techniques for attendance system have problems in it.

So our paper has used Image Processing techniques and automated the attendance system where the attendance is taken by the system by recognizing the faces of the students. Also the system has a dataset of known faces such that when any unknown face detected inside the classroom, he/she will be recognized as intruder. This will safeguard the students from any kind of invasion or attack. In this paper we have discussed the techniques which can be used to implement image processing for automating the attendance system and assure security of the students.

Keywords: Face Detection, Face Recognition, Viola Jones, Local Binary Patterns of Histogram(LBPH), Image Processing.

I. INTRODUCTION

With new technologies being developed, manual attendance system has been replaced by RFID based attendance in few colleges and universities. But in most educational institutions we can find manual method existing. Manual attendance is taken by using attendance sheet by the faculty member or professor in the class . This method is very monotonous and time consuming. Manually recorded attendance is easy to manipulate. Moreover , it is very difficult to verify one by one student in classroom environment which results the attendance not to be completely accurate. There exist chances of absent student to be marked present and vice versa. RFID based attendance system can turn out to be expensive to implement. Also, the RFID card marks attendance present which means in the case of absence of student if the card is somehow present then the student is also marked presence. So, the result of RFID is also not completely reliable.

There still exist terrorist attacks in some countries of the world. There are chances that invaders enter the classroom , play the role of one of the students and carry out some harmful activities. For this part of security issue we don't have a rigid solution existing . CCTV cameras are fit inside the classrooms but, it is not necessary that the observer knows every individual student . So, in case of intruder's attack, students are completely unsafe.

We can solve this problem of manual , time consuming attendance system and student's classroom security by adopting automated attendance system which uses image processing. In image processing we have face detection and face recognition. The faces of students need to captured and stored in our dataset. Then the system will recognize their faces and carry out the attendance of present students automatically. Also when a person not present in the list of student's dataset is detected, that new person will be detected as an intruder. Whenever an intruder is detected by the system, the system can play siren as an alert of dangerous situation.

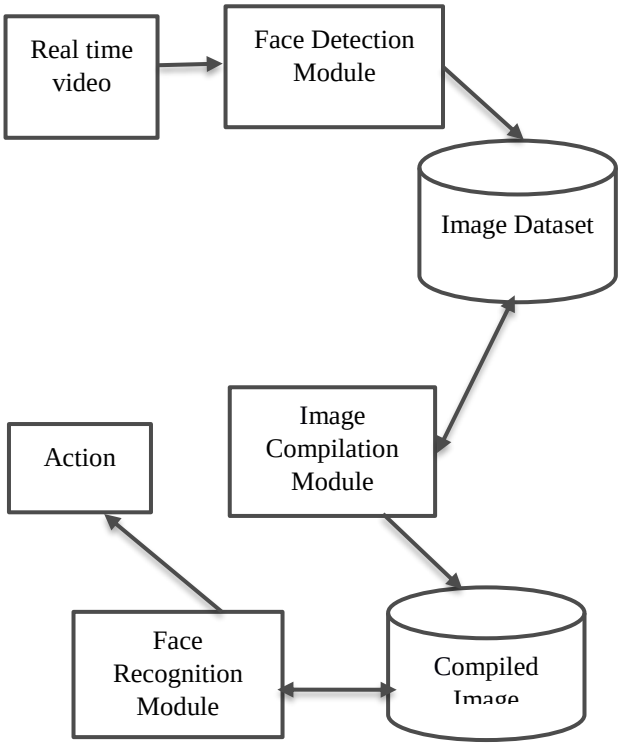
II. RELATED WORK

In present context, we don't have Real Time Attendance and Security System using image processing. We have RFID based attendance and security system existing which is expensive and time consuming. Similarly, we have Fingerprint based system which is limited to staffs only. It is difficult to implement it for students . In fingerprint based security system face of intruder can't be traced. We have CCTV Cameras for security purpose but in this approach a person should always be watching at the CCTV footage to maintain security.

A model has been proposed which takes attendance automatically using image processing. The model uses Principal Component Analysis(PCA) which extracts a set of Eigen images known as Eigen faces and weights of this representation are used for recognition[1]. Another proposed system uses Support Vector Machine (SVM) classifier. The system does automatic attendance of students which is not based on real time. Detection and recognition is done on captured video[2]. A model was proposed which could detect intruders to restricted areas. The system takes snapshots of people and alarm is rang if the person is detected as intruder after comparison of captured images with image present in database[3].A system was made that could detect students automatically by web cam when students enter into class . The system couldn't detect large number of faces and had less accuracy , detection rate, recognition rate[4]. A system was proposed for bank areas. The system can capture video of entire activity when intruder is detected and sends message to mobile numbers of authenticated person. Admin can see live streaming of the attack and take appropriate action. If admin wont response then system will take action[5].A system was proposed which used Viola Jones and PCA algorithm for face detection and recognition. The system detects students, recognizes students and automatically updates the database. However this system doesn't have efficient multiple face recognition and performance[6]. A system was proposed in which video was captured and recognition was done from the video itself. Recognized students were made present automatically but the system was not real time based [7].

III. METHODOLOGY

Initially image of each student is captured and stored in our image dataset. A compiler file is then created which is used for recognition by our module. When the system starts, camera is turned on which captures real time video of the classroom.Our face detection module then starts the detection process. It detects face using Viola Jones and recognizes image by using LBPH algorithm for which it refers to image dataset and the compiler file. Now if the image is successfully recognized then the student is automatically made present in our system . Also if any unknown face is detected then the face is detected as intruder and siren is played as an action .



IV. Implementation

A. Algorithms

1) Viola Jones or Haar Cascade for Face Detection

Viola Jones algorithm or Haar Cascade is the first real time face detection algorithm.It requires full view frontal upright faces for detection of faces.The entire face should be pointed towards the camera and shouldn't be

tilted to either side. Viola Jones Algorithm has four stages:

1. Haar Features

2. Creating an Integral Image

3. Adaboost Training

4. Cascading Classifiers

1. Haar Features: Viola Jones Algorithm requires a large number of positive and negative images to train the classifier. Then features are extracted from the images.

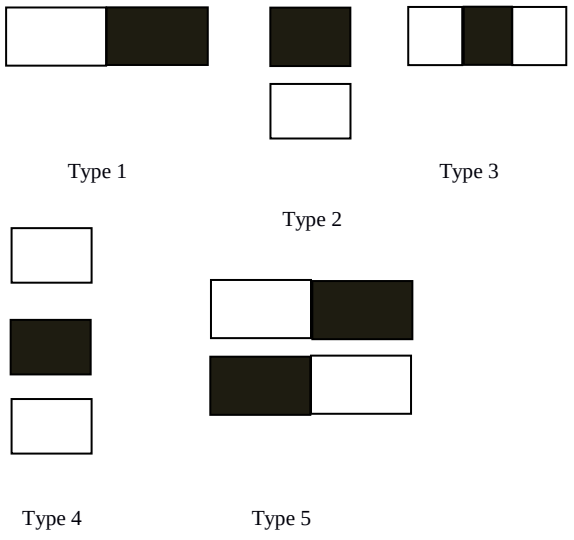


Fig 1: Haar Features used in Viola Jones

We have two , three and four rectangle features as shown in fig 1. Each feature gives a value which is sum of pixels in white area subtracted from sum of pixels in black area. Viola Jones uses two rectangle feature. The general structure of a face to be detected is composed of nose,eyes,forehead, chin and mouth.Haar features are used to detect these general structure of face. Dark and white region resembles that eye section is darker than upper cheeks, Nose bridge section is darker than eyes and so on. Each feature is related to a special location in a sub window.Viola Jones uses a 24*24 window as a base size to start evaluating these features in the input image. A 24x24 window results over 160000 features.

2. Creating an Integral Image : Integral Image does simplification of calculation of sum of pixels.

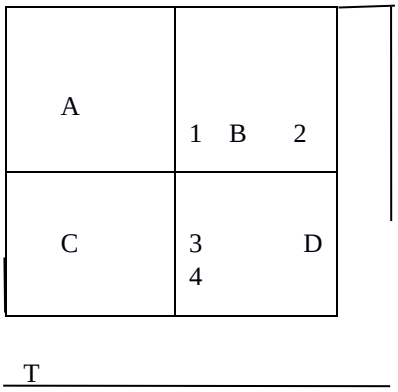
1	1	1
1	1	1
1	1	1

Fig 2.1. Input Image

1	2	3
2	4	6
3	6	9

Fig 2.2. Integral Image

The calculation of sum of all pixels inside any rectangle can be done using only four values at the corner of the rectangle through integral image.



Sum of all pixels in D = 1+4- (2+3)

= A+(A+B+C+D)-(A+B+A+C)
= D

3. Adaboost Training: Among all the features calculated, many are irrelevant. For example a feature of Type II from figure 1 can focus on the property that eye region is darker than the region of nose and cheeks . Type III feature from fig 1 relies on the property that eye region is darker than the nose bridge. When these features are applied on regions except eyes and nose these features become irrelevant. Each feature is applied on training image. For each feature, best thresh-hold which which will classify the faces to positive and negative is found. Features which best classify face and non face image is selected. After these features have been found , weighted combination of these features is used in evaluation and deciding whether the input window contains face or not. These features are also called weak classifiers. A Strong classifier is formed by Adaboost by summing up weak classifiers together. Adaboost reduced features from 60,000+ to 6000 features.

$$F(x) = \alpha 1 f1(x) + \alpha 2 f2(x) + \alpha 3 f3(x) + ...$$

Strong Classifier Weak Classifier

4.Cascading Classifiers: Instead of looking for a face region, Cascading Classifiers checks if a window is a

non-face region. If it is non-face then it discards it in the first shot itself. We have 6000 features from Adaboost which is now grouped into different stages of classifiers and apply one by one on the window. Initial groups/stages will have very less number of features. If a window fails the first stage , it is discarded.If it passes then second stage of features is applied and so on. The window which passes all the stages will be the face region.

2) Local Binary Patterns of Histogram(LBPH) for Face Recognition

Local Binary Pattern is specific binary code received by using LBP operator on a given pixel in a gray scale image. LBPH is histogram representing number of occurrences for each binary code for a given image patch. The original LBP operator works with 8 neighbors of a pixel where value of center pixel is used as a threshold. If neighbor pixel has a value greater than or equal to center pixel, 1 is assigned to the neighbor pixel else 0 is assigned . Now eight or zeroes are concatenated to form a binary code which is LBP code for the center pixel as shown in fig 3.

Texture and shape of digital image is possible to describe with LBP by dividing an image into several small regions from which features are extracted. These features consists of binary patterns that describe the surroundings of pixels in the regions. When LBP is calculated for every pixel, the feature vector of the image can be constructed. Feature vector is constructed by concatenating regional

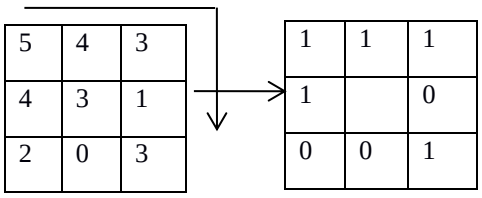


Fig 3. LBP operator with Binary value as 11101001 and Decimal value as 223.

histogram to one big histogram.The feature vector is description of the face on three different levels of locality.The labels contain information about patterns on a pixel-label. The regions in which different labels are summed contain information on a small regional level. And Concatenated Histograms give a global description of face. These Histograms can be used to measure the similarity between the images by calculating distance between the histograms.

V. RESULT AND ANALYSIS

We used Viola Jones Algorithm for face detection and Local Binary Patterns of Histogram. By using these algorithms images of students are detected and recognized. We have stored images of students in our dataset. The images detected are compared with image in our dataset. Then the students successfully recognized are automatically made present in our database. In the classroom when any person except from the list of images of students present in our dataset are detected, these unknown faces are detected as intruders. Whenever an intruder is detected siren is played as a symbol of danger.

Fig 4.1 : Dataset of Students

Fig 4.2 : Attendance being taken

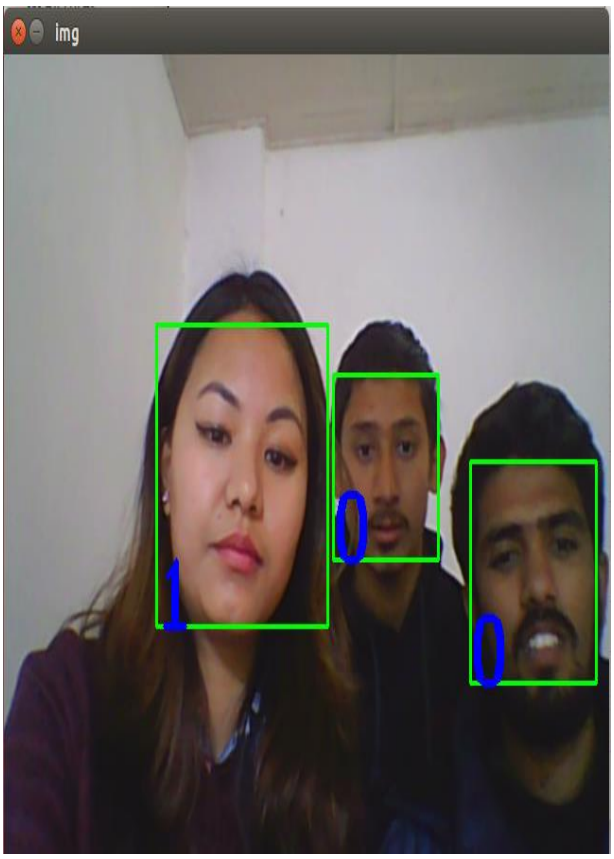


Fig 4.3 : Intruder being detected in classroom

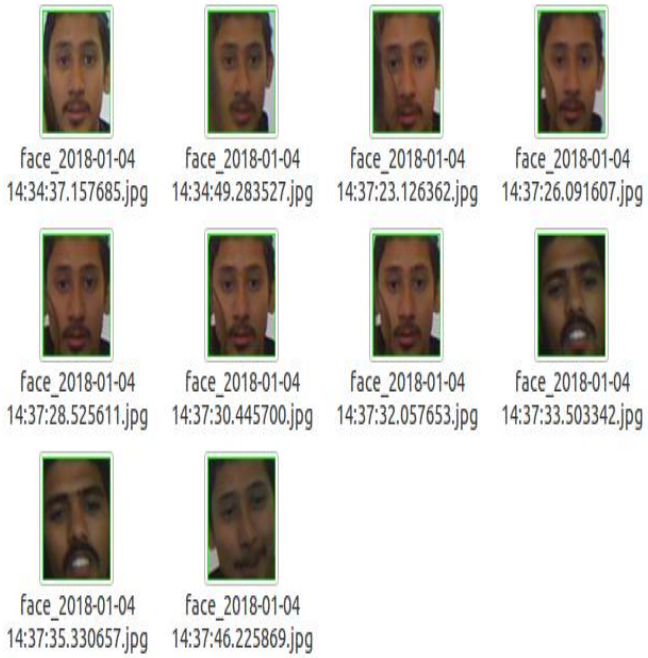


Fig 4.4 : Dataset of intruders detected during attendance

id	name	password	day1	day2	day3	day4	day5	day6
1	raisha	111	1	1	0	0	0	0
2	rahul	222	0	1	0	0	0	0
3	saurav	333	0	0	0	0	0	0
4	suraj	444	0	0	0	0	0	0

Fig 4.5 : Database of attendance of students

VI. CONCLUSION

The paper demonstrates that manual attendance system can be replaced by automated system using image processing ensuring security of students. We accomplished the goal using Viola Jones and LBPH algorithm .Our future work will be oriented towards implementing deep learning in image processing and getting more accurate output for a larger number of students.We hope our research will made the universities more conscious about student security inside the classroom and automation in attendance.

ACKNOWLEDGEMENT

We would like to thank Er.Anku Jaiswal for her encouragement and guidance throughout this research as well as Er. Pratik Adhikari and Er, Binod Chandra Shrestha for their support and guidance. We would also like to remember our family and friends as they have also supported us to accomplish this project.

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