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An Automatic Attendance System Using Image processing

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----------**ABSTRACT**----------
The face is the identity of a person. The methods to exploit this physical feature have seen a great change since the advent of image processing techniques. The attendance is taken in every schools, colleges and library. Traditional approach for attendance is professor calls student name & record attendance.The system described in this paper aims to deviate from such traditional systems and introduce a new approach for taking an attendance using image Processing.This paper describes the working of An Automatic Attendance System in a classroom environment. Initially video clip of classroom is taken and is stored in the database, and these video is converted to frames/images, then we apply Face detection techniques such asAda-boost algorithm to detect the faces in frames/images and then features are extracted of detected face by Histogram of Oriented Gradients (HOG) and Local Binary Pattern (LBP) algorithm. The system first stores the faces of the students in the database. The detected faces are compared with the faces stored in the database during face recognition by using Support Vector Machine (SVM) classifier. If the system recognizes faces, the attendance gets marked immediately of recognized faces.

Keywords- Face Recognition, Face Detection, AdaBoost, Local Binary pattern(LBP), Histogram of Orientation(HOG), Support Vector machine(SVM).

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I. INTRODUCTION

A key factor of improving the quality of education is having students attend classes regularly. Traditionally students are stimulated to attend classes using attendance points which at the end of a semester constitute a part of a student's final grade. However, traditionally this presents additional effort from the teacher, who must make sure to correctly mark attending students, which at the same time wastes a considerable amount of time from the teaching process. Furthermore it can get much more complicated if one has to deal with large groups of students.

Maintaining the attendance is very important and compulsory in all the institutes for checking the performance of students. 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 attendanceusing some biometric techniques. There are many automatic methods availableforthis purpose i.e. biometric attendance. All these methods also waste time because students have to make a queue to touch their thumb on the scanning device.

Organizations of all sizes use attendance systems to record when student or employees start and stop work, and the department where the work is performed. When it comes to schools and universities, the attendance monitoring system is a great help for parents and teachers both. Parents are never uninformed of the dependability of their children in the class if the university is using an attendance monitoring system. The registers could easily be exploited by students and if information was mailed to the parents, there were high chances that mails could be made to disappear before parents even saw them. With the monitoring system in place, the information can easily be printed or a soft copy can be sent directly to parents in their personal email accounts.

Hence, we proposed An Automatic Attendance system for students.

II.PROPOSED METHODOLOGY

The system consists of a camera that captures the video of the students sitting in the classroom and sends it to the administration server using the web service. For the database, the input are the image of the student, the pre-processing of the image is done and then the features of face are extracted using Local Binary Pattern (LBP) and Histogram of Oriented Gradients(HOG), the features are eyes, nose, and mouth, and then it is subjected to the Support Vector Machine (SVM) classifier. After all this process the images of the student are stored in the database.

In the administration server, videois processed.From the video we generate number of frame/images. The the pre-processing of the image/frame is doneand then image subjected to the Face Detection where faces from the image/frame is detected. The features of the face are to be extracted in the feature extraction module using LBP and HOG; the features are eyes, nose, and mouth.Then the SVM training is done on the faces. Here all the faces are detected from the input image and the algorithm compares them one by one with the face database. If the features of the face match that with the face of the database then the attendance is marked from where anyone can access and use it for different purposes. Teachers come in the class and just press a button to start the attendance process and the system automatically gets the attendance without even the intensions of students and teacher. In this way a lot of time is saved and this is highly securing process no one can mark the attendance of other. Camera takes the video continuously to detect andrecognize all the students in the classroom.

In order to avoid the false detection we are using the Ada boost technique. Using this technique enhance the efficiency and accuracy of the detection process.

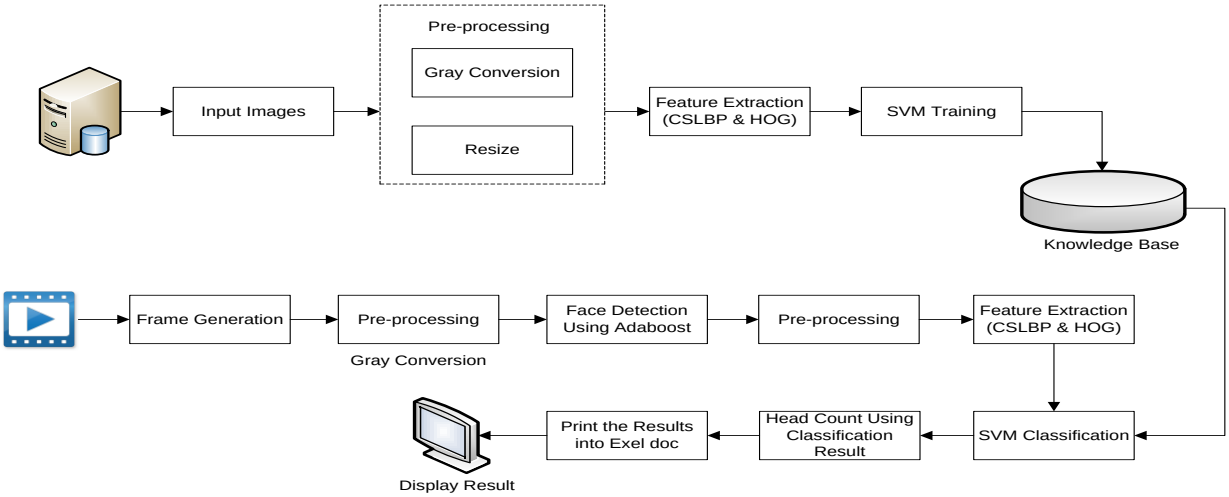


Fig. 1. System Architecture

III. ALGORITHM

This section describes the software algorithmfor the system. The algorithm consists of thefollowing steps

- Creation of database
- Video acquisition
- Frame generation
- Pre processing
- Face detection
- Face recognition
- Attendance

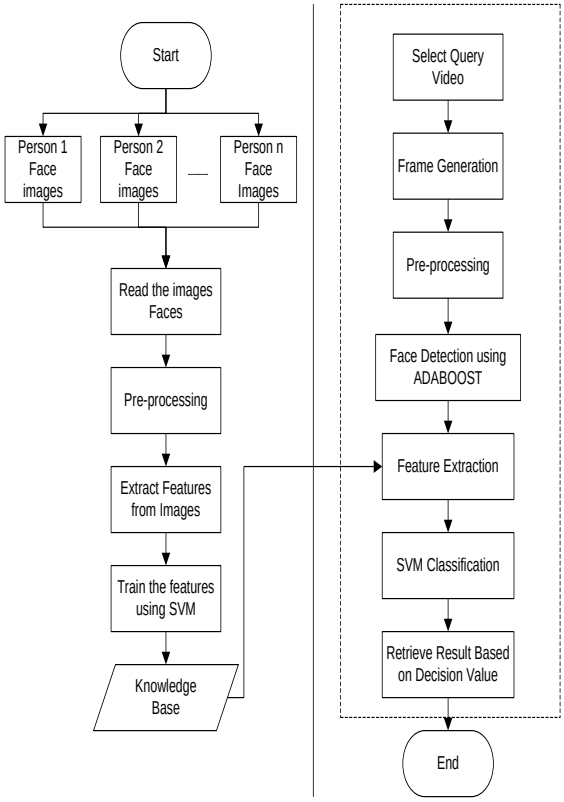


Fig. 2. Data Flow Diagram

3.1 Creation of Database

In this module we are going to maintain student details in the database which includeinformation like Branch, SEM, Name, USN etc.and we also store the image of allstudents in the database for further process.

These images are preprocessed in this the RGB image is converted to binary image, then from the binary image we extract the features, the features to be extracted are eyes, nose, and mouth using Histogram of Orientation Gradients(HOG) and Linear Binary Pattern(LBP) algorithms. These features extracted are loaded into SVM for training the features where SVMs are set of related supervised learning methods used for classification and regression.They belong to a family of generalized linearclassification. A special property of SVM is, SVMsimultaneously minimize the empiricalclassification error and maximize the geometricmargin. So SVM called Maximum MarginClassifiers. Here we are creating a double matrix so our training data are no. of row vectors and column vectors.

1) The SVM classification function F(x), $F(x) = w \cdot x - b$. w is the weight vector and b is the bias.

2) ComputeLagrange's Function LP

LP = L(w, b, α)

$= 1/2 w.w - \Sigma \alpha i \{yi(\mathbf{w} \cdot \mathbf{x}i - b) - 1\}$

Where αi is a Lagranges multiplier.

3) The kernel used is Radial Basis Function (RBF):

$K(xi, xj) = \exp(-\gamma \| xi - xj \| 2)$, $\gamma > 0$

γ is kernel parameter.

4) Samples along the hyperplanes are called

Support Vectors (SVs).All the support vectors SVs are stored in the format as follows: [SVs from Class 1, SVs from Class 2, ... SVs from Class L];

We use nonlinear kernel to solve classification problems, so we need the cost parameter (C) and kernel parameters (γ).Then we will load the features extracted when applied HOG and LBP along with the above algorithm result leads to SVM training and these is stored in the database.

3.2 FaceDetection and Feature Extraction of Face

Detecting a face is in essence an object detection task, where the object of interest in this case is the face. However, many factors can interfere with the face detection algorithms, factors such as face pose, scale, position, rotation, light, image colors etc. There are plenty face detection algorithms which can effectively detect a face (or any other specific object) in a picture. In the system presented here, most students face the camera frontally hence we chose to use the HAAR classifier for face detection.The integral image computes a

value at each pixel for example (x,y) that is the sum of the pixel values above to the left of (x,y). This is quickly computed in one pass through the image Haar classifier is nothing but scalar product between the image & some haar like structures. Feature is selected through Ada- boost. Ada-Boost provides an effective learning algorithm and strong bounds on generalization performance. The overall form of the detection process is that of a degenerate decision tree, what we call a "cascade". A positive result from the first classifier triggers the evaluation of a second classifier which has also been adjusted to achieve very high detection rates. A positive result from the second classifier triggers a third classifier, and so on. A negative outcome at any point leads to the immediate rejection of the sub-window. The cascade training process involves two types of tradeoffs. In most cases classifiers with more features will achieve higher detection rates and lower false positive rates. At the same time classifiers with more features require more time to compute. In principle one can use following stages. i) the number of classifier stages, ii) the number of features in each stage, and iii) the threshold of each stage, are traded off in order to minimize the expected number of evaluated features.A target is selected for the minimum reduction in false positives and the maximum decrease in detection. Stages are added until the overall target for false positive and detection rate is met.After a face has been detected, it will display the result as face detected with the faces of the student.

After theface detection next procedure is to extract the features of face which is called the feature extraction, algorithms used are Local Binary Pattern (LBP) and Histogram of Oriented Gradients (HOG).

3.2.1 Histogram of Oriented Gradients

1) Gradient Computation

For the gradient computation first the gray scale image is filtered to obtain x and y derivatives of pixels using ***conv2(image,filter,'same')*** method with those kernels: D_x = [-1 0 1] D_Y= $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$, for an image I, we obtain x and y derivative's by using convolution operation:

$I_X = I * D_X$ *and* $I_Y = I * D_Y$then the magnitude and orientation of the gradient is also computed:

G= $\sqrt{{I_X}^2 + {I_Y}^2}$ and Θ = arctan$\frac{I_Y}{I_X}$

at orientation calculation rad2deg(atan2(val)) method is used, which returns values between [-180°,180°].

2) Orientation Binning

The next step is to compute cell histograms for later use at descriptor blocks. For 8x8 pixel size cells are computed with 9orientation bins for [0°,180°] interval. For each pixel's orientation, the corresponding orientation bin is found and the orientation's magnitude |***G***| is voted to this bin.

3) Descriptor Blocks

To normalize the cells' orientation histograms, they should be grouped into blocks. From the two main block geometries, the implementation uses R-HOG geometry. Each R-HOG block has 2x2 cells and adjacent R-HOGs are overlapping each other for a magnitude of half-size of a block.

4) Block Normalization

L1-Norm normalization is implemented using ***norm(vec)*** method:

$$f = \frac{V}{||V_1|| + e}$$

e is a small constant.

6) Detector Window

The detector window will be computed based on the size image.

3.2.2Local Binary Pattern

Given a pixel in the image, an LBP code is computed bycomparing it with its neighbor's

$$LBP_{P,R} = \sum_{P=0}^{P-1} s(g_P - g_C)2^P$$

$$s(x) = \begin{cases} 1, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

where*gc*is the gray value of the central pixel, *gp*is the value ofits neighbors, *P* is the total number of involved neighbors and *R*is the radius of the neighborhood.Suppose the coordinate of *gc*is (0, 0), then the coordinates of *gp*are

(*R*cos(2π*p* / *P*), *R*sin(2π*p* / *P*)). After the LBP pattern of each pixel is identified, a histogram is built to represent the texture

image:

$$H(k) = \sum_{i=1}^{I} \cdot \sum_{j=1}^{J} f\left(LBP_{P,R}(i,j), k\right)$$

k € [0 , K]

$$f(x,y) = \begin{cases} 1, & x = y \\ 0, & otherwise \end{cases}$$

where*K* is the maximal LBP pattern value.Then it return the histogram of the center pixel calculated.

Finally, the system does recognize the face. After extracting the features from the given image, a recognizer is needed to recognize the face image from the stored database. This phase involves a SVM classification algorithm. The features extracted by HOG and LBP for the faces of student are loaded into the SVM classifier, SVM Classifier here is mainly used to do the input parameter checking if the features of a face of particular student matches with the features of face of student in the database then the decision value for that face will be 1 then attendance is marked automatically.

An error message is displayed if there are faces that does not with the faces of database. In this way faces of students are verified one by one with the face database using the SVM classification and attendance is marked on the server.

IV. IMPLEMENTATION

The proposed plan for An Automatic Attendance System using image processing includes:

- Enrolment of student faces.
- Capturing the video of students.
- Face detection and feature extraction.
- Face recognition and marking attendance.

Following are the screenshots of the implementation of this project.

4.1 Creation of Database

This window shows the creation of database of the students

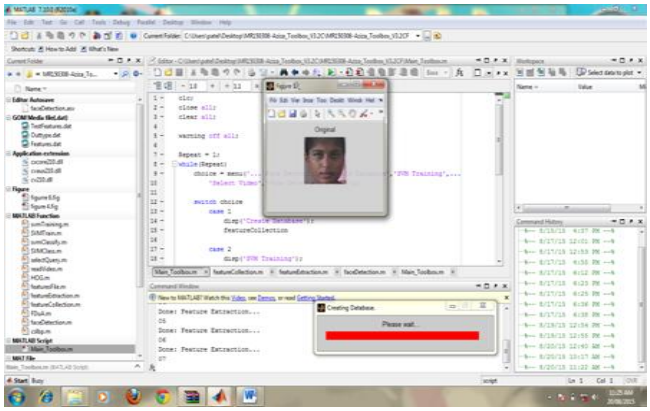


Fig. 3. The Database Creation of Students.

4.2 Menu Form

This window contains the list of menu items. The menus are create database, SVM training, select video, face detection and exit.

Fig. 4.The Menu Form

4.3 Video Acquisition

Video is acquired from a high definition camera that is connected in the class room such that all the student faces to the camera. This camera is connected to the computer. It captures video for 2 minutes and sends thesevideo to the computer for processing.

Fig. 5. The sitting arrangement of student in classroom

4.4 Image Conversion

The input image which is in RGB format is first converted into the gray-scale image. For this process, we calculate the average value of RGB for each pixel and if the average value is below than any specified value like 110, we replace it by black pixel and otherwise we replace it by white pixel. By this method, we get a binary image from RGB image.

Histogram normalization is good technique for contrast enhancement in spatial domain

Fig. 6. Histogram Equalized Image

4.5Frame Generation

After inputting the videoto the computer, frame generation is first performed by dynamic frame generation of video. We get no. of frames/images, the generation of frames/images per/sec is 30 to 40 frames. The length of the input video captured is 1 minute 8 sec, hence the generation of frame is huge, so we can select the frames in between, like between 99 to 1356. Hence the frames will be processed between 99 to 1356 frames.

Fig. 7. The Frame Generation

4.6 Face Detection

This window consists of the detecting faces.
These faces detected are from the video.

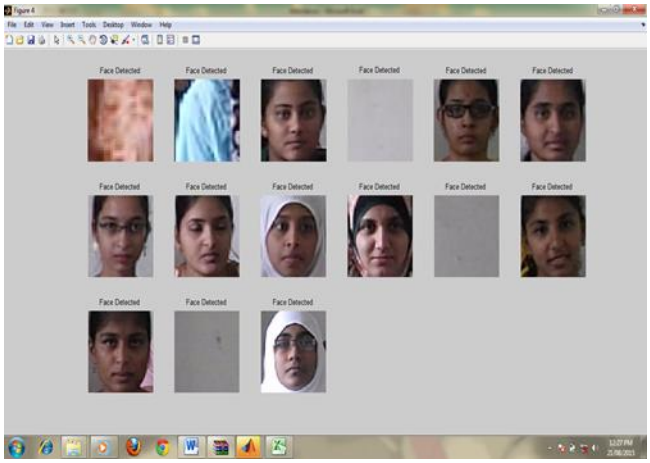


Fig. 8.Face Detection

4.7 Face Recognition

First the faces on the screen are traced out and the recognition process starts. During the recognition phase, the detected facial features are compared to the features stored in our database. If the system recognizes the features, the corresponding face is recognized and the name of the recognized student is displayed on the screen in message box.

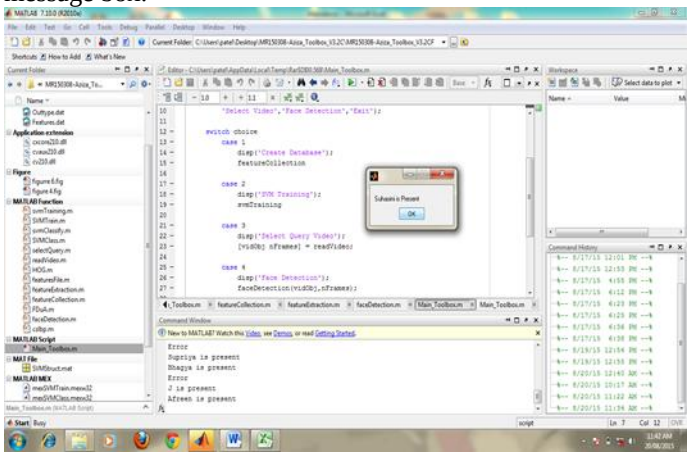
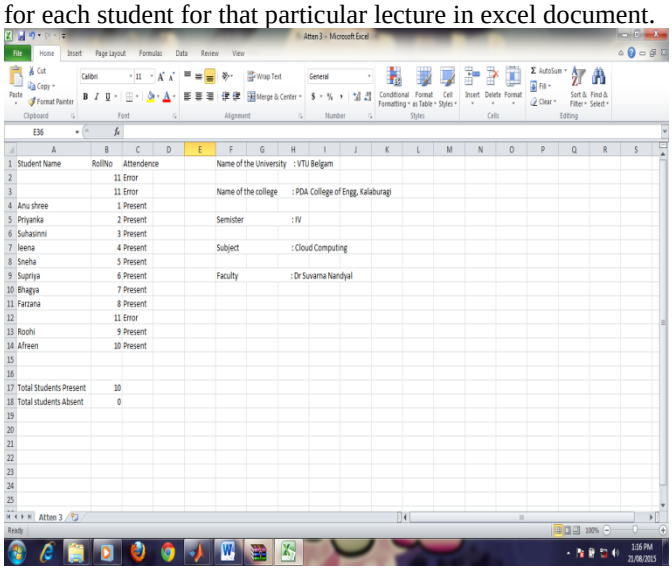


Fig. 9. The name of the student in message box displayed after face reorganization

4.8 Report

This window shows the report of the marked attendance. Attendance is marked along with the date and the time for each student for that particular lecture in excel document.



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Student Name	RollNo	Attendence			Name of the University		: VTU Belgam											
2			11 Error																
3			11 Error			Name of the college		: PDA College of Engg, Kalaburagi											
4	Anu shree		1 Present																
5	Priyanka		2 Present			Semister		: IV											
6	Suhasinni		3 Present																
7	leena		4 Present			Subject		: Cloud Computing											
8	Sneha		5 Present																
9	Supriya		6 Present			Faculty		: Dr Suvarna Nandyal											
10	Bhagya		7 Present																
11	Farzana		8 Present																
12			11 Error																
13	Roohi		9 Present																
14	Afreen		10 Present																
15																			
16																			
17	Total Students Present		10																
18	Total students Absent		0																
19																			
20																			
21																			
22																			
23																			
24																			
25																			

Fig. 10. Report

V.CONCLUSION

Our proposed project, "An Automated Attendance System" has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system. The aim is to automate and make a system that is useful to the organization such as an institute. The camera plays a crucial role in the working of the system hence the image quality and performance of the camera in real-time scenario must be tested thoroughly before actual implementation.

This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the classroom. It can be constructed using a camera and computer.

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