Smart Attendance System using HOG and SVM

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***Abstract* - As we know, attendance is an essential thing for schools, colleges, etc. However, the current attendance approach is very time-consuming, manual work, and a chance to make some mistakes like a proxy in attendance. This research can solve all the problems of the current attendance system. Our research is aimed at the attendance systems using face recognition which is very useful, less time-consuming, and accurate. The attendance system uses faces as input to be detected and recognized by a student and stored as a face database. The process of identifying face images using Histogram of Oriented Gradients (HOG) data captured by the camera with face images.**

***Index Terms* - face detection, face recognition, Histogram of Oriented Gradients (HOG)**

INTRODUCTION

Students' attendance is taken manually by professors, and it is very time-consuming, a chance for some mistakes to happen. Also, it is difficult to track students in a substantial class. If the attendance sheet is lost, the professor will have to take attendance again and, in this case, students who are absent in that class have a chance to make their presence in that class(proxy).

So our proposed system is to take attendance using face recognition; it is a straightforward process than attendance taken manually by professors. Face recognition technology is evolving moderately. This project eliminates student identification, such as calling students names or checking student ID cards. So basically, our attendance system can recognize students using the class camera and, after identifying it marks its presence in the sheet.

LITERATURE SURVEY

The paper [2] focused on feature extraction using HOG by exhibiting greater accuracy primarily in recognizing faces in AT & T facial databases. The increase in cross-validation testing can evaluate the system in such a way that the rejection of false detections is improved to ensure better classification. As the number of subjects increases, the method of generating feature vectors using HOG would be time-consuming.

According to H. Rathod, Y. Ware, S. Sane, S. Raulo, V. Pakhare, and I. A. Rizvi[11] in this system we can see that they can easily implement these HOG and SVM based systems. They created a dataset of students for training and then started the training model using these which is time-consuming.

This system aims to reduce errors within the manual attendance system. The aim of the paper [12] is to alter And build a system that's helpful to the organization like an institute. The camera plays a vital role within the operating of the system therefore the image quality and performance of the camera within the period state of affairs should be tested totally before actual implementation. This methodology is secure enough, reliable, and accessible to be used.

The experiment was done by Akash S Chachad, Soyeb M Khan, Rahul S Yadav, Dr. Pradip Mane results show how the proposed system works with Hog Conversion. There are two images: the first image is before conversion and the second image is after conversion. Based on these experimental results further conclusions are derived. Faces were successfully detected by the algorithm used. It is easier to implement.

A number of face recognition algorithms (LBP, PCA, and HOG) with a classifier/learning algorithm were implemented and tested using human subjects (eight UTM students) for the Development of a biometric authentication class attendance system. From the results obtained, the performance of the algorithm is affected when tested on various angled, Expression, and low illumination faces of the subjects. The combined HOG+SVM algorithm Was found to be the best algorithm based on robustness and efficiency

tests. Therefore, this algorithm is suggested to be utilized in the development and implementation of the Proposed attendance system.

METHODOLOGY

The proposed system is designed for the attendance of the different organizations to reduce the fault of an existing manual system. Data of students are added manually by an administrator.
Our system is divided into two parts. The main focus of this project is to give a smart way of an attendance-taking system in organizations for the attendance of students. and the second is the backend of the project which consists of logic and based on python machine learning.

IMAGE AQUARION

A dataset of students is created before the recognition process. We have created a dataset of 5-10 students which involves their name, roll number, and pictures of the student. This picture is saved manually in the face folder of the system. Which is useful while training the model and recognizing the person.

FACE DETECTION

The faces are detected using haarcascade_frontalface_default.xml. This file is used to detect the human face from the frame.

The following steps are for HOG for feature extraction:
Step1: Preprocess the Data (64 x 128):
This is a step most of you will be pretty familiar with. Preprocessing data may be a crucial step in any machine learning project and that is no different when working with images. We need to preprocess the image and bring down the width to height ratio to 1:2. The image size should preferably be 64 x 128. This is because we will be dividing the image into 8*8 and 16*16 patches to extract the features. Having the specified size (64 x 128) will make all our calculations pretty simple.

Step2: Calculating Gradients (direction x and y):
The next step is to calculate the gradient for every pixel in the image. Gradients are the small changes in the x and y directions. Here, I'm getting to take a little patch from the image and calculate the gradients theorem. We will get the pixel values for this patch. Let's say we generate the below pixel matrix for the given patch (the matrix shown here is simply used as an example and these aren't the first pixel values for the patch):

12	56	73	92	39
32	93	68	69	33
23	78	85	89	71
45	58	65	40	29
64	59	14	85	11

Fig 1.1: Matrix for Pixel Value of patch

I have highlighted the pixel value 85. Now, to work out the gradient (or change) within the x-direction, we would like to subtract the worth on the left from the pixel value on the proper. Similarly, to calculate the gradient within the y-direction, we will subtract the pixel value below from the pixel value above the selected pixel. Hence the resultant gradients in the x and y direction for this pixel are:
Change in X direction (Gx) = 89 – 78 = 11
Change in Y direction (Gy) = 68 – 56 = 8
This process will give us two new matrices – one storing gradients within the x-direction and therefore the other storing gradients within the y-direction. This is almost like employing a Sobel Kernel of size 1. The magnitude would be higher when there's a pointy change in intensity, like round the edges.
We have calculated the gradients in both the x and y directions separately. The same process is repeated for all the pixels within the image. The next step would be to seek out the magnitude and orientation using these values.

Step3: Calculate the Magnitude and Orientation:
Using the gradients we calculated within the last step, we will now determine the magnitude and direction for every pixel value. For this step, we will be using the Pythagoras theorem (yes, an equivalent one which you observed back in school!).

Take a look at the image below:

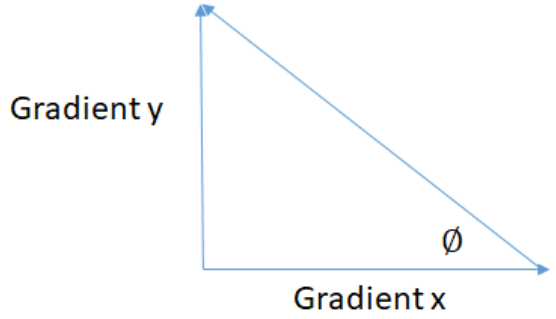

Fig 1.2: Pythagoras Theorem

The gradients are the base and perpendicular here. So, for the previous example, we had Gx and Gy as 11 and eight. apply the Pythagoras theorem to calculate the entire gradient magnitude:

Total Gradient Magnitude = √[(Gx)2+(Gy)2]

Total Gradient Magnitude = √[(11)2+(8)2] = 13.6

And next, calculate the orientation for the same pixel. We know that we will write the tan for the angles:

tan(Φ) = Gy / Gx

Hence, the value of the angle would be:

Φ = atan(Gy / Gx)

The orientation comes bent by 36 once we connect the values. So now, for each pixel value, we have the entire gradient (magnitude) and therefore the orientation (direction). We need to get the histogram using these gradients and orientations.

Step4: Method:

Here we have a bin size of 20. So, the number of buckets we would get here is 9. Again, for every pixel, we'll check the orientation, and store the frequency of the orientation values within the sort of a 9 x 1 matrix. Plotting this would give us the histogram.

12	56	73	92	39	
32	93	68	69	33	
23	78	85	89	71	
45	58	65	40	29	
64	59	14	85	11	

Magnitude		1						
Bin	0	20	40	80	100	120	140	160

Fig 1.3: Method to stores different angle in Magnitude form in the Distributed bin

FACE MATCHING

This is the final step of the face recognition process. So we can compare encoded images produced by the HOG model with the images stored in databases.

ATTENDANCE MARKING

Once the face is recognized with the image stored in the dataset, the system generates an attendance table that includes the Roll no, name, date, and time. Then it is stored in a file.

BLOCK DIAGRAM OF HOG

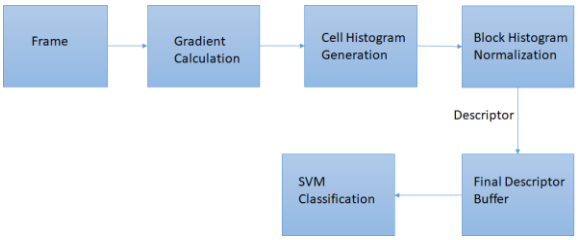

Fig 2: Block Diagram

Step1: Access the Attendance system GUI

The first step of this attendance system is it can be started by the lecturer then It pops up the window of the main GUI, consisting of all buttons of the attendance system.

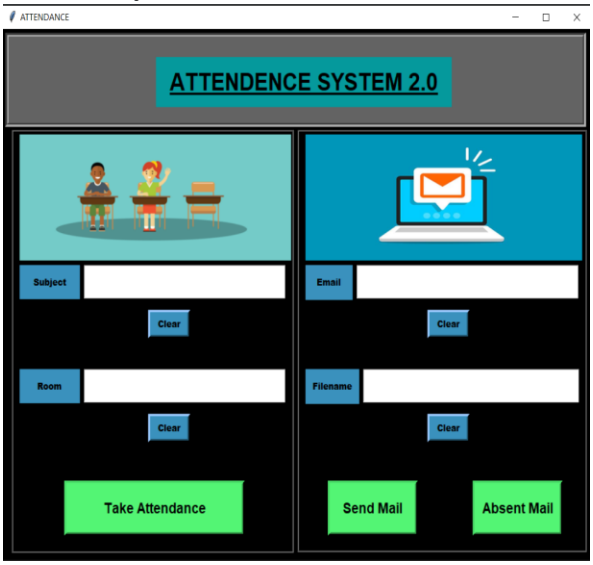

Fig 3.1: System Interface

Then the lecturer has to select the subject and classroom no.

Step2: Take attendance:
In this step, we have to click on the take attendance button. Then the camera will open and recognize the students who are in the range of that camera.

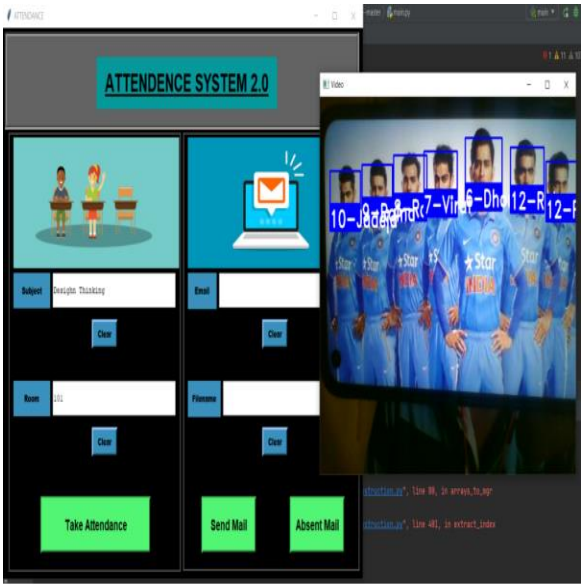

Fig 3.2: Video Capturing and Detecting person

Step3: Send Mail
For sending mail to the teacher, we have to write the teacher's mail in that mail section. Then we have to select a subject name file that is stored in the database. After that, we have to click on the send mail button.

Fig 3.3: Send Mail Successfully

Step4: Send mail to an absent student

Fig 3.4: Send mail to an absent student

For sending mail to absent students we have to click on the absent button. After we clicked on the absent button then the students who were absent in that class got a notification of absent mail.

CONCLUSION

The Face recognition attendance system is meant to unravel the problems of existing manual systems. We have used the face recognition concept to mark the attendance of students and make the system better. The system performs very well in different poses and variations. In the future this system needs to be improved because this system sometimes fails to recognize students, also we have some processing limitations, working with a system of high processing may end in even better performance of this technique.

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