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Facial Recognition Attendance System Using Python

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ABSTRACT-

In this digital era many educational institutes are more concerned about the presence of students because the quality of education depends on that. There is a two traditional method of marking the attendance, first is by calling out the name of student and second is taking sign on paper, but both the methods are time consuming and tedious, so revolization of attendance system is needed. In this project, "Student Attendance System using Python based on Facial Recognition" computer system's camera will capture photo of student, an algorithm is used for extracting the features of face and recognising the face, mark the attendance. Record of attendance can be extracted in the form of excel sheet. We have used Python Tkinter for GUI interface.

Index Terms-LBPH, Tkinter, RFID, Adaboost

I. Introduction

In this digital era attendance plays a pivotal role in the performance of students in colleges and schools, the continuous absence increases the risk of failure and early dropout of students.

As we know that in this technical era machine learning is getting advanced, we developed a system which automatically detects the face of students, marks the attendance and maintains attendance record with the time and date from the collected data.

This system first captures photo of student and collects the data samples of students photos, the data sample gets trained by a classifier and for performing all the things, many techniques have been developed but our system uses Haar Cascade Classifier which is a method for object detection, this classifier uses to find the positive and negative of the face after training of data, LBPH algorithm is used for face recognition by using python programming and OpenCv library for presentation or front end of this system we use the Python Tkinter module, after recognition all data gets saved with time and date. For the backend we use MySQL Workbench and time and date gets recorded by using the time and date module of python and all the attendance records can be extracted in the form of excel sheet. Facial recognition becomes more popular day by day because it is continuously upgrading and gives more accurate results day by day. Facial recognition is also used by China to identify a particular person in the crowded area and nowadays this technology is also used in our mobile phone for recognizing the authorized person and using this technology our system can take attendance accurately without human interface.

II. Objective

The core objective of this project is to develop an automated system for human face recognition in a real background for the educational institution to mark the attendance of their students and this can reduce the human interface and mark the attendance with high accuracy.

III. Literature survey

There are so many attendance systems that exist with several methods for replacing the traditional paper method of attendance system. RFID [1] based attendance has been proposed by M.T. chew and H.K. Nguyen in this a card is given to the students and there is a scanner on that card but this system if the card get misplaced then an unauthorized person may take entry easily in the institute.

Jomon Joseph, K.P. Zacharia proposed a system[2] which is based on the image processing, PCA , eigen faces and all the things are implemented using MATLAB but there is a problem with this system is that it can only works with front face images, side view of person can't be recognised by this system.

There is a fingerprint based attendance system[3] in a portable finger device used for collecting fingerprints of students and marking the attendance. An iris based attendance system[4] is also proposed but it won't work when the person is at some distance.

In recent years face recognition based attendance systems are becoming famous among the institute[5][6][7]. In [8] the author uses a facial recognition based attendance system using an eigenface algorithm. This algorithm is very responsive but the problem is that it can't work in low light situations.

In 2001 Viola and Jones proposed an object detection framework for real time face detection in video footage. This algorithm is also known as Haar Cascade.On this algorithm face recognition system Prof Graceline Jasmine proposed a system which is based on face recognition[9]

In [10] the author compares different face recognition techniques and algorithms using OpenCV 2.4.8 by using ROC () curve in their training data set.

IV. Methodology

Face recognition comes under computer vision technique and it becomes more popular as implementation by using Machine Learning technology is easy.Now, it is necessary to understand that face recognition is different from face detection.

4.1 Face Detection:

The objective of this is to find whether the human face is present in the given image and it also finds the location of face and size.

4.2 Face Recognition:

various images are taken for extracting the features of the face and this gets stored in the database. It converts the image in grayscale. After that various face recognition algorithms are used for finding characteristics, which best describe the image.

4.3 Haar Cascade Classifier

Haar cascade is a machine learning based method which provides an effective way for object detection. In this cascade function gets trained with lots of positive and negative images and this trained Classifier is used to detect that particular object which we want to detect in other images.

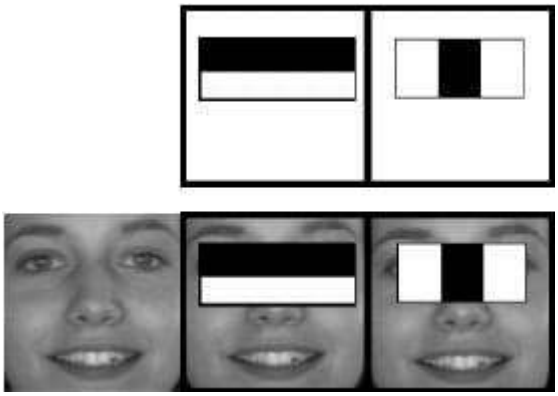


Fig 1: Haar cascade identification

Positive images:- we trained the classifier with that particular object image which we wanted to identify in the other images and videos.

Negative images:- we also trained the classifier with the images which don't contain objects that we want to detect as it will increase the accuracy in detecting the face.

In face detection, we needed many positive and negative images. There are four stages to understand the Haar Cascade Classifier

1. The first step is to collect the features from the object as a feature operates much faster than a pixel system. In face recognition features would be our eyes, nose, eyebrows etc. It will select in three forms: edge, line and four-rectangle.

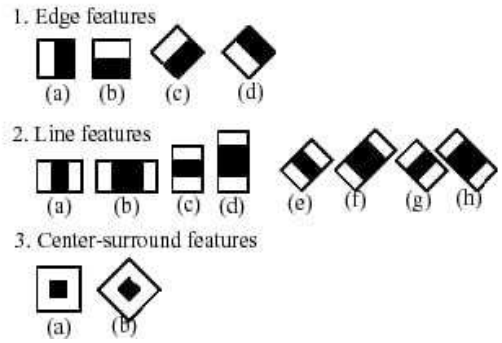
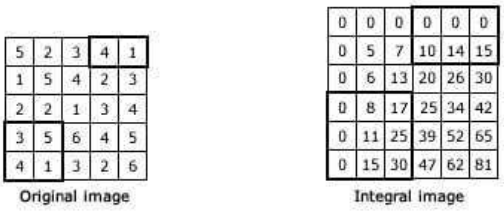


Fig 2 : Different types of haar features

Let us take an example of edge feature, that is the difference of the sum of pixels of area inside the rectangle which can be any position and scale within the original image. It won't work for a large image, for this we use an integral image.

2. Second stage is the integral image that makes our work superfast. It creates sub-rectangles and creates array references for each sub-rectangles.



5	2	3	4	1
1	5	4	2	3
2	2	1	3	4
3	5	6	4	5
4	1	3	2	6

Original image

0	0	0	0	0	0
0	5	7	10	14	15
0	6	13	20	26	30
0	8	17	25	34	42
0	11	25	39	52	65
0	15	30	47	62	81

Integral image

3. Adaboost is used to choose the best features as in a window 24X24 pixels, there can be nearly 162,336 possible feature and evaluation of that is not easy.

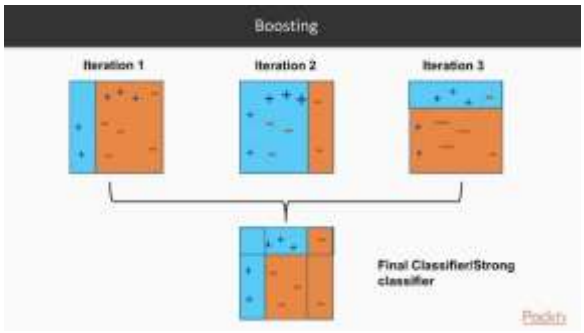


Fig 4 : Representation of Ada boosting algorithm

4. 4. Cascading Classifier:- the cascading Classifier is a combination of all three stages and a properly trained classifier is now ready to work. It makes a large number of small decisions as to whether it's an object or not. Its structure is a degenerate decision tree.

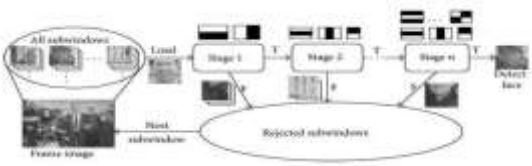


Fig 5 :Stages of Cascade Classifier

4.4 Local Binary Pattern Histogram

In the training part, it deals with grayscale images. This algorithm is based on the local binary operator and it is well known for its performance as it can recognise the face of the human face front and side face.

Radius :- it defines the distance of the circular local binary pattern from the center pixel to its circumference. Generally, we take its value as 1.

Neighbors :- It defines sample points within a circular local binary pattern. Usually, its value is taken as 8.

Grid X :- it defines the number of cells in the horizontal plane. Generally, it has a value 8.

Grid X :- it tells about the number of cells in the vertical plane. Generally, it has value 8.

4.4.1 Working of LBPH algorithm:

Let us consider an image for understanding the steps involved in the LBPH algorithm.

Fig 6 : Flow chart of LBPH algorithm

Suppose we have a grayscale image of dimensions NXM.

We divide the image into regions of the same height and width.

We used a Local binary operator of window size of 3x3 for every region.

$$LBP(x_c, y_c) = \sum_{p=0}^{P-1} 2^p s(i_p - i_c)$$

(Xc,Yc)=central pixel with Intensity Ic

In=Intensity of neighbor pixel

Now the comparison has been done by setting the median pixel value as threshold.

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

If the value of neighbors are not greater than or equal to the central value, it is 0 and if it is equal to central value then it will be 1.

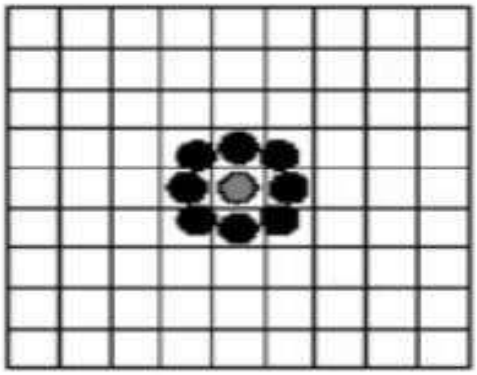


Fig 7 : Circular LBP

So, we have a total of 8 binary values and by combining these values, we have a 8 bit binary number.

We convert this binary number into a decimal number and it is LBP value of range 0-255.

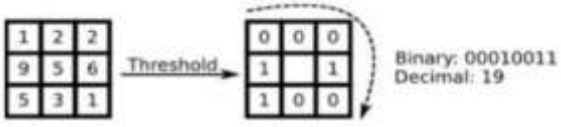


Fig 8: Conversion of binary value into decimal value (LBP Value)

LBP value of histogram of each region is generated by counting the number of similar LBP be values in the region.

When the histogram for each region, all the histograms are merged and forms a single histogram that is known as feature histogram.

Now it compares the database image with the test image and the output returns with the closest histogram.

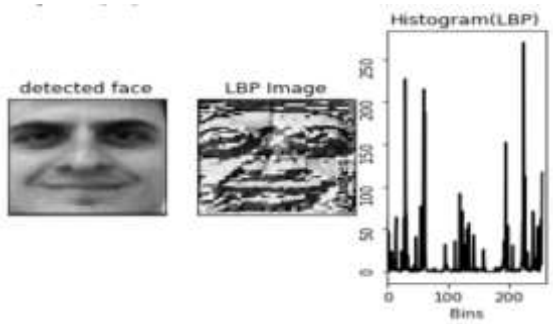


Fig 9: Detected face on comparing LBP image and Histogram

IV. Working and Experimental Result

First, the user needs to enter his username and password login into the system. This system works in four stages

1) Generating Dataset
2) Training with Classifier
3) Detecting the face
4) Marking the attendance

Homepage has 5 buttons for entering into other windows. Let us see the working of the system by clicking on these buttons.

Fig 10: Homepage

1) On clicking "Student Details" (Dataset Generation)

Database is generated by filling all details of students and it takes photo samples by clicking on the button "Take Photo Sample".

Fig 11: Dataset Generation

2) On clicking "Photos"

Photo samples are stored in a folder.

Fig 12 :Folder of sample photos

3) On clicking " Train data"

Data gets trained (with Classifier) by clicking the "Train" button and after it shows the message training dataset is completed.

Fig 13: Training of image with previous images

Fig 14: Message box with training dataset is completed

4) On clicking "Face Recognition" button

Face gets detected by clicking the face detect button, it opens the webcam and makes a square if the face matches.

Fig 14: Face recognition with name

Fig15: The face which is not in the database

5) On clicking "Attendance" button

The attendance gets stored in My SQL database with time and date and we can get this in Excel form on clicking "Export CSV".

Fig 16: Exporting CSV file

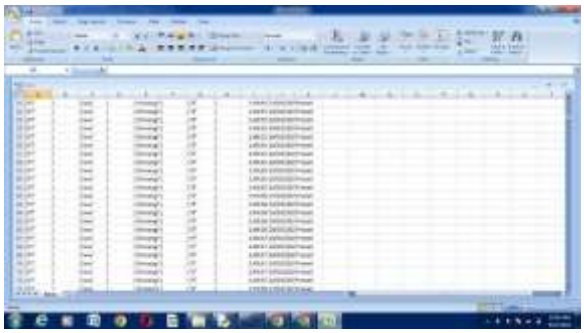


Fig 17: Marked attendance in Excel sheet

V. Conclusion and Future scope

This paper gives information about facial recognition based attendance systems using OpenCV's productive algorithm that is LBPH. It marks accurate attendance so it will help the institute to decide whether a student is eligible to give the exam or not and teachers will also be more focused on their academics as this system is less time consuming.

We can also add voice commands in this system using python text to speech converter so it will become more helpful. It can be easily installed in the institute using a camera and computer.

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