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Attendance System Using Face Recognition

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ABSTRACT:-Face detection and recognition has gained a lot of popularity in the domain of Image Processing in the last few years and researchers have been able to implement it in various fields of our daily life including security purposes, gender classification, human computer interaction, biometric control etc. This paper aims toward another successful implementation of Attendance system using face detection and recognition. Manually taking attendance by teachers cause a lot of manipulation and a lot of confusion at times. The automated system for attendance designed by us prevents the extra proxies and manipulation of the data. It also saves the time spent on counting the students and taking attendance, which in turn can be used for betterment of students. Our Attendance system compromises of four steps i.e. creating a database, taking a group photo of class, face segmentation, matching the face with the database. This paper consists a basic introduction of our work, previous works on the same topic, a proposed architecture, simulation and results and conclusion.

KEYWORDS: PCA-LDA, segmentation, Ada-Boost, cascading classifier, background regions.

General Terms : Face Recognition, Viola-Jones Face Detection Algorithm, Local Binary Pattern Algorithm.

I. INTRODUCTION

Manually taking attendance causes a lots of discrepancies in the attendance report and chances are there of manipulation of data. In addition, it makes the teacher's job tedious and some amount of time out of total allotted time for teaching results in a total wastage. Face detection and recognition can be successfully implemented here to mark the attendance. The image is captured through a high definition camera during the class hours. Faces of students are detected, segmented and stored for verification with database. After the successful match of faces, the attendance is marked by itself.

Our system works on 3 divisions which we will be explained in later part. An introduction for all the 3 divisions is being given to have a proper understanding.

The first one is creating a database of the students; system uses python code using opencv to prepare a database of the person sitting in front of the camera in various moods and positions. This is only one-time procedure. The images captured and segmented will be added to the database for the continuous update of the database.

The second one is face detection; a high definition camera is used to capture the photo of the whole class. The captured image is then segmented into faces using a well-known algorithm i.e. haarcascades designed by viola jones for eyes and face detection. This algorithm eliminates the issues of illumination, rotation and scaling to some extent.

The third one is face recognition; system uses local binary pattern (LBP) to recognize the face. In this the face is captured and divided into different blocks. Histograms of each block is made and block histogram are concentrated into face image. The original LBP operator labs the pixels of image by thresholding the pixels with the centre pixel. If the value of the neighbour pixel is greater than or equal to the centrepixel, the neighbour pixel is assigned as 1 else 0.

II. EARLIER WORKS

Face detection using LBP was proposed by Jo Chang-yeon. His paper describes how the LBP works and how it is used for face recognizing. The outcome of his paper was that LBP is simpler than haar-like features and faster to discriminate between faces and non faces.

Face detection and recognition for automatic attendance system was proposed by Dr. Nita Thakare, Meghna Shrivastava,NidhiKumari, Neha Kumari, Darleen Kaur, Rinku Singh which aims at the efficiency of the system.

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Automated Attendance Management System using Face Recognition was proposed by Mrunmayee Shirodkar, Varun Sinha, UrviJain, Bhushan Nemade. Their paper describes the real time automatic attendance system. Their developed algorithm in taking attendance is achieving 83.2% efficiency.

III. REVIEW OF LITERATURE SURVEY

In the literature survey done for the face recognition, we realized that it is two-step process face detection and face recognition. In the face detection, when image is captured, the image area is classified into regions like "face" and "non face". Real Time Human Face detection and Tracking was proposed by J. Chatrath, P. Gupta, P. Ahuja, A. Goel [5]. Their paper describes the technique of real time profile detection and recognition by modifying Viola-Jones algorithm [3]. Results achieved by the developed algorithm showed that up to 50 human faces could be detected and tracked by systems using the modified algorithm. Processing of data and time consumption is comparatively less in such systems. Implementation of Attendance Management System was proposed by G. Lakshmi Priya [3] and M. Pandimadevi [4]. Systems built around this proposal would capture an image using a web camera at divergent instances. An accuracy of 68% was observed in such systems respectively.

Table.1 Comparison of various algorithms for face recognition. [9]

Method	No. of Images	Success Rate	Reference no.
Principal Component Analysis (PCA)	400	79.65%	5
Principal Component Analysis + Relevant Component Analysis	400	92.34%	5
Independent Component Analysis	40	Gauss function 81.35%	8
Support Vector Machines	-	85-92.1%	10
Neural Networks	-	93.7%	11
Eigenfaces Method	70	92-100%	12
Eigenfaces with PCA method	-	92.30%	13

IV. SYSTEM ARCHITECTURE

1. Creating the database
2. Capturing the image
3. Face detection and segmentation using Haar cascades
4. Face recognition using LBP
5. Attendance marker

A. Creating the database:

A database of all the students will be created using python and opencv. It is a onetime process so that we will have a real time database to train our system and to match the captured faces. For creating a person's database,the person has to sit in front of the camera around 80cms away from the camera with light on the opposite side of the face. The camera must be at level of the face of the person. When the coderuns, the person has to give 8 poses with different expressions so that a database of different types of photo gets made. The poses can be looking sideways, up down or any direction in which face is visible. The expressions to be recorded can be happy, sad, bored, yawning etc. Also the faces detected from the captured images will be added to the database so that the database is updated continuously. Once the database is done we are ready with our implementation part.

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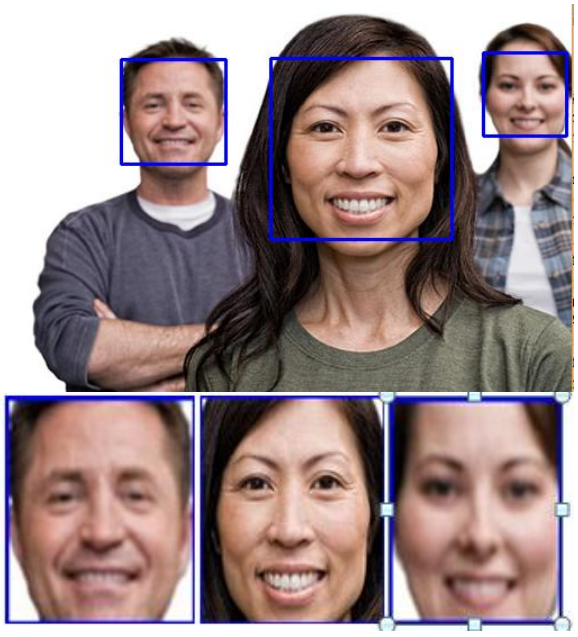
B. Capturing the image

A high definition camera will be installed in the classroom above the board so that it could capture all the students present in the class. The camera can be manually controlled or programmed as per the choice of the user. After capturing the image, it will be sent to the system for further processing.

C. Face detection and segmentation using Haar cascades

Once the system gets the input image, it will be processed and all the faces present will be detected using the haar cascade feature of opencv. The image then will be segmented to all the faces present and will be stored in a file for that particular date.



D. Face recognition using LBP

Once all the faces are segmented into different faces, we will run the face recognition code. Each of the faces from the particular date folder will be checked with the database using the local binary pattern algorithm and if similar face is found the photo will be added to the database for better efficiency in future.

E. Attendance Marker

If a face from the particular date folder is matched with the database, then the particular student will be marked present. Following the same procedure, we will have list of all students who were present in the class. Rest of the class students will be marked absent.

V. PROPOSED ALGORITHM

A. Viola jones algorithm [1]

It is used for face detection.
The algorithm uses 4 techniques
1.Haar –like features
2.Integral images
3.Ada boost
4.Cascading
This algorithm trains a system to identify the difference between face images and non-facial images. We extract the features of a face image and store it in a file,if a given input image processes all the comparison in the file then it is recognized as a facial image.we are classifying the image is whether a face or a non-faceimage, just by referring to the file,which is already stored in the database

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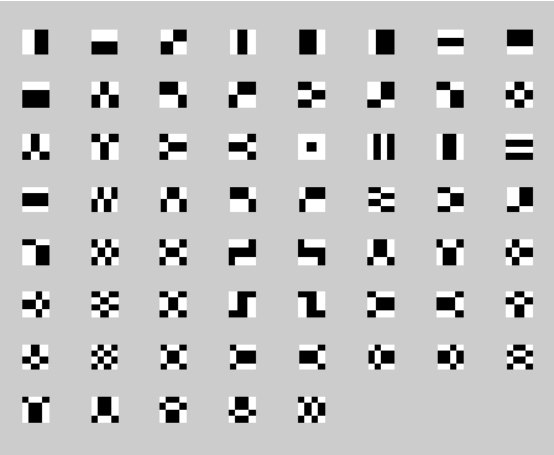
A.1. Haar –like features

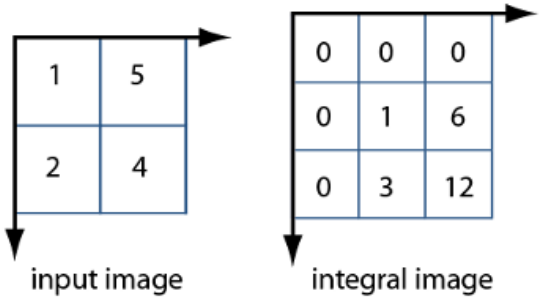
There is different type of haar feature which are applied on the image to see whether the feature exists in the image.The 24X24 window is applied all over the image, in which for each operation,we are subtracting the sum of pixels in white region with, sum of pixels in black region which output an integer value,that determines the validation of the corresponding feature.



For every 24X24 window we end up calculating nearly 160,000 features, because in each scale of image every feature is interpreted in all possible dimensions,positions and sizes.

A.2Integral image*:*

This method reduces the cost of calculating sum of pixels while validating a feature.we are doing the same by taking only the corner pixel values.For a given input image, or getting integral image, we sum up all pixels that are falling to the left and top region of the pixel. The advantage of the integral image is; it reduces the computation by 4 times.



A..3 Adaboost:

Calculating 160,000 feature's validation for each 24X24 window is practically impossible and computationally intensive.so,we are going to use only the features which are more effective in face detection,rather than less effective haar-transforms.This is done by adaboost,it narrows down to thousands of features that are redundant to use.Adaboost decides some set of features and gives weight to each feature, and the linear combination of all these features, is used to decide whether it is a face or not.Weak classifiersare some features which at least perform better than random guessing,if we give hundred face images,it will be able to detect more than fifty as face images.The output of the weak classifier is 1, if the feature is recognized else 0. The sum of product of relevant weak classifiers and their weights gives the strong classifier,whose value must be more than threshold for validation as a face image,which is less for a non-facial image.

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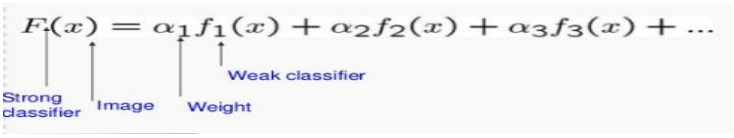
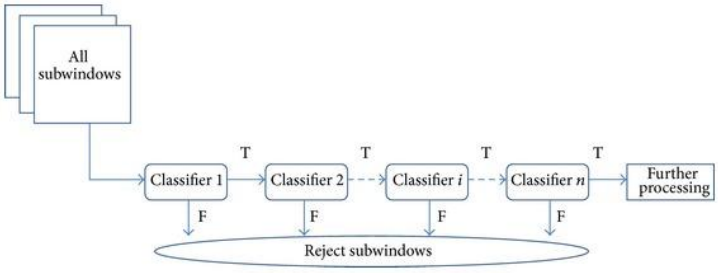


A.4 Cascading:

If we have an input image say 640X480, we have to perform 2500 feature validations for each 24X24 window, and take the linear combination of all those classifiers for validation.In cascading, we divide these 2500 features into set of stages in which the number of features increases in ascending order.The advantage is we can reject any non-face image with less time, without processing for each and every feature.

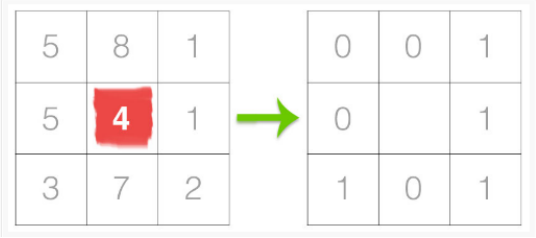


B. Local Binary Pattern

Local Binary Pattern[6] is an algorithm which is based on the texture of the object. However, unlike other texture based algorithms which generally uses a global threshold, this algorithm computes the local representation of the texture[7]. The steps involved in the algorithm are:

1. Convert the image into grayscale image.
2. For each pixel in the image, take neighborhood of size = r(say 8) around the pixel
3. Calculation of the LBP value goes like this. Any value greater than the Centre pixel(threshold) is assigned a value 1 whereas others lesser then the threshold are assigned 0.
4. They are then written in an array of length 8 in clockwise or anti-clockwise direction from the first pixel.
5. Finally, the LBP value for the pixel is calculated by multiplying the values of the array with values equal to 2 raise to the power the index of the array.
6. This LBP value for each pixel stored in a 2D array of size same as the size of the input image
7. A histogram of the frequency of each number over the cell (the number greater and the number smaller) is plotted.
8. The histogram is then normalized.
9. Thus, we get 256 bin histograms.
10. Finally, the histograms corresponding to all the cells are concatenated to get the final feature vector.

There is different neighbor size available for LBP [8] operator. For instance, (LBP4, 1) uses 4 neighbors on a circle of radius 1. Similarly, (LBP16,2) consists 16 neighbors on a circle of radius 2. Thus in general, LBPP, R refers to P pixels on a circle of radius R. These fundamental patterns are as those with a small number of bitwise transitions from 0 to 1 and vice versa. For example, 00101110 and 10110001 contain 4 transitions while 00010110 and 01110110 contain 3 transitions and so on.



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VI. CONCLUSION

The smart and automated attendance system can be proven as an efficient system for classroom attendance. By using this system, the chances of fake attendance and proxies can be reduced. There are a lots of Biometrics Systems which can be used for managing attendance, but the face recognition has the best performance. So we need to implement a reliable and efficient attendance system for classroom attendance which can work for multiple face recognition at one time.Also to implement this system, no any specialized hardware is required. A camera device and a standalone PC, database servers are sufficient for constructing the smart attendance system. With the help of a divergent combination of algorithms, this system helps us to achieve desired results with better accuracy and less time consumption.

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