Attendance Management System using Face Recognition

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***Abstract*:- Facial recognition technologies have undergoes large scale upgrades in performance in the last decade and such systems are now popular in field such as security and commerce. But the real difficulty is to implement an accurate attendance system in real time. This is difficult to mark attendance of large number of students present in a classroom. By this paper, attendance is easy by recognize faces of students and mark attendance. Cascade classifier and LBPH (Local Binary Pattern Histogram) algorithms use in face recognition. This system saves time of mark attendance.**

I. INTRODUCTION

Face recognition is an important application in student attendance system because it saves time in marking attendance. It is a biometric technique. This application is used in where large numbers of students are present, it is difficult and time consuming to take attendance on paper one by one. So this application will help to reduce time consumption and make easy to take attendance of every student just by their face recognition. In this application students need to register themselves by entering their roll number and name which is attached with their face recognition. This data is connected with data base and store all students' data. In this application LBPH (Local Binary Pattern Histogram) and cascade classifier used to recognize faces of students.

Our brain, as a human is made to do all of this automatically and instantaneously. Computers are incapable of this kind of high level generalization, so we need to teach or program each step of face recognition separately[4].The main motive of

developing this type of application is to reduce time consumption of taking attendance of students on paper by a teacher during their lecture.

Various Techniques For Marking Attendance are:

1. Signature based system
2. Fingerprint based system
3. Iris recognition
4. RFID based system
5. Face recognition

II. APPLICATIONS

A. School

This application can use in schools because in schools traditional way of attendance marking in use where they call every student by roll number to check that they are present or not. This method is time consuming. During class taking attendance can take long time. This application can improve the standard of the school. By this system, students can't mark proxy attendance. Efforts of teacher is decrease, increase productivity and reduce human error.

So form these above importance of this system, it can be easily used in school.

B. Institutions

This application can use in institutions because like schools, institutions also use traditional way of attendance marking where they call every student name or roll number to check that they are present or not. This method is time consuming. This application can improve the standard of the institute. By this system, students can't mark proxy attendance. Efforts of teacher is decrease, increase productivity and reduce human error.

So form these above importance of this system, it can be easily used in school.

C. College

In college traditional way is used like school and institute. By using this application, process of taking attendance can improved and save time consumption of marking attendance. This application can improve the standard of the college. By this system, students can't mark proxy attendance. Efforts of teacher is decrease, increase productivity and reduce human error.

So form these above importance of this system, it can be easily used in school.

III. RELATED WORK

Types of face recognition algorithms

A. PCA

Derived from Karhunen-Loeve's transformation. Given an s-dimensional vector representation of each face in a training set of images, Principal Component Analysis (PCA) tends to find a t-dimensional subspace whose basis

vectors correspond to the maximum variance direction in the original image space. This new subspace is normally lower dimensional (t<<s). If the image elements are considered as random variables, the PCA basis vectors are defined as eigenvectors of the scatter matrix. [10]

B. ICA

Independent Component Analysis (ICA) minimizes both second-order and higher-order dependencies in the input data and attempts to find the basis along which the data (when projected onto them) are - *statistically independent* . [10]

C. LDA

Linear Discriminant Analysis (LDA) finds the vectors in the underlying space that best discriminate among classes. For all samples of all classes the between-class scatter matrix *SB* and the within-class scatter matrix *SW* are defined. The goal is to maximize *SB* while minimizing *SW*, in other words, maximize the ratio det|*SB*|/det|*SW*| . This ratio is maximized when the column vectors of the projection matrix are the eigenvectors of (*SW*^-*1* × *SB*). [10]

D. EP

An eigenspace-based adaptive approach that searches for the best set of projection axes in order to maximize a fitness function, measuring at the same time the classification accuracy and generalization ability of the system. Because the dimension of the solution space of this problem is too big, it is solved using a specific kind of genetic algorithm called Evolutionary Pursuit (EP). [10]

E. EBGM

Elastic Bunch Graph Matching (EBGM). All human faces share a similar topological structure. Faces are represented as graphs, with nodes positioned at fiducial points. (exes, nose...) and edges labeled with 2-D distance vectors. Each node contains a set of 40 complex Gabor wavelet coefficients at different scales and orientations (phase, amplitude). They are called "jets". Recognition is based on labeled graphs. A labeled graph is a set of nodes connected by edges, nodes are labeled with jets, edges are labeled with distances. [10]

F. Kernel Methods

The face manifold in subspace need not be linear. Kernel methods are a generalization of linear methods. Direct non-linear manifold schemes are explored to learn this non-linear manifold. [10]

G. Trace Transform

The Trace transform, a generalization of the Radon transform, is a new tool for image processing which can be used for recognizing objects under transformations, e.g. rotation, translation and scaling. To produce the Trace transform one computes a functional along tracing lines of an image. Different Trace transforms can be produced from an image using different trace functionals. [10]

H. AAM

An Active Appearance Model (AAM) is an integrated statistical model which combines a model of shape variation with a model of the appearance variations in a shape-normalized frame. An AAM contains a statistical model of the shape and gray-level appearance of the object of interest which can generalize to almost any valid example. Matching to an image involves finding model parameters which minimize the difference between the image and a synthesized model example projected into the image. [10]

I. 3-D Morphable Model

Human face is a surface lying in the 3-D space intrinsically. Therefore the 3-D model should be better for representing faces, especially to handle facial variations, such as pose, illumination etc. Blantz et al. proposed a method based on a 3-D morphable face model that encodes shape and texture in terms of model parameters, and algorithm that recovers these parameters from a single image of a face. [10]

J. 3-D Face Recognition

The main novelty of this approach is the ability to compare surfaces independent of natural deformations resulting from facial expressions. First, the range image and the texture of the face are acquired. Next, the range image is preprocessed by removing certain parts such as hair, which can complicate the recognition process. Finally, a canonical form of the facial surface is computed. Such a representation is insensitive to head orientations and facial expressions, thus significantly simplifying the recognition procedure. The recognition itself is performed on the canonical surfaces. [10]

K. Bayesian Framework

A probabilistic similarity measure based on Bayesian belief that the image intensity differences are characteristic of typical variations in appearance of an individual. Two classes of facial image variations are defined: *intrapersonal* variations and *extrapersonal* variations. Similarity among faces is measured using Bayesian rule. [10]

L. SVM

Given a set of points belonging to two classes, a Support Vector Machine (SVM) finds the hyperplane that separates the largest possible fraction of points of the same class on the same side, while maximizing the distance from either class to the hyperplane. PCA is first used to extract features of face images and then discrimination functions between each pair of images are learned by SVMs. [10]

M. HMM

Hidden Markov Models (HMM) are a set of statistical models used to characterize the statistical properties of a signal. HMM consists of two interrelated processes: (1) an underlying, unobservable Markov chain with a finite number of states, a state transition probability matrix and an initial state probability distribution and (2) a set of probability density functions associated with each state.[10]

N. Boosting & Ensemble Solutions

The idea behind Boosting is to sequentially employ a weak learner on a weighted version of a given training sample set to generalize a set of classifiers of its kind. Although any individual classifier may perform slightly better than random guessing, the formed ensemble can provide a very accurate (strong) classifier. Viola and Jones build the first real-time face detection system by using AdaBoost, which is considered a dramatic breakthrough in the face detection research. On the other hand, papers by Guo et al. are the

first approaches on face recogntion using the AdaBoost methods.[10]

IV. IMPLEMENTATION

There are many types of face recognition. But we use only these algorithms in this application.

A. Algorithm

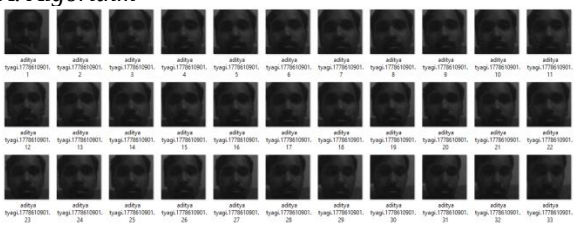

Fig. 2 Images stored in grayscale

1. LBPH algorithm:

LBPH stands for Local Binary Pattern Histogram, this algorithm is proposed in 2006, It is a basic algorithm that's used to detect faces from front side. It is used for object as well as face detection. The LBP operator helps to get local features by Local Binary Pattern acts. The local special arrangement of the face is shortened by these LBP acts. The LBP operator divides the face in the image into pixels. Every pixel is associated with 8 neighbor pixels that surroundings it. Each pixel value is then compared with the surrounding neighbor pixel values. The equation is for this is:

$LBP(x_c,y_c) = \sum^{7}_{n=0} s(i_n - i_c)2^n$ (i)

Where

i_c - It's the value of the center pixel

(x_c, y_c), - It's value of eight surrounding pixels.[3]

FLOW DIAGRAM OF ALGORITHM

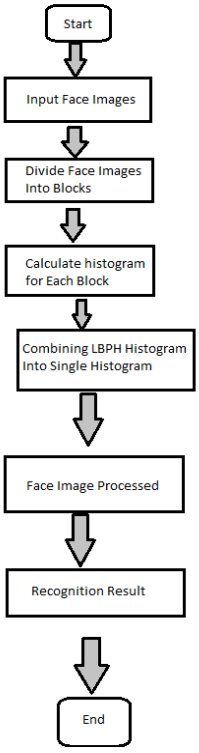

Fig. 2

2. Haar Cascade Classifier

Haar cascade is based on the Haar Wavelet technique to analyze pixels in the image into squares by function. This uses machine learning techniques to get a high degree of accuracy from what is called "training data". This uses "integral images" concepts to compute the "features" detected. Haar cascades use the Adaboost learning algorithm which selects a small number of important features from a large set to give an efficient result of classifiers.

The training data used in this project is an XML file called: Haarcascade_frontalface_default.XML

The OpenCv HaarCascade method to load the haarcascade_ trainedfaces.txt as the classifier. The classifier outputs a "1" if the region is likely to show the object (i.e., face), and "0" otherwise [6].

B. WORKING OF APPLICATION

1. For adding new student:

i. Enter roll number in roll number field.

ii. Enter name in name field.

iii. Then take image.

iv. Image is capturing through the camera.

v. Image is processed and convert in grayscale, then stored in database.

2. For attendance of students

i. Click automatic attendance button.

ii. Input subject name.

iii. Image is capturing through the camera.

iv. Image is comparing to registered students.

v. If face is match then attendance is marking for that subject with date and time of that student.

3. For checking registered students.

i. Clicked check registered students.

ii. Enter admin id and password.

iii. Click login button.

iv. Registered students details is shown.

V. PROPOSED METHODOLOGY

A. Local Binary Patterns Histogram(LBPH)

The method proposed in this paper is marking attendance using face recognition. Attendances is mark using a camera and detect the faces in the image and compare the detected faces with the student database and mark the attendance[4]. The attendance get marked in a excel file.

The application has two main parts:

1. Development of Face Recognition System.

2. Development of Attendance System.

Development of complete attendance system is achieved using LBPH algorithm and python. Here the application takes data like roll number, name, subject name and provide a click to start the attendance(auto and manually).

B. Pros

1. LBPH algorithm is one of the easiest face recognition algorithms.

2. It can represent local features in the images.

3. It is possible to get great results (mainly in a controlled environment).

4. It is robust against monotonic gray scale transformation.

C. Cons

1. It will require high processing power (8 GB RAM & 2 GB GC or higher)
2. If you think it will recognize person just like humans, than leave it, It's not possible.
3. Noisy image can reduce your accuracy so quality of images matter.
4. It can take maximum 5-7 students at a time.

VI. CONCLUSION

In this paper, we have discussed many algorithms that are used to make attendance. Every one have different advantage and disadvantage.

An attendance management system is important for any organisation. Because most of the organisations have same traditional system which is time consuming for teachers and students. This application is to solve this issue by adding face recognition with attendance management system.

The aim of this application is to make a system that is useful to the organization such as school, college and institute. The efficient and accurate method of attendance in the organization that can replace the old manual methods. This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the organization. It can be constructed using a camera and computer.

VII. REFERENCES

[1] Zhao Pei, Hang Xu, Yanning Zhang, Min Guo and Yee-Hong Yang, "Face Recognition via Deep Learning Using Data Augmentation Based on Orthogonal Experiments", Article Electronics August-2019.

[2] Ghalib Al-Muhaidhri, Javeed Hussain ,"Smart Attendance System using Face Recognition", International Journal of Engineering Research & Technology, ISSN: 2278-0181, Vol. 8 Issue 12 , December-2019.

[3] Rajath S Bharadwaj, Tejus S Rao and Vinay T R,"Attendance management using Facial Recognition", International Journal of innovative Technology and Exploring Engineering ISSN:2278-3075 , Volume: 8 Issue: 6,April 2019

[4] Anushka Waingankar, Akash Upadhyay, Ruchi Shah, Nevil Pooniwala, Prashant Kasambe ," Face Recognition based Attendance Management System using Machine Learning", International Research Journal of Engineering and Technology ,e-ISSN: 2395-0056, p-ISSN: 2395-0072, Volume: 05 Issue: 06, June-2018.

[5] Sathyanarayana N, Ramya M R, Ruchitha C, and Shwetha H S, "Automatic Student Attendance Management System Using Facial Recognition", International Journal of Emerging Technology in Computer Science & Electronics , ISSN: 0976-1353 Volume 25 Issue 6 , MAY 2018.

[6] Rohit Chavan, Sankalp Sawant, Vinayak Futak,Baburao Phad and Asha Rawat,"Attendance Management System using Face Recognition", International Journal for Innovation Research in Science & Technology, volume 1,Issue11, ISSN 2349-6010,april 2015.

[7] K.senthamil Selvi,P.Chitrakala, A. Antony Jenitha, "Face Recognition Based Attendance Marking System ",International Journal of Computer Science and Mobile Computing, ISSN 2320-088X,vol 3,Issue 2,February 2014.

[8] Jomon Joseph and K.P. Zacharia, "Automatic Attendance Management System Using Face Recognition", International Journal of Science and Research ,Volume 2 Issue11, ISSN: 2319-7064, November 2013.

[9] https://becominghuman.ai/face-detection-using-opencv-with-haar-cascade-classifiers-941dbb25177

[10] https://www.face-rec.org/algorithms/