Smart Attendance System Based on Facial Recognition

Mr. Omkar Raut[1], Mr. Ravindra Hajare[2], Mr. Bhavesh Patil[3], Prof. Sagar Dhanake[4]
[1, 2, 3, 4] Dept of Information Technology,
[1, 2, 3, 4] DYPIET, Ambi, Savitribai Phule Pune University, Pune, India

Abstract- *Many advancements in the world of change have been made possible by automatic face recognition (AFR) technologies. Smart Attendance use Real-Time Face Recognition is a real-world solution which comes with day to day actions of usage student attendance system. Face recognition-based attendance system is a method of recognising a student's face for the purpose of taking attendance, which is based on high-definition monitor video and other information technology. In my face recognition project, a computer system will be able to discover and recognize person faces fast and precisely in images or videos that are being captured through a surveillance camera.*

Face recognition algorithms and techniques such as Eigenface and opencv have been established, but the theory to be finished here is Deep Learning. It aids in the conversion of video frames into pictures, allowing the candidate's face to be easily identified for attendance and the attendance database to be automatically updated.

Keywords- Face recognition, Face detection, Deep Learning, Convolution Neural Network(CNN).

I. INTRODUCTION

The Technology today aims to bring about vast knowledge-based innovations. Deep learning is one of the interesting areas where machines can train themselves by providing several datasets as inputs and apply different learning algorithms to provide reasonable output during testing. Today, attendance is seen as an important factor for both students and teachers in educational institutions. With advances in deep learning technology, this machine automatically detects student attendance performance and records this collected data.

Automatic Attendance System (AAS) is a process that uses facial recognition technology to automatically estimate the presence or absence of students in the classroom. It is also possible to detect whether a student is asleep or awake during a lecture, and can be done in an exam session to ensure student attendance.

Student attendance can be detected by capturing the face with a high resolution video streaming service. This allows the machine to detect the presence of all students in the classroom with great certainty.

Two common human face recognition techniques are:

- Function-based approach
- Brightness-based approach.

The feature-based approach, also known as the local facial recognition system, is used to display the most important facial features such as eyes, ears, nose, mouth, and edges, while the brightness-based approach is a global face. As a recognition system, it is used to detect every part of an image.

II. LITERATURE SURVEY

2.1. FACE RECOGNITION BASED ATTENDANCE MARKING SYSTEM

The system uses a camera to capture an employee's image and perform facial recognition and recognition. The captured image is compared individually with the face database to find the worker's face. If the result is found in the face database, the presence is marked. The main advantage of this system is that its presence is marked on the server. This is a very safe place where you can't mark the presence of other users. In addition, in this proposed system, the face recognition algorithm has been improved by using skin classification techniques to improve the accuracy of the recognition process.

2.2. ATTENDANCE SYSTEM USING NFC TECHNOLOGY WITH EMBEDDED CAMERA ON MOBILE DEVICE

The lecturer's cell phone will subsequently be used to track attendance for each lesson by tapping or repositioning these tags. The phone's embedded camera will then capture the student's face, which wil be used to submit all of the data to the college server for confirmation and verification. the connection's speed The initial owner of the property. As a result, the professor found the convenience of the system that uses the cell phone as the NFC reader to be an annoyance.

2.3. RFID BASED STUDENT ATTENDANCE SYSTEM

A tag and a reader are used to track the pupils' attendance in this system. The difference between the first and this journals is that this one allows you to view attendance data via a web interface. It makes retrieving information more convenient. Again, this technology is flawed in that it is not portable, as the RFID reader can only function when attached to a computer.

III. ADVANTAGES

- Automatic time tracking system
- Efficient cost
- More accurate and better worker attendance
- Easy to manage
- Improved security

IV. DISADVANTAGES

- Poor image quality limits the effectiveness of face recognition
- Small image size makes face recognition more difficult
- Data processing and storage may limit facial recognition technology
- Different face angles can affect the reliability of face recognition

V. SYSTEM ARCHITECTURE

All students in the class must register by entering the required details and then their images will be captured and stored in the dataset. During each session, faces will be detected from the classroom's live video. The detected faces will be compared with the images contained in the dataset. If a match is found, attendance will be credited to the respective student. At the end of each session, a list of absentees will be mailed to the department responsible for the session. The system architecture of the proposed system is given below,

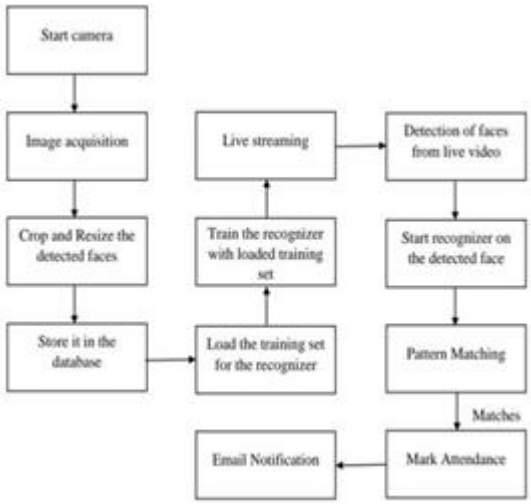

Fig 1. System Architecture

In general, the process can be divided into four steps,

1. DATASET CREATION

Student pictures are taken by webcam. Several images of a student will be collected using various gestures and angles. These images are preprocessed. The images are cropped to obtain the region of interest (ROI) which will then be used in the identification process. The next step is to scale the cropped images to a specific pixel position. These images are then converted from RGB to grayscale images. And then these pictures will be saved under the respective student name in a folder.

2. FACE DETECTION

Face recognition is done using OpenCV and the Haar Cascade classifier. Before using it for face recognition, you need to teach the HaarCascade algorithm to recognize human faces. Feature extraction is the terminology. To train the haar cascade, the default xml file in front of the haar cascade was used.

3. FACE RECOGNITION

The face recognition process can be divided into three steps: training data preparation, face recognition training, and prediction. Here, the training data is the image that exists in the dataset. They are assigned an integer designation for the student to which they belong. These images are used for face recognition. The face recognition used in this system is a local binary pattern histogram. First, get a list of local binary patterns (LBPs) for the entire face. These LBPs are converted to decimal numbers before a histogram of all these decimal values is created. Finally, a histogram is created for each

image of the training data. Then, during the recognition process, a histogram of the recognized faces is calculated and compared to the already calculated histogram to return the best matching label associated with the student to which it belongs.

4. ATTENDANCE UPDATION

After face recognition, the recognized faces are marked as present in the Excel spreadsheet, the rest are marked as absent, and a list of absentees is sent to each faculty. Faculty members will be updated on the monthly attendee list at the end of the month.

VI. RESULT AND ANALYSIS

The users can interact with the system using a GUI. Here users will be mainly provided with three different options such as, student registration, faculty registration, and mark attendance. The students are supposed to enter all the required details in the student registration form. After clicking on register button, the web cam starts automatically and window. pops up and starts detecting the faces in the frame. Then it automatically starts clicking photos until 60 samples are collected or CRTL+Q is pressed. These images are preprocessed and saved in the training images folder. The faculty should register using the respective course code and its email ID on the faculty registration form provided. This is important because the absentee list will eventually be mailed to each faculty.

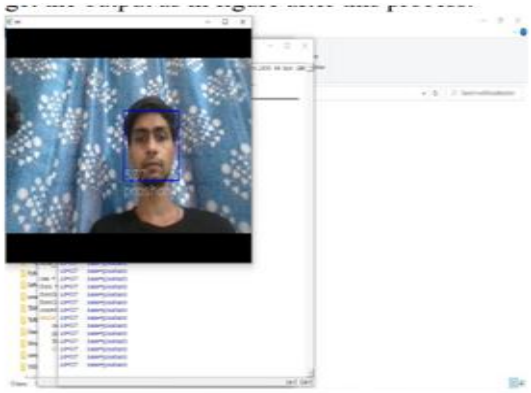

Fig 2. Face Recognition

In every session, respective faculty must enter their course code. Then after submitting the course code, the camera will start automatically.

The face recognition window where two registered students are recognized and if in case they were not registered it would have shown `unknown`. By pressing CTRL+Q, the window will be closed and attendance will be updated in the excel sheet and names of absentees will be mailed to the respective faculty.

The attendance sheet updated after recognition process. Recognized students are marked with a "1" and absent students are marked with a "0". The absentee list will be sent to the email address of each faculty.

VII. SYSTEM REQUIREMENT

7.1. SOFTWARE REQUIREMENT

- Operating System - Windows 7, 8,10
- Language Used – Python

7.2. TOOLS USED

- PyCharm Integrated Development Environment (IDE)
- Netbeans IDE

VIII. ALGORITHM AND TECHNOLOGIES

Fig 3. System main overview

This system consists of two types of processes. The first process is the training process. It is used to store the weight values of the training results (extracted from the face image) in the database. The second process is the recognition process.

This process takes the image in real time and compares the weight value of the test image with the weight value of the image stored in the database.

8.1. TRAINING PROCESS

The process of training or storing feature weights in a database consists of several steps. The first step in the training process is to enter a name in the fields available in the GUI and then select the Training menu. The face image is taken 100 times by the camera and saved in the database. The face recognition process runs before the data is stored in the database.

When a face is detected, the face image is cropped. The cropped image is converted to grayscale, and then histogram equalization is performed on the grayscale image. Images from histogram equalization are converted to flat vectors or one-dimensional arrays. The next step is automatic face extraction. This process is performed to get the weight value or own weight of the image, and after all the processes are completed, the data between the ID and value of the obtained weight is saved.

8.2. RECOGNITION PROCESS

The recognition process goes through several steps before the recognition result is obtained. The first step in the recognition process is to select the test menu when the recognized face is in front of the camera. The camera will take the images of the face to be used as input for face detection process. When a face is detected, the generated image is preprocessed and the image is converted to a flat vector. The next process is to apply self-extraction to the facial image. This process is done to get the weight value of the image. The image weight value is used to compare the image stored in the database with the recognized image. The recognized image data is the image data with the smallest difference in error value.

8.3. IMAGE ACQUISITION

Image capture is the process of capturing an image that is used in the recognition process. The image used is a face image. Image capture is performed directly from your computer using your webcam camera. When the user selects the training menu or the test menu, the webcam display is activated.

8.4. EIGENFACE ALGORITHM

The word eigenface comes from the German language "eigenwert" where "eigen" means characteristics and "wert" means value Eigenface is a face pattern recognition algorithm based on Principal Component Analysis (PCA). The eigenface method extracts relevant information from a face image and converts it into a set of face codes called eigenvectors. This face code is then compared to the face database that stores the face code from previous training. This method is called because the eigenvectors are also represented as facial features.eigenface. Each face is represented in a linear eigenface combination.

I. Preparing data with making a set S consists of training image Γ1, Γ2, ...,ΓM

$$S = \Gamma 1, \Gamma 2, ..., \Gamma M$$

II. Calculating the difference (Φ) between training image value (Γi) with mean value (Ψ).

$$\Psi = \frac{1}{M}\sum_{n=1}^{M}\Gamma$$

III. Calculating the average or mean value (Ψ) in Equation 2 refers to training image. M refers to total amount of training image

$$\phi i = \Gamma_i - \Psi .$$

IV. Calculating the value of the covariance matrix (C),

$$C = \frac{1}{M}\sum_{n=1}^{M}\phi^n\phi^n = AA^T$$

$$L = A^T A = \phi_m^T \phi^n$$

A is the matrix that consists of differences between each training image with mean value

$$A = \{\phi 1, \phi 2, \phi 3, ..., \phi n\}.$$

V. Calculating the eigenvalue (λ) and eigenvector (v) from the covariance matrix (C).

$$C \times vi = \lambda i \times vi.$$

After the eigenvector (v) is obtained, the eigenface (μ) can be calculated by Equation 8.

$$\mu_i = \sum_{k=1}^{M} v_{ik}\phi_k$$

The face recognition stage algorithm on Eigenface is as follows [2].

IX. OUTPUT

You will get the following output. You can then use the various functions in the table to derive the results in the appropriate format.

Fig 4. Main Screen

As shown in the figure, you can use this format as output to get the following parameters: This function is performed using PYTHON's Spreadsheet LinkEx toolbox.

• If there are people, a "1" is passed to each student's field.
• The date and time are also passed to the sheet.

Fig 5. Camera Enabled Screen

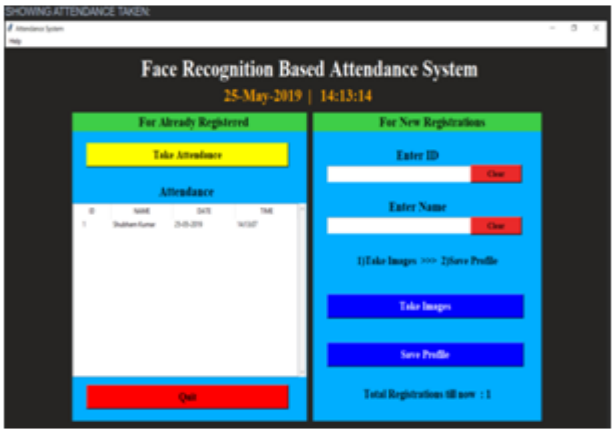

Fig 6.Attendance Screen

With a higher quality image capture device, this system can capture as much student data as you need. The next section describes how to use a graphical user interface (GUI) to integrate all these features. This gives users an easy-to-use interface

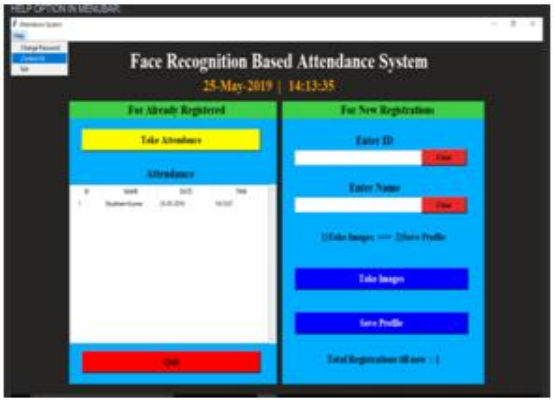

Fig 7. Help Screen

Fig 8. Change Password Screen

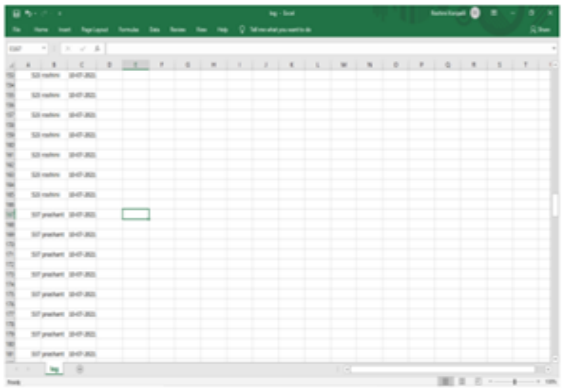

Fig 9. Attendance Sheet

X. CONCLUSION

The system has implemented a lecture, section, or lab attendance system that allows instructors or teaching assistants

to record student attendance. This saves time and effort, especially for lectures with a large number of students. An automatic attendance system was conceived with the aim of reducing the disadvantages of traditional (manual) systems. This attendance system demonstrates the use of image processing techniques in the classroom. Not only can this system help the attendance system, but it can also improve the good will of the institution.

XI. FUTURE SCOPE

The future of face recognition technology is bright. The forecast is that the technology will grow at a remarkable growth rate and generate huge revenues over the next few years. Security and monitoring are key segments that are heavily affected. Other areas that are currently adopting it include private industry, public buildings and schools.

It is estimated that over the next few years, it will also be adopted by retailers and banking systems to prevent fraud in debit / credit card purchases and payments, especially online payments. This technology fills a loophole in the widely used improper password system.

In the long run, robots with facial recognition technology may be wandering around. They help complete tasks that are unrealistic or difficult for humans to perform.

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