A Survey Paper on
Automation of Attendance System through Facial Recognition

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Abstract—In recent times almost, everything around us is being automated in some way just to make life easier for us. With the use of machine learning and deep learning we can allow non-living objects to program themselves to self-learn from the available data and perfect itself in the process. The process of recording attendance in educational institutions and workplaces has traditionally relied on manual methods, which are time-consuming, error-prone, and lack the level of security and accuracy desired in today's digital age. This research presents a technological solution to these challenges.

This technology offers a range of compelling advantages. It eliminates the need for manual attendance tracking, reducing the potential for errors and administrative workload. Moreover, it enhances security by ensuring that only authorized individuals can mark their attendance. Real-time data is available for monitoring and generating attendance reports, offering valuable insights into punctuality and attendance patterns. This research provides a comprehensive overview of the system's architecture, algorithms, and the underlying technology, along with a discussion of the ethical and privacy considerations associated with face recognition. By implementing this innovative technology, educational institutions and organizations can streamline attendance management, increase operational efficiency, and contribute to a more secure and productive environment.

Keywords: Face recognition, LBPH, Haar-cascade, face detection, Viola n Jones, openCV, Adaboost

I. INTRODUCTION

A face recognition attendance system is a type of bio-metric technology that uses artificial intelligence to automatically identify and verify individuals based on their facial characteristics. These systems are commonly used to track attendance in workplaces, stores, and other organizations. The system captures an image of the individual's face and then compares it to a database of pre-registered faces. If a match is found, the system records the individual's attendance. These systems can be integrated with existing time and attendance software and can also be used for security and access control purposes.

A face recognition attendance system uses AI and machine learning algorithms to identify and verify an individual's identity based on their facial features. It works by capturing an image or video of a person's face, then extracting facial features such as the distance between the eyes, nose, and mouth, and comparing them to a database of known faces. If the system finds a match, it will mark the person as present.

The rest paper is organized as follows: Section 2 introduces

about the attendance system through face recognition, algorithms require for it.Section 3 reviews the previous literature study on attendance system through facial recognition. Section 4 describes about the methodology. Section 5 concludes the paper.

II. LITERATURE REVIEW

Author overcomes the problems of time consumption through Viola and Jones Algorithm by implementing automatic attendance system using face recognition technique is proposed in his document. Author utilizes the haar cascade algorithm for face recognition, which has been found to have high accuracy. The system captures images of students, creates a dataset, and trains it with the help of graphical user interface. After recognizing the faces, the system displays the student's name and roll number, and automatically stores the attendance information in a sheet with the date and time.[1] [1]

Serign Modou Bah, Fang Ming presents a new method using Local Binary Pattern (LBP) algorithm combined with advanced image processing techniques to improve the accuracy of face recognition systems. The results show that the method is accurate, reliable, and robust for face recognition in real-life environments.[2]

Time is saved automatically by detecting and marking the attendance of students in a classroom using machine learning techniques such as the convolutional neural networks (CNN) algorithm. The system captures images of students during class hours, detects and recognizes their faces, and marks their attendance based on the recognition. [3]

Author tries to use Improved Viola Jones and Haar-Cascade for face recognition.The system follows a methodology that includes steps like capture, extraction, comparison, matching, and attendance marking. It offers advantages such as convenience, security, and improved accuracy. The attendance data is saved in a database and can be exported to an Excel sheet for further analysis.[4]

In this paper Shireesha Chintalapati, M.V. Raghunadh used Viola- Jones algorithm for face detection for develop a attendance system which detects and recognizes the face of the students when he enters the room.Author used LDA algorithm for face recognition.The system is liable to even recognize more than one face at a time. They also implemented a distance classifier for recognizing the faces from a distance.Excel Sheet and Emails are generated when Recognitionis completed.[5]

Mrunmayee Shirodkar, Varun Sinha, Urvi Jain, Bhushan Nemade proposed a system through this which detects and recognizes faces of students attending the classes.Viola-Jones algorithm is used for face detection and for face recognization Local Binary Pattern. Author made used of Yale database techniques and the system have a overall efficiency of 83.2%. A monthly report is generated at the end of the month and it is mailed to HOD and it is according to the institution norms.[6]

Author presents a different method of PCA (Principal Component Analysis)/ LDA (Linear Discriminant Analysis) LBPH (Local Binary Pattern Histogram) algorithms for feature extraction whereas Distance Classifier / SVM (Support Vector Machine) / Bayesian these are proposed for classification purpose. In actual implemented model, firstly image dimensionality is reduced using PCA and then Back Propagation Neural Network is used for facerecognition.[7]

In this paper author has used Viola-Jones Algorithm for image face detection and Local Binary Pattern(LBP) for feature extraction.Viola Jones algorithm is mainly used to recognize the image and have four classifier for better object detection.Also these extracted feature data is used by Support Vector Machine(SVM) for recognition and marking the attendance.[8]

This paper presents a transfer learning by using three pre-trained CNN model and trained them. When compared to other approaches, the system showed very high performance in terms of high accuracy and training time. The three networks are SqueezeNet, GoogleNet and AlexNet where they achieved a accuracy of 98.33%, 93.33% and 100% respectively.The images in database are in between 3 to 4 mb of size.[9]

The main objective of this paper is to develop an effective attendance system based on face recognition and face mask detection, and to provide this service online through a browser interface.A SVM recognizer is appilied for recognition. The server application is coded in Python and uses the Open-Source Computer Vision (OpenCV) library for image processing. For web interfaces and the database, PHP and MySQL are used.[10]

In[11] 2021, Akash Singh, Shreya Bhatt, Abhishek Gupta presents a different solution for face recognition through video capturing for attendance.They used Python's dili library for building their deep learning model for face recognition. This model has an accuracy of 99.38% on the "labeled faces in the wild" benchmark.

In[12] 2019, Shreyak Sawhney, karan kicker, Samyakjain introduced Real Time Smart Attendance Management System Using Face Recognition Techniques. In this system they use face detection and recognition method using convolution Neural Network and Principal Component Analysis (PCA) but using two camera some camera is used for the face detection and recognition at the door of classroom and the camera is used at inside the classroom for checking proxy attendance.

III. METHODOLOGY

After having a brief survey on above research on above mention papers we came to decision for using Viola-Jones Algorithm for face detection and for face face recognition Local Binary Pattern Histogrm(LBPH).Here we will be creating a user interface(GUI) for storing name, roll no and other information of students. The information gathered generates a dataset and saved in a folder.Images captured for the first while registering the students are trained and stored

in folder which comes to be known as trained dataset which we will be using for face recognition.

Basic phases of our system are: 1. Image input of class

2. Face Detection using Viola Jones

3. Face Recognition using Local Binary Pattern

4. Feature Comparison
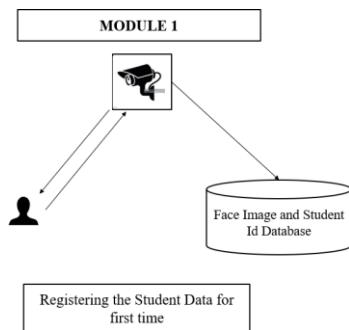
5. Attendance Database

6. Monthly Report

Fig. 1. Registering phase

Stages of the fig1 and fig2 is explained below.

1. Image input of class:

Image input of class will be taken from camera. This image will consist of all the students present in class for that particular lecture.
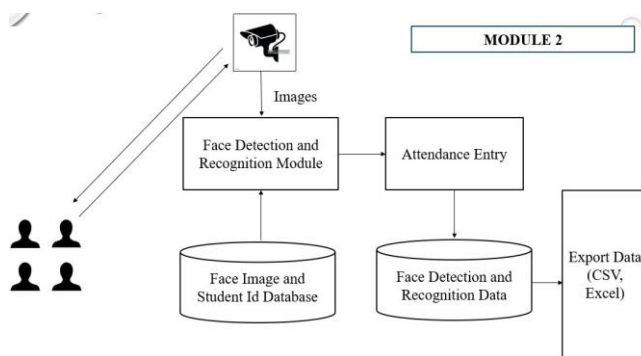

Fig. 2. System Flow

2. Face Detection using Viola-Jones Algorithm:

This algorithm consists of four phases integral image, Haar-like Features, AdaBoost, Cascading Classifier. In integral image we assign each pixel a value. And these values are converted by summing up all the pixel values present above and at the left side. Haar-like features consists of special pattern which is compared with image pixels and accordingly 1 or 0 is assigned. In AdaBoost only some necessary features are selected removing redundant ones. In Cascading classifiers weak classifiers are cascaded to make a strong classifier. The detailed method is explained in later section.

3. Face Recognition using Local Binary Pattern Histogram:

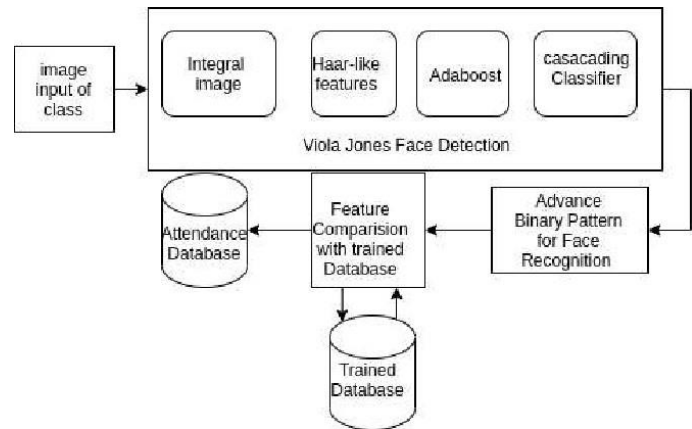In this algorithm image is divided into several parts and on

Fig. 3. Face detection by Viola-Jones

each part LBPH is applied. Initially 3 X 3 top left corner window is taken and each pixel is converted into equivalent grey level.

After this centre pixel value is compared with all the neighborhood values and if centre pixel value is greater than surrounding pixel then it is 1 else 0.After this, the 8-bit code is converted into decimal equivalent and this procedure is repeated for the whole image. After this all the decimal values are plotted on histogram. The detailed method is explained in later section.
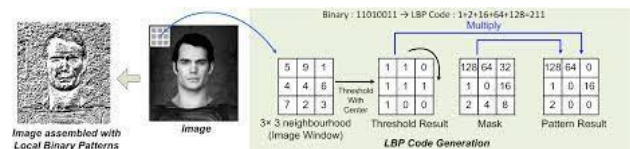

Fig. 4. Face recognition by LBPH

4. Feature Comparison:

In this phase the calculated features are compared with stored features.Images taken while registration if students which is stored in database is compared with the images taken after capturing the student face while attendance phase.

5. Attendance Database:

If features match in comparison phase, then attendance for particular student is registered in the database. This database is stored in the backend of the system and the results drawn are all entered in the same.

6. Monthly Report:

At the end of the month faculty can export the attendance data of past month in form of csv file or excel sheet. This helps to maintain the data.

In this way, the proposed system does the work of attendance marking using face detection and face recognition respectively and generates the final report as per the required institute norms.[6]

IV. CHALLENGES

Some of the key challenges in automated attendance systems include:

Privacy and Data Security: Collecting and storing personal attendance data can pose privacy and security risks. Safeguarding this data is crucial to prevent unauthorized access or breaches that could compromise individuals' personal information.

Technical Glitches: Automated systems are dependent on technology, and technical issues such as hardware failures, software bugs, or network connectivity problems can disrupt attendance tracking and lead to inaccuracies.[11]

Integration with Existing Systems: Integrating an automated attendance system with existing databases, software, or hardware can be challenging, especially in large organizations with complex IT infrastructures.

User Acceptance and Training: End-users may resist or struggle with using new technology. Adequate training and support are necessary to ensure that the system is adopted effectively.

False Positives and Negatives: Biometric systems, like facial recognition, can produce false positives (mistakenly recognizing someone as present when they are not) or false negatives (failing to recognize someone who is present). These issues can affect the accuracy of attendance data.[12]

Occlusions:Variation in facial appearance can also be caused due to presence of objects that such as occlusion that partially cover the face. This makes it a difficult task for the system to classify the image. Although the face is found, it may be difficult to recognize it due to some hidden facial parts, making it difficult to recognizefeatures.[12]

Similar Faces: This is usually a not so common challenge. But we have seen that even humans find it difficult to identify people with similar faces. Hence we can imagine the difficult situation for computer to identify similar face individuals.[7]

V. CONCLUSION

In conclusion, Automated attendance system will help to manage the attendance and can be a very useful technology. Now in this todays era a large number of systems are available like biometrics or other methods but the facial recognition is the best option for the accuracy.It will help us to save time and work of faculties. Also it will help the faculty to keep a track of students on daily basis. It will also help to maintain the data. Viola-Jones algorithm for face detection and for recognition technique LBPH algorithm which has a accuracy of 98 percentage with help of haar cascade classifier.

It will help staff to overcome the situation of traditional way of roll call.

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