AN EXPLORATORY STUDY ON FACE RECOGNITION BASED ATTENDANCE MONITORING SYSTEM

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*Abstract:*In the human body, face is considered to be the distinctive part that identifies a person. Face recognition system can be built by making use of facial features and techniques could. Taking or marking attendance is an important task in any organization. In educational institutions like college or schools, the teachers used to call out student's name and used to mark their presence or absence in an attendance register. However, these traditional techniques of marking attendance are considered to be time taking and annoying. A better system which makes use of artificial intelligence can address this. The planned model makes use of a camera which supposed to take a photo as an input file, an algorithm for identification of face, then encoding and detecting the face captured in the image, marking the attendance in a excel sheet. Then the resultant images are stored in the database against an identifier. The features of the face can be extracted using Local Binary Pattern Histogram algorithm. The parameters radius, neighbours, gridx, gridy are considered. The algorithm trains the images and performs LBP operation and concluded with recognition of face. A test sample of images are taken as test images and these images are trained for detection and recognition of faces. The first functionality would be to capture the image and then detecting the faces and then to extract the features of images and storing it in the database. Use of Python flask as a web application framework, addresses frontend of the application.

Index Terms - **Artificial Intelligence, Face recognition, Attendance, facial features, database.**

I. INTRODUCTION

Usually, in the classroom the attendance used to be taken by the teachers manually at the beginning and at the end of the class. The problem found with this approach was that it requires some time to take the attendance and also it was found that the manual process will have chances to make mistakes in most of the cases. In order to avoid such problems, Radio Frequency Identification technique came into existence in the past years. Even that system was a failure. So, we have come up with the concept of attendance management based on the recognition of face. The main idea of the system proposed here, is to allot attendance to the students using facial recognition-based techniques is to achieve fail proof attendance system. Face detection is one of the most common method used in many applications for identifying human faces in digital images or in an video. This technology is capable of predicting frontal or near-frontal faces in a captured photo, regardless of position and lighting conditions . The proposed system is a form of software based on biometric that maps an individual's face features mathematically and then stores the data in the form of faceprint. The various techniques which would be used for marking attendance are:

1. Attendance system based on signature
2. Attendance system based on fingerprint
3. Attendance system based on iris recognition
4. Attendance system based on RFID
5. Attendance system based on Recognition of the face

From the mentioned techniques, Recognition of the face is considered to be natural, easy to use and implement. The problems, which can be solved in following steps.

1. To capture an image and detect the face in the captured image.
2. Focus on a single face at a time and recognize the face even when captured in a strange direction or in bad lighting, it should recognize that person.
3. Identify several distinct features of the face which will help in differentiating with the other person's face. The features of the face considered would be eyes, nose, face, etc.
4. The next step is to compare these unique features of the detected face with the trained database images. The need of Machine Learning techniques to compare a detected image to the face print which is stored in the database, for verifying the identity of a person.

1.1 Face Recognition using Python

Thousands of fine lines and attributes will be there in faces. Using Python, face recognition is used to divide the work of recognizing the face into thousands of smaller, bite-sized tasks that are simple to recognize. In Machine Learning methods, facial recognition is the latest technology. OpenCV uses algorithms of Machine Learning to search for faces inside a picture.

1.2 Facial Recognition using Python Libraries

The OpenCV built-in library functions written in C/C++, OpenCV, is a simple way to detect faces using Python. It uses machine learning algorithms to search for faces within an image. The faces of each person are very complex, made of thousands of small patterns and characteristics that must be balanced.The face recognition algorithms split into thousands of smaller bite-sized tasks, each of which is simple to solve, known as classifiers, to classify the face. There may be 5000 or more classifiers for a face, all of which must fit to detect a face from the captured image. You may have millions of calculations to do in each block, as there are at least 5,000 or more tests per block, which makes it a difficult task. OpenCV makes use of cascades to address this. The OpenCV divides the issue of detecting faces into different phases. For each block, it conducts a thorough test. On about 50 to 60 of these stages or cascades, the algorithm can be performed, and it will only detect a face if all stages pass. Cascades are a collection of XML files containing data from OpenCV that are used for object detection.

II. LITERATURE SURVEY

K. The Shah (B) , D. Bhandare, S. Bhirud in paper[1], notes that the key results of the proposed scheme include: an integrated attendance system in real-time, strong model precision in identification of facial characteristics, avoidance of signature verification-related problems. They addressed in the paper about the accuracy obtained for the Haar model with attendance systems based on face recognition by making use of local binary pattern histogram (LBPH), K-nearest neighbour(KNN), principal component analysis (PCA) resulting in 93.1% of accuracy.

Sudhir Bussa, Shruti Bharuka, Ananya Mani,, Sakshi Kaushik in[2] notes that the face is the main feature of the human body that distinguishes a human. This suggested system can be applied by using the features of a face as biometric. He stated that the OpenCV based facial recognition approach has been proposed in this project.And it describes that this model incorporates a camera in the proposed framework which will capture the image that is inputted, an algorithm that detects the face from an image inputted, encoding and recognizing face, labeling the current time attendance to an excel sheet and translating it into a PDF. Using the faces of each particular student the training data base will be created. The clipped images are stored in a database with the corresponding unique identifiers. With the help of the LBPH algorithm, the features of the face are extracted.

Rahul Ray , Faisal Khan , Harsh Sharma , Gaurav Kumar in [3] says that, their project aims at developing software that helps the organizations and institutions to monitor attendance of the present students in a smart and in an efficient manner. In this project some technologies used are facial recognition, python, opencv etc. The prime idea of the system proposed here is to capture each student's face and save it in the database to mark their attendance. The proposed system consists various processing phases they are: Capture Video, Separation of the Whole Video file into the Frames, Face Detection.

Divya Pandey, Priyanka Pitale, Kusum Sharma in [4] discusses that in today's evolving world, face recognition technologies have made several improvements. They said that the introduced system's role is to capture each student's face and then store the image for their attendance in the database. The student's face should be captured in such a way that it is necessary to detect all the features of the student's face. As the device records a video and the face is recognized and the database is modified by more processing steps, there is no need for the faculty to take part in the class manually. And they told that their software is designed using a python module named opencv.

Mayank Srivastava, Amit Kumar, Aditya Dixit, Aman Kumar[5] suggest combining face recognition technology with the OpenCV algorithm and building an attendance scheme. In this suggested method, three phases are involved.The initial step is the task of identifying and extracting the image of the face that is saved in an xml file and is used in next steps. The second step involves understanding and training the face image and thereby calculating the eigen vector and eigen value of an image. The concluding step is to identify images of the face stored in the xml file by comparing them.

Samridhi Dev, Tushar Patnaik in[6] says that there are proxies in the conventional method of attendance and in existing biometric based systems. Therefore, to resolve all these issues, they presented this article. The suggested method uses Haar cascade classifiers, KNN, CNN, SVM, Generative adversarial networks, and filters like Gabor. The proposed method has measures that are below. They are building databases, enhancing images, detecting faces, extracting features, identifying faces, eliminating redundancies, producing reports. The goal of obtaining higher precision and lesser computational complexity is fulfilled by the proposed method. They mentioned that the planned scheme is economical and has reduced manual labor requirement. Precision is significantly enhanced using Gabor filters. Three algorithms have been used for face recognition, including KNN, CNN, and support vector machine, of which the KNN algorithm has been shown to have the highest accuracy of 99.27 percent. It has been found that CNN has low computational complexity. The SVM algorithm is not that efficient when compared to other algorithms.

Amritha, Sudhakar[7] notes that, for computer vision applications, machine learning has been more explored. The author used face recognition and face detection algorithms in this paper, providing the machine with the detection and recognition of human faces in photographs or videos such that the systems can be utilized to mark attendance.The proposed face recognition based attendance system can be split into 7 main modules. They are Image Capture, Face Detection, Understanding Haar Cascades, Feature Extraction, Pre-Processing, Database Development, Post-Processing.

S. Sawhney, K. Kacker, S. Jain, S. N. Singh and R. Garg in [8], presents a system which implements an automatic attendance system for students present in class using techniques like recognition of face, eigen face values, principle component analysis (PCA) and convolutional neural network (CNN) . The methodology used in this paper are enrollment, detecting face, recognition of face, capturing by the class camera, attendance marking.

JenifD'Souza W S, Jothi S, ChandrasekarA[9], suggeststhat the system isimplementedusing 4 mainmodulessuch as image capturing, communitypicturesegmentation and detection of face,facecomparison and identification, databaseattendance update. In thispaper, the authorssuggestedthatthisproposed system herefollows a modularapproach, addingthatanyprogressisincorporated as addition to the system. This paper uses emerging trending innovations to execute day-to-day tasks effectively.

In article [10], Sumeet Kewalramani suggested that an individual's uniqueness lies in his face. And he also adds that attendance is of prime importance to an educational organization's students and teachers. In this paper, he discussed the steps of the proposed systems, which are input image acquisition, skin type extraction using HSV color, output is converted to RGB color and binary image is generated on basis of RGB value, black dot filling within the white field, morphological output is done to eliminate the areas that is too small to accept as face, bounding box drawing around each face region. The paper presented about principal component analysis (PCA) section for recognition of face.

Chetan Chaudhari, Rahul Raj, SwajeyShirnath, Ms. Tanuja Sali[11] suggested that a student's attendance tracking in an academic institution has a major role in assessing the success of students. In this paper, an automatic attendance management system based on techniques of detection of face and recognition of face is proposed as the conventional approach involved in this is time consuming. The proposed system in this paper uses modified Viola-Jones algorithm for detecting face, and Principal Component Analysis technique for recognizing face.

O. A. R. Salim, R. F. Olanrewaju and W. A. Balogun in [12], the technique of designing an embedded class attendance system making use of facial recognition approach is discussed which makes use of door access approach . With a data set of 11 individual images, this device has 95.1 accuracy. This method uses LBPH algorithm for the implementation. Steps involved are, Capture the student's image, detect feature using Haar-cascade-based algorithm, convert the image to grayscale, apply LBPH algorithm, store the MySQL database. This paper explores three programs that were developed using Python for the implementation of face recognition. The first is to collect selfies by taking frames from a video record of the face of the students, the second step is training and storing the captured selfies in an SVM classifier that is later used to identify the face of the students. The last program was used to identify the face inputted, that was contrasted by using the trained data using the classifier, as described before. In this article, he suggested that the face 'Region of Interest' was identified, clipped, encrypted and saved in a file as strings by collecting selfies by taking a video record while taking video. Each string line represents a student picture.

Amrutha H.B, Anitha C, Channanjamurthy K. N, Raghu R in [13] suggested that the database containing the photographs of all the students be generated initially. He states in this paper that, the system is set in the classroom so as to take a clear image of the face of the student. After the professor concludes the class, the camera takes the entire class image by logging into the system.The captured image will then be cropped to separate each one of the students and the image is updated automatically on the main server to give each student a good picture of their attendance.

M.Kasiselvanathan, Dr.A.Kalaiselvi, Dr.S.P.VimalmV.Sangeetha in [14] says that the suggested scheme is used to automatically measure attendance by considering the facial measurements. Here, they discussed an effective attendance system focused on face recognition created by improving the system's efficiency and also for safe attendance. Eigen Faces is the algorithm mentioned in this text.In addition to detecting the student's face, the system also determines the distance of the features of the face under different circumstances. The presented system provides the accuracy about 93%-95% and face recognition is upto 99%which has much greater performance than the present existing technique.

Shubhobrata Bhattacharya, Gowtham Sandeep Nainala, Prosenjit Das and AurobindaRoutray in [15],suggested that this framework can be built by combining ambiguous components to create a portable device using Face Recognitizing technology which can monitor the attendance of the students.The methodology in this paper includes the following steps, they are face detection, parameters for algorithm like posture estimation, sharpness, size of image or resolution and brightness, final score and representation.

Radhika C. Damale, Prof.Bageshree.V.Pathak in [16], suggested that amid the several computer vision algorithms like detection of the face, expression recognition and much more applications for video surveillance,a facial feature can be used. Three different strategies were presented in this approach, such as SVM, NLP, and CNN. On self-generated databases, the SVM, NLP and CNN achieve test accuracy of about 87 percent, 86.5 percent and 98 percent, respectively.The scheme for recognition of the face using machine learning techniques and computer vision was proposed here. A robust DNN base face detector is used to detect the face. With the number of images, the pre-trained module is trained. The accuracy of face detection based on DNN is more than a state of art tool.

Reetha.s,Dr.P.Visu in [17], discussed that they implemented a IOT based web camera technique for attendance monitoring.The authors of this paper mentioned that they are using PIR sensors. The authors addressed a sensor called an electronic sensor that detects infrared light radiating from objects in its field of view and its motion detectors centered on PIR. And he added that through the sensor system, these Passive Infrared Sensors detect motion images and capture the image. Arduino UNO board is discussed in this article,as it is the most common board amidst the family of Arduino boards and also best board for image capture coding.

E.Varadharajan, R.Dharani, S.Jeevitha, B.Kavinmathi, S.Hemalatha in [18],says that this paper is about the system which monitors the attendance based on biometric. The algorithm used is Eigen face for face recognition. The steps mentioned in this paper are, background subtraction, detection of face and cropping, recognizing the faces. They mentioned that by this approach the already existing techniques can be replaced. Automatic and efficient management of the attendance is introduced in this paper. For installation, this method just makes use of simple hardware. In this proposed process, the maintenance of attendance is easier and the attendance taken is more precisely when compared to conventional approaches.

Mathana Gopala Krishnan, Balaji, Shyam Babu in [19] , suggested that face recognition is one among the few biometric techniques with the advantages of both precision and less disturbance. For this reason, since 1970, this device has attracted researcher's attention in areas ranging from security and image processing to computer vision. They discussed that the algorithm used in the system is Principal Component Analysis (PCA). The basic steps used for implementing the proposed system are, detecting and extracting the face image and the details will be saved in xml file, calculating the eigenvalue and eigenvector for that particular image, recognizing the face in that image and then match it according to eigen values and eigen vectors stored in the xml file, Store the name of the face displayed to the Database.

ShireeshaChintalapati and M.V.Raghunadh in [20], says that an Automated Attendance Management System uses bio-metrics which is typically composed of Acquisition of the image, Database Creation, Detection of the face,Pre-processing,Extraction of the features, and Post-Processing Classification Phases. He clarified that spoofing is a major challenge to facial recognition systems. Anti-spoofing methods such as the eye blink detector are therefore included in their scheme.

III. PROPOSED WORK

The proposed system planned to reduce the manual work and to save the time. The planned working of the system is shown in below figure. The first step is to capture the input image through a webcam and the captured image is given as the input for the next stage that is to detect the image using face detection algorithms and in the third stage detected image is given as an input for extraction of facial features such as eyes, nose and mouth, and in fourth step classification of images will be done and finally in the fifth step the obtained image from the fourth step is compared with the stored trained images of database. If the face is recognized then the attendance is marked as present.
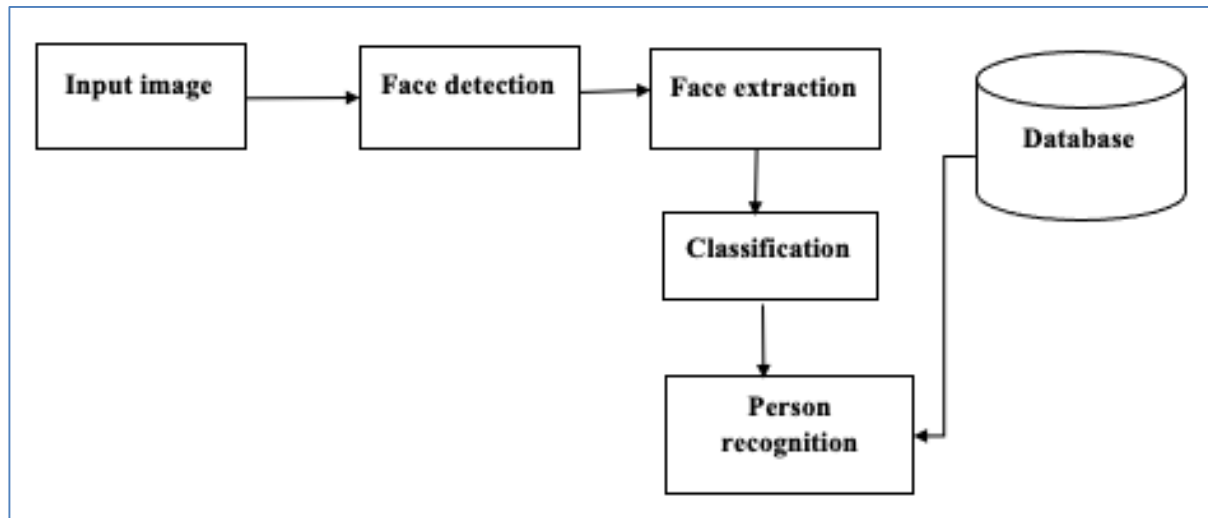

Figure 3.1. Proposed Approach

IV. CONCLUSION

The proposed model will capture the image of the student/person. Initially face detection and then recognition of the face in the image and the further step is that the attendance is marked on the excel sheet according to the image of the student recognized. The online automatic classroom attendance monitoring portal may aid in increasing the perfection and speed ultimately to achieve the highly accurate real-time attendance fulfilling the requirement for automatic class evaluation system. This auto updating attendance monitoring system could be installed in big rooms like in a seminar hall where it helps to sense the presence of large amount of audience with the help of a high resolution camera for capturing.

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