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Attendance Monitoring using Face Recognition and Machine Learning

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Abstract

In the era of modern technologies emerging at rapid pace there is no reason why a crucial event in education sector such as attendance should be done in the old boring traditional way. Attendance monitoring system will save a lot of time and energy for the both parties teaching staff as well as the students. Attendance will be monitored by the face recognition algorithm by recognizing only the face of the students from the rest of the objects and then marking the students as present. The system will be pre feed with the images of all the students enrolled in the class and with the help of this pre feed data the algorithm will detect the students who are present and match the features with the already saved images of the students in the database.

Keywords –Face Detection, Face Recognition, Viola-Jones, LBPH

The paper is organized as follows. Section I describes the Introduction of the proposed system. The motivation behind this proposed work is mentioned in Section II. Section III presents the related work of the system. The proposed system is described briefly in Section IV. Future scope of the proposed system is listed in Section V. Section VI presents the conclusion of the paper.

I. INTRODUCTION

The purpose of the attendance monitoring system using face recognition is to ease the attendance process which consumes lot of time and efforts by the lecturer which can be utilized in teaching, it is a convenient and easy way for students too. The system will capture the images of the students present in the classroom and using face recognition algorithm mark the attendance in the sheet. This way the class will get their attendance marked without actually spending time in roll call which often leads to proxy attendance. The user of this system is lecturer, admin, students. The system will allow to the lecturer to control the attendance that is when to start image capturing process. The system will also allow the admin to update the database when a new student enrolls. For students, this system will help in supervising their attendance. Students can only view their attendance and will not be able to edit or control the system database. The administrator of the system will have the privilege of controlling, uploading and updating the database.

Following are the functionality of the lecturer

- Start the attendance
- View the attendance

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- Retrieve queries
- Control over the system
- Manual attendance marking
- Time

Following are the functionality of students

- View attendance

Following are the functionality of the administrator

- View attendance
- Retrieve queries
- Control over the system
- Update the database.

The teacher spending a lot of time in marking the attendance manually and thus wasting a lot of time in this process which could have been utilizes in other constructive way such are teaching and doubt solving session, thus this system will mainly benefit the education industry and also to other industries such as IT firms , offices , banks ,airport and other places wheresecurity and identity matters the most .

The system consists of the algorithm which only detect the face of the student from the rest of the spaces and body parts and then matching this recognized image from the pre feed data, this data will be fetching while students enroll in the college or in a particular class .The system will work in three different sections first is to feed the images of the students who will be attending the classes ,it is extremely important to get all the images of the students captured . The second phase of the attendance monitoring system using face recognition is the detecting the faces this is the dynamic phase where the camera will capture the images of the faces only and with the help of the pre feed data this image which was being captured will be detected. The last phase of this system is updating the attendance sheet. The recognized faces will be marked as present and the rest of the students will be marked absent.

Many face detection methods have appeared in the last two decades, while the classical methods have been very successful, their major disadvantage is that they use only 2D facial photos. However, we know that such a representation is sensitive to changes in expression, illumination and poses. In addition, the complexities of calculation and storage as well as the procedure for generating the examples are very complicated. The requirements of these systems may include the addition of machine learning capability to enable a machine to evolve through a learning process, and perform tasks that are difficult or impossible to complete by more conventional algorithmic means. These new methods are essentially based on the notion of learning, which has been at the heart of artificial intelligence research for many years. Since face detection can be understood as a two-class model identification problem.

II. MOTIVATION

The motivation behind this proposed work comes from the advancement of technologies like image processing, AI and machine learning and Face unlock feature given by smart-phone manufacturers. The classroom often consists of huge number of students which usually takes a lot of time thus creating a system which will automatically detect the present students and then marking the students accordingly will be very helpful, Just like staff Id scanning but way too easier than that. This system will also reduce manipulation of attendance records by the students.

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III. RELATED WORK

Hajar Filaliet. al. [1] had compared four methods based on machine learning that allows a machine to evolve through a learning process, and to perform tasks that are quite difficult to fill by more conventional algorithmic mean (Haar-AdaBoost, LBP-AdaBoost, GF-SVM, GFNN).The first two methods "Haar-AdaBoost, LBP-AdaBoost" are based on the Boosting algorithm, which is used both for selection and for learning a strong classifier with a cascade classification. While the last two classification methods "GF-SVM, GF-NN" use the Gabor filter to extract the characteristics. From this study, we found that the detection time varies from one method to another. in terms of performance rate, the Haar-AdaBoost method remains the best of the four methods. So, we will be using Haar-AdaBoost.

In [2] the authors have proposed a system to avoid drawbacks of traditional manual attendance system. This paper describes how real time face detection and recognition can prove useful for marking attendance of students. The paper illustrates an automated attendance system which consists of a camera, installed in the classroom for capturing images, followed by the detection of multiple faces. This system consists of multiple steps such as Face Database Creation of Students, HOG features, Face Detection and Eye Detection, SVM Classifier, Comparison/Recognition, Attendance marking. The algorithms like Viola- Jones and HOG features along with SVM classifier are used to acquire the desired results. The paper had certain drawbacks where the system may be sensitive to lighting. The proposed system may eliminate this drawback by using the algorithms which may not be sensitive to lighting and also by using advanced high-resolution cameras.

E.Varadharaja et. al [7] proposed a system for automatic attendance system using face recognition. The system is divided into four parts. First one is the Background Subtraction in which background of image is subtracted and only face remains in image. Second part is face detection and cropping of images i.e. only faces are cropped and stored. Third step is recognizing images with the help of Eigen-value method. In this method Eigen vectors are calculated using formulae and to recognize images Euclidean distance is calculated between stored images and testing image. Then attendance is marked for matching student. This method requires simple hardware installation but face recognition is difficult. Eigen vector method used in this paper gives an accuracy of 60-70%.Hence instead of using eigen vector, proposed system will use Haar features for face detection which gives better result than eigen vector method.

Shireesha Chintalapati, M.V. Raghunadh et. al [8] had described the different techniques to implement the attendance monitoring system using face recognition. The process is divided into two main parts. First one is the face detection technique and the second one is face recognition technique. Face detection can be implemented using Viola-Jones face detection algorithm which includes four main components i.e. Haar-features, integral image, Adaboost algorithm, cascade feature. Face recognition can be implemented using LBP (local binary patterns). LBP helps to convert the image into machine understandable formats i.e. in binary format. Before face detection and recognition, the captured image should be converted into grey scale to simplify the calculation. Face detection technique first capture the image (student dataset) and detect faces from the images, the detected faces are stored for further reference. Face recognition technique capture the images from classroom and try to recognize it by comparing it with a earlier detected faces.

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Paper Ref_No.	Main context	Advantages	Disadvantages
[1]	A comparative study between four machine learning methods for face detection	Haar-Adaboost method is better than other methods such as Gabor filter,HOG.	Limited head pose.
[2]	Smart Attendance Monitoring System using viola jones and deep learning	System performs satisfactorily with different facial expressions, lighting and poses.	Sometimes fails to recognize every face of the student in the class.
[3]	Real time human face recognition using LBPH	Recognize the faces with 90% accuracy	Difficult to recognize blur faces
[4]	Describes real time face detection and recognition using viola jones, HOG and SVM classifier.	Efforts and time taken for attendance is reduced.	Sensitive to lighting.
[5]	Attendance Monitoring system using viola jones and PCA algorithm.	Minimise computation in viola jones algorithm	Not possible to identify faces having similar facial features. For example – Twin faces.
[6]	Real time face recognition using eigenface and viola jones	High accuracy of face detection using Viola jones	Real time face recognition using Eigenface is not justifiable solution
[7]	Face recognition using eigen face method	Reduces statistical complexity	Sensitive to lighting, difficult to capture expression changes
[8]	Automated attendance management system based on face recognition algorithms	Quick calculation of attendance	Large dataset of images requires more calculations
[9]	Rapid object detection	High detection accuracy Minimized computations	Not effective in detecting tilted or turned faces

IV. PROPOSED SYSTEM

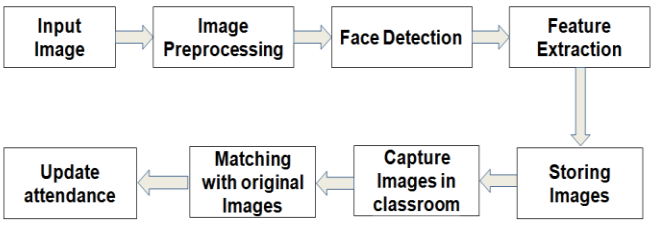

Fig.1: Block diagram for Attendance Monitoring System using Face Recognition

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Multiple images of students are captured for training data set. This dataset is used to match with real-time images which will be captured in classroom and marking attendance of matched data. These captured images goes through preprocessing phase. The aim of image pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing. Image pre-processing includes background subtraction and conversion of image into grayscale. Generally the background of an image does not move i.e. it remains static. Hence the background is subtracted in a set of image. Before subtracting the background, image is converted into grayscale. This is done to get good accuracy in detecting faces. Features are extracted from detected faces and cropped images of faces are stored for comparison. Feature extraction is a type of dimensionality reduction that efficiently represents interesting parts of an image as a compact feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to quickly complete tasks such as image matching and retrieval. After that images of students in classroom are captured to mark attendance of students present in the classroom. These images also goes through preprocessing as well as face detection process. Faces detected in classroom images are compared with the images in original dataset. If the match is found then that students roll number and name will be added in lit of present students. Face recognition technique is used for matching purpose.

- **Face Detection:** Face detection is a computer technology being used in a variety of applications that identifies human faces in digital images. Face detection step will detect faces in captured images so that these faces can be used for comparison. For face detection Viola-Jones algorithm is used.
  - **Viola-Jones Algorithm:**
    The Viola-Jones algorithm is a widely used mechanism for object detection. The main property of this algorithm is that training is slow, but detection is fast. This algorithm uses Haar basis feature filters. The efficiency of the Viola-Jones algorithm can be significantly increased by first generating the integral image. There are four main contributions of object detection framework which are listed below-

    1. Haar features
    2. Integral Image
    3. Adaboost algorithm
    4. Cascading

- **Face Recognition**:
  - With the facial images already extracted, cropped, resized and usually converted to grayscale, the face recognition algorithm is responsible for finding characteristics which best describe the image.
  - There are different types of face recognition algorithms, for example: Eigenfaces,LBPH(Local binary patterns histograms), Fisherfaces. Out of these algorithms LBPH is most suitable for the proposed system.
  - **Local Binary Pattern** (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighbourhood of each pixel and considers the result as a binary number.
  - Steps involved in LBPH:

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1. Parameters: Radius, Neighbour, Grid X, Grid Y.
2. Training the algorithm
3. Applying the LBP operation
4. Extracting the histograms
5. Performing the face recognition

V. RESULTS AND DISCUSSION

For face recognition implementation, the following results were obtained –

5.1. User Interface

It contains list of menu items which can be accessed to have the complete view of the system. The system takes the input such as Id and name of the students for registration purpose. The 'Take Images' button is used to capture the images of the students. 'Train System' button is used to train the captured images. 'Take Attendance' button is used to store the attendance results in an excel sheet. Fig 2 shows the registration page.

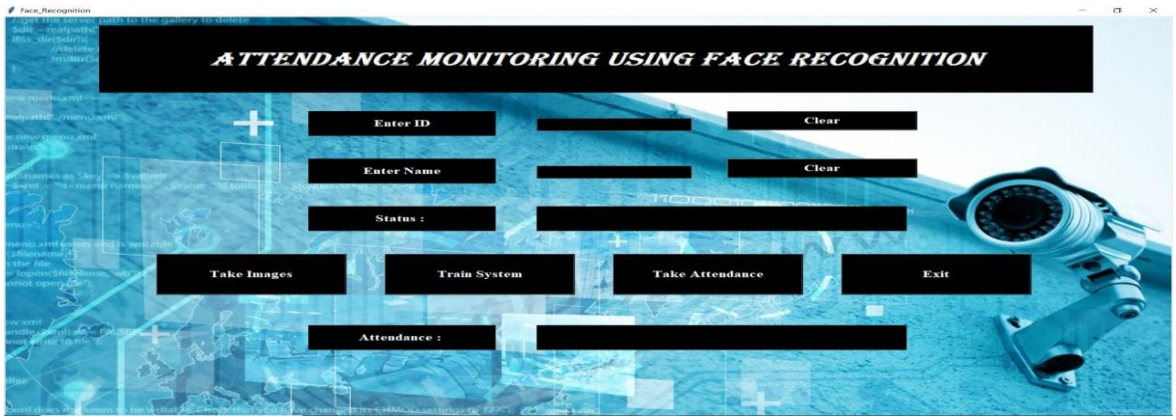

Fig. 2. User Interface

5.2. Face Detection

Multiple images of the students are captured and the images are pre-processed for detecting only the faces of the students. Fig 3 shows Face Detection.

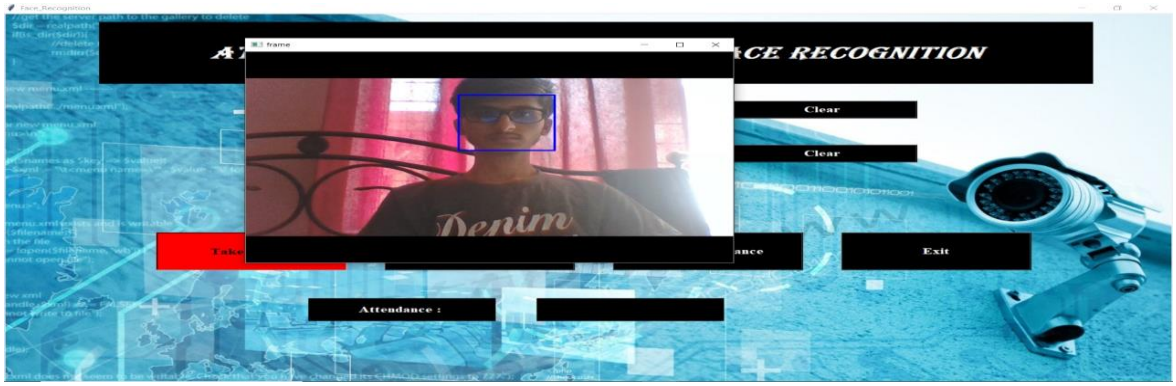

Fig. 3. Face Detection

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5.3. Training

The captured images of the students are stored in a local database. The stored images are trained and are assigned corresponding labels such as Id and name. Fig 4 shows multiple images stored in a database.

Fig. 4. Dataset of Images

5.4. Face Recognition

On carrying out the recognition process, feature comparison takes place with respect to the features stored in the database. The face is displayed along with corresponding roll no and the name of the student and used for marking the attendance. Fig 5 shows the Face Recognition.

Fig. 5. Face Recognition

5.5. Attendance Results stored in an excel sheet

The corresponding attendance of the students is stored in an excel sheet. Fig 6 shows the Attendance Results.

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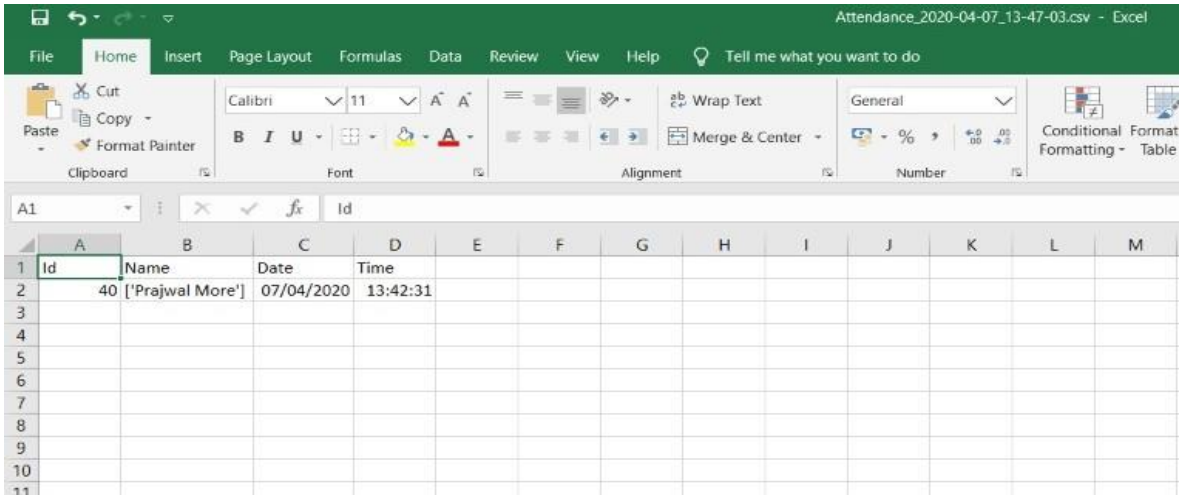

VI. FUTURE SCOPE

Almost all academic institutions require attendance record of students and maintaining attendance manually can be hectic as well as time consuming task. Hence maintaining attendance automatically with the help of face recognition will be very helpful and less prone to errors as compared to manual process. This will also reduce manipulation of attendance record done by students and it will save time as well. The future scope of the proposed work can be, capturing multiple detailed images of the students and using any cloud technology to store these images. The system can be configured and used in Atm machines to detect frauds.Also, the system can be used at the time of elections where the voter can be identified by recognizing the face.

VII. CONCLUSION

This paper introduces the efficient method of attendance management system in the classroom environment that can replace the old manual methods. This method is secure enough, reliable, accurate and efficient. There is no need for specialized hardware for installing the system in the classroom. It can be constructed using a camera and computer. There is a need to use some algorithms that can recognize the faces in veil to improve the system performance.

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