Online Student Attendance System Via Face Recognition using Haar Cascade Classifier

[1] Supriya Patil, [2] Atharva Tillu, [3] Shubham Bankar, [4] Mayur Dawande, [5] Akshay Jadhav
[1]Assistant Professor, [2]Student, [3]Student, [4]Student, [5]Student,
[1]Department of IT engineering,
[1]Zeal College of Engineering and Research, Pune-411041, India

Abstract: Nowadays Attendance management system is an important tool for taking attendance. Although, the traditional approach is time-consuming, intrusive, and requires manual work from the users. This research is focused on developing a less difficult, cost-effective, and more efficient automated student attendance management system using face recognition. This system takes attendance by using a camera mounted in front of a classroom, to capture images of the entire class. It detects the faces which are captured in the image and compares them with the enrolled faces in the database. On identification of a registered face on the captured image collections, the attendance register is marked as present otherwise absent.

I. INTRODUCTION

In this era of the internet explosion, engineering has involved many areas of people's lives and work. The occasions where people inherit contact with computers are gradually expanding. As a very important identity label for people to tell apart different individuals, face recognition technology has gradually entered people's lives. Face recognition is that the combination of artificial intelligence and computer. thanks to its huge challenging innovation and broad application prospects, it's become the foremost challenging topic during this field.

Maintaining attendance is extremely important in all told educational institutions. Every organization has its own method of taking student attendance. Some institutions use a paper-based approach and others have adopted automated methods like fingerprint biometric techniques. However, these methods subject students to attend in a very queue which consumes time and it's interfering. Face recognition technology is one of all the smallest amount intrusive and fastest-growing biometric technology. It works by identification of humans using the foremost unique characteristics of their faces. Face recognition has characteristics that other biometrics don't have.

Facial images is captured from a distance and any special action isn't required for authentication. because of such characteristics, face recognition technology is applied widely, not only to security applications but also to image indexing, image retrievals, and natural user interfaces. Faces are highly challenging and dynamic objects that are employed as biometric evidence, in biometric authentication. Biometrics systems have proven to be an important security tool, during which bulk matching of enrolled people and watch lists is performed daily. The importance of developing a replacement solution to boost the performance of face identification methods has been highlighted and CC is one amongst the foremost promising technology paradigms that may be accustomed achieve it.

Face recognition being a biometric technique implies determination if the image of the face of any particular person matches any of the face images that are stored during a database. This difficulty is hard to resolve automatically thanks to the changes that several factors, like face expression, aging, and even lighting can affect the image. identity verification among the assorted biometric techniques might not be the foremost authentic but it's various advantages over the others. Face recognition is natural, feasible, and doesn't require assistance. The expected system engages the face recognition approach for automating the attendance procedure of scholars or employees without their involvement. A webcam is employed for capturing the photographs of scholars or employees. The faces within the captured images are detected and compared with the pictures in database and also the attendance is marked..

The primary function of this step is to conclude whether the human faces emerge during a given image, and what's the placement of those faces. The expected outputs of this step are patches that contain each face within the input image. so as to induce a more robust and simply designable face recognition system. Face alignment is performed to rationalize the scales and orientation of those patches.

Taking this fingerprint attendance system as an example, the study has found that the fingerprint attendance system has a blunder rate of about 5%, and there'll be a phenomenon that fingerprints can't be hit, which seriously affects the efficiency of attendance, especially in large attendance sites, which is more likely to cause congestion. Face Recognition Attendance System supported Real-Time Video Processing cards for somebody else, and it's difficult to realize the aim of real-time attendance. Compared with the 2 attendance systems, the face recognition system has higher accuracy and stability, because there are more points for face recognition, which is more accurate than other systems. Greatly improved, it's difficult to congestion. Although China's research on face recognition technology started late, our scientific researchers have trapped and a few leading figures have established their own industry positions within the field of face recognition. With the appearance of the age of massive data in today's world and therefore the commercial value of face recognition technology, the prospect of this technology research is extremely bright and has great market demand.

II. LITERATURE SURVEY

Current biometric methods for attendance are too intrusive. This paper presents a stress-free non-intrusive way of taking class attendance using the face because the biometric. It also has the added novelty of relaying vital information about class attendance to handheld devices via any available cellular network. During enrollment, a camera was wont to acquire facial images that were made into templates using the Fisherfaces algorithm. These templates were stored in an exceedingly database. During verification or attendance taking, facial expression extracted from acquired face images and stored picture templates were compared using the Fisher Linear Discrimination algorithm for any match within the pre-set threshold. Vital information about collated attendance reports was sent via a cellular network to designated handheld devices. The designed and implemented system had 54.17% accuracy during verification when the lighting was varied with none variation in countenance during enrollment. The system had 70.83% accuracy during verification when facial expressions were varied together with variations in lighting conditions during enrollment..[1]

In this paper, we present a replacement way for an automatic attendance system that creates use of Principal component analysis (PCA) together with Artificial Neural networks (ANN). because the human brain has the training ability to acknowledge persons by their faces even the feature characteristics change with time because the neurons of the human brain are trained by reading or learning the face of someone and may identify that face even after several years. Similarly, this ability to coach and identifying is converted into a machine system using Artificial Neural networks (ANN). the fundamental function of the face recognition system is to check the face of an individual which is to be recognized with the faces already trained within the Artificial Neural Networks and it recognized the most effective matching face as output even at different lightening conditions, viewing conditions, and facial expressions.[2]

Face recognition presents a challenging problem within the process of image analysis and computer vision. Face recognition techniques may be broadly classified into three categories supported the face data acquisition methodology: methods that care for intensity images; those who accommodate video sequences; and people that need other sensory data like 3D information or infra-red imagery. High data dimensionality makes it challenging to tell apart the desired discriminative information. during this paper, an outline of some well-known dimension reduction techniques is presented and a few of the advantages and downsides of the schemes mentioned therein are examined. This paper also mentions the classification of dimension reduction techniques being developed and tries to present a thought of the state of the art of face recognition technology.[3]

Face recognition is that the ability to categorize a collection of images that supported certain discriminatory features. Classification of the popular patterns is often a difficult problem and it's still an awfully active field of research. The paper introduces a conceptual framework for descriptive study on techniques of face recognition systems. It aims to explain the previous researches that are studied the face recognition system, so as to scope on the algorithms, usages, benefits, challenges, and problems during this felids, the paper proposed the face recognition as sensitive learning task experiments on large face databases demonstrate of the new feature. The researcher recommends that there is a has to evaluate the previous studies and researches, especially on the face recognition field and 3D, anticipating advanced techniques and methods within the near future.[4]

III. PAPOSED SYSTEM OVERVIEW

Traditional student attendance marking techniques is often facing plenty of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking techniques like marking attendance on paper. There causes distraction for college students during exam sessions and there are human errors over and over. The lecture class particularly the category with an outsized number of scholars might find it hard to possess the attendance sheet being passed within the category. Hence, a face recognition student attendance system is presented so as to switch the manual signing of the presence of scholars which is troublesome and causes teachers to urge distracted so as to sign maintain student attendance. Furthermore, the face recognition-based automatic student attendance system is ready to manage the matter of the fraudulent approach.

Systems design is that the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design may well be seen because of the application of systems theory to development. The proposed automated attendance system is often divided into five main modules. The modules and their functions are defined in this section. The five modules into which the proposed system is split are:

a) Image Capture
b) Face Detection

The Camera is mounted at a distance from the doorway to capture the frontal images of the scholars and therefore the further process goes for face detection. A proper and efficient face detection algorithm always enhances the performance of face recognition systems. Various algorithms are proposed for face detection like Face geometry-based methods, Feature Invariant methods, System Diagram Machine learning-based methods. Out of these methods, Viola and Jones proposed a framework that provides a high detection rate and is additionally fast. Viola-Jones detection algorithm is efficient for real-time application because it is fast and robust. Hence we chose Viola-Jones to face detection algorithm which makes use of Integral Image and AdaBoost learning algorithm as a classifier. We observed that this algorithm gives better leads to different lighting conditions and that we combined multiple haar classifiers to realize a far better detection rate up to an angle of 30 degrees.

Although many various algorithms exist to perform face detection, each has its own weaknesses and strengths. Facial detection is impossible if the face isn't isolated from the background. Analyzing the pixels for face detection is time-consuming and difficult to accomplish thanks to wide variations of shape and indecent within somebody's face. Pixels are required for scaling and precision. Viola and Jones devised an algorithm, called Haar Classifiers, to rapidly detect any object, including human faces, using AdaBoost classifier cascades that are supported Haar-like features and not pixels.

One of the difficulties of facial identification is that the identification between known and unknown images. additionally, paper proposed by Pooja G.R et al. (2010) discovered that the training process for face recognition student attendance system is slow and time-consuming. additionally, the paper proposed by Priyanka Wagh et al. (2015) mentioned that different lighting and head poses are often the issues that would degrade the performance of face recognition based student attendance system.

Hence, there's a requirement to develop a real-time operating student attendance system which suggests the identification process must be done within defined time constraints to stop omission. The extracted features from facial images which represent the identity of the scholars need to be consistent towards a change in background, illumination, pose, and expression. High accuracy and fast computation time are going to be the evaluation points of the performance.

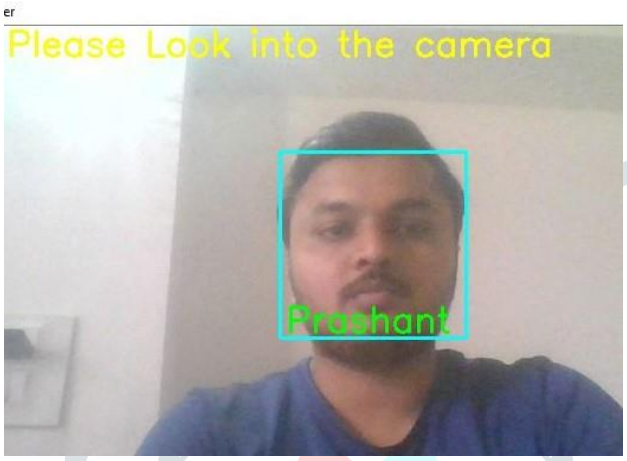

Fig 1.1 Face Detection

Haar Cascade Classifier:

Computer vision could be a field of study which aims at gaining a deep understanding of digital images or videos. Combined with AI and ML approaches, today many industries are investing in researches and solutions of computer vision. Object detection could be a powerful instrument. we've to use OpenCV (Open Source Computer Vision Library) which is an open-source computer vision and machine learning software library and simple to import in Python. Particularly, also we've to use the Haar Cascade algorithm.

Haar Cascade is a machine learning object detection algorithm proposed by Paul Viola and Michael Jones in their paper "Rapid Object Detection using a Boosted Cascade of Simple Features". It is a machine learning-based approach where a cascade function is trained from a lot of positive and negative images (where positive images are those where the object to be detected is present, negative are those where it is not). It is then used to discover objects in other images. Luckily, OpenCV offers pre-trained Haar cascade algorithms, organized into categories (faces, eyes, and so forth), depending on the images they have been trained on.

Fetching human facial expressions, like the mouth, eyes, and nose require that Haar classifier cascades first are trained. so as to coach the classifiers, this gentle AdaBoost algorithm and Haar feature algorithms must be implemented. Fortunately, Intel developed an open-source library dedicated to easing the implementation of computer vision-related programs called Open Computer Vision Library (OpenCV). The OpenCV library is meant to be employed in conjunction with applications that pertain to the sector of HCI, robotics, biometrics, image processing, and other areas where visualization is very important and includes an implementation of Haar classifier detection and training.

Now let's see how this algorithm basically works. the concept of Haar cascade is extracting features from images employing a quiet 'filter', kind of like the concept of the convolutional kernel. These filters are called Haar features and appearance like that:

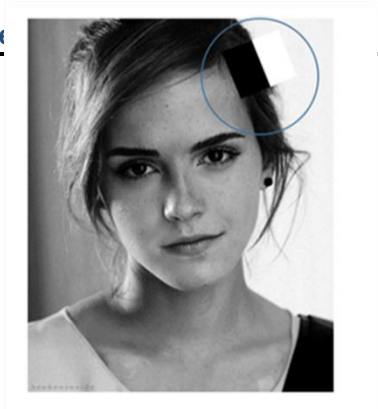

Fig 1.2 Features used in Haar filter

Thus with help of this algorithm system will detect the person's face within the video. The face of the person gets Green Square as a sign of the detection process.

The idea is to pass these filters on the image, inspecting one portion (or window) at the time. Then, for every window, all the pixel intensities of, respectively, white and black portions are summed. Finally, the worth obtained by subtracting those two summations is that the value of the feature extracted. Ideally, an excellent value of a feature means it's relevant. Namely, if we consider the sting feature (a) and apply it to the subsequent B&W pic:

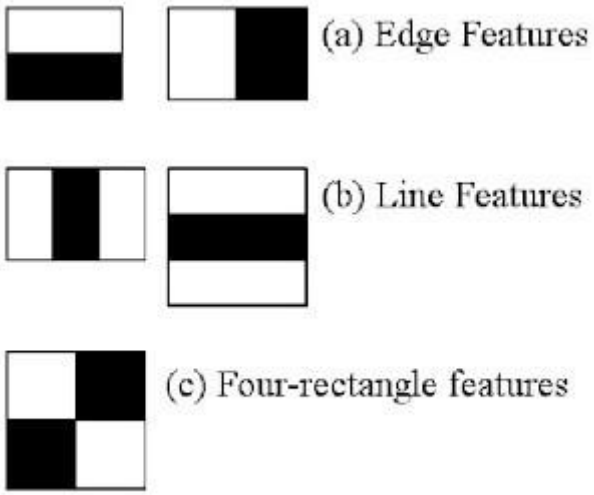

Fig 1.3 B&W pic used in face detection

We will obtain a major value, hence the algorithm will return a footing feature with high probability. Of course, the 000 intensities of pixels isn't adequate to white or black, and that we will often face the same situation:

Fig 1.4 Extracted feature in pixel format

Nevertheless, the thought remains the same: the upper the result (that is, the difference between black and white summations), the upper the probability of that window of being a relevant feature.

Now, imagine the large amount of features returned by this computation. to relinquish you an inspiration, even a 24x24 window ends up in over 160000 features, and windows within a picture are lots. a way to make this process more efficient? the answer came out with the concept of a Summed-area table, also called Integral Image. it's an information structure and algorithm for generating the sum of values in a very rectangular subset of a grid. The goal is to cut back the quantity of computations needed to get the summations of pixel intensities within a window.

The next step also involves effectiveness and optimization. Apart from being numerous, features may also be irrelevant. Among the features we achieve (that are over 160000), how can we decide which of them are good? the solution to the current question depends on the concept of the Ensembilg method: by combining numerous algorithms, weak by definition, we are able to create a strong algorithm. This is often accomplished using Adaboost which both selects the simplest attribute and trains the classifiers that use them. This algorithm establishes a “strong” classifier as a linear combination of weighted simple “weak” classifiers.

The last concept which must be known could be a final element of optimization (in terms of the time of training). Indeed, although we reduced our 160000+ features to a more manageable number, the latter continues to be high: applying all the features on all the windows will take lots of your time. That’s why we use the concept of Cascade of classifiers: rather than applying all the features on a window, it groups the features into different stages of classifiers and applies them one by one. If a window fails (translated: the difference between white

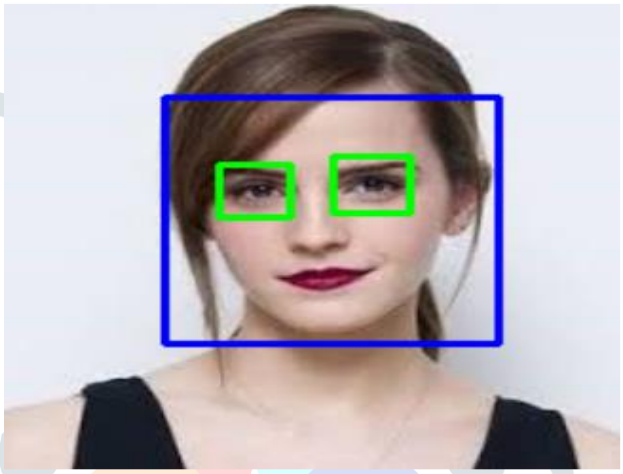

Fig 1.5 Captured image extracting feature

and black summations is low) within the first stage (which normally includes few features), the algorithm discards it: it won’t consider the remaining features on that. If it passes, the algorithm applies the second stage of features and continues the method.

As you'll be able to see, within the above image algorithm is functioning pretty well! If you explore the entire library of Haar algorithms, you'll see that there are specific models trained on different features of the human physical aspect.

IV. Application of Proposed System

Institutions have the standard way of marking attendance where calls out each student's name to test if they're present. This method of utterance is time-consuming and tedious. By using identity verification, the method of taking attendance is often significantly improved to save lots of time and supply a hassle-free thanks to automatically mark attendance. Since the quantity of scholars in an establishment is more, using an automatic system improves the productivity and standard of the school.

In most companies, employees have the practice of using their biometrics or ID card to log their entry time and exit time. During the height hours the quantity of individuals entering and exiting the office.

In prisons, each day a headcount of the prisoners is finished to test if all inmates are present. Using automatic face recognition to automate this process of doing headcount increases the efficiency and reliability is improved. the protection also increases as tabs may be kept on each prisoner in the slightest degree times

V. Future Scope of System

For future work, Embedded systems would be integrated into the attendance system to create it fully autonomous. The system would be converted for transmission of attendance information via local area networks and WIFI to designated nodes on a network.

Using a cloud platform will make the compute-concentrated tasks faster. This can also enable adaptability from one machine to clusters of servers on a public or private cloud infrastructure and improved performance.

VI. CONCLUSION

An automated Attendance System has been envisioned for the aim of reducing the errors that occur within the traditional (manual) attendance-taking system. The aim is to automate and make a system that's useful to the organization like an institute. The efficient and accurate method of attendance within the office environment can replace the old manual methods. This method is secure enough, reliable, and available to be used. No need for specialized hardware for installing the system within the office. It will be constructed employing a camera and computer.

VII. ACKNOWLEDGMENT

Greatly acknowledge the Zeal College of Engineering & Research,Pune for encouraging for project on 'Online Student Attendance System via Face Recognition Using Haar Cascade Classifier'. We express our deep gratitude to Dr. R. B. Gurav (Head of Information Technology department) for his unending support to carry out this work.

REFERENCES

[1] Samuel, J. 2017. A Face Recognition Attendance System with GSM Notification. 2017 IEEE 3rd International Conference on Electro-Technology for National Development (NIGERCON).

[2] Papola, A. 2014. Smart Attendance using Face Recognition with Percentage Analyzer. International Journal of Advanced Research in Computer and Communication Engineering.

[3] Singh, H.2016. A Review Paper on Face Recognition Techniques.An International Journal of Engineering Science.

[4] YANG, H.2020. Face Recognition Attendance System Based on Real-Time Video Processing,IEEE.

[5] Rao, R 2021. AN EXPLORATORY STUDY ON FACE RECOGNITION BASED ATTENDANCE MONITORING SYSTEM, International Research Journal of Engineering and Technology (IRJET), 2320-2882.

[6] Wu, D.,2016,''Roboust face recognition based on significance local directional pattern and deep learning,'' J. Optoelectron. Laser, vol. 27, no. 6, pp. 655–661.

[7] Chakraborty, S..2018, ''Local gradient hexa pattern: A descriptor for face recognition and retrieval,'' IEEE Trans. Circuits Syst. Video Technol., vol. 28, no. 1, pp. 171–180.

[8] Solanki, K.2016, ''Review of face recognition techniques,'' Int. J. Comput. Appl., vol. 133, no. 12, pp. 20–24.

[9] Attendance System Using Face Recognition and Class Monitoring System, Arun Katara1, Mr. Sudesh2,V.Kolhe3http://www.ijritcc.org/download/browse/Volume_5_Issues/February_17_Volume_5_Issue_2/1489565866_ 15-03-2017.pdf

[10] Viola, P. 2016.Object detection using a boosted cascade of simple features. In Proceed-ings of the 2001 IEEE Computer Society Conference on Computer Vision and Pattern Recognition. CVPR 2001, volume 1, pages I–511–I–518 vol.1.

[11] Verma A. 2020. ATTENDANCE SYSTEM USING CASCADE CLASSIFIER, International Journal of Creative Research Thoughts (IJCRT), 2320-2882.