

Facial Recognition Based Attendance System

Literature Review

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Research Work

Web based application

The system will be a web-based application. It can be accessed easily from any device through the internet instead of having to be individually installed. It will work on most browsers and operating system, regardless of their version or update. This will give the users with accessibility and flexibility while increasing their overall productivity. All the security, uptime, backups, and upgrades can be handled through a central point and the users do not have to worry about it and focus on what's important. Using of web-based apps also enables sensitive user data to be secure and backed up.

To develop the web app, I'll be utilizing Python, Django and OpenCV. Python supports artificial intelligence programming with neural network simulators and expert system shells, as well as OOP, System Programming, GUI, Component Integration, Database Programming, Numeric Programming, Image Processing Tools built-in, a library, and third-party apps. Django is a python-based framework, which is highly secure and scalable and comes fully loaded with wide range of packages.

End User

The target of the system will be organizations involving large number of peoples whose attendance need to be kept. Target end users include offices, companies, factories and educational institutions like schools, colleges, and universities.

Solution

Maintaining attendance is very important and compulsory in every institute and organization. Most of the organization utilizes traditional method of paper based or semi-automatic approach. The traditional approach of student is manual and time consuming. It might be effective for attendance of limited/small number of attendees. But handling and tracking attendance of large mass of people is very tedious and prone to manual errors.

Comparison of biometric technologies

Biometric Technology	Accuracy	Cost	Tools Required	Disadvantages
Facial recognition	Moderate	Moderate	Camera/ Image Capture device	Privacy invasion
Voice recognition	Moderate	Moderate	Mic/Audio Capture device	Less accurate than another tech
Fingerprint scanning	High	Moderate	Biometric Scanner	Time consuming
RFID Card System	High	Minimal	Card Scanner	Fraudulent usage/ Time consuming

The proposed system is an automatic and dependable system that utilizes facial recognition technology in real time while considering different factors such as time consumed, background, illumination, poses, and expressions with fast computation and high accuracy. The system will also be secure and is able to effectively maintain users' privacy and it involves their sensitive (personal and facial) data.

The main goal of the system is to biometrically identify all the attendees present in the designated location with the help of camera or similar optical device by detecting and recognizing the faces and store the attendance record updating the corresponding data in the database. The proposed automated system will be more reliable efficient and rigid than the traditional attendance systems.

Similar Works

“Face Recognition based Attendance System” proposes an automated attendance management system that deals with the problem of face identification in biometric frameworks under varying constant conditions such as light, revolution, and scaling. The model combines a camera that captures an input image, a computation to recognize a face from the input picture, encode and perceive the face, and stamp the participation in a spreadsheet before converting it to a PDF file.

An android phone's camera captures the image and sends it to a server, where faces are recognized from the data set and attendance is recorded. (Dhanush Gowda H.L, 2020)

“An improved face recognition algorithm and its application in attendance management system” suggests a system that employs a different technique that combines the calculation of Local Binary Patterns (LBPs) with advanced image processing, such as contrast, image Blending, bilateral Filter, adjustment, and equalization of histograms to alleviate some of the concerns reducing the precision of facial recognition in order to improve the LBPA's a result, the overall face's accuracy is improved framework for acknowledgment The outcomes of the examination demonstrate that the approach is extremely precise, reliable, and strong face recognition system that can be basically carried out in a real-life setting as an Attendance management system that has been programmed. (Serign Modou Bah, 2020)

“Automated Attendance Management System Based on Face Recognition Algorithms” utilizes the Viola Jones Face Detection Algorithm. This algorithm provides superior outcomes in a variety of illumination settings and utilizes several Haar classifiers to obtain higher output rates up to 30 degrees. The histogram equalization of the facial picture acquired when it is scaled down to 100x100 is part of the preprocessing phase. Photos are converted to grayscale, histograms are equalized, and images are resized to 100x100 pixels. The LBPH technique was used to extract the attributes, and the SVM classifier was used to classify them. This publication made use of an 80-person database (NITW database) that included around 20 photos of each person. The false positive rate is 25%, the object distance for correct recognition must be 4 feet, the training time is 563 milliseconds, 95 percent recognition percentage for static images, 78 percent recognition percentage (real-time video), and the occluded faces are 2.3 percent, according to this document. (Shireesha Chintalapati, 2013)

Findings of research from similar works

Based on research papers reviewed, the conclusion is reached that the accuracy of the face detection and recognition is exponentially related to the number of datasets that are trained to develop the face recognition model.

The successful working of the model is observed under the available conditions that includes:

Background	The model's efficiency is affected by the background and environment of the attendees. Because it is difficult to recognize faces in a dynamic background, static backgrounds are ideal.
Illumination/Lighting	In comparison to dimly lit areas, situations with enough illumination produce accurate results when using the model. The recognition of face features is particularly hampered by a dimly illuminated setting.
Pose	Variation in body or facial positions means capturing image from a difficult angle, which can cause distortion in the recognition process, particularly for Fisher and Eigen face recognition techniques.
Expression	Humans use a variety of facial expressions to express themselves. The shape and size of facial features vary as a result of changes in facial emotion.
Occlusion	The performance of the face recognition model will be diminished by parts of the human face that are not visible.
Rotation, scaling and translation	The image has a chance of being distorted during scaling and preprocessing, which could impact the original information in the image.
Facial features / Accessories	During the face recognition process, a variety of facial expressions/poses may cause inaccuracies. Similarly, facial traits and accessories such as glasses, veils, caps, moustaches, beards, and other facial features and accessories may make it difficult to recognize the face of attendees.

Advantages and Disadvantages of Facial Detection Methods (Varsha Gupta, 2014)

Face Detection Method	Pros	Cons
Viola Jones	High accuracy High detection speed	Long training time Limited facial pose Not able to detect poorly/dimly lit faces
Local Binary Pattern	Simple computation High tolerance against monotonic change in lighting.	Only used for monotonic images Overall performance is inaccurate
AdaBoost algorithm	Works without any prior knowledge about facial features.	Result highly depends on the provided training dataset. Weak classifiers might affect the result.
SMQT Features and SNOW Classifier	Capable to deal with illumination problems. Efficient computation	Grey value regions might be misidentified as part of the face.
Neural Network	High accuracy only if large number of image datasets are trained.	Detection process is very slow Complex computation is involved Overall performance is weaker

Methods of Contrast Improvement

Histogram equalization

Contrast enhancement is carried out by transforming intensity values resulting in uniformly distributed histogram.

Pros - Less sensitive to noisy, grainy images

Cons – Depends on global statistic of the image, causes over enhancement to some part of the image whereas some peripheral part might need more enhancement.

Contrast Limited Adaptive Histogram Equalization

Unlike Histogram Equalization, it works on small data regions. Each tiles contrast is exchanged to ensure uniformly distributed histogram. Bilinear interpolation is then used to merge the neighboring tiles.

Pros – It prevents noise amplification and over enhancement

Cons – More sensitive to noisy and grainy images.

Comparison of Algorithms

Method	Pros	Cons	Accuracy
Eigen face/ kernel PCA	High speed in training and recognition	Recognition depends on training database	77.97%
Fisher face/ LDA	Facial images with varied lighting and expressions can be recognized if more samples are trained	Bigger database is required because multiple expressions of individual have to be trained	82.45%
LBP	Can overcome variety of facial expressions, lighting, angles and age of the individual	Training time is significantly longer	90.93%

Neural network	High accuracy only if large database is trained	Requires very long time to train Database is extremely large	N.A.
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Conclusion

The idea of developing a automated facial recognition-based attendance system is thoroughly reviewed. The proposed approach describes a method to identify attendees by comparing input image obtained from real time video to get the training set. After the initial review, Viola Jones Algorithm will be used along with Eigenfaces (PCA), Fisher face (LDA) and LBP and OpenCV. All of the available methods will be evaluated, and the most efficient and accurate approach will be utilized to develop the proposed system.

References

Dhanush Gowda H.L, K. V. ., B. R. N. K. D. P. M., 2020. Face Recognition Based Attendance System. *International Journal of Engineering Research & Technology* , 9(6), pp. 761-767.

Serign Modou Bah, F. M., 2020. An improved face recognition algorithm and its application in attendance management system. *ELSEVEIR*, Volume 5.

Shireesha Chintalapati, M. R., 2013. Automated Attendance Management System Based on Face Recognition Algorithms. *IEEE International Conference on Computational Intelligence and Computing Research*.