International Journal of Integrated Science and Technology (IJIST)
Vol.2, No.1, 2024: 45-52

Facial Recognition Attendance Monitoring System Using deep Learning Techniques

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A R T I C L E I N F O

Keywords:FacialRecognition,Attendance Monitoring, Deep Learning Teachniques, LPBH and Ethical Considerations

Received : 23, November
Revised : 25, December
Accepted: 29, January

A B S T R A C T

Using deep learning techniques, the facial recognition attendance monitoring system is an innovative use of artificial intelligence in corporate and educational settings. Using a facial recognition system can help recognize or confirm a person's identification from a digital picture. Precise attendance documentation is essential for assessing the classroom.Manual attendance recording, however, may lead to mistakes, absent students, or redundant entries. Implementing an attendance system based on facial recognition could aid in removing these drawbacks. Using a camera to take input images, this novel method detects faces using algorithms like Eigen values, Haarcascade, support vector machines, or the Fisher face algorithm. The faces are then cross-referenced with a database of student profiles, and attendance is recorded in an Excel sheet. Using OpenCV as a open-source computer vision framework guarantees the effectiveness .

INTRODUCTION

The potential for several applications in law enforcement and other industries has drawn a lot of interest to facial recognition technology in recent years. This technology, which has become a popular option for identity verification, can recognize or authenticate a person from a digital photo. The increasing use of image-capturing equipment, such as CCTV cameras and smartphones, has raised the necessity for computational analysis of multidimensional facial features. An automated solution to problems with labor-intensive and error-prone manual attendance taking was created: the face recognition-based attendance system. Teachers may miss pupils or record numerous entries, but attendance is a crucial component of daily classroom evaluation in educational institutions. This results in data. irregularities, which the face recognition-based attendance system can fix. This study aims to provide a straightforward and automatic biometric attendance tracking and recording solution for students. To record attendance, the system compares the user's face with pictures that are kept in the dataset. The goal of this study is to expedite and improve the accuracy of the attendance process. The paper's description, goal, design, implementation, testing, and potential improvements are all included in the documentation. Lecturers must take the time to gather, check, and maintain student records under the labor-intensive manual attendance system. On the other hand, the automated system is more beneficial and lightens the lecturer's duty.

LITERATURE REVIEW

This study looks at the many attendance and monitoring systems that are currently in use in the sector; these systems are primarily automated, although they can still make mistakes. It is suggested to implement a new attendance system that integrates deep learning advancements with cutting edge techniques. To attain high accuracy, the system makes use of fewer facial photos and a suggested augmentation technique. The practice of taking attendance has been transformed by automated face recognition, which uses less paper and requires less manual labor while increasing security and efficiency. Using a variety of methods and methodologies, the system collects and stores the facial biometrics of students, recognizes them when their data is recorded, and marks their attendance. The suggested solution makes use of the OpenCV package, which provides a thorough collection of both traditional and cutting-edge computer vision techniques. vision and machine learning techniques for object identification, face detection and recognition, and other applications.

The 3 techniques of face recognition in OpenCV library are:

a) Eigen faces algorithm

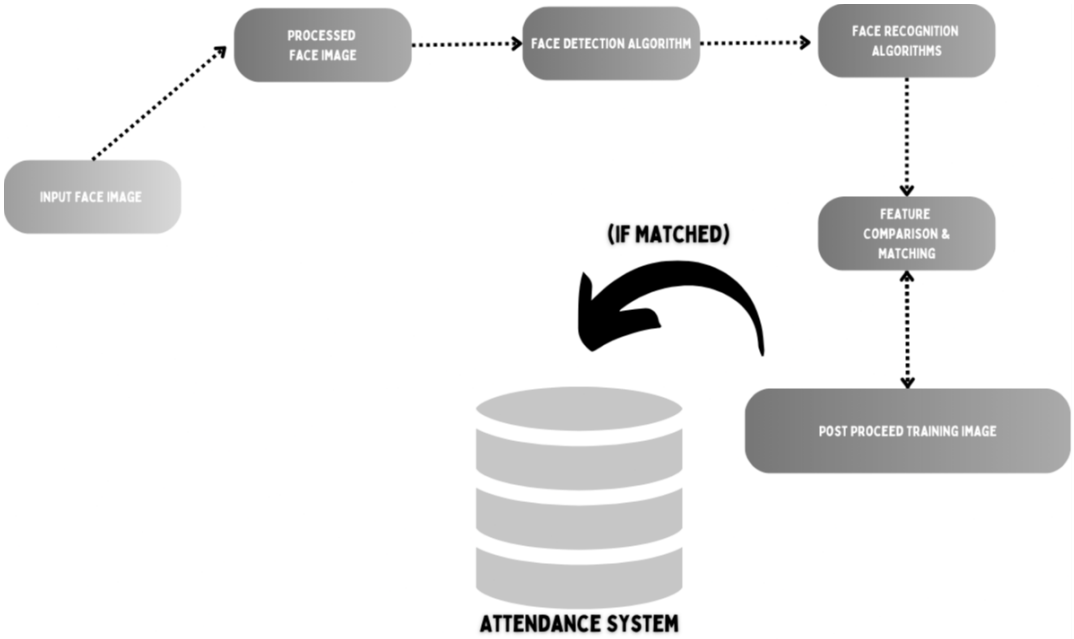
b) Fisher faces algorithm

c) Local Binary Pattern Histogram (LBPH) algorithm

Instead of depending on the physical characteristics of the face for identification, the Eigen face approach uses mathematical transformations to attempt to acquire facial attributes analytically. Principal Component Analysis is used to identify a set of Eigenvectors from a training set of many individual faces in the first phase of the two-phase identification procedure. Nevertheless, this method is dependent on head location and lighting, and determining Eigen vectors and values takes time.

Fisher face, on the other hand, takes a similar approach to Eigen face and offers the advantage of improved image categorization across several classes, including facial emotions. Nevertheless, the Fisher face method requires more computing power to calculate ratios and is more complex than Eigen face in determining the face space projection. Larger face storage and longer recognition times are further outcomes of this method. The facial recognition technique used in the proposed system is the Fisher face approach, which is better and faster than previous algorithms and robust against illumination variations. Additionally, a straightforward method for face recognition that can identify both front and side faces is the Local Binary Pattern Histogram (LBPH) algorithm.

FLOWCHAT

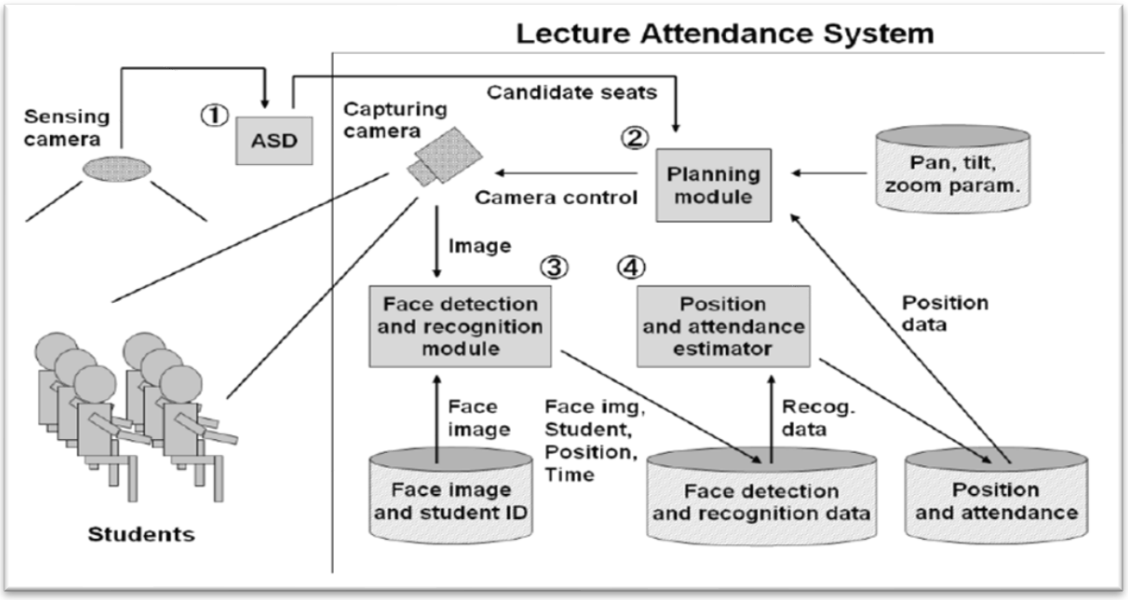


METHODOLOGY

The purpose of the Software Requirement Specification (SRS) is to specify the Uniform Resource Locator (URL) and functionality that the Intelligent Network Backup Tool must have. It seeks to provide a comprehensive grasp of the ultimate features and requirements of the product as envisioned by the client and the development team. This document contains a prioritized and complete list of the required statements. It provides information on design and implementation restrictions, external interface requirements, system features, non-functional needs, and dependencies to project developers, managers, users, testers, and documentation writers. For companies and organizations to assess their market performance and preserve a competitive edge, needs identification is essential.

A. Architecture of the proposed system

Using facial recognition technology, the proposed solution aims to automate the current human attendance system. Capturing and storing each student's face for attendance records is its primary goal. It is essential that every facial feature be accurately detected while taking an image. Using facial recognition techniques on the captured image, teachers can take attendance in class without having to physically do it. This essay addresses the issues that are frequently related to manual attendance records. Haar Cascade classifiers are employed to identify faces, while the Local Binary Pattern Histogram (LBPH) technique is used to identify faces of students. System Architecture (Fig. 3.1) The Face Recognition-based Classroom Attendance System that is being proposed. A camera must be placed in the classroom at a location that allows it to record footage for the system. and so successfully take pictures of every pupil in the classroom. The intended outcomes are obtained by processing this image. all the students in the classroom and thus capture their images effectively. This image is processed to get the desired results.

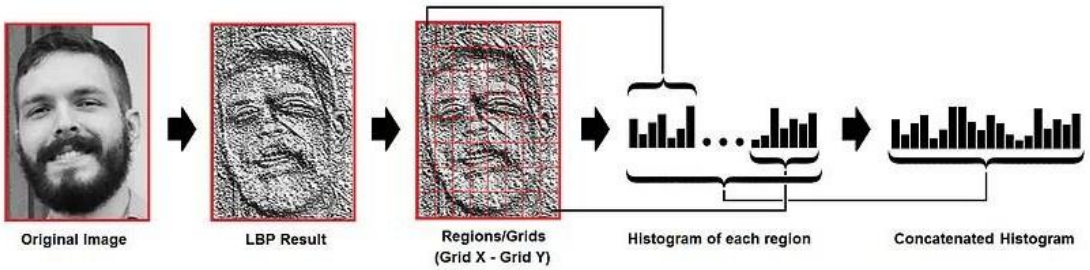


B. Algorithms and Flow Diagrams

Classifiers are algorithms that identify whether a picture contains a face (1) or not (0). They are used in face detection. It is an approach based on machine learning. where a large number of positive (face-containing photos) and negative (face-free) images are used to train a cascade function. In feature extraction, the algorithm makes use of training data to determine which features are most likely to be associated with a face.

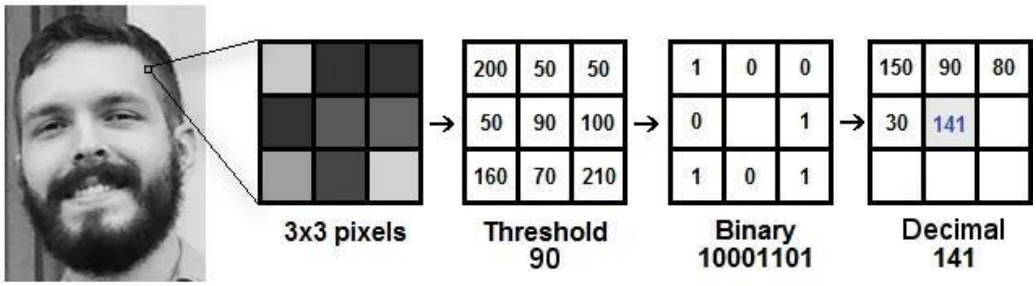
C. Local Binary Pattern Histogram (LBPH) Algorithm

Since its initial introduction in 1994, the Local Binary Pattern (LBP) has established itself as a significant figure in texture classification. Research findings indicate that the utilisation of LBP in conjunction with the Histograms of Oriented Gradients (HOG) descriptor considerably improves the accuracy of detection for specific datasets. By using LBP in



In order to represent facial photographs, we can easily generate a data vector using histograms. Figure 3.3: Structure for General Face Recognition The supplied flow diagram shows how the face detection technique is used to turn the original image into a grayscale image for feature extraction.

The image taken by the camera is shown as the input. Subsequently, verification and identification procedures are employed to compare the input image with the current image in order to guarantee a reliable recognition result.



Performing the Face Recognition

The algorithm has finished its training phase at this point. An image from the training dataset is represented by each histogram that is created during training. We repeat the previous stages to create a histogram that represents the features of a new input image. The closest match can then be found by comparing this histogram to the histograms in the training dataset. There are multiple methods for comparing histograms and figuring out the distance.

$$d(x, y) = \sqrt{\sum_{i=1}^{n}(y_i - x_i)^2}$$

Among them, including chi-square, absolute value, Euclidean distance, and others. We can apply the widely used Euclidean distance formula in this situation.

RESEARCH RESULT

Comparison Subject	Eigenface	Fisher face	LBPH
Value prediction when testing with the same face	4633.81	318.59	29.32
Smallest value prediction when testing with different faces	2004.2	61.42	71.88
Biggest value prediction when testing with different faces	8360.78	2805.77	367.5
FPS Range	0.67	1.23	6.58

CONCLUSIONS AND RECOMMENDATIONS

The automated attendance system for lectures, sections, and laboratories that the proposed system offers will make it simple for lecturers or teaching assistants to keep track of student attendance. This method saves time and effort by using face detection and recognition algorithms, particularly in classrooms with a large number of pupils. Because this automated technique eliminates the shortcomings of the human, old method, it can increase the goodwill of an organization. Student attendance is recorded by identifying their face and entering the information on an attendance sheet after extensive testing of the face detection and recognition algorithms. The client was satisfied with the system's accomplishment of its goals once it was created from specifications to a fully functional system, complete with testing and evaluation. Even if there were some

difficulties during implementation, they were resolved and sorted. This section covers strategies for upcoming work and system enhancements.

FUTURE WORKS

Our solution for marking attendance is effective in automatically logging attendance and producing an Excel sheet in real time. However, a highly efficient algorithm that is unaffected by changing classroom lighting conditions is required to develop a system specifically for educational institutions. The system also needs to use a camera that has the best resolution possible. Another thing that has to be improved is making an online attendance database with automatic updates. This can be accomplished by installing a standalone module in the classroom with wireless internet access. Implementing these improvements would greatly enhance the functionality andusefulness of the paper.

ACKNOWLEDGMENT

Every project's likelihood of success is mostly dependent on the support and direction of numerous people. Their assistance was essential to the success of our research project. Taking this occasion, we would like to thank everyone who has contributed to the successful completion of this project. Firstly, we would like to express our profound appreciation to our team's mentor, our Respected HOD, Mrs. Meenakshi Thalor, for her unwavering support and encouragement during the report's preparation, as well as for making the library resources necessary for its preparation available. Our several conversations proved to be quite beneficial. She has provided invaluable direction and frequent oversight, as well as the essential information regarding the project, for which we are quite grateful. for helping to see that the job was finished. We respect her because of the direction, support, and inspiration she has given usA

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