



# A Comprehensive Study on Machine Learning Based Approaches for Object Detection

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**Abstract:** To develop an automated system through which we can identify and recognize object using their images/data captured from videos. The idea that will be focused in this research is to create such a system for an organization in which the attendance of staff & students can be taken via images/videos captured through the camera, more particularly for a university/institute in which attendance of the class can be taken via image capturing. This will ease the attendance monitoring system with very less human intervention. This new system can replace the hectic attendance maintenance and will make attendance monitoring more accurate and efficient. Further, Machine Learning will be used to match the data captured through the image and the concerned staff/student will also be notified via software application that their attendance is marked. The system will be developed in such a way that it can be used for other applications also, especially in the area of agriculture & medical.

**Keywords** — Image Processing, Machine Learning, Automated System.

DOI: 10.48047/ecb/2023.12.5.498

## INTRODUCTION

Image processing is a method that involves applying a variety of processes to a image in order to enhance the image or derive some useful information from it. Image processing can also be thought of as a technique. It is a kind of signal processing in which a image serves as the input, and the output may either be another image or attributes or characteristics connected to the original image. One of the technologies that is undergoing rapid development at the moment is image processing. Both the area of engineering and the field of computer science make it a key focus of their research efforts. Image processing may be quite helpful in a wide variety of other aspects of our day-to-day lives as well.

Businesses of various types utilize attendance systems to keep tabs on when students and workers start and finish working as well as the division in which the work is being performed. In addition, some firms keep meticulous records on items pertaining to attendance, such as who calls in sick and who is tardy to work. A variety of benefits are available to companies via the use of an

attendance system. At one point in time, attendance was recorded using registers, and this included not just students but also employers. Nevertheless, many who were present in classrooms at the time when attendance registers were being used are aware of how simple it was for students to take advantage of this system by falsifying their attendance records for one another. Naturally, the use of technology is essential in this domain, just as it has been in many other domains.

The relevance and breadth of image processing are going to be investigated in this line of study so that conclusions can be drawn about their importance. It comprises investigating the many phases and methods that are used in a conventional image processing, in addition to investigating the usage of image processing tools and techniques in cutting-edge fields of study such as medical, security, agricultural, and organizational settings.

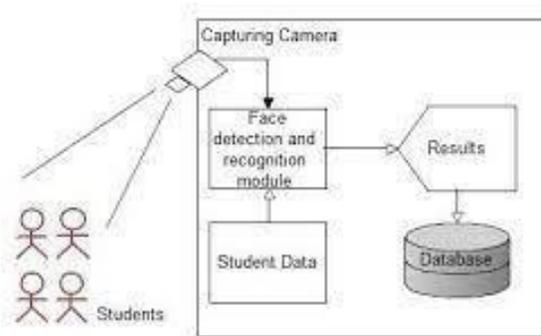


figure.1 General Attendance Monitoring System.

**Aim:** The aim of this research is to develop an automated system for identification and recognition of objects using their images/data captured from videos and then using this system to maintain the attendance of the staff & student.

## I. LITERATURE SURVEY

There are a variety of techniques and methods being proposed, as well as a variety of systems being built and put into action, all with the goal of gathering attendance information in a more effective and efficient manner. As a

result of these investigations that have been conducted, a literature survey has been carried out, and this part discusses and reviews some of the most noteworthy publications in order to get some understanding about the aforementioned study topic.

"Facial recognition based Attendance marking system" was suggested by K.Senthamil Selvi and colleagues[1], and the purpose of this research was to assess the attendance in a classroom lecture by employing position and face descriptions. The researchers projected the presence of students in the room using facial recognition technology while the professor was speaking. The system observed and documented the presence of each student as well as their whereabouts in a continual fashion. The results of this experiment showed that conducting continual inspections improved the precision of attendance estimate.

The concept of a "Student Attendance Recording System Using Face Recognition with GSM Based" was suggested by Mr.C.S.Patil and colleagues[2]. An investigation of and the implementation of a student identification system that makes use of facial recognition technology have both taken place. Several different images of people's faces were used to test the system. The system has been tested on a variety of hardware platforms and operating systems, and it has been found to perform well in each case. However, in order for face recognition to be deemed a trustworthy biometric for identification, it is essential that the detection accuracy be improved by addressing aspects such as lighting conditions and facial positions. Only then will facial recognition be able to compete with other forms of biometric authentication. In addition, it is anticipated that future developments in this area will concentrate on the use of video analysis methods and the incorporation of sophisticated 3D face models.

The concept of a "Face Detection System for Attendance of Class Students" was suggested by Muhammad Fuzail and his colleagues [3]. An attendance monitoring system is essential for every organization, but the vast majority of the solutions that are currently available are laborious and call for human input from either the teachers or the students. By including face detection into the process, our technique is able to overcome these difficulties. There is room for development despite the fact that it does not now have the capability to recognize each kid that is there. We are able to attain a good detection and identification rate if we use a modular strategy and continue to refine the many modules that make up that strategy. In addition, considerations of privacy have to be taken into consideration in order to make certain that the image data that has been saved cannot be abused by anybody.

"Implementation of Automated Attendance System using Face Recognition" was suggested by Mathana Gopala Krishnan, et al.[4]. Automated presence systems have been

shown to be successful in overcoming the challenges that are normally experienced with manual attendance monitoring systems. The objective is to design a computerized system that will be useful for many kinds of organizations. Traditional ways of manually recording attendance in an office setting will be replaced by this technology, which attempts to improve the accuracy of the process while simultaneously increasing its efficiency. This method is risk-free, dependable, and simple to use, and it does not involve the use of any specialist gear. A camera and a computer are all that are required to put it into action.

Principal component analysis was suggested for the "Attendance monitoring system using Image processing" by Divya Singh and her colleagues [5]. The system used projected faces on a feature space that included the substantial variances among recognized face images in order to record the attendance of the students. This allowed the system to accurately record the students' attendance. "Eigen faces" is the term that's used to refer to noteworthy characteristics like these. This method has a number of benefits, one of which is that it can record attendance by identifying certain facial Eigen characteristics. However, in order for this system to work well, it is necessary to have the right lighting conditions present. This is one of the system's drawbacks.

"An Automatic Attendance System Using Image processing" was the title of the proposal that Aziza Ahmedi and her colleagues [6] made. The system makes use of a camera to capture a video of a class, which is subsequently sent to an administrator server through a web service. The video may be viewed at any time. Both the Local Binary Pattern (LBP) and the Histogram of Oriented Gradients (HOG) are used in the process of extracting facial characteristics. These features include the eyes, the nose, and the mouth. A classifier known as a Support Vector Machine (SVM) is then used to do an analysis on these attributes. One of the benefits of using this technology is that it can automatically record the attendance of those whose faces it recognizes. However, it has the disadvantage of conducting recognition one item at a time rather than in parallel, which results in the demand of a large amount of time.

Pooja G.R and colleagues [7] introduced the Viola Jones Framework Algorithm for "Automated Attendance System Using Image Processing." The setup consisted of a video camera that was positioned at an elevated place in a classroom in order to capture video frames. Following the extraction of facial images with the use of HAAR characteristics, the Gray-Level Co-occurrence Matrix (GLCM) was used to do the necessary analysis on the data. The use of this method has the advantage of reaching a detection rate of 90 percent and a recognition rate of 80 percent.

In the Automated Attendance System that Prof. Sumita Chandak et al. [8] suggested for "A Prototype of Automated Attendance System Using Image Processing," the facial images are retrieved by utilizing the Viola-Jones method. This system was developed for "A Prototype of Automated Attendance System Using Image Processing." This method provides a number of advantages, such as the generation of detailed reports about students whose attendance has been noted and the subsequent emailing of those reports to the appropriate instructors. In addition, if a student's attendance is unsatisfactory, a message via SMS is sent to the student's parents. On the other hand, this system has several limitations, such as the fact that it is able to identify and flag fake photos and even recognize mock faces.

"Automatic Face Naming by Learning Discriminative Affinity Matrices From Weakly Labelled Images" by Shijie Xiao et al. [9] developed an affinity matrix and a low-rank representation. In order to recognize and categorize the individuals whose faces have been found within the photographs that have been taken, the system use machine learning algorithms and face detection methods. The fact that this system can automatically provide names to the people who use it is one of the advantages of using it. On the other hand, one of the possible drawbacks of the system is that it necessitates training for those who do not have a widespread reputation or are not renowned.

Utilizing Principal Component Analysis (PCA) to extract Eigen-images, more especially Eigen faces, is a strategy that was offered by Janarthany Nagendrarajah[10] to solve this difficulty. This approach has been suggested. Following that, the recognition process makes use of the weights that this representation provides. During the enrollment phase of the system, only one image of each individual is saved to minimize the trouble of storing several images of the same person. This is done to make the system more commercially viable (for example, for use at immigration offices). Individuals are instructed to have their hair pulled back and a neutral look on their face during this step of the process. In order to validate the model, a large and varied library of photographs of people from many countries, including English faces, was employed. Even though some of the people who were registered wore eyeglasses, the security system was still able to accurately recognize them. However, work is currently being done on the project to improve its ability to distinguish obstructed images in real-world settings.

Steven Fernandes and other researchers [11] The algorithms that are currently utilized for facial recognition were subjected to a comprehensive analysis and review by the researchers. Their objective was to come up with a fresh and reliable algorithm. To do this, they examined the efficacy of a mixture of appearance-based approaches,

especially Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), using the ORL and Sheffield datasets. This allowed them to achieve their goal. It was discovered that PCA performed better than LDA when it came to distinguishing persons, even when there were disruptions in the background. In addition to this, the PCA demonstrated quicker identification speeds. As a consequence of this, the researchers came to the realization that PCA and the many variants of it are the most efficient face recognition algorithms.

Yugandhara M. Bhoge et al [12] [Citation needed] The algorithms for detecting and recognizing faces, which go by the names Viola Jones and PCA (Principal Component Analysis), respectively, are very effective and precise. PCA works with matrices produced from images rather than the images themselves, while Viola Jones focuses on recognizing faces by analyzing the differences in position of pixels inside rectangular boxes. PCA works to speed up matrix computing by reducing the size of the original image face database. This is accomplished by extracting distinctive characteristics of the images, which are referred to as Eigenfaces. This reduction is accomplished by generating a database with fewer dimensions that is decreased in size.

## II. RESEARCH METHODOLOGY

### Research Objective:

- To develop a system that can capture the images of the objects and then it can use that data for further processing, depending on the nature of application. Image processing technique will be used to Identify & Recognize objects.
- To design a classifier that can classify the captured images with the database based on their different attributes by using Machine Learning.
- To give output based on the classified data in the database and generate results as per the application used.
- To provide user with the result in some of the applications, like in Attendance Monitoring System user will be notified via an app whether his attendance is marked or not.

**Research Type:** The type of research that is going to be implemented in this methodology is of Hybrid nature, where we are going to do data collection as well as some experiments on the data as well, with the help of technologies like Image Processing & Machine Learning.

**Proposed Research Methodology:** This new system can ease the hectic attendance maintenance and will make attendance monitoring more precise and efficient. Further, Machine Learning will be used to match the data captured through the image and the concerned staff/student will also be notified via software application that their attendance is

marked. The system will be developed in such a way that it can be used for other applications also, especially in the area of agriculture & medical. The proposed methodology is as below:

- **Data Collection:** The Data collection for the research will be done with the help of captured images through the camera, recorded videos. In case of the failure of camera, subject can also send his/her image to the system for the attendance.
- **Data Processing:** After capturing the images, data will be send to the database and there it will be matched with the existing database. In case, the image is not clear or there is some missing features then it can be resolved with the help of other software. After resolving all the issues, Machine Learning will be used to match the data with the existing database and if it matches correctly then attendance will be marked for the particular user.
- **Output:** After completion of all the data processing, the attendance for the particular user will be marked in the system and it will also be informed to user via mobile application that his/her attendance is marked for the day.

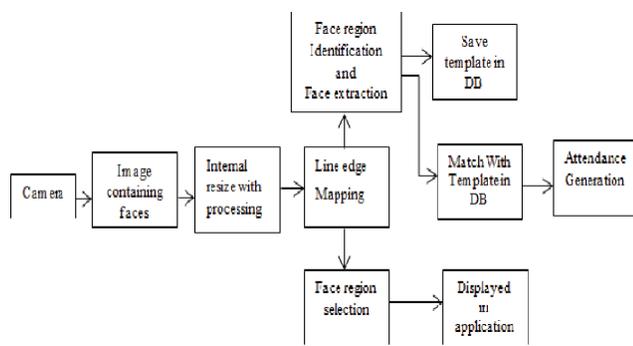


figure.2. Basic architecture of Proposed Methodology

### III. CONCLUSION

The implementation of image processing in attendance monitoring offers a solution to address the challenges and intricacies associated with manual record-keeping. The conventional approach is both time-consuming and susceptible to false attendance records. To overcome these issues, an automated attendance monitoring system has been developed. This system captures images of individuals (students/staff in this context) and records their attendance. Unlike the traditional manual method, which is prone to marking false attendance, our system utilizes camera technology to detect facial features and body movements/gestures, allowing for accurate attendance tracking through the use of machine learning techniques. In our system, we will also try to develop a mobile application which will further provide the notification to user that his attendance is marked and it will also keep the

record of all the data. Further, the system can be enhanced and can also be used for other different areas as well, like – agriculture, security, medical etc. As various studies have shown that these areas can also be exploited using the image processing and machine learning.

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