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# Attendance System Based on Face Recognition

**Md Serajun Nabi, Akibu Mahmoud Abdullahi**
*School of Computing and Informatics, Albukhary International University, Malaysia.*
*kibu.abdullahi@aiu.edu.my*

ABSTRACT

Face recognition is one of the most important applications of image processing in the technical world. The process of identifying students using a face biostatistics system based on high-definition monitoring and other computer technologies is called a face recognition attendance system. A machine learning algorithm (Convolutional Neural Network) has been proposed to utilize the system in this paper. The identification of the human face is a current problem for verification purposes, particularly in the context of student attendance. The methods used today to take attendance are cumbersome and time-consuming. Manual recording makes it simple to alter attendance data. Both the current biometric methods and the conventional method of keeping attendance are susceptible to proxies. The development of this system aims to digitally replace the outdated method of taking attendance by calling names and keeping handwritten records. The proposed system for this research will help the students get enough time to focus on their studies, which can make them good contributors to our society.

*Keywords:* face recognition, student, database, and social business.

## 1.0 INTRODUCTION

Face recognition is a biometric technique that uses data on the characteristics of the human face to identify people. Utilizing a camera or camera to capture a picture or video stream including a human face, then automatically detecting, and tracking the face in the image, and finally the face of the identified face using a number of related technologies, is also known as "portrait recognition" or "facial recognition" (Smitha et al., 2020).

Since the beginning of time, faces have been used to identify people, and as technology has advanced significantly, a smart society has been established. The human face is a vital part of the human perception system in commonplace scenarios like surveillance, access control, and criminal identification. Since face recognition is seen as the most crucial aspect of computer vision and picture analysis, more research is done on it and its different subsystems, such as creating new ways to properly detect and organize faces or upgrading existing algorithms. Over the past several years, it has been more important to have a reliable security system that can safeguard our assets in the best and safest manner possible (Saha, 2018). Carrying a photo ID on campus could soon be obsolete due to developments in artificial intelligence that have made face recognition technology practical and worthwhile to use on campuses. Smartphone users may already gaze at their phones to unlock them. Facial recognition will soon make it possible for classroom analytics based on audience responses during lectures and better-than-ever campus security on college campuses.

### 1.1 Problem Statement

Security systems are becoming more crucial in the modern world (Ferdinando, 2022). Security issues are now the subject of substantial study across several computer vision areas. According to the previous attendance management system, the key issue is the accuracy of the data that was collected (Ferdinando, 2022). This is due to the chance that the attendance may not have been individually recorded by the original person; in other words, a specific person's attendance may have been recorded by a third party without the institution's awareness, undermining the accuracy of the data. For example, if student or employee X is too lazy to attend a particular class or session, student or employee Y may have helped him or her in signing for the attendance even though student or employee X did not actually attend the class or office. Because there was no enforcement process in place, the system chose to disregard this problem. The old systems are unreliable because they are susceptible to theft and loss. Passwords and ID cards might be lost, stolen, or even misplaced, even if the previous system is burdensome. supposing it takes a person a minute to mark their name as present on a 3–4-page name list. The number of people who can sign their attendance in an hour is only approximately 60, which is obviously inefficient and time-consuming.

Access security solutions must thus advance to become more secure. The flaws in traditional systems need to be constantly fixed. Biometric technology is one of the most secure authentication techniques now accessible since it provides a higher level of security than conventional systems. A face is regarded as being exceptionally secure because it cannot be removed, borrowed, or faked in any way to gain entry to a facility.

### 1.2 Objectives

This paper aims to create an innovative attendance system utilizing face recognition technology. The objectives are includes:

- To examine the technique of real-time video-based student face recognition.
- To construct a smart attendance system using Convolutional Neural Network (CNN) algorithm.
- To assess and analyze the performance of the implemented smart attendance system.

### 1.3 Contribution in Social Business

The proposed attendance system based on face recognition has the potential to make a profound contribution to society, particularly in the field of education. By streamlining the attendance process, it enables students to mark their attendance quickly, accurately, and effortlessly within a matter of seconds. This eliminates the need for teachers to spend valuable class time manually taking attendance, allowing them to allocate more time towards delivering knowledge and engaging with students. The system ensures the utmost accuracy in attendance records as the data is securely stored in a database. Students cannot skip classes without the lecturer's permission before the class finishes, as their entry and exit times are continuously recorded. This feature not only encourages punctuality and accountability but also enables school management to monitor lecturers' attendance and presence in the classroom.

Moreover, the face recognition technology employed in this system has broader implications for school safety and student well-being. In addition to identifying strangers on school property, it can also track the movements of students. This information can be utilized to identify students who are frequently absent and target them for necessary interventions. By addressing the underlying reasons for absenteeism, such as personal challenges or disengagement, the system aids in improving overall student attendance, which in turn can lead to improved academic performance.

Furthermore, the face recognition technology can be leveraged to enhance other aspects of school safety, such as identifying

students who may be at risk of violence or bullying. Early detection of such risks allows for targeted support and interventions, promoting a safer and more inclusive learning environment. Additionally, the system can assist in monitoring student participation and engagement, enabling educators to identify students who may require additional support or customized teaching strategies.

By combining the convenience and accuracy of face recognition technology with the goal of enhancing education, this innovative attendance system fosters a more efficient educational ecosystem. It not only empowers students and educators but also contributes to the broader societal objective of nurturing well-educated individuals who can positively impact their communities and drive social progress.

Taking all of these factors into consideration, the attendance system based on face recognition has the potential to revolutionize traditional attendance management, providing tangible benefits to students, teachers, educational institutions, and society at large. By embracing technological advancements and prioritizing social impact, this innovative solution paves the way for more efficient educational practices and a brighter future for our society.

## 2.0 LITERATURE REVIEW

Kawaguchi and Shoji (2021) proposed a method that combines face recognition with continuous observation using support vector machines (SVM). The system introduced by the authors utilizes an active student detection method (ASD) and two wall-mounted cameras. One camera serves as a sensing camera to estimate the students' seating positions in the classroom, while the other camera is a capturing camera used for face recognition. The authors suggested a shooting strategy that involves predicting a seat based on the seating area identified by ASD and then capturing an image of that seat using the capturing camera. The estimation of the number of students is achieved through techniques such as inters frame and backdrop subtraction. Additionally, the authors addressed the relationship between students and seats by solving the linear sum assignment problem.

A face recognition system was proposed by Zulfiqar et al. that uses the Viola-Jones face detector to detect faces in an input image and a pre-trained Convolutional Neural Network (CNN) to automatically extract facial features for recognition. A large collection of subject facial photos was compiled for effective convolutional neural network training, and it was supplemented with more photographs for each subject and with different lighting and noise levels. Additionally, an enhanced pre-trained CNN model and a set of hyper-parameters were experimentally selected for deep face recognition. With an overall accuracy of 98.76%, the effectiveness of deep facial recognition in automatic biometric identification systems was shown in encouraging testing results (Zulfiqar et al. 2019).

Shubhobrata et al., used a convolutional neural network (CNN) in order to get low dimensional features because the pre-processed photos are too high dimensional for a classifier to use as input directly. They have employed the Viola and Jones method for face detection, and a correlation tracker has been utilized to track the face from frame to frame. The author has worked on a number of characteristics in this study, including pose estimation, sharpness, resolution, and brightness. The three-angle roll, yaw, and pitch are used to calculate the head position. The following method comprises calculating a final score for the face quality assessment by giving each of the normalised parameters a weight (Bhattacharya, et al. 2018).

A computer programme called face detection locates and measures the human face in any given (digital) picture. Any other items in the digital image, such as trees, buildings, bodies, etc., are disregarded in favour of the face features. Face localization may be thought of as a more generic kind of face detection. Finding the positions and dimensions of a known quantity of faces is the goal of face localization (usually one). Basically, there are two different approaches—the feature-based approach and

the image-based method—to identifying face features in a given image. The feature base technique aims to extract features from the image and compare them to the characteristics of the face. A computer programme called face detection locates and measures the human face in any given (digital) picture. Any other items in the digital image, such as trees, buildings, bodies, etc., are disregarded in favour of the face features. Face localization may be thought of as a more generic kind of face detection. Finding the positions and dimensions of a known quantity of faces is the goal of face localization (usually one). Basically, there are two different approaches—the feature-based approach and the image-based method—to identifying face features in a given image. The feature base technique aims to extract features from the image and compare them to the characteristics of the face. Instead of working directly with color photos, gray scale representations are employed for extracting descriptors since doing so simplifies the method and uses less computer power. In this instance, color offers no value, and adding further information can raise the quantity of training data needed to attain a certain level of performance. The assumptions proposed weren't found to be sufficient for face recognition since they are too rigorous for generic object recognition. The aforementioned factors are taken into account when creating the suggested system (Shivam & Bharadwaj, 2013).

Lukas, S., Mitra, A., Ririn Ikana Desanti, & Krisnadi, D. proposed a method for the student attendance system in the classroom utilizing facial recognition algorithms by combining discrete wavelet transforms (DWT) and discrete cosine transforms (DCT). These methods were utilized to extract the student's facial features, and then Radial Basis Function (RBF) was applied to categorize the facial objects. The accuracy rate for this method was 82% (Lukas, et al. 2016).

Seifedine Kadry, & Khaled proposed a Daugman's algorithm-based Iris recognition system. An iris recognition management system is used by this system to acquire, extract, store, and match iris recognition images. However, it might be difficult to build transmission lines in places with poor topography (Chintalapati & Raghunadh, 2013).

The literature review provides a comprehensive analysis of the existing research and studies related to the topic of the attendance system based on face recognition. In order to present a concise summary of the literature, a table has been prepared, highlighting the key findings and insights from the reviewed sources. This summary table serves as a valuable reference, offering a condensed overview of the relevant literature in this field.

TABLE I
Summary of Literature Review

| Author | Year | Title | Summary |
|---|---|---|---|
| Lukas et al. & Seifedine Kadry & Khaled | 2020 | student attendance system in the classroom & A Design and Implementation of a Wireless Iris Recognition Attendance Management System | The system can recognition of student's activities inside the classroom with attendance. As well as the authorities can see the students' activities from time to time. |
| Kawaguchi & Shoji. Edy Winarno et al., | 2021 | Face Recognition-based Lecture Attendance System & Attendance System Based on Face Recognition Using Hybrid Feature Extraction Method. | The system can take the attendance at the middle time of the lecture with the present lecturer in every single classes. |
| Jomon, J,. & Zacharia | 2019 | Automatic Attendance Management System Using Face Recognition | In this method the author used PCA algorithm which can |

| | | | |
|---|---|---|---|
| | | | detect the student faces within 3 seconds. |
| Fuquan Zhang & Mohammed Fuzail et.al. | 2017, 2014 | Research on face recognition method based on deep learning in natural environment & Face Detection System for Attendance of Class | The person needs to stay in front of camera for a while until the camera can detect the face. |
| Zulfiqar et al. | 2019 | Deep Face Recognition for Biometric Authentication | The system can recognize the person faces with wearing glasses within five seconds. |
| Varadharaja n al., & Shireesha Chintalapati & M.V. Raghunadh, | 2016, 2013 | Automatic attendance management system using face detection & Automated Attendance Management System Based on Face Recognition Algorithms | The author gives an idea for face recognition system using Eigenfaces model that can detect the human face within 7 seconds. |
| Shubhobrat a et al., & Rathod, Hemantkum ar, et al. | 2018, 2017 | A Face Recognition based Attendance System for Classroom Environment & Automated attendance system using machine learning approach | The system can detect the faces as attendance for twice when the person come in and go out. Therefore, the coming and outing time can record on the database. The author used CNN algorithm to implement this system. |

## 3.0 METHODOLOGY

The methodology employed in this paper outlines the approach taken to develop an attendance system based on face recognition. The key technique utilized is Convolutional Neural Networks (CNN), which enables the extraction of facial features from real-time video. By leveraging 68 facial landmarks, CNN generates 128-dimensional encodings representing facial features in the RGB format commonly used in digital cameras and scanners (Navdeep Singh Gill, 2023). These encodings are then compared to identify matches, with the ability to adjust the level of strictness through a tolerance value. The paper highlights the technical approach undertaken to implement the face recognition-based attendance system.

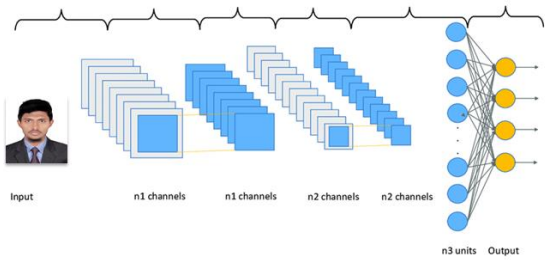


FIGURE 1
Convolutional Neural Network works flow for image processing (Pokhrel, 2019)

In Figure 1, the image displays various colors based on the red, green, and blue (RGB) color plane. Images can be represented in different color spaces, such as RGB and grayscale. Handling images with large dimensions, such as 8k (7680x4320), can be challenging. Convolutional Neural Networks (CNNs) offer the advantage of reducing image dimensions while preserving important features,

which improves prediction accuracy. This capability is particularly valuable when designing architectures that can handle large image datasets and learn distinctive features. Convolutional layers play a central role in CNNs, as they apply filters to input data and generate activations. Consequently, input images exhibit highly discernible characteristics that can be recognized effectively.

By incorporating these layers and their respective functions, the convolutional neural network can effectively process and analyze image data for various tasks, such as face recognition or image classification.

### 3.1 Preliminary Findings

Face detection is defined as finding the position of the face of an individual. Locating the facial region in an image is another way to describe it. Face detection is a crucial initial stage in face recognition because it allows for the extraction of facial characteristics that may be used for a variety of purposes, including face identification, facial expression recognition, observation systems, and human computer interfaces. The face recognition algorithm can only work after identifying faces. The process of face detection itself is complicated by factors including the environment, a person's posture, illumination, and more. For face detection, there are various known approaches. Some of them are based on features like the mouth, nose, and eyes, as well as skin color, characteristics, and neural networks.

### 3.2 Dataset

The dataset of this proposed system will be taken from the students' attendance, which will be number of 15 students attendance records from Bachelor of Computer Science final year students. Once the students enter the classroom, the camera will detect their faces as the attendance in the database and those data will be used for train the model.

### 3.3 System Process Flow

In Figure 2, the system process flow is shown. When the system is ready to work, it offers one way to do the recording, which is automatic capture of the image once the students come into the area, e.g3 meters. When recording the images, it is preferred to take eight pictures of one person in different positions. For every picture taken, the system determines if it has managed to identify the face, and if it has, it will be saved in the database. If it cannot recognize the face, it will say that identification was not possible.

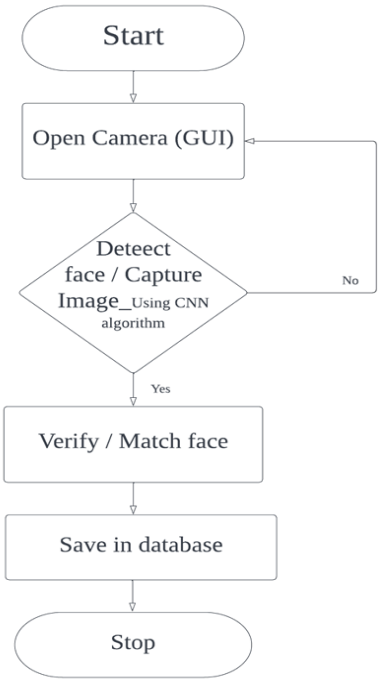


FIGURE 2
System process flow

### 3.4 System Architecture

The approach of the paper includes the following system architecture, as depicted in Figure 3. The system involves several components, namely the teacher, camera, student, database, and an Excel file. The process flow begins with the camera capturing an image of a student's face, which is then converted into a digital format. The captured image is subsequently subjected to

facial recognition algorithms, specifically Convolutional Neural Networks (CNN), for comparison with a database containing previously enrolled student images.

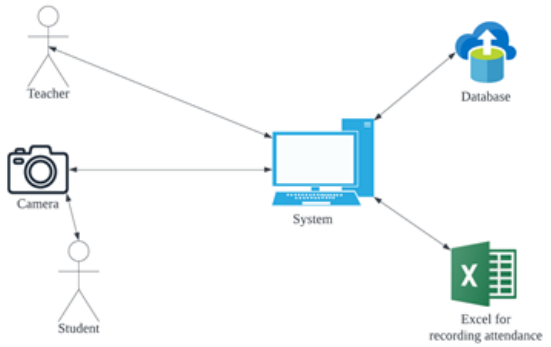


FIGURE 3
System architecture

The purpose of this comparison is to determine whether the student's face can be identified. If successful, the student's attendance is marked in a database or Excel file. The attendance records can be accessed by the teacher, who retrieves the data from the Excel file. Additionally, the system generates reports that provide information such as attendance records, including student names, student IDs, programs, and dates. These reports aid in monitoring attendance patterns over time, identifying students who have missed class, and assisting teachers in tracking student progress.

## 4. PROPOSED SOLUTION

In Figure 4, when the students enter the classroom, their faces are detected by the camera as attendance. Face detection is the act of looking for faces in an image that has been provided as input. Once a face has been located, the facial image is cleaned up for easier face identification.


FIGURE 4
Student faces detection throughout the entry in the class

Figure 5 illustrates the monitoring of students' activities inside the classroom using a camera. The camera periodically captures footage of the classroom, allowing school authorities to observe and monitor the students' behavior and actions. This monitoring serves as a means to ensure a safe and conducive learning environment.

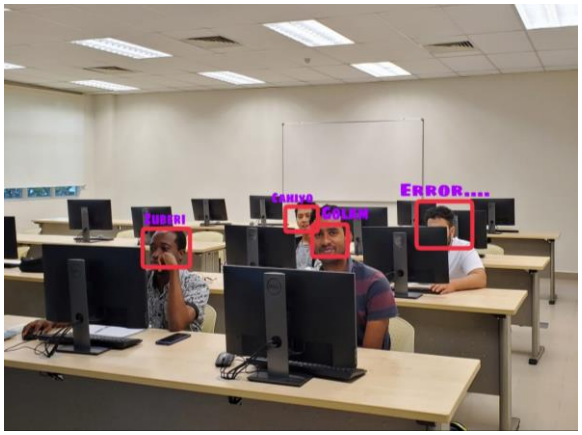


FIGURE 5
Proposed attendance and monitoring solution inside the classroom

By regularly monitoring the classroom activities, school authorities can gain insights into student behavior, interactions, and engagement levels during instructional hours. This information can be valuable in assessing classroom dynamics, identifying areas for

improvement, and ensuring that students are actively participating in the learning process.

Furthermore, the system records the time when students leave the classroom. This feature enables the school authorities to maintain an accurate record of student movement and attendance throughout the day. Tracking the time of student departures can aid in addressing issues related to punctuality, early dismissals, or unauthorized absences. Overall, the integration of camera-based monitoring within the system, as depicted in Figure 4.2, provides a means for school authorities to observe and record students' activities inside the classroom, promoting a safe and conducive learning environment while facilitating efficient attendance management.

After the completion of detecting and processing the face, it is compared to the faces present in the students' database to update the attendance of the students.

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Student's Name | | ID | | Programm | | Time In | Time Out | |
| 2 | Sulayman | | AIU2009201 | | Computer Science | | 8:50 AM | 12:30 PM | |
| 3 | Sofiyan | | AIU2009202 | | Computer Science | | 8:50 AM | 12:30 PM | |
| 4 | Popo | | AIU2009203 | | Computer Science | | 8:52 AM | 12:30 PM | |
| 5 | Anisa | | AIU2009204 | | Computer Science | | 8:52 AM | 12:30 PM | |
| 6 | Golam MD | | AIU2009205 | | Computer Science | | 8:58 PM | 12:30 PM | |
| 7 | Zuberi | | AIU2009206 | | Computer Science | | 9:10 PM | 12:30 PM | |
| 8 | Cahiyo | | AIU2009207 | | Computer Science | | 9:10 PM | 12:30 PM | |
| 9 | Mansour | | AIU2009208 | | Computer Science | | 9:10 PM | 12:30 PM | |
| 10 | | | | | | | | | |
| 11 | | | | | | | | | |
| 12 | | | | | | | | | |
| 13 | | | | | | | | | |

FIGURE 6
Proposed solution of recording student attendance in the database

As depicted in Figure 6, the system records students' attendance in a database along with relevant details. Once the process of detecting student faces is completed, the system proceeds to store the attendance information in the database. This recorded data includes not only the attendance status but also additional details associated with each student.

The database serves as a repository for the attendance records, storing information such as student names, identification numbers, programs, and the corresponding dates. This allows for easy access and retrieval of attendance data when needed. The system ensures that the recorded attendance details are accurately stored in the database for future reference and analysis.

By maintaining a comprehensive database of attendance records, the system provides a reliable and efficient means of tracking students' attendance over time. This information can be used to generate reports, monitor attendance patterns, identify students who have missed classes, and aid in overall attendance management.

## 5. CONCLUSION

In this paper, we proposed the utilization of Convolutional Neural Network (CNN) as a machine learning algorithm for face recognition in the context of a student attendance system. The Facial Recognition Attendance System aims to automate the attendance process, allowing students to allocate more time to their studies while providing teachers with a hassle-free way of managing attendance in the classroom. By implementing this system, students and universities can benefit from improved efficiency and accuracy in attendance tracking. Additionally, this study holds significant social responsibility, as it contributes to enhancing the education sector. The successful implementation of this system can empower educators and positively impact our society, ultimately fostering a brighter future for our nation.

The benefits of the proposed system are:

- Automation makes time monitoring easier, eliminates the need for staff to monitor the system around the clock, and makes human error impossible with automated solutions.
- With a quick and precise identification procedure, a time and attendance system utilizing face recognition technology can reliably record attendance, absences, and overtime.

- In the end, automation will result in more convenience and lower operating expenses.
- Without human error, facial recognition software can precisely manage time and attendance.
- With a face recognition time monitoring system, we will never have to be concerned about time fraud or buddy punching.
- When the system snaps a photo of someone who is not authorized to be in the classroom or at a seminar, it will immediately send out an alert.

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