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COMPREHENSIVE FACE RECOGNITION SOLUTION FOR ATTENDANCE AND SOCIAL SECURITY SYSTEM USING CNN

[i] Md Serajun Nabi, [ii]Golam Md Mohiuddin, [iii]Zuberi Mfaki & [vi*]Akibu Mahmoud Abdullahi

[i, ii, iii ,iv] School of Computing and Informatics, Albukhary International University. Malaysia

*(Corresponding author) e-mail: akibu.abdullahi@aiu.edu.my

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ABSTRACT

Face recognition is one of the most important applications of image processing in the technical world. Face recognition can be used for a variety of purposes, including access control systems, improve security, law enforcement, forensic investigations, health services, identity identification, and so on. The primary purpose of this project is to develop an attendance system based on face recognition for educational institutions to improve and modernize the existing attendance system. Regular attendance logs are vitally crucial to educational institutions, even though they are complicated and time-consuming to operate. There are several automated methods for identifying students, including speech recognition, Radio Frequency Identification (RFID), eye tracking, and biometrics. In today's world, the students are losing their time to get more study and getting trouble in-terms of social security. A face is one of the most frequently utilized biometrics for confirming a student's academic attendance and social security. In this project, face databases were created from the Computer science student of Albukhary International University, as well as the data were preprocessed based on the student full address, such as, name, ID, and program in order to input data into the recognizer algorithm. To implement this system, the machine learning algorithm was trained and test, which is a Convolutional Neural Network and OpenCV library with the accuracy of 94%. The system is capable to successfully recognize multiple students' faces for their daily attendance. The system gives overall accuracy of 94 percent in normal condition with facial expression and wearing glasses but there is some limitation as well,
which are twin faces and with beard. .

Introduction

Background of Study

The monitoring of attendance in educational institution is a crucial aspect in ensuring that students receive a comprehensive education and receive credit for their coursework. Traditional methods, such as sign-in sheets and roll calls, are prone to errors and can be time-consuming. With the advancement of technology, facial recognition has emerged as a potential solution to these challenges. Facial recognition technology uses a computer algorithm to identify and verify a student's identity by comparing their facial features to those stored in a database. This technology has been widely adopted in various industries and is now being explored as a means of tracking student attendance in educational institutions (Saha, 2018). An attendance system based on facial recognition offers several benefits over traditional methods. It is a quick and non-intrusive way of recording attendance, reducing the time and effort required for manual record-keeping. It also eliminates the possibility of students falsifying attendance records, improving the accuracy and reliability of attendance data. This system can also save time for instructors, who no longer must manually take a roll in class or keep track of attendance records (Smitha et al., 2020). However, the use of facial recognition technology in educational institution raises privacy concerns and ethical considerations. The collection and storage of facial recognition data must comply with privacy laws and regulations to ensure the protection of students' personal information. Additionally, there are concerns about the accuracy and fairness of the technology, particularly about marginalized communities who may be more likely to be misidentified by the system.

This paper aims to evaluate the effectiveness and efficiency of a facial recognition-based attendance system for university students compared to traditional attendance methods. The results of this project will provide insights into the benefits and challenges of using facial recognition technology for student attendance and inform the decision-making process for institutions considering the implementation of such a system.

Problem Statement

In today’s era, security systems are becoming more and more important. Several disciplines of computer vision are currently conducting extensive research on the topic of security concerns. According to the prior attendance management system, the accuracy of the data collected is the main problem. This is due to the possibility that the attendance may not be personally recorded by the original person; in other words, a specific person’s attendance may be recorded by a third party without the lecturer’s notice, which undermines the accuracy of the data, because if a student is late to attend a particular class, and another student assisted him or her in signing for the attendance even though that student did not actually attend the class (Yunus Rehana et al., 2016). The system ignored this issue because there was no enforcement procedure in place. The traditional systems are unreliable since they can be lost or stolen. Even if the prior system is cumbersome, passwords and ID cards might be misplaced, lost, or even stolen by unauthorized individuals. Assuming it takes a student about a minute to sign their name on a three to four pages name list as the present, only about 60 students can sign their attendance in an hour, which is plainly inefficient and time-consuming (Fuzail et.al., 2019).

Therefore, the attendance system needs to be more developed to provides a secure, efficient, and accurate solution to the problems faced by traditional attendance tracking methods. Which will be able to offers significant benefits such as real-time tracking, reduced errors, and increased security.

Objectives

The purpose of this research project is to building an attendance system based on face recognition. In order to meet the purpose, the following objectives are referred:

- To analyse the method of recognizing students’ faces from real-time video.
- To develop a smart attendance system using Convolutional Neural Network.

Literature Review

Related Work

This paper's main goal is to examine the many approaches put out by authors in order to create a real-time attendance system that addresses the drawbacks of earlier systems and offers the best answer.

Srilatha, Hemalatha (2020) 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%. Although the accuracy is high but still the detection systems provides some issues relate to capturing the photo for more than one student at the same time, but the author has tested the system using personal computer rather than webcam or so on (Srilatha & Hemalatha, 2020).

Kawaguchi and Shoji, (2021) proposed a method that relies on face recognition in addition to continuous observation using support vector machine (SVM). The author presented a system that uses an active student detecting method (ASD) and two cameras mounted on the wall, one of which is a sensing camera used to estimate where students are seated inside the class and the other of which is a capturing camera used to recognize faces. They have suggested a shooting strategy in which one seat is predicted from the sitting area provided by ASD, and the capturing camera is then pointed at the seat to take a picture. Inters frame and backdrop subtraction are used to estimate the number of students. The authors Kawaguchi and Shoji has provided the relationship of students and seats by solving the linear sum assignment issue.

Joseph and Zacharia (2014) introduced a system based on Matlab that makes use of image processing, principle of components analysis (PCA), eigen faces, and a microcontroller. Only front face images can be used by their system, so an appropriate technique that takes into account the system's orientation is required. Using PCA algorithms, the accuracy wasn't so down but still system can detect the many face at once and save them into the excel one after another. Even, System is able to detect the student face without wifi network.

Bhattacharya, Nainala, Das, and Routray (2018) 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 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 normalized parameters a weight (Bhattacharya et al., 2018).

The research presented in this paper is based on the use of face detection and recognition technology to identify a person based on facial attributes Hybrid Feature Extraction Method (HFEM). This strategy is used to create an attendance schedule based on facial traits instead of the conventional laborious method. The class instructors and students will lose 5 to 10 minutes of class time if the class lasts 50 minutes and standard attendance recording takes 5 to 10 minutes. It can utilize an automatic procedure to call the roll that is based on facial detection and recognition to shorten the time it takes to record attendance or even avoid any time loss from this process. The student's name, picture, and roll number will all be stored in this section of the database. This method of recording attendance is practical and manages the attendance process simply (Edy et al., 2021).

Mohammed Fuzail et.al., (2019) proposed "Face Detection System for Students' Attendance in Class," using K-Neearest Neighbors (KNN) algorithm. Any learning management system (LMS) must have a way for regularly monitoring attendance. The majority of the current systems take a lot of time and require the instructor or pupils to work from a semi-instructional handbook. By using face detection in the process,

this method seeks to explain the problems. There is still tremendous space for improvement even though this approach cannot yet recognize every student present in class. Since we use a modular approach, we can improve on individual modules until we obtain a detection and identification rate that is acceptable. Processes that protect users' privacy are another concern that must be taken into account while considering the potential. If a depiction that you like is saved on servers, it must be hard for someone to use that image (Mohammed et al., 2019)

A face recognition system based on convolutional neural networks (CNN) was proposed by Zulfiqar et al. (2019) that uses the Viola-Jones face detector to detect faces in an input image and a pre-trained 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 percent, the effectiveness of deep facial recognition in automatic biometric identification systems was shown in encouraging testing results (Zulfiqar et al., 2019).

Varadharajan et al., (2016) detailed a system that utilized the Eigenfaces method for face recognition. They have worked on background subtraction for binary and grayscale images after performing face detection, face cropping, and background subtraction. The eigenface approach was employed by the author because of its efficiency, quickness, and capacity for learning and the accuracy was found 88% which gives the best performance where face can detect into the dark as well (Varadharajan et al., 2016).

Shubhobrata et al., (2018) 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 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 normalized parameters a weight (Shubhobrata et al., 2018).

Chintalapati, and Raghunadh proposed the numerous approaches for putting into practice a facial recognition-based attendance. The procedure is divided into two steps. The face detection method is the first, and the face recognition method is the second. The four main elements of the Viola-Jones face identification algorithm, which can display the average attendance of the entire class or a specific student, are the Haar-features, integral graphic, Adaboost algorithm, and cascade function (Shireesha & Raghunadh, 2013).

Rathod, Hemant Kumar, et al., (2017) proposed an attendance system based on facial recognition. The algorithms like Viola-Jones and Histogram of Oriented Gradients (HOG) features along with Support Vector Machine (SVM) classifier were used to implement the system. Various real time scenarios such as scaling, illumination, occlusions and pose was considered by the authors. Quantitative analysis was done on the basis of Peak Signal to Noise Ratio (PSNR) values and was implemented in MATLAB (Rathod et al., 2017).

Comparison of Related Work

Below the comparison of related work shown as a table, where the several authors proposed a method in several years and they used a different algorithm to build the face recognition system.

Table 1: Comparison of related work

Author	Title	Methodology and Related Article	Accuracy
● Srilatha & Hemalatha, (2020). ● Seifedine Kadry and Khaled, (2020).	● student attendance system in the classroom. ● A Design and Implementation of a Wireless Iris Recognition Attendance Management System.	These two systems can recognize of student's activities inside the classroom with attendance using SVM, ANN and KNN algorithm. As well as the authorities can see the students' activities from time to time.	91
● Kawaguchi, (2021). ● Shoji and Edy Winarno et al., (2021).	● Face Recognition-based Lecture Attendance System. ● Attendance System Based on Face Recognition Using Hybrid Feature Extraction Method.	Both systems can take the attendance at the middle time of the lecture with the present lecturer in every single classes. The system used CNN and K-means algorithm	93
● Jomon, & Zacharia (2013).	● Automatic Attendance Management System Using Face Recognition	In this method the author used PCA algorithm which can detect the student faces within 3 seconds.	87
● Fuquan Zhang (2017). ● Mohammed Fuzail et.al., (2014).	● Research on face recognition method based on deep learning in natural environment. ● Face Detection System for Attendance of Class	With the using of SVM and LR, the person needs to stay in front of camera for a while until the camera can detect the face around five seconds.	90
● Zulfiqar et al., (2019)	● Deep Face Recognition for Biometric Authentication	The system can recognize the persons faces with wearing glasses within five seconds using DNN	85
● Varadharajan al., (2016). ● Shireesha & Raghunadh, (2013).	● Automatic attendance management system using face detection. ● Automated Attendance Management System Based on Face Recognition Algorithms	The authors give ideas for face recognition system using Eigenfaces model and ANN that can detect the human face within 7 seconds.	88
● Shubhobrata et al., (2018). ● Daljit, K., (2018). ● Rathod et al., (2017).	● A Face Recognition based Attendance System for Classroom Environment. ● Automated attendance system using machine learning approach. ● Face Recognition for Attendance Management System Using Multiple Sensors.	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, SVM & Decision Tree algorithm to implement this system.	91
● Charan S., & Jahidul, L., (2019)	● Face Recognition based Attendance Management System	The authors used PCA to implement their system. The system is able to detect more than one faces at time within three seconds.	91

The comparison table elucidates the diverse approaches adopted by various authors in their papers and the resultant advancements in accuracy, underscored by the techniques employed. Notably, an observation reveals that a majority of authors have surpassed the 90% accuracy threshold by leveraging CNN and PCA algorithms. Furthermore, some researchers have explored the realm of deep neural networks, attaining accuracy levels exceeding 85%. The summary table encapsulates the profound influence of specific algorithms on accuracy, providing a comprehensive overview of each author's achievement in this context.

Methodology

Dataset

The images of 15 students of Albukhary International University's Bachelor of Computer Science Cohort one is taken using a webcam during the lab exercise class at Negeri Sembilan lab to store in the directory for pre-processing. The photos are cropped to acquire the Region of Interest (ROI), which is used in the recognition procedure. The clipped photos must then be resized to a specific pixel position, and then the images will be saved with the student's names, program, and student ID in the directory as our dataset.

Pre-processing

The collected images were pre-processed to standardize their size, orientation, and lighting conditions. This step was crucial in ensuring consistent inputs to the CNN model.

Model Training

The Convolutional Neural Network (CNN) algorithm was trained using the OpenCV library and the pre-processed images. The training process involved the following steps:

- The input to the CNN model was the pre-processed images.
- The model consisted of multiple convolutional and pooling layers that were used to extract features from the images.
- The features were then passed through fully connected layers that made predictions on the identity of the face in the image.
- During training, the model adjusted its weights through backpropagation to minimize the loss between the predicted and actual identities of the faces.
- The training process was repeated until the loss converged to an acceptable level.

Integration

The trained CNN model was then integrated with the OpenCV library to create the attendance system based on face recognition. The system was able to detect faces in real-time video streams and use the trained model to recognize and identify individuals.

Hardware and Software

- Webcam (HD).
- Monitor
- Powerful (64GB) Micro SD Card.
- MS Excel
- PyCharm

Webcam

In this proposed system, a high-definition (HD) webcam was used with premium price that are capable to provide video image with a sharp appearance. The specifications are: 60-degrees show a single person seated in front of a camera. A field of view of 78 degrees can record two people looking at a camera attached to a computer monitor and 90 degrees for viewed a group of people seated in a conference room, or any other meeting place.

Monitor
The monitor is required component to taking attendance as this proposed system. To view the attendance tracking using camera and to save the attendance in database we need a monitor which is as a laptop or desktop.

Micro SD card
MicroSD cards are utilised to increase the storage capacity of smartphones, drones, gaming systems, and cameras more frequently. Like full-sized SD cards, microSD cards are backwards compatible with hardware devices. Therefore, a 64GB micro-SD card needed for this proposed system to store the student attendance file from database.

PyCharm
PyCharm is one of the easiest platforms for implementing Python programming. PyCharm has been used for Python coding to build the attendance system based in face recognition. Additionally, PyCharm are tightly integrated to produce a practical environment for productive Python programming, website, and data science development.

System Architecture
The system architecture has been shown in Figure 2. Here is the system is generating the directions from one to another, which is including teacher, camera, student, database and excel file.

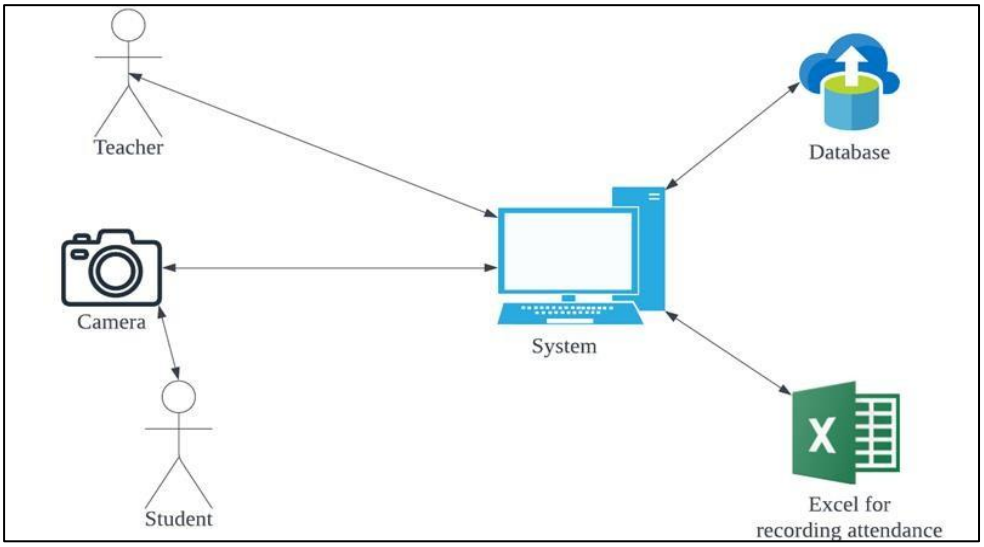


Figure 2: System architecture

The way the aforementioned system process flow operates is by using a camera to take a picture of a student's face, which is then digitally formatted. The student's identity is then ascertained by employing facial recognition algorithms (CNN) to compare this image with a database of previously enrolled student images. A database or excel file is used to record the student's attendance if their identification is successful. By extracting the attendance information from the excel file, the instructor can obtain the attendance records. In order to monitor student progress and track attendance over time, the system also generates reports that include attendance records for each student's name, student ID, program, and date. The general procedure for this face-recognition-based attendance system is to take a picture of the student, compare it to a database of student photos, and then mark the student's attendance if the identification is successful.

System Process Flowchart

In the Figure 3, the diagram "System Process Flowchart" is a flowchart for a face recognition-based attendance system. The process starts with capturing an image of a person's face using a camera. This image is then passed to a person face detector to ensure that the image captured is indeed a face and not any other object using Python 's OpenCV library.

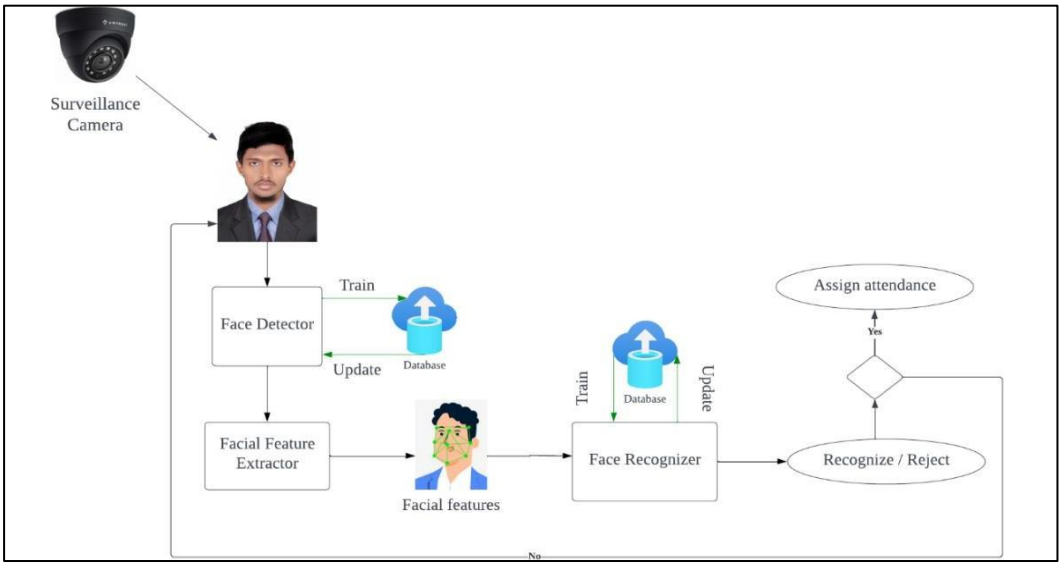


Figure 3: System process flowchart

Once the face is detected, the image is stored in a database to train and update the face recognition system. The next step is to extract the facial features of the person, which includes unique characteristics such as the shape of the eyes, nose, and mouth. The extracted facial features are then passed to a face recognizer, which compares them with the facial features of people in its database. If the face is recognized, the system assigns attendance to that person. If not, the system rejects the image and the person's attendance is not recorded.

Results and Analysis

The system has a faculty authentication system, and the faculty must register the student with their name, student ID, and program. The faculty only takes one picture sample of a student at registration. Once each student has registered their details then the system starts to operate automatically by pressing the start button.

In the Figure 4, the camera successfully detects a student face and displays the name and ID, it signifies the successful operation of the face recognition system. The process of recognizing a face involves several key steps. First, the system uses a face detection algorithm (CNN) to locate the face in the video frame captured by the camera. Then, the extracted face region is processed to extract unique features such as texture, colour, and shape that is used to represent the face. These features are then fed into a machine learning algorithm which performs the classification task to determine the identity of the student. This is typically done by comparing the extracted features with the stored features of enrolled students in the database to find the best match. Once the student's identity is determined, the system displays their name and ID on the screen, confirming the successful recognition. This process should be fast and efficient, allowing the system to recognize multiple faces in real time and accurately keep track of attendance.

Figure 4: Capturing student face

In Figure 5, the camera is capable of detecting and recognizing multiple student faces at the same time, even under varying lighting conditions and angles. This is made possible through the use of machine learning algorithm Convolutional Neural Networks (CNNs), and OpenCV library. The system employs a face detection algorithm to locate multiple faces in a single video frame, and then processes each face region using feature extraction methods to generate a compact representation of the face. These features are then fed into a CNN, which performs the classification task to determine the identity of each student. By training the CNN on large datasets of faces, the system can learn to recognize faces under different lighting conditions and at different angles, allowing it to accurately identify multiple students in a single video frame. An essential component of the face recognition attendance system is its capacity to identify and identify numerous faces under various lighting conditions. This feature makes it possible for the system to reliably identify students and monitor attendance even in difficult situations. Because of this, the system is a dependable and practical solution for academic or educational institutions' attendance problems.

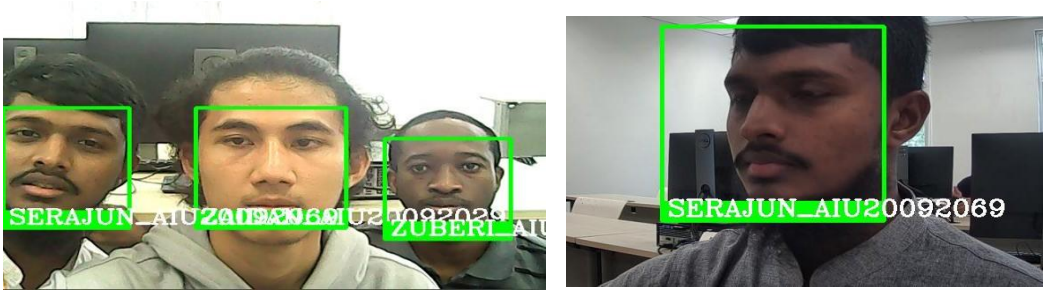
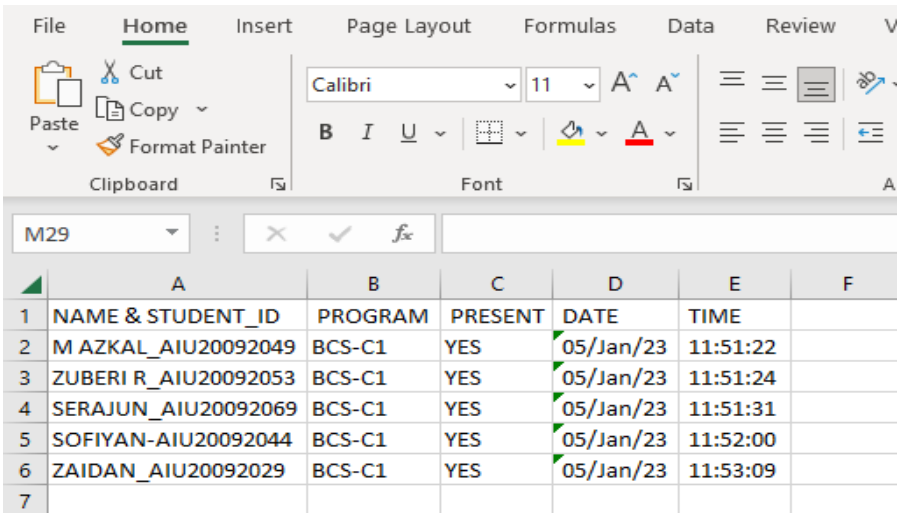


Figure 5: Detecting multiple faces, from different angle in light and dark condition.

In the Figure 6, the system automatically generated an Excel file with students' attendance. The excel file contains the attendance information of all the students who were present during the specified period in the class. It includes the Name, Student ID, and Program, Present or Absent, Date, and Time of each student's attendance. The file is organized in a clear and easy-to-read format. In addition to providing an accurate record of attendance, the generated excel file reduces workload and removes the possibility of human error while monitoring overall attendance patterns and student attendance. Thus, the face recognition attendance system effectively creates an excel file containing the attendance data, offering a practical and effective way to record attendance and produce reports with student information.



	A	B	C	D	E	F
1	NAME & STUDENT_ID	PROGRAM	PRESENT	DATE	TIME	
2	M AZKAL_AIU20092049	BCS-C1	YES	05/Jan/23	11:51:22	
3	ZUBERI R_AIU20092053	BCS-C1	YES	05/Jan/23	11:51:24	
4	SERAJUN_AIU20092069	BCS-C1	YES	05/Jan/23	11:51:31	
5	SOFIYAN-AIU20092044	BCS-C1	YES	05/Jan/23	11:52:00	
6	ZAIDAN_AIU20092029	BCS-C1	YES	05/Jan/23	11:53:09	
7						

Figure 6: Excel sheet for attendance

Accuracy

With the refer of appendices 9, the system was tested for several times with CNN algorithms where it's proved 94 percent accuracy. The system was evaluated under a range of circumstances, including lighting, facial expressions, head movements, and students' proximity to the camera. The system has been shown to perform well, even when the images include students with beards and glasses or without them. It was evaluated using real-time images of a classroom with 15 students. The attendance system has been tested in various scenarios and has achieved in Table 2, the following accuracy levels:

- Normal: The system demonstrated a 94 percent proficiency in identifying students' faces under normal circumstances.
- Facial Expressions: The system demonstrated an accuracy of 94 percent in recognizing students' faces even with various facial expressions.
- Wearing Glasses: The system demonstrated an accuracy of 93 percent in recognizing students' faces even when they were wearing glasses.

Table 2: Accuracy

Testing from different view	**Accuracy**
	CNN
Normal	94 %
Face Expression	94 %
Glasses	93 %

Evaluation

The results of the face recognition system using a CNN algorithm and the OpenCV library were evaluated using three accuracy metrics: precision, recall, and F1-Score. The results are shown in Table 3:

Table 3: Evaluation results of the face recognition system

Metrics	**Value**
Precision	94%
Recall	96%
F1-Score	95%

The evaluation result was shown in the table 3. The precision of the system is 94 percent, indicating that 94 percent of the positive predictions made by the system (i.e., faces that were recognized as belonging to a certain individual) were actually correct. The recall of the system is 96 percent, indicating that 96 percent of the faces that actually belong to the individual were correctly recognized. The F1-Score of 95 percent balances the trade-off between precision and recall, providing a single metric that summarizes the performance of the system.

Comparison of the System

Here is a comparison of our attendance system based on face recognition with the Smart Attendance Monitoring System (SAMS) described by Shubhobrata Bhattacharya et al., (2018):

- Accuracy: Both systems use CNN algorithms and have high accuracy, with our system reporting an accuracy of 94 percent and SAMS reporting an accuracy of 94 percent.
- Movement Detection: Our system has the advantage of being able to detect faces even while the students are moving, while the other system is not able to handle such scenarios effectively. This makes our system more versatile and better suited for real-world deployment.
- Glasses Detection: Both systems are able to detect faces even when the students are wearing glasses, which is a useful feature. However, the degree to which each system can accurately detect faces with glasses would need to be further evaluated.
- Detection Range: Our system is able to detect faces within a range of three meters, while the other system does not specify its range. The ability to detect faces from a greater distance can be useful in certain scenarios, such as large classrooms or lecture halls.
- Image Quality: The other system appears to struggle with image quality, particularly when the images are blurry, which can lead to reduced accuracy. On the other hand, our system does not mention this as an issue, which could suggest that it is more robust to changes in image quality.

Based on these comparisons, our system has several advantages over the other system, particularly with regards to its ability to handle movement and its greater detection range. However, further evaluation and testing would be necessary to determine the relative strengths and weaknesses of the two systems in different scenarios.

Conclusion

This system has been successfully implemented to build an efficient student class attendance through recognizing their faces from real-time video and successfully developed a smart attendance system using CNN algorithm. This approach shows a thorough comprehension of the algorithm and a methodical approach to accurately identifying student faces. The proposed system has a face-based attendance marking feature. It uses a webcam to detect faces and then recognizes them and it updates the attendance record and marks the student's attendance in the database, and the facial recognition approach has been applied to track student attendance and improve the system, as well as this system is designed to address the problems with the current manual systems. The system performs satisfactory in various position and variations.

Limitation

Inability to detect twin faces: The system assumes that it will not be able to detect twin faces as no method has been implemented in the system to address this. This means that if two individuals have similar facial features, the system may have difficulty differentiating between them, leading to possible errors in attendance records.

Inability to detect changes in facial appearance: A person's facial appearance cannot be changed by the system, such as by applying makeup or growing a beard. The system might not be able to correctly identify someone if, for instance, their photo was taken without a beard but they appear to the camera with one, which could result in mistakes in attendance records.

Contribution to Social Business

Attendance system based on face recognition has the potential to make a positive impact on society in various ways. Such as:

- It will help reduce the workload of teachers and administrative staff by automating the attendance process. This means that teachers and staff members no longer need to spend a significant amount of time manually marking attendance, which frees up their time for other important tasks such as preparing lesson plans, grading papers, and interacting with students. This will help to improve the quality of education in schools by allowing teachers to focus on teaching and students to focus on learning.
- The accurate attendance records generated by the system can be used for various purposes such as tracking students' academic progress, monitoring their behaviour, and providing feedback to parents. Teachers and administrators can more quickly identify students who are having attendance issues and take the necessary action to support them if they have access to accurate attendance data. In the end, this may result in increased student performance and higher educational standards.
- The likelihood of proxy attendance, a prevalent issue in many educational institutions, can be decreased with the use of this face recognition-based attendance system. When students are marked present when they are not, it can cause inaccurate attendance records and make it more difficult for administrators and teachers to keep an accurate eye on students' attendance. Utilizing facial recognition technology to authenticate students, the system can significantly diminish the likelihood of proxy attendance and guarantee precise attendance records.
- This attendance system can enhance the safety and security of schools by keeping track of who enters and exits the premises. This can help school officials monitor potential security threats and take appropriate measures to ensure the safety of students and staff.

Finally, in the current COVID-19 pandemic situation, our attendance system can help maintain social distancing by minimizing the need for students to touch shared surfaces such as attendance registers. This can help reduce the spread of the virus and ensure that schools remain safe and healthy places for learning. This attendance system based on face recognition has the potential to improve the efficiency and effectiveness of the educational system by saving time, reducing errors, enhancing safety and security, and promoting social distancing. By contributing to a better educational system, our system can have a positive impact on society as a whole.

Recommendation of Future Work

In the future, the system will be used in the Albukhary International University to take around two thousands of students' attendance everyday as well as the system can be used all universities over the world for their student attendance. The system can be cover up the current limitation, which are: might be able to detect twin faces using a particular algorithms or model also may detect the person whose image was taken without beard but now the person has beard. The system can be use in the multi-national company where many employers are work every day. Additionally, our system also can be use in a country during the elections to identify their voters by recognizing faces.

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