Algorithmic approach for automating attendance authentication in online classes

Akanksha Upadhyaya[1], Sonali Vyas[2]

{ akanskha.bhardwaj@rdias.ac.in[1], researcher.svyas@gmail.com[2]}

Rukmini Devi Institute of Advanced Studies, Delhi, India[1],

UPES University Dehradun, India[2]

Abstract. Because teachers who are standing in front of students are better able to recognize faces and voices of students, the Manual Attendance system is able to verify students' presence in the classroom with a high degree of accuracy. The requirement for online attendance as well as validating a student's actual presence during the class became a difficult problem as a direct result of the increase in the prevalence of online education, particularly as a consequence of the COVID 19 epidemic. The method of taking attendance at educational institutions is still the same, whether it's done physically or online. As a result, the primary focus of this work is on the development of a mechanism for verifying the presence of students participating in online classrooms. The problem has been approached from an algorithmic standpoint in order to suggest a solution to it. The algorithm has been suggested after taking into consideration a number of important criteria, such as the entry and exit timings, the total number of minutes of presence, and the number of times that a student exits the class. The method is an attempt to offer a simplified version of the authentication system for use in online classes. These classes are typically held utilizing online platforms like Google Meet, Zoom, or Microsoft Teams, amongst others. The educational institutions will be able to eliminate the need for manual attendance recording and verify the students' participation in the online class if the proposed algorithm is put into action.

Keywords: attendance, online classes, online education, online meeting tools, authentication, educational institutes.

1 Introduction

The regularity of student attendance is a problem for educational institution administrators in our nation and around the world. Academics in higher education are rising to the challenge of employing web-based or online learning to offer coursework. Numerous websites claim that most colleges regularly provide students the chance to receive schoolwork online. Universities are revising their strategic plans to include online learning as the Internet/Web has emerged as a significant change agent in higher education. The focus on the Web in learning environment

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research is timely given the rise in online courses [11]. Information and communication technology assist us in creating effective solutions that can quickly address challenging daily issues. Only when a learner is serious about their studies can learning become effective. One of the biggest issues facing educational institutions is absenteeism because not everyone utilises the efforts made by the professors and institutions. One of the key factors in determining a student's success is attendance; by routinely attending class and other course activities, a student's performance can be improved [10].

Considering the importance of student attendance and in order to assist universities and other educational institutions in automating student attendance activity, this paper suggests an algorithm. The proposed algorithm makes it difficult for students to enter inaccurate data, or inaccurate presence into the server and very difficult for an enemy to mimic..

2 Literature Review

[2] Attendance is a key part of each day's classroom evaluation. Managing attendance with traditional procedures like roll calls or signatures can be time-consuming. The teacher usually checks it, although they may overlook certain answers. Face recognition-based attendance system uses high-definition monitor video and other technology to recognise faces for collecting attendance. This study presents a real-time Face Recognition System for tracking student attendance. The suggested solution includes detecting human faces from a camera using Viola-Jones, scaling the recognised face to the appropriate size, and analysing the resized face using a basic Local Binary Patterns Histogram algorithm. After recognition, attendance will be maintained in a SQLite database. This will help many institutions. Time and human errors are reduced, making it more efficient.

[3] This research aims to construct a facial recognition-based attendance tracking system for educational institutions to upgrade their current attendance system. The old system's ambiguity causes erroneous and inefficient attendance taking. When the authority can't enforce previous regulations, many difficulties develop. Face recognition will be used. The human face is a natural identifier.

[4] Computer vision research includes facial recognition. Face recognition is utilised as an attendance system. The attendance system detects and stores faces as a face database. Facial identification is achieved by matching face image data acquired by the camera with face images saved in the face database. The authors shown that face recognition-based attendance system uses CNN-PCA (Convolutional Neural Network - Principal Component Analysis). Combining these strategies should improve feature extraction. This camera's face recognition-based attendance system improves data accuracy. This facial recognition-based attendance system using this camera has accurate data processing and high precision, so it can detect human faces in real-time.

[5] Learning requires persistency in terms of student attendance. Signatures are one technique to document student attendance. Taking attendance takes a lengthy time, the attendance paper is misplaced, and the administration must enter attendance data one by one into the computer. The article presented a face-recognition-based web-based student attendance system. CNN detects faces in photos, deep metric learning produces facial embedding, and K-NN classifies

student faces. Computers can recognise faces. From experiments, the system recognised students who attended and kept their attendance data. So, university management is relieved of attendance recording.

[6] Attendance marking is a tedious job. In this study, we proposed an automatic attendance management system that recognises faces in biometric systems under illumination, rotation, and scaling. This model includes a camera that collects input image, an algorithm to detect a face, encode it, and recognise it, and a database and PDF converter. The camera delivers the image to the server, which recognises faces and calculates attendance. The authors utilised HOG (HOG). The HOG plus LBPH approach to recognise HOG descriptors of individuals is a popular and successful "person detector."

[1] Attendance management is vital for every organisation; it can determine a company's future success. To maximise success, organisations must track employees and pupils. Managing lecture attendance is challenging and also on other hand calculating attendance percentage is time-consuming and error-prone. An efficient Web-based attendance management system tracks student activity for the specified reason. This programme stores attendance records in a database

[7] Regular class attendance plays a big role in competency mapping and quality monitoring in today's academic system. Most institutions use time-consuming and insecure methods like calling names or signing papers. This article describes a convenient and reliable automatic attendance system. The system integrates ubiquitous components to create a portable Face Recognition device for managing student attendance.

[8] Classroom attendance helps student participation and course performance. Calling out names or passing around an attendance sheet is time-consuming and fraud-prone. Alternatives include RFID, Bluetooth, fingerprint, iris, and face recognition. High installation costs are the main downside of these approaches. This research proposes a face recognition-based mobile automatic classroom attendance management system. Face recognition filtering uses Euclidean distances derived by Eigenfaces, Fisherfaces, and Local Binary Pattern. The proposed system includes three mobile apps for teachers, students, and parents to install on smart phones to handle real-time attendance. The proposed system was tested at Ankara University with positive results.

[9] This research proposes a deep learning-based face recognition attendance system in light of recent advances in deep convolutional neural networks (CNNs) for face detection and recognition. The full facial recognition model development process is detailed. This model uses CNN cascade for face detection and CNN for face embeddings. This project aimed to use cutting-edge deep learning techniques to facial recognition. The biggest problem was applying CNNs to smaller datasets, which isn't the case in production. New face recognition image enhancement method proposed. On a small dataset of real-time employee facial photos, accuracy was 95.02%. The proposed facial recognition model could be implemented into another monitoring system with or without minimal changes.

Considering the technologies used by previous researchers, this paper attempts to propose algorithmic approach that can be implemented using any platform and provides assistance to the educational institutions to authenticate the presence of the student during the online classes, even if the student or attendee has turned off the video.

3 Proposed Work

The suggested algorithm offers a straightforward method for automatically marking attendance and validating whether or not a student is present in the classroom. When attending classes that are held online, it is common for students to join the link and then move away from where they were sitting previously. As a result of the fact that it is not always possible to turn the student's video ON due to network issues, this provides a handy way for students to move out of their locations after joining the link. The suggested approach is straightforward in the sense that it makes minimal use of hardware applications and is straightforward to build as a software module. Additionally, it can be done so with relative ease. There are alternative algorithms that are based on more in-depth technological dimensions such as the utilisation of QR-codes, IMEI, GPS, RFID, MAC address, and other similar technologies.

Algorithm:

The steps of proposed algorithm are as follows:

Step1: Input as "Entry time of each student" from log record.

Step2: Based on scheduled duration of meeting set "Minimum time to attend" (Min), "Maximum no. of exit as Frequency" (F) and "Exit time allowed" (E), "Response" (Res).

Step3: Calculate total number of minutes (T) attended.

Step 4:

If T >=Min

Set Status "P"

Else

Go to Step 5.

Step 5: Calculate frequency of exit (FE) and total duration of exit (TE).

If FE > F and TE >E

Set Status "A"

Step 6: Send auto-generated messages at each interval of time: "Do you want to continue?"

If "Yes"

a. Count the number of times user ticked to "Yes" when message appears.

b. Compare it with number of times auto generated messages sent.

i. Calculate rate of response (RR) = Number of times responded Yes/Number of times Auto-generated message sent.

ii. If RR > = Res, Set Authentication of student "True"

Else if RR < Res,

Set Authentication of student "Defaulter"

iii. Go to step 3.

If "No"

a. Resend the confirmation message: "Are you sure you want to exit?"

If "Yes" : Student willing to discontinue the Class,

set Authentication of student "True" and Go to step 3

IF "No": User wishes to remain on class and Go to step 3.

If "No response"

The auto-generated message will disappear in 30 seconds.

Go to Step 6

4 Interpretation of Proposed work

The algorithm requires recording of entry and exit time for each student. Additionally, there is a need to set the value of following parameters:

a. Minimum time to attend, represented by Min

b. Maximum no. of exit allowed as Frequency, represented by F and

c. Exit time duration allowed, represented by E.

d. "Response", represented by Res.

Set the minimum time for attendance in the class based on the length of the scheduled meetings, for example, if a meeting is scheduled for 60 minutes, students must stay for a minimum of 45 minutes. Next, determine the total number of class "T" minutes that each student attended. Compare the value of T higher with "Min" now, and indicate "Present" as the attendance status. Calculate the number of times the student left the meeting (FE) and the length of time (TE) that they were gone (TE) if the value of "T" is less than Min. If the values of FE and TE are greater than F and E, respectively, than record the attendance status as "Absent." Otherwise, compare the values of FE and TE with F and E, respectively. Whether a student is present for class or not, the authentication process will continue by randomly sending them auto-generated messages at various times throughout the class period. When a

student clicks "Yes," the algorithm calculates the response rate and compares it to parameter "R"; for example, if a student was sent an auto-generated message 10 times and only responded to it 7 times, the response rate ("RR") will be 70%. Now, if the Response (Res) was initially set to 60%, the student's authentication would be set to True. If necessary, RR Res will establish student authentication as the default setting and will check the meeting's time limit. If a student selects "No," the system will prompt him or her again to clarify whether they are certain to leave the class. A "Yes" response will authenticate the student's presence and designate the status as Present or Absent depending on the time period. If there is no response, the RR will be recalculated and compared to the response. Authentication status will be set to Defaulter if RR is less than 60%.

The algorithm operates primarily on two dimensions in this fashion. First, depending on length of time and consistency, it automatically assigns the student the attendance status of Present or Absent. Second, it is validating student attendance in the class by guaranteeing their presence throughout the lesson. The major goal of this algorithm's proposal is to confirm whether a student is sitting at the opposite end of the classroom and continually observing the lesson. Periodic auto-generated message transmission will guarantee the opposite end's presence. The algorithm was created taking into account a variety of initialization factors. The remainder of the calculation is straightforward and doesn't call for a sizable number of factors or any kind of hard core technology. Any educational institution can use the algorithm, which can be integrated as a software module for automatic attendance generation and student presence verification, to their advantage.

5. Conclusion and Future scope

The primary objective of this method is to ascertain whether or not the student in question is located at the opposite end of the room and is continuously observing the class. It is possible to confirm one's existence at the other end by periodically sending auto-generated messages. The algorithm was developed taking into consideration a number of parameters that had to be set to their default values at the beginning. The remainder of the calculation is straightforward and does not call for an excessively large number of parameters or any kind of hard core technology. Any educational establishment is able to utilise the algorithm, and it can be incorporated as a software module for the purpose of automatically generating attendance records and confirming that students are physically present at the other end. In this research, an algorithmic solution to online attendance authentication is presented. The algorithm could be improved in terms of its accuracy and its applications through additional implementation.

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