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Recognition and Maintenance of Attendance Management System using Artificial Intelligence over Machine Learning via Biometric System

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Abstract

We are living in an automated world where technical advancements are taking place and devices are connected to cyber. There has been a technical evolution in internet of things, image processing, and machine learning. Drastic change in the systems to achieve the accurate results is the trend. Evolution of Technical advancements has led to changes in education system. Considerable advancements have to be done on the Attendance marking in a classroom during a lecture is not only a onerous task but also a time consuming one at that. Proxy attendance(s) has been increased because of increase in the number of students. The traditional methods aren't efficient way of marking the accurate attendance results, hence an advanced face recognition using the Artificial Intelligence is introduced in this research work. In recent years, the problem of automatic attendance marking has been widely addressed using standard biometrics like fingerprint and Radio frequency Identification tags etc., However, these techniques lack the element of reliability. The attendance system is a typical example of this transition, starting from the traditional signature on a paper sheet to face recognition. This paper proposes a method of developing a comprehensive embedded class attendance system using facial recognition with controlling the door access. In this proposed work an automated attendance marking, and management system is proposed by making use of face detection and recognition algorithms. Instead of using the conventional methods, this proposed system aims to develop an automated system that records the student's attendance by using facial recognition technology.

Keywords: Advancements; Artificial Intelligence; Biometrics; Convolution Methods; Cyber; Face recognition technology; Machine learning

Introduction

Figure 1: Flow Diagram of Student Attendance Management System.

Capturing of attendance using face recognition Technology via Biometric attendance management system is introduced in this paper. As shown in Figure 1, we have designed a Biometric attendance management system, the detailed working of this system has been given under the section Implementation and Methodology . Accessing of attendance information of individual students and evaluating attendance eligibility criteria of a student is the key to this research work. The information's is sorted by the operators, which will be provided by the teacher for a particular class. Daily evaluation of students in their continuous assessment record, and performance in accordance with the principle of the institution can be achieved.

Details such as Name of the student, class, Subject, Attendance percentage, academic semester are the input details that must be inputted. Results will be captured based on the Biometric measure using Face recognition technology. This system can be used through out the academic year. Computerizing the traditional way of taking attendance is the main purpose of this work. Auto generation of the report at the end of the academic year is another important purpose of designing this system.

Both web based and mobile(android) application is available for this software. Educational sectors such as school, University can be considered. This is mainly used while the online academics has been present.

Weaknesses In Current System

1. Not User Friendly: Since the retrieval of the data is very slow and the data may contain missing values or incorrect values the traditional system is not user friendly.
2. Difficulty in report generating: Since manual calculations are required to process the report at the end of the system, efficiency of the obtained value may be incorrect, this leads not only to disperancy in the data that is obtained, but also obtaining incorrect results.
3. Lots of paperwork: Traditional system involves lot of paper work to capture the results, loss of even a single number would cause inaccurate results.
4. Time consuming: Capturing attendance on everyday basis and then totalling to obtain the average days in a month present for each subject in a semester is very time consuming.

User Requirements: The User requirements for the new system are to make the system fast, flexible, less prone to errors and reduce expenses and save time. A system that can automate the checking of answers which are pre-stored so that results can be generated as soon as the student gives the reason. A facility that can generate result charts as per required. The New system should be more secure in managing Student records and reliable enough to be used in any condition. Finally, it should prove cost effective as compared to the

current system. This project focuses on the implementation of the proposed system, i.e., the smart attendance system using OpenCV. The traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking techniques such as calling student names or checking respective identification cards. Hence, there is a need to develop a real-time operating student attendance system which means the identification process must be done within defined time constraints to prevent omission. The extracted features from facial images that represent the identity of the students must be consistent towards a change in background, illumination, pose, and expression. High accuracy and fast computation time will be the evaluation points of the performance. Details of the student such as Name, USN, Ph. Number, Mail ID of the student. The preregistered details of the student are available in CSV file, where in the details are present in prior in advance in CSV file, the student has to get captured in the webcam, once after his or her photo has been recognized and verified with CSV, if the photo of the student captured by the webcam gets verified with the preregistered CSV file, then he or she will be marked as present, otherwise he or she will be marked as absent for the class.

Literature Survey

1. "Web Based Student Information Management", S.R. Bharamagoudar et al., this paper assist in automating the existing manual system. It can be monitored and controlled remotely. This paper provides accurate information always. All years together gathered information can be saved and can be accessed at any time. The purpose is to design a college website which contains up to date information of the college. That should improve efficiency of college record Management.
2. "Attendance Management System G. Gangagowri et al., this system is used Way to SMS software. This software is used to send SMS easily to their parent's. This system can store their data about the students and those cares absent student details. It is an efficient method to store the attendance in the Web Site rather than wasting the paper. It also updates the student report directly on the server reducing the faculty's time on logging from the computer.
3. "Online Student Attendance System", P. N. Garad et al, in this project, we gave access to three users i.e., Admin, Student, Others. This project is based on client-server. Here, the serve is Tomcat and client is JSP. In this project teachers or the admin will be filling attendance and sending message to the student who is absent. They will have privilege to fill attendance form, update attendance form, send message to the guardian's account whose child is absent, also those attendance is less than 75%, and they also have privilege to send message to the students whose fees are pending. The staff can also view the message whenever they want and also can modify the details of students. Parents have privilege to view attendance and to view message sent by the teacher. Students also have their account with the privilege to view message sent by the subject teacher and to view the attendance.
4. "Web Based Coaching Institute Management System", Mayuri Kamble et al, "Coaching Institute Management System" software developed for an institute has been designed to achieve maximum efficiency and reduce the time taken to handle the storing activity. It is designed to replace an existing manual record system thereby reducing time taken for calculations and for storing data. The system is strong enough to withstand regressive daily operations under conditions where the database is maintained and cleared over a certain time of span. The implementation of the system in the organization will considerably re duce data entry, time and also provide readily calculated reports.
5. "Classroom Attendance Application", Pranjul Khare1 et al, the scope of the project is the system on which the software is installed, i.e., the project is developed as an ANDROID application, and it will work for a particular institute. Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google with a user interface based on direct manipulation. RAD approaches to software development have put le ss emphasis on planning tasks and more emphasis on development. It has revealed that an online system for recording and reporting students 'attendances is indeed a needed application in order to make the process more efficient and timesaving where more than 70% of the sample group agreed to that matter.

Methodology

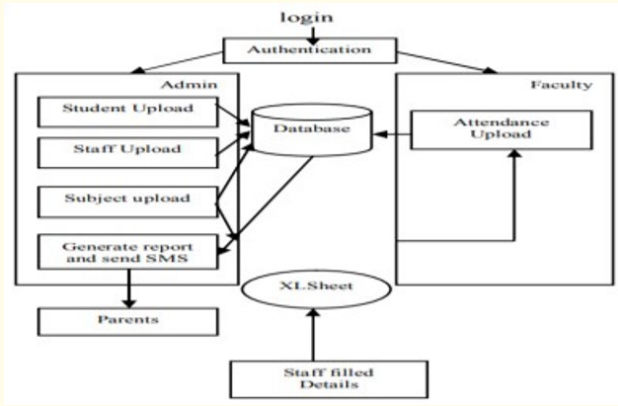


Figure 2: System Architecture.

As shown in the figure 2, we have divided the architecture into 2 blocks, Admin and Faculty. Admin has the access of the uploading the student details such as Student Name, Subject, Generating the report and sending SMS is present on the admin side which is done using Biometric face recognition technology. Faculty does the attendance upload in the database.

Interface Design Objectives

In this work, a software is developed that can recognize the identity of every individual and eventually record down the info into a database system. Apart from that, an interface will be developed to supply visual access to the data. The objective of this project is to develop a Smart Attendance System with Face Recognition.

The achievements to fulfil the objectives are:

- To detect the face segment from the moving video frame.
- To extract useful features from the face detected.
- To classify the features to recognize the face detected.
- To mark the attendance of the identified student.

Software System and Image Processing: The purpose of this module is to receive the incoming information, retrieve data from the database, and compare two pictures. To be efficient the image processing will be implemented and tested in parallel with the other software parts. Once every part is working, the integration phase will be done and testing will be conducted.

1. ***Face detection***: The algorithm will be tested to detect the face on preloaded images and an image taken with a webcam. Different people will take part in the tests and different positions & lighting conditions will make the test cases. The algorithm will handle one face per picture as discussed in our requirement specification.
2. ***Face recognition***: Face recognition is related to the previous module. Once the face is detected the system will try and identify the person. A pre-loaded picture will be stored in the computer and the algorithm should be able to identify the person. Different persons will take part in the test and this iteration is repeated to identify different persons.
3. ***The software solution Database and information retrieval***. A database will be created and filled with some random information for testing purposes.
    - The first testing step after that is to make sure that the connection between the program and the database is secure and reliable. Once the connection is made, a random number with the same format as the tag number will be used to access

the database.

- The second step will be to store an image in the database and to retrieve it using the same number.

4. The software solution –Add image processing.

After retrieving information, a person will try to be identified. A wrong person and the real person will take part in the test.

Implementation

Firstly, the image is imported by giving the area of the picture. At that point, the image is changed from RGB to Grayscale because it is anything but difficult to distinguish faces in the grayscale. From that point forward, picture control is utilized, in which the resizing, editing, obscuring, and honing of the pictures is done if necessary. The following stage is picture division, which is utilized for form location or sections the different items in a solitary picture so the classifier can rapidly distinguish the articles and faces in the image. The following step is to use an algorithm. The calculation is used for finding the area of the human countenances in a casing or picture. All human faces share some all-inclusive properties of the human face like the eyes area is more obscure than its neighbour pixels and the nose district is more splendid than the eye locale.

Figure 3a: Working on Face Detection.

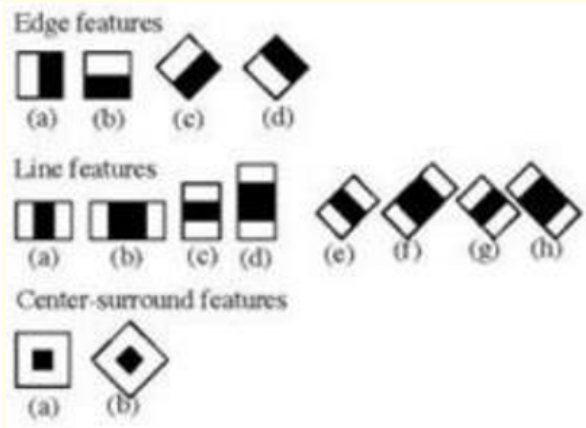


Figure 3b: Edge, Line, Central features.

As shown in Figure 3a and 3b: The hair-like calculation is likewise utilized for highlight determination or highlight extraction for an article in a picture, with the assistance of edge location, line identification, focus detection for recognizing eyes, nose, mouth, and so forth in the image. It is utilized to choose the fundamental highlights in a picture and concentrate these highlights for face detection. The subsequent stage is to give the directions of x, y, w, h which makes a square shape enclose the image to show the area of the face or we can say that to show the locale of interest in the picture. After this, it can make a square shape enclose the zone of interest where it identifies the face. There are additionally numerous other identification strategies that are utilized together for recognition, for example, grin detection, eye location, squint detection, and so on.

Software's required for implementation:

1. ***OpenCV***: We used OpenCV 3 dependency for python 3. OpenCV is a library where there are lots of image processing functions available. This is a very useful library for image processing. Even one can get the expected outcome without writing a single code. The library is cross- platform and free for use under the open-source BSD license.
   Example of some supported functions are given below: ● Derivation: Gradient/Laplacian computing, contours delimitation ● Hough transforms: Lines, segments, circles, and geometrical shapes detection ● Histograms: Computing, equalization, and object localization with a back-projection algorithm ● Segmentation: Thresholding, distance transform, foreground/background

detection, watershed segmentation ● Filtering: Linear and nonlinear filters, morphological operations ● Cascade detectors: Detection of a face, eye, car plates ● Interest points: Detection and matching ● Video processing: Optical flow, background subtraction, camshaft (object tracking) ● Photography: Panoramas realization, high-definition imaging (HDR), image inpainting.

2. ***sudo apt-get install spider***: All our code is written in Python language. Below are the important python codes which are the core of our implementation of this software engineering project.
    1. ***Dataset***: Where all the faces are saved.
    2. ***main.py***: Main program file to run the program.
    3. ***train_image.py***: Train the captured images and work on datasets.
    4. ***recognize.py***: To recognize and mark attendance
    5. ***automail.py***: To send mail to a specific mail id.

1. ***main.py***: This is the main python code for our project that includes functions from other files and has all the options which are allowed in the user interface. Once this file is run, the user gets to choose whatever action has to be taken place, say whether it is to capture an image or to train an image, etc. The main function calls the other functions and specifies options to the user.
2. ***Train image.py***: In this step, the image gets trained with database images and machine learning techniques. This is done by making use of a haar cascade classifier. Once the images are trained and the model is ready for the next step, the "image trained" message appears on the screen.
3. ***Recognize.py***: In this step, the faces are recognized with the help of the LBPH Face recognizer function. Along with this, the time and date also get recorded. If the function works successfully then the attendance is marked for the recognized face.
4. ***Automail.py***: In this project, we have added an extra feature called auto-mail. It automatically sends the attendance file to specific mail (specified in the system model).

Software Testing

Testing is the technique for assessing a framework or its parts to search out whether it fulfils the ideal requirements or not. In direct words, testing is executing a framework to recognize any holes, mistakes, or missing requirements. It is a fundamental advance in a product designing cycle to develop any product. Software Testing is fundamental since we as a whole commit error. A portion of those errors are irrelevant, however, some of them are costly. We have to check everything and anything we produce since things can generally turn out wrong.

Black Box Testing: In black-box testing, the structure of the program ins' t thought about. It considers the usefulness of the application as it was. It is likewise called practical testing. In this sort of testing, the analysers focus on utilitarian testing, that is, on giving known information and checking if the realized yield is acquired. This strategy is by and large followed while completing acknowledgment testing when the end-client ins' t a product engineer however just a client.

White-Box Testing: White-box Testing is a kind of testing technique where the tester (a developer testing the application) knows about the framework internals. Its usage is straightforward. The goal is to guarantee that each line of the code is tried. The tester recognizes all consistent, plan, and typographical mistakes. The tester likewise needs to approve the interior structure of the thing viable alongside the yield.

Case Tools: Computer-Aided Software Engineering (CASE) is the computer computerization of framework advancement exercises. These can be arranged into 3 classes: front-end, back-end, or cross life cycle. CASE items, as indicated by when they are utilized during frameworks improvement. Frontend apparatuses now and again called capitalized devices, are utilized during primer examination, venture arranging, investigation, or plan. Back-end instruments, here and there called lower-case devices, are utilized during advancement, execution, assessment, and upkeep. Cross life cycle CASE apparatuses are utilized to help progressing exercises, for example, venturing the board and making documentation, which happens over numerous periods of framework improvement. CASE apparatuses can likewise be free or coordinated. Framework documentation is regularly done utilizing CASE instruments that are autonomous of one another, to computerize explicit advancement exercises, for example, information stream outlines or ER diagrams. In any case,

these individual apparatuses may not have similar organizations for sharing data. Any progressions to the framework imply that the tedious cycle of refreshing the documentation is frequently ignored. Future upkeep of the framework at that point turns out to be incredibly troublesome. Interestingly, incorporated\ CASE climate centers around the upkeep of configuration records, and CASE devices are utilized to deal with exercises all through the whole framework advancement. Incorporated CASE devices utilize a typical vault with the goal that data can be shared over all instruments and framework improvement exercises. Any progressions to the plan records typically bring about the most different parts of the framework mirroring those changes.

Test Cases and Output

Web camera detecting faces live: The software locates the eyes and mouth, we can also rotate, scale, and shear the image which results improper centering of the eyes and mouth to its best.

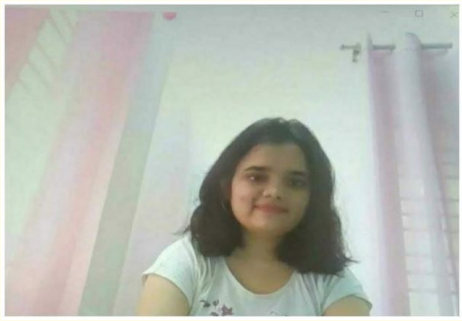


Figure 4: Webcam detection.

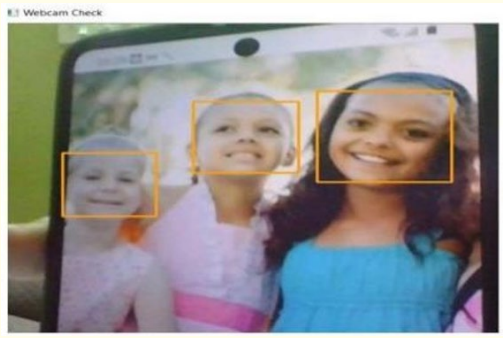
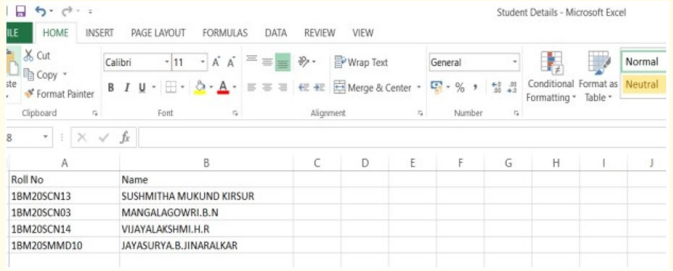


Figure 5: Detection of Multiple Faces.

As shown in the Figure 5: Not only for a single face, however when the academic class has more than 1, up to 4, multiple faces can be captured simultaneously.

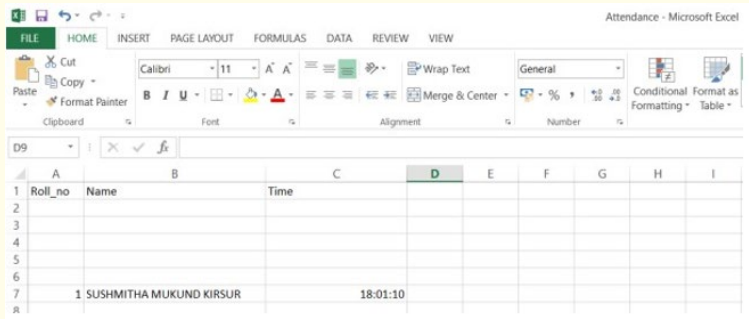


Roll No	Name
1BM20SCN13	SUSHMITHA MUKUND KIRSUR
1BM20SCN03	MANGALAGOWRI.B.N
1BM20SCN14	VIJAYALAKSHMI.H.R
1BM20SMMD10	JAYASURYA.B.JINARALKAR

Figure 6: CSV Screenshot.

As shown in the Figure 6, an example of csv screenshot is attached.

Figure 7: Recognising faces in the registered CSV.



Roll_no	Name	Time
1	SUSHMITHA MUKUND KIRSUR	18:01:10

Figure 8: Marking attendance.

As shown in the figure 8, the Student-Sushmitha Mukund Kirsur, is present for the class at 18:01:10 and this time in the hours: minutes: seconds format is recorded.

Results

The main objective of this work is to make the attendance marking and management system efficient, time saving, simple and easy. Here faces will be recognized using face recognition algorithms. The processed image will then be compared against the existing stored record and then attendance is marked in the database accordingly. This proposed system will be implemented with 4 phases such as Image Capturing, Segmentation of group image and Face Detection, Face comparison and Recognition, Updating of Attendance in database. This work is about the biometric attendance management. The automatic attendance management will replace the manual method, which takes a lot of time consuming and difficult to maintain. There are many biometric processes, in that face recognition is the best method. In this paper we are going to describe the attendance without human interference. In this method the camera is fixed in the classroom and it will capture the image, the faces are detected and then it is recognized with the database and finally the attendance is marked.

If the attendance is marked as absent the message about the student's absent is send to their parents. The project is based on OpenCV and Python.

While testing the working model, we chose some pictures of ourselves, our friends, and some well- known celebrities. It turned out that the hit percent was pretty satisfying, i.e., around 85%. Below is the observation table containing the information about the number of times faces got recognized correctly. The test was performed around 40-50 times and it includes multiple faces in the same image as well. The face detection shows 88.23% of the right hit rate. An important step is filtering out non-facial test images from an image. Several approaches have been taken, but it was not easy to find an absolute threshold value which can be applied to various pictures with different light conditions and composition.

Approaches using luminance, average brightness, etc., have been tried, but they turned out not to be good enough to set an appropriate threshold for filtering out non-facial test images. Lastly, a statistical method was tried. After filtering out the leftmost column elements, which are12 test images. Out of 21 faces in the picture, the algorithm has detected 19 faces within the acceptable error of the location of faces. The two undetected faces are partially blocked by the other faces. Conclusively, this statistical approach, which is a seemingly rough estimation, works great in this picture and it turned out to produce good results for other pictures as well.

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