International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 04 | April - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Smart Attendance Management System Face Recognition

MS.SANTHOSHI P AP

JAGADHEESAN S, ANUSHIKA .R, MAHESH KUMAAR. K
BACHELOR OF TECHNOLOGY-2ND YEAR
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS) COIMBATORE 641062

ABSTRACT

Taking attendance is one of the most crucial duties that needs to be completed every day in businesses, schools, institutions, and organizations. Most of the time,it is done by hand using methods like calling someone by name or roll number. This project's primary objective is to develop an automated face recognition- based attendance system that will replace the current manual procedure. This project satisfies the time management requirements as well as the requirements for updating the attendance system. This device is placed in the classroom and isused to train students' personal data, including name, roll number, class, sec, andphoto. Open CV is used to extract the photos.The student can approach the machine prior to the commencement of the relevant class, and it will start takingphotographs and comparing them to the eligible dataset. For this project, the processing board and camera were an NVIDIA Jetson Nano Developer kit and aLogitech C270 webcam. The picture is handled in this way.The device automatically labels attendance after identifying faces using a Haarcascade classifier, the LBPH (Local Binary Pattern Histogram) Algorithm, and comparing the histogram data to a pre-existing dataset. An firebase is created and updated hourly using data from the relevant class instructor.

INTRODUCTION

Attendance is prime important for both the teacher and student of a educational organization. Thus, maintaining a record of attendance iscrucial.

When we consider the conventional method of recording attendance in a classroom, the issue appears.

Inquiring about a student's attendance by calling their name or roll number requires energy in addition to time. Thus, every issue listed above can be resolved with an automated attendance system.

Currently, many institutions use automated systems for creating attendance reports. RFID technology and biometrics are two examples of such systems. Despite being automatic and more advanced than the conventional method, it is unableto meet the time constraint. It takes time for the student to get in line to give their attendance.

With no disruption to the regular teaching process, this project provides an involuntary attendance marking system. The technique can also be used in classroom settings where attendance is crucial, such as during exam periods. This approach does away with traditional methods of identifying students, such calling their names or examining their individual identification cards. These methods can cause disruptions to the teaching process and anxiety in the exam rooms for the students. Furthermore, in order for the pupils to be identified, they must register inthe database. With the user-friendly interface, enrollment can be completed immediately.

In everyday life, face recognition is essential for recognizing friends, relatives, and other people we know. We might not realize that recognising human faces requires a number of stages. In order to recognize things, human intelligence

enables us to receive information and analyze it.

We take in information from the image that is presented into our eyes, specifically by light reaching the retina. Electromagnetic waves, or light, are emitted from a source, projected onto an object, and seen byhumans.

According to Robinson-Riegler, G., & Robinson-Riegler, B. (2008), we really categorize shape, size, contour, and texture of the object in order to assess the information after the human visual system has completed its visual processing. Theinformation that has been evaluated will be contrasted with alternative representations of faces or objects that we can identify from memory.

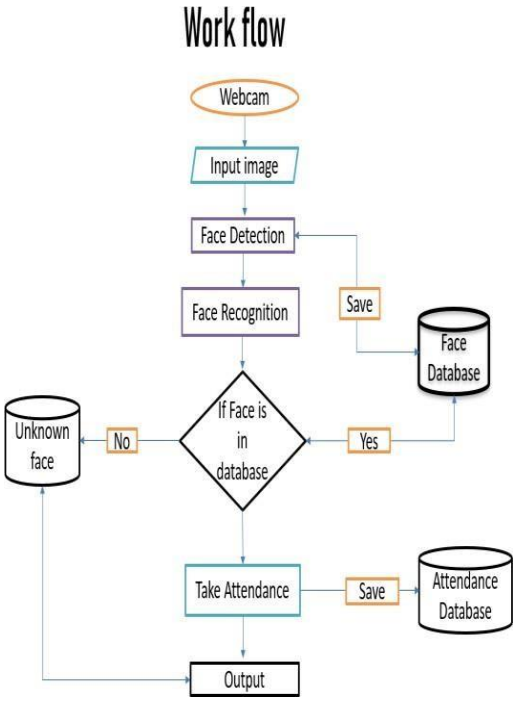
Building an automated system with the same level of face recognition skill as a person is actually a difficult task. To identify various faces, however, we require a large memory.

Problem Statement:

The traditional method of recording student attendance is frequently fraught with issues. Because the facial recognition student attendance system does away with traditional student attendance marking methods like calling student names or checking respective identification cards. Not only do they impede the teaching process, but they also divert students' attention during exam periods. During the lecture sessions, in addition to calling names, an attendance sheet is circulated throughout the classroom. It could be challenging to pass around the attendance sheet in a lecture session, particularly one with a big number of pupils. Thus, the manual signing of students' presence, which is tedious and leads to pupils being distracted while signing for their attendance, is to be replaced with a facial recognition attendance system.Moreover, the automatic student attendance system that uses facial recognition technology can detect and identify fraudulent approaches, eliminating the need for lecturers to repeatedly count the number of students in order to verifytheir presence.

Scope of the project:

We are finally preparing to design a two-module system. The firstmodule, named "face detector," is a mobile component that acts basically as a camera application. It uses computer vision face identification algorithms and face extraction techniques to record student faces and store them in a file. The second module consists of a desktop programme that recognises faces in photos that have been taken, logs students' registration and keeps the results in a database for later use.



The first step in the workflow is where an image is captured and converted into a digital form using a sensor and an analogue-to-digital converter. This step might also include pre-processing tasks likescaling.

Techniques are applied to images to make them more suitable for aspecific application. It includesadjusting brightness, contrast, filtering noise, sharpening, and histogram equalization. The goal is to improve the visual appearance of an image or to highlight certain features.

It aims to improve the appearance of an image by removing known distortions such as motion blur, noise, and camera misfocus. Unlike enhancement, which is subjective, restoration is based on mathematical or probabilistic models of image degradation.

The use of neural networks with many layers (deep learning) for image processing tasks such as image classification, object detection, and style transfer has become prevalent, offering superior results in many cases.

Definition of Terms and HistoryFace detection

The act of recognising and locating
every face in a single picture or video, regardless of its size, position, orientation, age, or emotion, is known as face detection. Additionally, the detection must be independent of the image and video content as well as unneeded lighting circumstances.

Face Recognition

Face recognition is a visual pattern recognition issue in which the goal is to identify a face based on recorded photographs. The face is represented as a three-dimensional object that is subject to altering illumination, 13positions, and other factors [6]. Therefore, the challenge of determining whether a face that has already been identified is known or unknown, and in more complex circumstances, identifying precisely whose face it is, is known as face recognition [7].

Viola-Jones Algorithm

The most widely used technique for localising the face segment from static photos or video frames is the Viola-Jones algorithm, which was first presented by P. Viola and M. J. Jones (2001). In essence, there are four components to the Viola-Jones algorithm concept.

The first component is referred to as the Haar feature; the second is where the integral image is generated; the third element involves the Adaboost implementation; and the fourth and last step is the cascade process

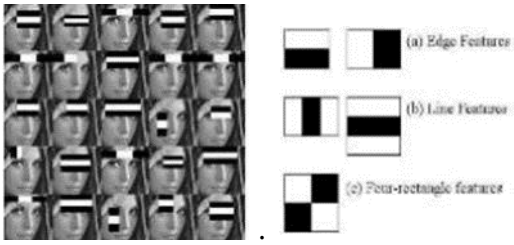


Figure 1

Local Binary Pattern Histogram

The Local Binary Pattern (LBP)texture operator is a straightforward yet highly effective technique thatassigns a binary

number to each pixelin an image by thresholding itssurrounding pixels. Since its initial description in 1994 (LBP), it has been discovered to be an effective feature for texture categorization. It has also been found that on some datasets, combining LBP with the histograms of oriented gradients (HOG) descriptor significantly enhances detection performance. We may use a straightforwarddata vector to represent the facial photos by combining the LBP with histograms.

LBPH algorithm work step by step:

LBPH algorithm work in 5 steps.

1. Parameters: The LBPH uses 4 Parameters: Radius: the radius is used to build the circular local binary pattern andrepresents the radius around thecentral pixel. It is usually set to 1

Neighbours: the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.

Grid X: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8

Grid Y: the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8

2. Training the Algorithm:

First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output.

3. Applying the LBP operation:

The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

The image below shows this procedure:

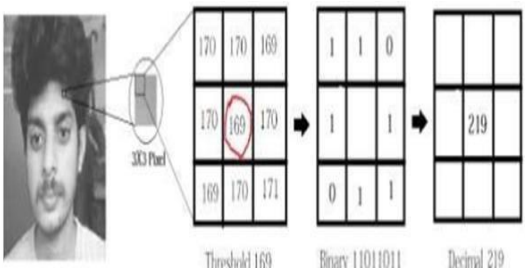


Figure 3

4. Extracting the Histogram:

Now, using the image generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids, as can be seen in the following image:

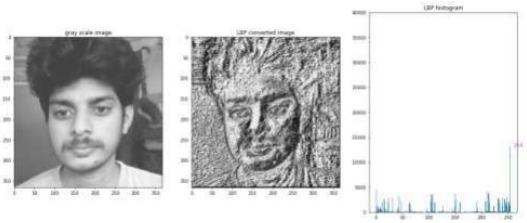


Figure 2

MODAL IMPLEMENTATION ANDANALYSIS

The process of face detection entails splitting picture windows into two groups, one for faces and one for backgrounds (clutter). It is challenging because, despite certain similarities, faces can differ greatly in terms of age, skin tone, and facial expression. Different lighting conditions, image quality and geometries, as well as the potential for partial occlusion and disguise, further exacerbate the issue. Therefore, the perfect face detector would be able to identify the presenceof any face on any background and inany set of lighting conditions.

Modal Implementation

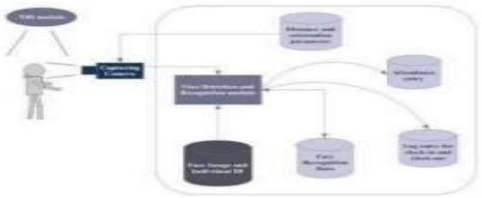


Figure 4

Design Requirements:

We used some tools to build the system. Without the help of these tools it would not be possible to make it done. Here we will discuss about the most important one.

Software Implementation:

Make sure you have the necessary libraries installed. Use the following command to install OpenCV,NumPy, and face recognition.

Gather images of individuals for training the face recognition model. Organize these images into folders based on person names.

Use the face_recognition library to train a face recognition model. Here'sa sample code snippet:

Use OpenCV to capture the live video stream from a PC's webcam. Modify the code snippet for capturing live video stream accordingly.

In the video stream loop, use the facerecognition model to identify faces and mark attendance accordingly:

Maintain a database or file to store attendance records. Update the database based on the recognized faces.

Consider adding additional security measures, error handling, andoptimizing for real-world scenarios.

Firebase

Google created the Firebase platform to allow developers to create both online and mobile applications. Google purchased it in 2014 after it was first established as a stand-alone business in 2011. To assistdevelopers in effectively creating, enhancing, and expanding their apps, Firebase provides a range of tools andservices. The following are some of Firebase'ssalient characteristics and offerings:

1. **Firebase Realtime Database and Firestore**:NoSQL databases hosted in the cloud that let you store and share data instantly across users. Themost recent of the two, Firestore, hasmore advanced querying features andscalability.

2. **Firebase Authentication:**Brings ready-made UI libraries, back-end services, and simple SDKs for user authentication into your project. It supports federated identity providers such as Google, Facebook, Twitter, and others, as well as passwords and phone numbers for authentication.

3. **Firebase Hosting**: Offers both static and dynamic content hosting at CDN-backed global edge locations, together with fast and secure hostingfor your web application content.

4. **Firebase Cloud Functions**: Enables you to execute backend code in response to events brought forth by HTTPS requests and Firebase features. Your code operates in a managed environment and is kept onGoogle's cloud.

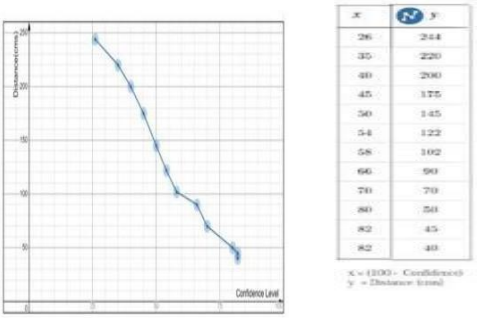
PERFORMANCE ANALYSIS

To demonstrate how the system performed in various scenarios, we ran a number of tests. We were able to obtain the graph (Distance vs. Confidence Level) above by doing those tests. The graph suggests that the confidence level increases with the face's proximity to the cameraand vice versa. Therefore, we canmark attendance for an individual based onthe criterion by maintaining a threshold for confidence level.

Evaluation:

Here, we're only looking at the light's constant parameter intensity. We conducted various studies at various distances and angles.We increased the distance progressively to observe the degree of confidence at each location.We used the x and y coordinates to plot the graph, interpreting the x values as the accuracy rate or confidence level. and y values as the length in centimeters.

Figure 5



CONCLUSION

The Smart Attendance Management System using face recognition in software development proves to be an efficient and accurate solution forattendance tracking. The implementation of facial recognition technology enhances security and eliminates the need for manual record-keeping. This project successfully addresses the challenges of traditional attendance systems, offering a user-friendly interface and real-time tracking capabilities. The integration of advanced technology not only improves accuracy but also streamlines administrative tasks. Overall, the system demonstrates the potential for modernizing attendance management processes in various educational and corporate settings.

REFERENCES

1. Face detection,TechTargetNetwork, Corinne Bernstein, Feb, 2020 https://www.researchgate.net/publication/326261079_Face_detection_ system_for_attendance_of_class'_students
2. .[Online]. Available:https://searchenterpriseai.techtarget.com/definition/face- detection
3. Rathod, Hemantkumar, et al."Automated attendance system using machine learningapproach." 2017 International Conference on Nascent Technologies in Engineering (ICNTE). IEEE, 2017.
4. Student Attendance System inClassroom Using FaceRecognition Technique,Samuel LukasAditya Rama Mitra,RirinIkana Desanti,Dion Krisnadi, InformaticsDepartment,ComputerSystem Department, Information Syste DepartmentUniversitas Pelita HarapanKarawaci, Indonesia
5. KushsairyKadir , Mohd KhairiKamaruddin, Haidawati Nasir,Sairul I Safie, Zulkifli AbdulKadirBakti,"A comparativestudy between LBP and Haar-like features for FaceDetection using OpenCV", 4thInternational Conference on Engineering Technology and Technopreneuship (ICE2T),DOI:10.1109/ICE2T.2014.70 06273, 12 January 201
6. https://console.firebase.google.com/u/0/project/smartattendacerealtime-735ee/overview.