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Implementing CCTV-Based Attendance System

Dr.R.MohanDas [a], Gangula Pooja [b], Modem Meghana [c], Boini Shruthi [d], Eegala Abhinav[e]. Maduri Nikeleesh [f]

[a] Professor, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.

[b,c,d,e,f] Student, Department of Electronics & Communication Engineering, Balaji Institute of Technology & Science, Warangal.

ABSTRACT

Security professionals have been paying close attention to face recognition (FR), particularly when it comes to using closed-circuit television (CCTV) cameras for security surveillance. Even though the science of computer vision has made great strides, sophisticated face recognition algorithms have only performed well under controlled circumstances. When faced with real-world situations like illumination, motion blur, camera resolution, etc., they drastically decrease. The design, implementation, and empirical comparisons of machine learning open libraries in creating attendance taking (AT) Support systems employing interior security cameras, or ATSS, are demonstrated in these papers. Our design enables flexible system scaling and can be used for general school attendance with CCTV. The measurement results demonstrate that the accuracy is appropriate for a wide range of settings.

Keywords: computer vision, deep learning, facial recognition, CCTV, and attendance system

1. Introduction

Manually recording attendance takes a lot of time and is a laborious process. An extremely effective, dependable, and user-friendly automatic attendance system is required to solve this issue. Several techniques can be used to track attendance, incorporating manual sign-in forms, RFID, barcode scanning, and biometric technologies like attendance systems based on facial recognition[1,2,3]. The quantity of pupils, the accessible technology, and the institutional policies all influence the technique selected. Face recognition is the process of identifying an individual based just on the features on their face. This paper focuses on the installation of an automatic attendance system that manages the attendance database and takes student attendance using face recognition algorithms. Modern technology is advancing regularly and is a necessary component of our everyday existence. Nowadays, people live smarter lives because they save time, money, and effort. For instance, teachers in schools frequently battle with student attendance. Conventional methods such as calling students' names and handing the attendance sheet take a lot of time and lead to attendance system fraud. This paper discusses our suggested model[4,5]. The many parts of the system, such as the software, face detection algorithms and methodologies, and database administration utilized to store attendance records, will all be thoroughly explained.

2. Proposed System

The suggested system's job is to take a picture of every student's face and save it in the database

for their attendance. The students' faces must be captured in a way that allows for the detection of all facial features, even seated.

The teacher does not have to collect attendance by hand. When students enter a class with their name, hall ticket number, time, and date on them, the CCTV automatically records, identifies, and updates the attendance in the database[6,7].

Fig 1: Proposed system

3. Objective of Project:

The objective of this project is to develop face recognition attendance system. Expected achievements in order to full fill the objectives are:

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

4. Formulation / Algorithm:

Haar Cascade Algorithm:

It is an object detection technique based on machine learning. It may be used to identify things in pictures or videos, and it works especially well for face detection. Since its initial proposal by Viola and Jones in 2001, the application. An image's retrieved features are used by the Haar Cascade technique to operate. These characteristics are essentially patterns that are frequently observed in interesting items, like the corners of an eye or the borders of a face. The system chooses the most significant features for detection using a machine learning method known as AdaBoost[8,9].

A series of classifiers known as a cascade is developed when the key attributes are chosen. Every classifier is in charge of identifying a certain image feature. In order to maximize efficiency, the cascade is engineered to rapidly eliminate areas of the image that do not include any objects and do not have any features.

The image is rejected and the algorithm advances to the following area of the image if the feature is absent. Numerous applications, such as face detection, object tracking, and pedestrian detection,

have made extensive use of Haar Cascade. Additionally, it has been incorporated into other well-known computer vision libraries, like OpenCV, making it simple for developers to use. An image's retrieved features are used by the Haar Cascade technique to operate[10]. In order to maximize efficiency, the cascade is engineered to rapidly eliminate areas of the image that do not contain any objects or features.

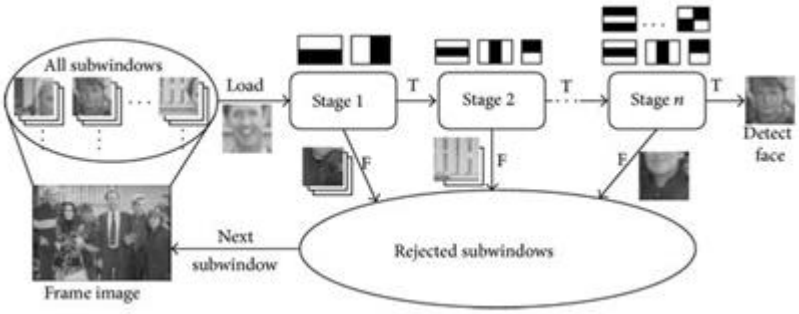

Fig 2: Haar Cascade Algorithm

The image is sent through the cascade of classifiers in the Haar Cascade algorithm in order to identify an object in the image. The picture is examined at each step to see if the particular feature being looked for is there. The image moves on to the following phase if the feature is present.

The image is rejected and the algorithm advances to the following area of the image if the feature is absent.

Numerous applications, such as face detection, object tracking, and pedestrian detection, have made extensive use of the Haar Cascade. Additionally, it has been included in some well-known computer vision libraries, such as OpenCV, making it easy to use for developers[11,12].

LBPH (Local Binary Patterns Histogram):

It is a straightforward yet effective computer vision facial recognition technique. It is a texture-based method that encodes the variation in intensity values between adjacent pixels to extract characteristics from a picture.

The Local Binary Pattern (LBP) descriptor for each region is calculated by the LBPH algorithm after the image has been divided into smaller sections. the middle pixel and its surrounding pixels. Every pixel in the area is compared to its neighbors in order to calculate the LBP descriptor[13,14]. The neighbor, pixel is given a value of 1 if it is larger than or equal to the central pixel, and 0 otherwise. The LBP code for that area is subsequently formed by concentrating each pixel's binary data.

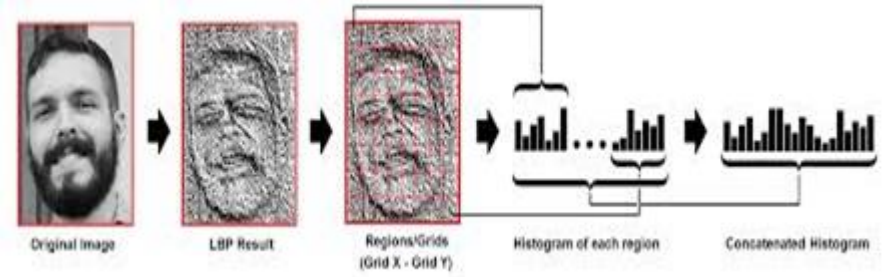

Fig 3: LBPH Algorithm

A histogram containing all of the LBP codes is produced following the computation of the LBP descriptor for each area of the picture[15]. The textural qualities of the picture are represented by this histogram and are then utilized recognition.

The LBPH method is adaptable to various image resolutions and resilient to variations in lighting. It has been applied to many different areas, including access control, security systems, and computer-human interaction[16]. However, when dealing with more complicated facial recognition circumstances, it could not be as accurate as more sophisticated algorithms like Deep Learning.

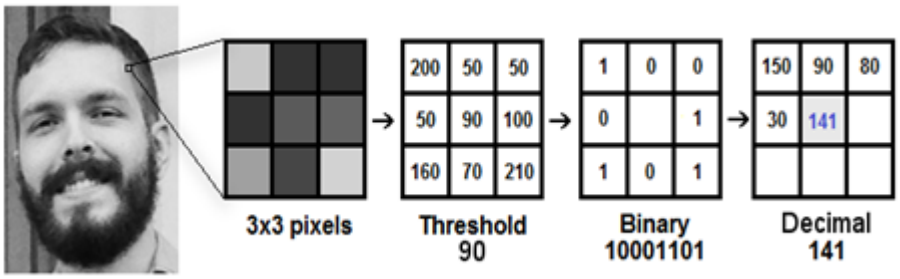

Fig 4: Results from LBPH algorithm

5. Implementation:
Organizations can minimize their administrative workload and expedite attendance tracking by implementing a facial recognition-based attendance system. But, it's crucial to make sure that privacy and security issues are taken into account during the design and implementation of such systems[17]. We require a PC/laptop with at least 128 GB SSD, an i3 5th Generation 2.2 Ghz processor or above, and 4 GB+ RAM in order to implement our concept.

Tools we used:
- Python 3.9+
- Python Libraries (Numpy, OpenCV, face_recognition, os, datetime)

In our proposed model we have taken following steps to implement our model.

Database Creation: Databases are initially established by hand. Each student's clear photo is uploaded to a folder, and each image file is given a unique roll number or enrollment number.

Face Detection: Among the most crucial actions in this system. A video sequence, usually in RGB format, is used as input and is then transformed to grayscale. In order to detect faces, the Haar Cascade algorithm is used. Certain features, such as the lips, the bridge connecting two eyes, or the eyebrows, help us recognize faces. Nearly 6000 characteristics are employed in the Haar

Cascade method to identify faces. Initially, pictures are subjected to a mixture of attributes pixel by pixel. Only when a face is present will these traits match. By saving the pixels that matched the features, the face can be identified. After that, a face boundary box is sketched[18].

Face Recognition:LBPH (Local Binary Patterns Histogram) is used for feature extraction and matching. Nine pixels (3x3 matrix) are taken in LBPH. The central pixel and the eight surrounding pixels are compared. A pixel's intensity ranges from 0 to 255. The threshold is defined as the value of the central pixel. When a pixel's intensity in relation to its surroundings is equal to or greater than the threshold value, it is designated as either 1 or 0. We now have a binary number for an eight-pixel combination. This binary value is placed in the center pixel after being translated to decimal[19,20,21]. This is applied to the entire image, yielding comparable results for every 3x3 matrix.

Report Generation: The faces from the camera's video sequence input are compared to the pictures stored in the database. The attendance is noted in the CSV file and the roll number is displayed if any face matches[22].

7. Result:

After executing the program we got a result where we can see that the compiler gives an output of detected image like Fig 5. Finally the attendance is marked in the excel sheet as shown in the Fig 6.

Fig 5: Image Detected

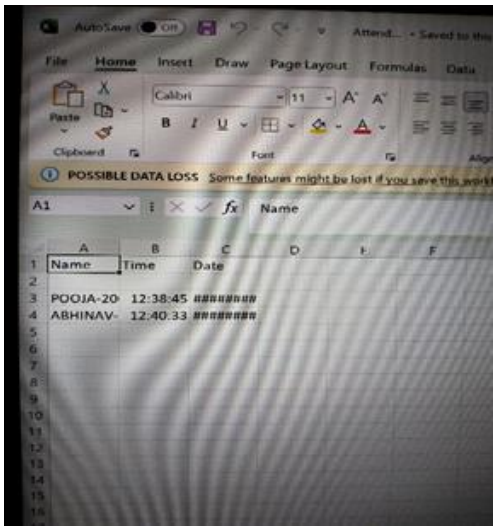

Fig 6: Attendance marked in Excel sheet

8.Conclusion:

The goal of putting this system in place is to reduce labor costs and save time and money. This strategy shows a thorough understanding of the set of guidelines and a methodical approach to correctly identifying clients. The stop result indicates that the system can handle improvements in face projecting and posture, together with room modifications. Python-based facial recognition claims that while the unique photo is converted into a HOG graphic that captures the essential aspects of the image regardless of photo brightness, face identification solves the issue of altered environments. The face recognition computer additionally processes information based on local facial landmarks. After encoding the stuck face, 128 measures are obtained. The character's name is removed from the encoding to provide an acceptable face recognition. An Excel spreadsheet is then created using the result. As of right now, the system can achieve up to 91% accuracy.

9.Future Scope

It may also be necessary to take a large number of descriptive pictures of the scholars and save them in the cloud in order for the suggested effort to be as robust as possible. The gadget might be programmed and used in ATMs fraud.

•Moreover, the program can be utilized during elections to identify voters by recognizing their faces.

•When used with high-resolution cameras, the system can provide more accurate results.

• In this assignment, it became clear that faces can only be identified when a person's face is clearly visible and that faces cannot be identified when a person's status is changing. Therefore, more research is needed to use deep learning algorithms to fully recognize human faces in all commands.

Our goal is to develop an application that might enable users to update student photo samples.

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