Student Attendance System Utilizing Face Recognition with Inherent Features

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Abstract*— A person's face serves an important part of everyday affairs, specifically when it comes to remembering people. Facial recognition is a method of biometric identification that utilizes a human's facial characteristics to distinguish them as well as retains information as a unique face biometric print. Biometric face recognition software has stimulated the interest of many experts attributed to its broad use. Since it is a non-contact methodology, face recognition system trumps existing multimodal biometric technologies such as iris, finger print and palm print recognition-based systems. Face recognition can distinguish a human from afar without the need of any engagement or communication, nor any physical type of contact. Face recognition technologies are currently being utilized in venues and organizations like industries, educational institutions, Facebook, airports etc. Teachers might well be under enough of pressure whenever attendance is recorded by hand. To address these issues, a creative and intelligent attendance management system is now being implemented. The issues of intermediaries and pupils being marked present even if they're not physically there could be easily addressed with this architecture. To track attendees, this methodology uses a live video feed. For extracting pictures from feed, OpenCV is deployed. Face detection, and also the recognition are significant implementation phases in this type of technology, and dlib is used for both. Following that, integrating them should be accessible by correlating detected faces to a database of student faces. This model will be a productive tool for managing student attendance.

***Indexed Terms*— Face-Recognition, OpenCV, Python, HOG, Matplotlib, Viola Jones Algorithm, Deep Learning, Image Processing**

I. INTRODUCTION

The traditional system of attendance marking is a time-consuming task at many institutions and universities. Professors are especially burdened since they must personally call out students' names to register attendance, which might take up to 5 minutes of the entire class. It takes a long time to accomplish this treatment. A proxy is almost certainly going to be present. As a result, a range of novel attendance-tracking methods, such as radio frequency identification (RFID), iris identification, and fingerprint recognition, have been implemented. These solutions, on the other hand, are queue-based, which might take a long time and be inconvenient. Human faces are essential in our daily lives, especially when it comes to recognising others. Face recognition is a type of biometric identification in which the character traits of a person's face are used to develop a custom face print that can be used to identify them. Because of its wide implementation, biometric facial recognition has piqued that interest of many researchers. Because it is noncontact, face recognition technology outperforms other biometric-based achieving the shared such as biometric, palmprint, and iris recognition.

II. FACE RECOGNITION

Recognition systems can recognise a person from afar without any interaction or touch. Face detection and recognition technology is primarily used in places like Facebook, airports, and train stations. This is true in criminal cases. The procured snapshot can be stored electronically and then used to identify a person, and the facial recognition tactic [11] can be used in criminal investigations. Input face images are used by Facebook to automate tagging people. Face recognition requires a large dataset and sophisticated

attributes to recognise a person in a lot of circumstances, such as changing lighting, age, and stance. Recent research shows that scanners have improved.

A facial biometric recognition tool acts by comparing human face in an electronic image that is stored in the database after capturing it from the feed. It is extensively used to evaluate users via verification services because it locates and analyzes face features from a given image. Similar types of technologies were first developed as a type of computer program six decades ago. From the time frame of their introduction and development, facial recognition systems are being known to be employed on different types of smartphones and in other sorts of technologies, such as robots, that are also automated. But since they incorporate the assessment of an user's physiological measurements, electronic facial recognition systems are classified as biometrics.

Facial recognition systems have been employed in advanced human–computer interfaces, video surveillance, and automatic photo indexing. It identifies and measures face features of the image and is commonly used to verify users through ID verification services. Similar methods were first developed as a type of processor application throughout the 1960s. Since their original conception, face recognition systems were used in smartphones as well as other types of technology, like robotics.

Because they engage the measuring system of a person's bioactivity, automated face recognition systems are generally classified as biometrics. Face recognition systems are widely used due to their own non - contact essence, regardless of the fact because they're less accurate as biometric technology than iris and fingerprint recognition. Evolved civilization interfaces, surveillance cameras, and due to faster indexing have all used facial recognition systems.

III. RELATED WORK

According to Xin Geng's paper "Individual Stable Space: An Approach to Face Recognition Under Uncontrolled Conditions," many face recognition systems necessitate face images to also be pumped in to the system on the basis of certain rules, like constrained illumination, a particular region, a specific view tilt, and no obstructions. Of this kind processes are defined as face recognition systems when it is used under controlled circumstances. Face recognition can be used for many practical uses because these requirements are not satisfied. Face recognition in real-time applications necessarily requires remedies which do not demand proper supervision over living beings. In these systems, biometric authentication is vital in unrestrained settings.

Edy Winarno proposed a system in his article "Anti-Cheating Presence System Based on 3WPCA-Dual Vision Face Recognition" that may forecast cheating in facial recognition-based systems by using a photograph of an authorised person or an image that looks like the authorised person. They employed a dual vision camera, also known as an asstereo vision camera, which uses two lenses to produce one image from each. They employed the half-join approach to combine the half of the left picture and the half of the right image of a person into a single image of the person, which could then be extracted using the 3WPCA method. Cheating is detected 98 percent of the time with this approach. [2] This study's term denotes and attempted to explain how and where to optimise a picture-based attendance system that collects the face images of many students and may be the next era of biometric devices. Because of person's face is indeed a distinctive artefact with a substantial percentage of variation, highlighting pupil external and internal has to be simple and efficient way. Pupils will be photographed and enrolled for the system before even being taken for attendance monitoring. Perpetual registration required for good and concise reliability. This system is in place. This record will explain this same system as well as provide evidence backing up the method. The project could be used as part of an online certificate program.[3]

Conventional methods of data collection, which already have drawbacks and therefore are incredibly hard to use, and face recognition establishment are advanced devices for tracking attendance. The research examined relevant helps. Attendance monitoring system systems include NFC, face authoritative areas, personal computers, and cloud spaces. Then it introduces a method, development framework, and making plans. As a result of this, a

system has been developed that decreases the use of paper and eliminates the time and energy wasted by attendance. Attendance system that is based on a mobile device. [4]

IV. IMPLEMENTATION AND ARCHITECTURE

The system architecture is presented as follows:

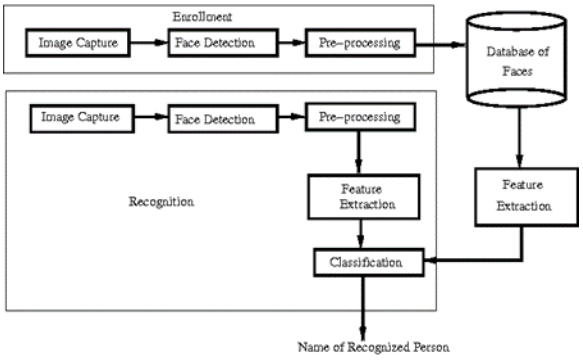

Figure 4.1: System Architecture

The above architecture is implemented by going through a series of critical processes, which include gathering the data, collecting, correcting, and integrating it based on our project's goals.

The entire process is to be divided into four stages:

a) Dataset Creation: Pictures of students are captured using a video camera. A single person's image would be captured numerous times, each with its own different sign as well as slope. Such photos have indeed been processed earlier. The Region of Interest (ROI) is acquired by resizing the visuals, which can then be used in the recognition system. Afterwards when, the neatly trimmed image is transformed to a specific pixel location. Then after, the pictures will be transformed from RGB to grayscale. These pictures will be ended up saving in a file called with the pupils' names.

Figure 4.2: Image is captured and stored in a separate location.

b) Face Detection: Face validation with HOG as well as OpenCV is being used here to detect the face. HOG both with Face Landmark Estimation algorithm should be trained to identify human features before being used for face detection. This one is referred to as extracting features. We could indeed tell if a new picture of an individual is also the same person by calculating the length in 128-dimensional space between both the enrolled faces as well as the new face. The OpenCV Color image would then be transformed to a Dlib cv image, which will then be transformed to a Dlib matrix. Dlib's cv known patterns is not identified by the neural net module. This same detection of face images inside the query image Ascertain the face region for each head. For every face, acquire a contorted as well as 150x150 patch. Now, calculate the facial expression descriptor to every face. This same Distance measure between both the facial expression descriptors inside the image data and also the face characteristics inside the enrolled images is now calculated. Discover the enlisted face that really is nearest to oneself. As according Dlib, unless two face descriptive term vectors have such a Euclidean distance with less than 0.6, people relate to the very same person; alternatively, people belong to multiple people.

```
encodeListKnown = findEncodings(images)
print('Encoding Complete')

cap = cv2.VideoCapture(0)

while True:
    success, img = cap.read()
    #img = captureScreen()
    imgS = cv2.resize(img,(0,0),None,0.25,0.25)
    imgS = cv2.cvtColor(imgS, cv2.COLOR_BGR2RGB)

    facesCurFrame = face_recognition.face_locations(imgS)
    encodesCurFrame = face_recognition.face_encodings(imgS,facesCurFrame)

    for encodeFace,faceLoc in zip(encodesCurFrame,facesCurFrame):
        matches = face_recognition.compare_faces(encodeListKnown,encodeFace)
        faceDis = face_recognition.face_distance(encodeListKnown,encodeFace)
        #print(faceDis)
        matchIndex = np.argmin(faceDis)

        if matches[matchIndex]:
            name = classNames[matchIndex].upper()
            #print(name)
            y1,x2,y2,x1 = faceLoc
            y1, x2, y2, x1 = y1*4,x2*4,y2*4,x1*4
            cv2.rectangle(img,(x1,y1),(x2,y2),(0,255,0),2)
            cv2.rectangle(img,(x1,y2-35),(x2,y2),(0,255,0),cv2.FILLED)
            cv2.putText(img,name,(x1+6,y2-6),cv2.FONT_HERSHEY_COMPLEX,1,(255,255,255),2)
            markAttendance(name)


    cv2.imshow('Webcam',img)
    if cv2.waitKey(1) & 0xFF == ord('q'):
        cv2.destroyAllWindows()
        break
```

Figure 4.3: findEncodings function is called for calling the stored face data.

c) Face Recognition: The face detection and recognition procedure is split into three steps. They would be delegated an integer label correlating to the pupil to whom they relate. These pictures will then be used to perform biometric authentication. The facial expression recognition system in this scheme is the Local Binary Pattern Histogram. The entire collection of local binary patterns (LBP) just on face is first acquired. Such LBPs are transformed to decimals, and plots for all decimal numbers are produced.

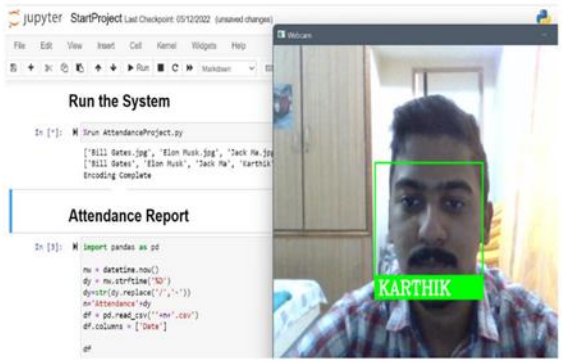

Figure 4.4: Face Recognition after enrollment.

d) Attendance Updation: For every discovered and paired face, this same attendance for the correlating USN in the dataset is labelled. The dataset also keeps a record of the pupil's title, and the time and date of enrollment.

```
def findEncodings(images):
    encodeList = []
    for img in images:
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        encode = face_recognition.face_encodings(img)[0]
        encodeList.append(encode)
    return encodeList


def markAttendance(name):
    nw = datetime.now()
    dy = nw.strftime('%D')
    dy=str(dy.replace('/','-'))
    n='Attendance'+dy
    if not os.path.exists(''+n+'.csv'):
        de = p.DataFrame(list())
        de.to_csv(''+n+'.csv')
    with open(''+n+'.csv','r+',encoding='utf8', errors='ignore') as f:
        myDataList = f.readlines()
        nameList = []
        for line in myDataList:
            entry = line.split(',')
            nameList.append(entry[0])
        if name not in nameList:
            now = datetime.now()
            dtString = now.strftime('%H:%M:%S')
            dString = now.strftime('%D')
            f.writelines(f'\n{name},{dtString},{dString}')
```

Figure 4.5: Attedance display and updation according to date.

V. SUBJECTIVE UNDERSTANDING

A. Viola Jones Algorithm

In 2001, Paul Viola and Michael Jones, two computer vision researchers, authored the Viola Jones algorithm in their paper "Rapid Object Detection Using a Boosted Cascade of Simple Features." Given its age, Viola-Jones is an immensely effective mechanism, and also its implementation in actual face recognition has indeed been especially noteworthy. Even though it takes time to learn, this method can recognize people at a high percentage in timely manner.

The software explores numerous relatively small subareas of a picture (this method works on grayscale) and attempts to find a face by searching for specific characteristics in each part of the region. Since an image may include many faces of various size, it must affirm numerous distinct roles and weights.

The Viola Jones method comprises four basic steps, which we will go over in detail in the following sections:

- Choosing Haar-like characteristics
- Creating a whole image
- AdaBoost training is being conducted.
- Cascades of classifiers are created.

Alfred Haar, a Hungarian mathematician, introduced the notion of Haar wavelets in the 19th century. Haar wavelets are a sequence of rescaled "square-shaped"

functions that collectively form a wavelet family or basis. Voila and Jones came up with the Haar-like properties after modifying the idea of using Haar wavelets.

Digital image characteristics recognised Haar-like characteristics have been used in object identification. Some widespread characteristics of the human face, like the eyes being heavier than its neighbours and friends and the mouth being brighter than that of the eyes, can be discovered in all human faces. A simple method to decide which zone is lighter and darker is to tally and start comparing the image pixels of the both regions. The sum of the pixel resolution in the darkened region would be less than the sum of the pixel resolution in the milder area. If such side of the box is lighter than another, this could portray the brow's edge, or even the centre area of a box may be glossier than the boxes around it, implying a mouth. This can be performed by employing Haar-like features, which allow us to interpret the various elements of a face.

Viola and Jones detected three sorts of Haar-like features in their research:

- Aspects of the edge
- Line-features
- Features on all four sides

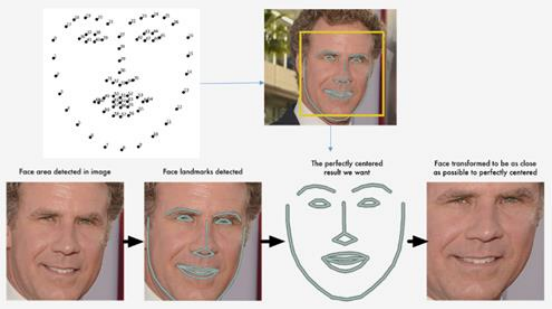

Figure 5.1: Face Landmark Estimation in the image recognition and processing stage.

To detect corners and line segments, edge as well as line character traits could be used. The multi characteristics are being used to discover diagonal aspects. The valuation of the characteristic is computed by deducting the total amount of the image pixels inside the black area from of the sum of the image pixels with in white area. A simple ground has a value of 0 since all pixels have same value so as to provide no valuable information.

Whenever the areas inside the black & white rectangles seem to be widely diverse, a Haar-like feature offers a large number. That use this value, researchers can extricate some helpful information of the image. There are a few features that are well-known for detecting human faces. We receive a favourable response when we apply this specific haar-like feature to the bridge of the nose, for example. Similarly, we combine a number of these characteristics to determine whether or not an image region comprises a human face.

VI. RESULTS AND SCOPE

The procedure highlighted above will produce reliable results. OpenCV should be used for frame extraction, and dlib will be used for face recognition. This technique should provide a faster response and improved precision in acknowledging multiple heads from a single photo. The proposed system's goal is to take photos each student's face and store it in a dataset for attendance uses. The student's face must be captured in just such a way that almost all of the student's facial features, and the student's seating position, and body posture, are recognised. No need for the instructor to individually take class attendance because of system records a video, identifies the face, and upgrades the attendance dataset through supplemental processing stages. The project has been successfully finished following the steps taken, as well as the system is developed in line with the specifications.

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REFERENCES

[1] Xin Geng, Zhi-Hua Zhou, & Smith-Miles, K. (2008). Individual Stable Space: An Approach to Face Recognition Under Uncontrolled Conditions. IEEE Transactions on Neural Networks.

[2] Winarno, Wiwien Hadikurniawati, Imam Husni Al Amin, Muji Sukur, "Anti-Cheating

[3] Presence System Based on 3WPCA Dual Vision Face Recognition, Faculty of Information Technology Universitas Stikubank Semarang Indonesia.

[4] Prototype model for an Intelligent Attendance System based on facial Identification by Raj Malik, Praveen Kumar, Amit Verma, Seema Rawat, Amity University Uttar Pradesh.

[5] Convolutional Neural Network Approach for Vision Based Student Recognition System, Nusrat Mubin Ara1, Dept. of CSE, SUST, Sylhet, Bangladesh.

[6] NFC Based Mobile Attendance System with Facial Authorization on Raspberry Pi and Cloud Server Siti Ummi Masruroh Andrew Fiade Imelda RistantiJulia.

[7] Face recognition-based Attendance System using Machine Learning Algorithms, Radhika C. Damale, Department of Electronics and Telecommunications, Cummins College of engineering for Women, Pune, Maharashtra, India.

[8] Class Attendance system based on Face Recognition" Priyanka Wagh.

[9] Design of Classroom Attendance System Based on Face Recognition, WenxianZeng.

[10] Student Attendance Using Face Recognition, Mahalakshmi A, Srikoushikkamal S

[11] Smitha, Pavithra S Hegde , Afshin, 2020, Face Recognition based Attendance Management System, INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT) Volume 09, Issue 05 (May 2020) Title and Author Details