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Smart Classroom Monitoring System

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ABSTRACT: Every organization or educational institution has a fundamental criterion to record the presence of the attendees. The conventional method of recording the attendance is to mark them manually. With the advancement of technology, attendance recording has shifted from manual methods to biometrics, RFID cards, and iris recognition technique. These methods are not viable as they may lead to high-cost installation, loss of cards, false attendance chance, and other drawbacks. In the present era, every institution has installed CCTV cameras in its classes. When we interface the camera with a face recognition algorithm through Python and Open CV through any microcontroller to operate between the data, we can record the attendance without any effort and it would cost the least time and least human contact. This strategy can also be improvised to monitor the usage of mobile during class hours, expression analysis, and student attention towards the lecture.

Keywords: Face recognition, Python, Open CV, automatic attendance monitoring.

I. INTRODUCTION

Every system is digitalized these days, electronic work is preferred additionally than manual work. Automation in processes implies less manual work and more efficiency. Automating attendance systems in educational institutions or companies is a part of automating the working environment. The conventional attendance system involves manually marking the data, this process is tedious and is time killing. There are systems such as biometric, and RFID to mark attendance but these technologies need additional tools promising no efficient results. Facial recognition is an approach to minimize time and effort by yielding practical results by consuming very few resources.

The motto of this project is to detect the faces from the input of the CCTV camera, compare them with the images present in the databases and acknowledge the individual's name to reflect the attendance automatically. There are several steps involved in the image recognition system. Initially, from the input database, faces are identified irrespective of their brightness or focus. Then, the features of the face are extracted and encoded to be compared to the CCTV's video or image. Finally, through encoding the most similar face is identified from the database, and attendance is marked after recognition. There are various Matlab as well as Machine Learning tools and algorithms to achieve facial recognition, in this project we are using Python and Open CV to accomplish automatic attendance marking which is the simplest way of approach.

II. METHODOLOGY

The initial step is detecting the faces from the CCTV's output; this is accomplished through HOG which is abbreviated as Histogram of Oriented Gradients. The whole image is sliced into pixels to map arrows rising from lighter to darker direction, the majority direction of arrows such as right, left, up, or down is considered as the final gradient for every single pixel as shown in the fig-2.1. Interpreting this process features our facial parts which help in understandable structuring the face.

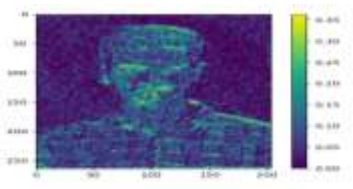

Fig – 2.1

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The software which we will obtain to identify faces has to realize faces irrespective of the facial expression or their facial orientation. This is possible through face landmark estimation; the procedure is to spot 68 points on the face. The points are so spotted that, they feature the eyebrows, circle the eyes, align the nose and lips. When this outlining is identified during the facial recognition time, the image is revolved or scaled such that the parallel lines are preserved and centered face is obtained to be correlated with the data sets.

The obtained unknown face from the outcome of the camera is now to be compared with our huge datasets. Every organization or institution has numerous populations in which people might resemble each other's features. It is important to consider the factor of accuracy and misinterpretation of one person's face with another. For this problem, encoding is the solution; the face is encoded in 128 measurements considering the distance between eyebrows, length of the nose, etc. as shown in fig-2.2a and fig-2.2b. From the encoded image the name of the person is found by classifying the coded image through the dataset. The closest match is found to retain the accuracy. This utilizes the Eigen face approach to compare the dataset with the input image.

Fig – 2.2a: Input Image

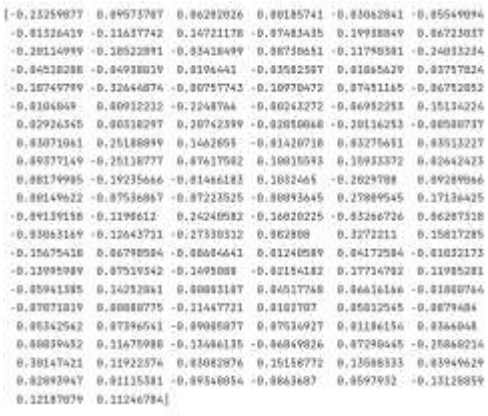

Fig – 2.2b: 128 measurements of input image

Eigen face approach:

Eigen face scenario is the facial recognition algorithm that moves toward linear algebra as well as dimensionality contraction as the principal component analysis. The training images database is converted into vectors and then the average of all these face vectors is evaluated to subtract it from individual vectors. A matrix of face vectors is so made to locate the covariance matrix which is to be utilized to build Eigen-values and vectors. The Eigen-face coefficients depict the training database which is used to distinguish the portraits from the CCTV. The linear mixture of Eigen-faces is obtained by casting the normalized vector into the Eigen-space. The obtained result vector is subtracted from the train vectors to obtain the least length between test and train, the lesser the displacement accurate is the prediction.

III. LITERATURE SURVEY

The prominent procedure utilized in the face recognition system is primarily the front face of the human being, some of the techniques include neural networks, hidden Markov model, face matching is done geometrically, and template matching. The most widely used tool is Eigen-face is also called the principal element in mathematical terms. The eigenvectors are used to represent various proportions of the variations in the faces.

An ANN (artificial neural network) was

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used in face recognition which contained a single layer, which shows adaptiveness in crucial face recognition networks. The face verification is done using a double layer of WIZARD in neural networks. The other option is graph matching. By using this method we can formulate object as well as face recognition.

Hidden Markov Models (HMM) the model applied to human face recognition where the faces get divided into parts such as the eyes, nose, ears, etc. The face recognition and correct matching are 87% correct, matching always gives out the best and right choice of face detection through the stored dataset. Geometrical feature matching is a technique that is based on the geometrical shapes of the face. The geometrical face configuration has a sufficient dataset for face detection and recognition system. Template matching is one of the processes through which the test image is represented as a two-dimensional array of values which can be compared using Euclidean distance with an individual template representing the whole face. This method can also use more than one face template from several points of view to depict an individual face.

IV. ADAVANTAGES

- The execution of this system is simple and cost-effective.
- It saves time and human effort.
- We don't need any additional data resources.
- It can be used in multiple industries for multiple purposes.
- It can detect many people at the same time.
- Obtained data can be further manipulated and analyzed.

V. DISADVANTAGES

- The chance of fraudulence is not completely precise.
- The distance of the person from the camera is limited.
- There will be a problem in recognizing identical twins.

SOURCE CODE:

```
import os
import datetime
import numpy as np
import cv2
import face_recognition
# from PIL import ImageGrab
path = 'ImagesAttendance'
images = []
classNames = []
myList = os.listdir(path)

print(myList)
for cl in myList:
   curImg = cv2.imread(f'{path}/{cl}')
   images.append(curImg)
   classNames.append(os.path.splitext(cl)[0])
print(classNames)

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):

   with open('Attendance.csv', 'r+') as f:

      myDataList = f.readlines()

      nameList = []
      for line in myDataList:
         entry = line.split(',')
         nameList.append(entry[0])

            if  name not in nameList:
               now = datetime.datetime.now()
         dt = datetime.date.today()
         dtString = now.strftime('%H:%M')
         f.writelines(f'\n{name},{dt},{dtString}')

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

cap = cv2.VideoCapture(0)

while True:
   success, img = cap.read()

   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):
```

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```
        matches =
face_recognition.compare_faces(encodeListKnown
, encodeFace)
        faceDis =
face_recognition.face_distance(encodeListKnown,
encodeFace)

       matchIndex = np.argmin(faceDis)
        if matches[matchIndex]:
                name =
classNames[matchIndex].upper()
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)
                print(name)
                print(faceDis)
   cv2.imshow('Webcam', img)

   cv2.waitKey(1
```

VI. RESULTS

The results of the project , executed using the above source code are as shown in the fig-6.1,fig-6.2,fig-6.3.The results shows the facial recognition of the student enabled with face tracking to monitor the movements of the student in the class. We have also successfully managed to mark attendance of the student recognized by algorithm automatically in an excel sheet in CSV format.

Fig-6.1

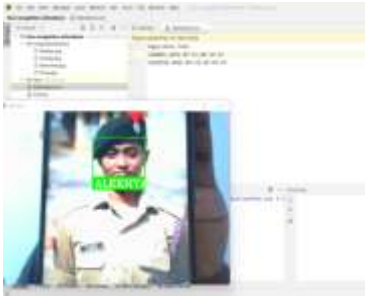

Fig-6.2

Fig-6.3

VII. CONCLUSION

The facial recognition system is employed in various other sectors like banking, security purposes, industries, crime detection, etc. Using this strategy in universities helps students and lecturers save time and perform analyses of attendees as data can be stored and manipulated through algorithms in the system. Further, the project can be taken to analyze emotions, their face time towards the lecture which helps in calculating student's individual activity. When the classroom size is huge, the class can be virtually divided into a matrix to find the density of population through heat mapping. Through this, we can control the electrical appliances like lights and fans in the classroom autonomously.

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