MINeD Hackathon 2023 at NIRMA UNIVERSITY

Company name : JK Lakshmi Cement Ltd. & Udaipur Cement Works l

Track Name : Manufacturing

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Summary ::

1. INTRODUCTION::

Problem statement ::

- Human face recognition by computer vision

Overview :

In this project the human face which are provided in the CCTV footage (video clip) will be detected using Computer Vision. This algorithm is capable to detect all the faces which appears in the camera.

2. PRODUCT DISCRIPTION :

- This project first loads the provided video clip and then using Computer Vision It detects the human face which appears in the video .
- When it detects if this is a human face then it simply puts the rectangular/square box on it with certain parameters and identifies the human face with the help of dataset for (name , time) and get displayed under the box. With the help of Computer Vision and Deep Learning it is possible to have identity of a person who appears in the CCTV camera.

3. WORKING :

Detection

Detection is the process of finding a face in an image. Enabled by computer vision, facial recognition can detect and identify individual faces from an image containing one or many people's faces. It can detect facial data in both front and side face profiles.

Computer vision

Machines use computer vision to identify people, places, and things in images with accuracy at or above human levels and with much greater speed and efficiency. Using complex artificial intelligence (AI) technology, computer vision automates extraction, analysis, classification, and understanding of useful information from image data. The image data takes many forms, such as the following:

- Single images
- Video sequences
- Views from multiple cameras

- Three-dimensional data

  Analysis

  The facial recognition system then analyzes the image of the face. It maps and reads face geometry and facial expressions. It identifies facial landmarks that are key to distinguishing a face from other objects. The facial recognition technology typically looks for the following:

- Distance between the eyes
- Distance from the forehead to the chin
- Distance between the nose and mouth
- Depth of the eye sockets
- Shape of the cheekbones
- Contour of the lips, ears, and chin

  The system then converts the face recognition data into a string of numbers or points called a faceprint. Each person has a unique faceprint, similar to a fingerprint. The information used by facial recognition can also be used in reverse to digitally reconstruct a person's face.

  Recognition

  Facial recognition can identify a person by comparing the faces in two or more images and assessing the likelihood of a face match. For example, it can verify that the face shown in a selfie taken by a mobile camera matches the face in an image of a government-issued ID like a driver's license or passport, as well as verify that the face shown in the selfie does not match a face in a collection of faces previously captured.

4. **MODULES AND LIBRARY** :

- NumPy : Numpy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays. It is the fundamental package for scientific computing with Python.

- OpenCV (cv2) : OpenCV is the huge open-source library for the computer vision, machine learning, and image processing. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis.

- OS : The OS module in Python provides functions for interacting with the operating system. OS comes under Python's standard utility modules. This module provides a portable way of using operating system-dependent functionality.

- Face_recognition : face_recognition OpenCV is an image and video processing library and is used for image and video analysis, like facial detection, license plate reading, photo editing, advanced robotic vision, optical character recognition, and a whole lot more.

5. Pros and cons

Advantages :

- **Security Through Biometric Authentication:** One of the benefits of facial recognition system centers on its application in biometrics. It can be used as a part of identification and access control systems in organizations, as well as personal devices, such as in the case of smartphones.

- **Automated Image Recognition:** The system can also be used to enable automated image recognition capabilities. Consider Facebook as an example. Through machine learning and Big Data analytics, the social networking site can recognize photos of its users and allow automated linking or tagging to individual user profiles.

- **Deployment in Security Measures:** Similar to biometric application and automated image recognition, another advantage of facial recognition system involves its application in law enforcement and security systems. Automated biometric identity allows less intrusive monitoring and mass identification.

- **Human-Computer Interaction:** The system also supports virtual reality and augmented reality applications. Filters in Snapchat and Instagram use both AR and facial recognition. In both VR and AR applications, the system facilitates further human-computer interaction.

- **Equips Devices with Added Functionalities:** It is also worth noting that equipping devices with facial recognition capabilities means expanding their capabilities. For example, iPhone devices from Apple use Face ID for biometric identification and supporting its AR capabilities.

Disadvantages:

- **Issues About Reliability and Efficiency:** A notable disadvantage of facial recognition system is that it is less reliable and efficient than other biometric systems such as fingerprint. Factors such as illumination, expression, and image or video quality, as well as software and hardware capabilities, can affect the performance of the system.

- **Further Reports About It Reliability:** Several reports have pointed out the ineffectiveness of some systems. For example, a report by an advocacy organization noted that the systems used by law enforcement agencies in the U.K. had an accuracy rate of only 2 percent. Applications in London and Tampa, Florida did not result in better law enforcement according to another report.

- **Concerns About Racial Bias:** A study by the American Civil Liberties Union revealed that the Rekognition technology developed by Amazon failed nearly 40 percent false matches in tests involving people of color. In general, the system has been criticized for perpetuating racial bias due to false matches.

- **Issues with Privacy Laws:** Alleged conflict with privacy rights is another disadvantage of facial recognition. In Illinois, for example, its Biometric Information Privacy Act requires affirmative consent for companies to collect biometric data. The fact that the system enables less intrusive mass identification also translates to mass surveillance, which according to groups, is a violation of privacy rights.

6. REQUIREMENTS :

1. Hardware requirement :
   - I3 processor system or higher
   - 4 GB RAM or higher
   - 100 GB ROM or higher
   - GPU enabled system (e.g. NVIDIA)

2. Software requirement :

   - Windows 7 or higher
   - IDE (Anaconda – jupyter)
   - Camera Drivers
   - GPU Drivers

7. FOLDER STRUCTURE :

1. Face_recognition
   1. Dataset_images.jpeg
      a. Knownimages
      b. unknownimages
   2. Dataset_video.mp4

8. CODE

```
import cv2
import numpy as np
import face_recognition
import os

path = "C:/Users/mansi desai/Downloads/dataset1/dataset1/img"
images = []
className = []
myList = os.listdir(path)
print(myList)

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

print(cl)
#img1 = face_recognition.load_image_file("C:/Users/mansi desai/Desktop/selfie.jpg")
#img1 = cv2.cvtColor(img1, cv2.COLOR_BGR2RGB)
#img2 = face_recognition.load_image_file("C:/Users/mansi desai/Desktop/img2.jpeg")
#img2 = cv2.cvtColor(img2, cv2.COLOR_BGR2RGB)

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("C:Users/mansi desai/Desktop/dataaaaaHackathon.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.now()
            dtString = now.strftime('%H:%M:%S')
            f.writelines(f'\n{name},{dtString}')

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

cap = cv2.VideoCapture("C:/Users/mansi desai/Desktop/VID_20230302_170157.mp4")
#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)
    faceCurFrame = face_recognition.face_locations(imgS)
    encodesCurFrame = face_recognition.face_encodings(imgS,faceCurFrame)

   for encodeFace,faceLoc in zip(encodesCurFrame,faceCurFrame):
        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),4)
            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('C:/Users/mansi desai/Desktop/VID_20230302_170157.mp4',img)
    cv2.waitKey(1)
```

9. Output :

10. CONCLUSION :

This project will be is very useful for proper authentication and validation of the identity and now a days, for the security purpose also it is very much useful for detecting and recognizing faces.