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Face Detection with Machine Learning and Open CV Classifier

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Abstract: *In the last few years, face recognitions owned considerable consideration and liked together of the foremost used functions within the area of image evaluation and recognition. Face detection reflects on consideration of an incredible section of face attention operations. The technique of face detection in pixels is elaborate with many features' variabilities provided throughout human faces. Faces include pose, expression, smile, role and orientation, pores and complexion, the presence of glasses or facial hair, variations in digicam gain, lighting conditions, and photo resolutions. Haar Cascade classifier is of outstanding assist when performing this undertaking smoothly. Face detection goes to possess a dramatic impression on the face detection field, as a result, familiarizing yourself with its functions like attendance recording system with the help of camera, Mask detection system.*

In this paper, we proposed a face detection system for the utilization of computer learning, especially OpenCV. The mandatory step required is face detection which we did with the usage of a broadly used step referred to as the haarcascade_frontalface_default classifier, python and its module.

Keywords*: Machine Learning, Face detection, Attendance Recording System via Camera, Mask Detection System*

I. Introduction

Face detection has emerged as a famous subject matter of lookup these days due to amplify in demand for protection as nicely as the speedy improvement of cellular devices. There are many functions which are face detection can be used to such as get entry to control, identity verify, security surveillance systems, and social media. Access control includes Computers, Offices, ATMs, Phones, etc. Most of these types available do not longer to use face detection as the widespread structure of heavy entry, however with advancing science technology in computer systems alongside with greater algorithms and classifier, facial detection is gaining some interaction in changing passwords and fingerprint scanners on security. And lastly, facial detection has surfaced in social media functions on systems such as Facebook advise its users to tag their friends who have been presents in photos. And it is clear that there are many purposes for facial detection systems are presents.It detects countenance and ignores the rest;the face appreciation is presently an energetic lookup vicinity inside the pc imaginative and prescient community. The face identification and detection are normally the first step in purposes in security system like video surveillance, Face detection and identified photos from database. Identifyingpresents faces should be first method for faceanalysis or facial expressions analysis, even it regularly considered that a normalizing face photo or video. In this paper we shall put into effect the Haar-Classifier for Face detection and monitoring supported the HaarFeatures. Additionally, face consciousness has been won't to goal humans enticing in covered speech. Within the close to future, face consciousness science will probably turn out to be greater ubiquitous. It's going to be individuals' moves get into thecomputerized car plate readers. Real-time face recognition is already getting used in different international locations.

II. Literature Review

Advancing technology and prescient is now not solely a computing region for discovering, however additionally neuro-science, psychology, etc.research, primarily due to the usual advancing in image processing lookup will supply insights into how our talent work and contrariwise, the creator has proposed to make an utility

that would possibly enable person get admission to a chosen computing device supported an in-depth evaluation of a person's facial expression.

This is going to be developed the use of Intel's open source laptop imaginative and prescient project, Open CV.[1] In this paper Based on Fisher Faces Algorithm it represents the match of a gadget which may also determine the character with the help of a face the usage of OpenCV.[2] In this paper the writer has proposed to make a software that would possibly enable person get entry to a unique computing device supported an in-depth evaluation of person's countenance. this may also be boosting the use of Intel's open supply pc imaginative and prescient project, OpenCV and Microsoft.[3]

In this they applied Face detection and monitoring the very pleasant poses function the usage of Haar Classifier. SimpleCV and OpenCV libraries are used for facial detection and monitoring the easiest poses position of face that are available. At the end of result calculatedthrough the use of pc imaginative and prescient SimpleCV and OpenCV modules resolutions for greater accuracy and speediness for face detection and monitoring the solely poses position. [4]

In this they graph a face consciousness device supported digicam and picture set algorithm via way of OpenCV and Python. The system has three part as mentioned Detection module, training module and recognition module. Key Words: Face detection, Face Recognition, OpenCV.[5]

This paper the accuracy and its presence of the face detection use of OpenCV and C# programming language. The adaboost algorithm is used for face detection on persons. This paper also researches on the robustness of the biometric authentication system when an undefined person face is being detected.[6]

In this face detection applied sciences a famous one of the higher and productive method of objectdetection and algorithm-based calculations.[7]

In this paper, to execute face detection calculation on an equipment stage, which is basic, yet productive in utilization is haunted. the merchandise source codes for both detection and recognition of countenances are composed utilizing OpenCV and Python.[8]

The intent of paper is that too deep find out about of face detection the use of OpenCV. A tabular contrast is carried out so as to recognize the algorithms in a neater manner. It talks about a range of algorithms like Adaboost, Haar cascades. This paper objectives to aid in appreciation the easiest stipulations for face detection.[9]

In this Face Detection and Recognition, the use of Open CV supported Fisher Faces Algorithm it represents the match of a machine which can decide the character with the assist of a face the use of Computer Vision (Open CV).[10]

In this Real Time Face Detection and Tracking Using OpenCV writer used three distinctive algorithms like Haar cascade, Adaboost, template matching was once described. all through this paper, they symbolize a method for face detection robustly in actual time environment. Here Usedof Harr-like-classifier and adaboost algorithm in this it tracksto faces on OpenCV module to detect.[11]

III. Research Problem

To hit upon a human face, the machine wishes to seize a picture the usage of an internet digital camera and search the photo for necessary elements and then use reachable elements to detect the face. Tolocating accurate result and there are several techniques are available that are together with skin color, and based on mentioned haarcascade_frontalface_default pre-trained algorithms who's available Colour is an essential characteristic of human faces. Using individual skin-colour and handy lighting fixtures as a characteristic for monitoring a face has quite a few advantages.

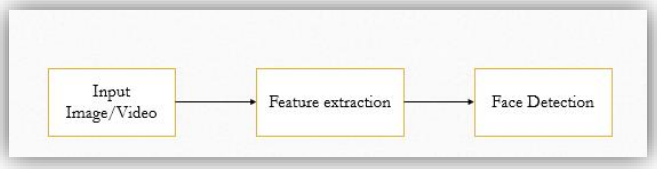


Fig.1. Face detection system

The center for a face detection device is constantly an image or video stream. The output is verification of objects that show up in the photograph or video stream. In face detection there is a two-type problemthat are placed. For that we have to determine if there is a face or no longer in video stream or image. Using this method can be considered as a simplified face detection problem. Face detection has to prove a given face, and there are many instructions as candidate. Hence face attention strategies are very comparable to face detection algorithms.

IV. Face Detection Process

Face Detection usinghaarcascade_frontalface_default classifier mentioned which is frequently usedstepfor its high detection rate, accuracy and fast processing speed for complex input. Face detection is method that is highly responsible for human faceidentifying and existence of objects of a withina small unit which are presents on it. As process of this considered as a method of image processing to identify face from live video via webcam which is record frame by frame.

We approach face cascade first in the code. After the face are located, after that we will call our solution that draw a one rectangle around them so after that we know what the machine locates and where. Sometime Machine can create mistakes, but our goals should be to teach the machine get the most and best result way so that prediction is more accurate and truer. In final step we will export our result in one text file that file contain all the details of image detection like how many faces founded at what time, and also at same time console side it shows same information same as text file and face detection live result. At conclusion it extracts a feature from the video and find all the detected faces and identify them by without error.

V. Cascade Classifier

The Cascade classifier detects objects in the moving framean over the picture. Every levelin given trained cascadeand itspositionsinobjectgives as +ve true or -ve false,+vemeans presents object was located and negative referred the specified object is not located in the picture. Incase labeled object is a -veoutput, then the classify of this specific region is hereby completed and the location of the window is moved to the next location first. If it gives a true result, then the region moves of to the next step of classification of detected. Mentioned cascade givesa decision of+ve, when all the levels, containing the last one, saying that object is found in the picture or video.

VI. Training Phase

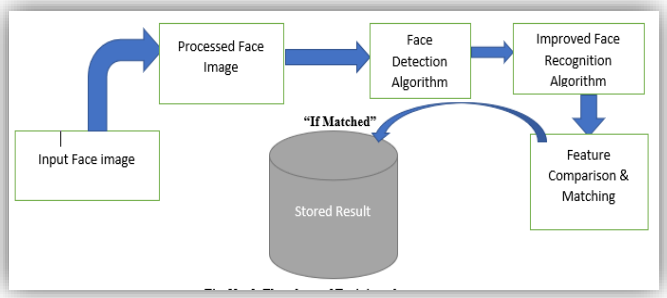
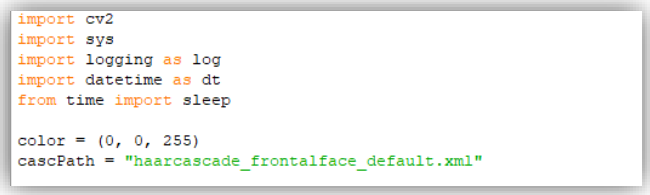


Fig.2. Flowchart of Training phase

Above Figure shows the flowchart of the training phase. The figure shown above flowchart of training phase of face detection process, after that the given input face images or video are computed using mentioned computingmethod, after that face detection algo will applied on it to located faces then Once faces are detected, to detected face pre-defined algorithm aided with our proposed method are going to be applied to detect faces. Once faces are detected, the detected faces are going to be extracted to outcome.

VII. Implementation Step

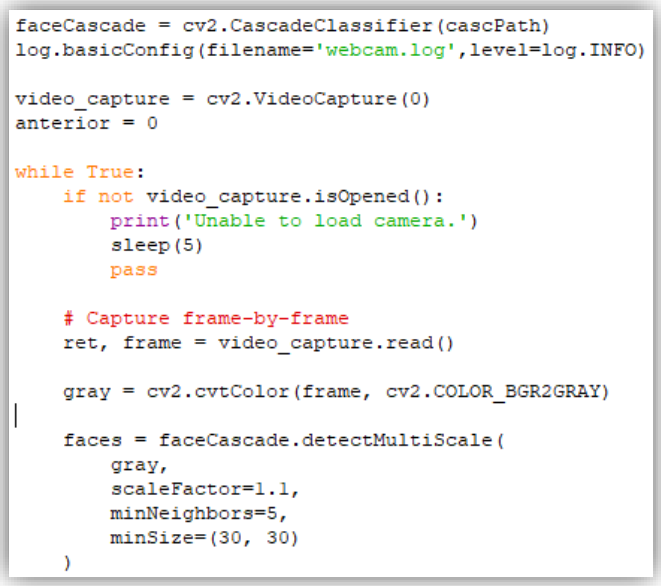


```
import cv2
import sys
import logging as log
import datetime as dt
from time import sleep

color = (0, 0, 255)
cascPath = "haarcascade_frontalface_default.xml"
```

Fig. 3 Step 1

In above snippet we import modules for face detection. All above module are well knowns on python. Python support above module which are downloaded using pip install module name. And secondly, weuse haarcascade_frontalface_default classifier for face detection.



```
faceCascade = cv2.CascadeClassifier(cascPath)
log.basicConfig(filename='webcam.log',level=log.INFO)

video_capture = cv2.VideoCapture(0)
anterior = 0

while True:
    if not video_capture.isOpened():
        print('Unable to load camera.')
        sleep(5)
        pass

    # Capture frame-by-frame
    ret, frame = video_capture.read()

    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

    faces = faceCascade.detectMultiScale(
        gray,
        scaleFactor=1.1,
        minNeighbors=5,
        minSize=(30, 30)
    )
```

Fig.4 Step 2

In above figure firstfixed camera inside the while loop, after that it will loadimage trough webcam. Now we invoked our cascadetype, then passing itby parameters on it.

```
    # Draw a rectangle around the faces
    for (x, y, w, h) in faces:
        cv2.rectangle(frame, (x, y), (x+w, y+h), (0, 255, 0), 2)
        print(str(len(faces)) +" face Found "+"at "+str( dt.datetime.now()))
        cv2.putText(frame,"Face",(x,y-5),
                    cv2.FONT_HERSHEY_COMPLEX_SMALL,1,color,2)


    if anterior != len(faces):
        anterior = len(faces)
        log.info("faces: "+str(len(faces))+" at "+str(dt.datetime.now()))


    # Display the resulting frame
    cv2.imshow('Video', frame)


    if cv2.waitKey(1) & 0xFF == ord('q'):
        break

    # Display the resulting frame
    cv2.imshow('Video', frame)


# When everything is done, release the capture
video_capture.release()
cv2.destroyAllWindows()
```

Fig.5 step 3

```
INFO:root:faces: 1 at 2020-08-31 09:15:51.101353
INFO:root:faces: 2 at 2020-08-31 09:15:51.326068
INFO:root:faces: 3 at 2020-08-31 09:15:51.458427
INFO:root:faces: 4 at 2020-08-31 09:15:56.903040
INFO:root:faces: 3 at 2020-08-31 09:15:57.050452
INFO:root:faces: 2 at 2020-08-31 09:15:57.180805
INFO:root:faces: 3 at 2020-08-31 09:16:00.175459
```

Fig. 6. Stored data

In above portion of code, detected faces on the image must be "mark" the faces within the image, using, for instance, a green rectangle with label thereon. If located faces in video are detected in video frame or images, it returns the accurate positions of detected faces in image or video as a green rectangle over face. All the available output we stored in one document, document store data like what how many faces detected during a frame at the one particular time, it saves all the info with time slots.

VIII. Experimental Result

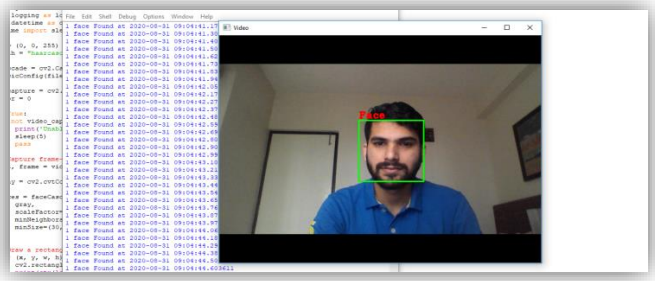


Fig. 6. Face detection in Single face.

In the above fig. 3 we input a single face via webcam and it detect and gives us complete result without any error or without any video lag in any frame. The present result is calculated based on face structure that already identify in cascade classifier.

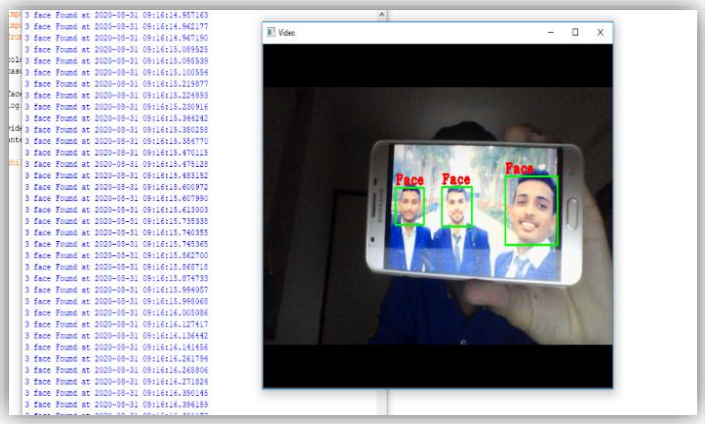


Fig. 7. Face detection in multiple faces.

In above mentioned fig. 4 we input multiple faces via webcam and it detect that all the present faces. And one good thing is that input image is which we showed to webcam from mobile and it detect all the faces from one picture. The result is calculated based on face structure that already identify in cascade classifier and it can detect multiple faces in one time.

IX. Applications

Face detection is employed in biometrics, often as a component of a facial detection system. Face recognitionusedforCCTV videosecurity, human computer interface and image detection.Some recent digital cameras and mobiles are used to face detection for auto focus mode and face lock. Face detection is useful for choosing regions of pictures slideshows.Other most used applications of face detection.

***Images database search*:** Searching available image on databases of licensed drivers, benefit recipients, locating missing children, immigrants checking and police verification.

Person General identity verification: Banking security, e-commerce services, national IDs, passports, employee IDs.

Surveillance Security*:* public places, surveillance by face detection and recognition user. the instance of face-based surveillance CCTV.

X. Conclusion

This paper gives an overall information about face detection that are used for the development of new machine interfaces for mobile robots and autonomous systems, based on computer vision techniques that systems are highly used in near future.An approach this paper for real-time face detection and tracking which can be very useful for machine interaction systems. In a machine interaction environment this system starts with aaccurate real-time learning process and then allows the machine to follow the person and to be sure it is always interacting with the right one under a wide range of conditions including: scale, pose and camera variation. The face tracking system works as a pre-processing stage to the face detection system, which allows it to concentrate the face detection task in a sub-window previously classified as face. Givenposition predictive stage also reduce the face detection area operating to the creation of automation of tracking, locating or real time detection system using proposed solution.

In future we will be planning to apply to add new classifiers along with the face detection that which will detects eyes and smile at same time. In other hand we can also apply mask detection system, automatic attendance recording system and complete face recognition with the its confidence level these all will be possible future enhancement for Face Detection with Machine Learning and OpenCV Classifier.

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