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Face Detection and Recognition using Raspberry Pi

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Abstract –

This paper describes the development of a system to provide information on Face detection and recognition .This is done in the context of a system of intelligent solutions,be it used as a solitary unit or implemented in larger and complex systems to provide a synergy,connected to Internet of Things. To create a complex system,a micro PC is used (Raspberry Pi 3). The outputs are stored inside the unit for further usage or analysis.This system can be used autonomously together powered by a battery.The application of the system is across various fields such as health care,security systems,attendance monitoring in offices and educational institutions.Thus the system may be regarded as a part of the IoT.

Key Words:Raspberry Pi, Face Detection, Face Recognition, IOT, OpenCV, Haar Classifier.

I. INTRODUCTION

Technological development has made viable the development of techniques of verbal exchange between people and objects, facilitating records float in terms of each speed and security. The Internet of Things (IoT) uses this type of development and integration of latest elements. As part of data systems, remote get admission to and various device controls, are enabled.

The Internet of Things ought to be taken into consideration a simple records network.If this data community is implemented to an area, for example, a clever home,then it's miles more and more getting used as a cheap and green sensor for simple cameras (IP cameras).

The Internet of Things is the connection of all physical gadgets based on the Internet infrastructure with the purpose of replacing information; gadgets and items are no longer disconnected from the digital world, but may be remotely managed and act as factors of get entry to services.

II. RASPBERRY PI

The Raspberry Pi is a one-chip PC corresponding to a (weaker) desktop laptop. It consists of a port for the screen (HDMI) and through a USB port it's miles viable to connect it to a keyboard and mouse. Multiple generations of this laptop have already been developed, all differing in overall performance and intended use. The micro CPU is from the ARM family, so it is akin to a not unusual smartphone. On Raspberry Pi, it's far possible to operate various distributions of Linux, Windows 10or the IoT Core, from Microsoft. Unlike PC Arduino, it is feasible to apply Raspberry Pi not best for numerous tool control (with GPIO contacts), however also for the relevant application improvement itself. For facial and motion detection, the newest version of Raspberry Pi 3, model B is used, which was released in February 2016. It is the first 64-bit Raspberry Pi, and is supplied with in built Wi-Fi and Blue-Tooth.

Figure 1
Raspberry-Pi-3-Model-B

Specifications:
1)Quad core 64-bit ARM Cortex A53 with frequency 1.2 GHz, approx. 50% faster than Raspberry Pi 2 802.11n Wireless LAN
2) Bluetooth 4.1 (including Bluetooth LowEnergy)
3) 400MHz Video Core IV multimedia
4) 1 GB LPDDR2-900 SDRAM (900 MHz)
5) 100 Mb/s Ethernet port, 4x USB 2.0, HDMI output

To create an self sustaining system, the Raspberry Pi camera module v2 is used. The camera has a high best 8 megapixel Sony IMX219 picture scanner. From thefactor of view of static images, the camera is capable of making 3280 x 2464 photo points of static pictures, it also supported 1080p in 30 fps, resolution of 720p in 60 fps and 640x480p in a 60 or 90 fps video.[6]

Specifications:
1) 8 megapixel native resolution
2) High quality Sony IMX219 image scanner
3) 3280 x 2464 image points of static pictures
4) Supports 1080p in 30fps, resolution of 720p in 60 fps and 640x480p in a 60 or 90 fps video
5) The camera is supported in the newest version of Raspbian
6) 1.4 um x 1.4 um pixels with technology OmniBSI for high performance (high sensitivity, low crosstalk, low noise)
7) Optical size ¼
8) Size: 25 mm x 23 mm x 9 mm
9) Weight (camera module + connecting cable)

III. OPEN CV

Open CV (Open-source Computer Vision, opencv.Org) is a multi-utility component of computer vision. It has a number modules with the aid of which it's far viable to solve a variety of issues in computer vision. The most useful a part of OpenCV can be its architecture and memory management. It gives a framework inside which it's miles viable to work with pictres and videos in any range of ways. The algorithms to apprehend faces are available in OpenCV library and are as follows:
1) FaceRecognizer.Eigenfaces: Eigenfaces, also defined as PCA, first used by Turk and Pentland in 1991
2) FaceRecognizer.Fisherfaces: Fisherfaces, also defined as LDA, invented by using Belhumeur, Hespanha and Kriegman in 1997
3) FaceRecognizer.LBPH: Local Binary Pattern Histograms, invented by way of Ahonen, Hadid and Pietikäinen in 2004 .

The preference of Fisherfaces has been made as it was based at the LDA algorithm. It has been claimed by many that when comparing special algorithms, a 95.3% success was done with LDA, while the time wanted for detection was in comparison to different algorithms. The technique used in Fisherfaces is taught from a magnificence transformation matrix. [2]
Unlike the Eigenfaces technique, it does now not report the depth of lighting. The discriminatory analysis reveals the facial tendencies wished for man or woman comparison. It is necessary to mention that the Fisherfaces´ performance is motivated to a notable extent via input data. In practical terms, if in a particular case Fisherfaces is taught the use of a well-lighted image, then in experiments with bad lighting fixtures, there could be a better wide variety of incorrect results. this is logical, as the technique does not have a chance to capture the lighting on the images.

IV. FACE RECOGNITION

EXISTING SYSTEM

Linear Discriminate Analysis LDA is a technique to find a linear combination of features which represent or separate two or extra classes of objects or events. Linear classifier can be

received from the resultant. Large variety of pixels are used to represent face in computerized face recognition. Before classification Linear discriminant analysis is used to reduce capabilities and makes it more manageable. New dimensions are a linear aggregate of pixel values which forms a template.

PROPOSED SYSTEM

The quality of photograph depends on plethora of factors that have an impact on the device's accuracy. It is vital to apply diverse pre-processing strategies to standardize the pix which you supply to a face reputation machine. Face popularity algorithm commonly locate it hard to understand a face underneath extreme light touchy conditions. If the gadget was educated to understand someone when they're in a dark room, then it's far highly viable that it won't apprehend them in a bright room. This problem is referred to as "lamination dependent". There are many different issues, such as the face should additionally be in a very regular function inside the images just like the eyes being in the same pixel coordinates, regular size, rotation angle, hair and makeup, emotion like smiling, angry, etc.

Hence it's far critical to apply a good photograph preprocessing filter[1]. For simplicity, the face popularity device presented on this paper is Eigenfaces the use of grayscale pictures. This paper indicates us that it is easy to transform color images to grayscale (additionally referred to as 'grayscale') and then to apply Histogram Equalization. It is a totally simple approach of routinely standardizing the brightness and evaluation of your facial pix. For better results, apply more processing stages consisting of aspect enhancement, contour detection, motion detection, etc. OpenCV uses a face detector algorithm known as a Haar Cascade classifier. An image, can come from a file or from live video, the face detector examines every photograph area and classifies it as "Face" or "Not Face." Classification assumes a fixed scale for the face. Faces in an photograph can be smaller or larger, the classifier runs over the image several times, to look for faces across a variety of photos. The category is fast, even when it is carried out at several scales.

SAMPLE CODE[3]

- **TRAINING SET**

```
def assure_path_exists(path):
dir = os.path.dirname(path)
if not os.path.exists(dir):
os.makedirs(dir)
recognizer= cv2.face.LBPHFaceRecognizer_create()
Detector=cv2.CascadeClassifier("haarcascade_frontal
face_default.xml");
def getImagesAndLabels(path):
imagePaths = [os.path.join(path,f) for f in
os.listdir(path)]
faceSamples=[]ids = []
for imagePath in imagePaths:
PIL_img = Image.open(imagePath).convert('L')
img_numpy = np.array(PIL_img,'uint8')
id = int(os.path.split(imagePath)[-1].split(".")[1])
faces = detector.detectMultiScale(img_numpy)
for (x,y,w,h) in faces:
faceSamples.append(img_numpy[y:y+h,x:x+w])
ids.append(id)
return faceSamples,ids
faces,ids = getImagesAndLabels('dataset')
recognizer.train(faces, np.array(ids))
assure_path_exists('trainer/')
recognizer.save('trainer/trainer.yml')
```

- FACE DETECTION[4][5]

```
def assure_path_exists(path):
dir = os.path.dirname(path)
if not os.path.exists(dir):
os.makedirs(dir)
recognizer=cv2.face.LBPHFaceRecognizer_create()
assure_path_exists("trainer/")
recognizer.read('trainer/trainer.yml')
cascadePath="haarcascade_frontalface_default.xml"
faceCascade=cv2.CascadeClassifier(cascadePath);
font = cv2.FONT_HERSHEY_SIMPLEX
cam = cv2.VideoCapture(0)
while True:
ret, im =cam.read()
gray=cv2.cvtColor(im,cv2.COLOR_BGR2GRAY)
faces=faceCascade.detectMultiScale(gray, 1.2,5)
for(x,y,w,h) in faces:
cv2.rectangle(im, (x-20,y-20), (x+w+20,y+h+20),
(0,255,0), 4)
Id,confidence=recognizer.predict(gray[y:y+h,x:x+w])
if(Id == 1):
Id="SUBRAMANYA{0:.2f}%".format(round(100 -
confidence, 2))
cv2.rectangle(im, (x-22,y-90), (x+w+22, y-22),
(0,255,0), -1)
```

```
cv2.putText(im, str(Id), (x,y-40), font, 1, (255,255,255), 3)
cv2.imshow('im',im)
if cv2.waitKey(10) & 0xFF == ord('q'):
break
cam.release()
    cv2.destroyAllWindows()
```

V. CONCLUSION

The Internet of Things is a new fashion in informatics that connects different gadgets to the Internet, typically wirelessly, the use of Wi-Fi or Bluetooth. The monitoring system designed here, may also be used autonomously, that means that with the assist of a battery or a solar panel, it may be placed anywhere and would perform with out any outdoor control. It will be used in diverse fields, together with healthcare, monitoring sufferers in hospitals and checking their status in real time. Motion activity may be monitored, for example, in parking lots, allowing get right of entry to to the lot most effective if there are vacancies.

But, even though cameras can provide significant amounts of information, the vast majority is personal data, and there are significant concerns that individual privacy could be compromised. Furthermore, since home appliances are increasingly being connected to the Internet via the IoT, it has become possible for user images to leak out unintentionally. With these concerns in mind, there is a need to propose a human detection method that protects user privacy by using

intentionally blurred images**.** However, In this paper we have developed a system for face detection and recognition using opencv. It is used to come across and apprehend human faces. The snap shots of the persons are the datasets which can be defined and trained before recognizing. Haar cascade set of rules is used for detection. For better face popularity and detection small features can be improved. In the approaching future, as generation advances, greater advance capabilities will be introduced to the system.

VI. REFERENCES

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