

Real Time Face Recognition using Raspberry Pi II

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ABSTRACT: In present day human machine interface is increasingly emerged in demand and human activities is identified by the machine. When the machine identifies the human activities, it will improve the efficiency of task. Limited work is done in face recognition in real time. In this proposed method is to perform the face recognition using PCA algorithm with Haar cascade classifier. In this method we use three steps such as face detection using Haar cascade classifier, feature extraction using PCA algorithm, classification of images by Ada boost classifier. The novelty of this proposed method is implementation of Real time Face recognition using raspberry pi II and average accuracy of 93% is achieved at real time.

KEYWORDS: Face Recognition, Feature Extrcaction, PCA algorithm, Raspberry Pi, Viola Jones Detection.

I. INTRODUCTION

Nowadays face recognition is acquiring much importance by multimedia information access, real time applications, human machine interaction etc. the face recognition is one of the biometric methods that serve as important tool for real time applications. The face recognition is done by recognizing frontal images of human faces. Tim Ahonen et.al [2], 2006 pointed out a novel and efficient facial image representation using LBP features. The facial image is divided into several regions in which the feature extraction is performed by the LBP Feature extraction. The face recognition analysis is important component for most of the applications. Face recognition is already well studied but real time method is lacking as it performs efficiency of recognition. It will estimates image with even low quality images .Most of the work is based on frontal images with different illumination conditons.when face recognition isperformed in real time method, these conditions are not uniform.

In this proposed method, the face recognition is performed by using real time databases consisting of various poses and illumination conditions. The system that uses raspberry pi II as the size is found to be very small and light weighted .it is important that it requires very less amount of power supply.it is used for various applications such as smart home applications, surveillance, security issues etc.. This paper is organized as section 2 outlines the background work, section 3 discusses the proposed work, and section 4 reported the analysis and conclusion and future work in last section.

II. LITERATURE SURVEY

There are lot of decades in which this research works on recognition and analysis have been carried out for various applications related to human machine interaction.

Only few approaches have been used in real time face recognition. face detection is the first step in face recognition of images. Viola jones [1] proposed an algorithm that uses haar cascade classifier, adaboosttraining and cascade classifier. Wan-Hung Liao et.al [5], 2011 used the local binary pattern (LBP) operator which is a efficient local texture descriptor and it is used in various applications. Tim Ahonen et.al [2], 2006 used a novel and efficient facial image representation which is based on local binary pattern and texture features. The LBP

feature descriptor are extracted by dividing facial images into various regions. In 2014 kamesh [5] used active appearance model and local binary pattern where AAM is generic based approach and local binary pattern is hybrid approach .



Figur.1: Circuit Board of Raspberry Pi II

After the extraction of features different classifiers are used for face recognition, such as support vector model SVM[3], neural networks,ada boost classifier ,least mean square etc. the software testing is done by creating real time databases .Each directory contains 30 images of individual. Later hardware implementation is performed by raspberry pi along with hardware set up.

III. PROPOSED METHOD

In this proposed method, the objective is to develop the real time face recognition from the facial images.it is performed using real time database which is collection of images from 10 subjects. The images of each subject is stored in specific directory with 30 images .Each image size is of about 100*130pixels. The viola jones detection algorithm is used for face detection whereas PCA algorithm is used for feature extraction and then Ada boost classifier is used for face recognition.Raspberry pi II is the credit card sized computer which contains system on chip Broadcom BCM 2836 with CPU,GPU,DSP,SDRAM .The CPU is made up of quad core ARM cortex running at 200 MHz. The architecture of proposed system is displayed in Figure 3 and explained as follows: The input image is captured from web camera and fed into the real time face recognition system as input. The real time face recognition is deployed with the Raspberry pi II which gives the identified image asoutput.This output is displayed in the monitor of the system .The operation of real time face recognition is displayed in Figure 1.

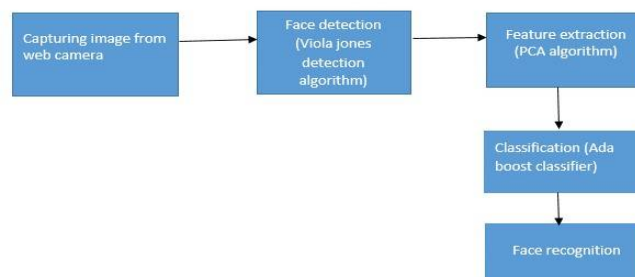


Figure 2. Block Diagram of the Real time face recognition

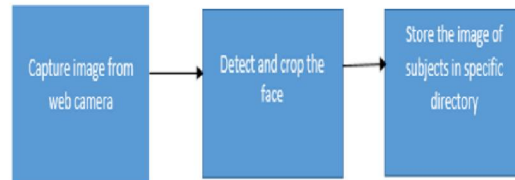


Figure 3. Creation of real time database

The algorithm for real time implementation of face recognition using raspberry pi II is explained as follows:

Step 1: Input image is captured from web camera

Step 2: The facial image is detected by using Viola – Jones face detection technique. The integral image is developed by using Haar wavelet concept to detect the face. It considers the different intensity of values of adjacent rectangular regions. The different areas of face have different intensity. Face is detected and pointed by using rectangular box.

Step 3: Feature extraction is performed by using the PCA algorithm. The training images are prepared for equal size and all images are centered. All images in the database are transformed into vectors and placed in the training set. The average face vector is calculated from images and it is subtracted from all original images in the database. These values are stored in a specific variable. The Eigen values and Eigen vectors are calculated. Keep the largest Eigen vectors that correspond to the largest Eigen values that contain large characteristic features of the image.

Step 4: The classification of the image is performed by the Adaboost classifier, which provides classification learning tasks. It is a very simple and flexible classifier that combines with any learning algorithm. It is a powerful committee that combines the performance of many weak classifiers.

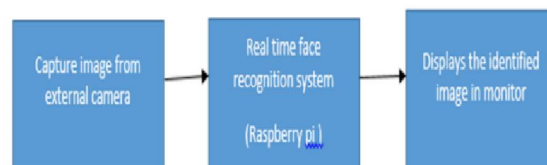


Figure 4. Real Time Face Recognition using Raspberry Pi II

Step 5: Hardware implementation using Raspberry pi II. The system of real-time implementation is tested using software and deployed in Raspberry pi II in a Linux environment. A monitor and keyboard are connected to Raspberry pi II. A laptop is connected to it as a display. Raspberry pi II and laptop are connected by PuTTY software and a Wi-Fi adapter. The software coding for real-time face recognition is copied into a memory card and attached to Raspberry pi II. In real-time face recognition, when a person looks into the camera, their image is taken and given as input to Raspberry pi II, and the face recognition software is already deployed and displays the recognized face on the monitor's display.

IV. RESULTS AND DISCUSSION

The result for creation of real time database are recorded. The real time database is created by using python . While executing it produces 30 images of each subjects. . Likewise, databases should be created for at least 10 individuals and it creates each image size of about 100*130 pixels of height and width.

```
pavi@pavi-Lenovo-G50-70: ~/code/pavi/face
pavi@pavi-Lenovo-G50-70:~$ cd pavi
bash: cd: pavi: No such file or directory
pavi@pavi-Lenovo-G50-70:~$ cd code
pavi@pavi-Lenovo-G50-70:~/code$ ls
pavi
pavi@pavi-Lenovo-G50-70:~/code$ cd pavi
pavi@pavi-Lenovo-G50-70:~/code/pavi$ ls
face  face1.py  P1Face-master
pavi@pavi-Lenovo-G50-70:~/code/pavi$ cd face
pavi@pavi-Lenovo-G50-70:~/code/pavi/face$ ls
create_data.py
datasets
Face recognition in python using Opencv 2.4.10.pdf
face_recognize.py
haarcascade_frontalface_alt.xml
haarcascade_frontalface_default.xml
pavi@pavi-Lenovo-G50-70:~/code/pavi/face$ sudo nano create_data.py
```

Figure 5. Creation of Real Time database

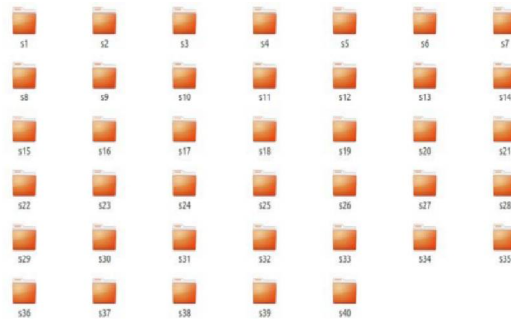
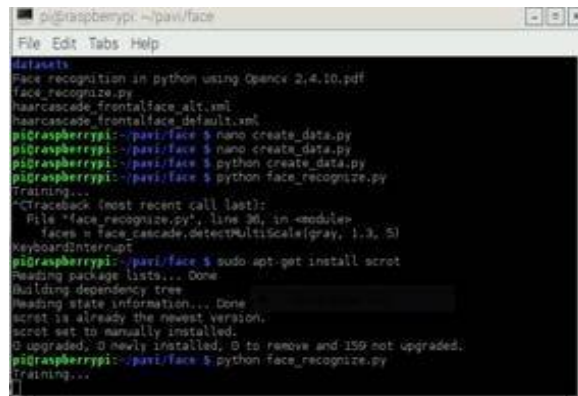


Figure 6. Storing database of each individual in specific directory



Figure 7 Hardware implementation of face recognition



```

pi@raspberrypi:~/pavi/face
File Edit Tabs Help
Datasets
Face recognition in python using Opencv 2.4.10.pdf
face_recognize.py
haarcascade_frontalface_alt.xml
haarcascade_frontalface_default.xml
pi@raspberrypi:~/pavi/face $ nano create_data.py
pi@raspberrypi:~/pavi/face $ nano create_data.py
pi@raspberrypi:~/pavi/face $ python create_data.py
pi@raspberrypi:~/pavi/face $ python face_recognize.py
Training...
Traceback (most recent call last):
  File "face_recognize.py", line 36, in <module>
    faces = face_cascade.detectMultiScale(gray, 1.3, 5)
KeyboardInterrupt
pi@raspberrypi:~/pavi/face $ sudo apt-get install scrot
Reading package lists... Done
Building dependency tree
Reading state information... Done
scrot is already the newest version.
scrot set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 159 not upgraded.
pi@raspberrypi:~/pavi/face $ python face_recognize.py
Training...
  
```

Figure 8. Implentation using Raspberry pi II

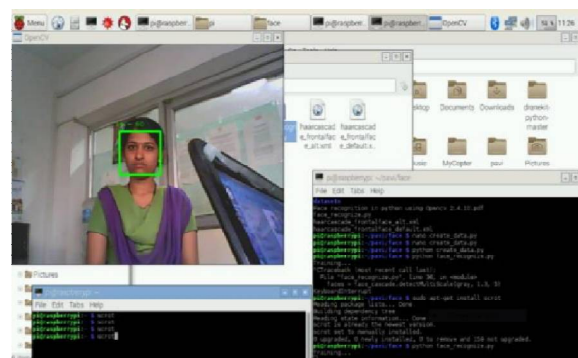


Figure 9.Face recognition using Raspberry Pi II

Table 1: Accuracy Of Proposed System

SIMULATION PARAMETERS	RANGE
NUMBER OF TRAINING IMAGES	100 IMAGES
NUMBER OF TESTING IMAGE	1 IMAGE
SIZE OF IMAGE	100*130
NORMAL CONDITIONS	95 %
ILLUMINATION CONDITIONS	83 %

The proposed system in real time , we tested using 10 individuals by looking into web camera connected to Raspberry pi as shown in Figure 7. The Hardware Implentation using Raspberry pi II can be implemented by Figure 8 and Face Recognition using Raspberry pi II is displayed in Figure 9 .

The accuracy of 93% is achieved by using Linux environment by average processing time of 100 ms with Raspberry Pi II (ARM1176JZF) as shown in Table 1. Implementation of real time face recognition in Raspberry pi II is novelty approach and it can be used for various application since raspberry pi II is very light weight and it needs only less power supply and it can be mounted on any device and used for various applications.

V. CONCLUSION AND FUTURE WORK

In this paper, we have proposed a method of Real time face recognition based on PCA algorithm using Raspberry pi II .we have achieved an overall accuracy of 95% with average processing time of 100 MS on Linux platform with python software coding using Raspberry Pi II (ARM1176JZF, 900 MHz).When the dispalyscreen is attached to the set up ,it can display face recognition under surveillance of hospitals,banks,authentication of entry etc. Our proposed work is more useful for society in various applications as face recognition plays major role. In future work, different algorithm for feature extraction can be implemented to improve accuracy of recognition. The face recognition with Raspberry Pi II can be applied for authenticated users in security basis. And it can be performed by various techniques inorder to achieve accuracy.

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