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Real Time Emotion Recognition from Facial Images using Raspberry Pi

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Abstract: Facial expressions play big role in judging emotions of a person. It is found that limited work is done in field of real time emotion recognition using facial images.In this project a new method is proposed to find real time emotion recognition from facial image. In this proposed method various steps of face detection like Haar cascade and Eigen Face Recognizer are used. Haar cascade is a classifier. It classifies various features of face like edge, line and center-surround features & it resizes the particular image equally. Eigen face Recognizer is used to recognize the captured image of different emotions. The camera which is externally connected to Raspberry Pi 3 can capture the images. The emotion recognition software will recognize the images and displays the recognized emotion into the display monitor and notification will be sent to the user via SMS(GSM) We have achieved an overall accuracy of 94 % with average processing time of 120ms on Linux platform by using Raspberry Pi. Other modality like speech can be combined along with image for emotion recognition.

Keywords: Eigen Face Recognizer, Haar Cascade, Raspberry Pi3, GSM, LINUX.

I. INTRODUCTION

In present day technology human-machine interaction is growing in demand and machine needs to understand human gestures and emotions. If machine can identify human emotion, it can understand human behaviour better, thus improving the task efficiency.The proposed system design using Raspberry Pi 3 with external camera, keyboard and display monitor, GSM. Monitor and keyboard are connected to Raspberry Pi 3 as it does not have display and input unit. Laptop can also be used as remote desktop for display and keyboard for input by using Virtual Network Connection (VNC) and put software. In real time, when a person faces the camera, his/her image will be captured and given to Raspberry Pi 3. Emotion recognition software that is already deployed will recognize emotions and displays the recognized emotion on the display monitor as shown in Fig1. As we give power to the Raspberry pi, the USB camera and also to GSM the video streaming is shown for continuous capture of images and later matches with the captured images of different emotions and the message is sent to the concerned person.

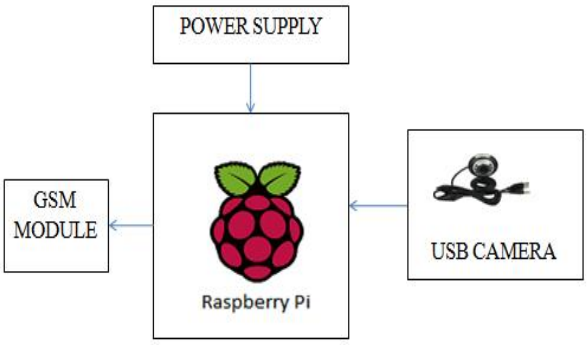
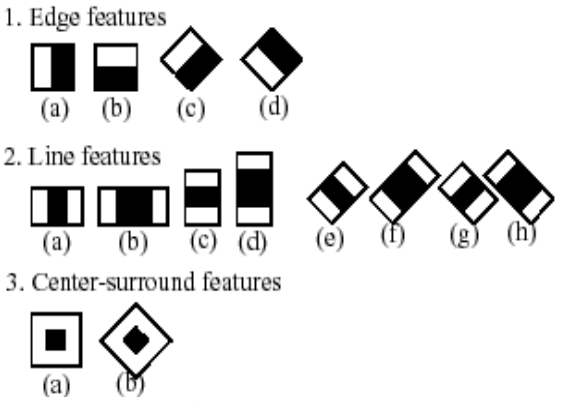


Fig.1.Block Diagram.

II. PROPOSED METHOD

In the proposed method, the objective is to develop real time emotion recognition from facial images to recognize basic emotions like happy, neutral, and sad. We have used CMU MultiPIE database, which is a collection of images with a variety of facial expressions. In this process we used method of Haar cascade and Eigen face recognizer.

Haar Cascade: This classifier trains the particular image and resizes equally. The classifier is designed so that it can be easily "resized" in order to be able to find the objects of interest at different sizes, which is more efficient than resizing the image itself. So, to find an object of an unknown size in the image the scan procedure should be done several times at different scales. The word "cascade" in the classifier name means that the resultant classifier consists of several simpler classifiers (stages) that are applied subsequently to a region of interest until at some stage the candidate is rejected or all the stages are passed. Haar-like features are the input to the basic classifiers, and are calculated as described below. The current algorithm uses the following Haar-like features:



Eigen Face Recognizer: Every Face Recognizer supports the training of a Face Recognizer on a given set of images (i.e; face database!).Prediction of a given sample image, that means a face with different values. Loading/Saving the model state from a given XML. Setting/Getting labels info, that is storaged as a string. String labels info is useful for keeping names of the recognized people. Training and prediction must be done on gray scale images, use cvtColor() to convert between the colour spaces. The eigen faces method makes the assumption, that the training and test images are of equal size. Thus the process is done.

III. REAL TIME IMPLEMENTATION

The Raspberry Pi board in serial communication with GSM is connected. then connect USB camera to the raspberry board with cables of keyboard and mouse. HDMI cable is connected to CPU and then give power supply. The first step is after setting the board we capture or train the images of different emotions like happy, neutral and sad. These are stored into the Pi database. Internally all the images are converted to Gray images as we are capturing color images. After capturing the images the database appends the trained data and then checks the faces with Eigen face recognizer, if the current image matches with trained images we get a prediction value of less than 5000.The less is the prediction value the more is the accuracy, and then the message is sent to the registered mobile number through the connected GSM, this the application of monitoring the disabled persons understanding through their facial expressions and helping them.

A. Software Design

The software implementation in this project is we have used Raspbian Jessie to operate Raspberry Pi and Python programming language in an open CV environment.

B. Flow Chart

Once the project is done we are initializing the web camera and GSM. The web camera captures the images of different emotions and stores into the database as shown in Fig.2. The saved images of different emotions like happy, neutral and sad are matched using the eigen recognizer with a prediction value less than 5000.After the emotion is detected the message is sent to the registered mobile number as shown in Fig.3.

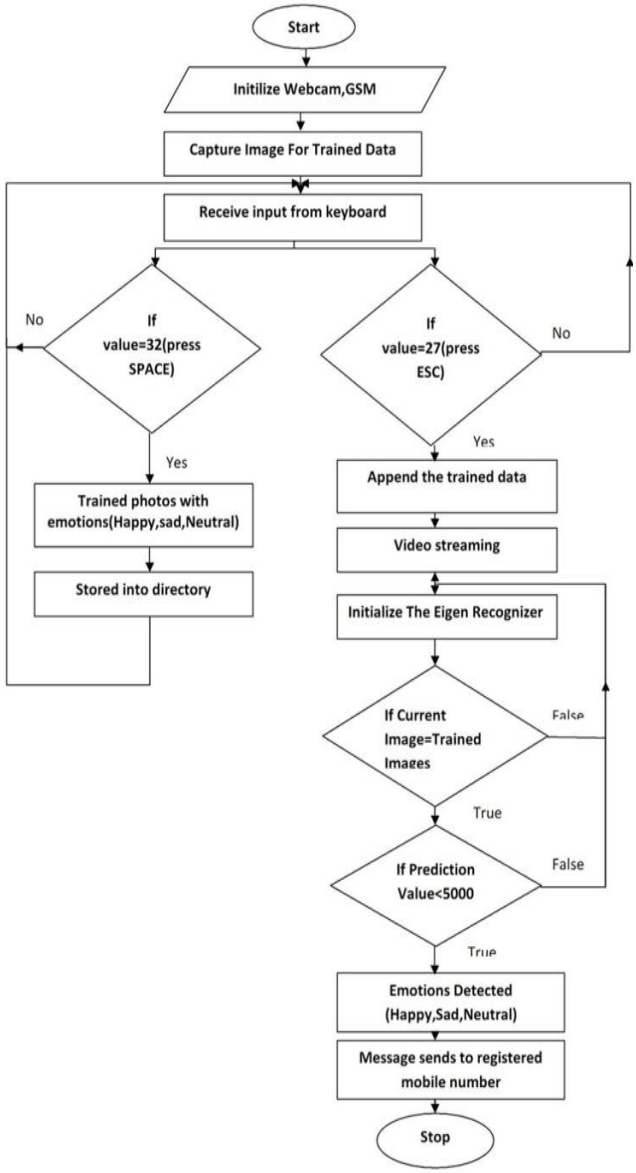


Fig.2. Flowchart.

Fig.3.Hardware model.

IV. RESULTS

Results of this paper is as shown in bellow Figs.4 to 7.

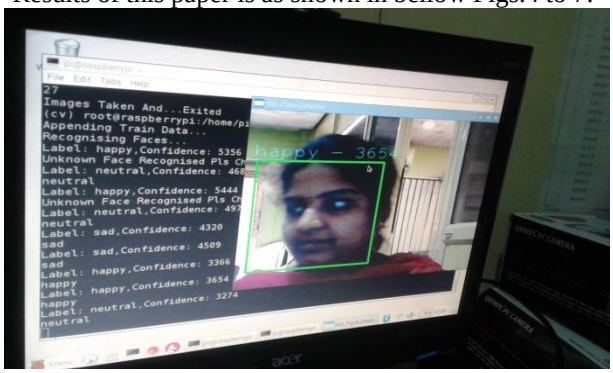


Fig.4. Happy emotion detected.

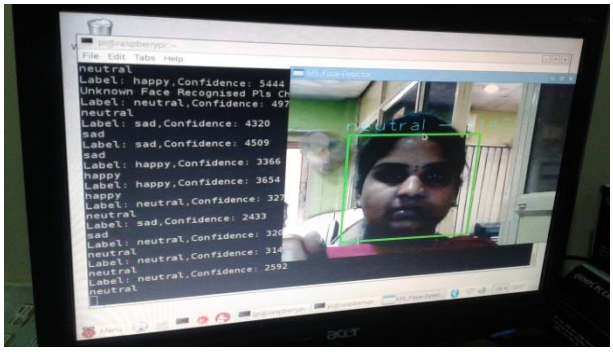


Fig.5. Sad emotion detected.

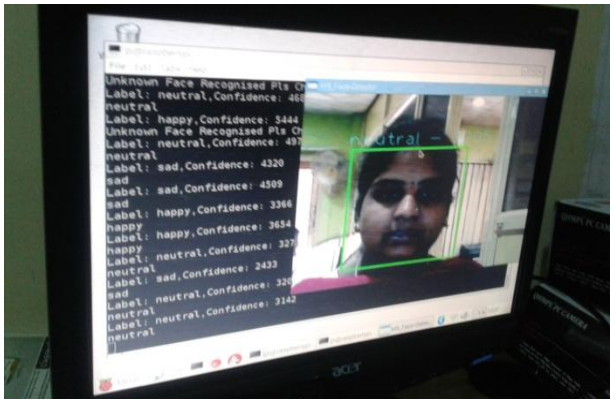


Fig.6. Neutral emotion detected.

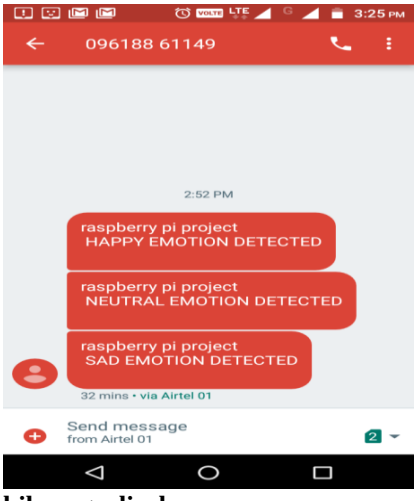


Fig.7. Mobile page display.

V. CONCLUSION

In this paper, we have proposed a method for emotion recognition in real time, based on geometric features using Raspberry Pi III. We have achieved an overall accuracy of 94 %with average processing time of 120ms on Linux platform by using Raspberry Pi III (A The Raspberry Pi III is a very small hardware kit with low weight which can be mounted on a mobile robot. If a portable small display screen is attached to the mobile robot, it can display the emotions of a person dynamically under surveillance / social environments like hospitals, old age home etc.,. Our proposed system is highly useful to the society for different applications where emotion recognition plays a major role. In future work, different algorithm can be implemented to improve recognition accuracy. Robots can also be made to recognize emotion by neurological inspiration. Other modality like speech can be combined along with image for emotion recognition.

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