Emotion Detection using Raspberry Pi

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Abstract - *Emotions play a very important role in our day to day life. Emotions are the natural physiological response of the human body which can be recognized by the facial expression. In the proposed system research has been done in the field of Human Computer Interaction(HCI). The entire project is divided into three major steps i.e. Face detection, facial feature extraction and classification. In the first phase face detection has been done using Haar Cascaded frontal face algorithm. The system detects and crops the lip region for further classifications, then the features are extracted into vectorized form. Extracted features are compared with trained database using Logistic Regression. the main hardware used in this project is Raspberry pi with linux based OS to neglect the drawbacks of personal computer and for better picture quality 8MP USB Camera is used.*

Key Words: Raspberry pi, 8MP USB camera, Facial expressions, Haar cascade, Logistic regression, Human computer Interaction(HCI).

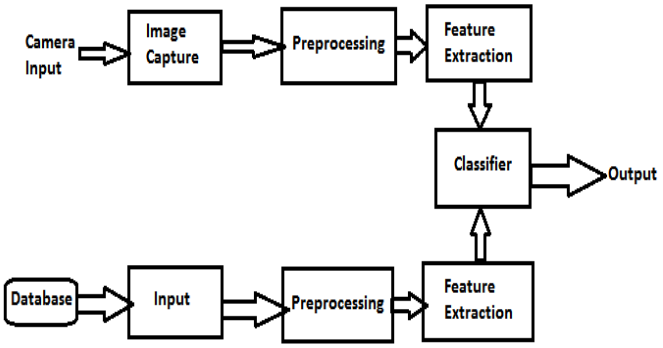
1.INTRODUCTION

In our day to day life emotions or facial expression are the prime factor which are required for communication purpose. For humans it is quite easy to detect an emotion but difficult for a computer or a machine to do so. Human emotions are mainly classified into 7 emotions i.e. Neutral, Happy, Sad, Anger, Disgust, Fear and Surprise. This project deals with 4 emotions they are Neutral, Happy, Sad and Surprise.

As we are developing the need and importance of automatic emotion recognition has increased which supports Human Computer Interaction applications. Facial expression defines the emotions of an individual which is required for Human Computer Interaction (HCI) in this project. Apart from Human Computer Interaction the system could be used for monitoring medical patients emotional states and stress levels.

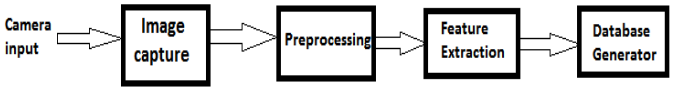
The Hardware used in this project is a camera and a Raspberry pi. PYTHON is the programming language which is used on LINUX based Raspberry pi.

2. Design Flow



The Design flow of this project consists of two parts i.e. Training and Testing. In Training generation of database for different emotions is maintained while in Testing part comparison of real time images with the stored database is carried out and accordingly a particular emotion is displayed.

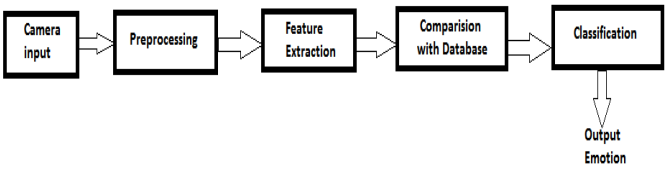
2.1 Training



Steps involved in Training process:

- Initializing the camera.
- Face Detection is carried out using Haar Cascaded Frontal face Algorithm.
- Then lip detection is done followed by cropping the lip region to avoid complexity
- The feature Extracted are then converted into vectorized form.
- These Images are stored to generate the database.

2.2 Testing



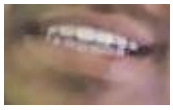
- Step 1 to Step 4 are same as the training process.
- Then the vectorized image is compared with the images to give the desired output.

A. Face Detection

Many problems are faced during the face detection. To avoid complexity our assumption is that, an input image is having single Face. Face detection basically means separating the region of image which contains face from the background. In this project Haar cascaded Algorithm is used for face detection.

B. Cropping Facial Region

After the completion of face detection te next step is to extract lip region. As we know lip region contains maximum red colour content therefore the red colour content other than the lip region will interfere during detection. So to avoid complexity only the region of our interest is cropped out. Because of this computational time is also reduced.



C. Lip Detection and Segmentation

After completing Face detection we have our region of interest. Then no this image Lip detection algorithm is applied. Basically emotions are detected in the lip region as well as the eye but most of the changes are visible in the lip region. After the detection process Lip segmentation is done. Lip segmentation is used to generate template for creating database which will be used for comparison with real time image.

D. Template Database Generation

This project is basically divided into two sections, First is the training part where database is generated and the other is the emotion recognition
part. In emotion recognition the input image is compared with the images stored in the database and then the desired output is produced. But for comparison generation of database is required.

E. Emotion Recognition

In Emotion recognition the input image is compared with the images stored in the database. This is done by cross correlation. In this process the images are divided into rectangular blocks. Each block in first image is compared with the block in other image to produce the cross correlation as a function of position. cross correlation is also used to find similarities between two similar images.

3. Hardware

A. Raspberry Pi

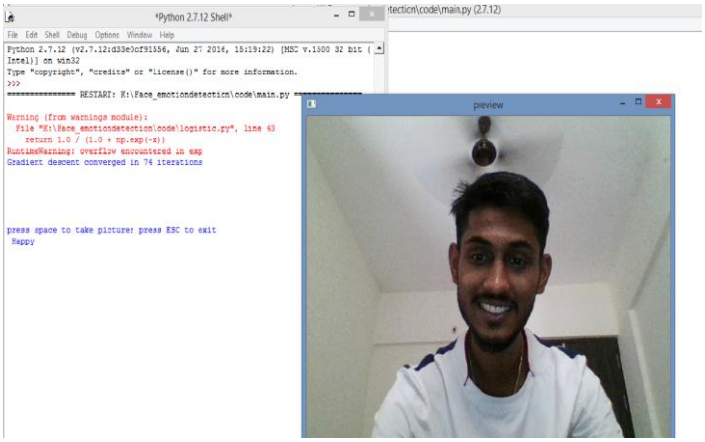
The main hardware used in this project is Raspberry Pi 3 model B. It is a Linux based platform which uses Python as programming language. In Linux software development is quite simple as it is an open source code development environment.

B. Camera Module

The camera module used in this project is 8MP high defination camera for better picture quality.

3. CONCLUSIONS

The proposed system is another link for the Human Computer Interaction (HCI). In the field of medical science this system manages to figure out patient's emotional stress level. To determine the mental state of the student in the field of E-learning. As high definition camera is used the picture captured will be of good quality and which will give the accurate output.



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