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. It is found that limited work is done in field of real time emotion recognition using facial images. In the proposed system research has been done in the field of Human Computer Interaction (HCI). In this proposed method various steps of face detection like Haar cascade and Eigen Face Recognizer are used. It classifies various features of face like edge, line and centre-surround features & it resizes the particular image equally. Eigen face Recognizer is used to recognize the captured image of different emotions. Extracted features are compared with trained database using Logistic Regression. The main hardware used in this project is Raspberry pi. 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.*

Keywords- Raspberry pi, Pi-cam, Facial expressions, Haar cascade, Logistic regression, Human computer Interaction (HCI).

I. INTRODUCTION

Detecting emotion has been an increasingly popular research topic in recent year. For humans it is quite easy to detect an emotion but difficult for a computer or a machine to do so. Applying this in a social network setting, it can be a powerful tool to gain knowledge about how individuals, social circles, communities, or cities feel about current events or other such topics. Human emotions are mainly classified into 7 emotions. This project deals with 4 emotions they are Neutral, Happy, Sad and Surprise. Emotion from images is to detect changes in facial expressions in according to an individual's internal emotion state and intentions. 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.

II. ARCHITECTURE

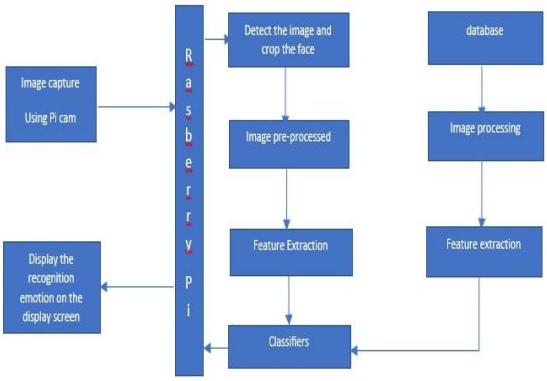


Fig.1 Overview of Real Time Emotion Recognition

The architecture of proposed system is shown in the above Fig. And explained as follows: The input image in real time is captured through webcam and fed to emotion recognition software as input. Emotion recognition software is deployed in the Raspberry Pi, which gives classified emotion as output. The recognized emotion is displayed in the monitor. The algorithm for real time implementation of emotion recognition using Raspberry Pi II is explained as follows:

Step 1: Input image is captured through webcam.

Step 2: processing and non-face area is removed by using fisher's classifiers.

Step 3: In image pre-processing, image is cropped according to required size and converted in grey image.

Step 4: Feature extraction is based on geometric approach for which Active Shape Model (ASM) is used.ASM automatic fiducial point location algorithm is applied first to a facial expression image, and then Euclidean distances between centre gravity coordinate and the annotated fiducial points coordinate of the face image are calculated. image is extracted.

Step 5: Classification is done by adaptive boosting classifier (AdaBoost). AdaBoost is a powerful learning concept that provides a solution to supervised classification learning task. It combines the performance of many weak classifiers to produce a powerful committee as shown in equation.

AdaBoost is a flexible classifier which can be combined with any learning algorithm. It is very simple and easy to perform in which only one parameter i.e., number of iterations is varied to get good accuracy.

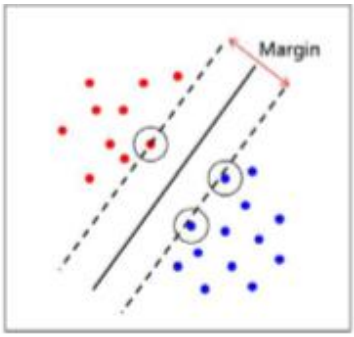
Step 6: Hardware implementation using Raspberry Pi II.

III. LITERATURE

Deep learning has emerged as a new area of machine learning research. The deep neural networks are composed of multiple levels of non-linear operations. Finally, use the learned weights to initialize a deep neural network. One of the main reasons to go deep is that a nonlinear function can be more efficiently represented by deep architecture with fewer parameters. But It is not convent for our projects because of its disadvantages.

K-Nearest-Neighbour Classification k-nearest neighbour algorithm [12,13] is a method for classifying objects based on closest training examples in the feature space. k-nearest neighbour algorithm is among the simplest of all machine learning algorithms. Training process for this algorithm only consists of storing feature vectors and labels of the training images. In the classification process, the unlabelled query point is simply assigned to the label of its k nearest neighbours. Typically the object is classified based on the labels of its k nearest neighbours by majority vote. If k=1, the object is simply classified as the class of the object nearest to it. When there are only two classes, k must be a odd integer. However, there can still be ties when k is an odd integer when performing multiclass classification. After we convert each image to a vector of fixed-length with real numbers, we used the most common distance function for KNN which is Euclidean distance. [4]

SVM- SVM classification uses different planes in space to divide data points using planes. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories or classes are divided by a dividing plane that maximizes the margin between different classes. This is due to the fact if the separating plane has the largest distance to the nearest training data points of any class, it lowers the generalization error of the overall classifier



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A main advantage of SVM classification is that SVM performs well on datasets that have many attributes, even when there are only a few cases that are available for the training process. However, several disadvantages of SVM classification include limitations in speed and size during both training and testing phase of the algorithm and the selection of the kernel function parameters.[4]

IV. APPLICATIONS

Tourism industry

In the tourism industries tourist can be allowed to take advantage of many adventurous things depending on their mood .If the tourism related business employee are not in a good mood they may spoil the entire day of the tourist.

Companies

Working environment can be judged by implementing this module along with the biometric module, if it seems that the employees are not happy or neutral then they can be monitored for the rest of the day.

Corporate offices

The behaviour of the staff members with clients can be monitored with the help of this module.

Medical uses

This can be a primary way to monitor the actual mood swings before consulting a doctor or psychiatrist.

V. CONCLUSION

In this paper the automatic facial expression recognition systems and various research challenges are overviewed. Basically, these systems involve face recognition, feature extraction and categorization. Various techniques can be used for better recognition rate. Techniques with higher

recognition rate have greater performance. These approaches provide a practical solution to the problem of facial expression recognition and can work well in constrained environment. Emotion detection using facial expression is a universal issue and causes difficulties due to uncertain physical and psychological characteristics of emotions that are linked to the traits of each person individually. Therefore, research in this field will remain under continuous study for many years to come because many problems have to be solved in order to create an ideal user interface and improved recognition of complex emotional states is required. In Case of a Dark person with a Bright Background, this System will be able to detect face with more accuracy. We will be able to detect Side Faced Images from them as it will be able to extract face feature. In this system there is no as such limitations of using Lips as Neuron to detect emotion. So, we will also be able to detect some of the mixed emotions.

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