REAL TIME HUMAN FACIAL EMOTION RECOGNITION SYSTEM

Mayur Tembhurney[1], Chetan Damre[2], Mrunal Saoji[3], Roshani Kalbende[4]

[1] *Assistant Professor, Department of Electronics and Telecommunication Engineering, S B Jain Institute of Technology Management and Research, Maharashtra, India*
[2] *Student, Department of Electronics and Telecommunication Engineering, S B Jain Institute of Technology Management and Research, Maharashtra, India*
[3] *Student, Department of Electronics and Telecommunication Engineering, S B Jain Institute of Technology Management and Research, Maharashtra, India*
[4] *Student, Department of Electronics and Telecommunication Engineering,S B Jain Institute of Technology Management and Research, Maharashtra, India*

ABSTRACT

Now-a-days human–machine interaction is most important area in recent research field where all types of machines try to understand human emotions and gestures.
Understanding the human behavior for machine, researchers worked continuously because if machine able to understand the human behavior it work better.
Human emotions can understand by pictures, verbal ,text, vocal, and facial expressions. For judge specific emotions of a human facial expressions plays an important role. Limited work is done in the field of real time human emotion recognition with the help of facial pictures/images. In this research paper, we will propose method for real time emotion recognition from facial image. There are three proposed method steps, we are using in this research work first one is for face detection- Haar cascade, second one we use here feature extraction using Active Shape Model (ASM) and third one is for classification of five emotions that is happiness, anger, disgust, surprise and neutral. Our proposed method lies in the implementation of emotion recognition of happiness, anger, disgust, surprise and neutral at real time on Raspberry Pi IV. The Raspberry Pi IV when mounted on any kind of robot and it can be recognize emotions dynamically in real time in any environments

Keyword : - Real time emotion recognition , Active Shape Model, Haar cascade, and Raspberry Pi

1. 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 behavior better, thus improving the task efficiency. It can serve as a vital measurement tool for behavioral science and socially intelligent software can be developed which can be used for robots. Emotions are the strong feelings which are govern by the surroundings and play a great role in daily task like decision making, learning, attention, motivation, coping, perception, planning, cognition, reasoning and many more, which leads to emotion recognition a big research field. Emotion recognition can be done by picture, text, vocal, verbal and facial expression. In 1968, Albert Mehrabian pointed out that in human to human interaction 7% of communication is contributed by verbal cues, 38% is contributed by vocal cues and major portion 55% is contributed by facial expressions. So, facial expression analysis is one of the most important components for emotion recognition.Most of the work are based on frontal view images of the faces. More work need to be done on nonfrontal images with different illumination conditions as in real time these global conditions are not uniform.In this paper, we propose a real-time emotion recognition system that recognizes basic emotions like anger, disgust, happiness, surprise and neutral using CMU MultiPIE database consisting 2D images with different illumination and poses.
The software system developed using our proposed method is deployed on Raspberry Pi IV as it can be used with robots as the size of Raspberry Pi IV is very small, light weighted and very less power supply is needed for it. As a

result it can be mounted over any robot very easily and can be used for many applications such as surveillance security, monitoring senior citizen or children at home.
Circuit board of Raspberry Pi is shown in Fig. 1

Fig1. Circuit Board of Raspberry Pi IV

2.PROPOSED METHOD

In the proposed method, the objective is to develop realtime emotion recognition from facial images to recognize basic emotions like anger, disgust, happiness, surprise and neutral.
In our worh we used CMU MultiPIE database, which is a collection of images from 337 subjects with a variety of different facial expressions including neutral, happiness, surprise, disgust and anger. The subjects include 235 males and 102 females with different level of illuminations and poses. Active shape Model (ASM) for extracting facial points and AdaBoost classifier have been used for developing the emotion recognition software.

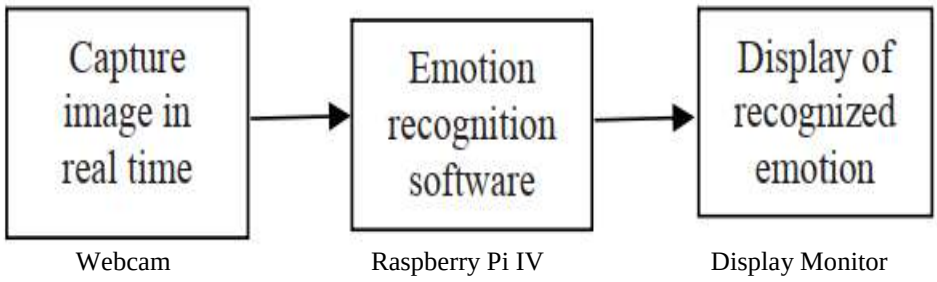
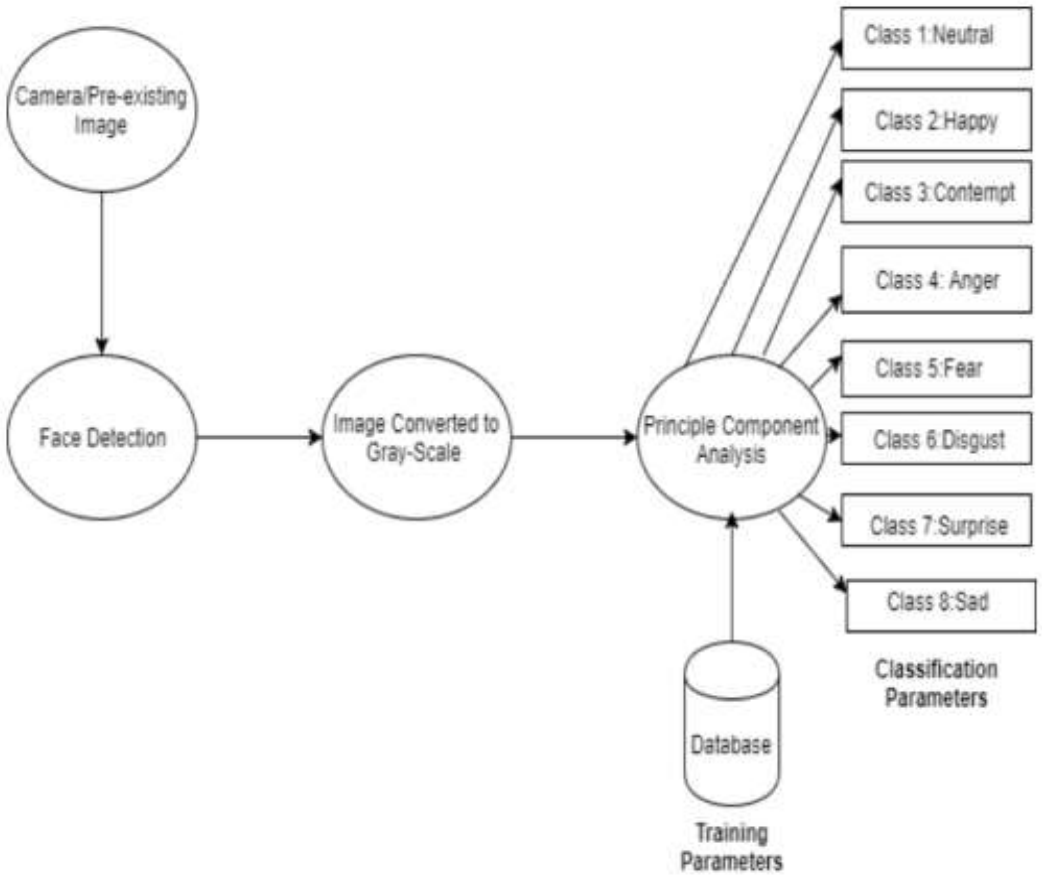


Fig2. Real Time Emotion Recognition System

Raspberry Pi IV is a credit card sized computer which has system on a chip Broadcom BCM2711. It contains an 1.5 GHz 64 bit quad core ARM Cortex-A67, with floating point, running at 900 MHz and a video core 4 GPU. The architecture of proposed system is shown in Fig. 2 and explained as follows: The images those we want to recognize by their emotions is captured by webcam and processd in a software of emotion recognition. Emotion recognition software is deployed in the Raspberry Pi IV, which gives classified emotion as output. The recognized emotion is displayed in the monitor.



3. Steps involved to perform Emotion Detection using OpenCV-Python:

1. After successfully installing all the necessary softwares, we must start by creating a Dataset. Here, we can create our own dataset by analyzing group of images so that our result is accurate and there is enough data to extract sufficient information. Or we can use an existing database.

2. The dataset is then organized into two different directories. First directory will contain all the images and the second directory will contain all the information about the different types of emotions.

3. All the output images will store into a different directory subsequent to running the sample images through the python code.

4. For emotion recognition special types of module can be used in OpenCV, but we will be mainly using Fisher Face one. [1]

5. Extracting Faces:OpenCV provides four predefined classifiers, so to detect as many faces as possible, we use these classifiers in a sequence [1]

6. The dataset is split into Training set and Classification set. The training set is used to teach the type of emotions by extracting information from a number of images and the classification set is used to estimate the classifier performance.

7. For best results, the images should be of exact same properties i.e. size.

8. Analyzation of each imagew is carried out and converted it to grayscale, then cropped and saved in directory .

9. Finally, we compile training set using 80% of the test data and classify the remaining 20% on the classification set. Repeat the process to improve efficiency[1]

4. RESULTS AND ANALYSIS

The results of the classification for 5 basic expressions for frontal poses are recorded. To determine the accuracy of ourproposed system in real-time, we tested using 25 subjects who performed 5 expressions by looking into the webcam connected to Raspberry Pi IV. Recognition accuracy of 89% is achieved with average processing time of 120ms on Linux platform by using Raspberry Pi IV (ARM Cortex-A67, 900MHz) as shown in the confusion matrix in Table II.

TABLE II. CONFUSION MATRIX SHOWING ACCURACY OF PROPOSED METHOD

	Anger	Disgust	Happy	Neutral	Surprise
Anger	90%	10%			
Disgust		100%			
Happy			80%	10%	10%
Neutral				100%	
Surprise					100%
Recognition Accuracy	90%	100%	80%	100%	100%

We have used only 26 feature points in a facial image and achieved better accuracy with less processing time when compared to other methods. Implementation of real time emotion recognition in Raspberry Pi IV is a novel method

and it is can be used in a variety of applications as it is very small, light weighted and very less power supply is needed. It can be fixed in any kind of mobile robot and used for many applications.

5. CONCLUSIONS

In this paper, we have proposed a method for emotion recognition in real time, based on geometric features using Raspberry Pi IV. We have achieved an overall accuracy of 94 % with average processing time of 120ms on Linux platform by using Raspberry Pi IV (ARM Cortex-A67, 900MHz). The Raspberry Pi IV 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 very much useful for the society where emotion recognition plays a most important role. In future work, different algorithm can be implemented to improve recognition accuracy. Robots can also be made to recognize emotion by neurological inspiration.

6. REFERENCES

[1]. Mehrabian, A. Communication without words, Psychology Today, volume 2, pp 52-55, 1968.
[2].Peng Zhao-yi, Zhu Yan-hui, Zhou Yu, Real-time Facial Expression Recognition Based on Adaptive Canny OperatorEdge Detection, IEEE, Multimedia and Information Technology (MMIT), SecondInternational Conference on (Volume:2), pp 154 - 157, 2010.
[3]. F. Abdat, C. MAAOUI And A. Pruski, Human-computer interaction using emotion recognition from facial expression, IEEE, Computer Modeling and Simulation (EMS), Fifth UKSim European Symposium, pp 196 - 201, 2011
[4]. Michel F. Valstar, Member, IEEE, And Maja Pantic, Senior Member, IEEE, Fully Automatic Recognition Of The Temporal Phases Of Facial Actions, IEEE Transactions On Systems, Man,And Cybernetics—Part B: Cybernetics, Vol. 42, pp 28 - 43, 2012
[5]. Ralph Gross, Iain Matthews, Jeffrey Cohn, Takeo Kanade, and Simon Baker," Guide to the CMU Multi-PIE Face Database", The Robotics Institute, Carnegie Mellon University
[6]. Paul V., Michael J., 'Robust Real-time Face Detection', International Journal of computer vision, May 2004, Volume 57, Issue 2, pp 137-154
[7]. Rohit Verma and Mohamed-Yahia Dabbagh, Fast facial expression recognition based on local binary patterns, IEEE, Electrical and Computer Engineering (CCECE), 2013 26th
Annual IEEE Canadian Conference, pp 1 - 4, 2013.
(CVPRW), IEEE Conference , pp 132 - 137, 2014.