INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 5 - V7I5-1196)
Available online at: https://www.ijariit.com

Facial expression recognition

Sakil Ansari
sakilansari4@gmail.com
DELL Technologies, Bengaluru, Karnataka

Rohan Raut
rohanraut@u.boisestate.edu
Boise State University, Boise, Idaho

Abstract— Facial expression is a very difficult task (FER) due to the variation of facial expression across the human population and to the context-dependent variation even for the same individual. We can see that FER has many applications in the fields like human behavior interpretation and human-computer interface. The study of Mehrabian shows that 55% of the message is comprised by facial expression while 7% of the communication is conveyed by linguistic language whereas 38% by paralanguage during human communication. This shows that facial expression has a significant role in communication. The proposed system uses a webcam to capture our face and determine whether you were smiling or not. The system uses openCV computer vision library to preprocess the webcam image, and in this system, we have used logistic regression algorithm to train on a provided dataset and evaluate the new image.

Keywords—*Facial expression recognition, facial expression, Feature Extraction, Classification*

1. INTRODUCTION

Nowadays, the face is our primary focus of attention in social intercourse, playing major role in conveying identity and emotion. Face recognition plays an important role in many applications such as security systems, credit card verification and criminal identification. We face many challenges in face based human recognition systems with pose, lighting intensity while doing our project. We have two approaches of facial recognition system:

A. **Holistic based facial recognition**
B. **Feature based facial recognition**

A. **Holistic based facial recognition**
In holistic based, the image data is treated as one entity without isolating different region in the face.

B. **Feature based facial recognition**
In feature based facial recognition, certain points on the face are identified such as eyes, nose and mouth etc.

In the designed system, we have used feature based facial recognition that identifies mouth and tells whether the image is smiling or not.

2. LITERATURE REVIEW

Ekman and Friesen developed a famous and successful facial action coding system [3] in 1977.The facial muscles that cause changes in the facial expression is identified by the Facial Action Coding System (FACS) and thus help to analysis facialexpression. The system has 46 Action Units describing the facial behaviors. A neural network is proposed in [4] which compresses the entire face region with 2-D discrete cosine transform. Ma and Khorasani [5] have extended this image compression with the constructive one hidden layer neural network with the optimal block size to be 12 and the maximum number of hidden units to be 6.

Many researchers have also used the MPEG-4 standard to provide the facial action parameters (FAPs) to represent the facial expressions. Aleksic and Katsaggelos [6] has developed a facial expression recognition system that utilizes facial action parameters which basically describes the eyebrow and the outer lip features, and the system classifies up to 93.66% of the test expressions by calculating the maximum likelihoods generated by the multi-stream hidden Markov Model (MS-HMM). Huang and He [7] have presented a super resolution method to improve the face recognition of low-resolution images. In their system, they applied canonical correlation analysis (CCA) to obtain the coherent features of the high resolution (HR) as well as low resolution (LR) images, then utilize radial basis functions (RBFs) which is based non-linear mapping favoring the nearest neighbor (NN) classifier for recognition of single input low resolution image. Eigenface method approach was given by Turk and Pentland [8].The Eigenface method to recognize the expression from the front view of the face and the system was tested for the Cohn-Kanade (CK) Facial Expression database and Japanese female facial expression (JAFFE) database has been enhanced by Murthy and Jadon [9].

3. PROPOSED SYSTEM

The block diagram of the proposed system is shown in Fig 1.

3.1 Image Acquisition

In the proposed system,we have used webcam to capture our faces. Firstly,all the image is converted into gray-scale before

going for further processing. In this step,the images are converted to grayscale and flattened into a vector of length 280, with each entry representing the grayscale of a pixel.

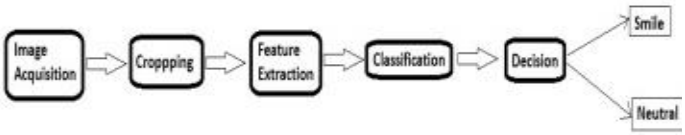

Fig 1. Block diagram for the Expression Recognition System of the proposed system

3.2 Cropping

We know that eyes, nose and mouth take different shapes for different expressions and significant information is carried by them. Generally,eyes,nose and mouth is processed instead of processing entire image. In the proposed system,we have processed only mouth. Here,the image is resized such that the output is a 28 pixels by 10 pixels image only containing the person's mouth and surrounding areas.

3.3 Feature Extraction

It is a method in facial recognition. In the proposed system, we have used openCV computer vision library to preprocess the webcam image.

a. OpenCV

At first, the system allows the user to take a picture of themselves. They are allowed to take picture with either a smiling or neutral facial expression using a webcam. Then the system uses an algorithm adopted from the OpenCV library to localize the mouth area.

3.4 Classifier

3.4.1 Logistic Regression: Logistic regression is a statistical model where the dependent variable is a categorical. In the proposed system, we built a logistic regression program that will take the user-provided image vector that determines whether that person was smiling or not. At first, the logistic regression is built to take an input of dimension 280.The logistic regression applies a set of weights to that input and then finally yields a single scalar. The model will say that the original person was smiling or not on the basis of activation. If the activation is closer to 0 then the person is smiling and if the activation is closer to 1 then the person is not smiling.

We trained the logistic regression model using gradient descent before the logistic regression is able to classify the user-provided image. The following figure 2 shows the workflow model of the system.

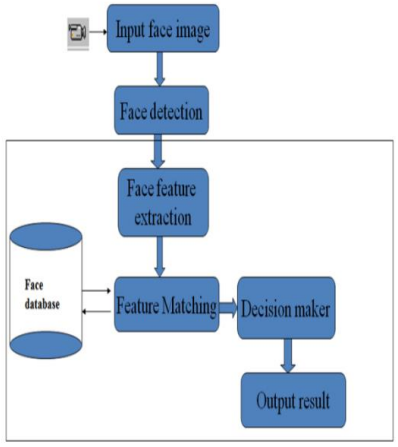

Fig 2. Workflow Model.

4. EXPERIMENTAL SETUP

The proposed system uses OpenCV computer vision library.

4.1 Dataset

We have used online dataset. The dataset has two types of images. One file containing neutral faces images and other file has smiles faces images. In the proposed system, we have used 64 neutral images from online datasets. The system uses 43 smiling images from online datasets. These images are used to train the logistic regression model and fine tune the weights. We can input the user's processed mouth image into the model with the suitable weights and biases and the prepared network can predict whether that person was smiling or not. The system prints either "You are smiling!" or "You are not smiling!"

The following figure 3 shows the smiling images from online datasets:

Fig. 3.a 1 to 24 smiling images from online dataset

Fig.3.b 25 to 43 smiling images from online dataset

Fig.3. Smiling Images from online dataset

The following figure 4 shows neutral images from online datasets:

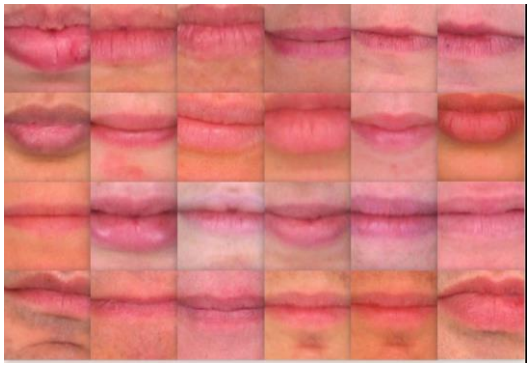

Fig.4.a.1 to 24 Neutral images from online dataset

Fig.4.b.25 to 48 neutral images from online dataset

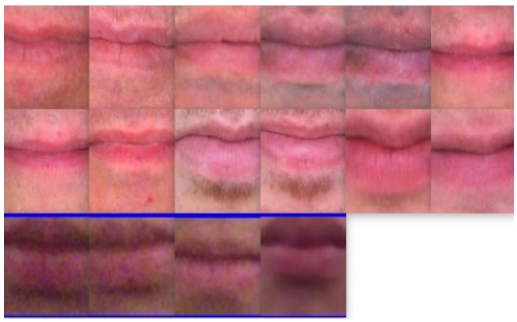

Fig.4.c. 49 to 64 neutral images from online dataset
Fig.4 Neutral images from online dataset

5. RESULT OF THE PROPOSED SYSTEM

The proposed system shows whether the image is smiling or not. The system captures user's provided image by using webcam and the image is preprocessed by openCV computer vision. The system detects the mouth region and restricts the image to a rectangle around the mouth. The system predicts whether the image is smiling or not. The system is prepared in python. We have used standard packages such as numpy and csv. For the system to work properly, the user who is taking the image must be in a well-lit area, must be front and center, and must smile fairly widely (i.e. showing teeth).

The following figure 5 shows that the proposed system captures the image provided by the user by webcam and the figure 6 tells that the image is smiling**.**

Fig.5. Image capture by the system using webcam

Fig.6. The system says You are smiling.

The following figure 7 shows that the proposed system captures the image provided by the user by webcam and the figure 8 tells that the image is not smiling**.**

Fig.7. Image capture by the system using webcam

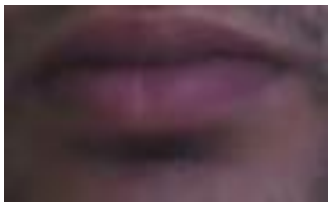

Fig.8. The system says You are not smiling

6. CONCLUSION AND FUTURE WORK

The proposed system designed in python captures the image provided by the user by using webcam and the system detects the mouth and restricts the image to a rectangle around the mouth and the system tells that you are smiling or you are not smiling. The user who is taking the image must be in a well lit area, must be front and center, and must smile fairly widely (i.e. showing teeth) for the system to work properly. There is only one facial expression is determined in the system. We hope to extend the framework for more facial expressions like surprise,happy,sad,fear etc**.**

7. REFERENCES

[1] A Mehrabian,"Communication Without Words",Psychology today,Vol.no.4,pp.53-56,September 1968
http://mplab.ucsd.edu, The MPLab GENKI Database.http://pics.psych.stir.ac.uk/2D_face_sets.htm. Utrecht EVP

[2] P. Ekman and W.V. Friesen, "Manual for the Facial Action Coding System," Consulting Psychologists Press, 1977.

[3] M. Rosenblum, Y. Yacoob, and L. S. Davis, "Human expressionrecognition from motion using a radial basis Afunction networkarchitecture," IEEE Transactions on Neural Networks, vol. 7, pp. 1121–1138, Sept. 1996.

[4] *L. Ma and K. Khorasani, "Facial Expression Recognition Using Constructive Feedforward Neural Networks",* IEEE Transactions on Systems, Man and Cybernetics—Part B: Cybernetics, vol. 34, no. 3, pp.1588-1595,June 2004

[5] P. S. Aleksic and A. K. Katsaggelos, "Automatic Facial Expression Recognition Using Facial Animation Parameters and Multistream HMMs", IEEE Transactions on Information Forensics and Security, vol.1, no. 1, pp. 3-11, March 2006.

[6] H. Huang and H. He, "Super-Resolution Method for Face Recognition Using Nonlinear Mappings on Coherent Features", IEEE Transactions on Neural Networks, vol. 22, no. 1, pp. 121-130, January 2011.

[7] M. Turk and A. Pentland, "Eigenfaces for recognition," Journal ofCognitive Neuroscience, vol.13, no. 1, pp. 71-86, 1991.

[8] G. R. S. Murthy and R. S. Jadon, "Effectiveness of Eigenspaces for Facial Expressions Recognition" International Journal of ComputerTheory and Engineering, vol. 1, no. 5, pp. 638-642, December 2009.

