

# Facial Expression Recognition Using Artificial Neural Network

<sup>1</sup>Belal Ahmad, <sup>2</sup>Ravinder Kumar, <sup>3</sup>Marghoob Ahmad Usmani

<sup>1</sup>Research Scholar, <sup>2</sup>Lecturer, <sup>3</sup>Design Engineer

<sup>1,2</sup>Department of Electronics and Communication Engineering, Alfalah School of Engineering & Technology, Dhauj, Faridabad

<sup>3</sup>EMF Pvt. Ltd, Shaheen Bagh, Okhla, New Delhi

**Abstract** -Facial recognition is a visible indication of effective state, personality, intention and psychopathology of any person. It not only express our expressions but also provides important communicative clue during social interaction. Facial expression recognition system is developed to analyze different type of human expressions like happy, sad, angry and surprised etc. Face detection is the important part of face recognition systems. Face detection function is complex due to its volatility present in human faces including color, position, expression, pose and orientation. So using various modeling techniques it is convenient to recognize various facial expressions. The FER system consists of 3 stages: face detection, feature extraction and expression recognition. JAFFE database is used for training the database. In the field of image processing it is very interesting to recognize the human gesture by observing the different movement of eyes, mouth, nose, etc. Any neural network for recognizing the facial expression can be carried out by classification of face detection and token matching. This paper proposes a method using artificial neural networks to find the facial expression using MATLAB (neural network).

**Key words** – Image processing, Artificial neural network, Facial expression recognition.

## I. INTRODUCTION

Facial expression, body movement and physiological reactions are the basic units of non-verbal communication. It plays a communicative role in interpersonal relations. In human communications facial expression play a major role because it has an effect of 55% of a communicated message. In human machine interfaces automatic recognition of facial expression can be an important component. It may also be used in behavioral science and clinical practices. A machine can be describe the analysis of human facial characteristics by using mathematical algorithm. An input sensing device such as web-cam reads the human body movements and communicates with the computer. The mathematical algorithm interpreted with the human gesture and it is based on artificial intelligence techniques. The facial expression recognition arrangement is as shown in Figure 1.



Figure 1: Facial Expression Recognition System

## II. IMAGE PROCESSING:

Image processing is a form of signal processing in which input is an image, and output can be either an image or a set of characteristics or parameters related to that image. A digital image is a composed of finite number of elements, in which each has a particular location and value. These elements are referred as picture elements, image elements or pixels. An image is converted into a digitized form because it can be easily stored in a computer's memory or on some type of storage media, such as hard disk or CD ROM. This digitization procedure can be done either by a scanner, or by a video camera connected to a frame grabber board in a computer. Once image has been digitized, it can be operated by various image processing operations. Image processing techniques are used to enhance or alter an image and also it prepare for image analysis. Image processing is divided into many sub processes, including Histogram analysis, thresholding, masking, edge detection, segmentation and others.

## III. ARTIFICIAL NEURAL NETWORK:

An Artificial Neural Network is a non linear and adaptive mathematical model which is inspired by biological neural networks. The brain consists of larger amount of interconnected set of nerve cells called neurons. An artificial neural network consists of less number of interconnected set of nerves or very simple processors, also called neurons, which are analogous to the biological neurons. It consists of an interconnected group of neurons which operating in parallel and communicating with each other through weighted interconnections. Artificial neural network changes its structure during a learning phase because in most cases it is adaptive system. It is used to model a complex relationship between inputs and outputs or to find data patterns.

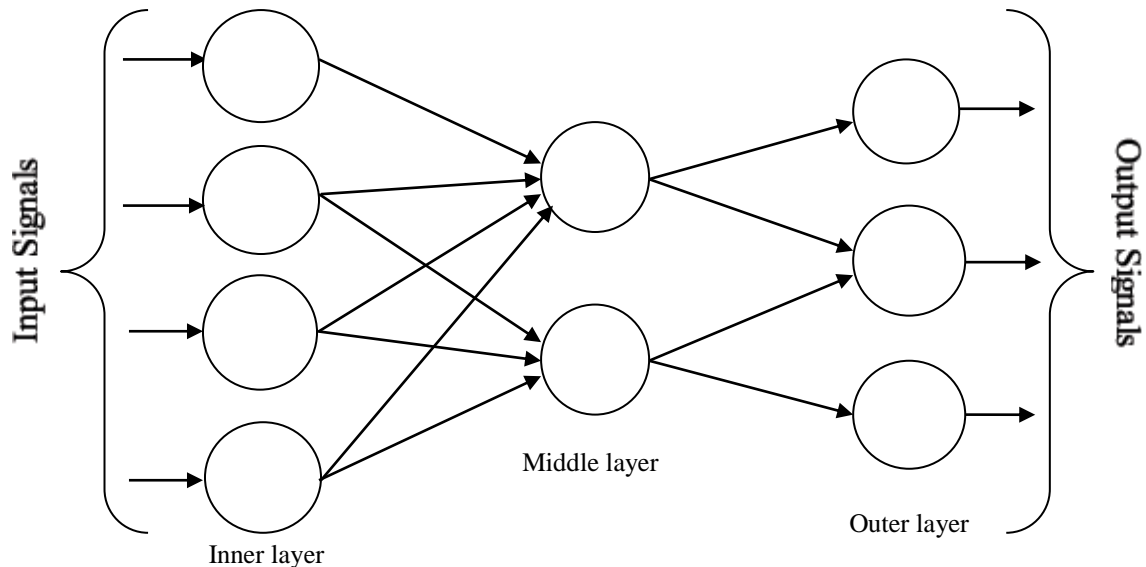


Fig2: Structure Of Artificial Neural Network

### 3.1 Advantages of Neural Networks

- A neural network can perform a tasks that linear program can not perform.
- If any element of neural network fails, it can continue without any problem because of their parallel nature.
- A neural network learns so it does not required to be reprogrammed.
- It can be implemented in any type of application.
- It can be implemented without any problem

## IV. FACIAL EXPRESSION RECOGNITION

The system that is designed for automatic analysis of facial actions is usually called Facial Expression Recognition System (FERS). The importance of facial expression system is widely recognized in social interaction and social intelligence. The FER system is composed of 3 main elements: face detection, feature extraction and expression recognition. There are number of techniques proposed for each stage of the system which we use for recognizing the facial expression.

Human face detection is a complex task due to the possible variations of the face. This variation are occur due to different sizes, angles and poses a human face. The presence of spectacles, beard, hair and makeup also have a considerable effect in the facial appearance.

There are four types of recognize expression. The first type uses emotion space to recognize facial expression. The second type is to recognize facial expression of an image frame by using optical flow. The third type is to use active shape models to recognize facial expression. The fourth type is to recognize the facial expression by using neural network. The paper proposes an automated facial expression recognition system using neural network. In neural network, for recognizing the facial expression we mostly used back propagation method. This paper proposes different techniques to extract the features such as forehead, mid forehead, mouth etc. By using back propagation method these extracted features provide different recognized output. The experimental results show that the back propagation method is appropriate facial expression than other methods. These networks are most widely used and the work as a main part of artificial neural network.

## V. PROPOSED WORK

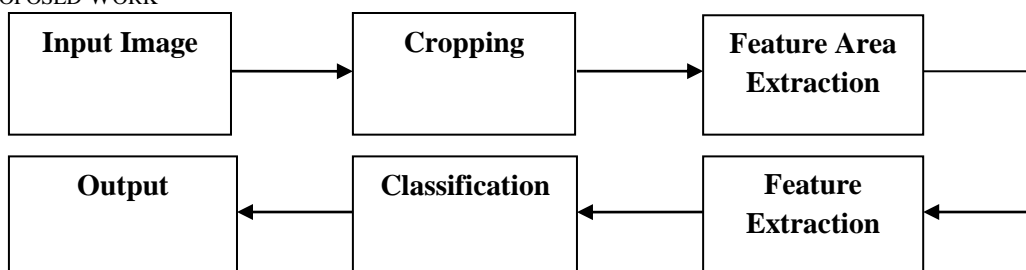


Fig3: Scheme Of Work

### 5.1 Input Image

Images used for facial expression recognition are static images. 2D monochrome facial image sequences are the most popular type of pictures used for automatic expression recognition with respect to the chromatic, spatial and temporal dimensionality of input images. A data base for facial expression images has been collected. Happy, sad and neutral three expressions are taken to identified. Some sample images are shown in fig 4.



Fig4: Sample Images

### 5.2 Cropping

To obtain the specific portions for expression recognition, the regions including eye and mouth are cropped out for selected image is done. Some cropped images are shown in fig 5.

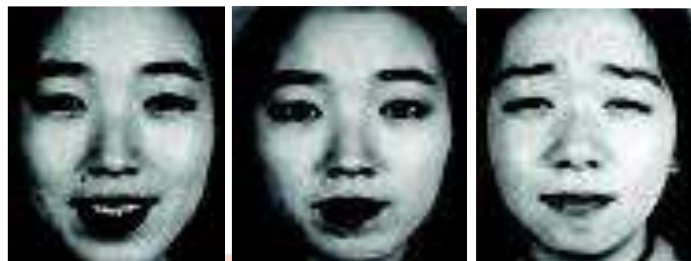


Fig5: Cropped Images

### 5.3 Feature Area Extraction

Two feature areas are selected to find out expression of image. Here we select the eye and mouth areas shown in Fig 6.



Fig6: Extracted Eye And Mouth Areas

### 5.4 Feature Extraction

The ultimate aim of the image processing application is to extract important features from image data. Significant number of coefficients has small magnitudes in transformed image and can be discard entirely without losing image features.

## VI. RESULT

For the validation of facial expression recognition system the JAFFE database consists some respondents to check their response similar to the results given by the system. As a result it was observed that when the respondents were anger 79.600769% of the times the results were accurate, when the respondents were Disgust the results were 93.333333% accurate, when the respondents were Fear the results were 90.40% accurate, when the respondents were Happy the results were 100% accurate, when the respondents were Sadness the results were 91.666667% accurate and when the respondents were Surprise the results were 100% accurate. So, our facial expression recognition system is overall 92.498333% accurate shown in fig 7.

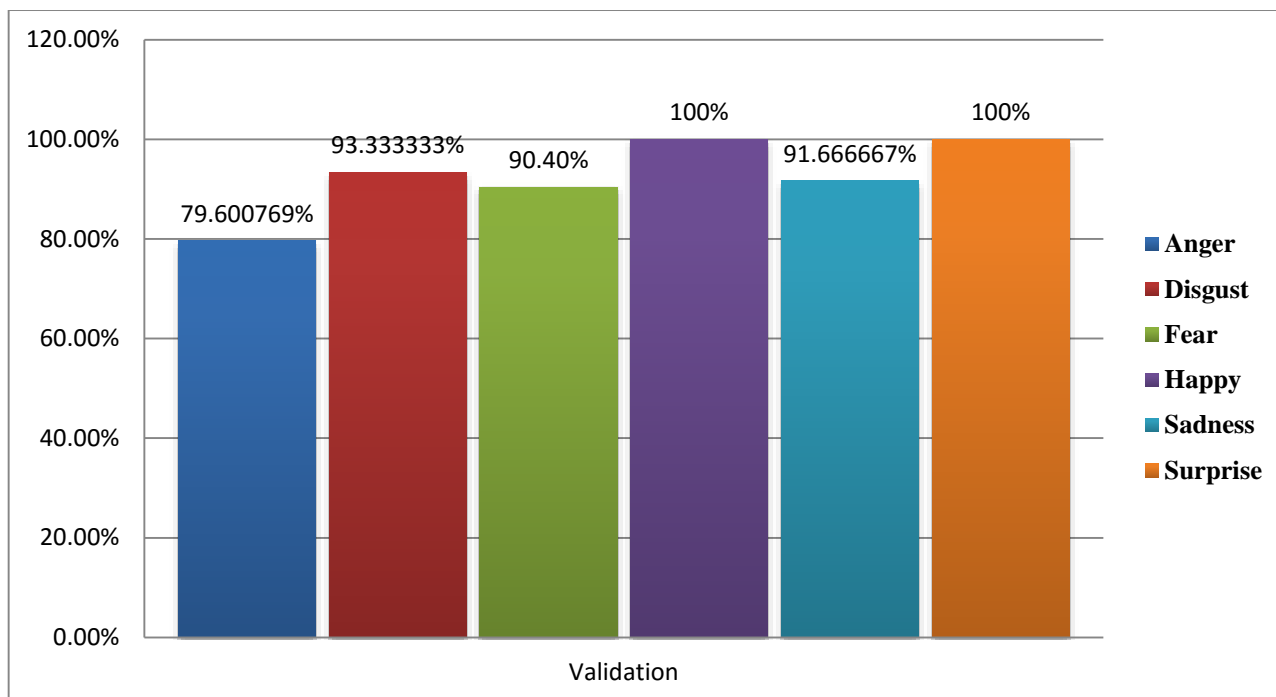


Figure7: Validation percentage of the facial expression recognition system

## VII. CONCLUSION

In this paper, an automatic facial expression recognition systems are overviewed for recognize the human emotion. The neural network approach is based on face recognition, feature extraction and categorization and training is provided to the software to analyse or recognize the emotion. The facial expression recognition system is found to be 92.498333% accurate. A still image facial expression recognition technique has been developed. For future improvement and development of the system, a real time facial expression recognition system can be developed and video based image processing can be included.

## VIII. REFERENCES

- [1] Pushpaja V. Saudagare and D.S Chaudhari "Facial Expression Recognition Using Neural network-An Overview" International Journal of Soft Computing and Engineering ISSN:2231-2307, Volume-2, Issue-1(2012).
- [2] AlMejrad, A. S. Human emotions detection using brain wave signals: A challenging". European Journal of Scientific Research, 44(4), 640-659 (2010).
- [3] M. Agrawal, N. Jain, M. Kumar and H. Agrawal "Face Recognition using Eigen Faces and Artificial Neural Network" International Journal of Computer Theory and Engineering, August (2010).
- [4] J. L. Raheja and U. Kumar "Human Facial Expression Recognition from Detected in Captured Image Using Back Propagation Neural Network" International Journal of Computer Science and Information Technology, February(2010).
- [5] "Facial Expression Recognition: A Brief Tutorial overview", C.C. Chibelushi and F. Bourel (2002).
- [6] F. Bourel, C.C. Chibelushi, A.A. Low, "Robust Facial Expression Recognition Using a State-Based Model of Spatially-Localized Facial Dynamics", Proc. Fifth IEEE Int. Conf. Automatic Face and Gesture Recognition, pp.106-111, (2002).
- [7] J. Chang and J. Chen "Automated Facial Expression Recognition System using Neural Networks", Journal of the Chinese Institute of Engineers, pp. 345-356 (2001).
- [8] P. Brimblecombe " Face Detection using Neural Network", Meng Electronic Engineering School of Electronics and Physical Sciences, University of Surrey.