Facial Expression Recognition Using Neural Network

Manisha
Industrial Design&PEC university

Dr Jagjit Singh
Production Engineering & PEC university

Dr Neelam R. Prakash
ECE & PEC university

Abstract—**Facial expression recognition is a key element in human communication.Emotions play a vital role in people's everyday life. Analysis and recognition of human facial expression from images forms the basis for understanding the human behaviour. In this paper, we explore the use of Artificial Neural Network and machine learning.Facial Expression Recognition System is developed to analyze four type of human expressions- happy,sad,angry and surprised. Jaffe and Paul Ekman database is used for training the database. This facial expression recognition system is found to be 76% accurate in analyzing the human emotion.**

Keywords—*Facial Expression,Emotion,Neural Network*

1.   INTRODUCTION

Emotions play a vital role in people's everyday life. It is a strong feeling deriving from one's circumstances, mood, or relationships with others. Emotion play critical role in rational and intelligent behavior. It is a mental state that does not arise through free will and is often accompanied by physiological changes. These changes need to be monitored as they contain information about different types of emotions which will assist in understanding behaviors. We make decisions based on whether we are happy, sad, angry, or surprised. We choose activities and hobbies based on the emotions they incite. Of all the nonverbal behaviors-body movements, postures, gaze, voice, etc- the face is probably the most accessible window into the mechanisms which govern our emotional and social lives.Face is a complex multidimensional visual model and for developing a model for face recognition is a difficult task. Facial Expression Recognition plays a vital role when it comes to developing multi-cultural visual communication systems for emotion translation. Various researches have been done in this field. Ekman(1969) studies emotions using facial expressions in different cultures. He uses six basic emotions i.e. happy, sad, anger, surprise, disgust and fear. These six basic emotions have been accepted widely and till date they are used. Ekman later expanded various emotions in his list.Valstar et al. (2006) designed a fully automatic system for fast and robust facial expression recognition from face video. They analysed subtle changes in facial expression and their temporal behaviour by recognizing facial muscle action units. These action units helped in the detection of facial expressions of emotions, attitudes and moods from facial signals in a face video. AlMejrad (2010) studied emotions of human using wave signals of wave and classified emotions of human in three types i.e. social, motivational or social. J.L.Rehaja et al.(2010) A system is developed that recognize the different human gesture in color image. Depending on threshold value the researchers system can recognize the facial expression.Agrawal et al.(2010) discussed the method of eigenfaces which are calculated by using Principal Component Analysis(PCA). Two type of methodology was introduced- feature extraction using principal component and feed forward back propagation neural network method.Saudagare et al.(2012) reviews various techniques of facial expression recognition systems using neural network toolbox. Pushpaja et al.(2012) reviews various techniques of facial expression recognition system using Neural Network Toolbox.It presents coding and decoding methodology for face recognition Savran et al. (2013) here the first practical 3D expression recognition using cheap consumer depth cameras was done. Despite the low fidelity facial depth data, and show that with appropriate pre-processing and feature extraction recognition is possible.

Two procedures are necessary for an automatic expression analysis system: facial feature extraction and facial expression recognition. In facial feature extraction, there are mainly two types of approaches: geometric feature-based methods and appearancebased methods. In geometric feature-based methods, the facial components or facial feature points are extracted to form a feature vector that represents the face geometry. In appearance based methods, image filters are applied to either whole-face or specific regions in a face image to extract a feature vector.Geometric feature extraction can be more computationally expensive, but is more robust to variation in face position, scale, size, and head orientation.

The neural network performs the very important role for recognizing the facial expression. The neural network has an ability to do task based on data given for training and it also creates its own organization during learning time.

In this paper, a facial expression algorithm is developed using neural network.

Facial Expression Interpretation

By contrast with non-connectionalist approaches which usually use geometrical face codings, connectionist approaches has typically used image based representation of faces in the form of 2D pixel intensity array While this model has the advantage of preserving the relationship between features and texture very high sensitivity to variations in lighting conditions,head orientation, and size of the picture These problems typically justify a large amount of work in preprocessing the images. Normalization for size and position is necessary and can bc performed automatically with algorithms for locating the face in the image and rescaling it.In our particular data set, there was no need for rescaling,as all the images were consistent with each other along that dimension.
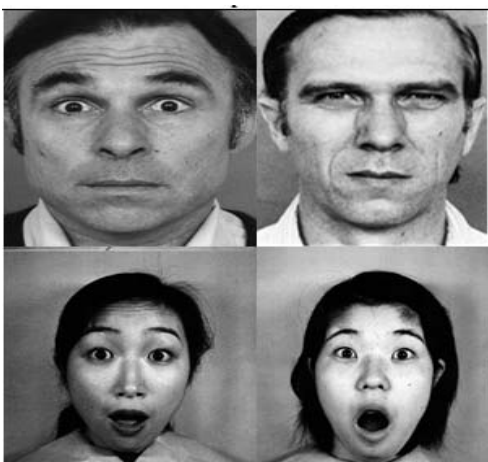
The Database of Images

In this system of facial expression recognition system we used images from two sources.The result described have been derived mostly from using the Jaffe and Paul Ekman database of face images which includes happy,sad,surprised and angry faces.The Jaffe and Paul Ekman database includes pictures of faces with various poses for each person.These pictures are useful to build face expression recognition algorithm in terms of person identification of emotion.We built a subset of the Jaffe and Paul Ekman database to include four different poses per person. Figure1 shows the sample images from Jaffe and Paul Ekman database.
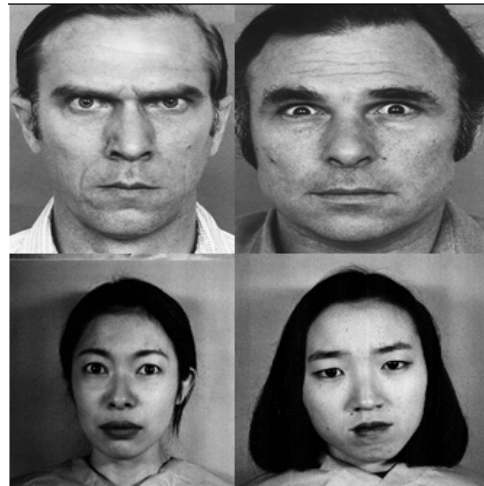

Happy

Sad

Surprised

Angry

Figure1: Sample images from Jaffe and Paul Ekman Database

The Network Architecture

Network is designed to deal with the geometrical features of the face. Different images of faces are stored in the database by inserting the name of recognized facial expression.Principal component analysis is used for feature extraction of the image and the neural network tool is used in the system which has an ability to do task based on data given for training and it also creates its own organization during learning time.

II. METHODOLOGY

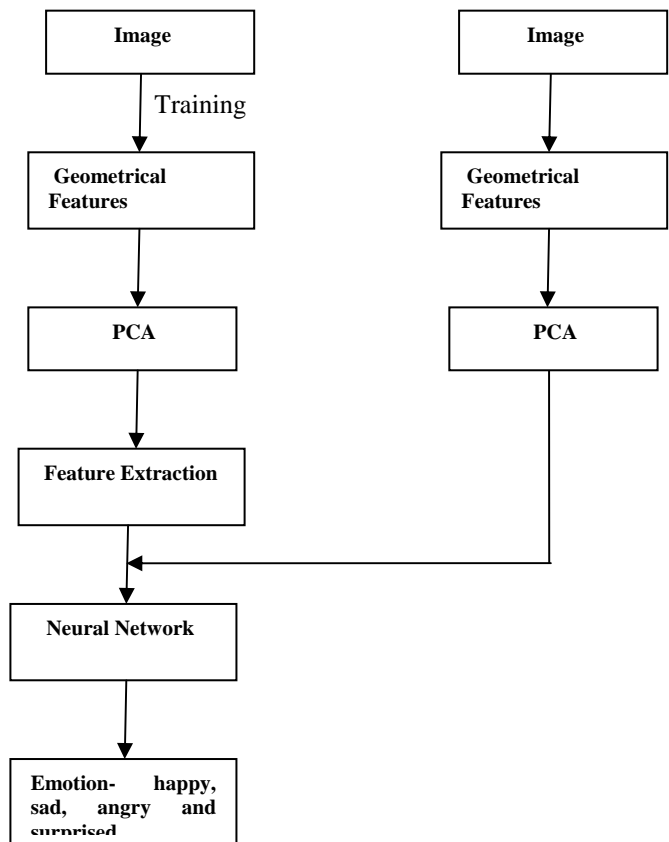

Figure2: Architecture of the facial expression recognition system.

1) Geometrical features of four emotion images(happy, sad, angry and surprised) are trained to neural network.
2) Different images of emotion are stored to database(based on Jaffe and Paul Ekman images) by inserting the name of recognized facial expression.
3) Principal component analysis(PCA) is used for feature extraction of image.
4) Neural network tool is used and call in the program to show the processing done behind the program i.e. it shows   and displays the time, performance and regression graph of the particular image.

III.   RESULT

Facial Expression Recognition

For the validation of the facial expression recognition system we selected 20 respondents to check weather their response was similar to the results given by the system.As a result(Figure3)it was observed when the respondents were happy 80% of the times the results were accurate,when the respondents were sad the results were 75% accurate, when the respondents were surprised the results were 80% accurate and when the respondents were angry the results were 70% accurate. So, our facial expression recognition system is overall approx. 76% accurate.
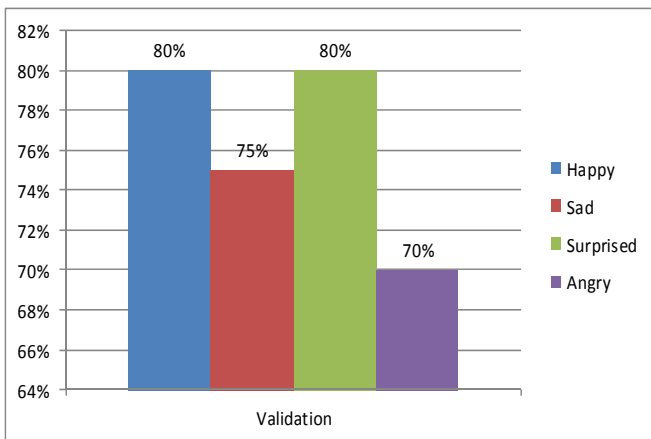

Figure3: Validation percentage of the facial expression recognition system

IV.   CONCLUSION

In this paper, an emotion recognition system was developed which is based on data provided that will recognize the human emotion. The neural network approach is based on face recognition and feature extraction and training is provided to the software to analyse or recognize the emotion. A still image facial expression recognition technique has been developed. The facial expression recognition system is found to be 76% accurate. 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.

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