Open access Journal International Journal of Emerging Trends in Science and Technology

DOI: http://dx.doi.org/10.18535/ijetst/v2i11.01

Neural Network Allied With Recognition of Facial Expressions of Basic Emotions

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Abstract

This paper deals with recognition of facial expressions with the help of neural network. The working methodology include face detection , features extraction, points selection for calculating distance then sending these calculated length to neural network for training. This paper briefly describes the working of FERS. In this paper, we proposed a model of facial expression recognition, which is fast, reasonably simple, and accurate.

Keywords: *Feature Points, Distance, Neural Network, Feed Forward Back Propagation, Facial Expression Recognition System and FERS.*

1. Introduction

Facial expression results from one or more motions or positions of the muscles of the face. Mehrabian[7] pointed out that 7% of human communication information is communicated by linguistic language (verbal part), 38% by paralanguage (vocal part) and 55% by facial expression. Therefore facial expressions are the most vital information for emotions perception in face to face communication. These movements convey the emotional state of the individual to observers.Facial expressions are a form of nonverbal communication. For classifying facial expressions into different categories, it is necessary to extract important facial features which contribute in identifying proper and particular expressions. Recognition and classification of human facial expression by computer is an essential issue to develop automatic facial expression recognition system in vision community. Further facial expressions can be ambiguous. They have several possible interpretations. Facial expression recognition should not be confused with human emotion recognition as is often done in computer vision. Facial expression recognition deals with classification of facial motion and facial feature deformation in to abstract classes that are purely based on visual information. They are the primary means of conveying social information. In the field of networking and robotics, facial expression recognition can play a very important role. The process of expression recognition involves processing images, extracting the facial features, and then using an algorithm to identify the expressions made based on the movements of the features made.

There are two different approaches commonly used in computer vision based facial expression recognition so far: recognition using 2D still images and recognition using image sequences. Approaches using image sequence often apply optical flow analysis to the image sequence and

use pattern recognition tools to recognize optical flow patterns associated with particular facial expression [12]. This approach requires acquisition of multiple frames of images to recognize expressions and thus has limitations in real-time performance and robustness. Facial expression recognition using still images often use feature based methods [4] for recognition and thus have fairly fast performance but the challenge in this approach is to develop a feature extraction method that works well regardless of variations in human subjects and environmental conditions.

This paper explains about an approach to the problem of facial feature extraction from a still frontal posed image and classification and recognition of facial expression and hence emotion and mood of a person. Feed forward back propagation neural network is used as a classifier for classifying the expressions of supplied face into five basic categories like angry, disgusting, happy, sad and surprise. Two permanent Facial features like eye (left and right) and mouth are extracted using facial geometry, edge projection analysis and distance measure and feature vector is formed considering the vertical and horizontal distance of the left eye, vertical and horizontal distance of the right eye and vertical and horizontal distance of mouth. The paper is organized as follows.

Section 1 gives brief introduction, Section 2 describes about working of FERS, section 3 presents methodology followed, section 4 presents conclusion and future scope and last section gives references used. The following figure Fig 1 shows the working of the FERS.

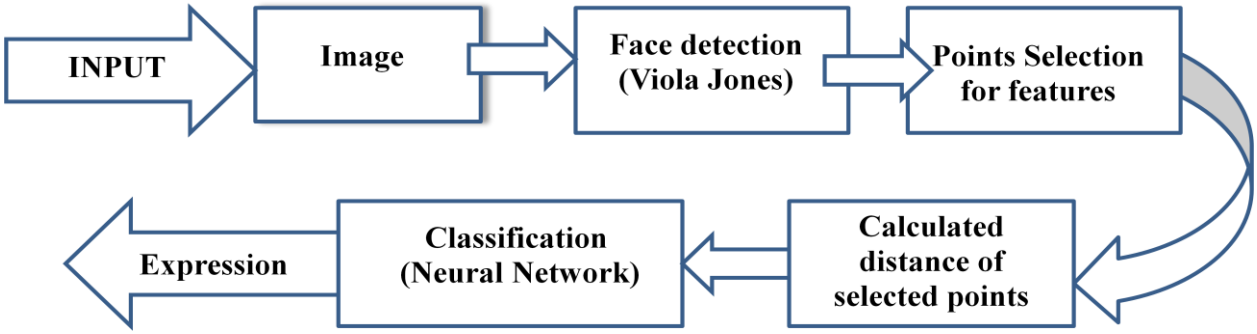

Fig 1 Working of FERS

2. Working

The method of facial Expression Recognition System consists of four components: input image, image processing, component analysis or feature selection and Expression Recognition. Image processing consists of scaling and image rendering to prepare the face for expression recognition. The process of expression recognition involves processing images by extracting the facial features, and then using an algorithm to identify the expressions made based on the movements of the feature made. The working of project can be understood by the diagram as shown in Fig1..From the input image, first of all face will be detected through the Viola Jones algorithm, thereby; from the face the feature points will be selected. The features points are taken from the eye and mouth region. Then with the help of an algorithm the distance between the points will be selected. These distances will be further rounded up and according to the calculated distance the system will be trained for the expressions through Feed Forward Back Propagation Neural Network. The main advantage of this proposed model is that there is no extra learning process included, only by saving the face information of the person and appending the person's name in the learned database completes

the learning process. In the second technique, extracted features are fed into the input of multilayer neural network and the network is trained to create a knowledge base for recognition which is then used for recognition.

3. Methodology

3.1 Face detection.

Face detection is a process that aims to locate a human face in an image. The process is applied on stored image. Human face varies from one person to another. This variation in faces could be due to race, gender, age, and other physical distinctiveness of an individual. Therefore face detection becomes a challenging task in computer vision. It becomes more challenging task due to the additional variations in scale, orientation, pose, facial expressions, and lighting conditions. Many methods have been proposed to detect faces such as neutral networks, skin locus, and color analysis. Since these detected faces become an input to the recognition of the gestures, it is important to get rid of non-facial information in the image. In this paper, the technique proposed by Viola and Jones is used to detect the face. The main reason for using this technique is that its implementation is feature based and relatively fast compared to other available techniques. The following figure (Fig 2) represents the detected face with its corresponding input image.

Fig 2. Step1: Face Detection

3.2 Facial Feature Extraction

Feature Extraction is a process where the required feature for expression recognition is extracted. The face of a human has several features such as, mouth, eyes, nose, eyebrows, and forehead. Each of these features has a unique shape and a unique pattern. Ekman and Friesen [9] have described the six principal emotions. These cues describe the peak of each expression and thus they provide a human interpretation of the static appearance of the facial feature. For Example: A description such as "Brows are raised" means that the human interpretation of the location of the brows relative to the other facial features indicates that they are not in neutral state but higher than usual. The viewer uses many cues to deduce such information from the image. Unfortunately the performance of humans in arriving such descriptions is far better than what can be currently achieved by computers if only static images are considered. These descriptions seem rather instinctive to human but are quite difficult to translate into computational procedures. Here, we have extracted feature points for three main features (Fig 3):

1. **Left Eye**- led (horizontal distance) and lved (vertical distance)
2. **Right Eye**- red (horizontal distance) and rved (vertical distance)
3. **Mouth**- mhd (horizontal distance) and mvd (vertical distance)

Thus total 6 parameters are obtained and considered as feature vector (Fig.3). Thus-

Fv={led,lved,red,rved,mhd,mvd }

Where,

led =horizontal distance between the two extreme points of the left eye

lved = vertical distance between the two points of the left eye

red = horizontal distance between the extreme points of the right eye

rved = vertical distance between the two points of the right eye

mhd = horizontal distance between the two extreme points of the mouth.

mvd = vertical distance between the two points of the mouth

These extracted features will then be used to calculate the distance of feature's point i.e. for the left eye the horizontal and vertical distance will be calculated, similarly for the right eye and mouth

too, as shown in fig.3.The neural network will be trained with these data for each of the different types of expressions.

Fig 2: Parts of Facial Feature and points to be extracted

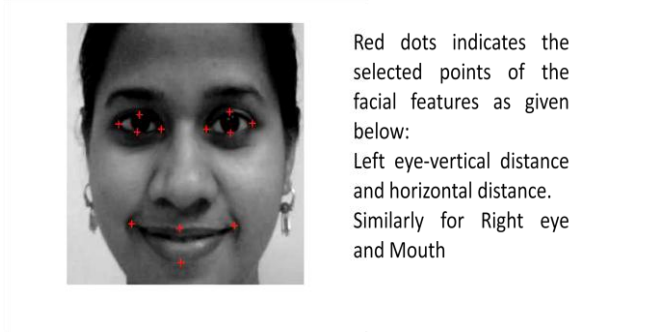

Fig 3. Step 2 : Extracted points.

3.3 Training and Classification- (FFBPNN)

Expression Classification using Neural Network:
Neural computing has re-emerged as an important Programming paradigm that attempts to mimic the functionality of the human brain. This area has been developed to solve demanding pattern processing problems, like speech and image processing. These networks have demonstrated their ability to deliver simple and powerful solutions in areas that for many years have challenged conventional computing approaches. A neural network is represented by weighted interconnections between processing elements (PEs). These weights are the parameters that actually define the non-linear function performed by the neural network. Back-Propagation Networks is most widely used neural network algorithm than other algorithms due to its simplicity, together with its universal approximation capacity. The back-propagation algorithm defines a systematic way to update the synaptic weights of multi-layer perceptron (MLP) networks.
Here, The training and classification is done using the Feed Forward Back propagation Neural Network[6]. During training, the network is trained to associate outputs with input patterns. When the network is trained, it identifies the input pattern and tries to output the associated output pattern. In order to train a neural network to perform some task, we must adjust the weights of each unit in such a way that the error between the desired output and the actual output is reduced. This process requires that the neural network to compute the error derivative of the weights (EW). In other words, it must calculate how the error changes as each weight is increased or decreased slightly. The back propagation algorithm is the most widely used method for determining the EW. The power of neural networks is realized when a pattern of tokens, during testing, is given as an input and it identifies the matching pattern it has already learned during training.
The Feed Forward Back Propagation Neural Network is designed based on the facial components extracted as above. The neurons in the layer are fully interconnected with weight. The training in Neural Network involves three stages. The feed forward of the input training pattern, then calculation and back propagation of associated error and then adjustment of weights, to detect the facial expression in the image. The training samples are taken from the JAFFE database. This work has considered 60 training samples for all expressions.

4. Recognition

After the completion of training, the network is ready to recognize expression presented at its input. Again the image will be input and the points have to be selected for the input image. Then the neural test will be performed. This work has considered 60 training samples for all expressions. After getting the samples, supervised learning is used to train the network. It is trained three times and shown good response in reduction of error signal. There exist many gestures of the face. The network is trained mainly of five facial gestures-anger, disgusting, happy, sad and surprise. When this gestures are given to the network it will undergo training process and the gesture with the highest percentage will be matched. The gesture with the highest percentage is the corresponding result.

5. Conclusion and Future Work

Facial expression recognition is challenging problem and there is still a lot of work that needs to be done in this area. In this project we have taken 60 images of 10 different people for training and the testing have been done for 15 images. More number of images can be taken for better performance and moreover, there lies a task which is quite complicated-the generation of threshold value. It is a tedious task to decide the best threshold value to generate the tokens. So as a next process or the future work is to determine the best threshold value, so that without the interaction of user the system can generate the tokens. Again we can increase the number of facial features, so as to improve the system accuracy.

References

1. Mehrabian. A, 1968. "Communication without Words", Psychology Today, Vo1. 2, No.4, pp 53-56.
2. Jagdish Lal Raheja, Umesh Kumar, "Human facial expression detection from detected in capture image using back propagation neural network"- IJCSIT,Vol.2,No.1,February 2010.
3. Irene Kotsia and Ioannis Pitas,, "Facial Expression Recognition in Image Sequences Using Geometric Deformation Features and Support Vector Machines"- IEEE Transactions On Image Processing, Vol. 16, No. 1, January 2007.
4. Michel Valstar and Maja Pantic, "Fully automatic facial action unit detection and temporal analysis" IEEE- Conference on Computer Vision and Pattern Recognition Workshop (CVPRW'06) 2006
5. Shishir Bashyal, Ganesh K. Venayagamoorthy , "Recognition of facial expressions using Gabor wavelets and learning vector quantization"- Engineering Applications of Artificial Intelligence ,12 November 2007
6. L. Ma and K. Khorasani, "Facial Expression Recognition Using Constructive Feed forward Neural Networks", IEEE Transactions On Systems, Man, And Cybernetics—part B: Cybernetics, Vol. 34, No. 3, June 2004
7. Mehrabian, A. (1981) Silent messages: Implicit communication of emotions and attitudes.Belmont,CA.(http://www.businessballs.com/mehrabiancommunications.html)
8. [Mitchell, 1997] Mitchell, T.M., 1997. Artificial neural networks. In Mitchell, T.M. Machine learning. McGraw-Hill Science/Engineering/Math. pp.81-126.
9. P.Ekman and W.Friesen, The Facial Action Coding System, Consulting psyc-hoogysts Press, SanFrancisco, CA,1978
10. R.Q.Feitosa ,M.M.B.Vellasco, Facial Expression Classification Using RBF AND Back-Propagation Neural Networks
11. Cohn, kanade," Database for Facial Expression Analysis"
12. Cohn, kanade,"The Extended Cohn-Kanade Dataset (CK+): A complete dataset for action unit and emotion-specified expression"

Biography

Rehmat Khan is pursuing master of engineering from Computer Technology And Applications from SSTC, SSGI, CSVTU University, Bhilai (C.G) and completed Bachelor of engineering in Information Technology in 2008.

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