

Performance evaluation of Adaptive Neuro Fuzzy inference System (ANFIS) with JAFFE Database and PICS Database

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Abstract-- A novel method of facial expression detection has been done using Adaptive Neuro Fuzzy inference System (ANFIS). In order to find the efficiency of the network it is tested with both low resolution and high resolution images i.e., JAFFE (Japanese Female Facial Expression) and PICS (Psychological Image Collection at Stirling) database. And with the help of these two databases the performance of the network is tested by using the parameters like specificity, sensitivity, Accuracy, Precision and with the help of target vs. output plot.

Key words: JAFFE, ANFIS, PICS, Specificity, Sensitivity, Accuracy, Precision.

I. INTRODUCTION

In this work a new method of finding the facial expression has been done and to find its performance whether it works well for both good quality and low quality images, here a comparative work has been done with the help of two database i.e., JAFFEE and PICS.

II. RELATED WORK

In paper [1][2] [6][8] they have compared the JAFFE and CK database by using various feature extraction techniques, in paper [5] they deal with the facial data field efficiency in identifying the facial expression detection, in paper [7] they evaluate the recognition rate they used similar to the proposed work i.e. precision, Accuracy, Sensitivity, Specificity, in paper [9][12] they explain about various facial emotion, expression, individual differences and perception. [10][11] deals with how facial expression is identified with ANFIS

III. DATABASE

A. JAFFE:

The Japanese female facial expression database consist of 213 images with seven different expressions given by the 10 female subjects. This database uses ekman six universal emotions, along. Each image in the database was graded by 60 different japanese graders to ensure consistency and relation to the emotion being expressed. The creation of the images involved the subjects being told which emotion to express. So rather than the emotion being evoked, the subjects simply provided the expressions needed which is shown in Figure 1 with the resolution of 256x256 [3].

B. PICS:

It consists of 63 Cropped Images with 7 expressions (not sad) from each of 9 women. Angry, disgust, fear, happy, normal, surprise with the of Resolution: 181x241 monochrome. They are free for research use.

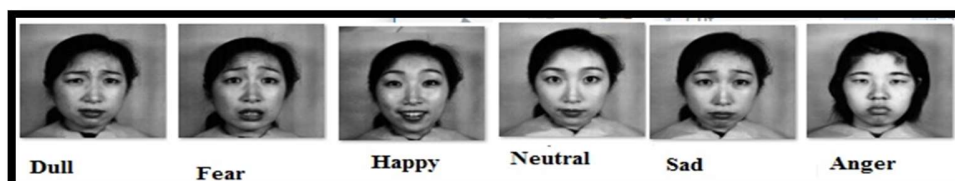


Figure 1: Jaffe facial expression database



Figure 2: PICS Facial Expression database

IV. METHODOLOGY

A. Feature extraction

Initially the human face features are detected from the original image by removing the neck and part of hair. This is achieved by cropping the image. The cropped image is fed as input to image enhancement unit. In this, contrast adjustment is carried out. Gamma correction is performed with a gamma value of 1.25. Gamma value greater than 1, expands the lighter regions and compresses the darker regions of the original image. This makes the facial features of the images to stand out. For removal of hair a mask is created from the preprocessed image by converting the image into black and white and removing smaller structures. The enhanced image is obtained from the preprocessed image by converting the image into black and white and complementing the result. By ANDing the mask with the enhanced image facial features are obtained by their orientation and size. The facial features extracted are eyes, mouth and eyebrows. For the extracted features the geometrical feature values viz. area, orientation, perimeter, solidity, major axis length, minor axis length and Centroid are determined. As Centroid has x and y values, totally 40 features (eight geometrical features of five facial features (two eyes, two eyebrows and mouth)) are obtained for each image. Then the facial features are classified into different expressions. The facial features include the change in the shape and size of eyebrows, eyes and lips. The features extracted from the image are quantified and are used as training set for the ANFIS.

V. PERFORMANCE EVALUATION

A. Accuracy

Accuracy is the measure of closeness of the predicted class to the actual class. It is defined as,

$$Accuracy = \sum_{i=0}^n \frac{TP(i) + TN(i)}{TP(i) + FP(i) + TN(i) + FN(i)} \text{-----(1)}$$

B. Sensitivity

Sensitivity is the measures of correctly identifying the signals of a particular class as belonging to that particular class

C. Precision

Precision refers to the closeness of two or more measurements to each other

$$Prec = \text{mean}(tp / (Tp + fp)) \text{-----(2)}$$

D. Specificity

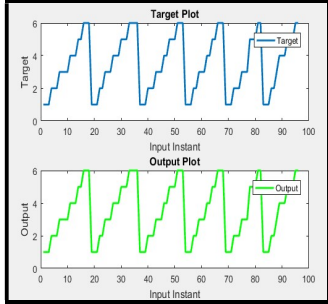
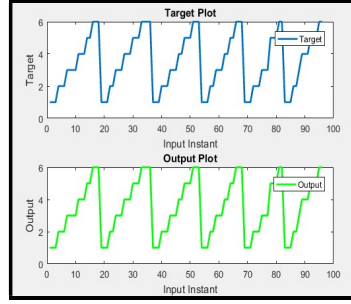
Specificity is the measures of correctly identifying the signals not belonging to a particular class as not belonging to

that class.

$$Specificity = \sum_{i=0}^n \frac{TN(i)}{FP(i) + TN(i)} \text{----- (3)}$$

Table1: Performance Evaluation

Neural Networks	ANFIS- emotion JAFFE Database	ANFIS emotion PICS Database
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Accuracy	0.72	0.68
Precision	1	0.66
Sensitivity	0.167	0.03
specificity	1	1
Target vs. Output	 <p>The Target vs. output plot gives the exact Match between the Target and the output pair.</p>	 <p>The Target vs. output plot gives the exact Match between the Target and the output pair.</p>

VI. CONCLUSION

A novel feature extraction has been carried out, i.e. from the original image the face region is cropped and from the face region the features such as eyes, eyebrows and mouth region are extracted and from the extracted region the dimensions such as area, perimeter, sensitivity, solidity, Centroid, Major Axis Length, Minor Axis Length are measured and based on these values the ANFIS is trained and in this paper performance of this method is tested by the use of two types of database, and it proves that this method of identifying facial expression has been proven to be efficient with both PICS and JAFFE database.

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