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CHARACTERISTICS AND MOOD PREDICTION OF HUMAN BY SIGNATURE AND FACIAL EXPRESSION ANALYSIS

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Abstract - *Nowadays human computer interaction is trending to explore new researches Human-Computer Interaction (HCI) explores the plan and usage of computer technology concentrated on the boundaries between human and computers. This paper is designed to develop techniques for predicting mood and behavior of human through automated skills for which we had used Improved Susan method and Eigenvector approach using PCA techniques for predicting mood and behavior is predicted by signature analysis.*

Keywords: *Graphology, PCA technique, Handwriting, Signature, Backpropagation*

1. Introduction

In the 21st-century the most secure and convenient validation tool is biometric, nowadays computer performances and presentation spreads, day by day and the evolution in this field are due to the up gradation of human intelligence. All collaboration between human being and computer technology is intermediated by our senses. The knowledge of machines working like human beings stimulated to be in the center of scientist's performance. Day by day research has explored to dig out supplementary information from numerous biometric procedures such as the face, voice, iris, handwriting, etc. One of the unique characteristics of a human being is handwriting, which expects the physical, mental, and the emotional state-run of the author. The study of handwriting is known as Graphology, it is a scientific technique used to regulate a person's personality by estimating the number of features from the handwriting. Similarly Human mood changes with respect to mental and emotional state of person. Facial Expressions plays important role in predicting mood of person which changes with time. So to make thisautomated many techniques were used such ANN and MATLAB codes, SVM.

2. Background

In 1983, a technique of examining scripts is drawn. The capability to infer distinct abilities through handwriting analysis is reviewed in light of the two basic psychometric questions: reliability and validity.

In 1988 ANN was effectively executed to Optical Character Recognition (OCR) in direction to return outstanding results.In 1990,an application of back-propagation networks to recognize handwritten digit was implemented. Latter on Champa H. N. and Dr. K. R.AnandaKumar (2010) said that Graphology is a technical method of recognizing, approximating and understanding personality with the strokes and the patterns exposed by handwriting. In 2010, in the direction to make this technique online we measured six different types of parameters are as follows: (i) size of letters. (ii) pen pressure, (iii) slant of letters and words, (iv) baseline, (v) letters spacing and (vi) spacing between words in a document to detect the behavior of the writer.In 1992, the author estimates the procedure of machine recognition of facial expressions. In 1998, the authors examine two uses of types of features take out from face representations for recognizing facial expressions.

In 2005, B.Vermalooks at a feature collection and arrangement system for face recognition via genetic techniques and artificial neural networks .In 2016Automated Facial Expression Recognition (FER) has endured an encouraging and thought-provoking problem in computer apparition. Even with the determinations made in emerged numerous approaches for FER, remaining methods lack generalizability once implemented to unseen images or individuals that are seized in wild situation.

2.1 Pattern Recognition

It is the procedure of identifying patterns by using a machine learning algorithm. It can be well-defined as the ordering of data based on knowledge at present or on statistical information put in patterns for their representation.

2.2 PRTools overview

PRTools means Pattern Recognition tools that offer more than 300 MATLAB procedures for constructing pattern recognition methods. PRTools are basically used for preprocessing raw data, representation of entities in vector spaces, classification, and estimation. There are hundreds of references in the scientific texts to PRTools by investigators who used it for their research and studies.

3. Software used in the study

MATLAB stands for matrix laboratory. It is a multi-purpose numerical computing system. It is a Domain-specific language presented by Mathworks. MATLAB is a special-purpose language that is an outstanding excellent for writing moderate-size programs that resolve problems including a number of operation.

4. Proposed Work

The work aims at predicting behavior and mood of human by signature and facial expression analysis.

4.1 Improved Susan Method

Human facial expressions are recognized based on the mouth feature using Susan edge detector the process of Facial expression recognition is done in three steps are as follows face detection, feature extraction, and expression classification. Many investigators have done work in this research area yet well-organized and robust facial expression system essential to be established. This is the technique to recognize the facial expressions of a user by processing the pictures taken from a webcam. Steps involved in the proposed system are:

Step 1: Preprocessing

In preprocessing quality of the image is enriched by different filters such as median filter, average filter, Wiener filter depending upon the noise present in the image, refining contrast of the image by histogram equalization, etc.

Step 2: Mouth Detection

The second step is mouth detection it is appropriate edge detector such as Sobel, Pewitt, etc are applied on the image to detect edge on the given image and face boundary is located by using suitable threshold value.

Step 3: SUSAN operator to detect corners

SUSAN operator is implemented on the face zone to identify far and near corner aimed at two eyes and two corners for the mouth area, and increase the accuracy.

Step 4: In this step Geometrical features like height, area, and width of the mouth region are calculated for the determination of expression, by following equations as shown below.

$$A = w\chi l \qquad (1)$$

$$P = 2(l + w) \qquad (2)$$

$$l = \frac{P}{2} - W \qquad (3)$$

$$W = \frac{P}{2} - l \qquad (4)$$

Where w = width, l = length and p = perimeter.

After calculating the area covered by mouth region we compare that calculated area with the given range of facial expression as shown in table 1.Facial expressions such as surprise, neutral, sad and happy constructed on the variety of standards given for every expression satisfying the equations as given in equation (5).

$$
\left.
\begin{aligned}
e &= \text{Normal if } N_{m\,min} < M_a < N_{m\,max} \\
e &= \begin{cases} \text{Very Sad, if } \dfrac{\left(S_{m\,min} + S_{m\,max}\right)}{2} < M_a < S_{m\,max} \\ \text{Not Very Sad, if } S_{m\,min} < M_a < \dfrac{\left(S_{m\,min} + S_{m\,max}\right)}{2} \end{cases} \\
e &= \begin{cases} \text{Very Happy, if } \dfrac{\left(H_{m\,min} + H_{m\,max}\right)}{2} < M_a < H_{m\,max} \\ \text{Not Very Happy, if } H_{m\,min} < M_a < \dfrac{\left(H_{m\,min} + H_{m\,max}\right)}{2} \end{cases} \\
e &= \begin{cases} \text{Very Surprised, if } \dfrac{\left(SU_{m\,min} + SU_{m\,max}\right)}{2} < M_a < SU_{m\,max} \\ \text{Not Very Surprised, if } SU_{m\,min} < M_a < \dfrac{\left(SU_{m\,min} + SU_{m\,max}\right)}{2} \end{cases}
\end{aligned}
\right\} \quad (5)
$$

Where, N_m = Mouth for normal expressions, S_m = Mouth for sad expressions, H_m = Mouth for happy expressions, SU_m = mouth for surprise expressions

4.2 Eigen Approach: PCA Technique

4.2.1 Principal Component Analysis (PCA)

The Purpose of PCA is to reduce the large dimensionality data space into the smaller dimensionality feature space that is required to describe the data economically.In this method, it consists of some steps such as preprocessing, Principal Component analysis and facial expression grouping using Euclidian classifier. Mouth region is cropped and then this cropped database of mouth is converted to eigen vector dataset by PCA techniques.

4.2.2 Algorithm: An algorithm for classifying facial expression

Step I: A small dimensional mouth space is taken from the trained images. This is done by PCA technique for training set.

Step II: The experiment images are projected on the mouth space the most significant principal components are used to represent the test images.

Step III: Euclidian distances between the test image and all the train images are calculated and the minimum value is selected permitted to catch out the train image .which is identically considerable nearby to the test image. Using equation (6)

$$D = \sqrt{\left(x_1 - x_2\right)^2 + \left(y_1 - y_2\right)^2} \quad (6)$$

Where $x = (x_1, x_2)$ and $y = (y_1, y_2)$

Step IV: To find the expression, we find the Euclidian distance between neutral expression and test dataset of expression that is to be tested. More the distance the far from the neutral expression As a result, it can be identified as a stronger the mouth expression as shown in the flow chart.

4.3 Conclusion of Improved Susan method

Human mood prediction is getting very concern after the investigation communal for which facial expression identification plays a very significant role. Improved Susan method is used to produce different expression of human by means of mouth as a parameter with the help of SUSAN operator, and the suggested system is verified on the extensively used standard.

JAFEE database in which facial expressions of different peoples are well thought-out and outcomes obtained and presented as shown in tabulated form.

4.4 Experimental Results and Analysis of Improved Susan method

After the implementation of MATLAB code resulted into recognition of expression as shown below.

1) Happy face

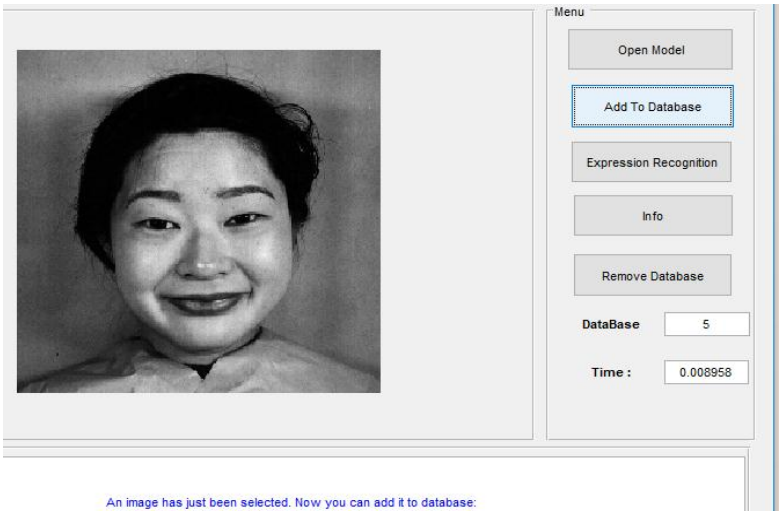


Fig-1

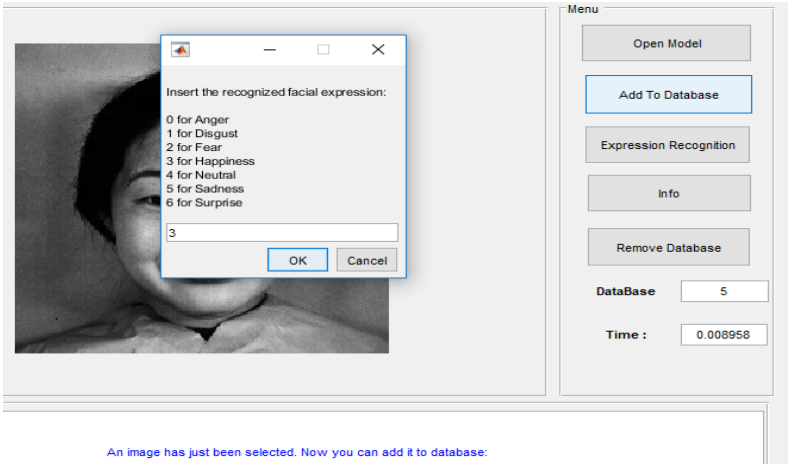


Fig-2

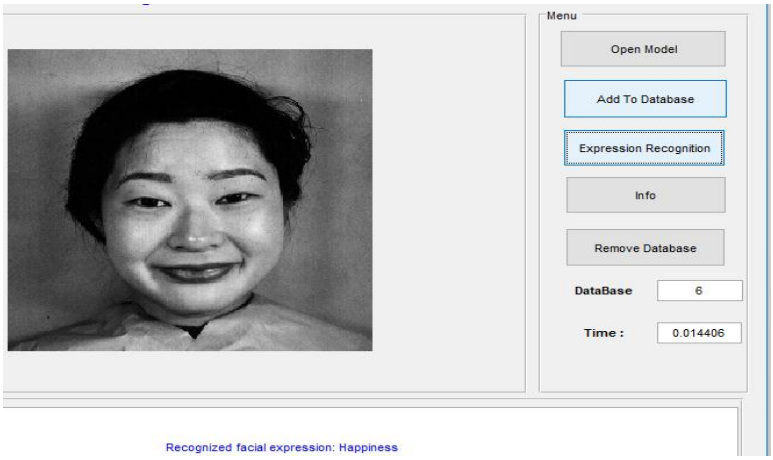


Fig-3

Table-1: Sample experimental results with mouth samples are as:

Expression of a persons	Mouth area ranges between	
	Min	Max
Normal	4102.591500	5014.278500
Sad	3646.748000	4102.591500
Happy	5014.278500	5470.122000
Surprise	5470.122000	6080.965500

In this work, four images are carefully chosen from ten persons from the JAFFE database. Table 2 displays different investigational results for JAFFE database of the four different facial expressions like (happiness, neutral, sadness, surprise).

Table-2: Experiments based on Improved Susan method

Database JAFFE	Total number of sample images	Correct Detection	Misdetection	% of success Rate
Happy	40	34	6	85%
Neutral	40	36	4	90%
Sad	40	33	7	82.5%
Surprise	40	37	3	92.5%
Average				87.5%

Recommended system is verified on the extensively used standard JAFEE database in which facial expressions of dissimilar peoples in different moods are measured and suitable results are attained and tabularized with considerations.

4.5 Experimental Results of Eigenvector approach using PCA:

This is more advanced method for facial expression recognition, in this features are taken in the form of Eigenvector applying PCA and on the basis of it we had prepared a table to check the success rate and calculate misdetection rate as shown in table 3

Table-3: The Success rate of various facial expressions

Type of Expression	Happy	Disgust	Anger	Sad	Surprise	Neutral	Average
Happy	47	0	1	2	0	0	
Disgust	1	45	0	1	1	2	
Anger	0	2	44	0	3	1	
Sad	0	0	1	46	1	0	
Surprise	1	0	0	1	48	1	
Neutral	0	1	0	2	1	46	
Recognition	94%	90%	88%	92%	96%	92%	92%

4.6 Signature Analysis

Based on the MATLAB codes and prepossessing techniques to find the features of handwriting we apply the ANN and SVM and then predict the behavior of human based on pen pressure. After scanning the signature by PC and through MATLAB codes then, we have to estimate the feature of signature.

4.7 (SVM) Support Vector Machines

SVM are supervised learning models with associated learning algorithms that analyze data and recognize patterns, used for classification we used RBF to give input to the SVM basically SVM takes input as a function. SVM gives the better and exact result.

4.8 (RBF) Radial Basis Function

RBF is a real-valued function whose value depends only on the distance from the origin Sums of radial basis functions are typically used to approximate given functions. This approximation process can also be interpreted as a simple kind of neural network. RBFs are also used as a input in support vector classification.

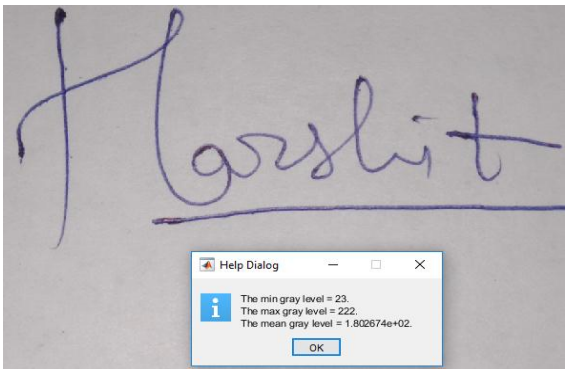
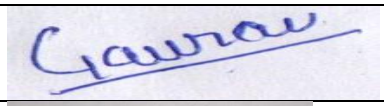
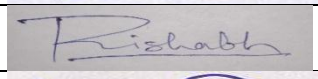
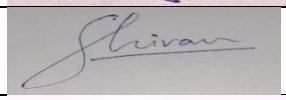
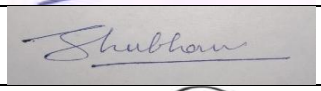
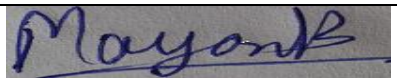
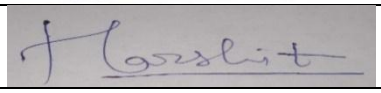


Fig-4: Pen Pressure

After various techniques and using various MATLAB codes we find the value of various parameters like alignment pen pressure etc, as shown in table 4After getting all these data we train our network to predict human behavior by the training through backpropagation algorithm. We have been working with the 4 features which are: Alignment, Pen Pressure, and Alignment. We have taken a sample of signatures 10 persons and then extracted features are, considered in the table below.

Table-4: Various data of features is predicted in tabulated form

S.No.	Name	Signature	Mean Square Error	Pen Pressure	Alignment	Behaviour
1	Gaurav		.5642	2.825	0.371	Cheerful , Positive attitude,
2	Rishabh		.6484	1.856	0.117	Dependable, Steady
3	Arvind		.536	2.213	0.423	Determined and hopeful
4	Shivam		.6479	1.748	0.223	self-motivated
5	Neha		.3336	2.448	0.378	Determined, Deep thinking
6	Shubham		.6506	1.875	0.332	Cheerful
7	Mahendra		.369	2.386	0.399	Optimistic , Progessive
8	Mayank		.6507	2.496	0.266	Long lasting effects,
9	Himani		.3434	1.204	0.378	Strong-minded, stays on track
10	Harshit		.6496	1.602	0.221	Self-motivated, enjoys secrecy

The results obtained after many repetitions, training and testing the normal standards on the basis of assured parameters such as Alignment, pen pressure, etc of a different person. On the basis of these parameters, we have evaluated the behavior of a person. So, initially we ran a standardize MATLAB program in which signature of person was uploaded and after that its normal and Eigenvalues are calculated and on the behalf of the foreign values we took standard individual two parameters and ran them to recognize the behavior of a person.

5. Conclusions

The proposed methodology to predict the personality and mood of human on the basis of signature analysis and face expression analysis. First methods named as improved SUSAN method and result shown in **Table-2** in which facial expression recognition success rate is 87.5% along the same experiment was done by Eigen Vector approach using PCA approach the success rate is 92% as shown in table 3. This concludes that the results using the PCA method are much effective than Improved Susan method as both methods are good and promising and are implemented through MATLAB code based on standard JAFFE dataset. Using these two methods mood of a person was predicted which the half part of the task is by considering the only face. Another half task is based on the signature analysis, Features are extracted by preprocessing and various features such as pen pressure, alignment, etc was calculated by the MATLAB code using the various functions. The algorithm named back propagation algorithm was used to train the network and then these features are fed to SVM then it predicts the behavior of person as shown in table 4 .so, on the basis of both these studies, we easily got to know about the behavior and mood of a person. Three methods along with the MATLAB coding are used in this study.

In this paper signature and facial expression analysis are automated which results and help us to predict behavior of any unknown person and similarly if we train our robots or machine to predict human mood then it will be beneficial for all because they respond to others according to their mood. On an application part if we train our machines through these two techniques it will be prove beneficial in field of artificial intelligence.

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