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Genetic Algorithm Based Facial Sentiments Recognition using Edge Feature

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Abstract — Most of sentiment based image classification approaches have done lots of complex calculation such as number of feature was collected for identifying correct class. In case of supervised learning models prediction of sentiment class for the unknown image leads to false alarm. So this work take facial input image features and find the sentiment of image by genetic approach. In this work grouping of various sort of information was managed without bargaining the security using genetic algorithm TLBO teacher Learning Based Optimization. Experiment was done on real dataset of JAFEE Images. Results show that execution time for the sentiment identification of image information was low. Here proposed work was capable to classify input data with high accuracy as compared to previous machine learning approaches.

Keywords- Color format, digital image processing, facial sentiment detection, and genetic algorithm.

I. INTRODUCTION

It is observable that face detection is being used for security and authentication purpose now days but what will be the state where we will be able to understand the people without they say; this thing has its own kind of glory like if someone is threatening to someone but he can't speak the words which can be required. So in such occasions just by expressing such emotions on face system will be able to understand what he is supposed to get. Emotion detection in coached environment can be easy, so to detect the expression in non-controlled environment will be the one of the objective. When it will get into picture it will be quite helpful for disabled people.

Facial expression recognition scheme is fastly becoming a well-known feature in 'apps' and on websites for many different purposes. Additionally facial feature individuality is much effective in biometric credentials which automatically identify a person from a digital image or a video image. FEs is used not only to utter our emotions as well as to grant important talkative cues during social interaction, such as our level of attention.

While communicating with others the facial movement and the expressions plays major role in conveying the message and thus we can utter that the face features have significant contribution in human interactions. Understanding facial expression with more accuracy still is tough task due to the intricacy and variability of facial expressions even after putting many efforts earlier.

It can be computationally possible to process whole image. So we opt to process only some part of that, region of interest. Computer vision is a research area which has several applications, in most of the digital image processing it is applied for detecting relevant image information. An instance of computer vision application is the Facial Expression Recognition (FER) that can be functional to detect mental disorders, detect whether a person is mendacious, detection of emotions, among others. To extract the useful part of the image, there are methods like those are based on image textures, image threshold or locating the image points.

The main ROI's that are supposed to be fetched in face image are those containing eyebrows, eyes, nose and mouth because they contribute the most.

Computer vision is a technique which helps to extract the spatial information from 2d image. Facial Expression Recognition uses its feature that can be applied to detect if a person is lying or detection of emotions. Communication among human can be either verbal or non-verbal. It may not only through words but also by facial expressions, movement of head and emotions. The six basic emotions like happy, depression, fury, hatred, dread and astonish are considered for analysis purpose.

A. PROBLEM STATEMENT

There are several techniques to detect the facial expression but the parameter accuracy matters. The accuracy may depend on several features such as for a controlled environment the accuracy will be high but for non-controlled

environment accuracy may affect due to face-posed, illumination, occlusion.

Implementation of facial expression detection is to address following issues-

I. Recognize the facial expression in non-controlled environment.

II. Reduction in execution time and higher the accuracy.

Section I introduces the importance of facial expression recognition and its applicable areas and problem statement.

Section II describes previous work done in this technology. It involves various ways of implementing it.

Section III describes the proposed methodology.

Section IV describes experimental setup and results of the applicable parameters.

Section V describes the conclusion of the work and scope for future in this technology.

II. RELATED WORK

Bing-Fei Wu, Chun-Hsien Lin [1] has proposed paper on Adaptive Feature Mapping for Customizing Deep Learning Based Facial Expression Recognition Model. They proposed mainly Weighted Center Regression Adaptive Feature Mapping. Image preprocessing has been done for spatial normalization and then convolution feature extractor and fully connected feature extractor is performed on input image. They have shown the higher accuracy rate as compare to other methods by applying the convolutional neural network.

Ghulam Muhammad, Mansour Alsulaiman, Syed Umaramin et .al [5] has proposed paper on facial expression monitoring system for improvising healthcare facilities. image is inputted to the band let transform at first in their proposed model and then it gets divided into blocks and blocks may be of different sizes and then center symmetric lbp is applied to each block and after that histogram concatenation takes place to extract the feature and selecting them by gmm and svm and the one having high value is considered. both the classifiers are used in it. the accuracy improves in no weighted center symmetric lbp. they have combined the score of both classifier, accuracy has been calculated under public and private dataset.

Yuma Sasaka, Takahiro Ogawa et.al [6] has proposed a novel framework for asserting the viewer interest by unsupervised multimodal anomaly detection. They have mentioned the factors responsible to interest and they suggest model for viewer interest. They have considered the many AUs for calculating the facial feature such as chin open, lip pucker, lip stretcher right and left, left eyebrow lowerer ,right and left cheek puff etc. They have calculated the event related synchronization by dividing the difference of band power of rest and task to the band power of rest. They have proposed to refine the interest of user while watching video on web and it is done through biological signal.

Biao Yang, Jinmeng Cao,et.al [7] have proposed paper on facial expression recognition using weighted mixture deep neural network based on double-channel facial images. In their proposed approach model preprocessing like face detection, rotation, sub sampling and data amplification is performed then only feasible portion of the face is being extracted. Then they have applied VGG16 network and shallow CNN after calculating local binary pattern images. Then weighted fusion takes place then with the help of softmax classification expression is being classified that it belongs to which category. Fusion is performed on binary outputs. In this paper databases like Cohn Canade, Jaffe, Oula-Casia is taken into consideration .VGG16 network process the image at various level of convolution then a dense image generated as output .\

Prasad M, Ajit Danti [8] have Proposed Paper on Eigen based facial expression using mouth feature. In this paper, facial expression detection system has been proposed by applying principal component analysis. In this paper instead of entire face only mouth feature is used for the facial expression recognition which in reduced the computational cost of analysis. Proposed approach is experimented on sample images taken from JAFFE and own dataset and demonstrated the efficacy of the proposed system.

M. Mahadevi, c. P. Sumathi. IJCII Vol. 5: No. 4, March 2016 [9] has Proposed Paper on Facial expression recognition for color image using genetic algorithm. In this paper face localization has been implemented using skin color segmentation, and statistical extracted from different facial parts. About 12 features for a set of training images were calculated out of which six features were selected using a genetic- algorithm. A Naive Bayes classifier was used to classify the facial expressions and four basic expressions of disgust, happy, neutral and sad were classified with an accuracy of 92.31%.

III. PROPOSED METHODOLOGY

This work has classified kind of information, obtained from input facial image with tag of sentiment information**.** Entire work is clarified in this segment of the work and block diagram of fig. 1 demonstrates all means of the work. This proposed work is characterized into module where initially is for population generation side where unique cluster set having feature values was taken in the image. While in second module population set was update or modify as per genetic algorithm TLBO teacher Learning Based Optimization.

A. Preprocessing

As the image is the group of picture elements called pixels where each one of them is representing a number .For each number depending on the format, it has its range such that for the gray scale layout it is in the range of 0-255. So

reading a image implies making a matrix of the same dimension of the image then assigning the matrix by the pixel value of the image at the cell in the matrix.

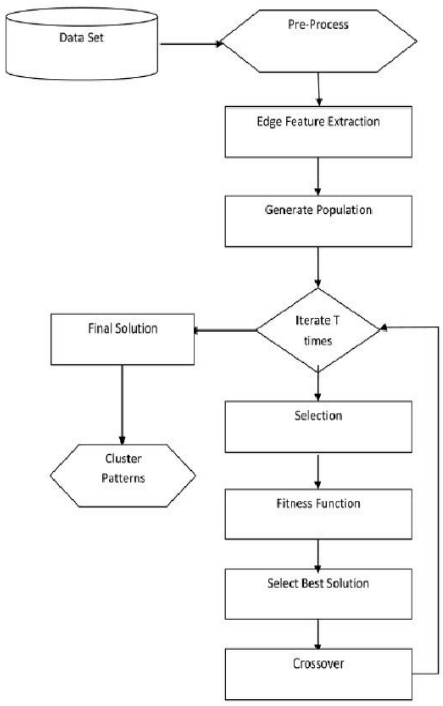

Fig. 1. Block diagram of the proposed work.

B. Edge Detection

In order to find the edges in the image translate it into gray format then operate the Canny algorithm on that. This is the routine to convert a gray scale image into binary image. For this, analysis of each picture element is done.

C. Population Generation

This is generated by the accidental function which selects definite number of emotion cluster with respect to centroid. Let the number of centroid be Cn and number of cluster are n then {C1, C2, …..Cn} can be a probable solution.

D. Fitness Function

In order to obtain good chromosome from the bunch of available set fitness value of each probable cluster center set is passed in this function**.** So fitness value returns. Euclidian distance formula was used for finding the fitness value. This can be understand as let cluster set Cc = [C_1, C_2] fitness value need to calculate. Than distance of cluster center image values from each non cluster center image was evaluate. Now each non cluster center image was assign to minimum distance cluster center. While sum of all minimum distance of each non cluster center was consider as fitness value.

$$D_{m,s=\sum \sqrt{(}Cci\text{-}B_{s)}{}^{\wedge 2}$$

Where m regards number of cluster center and s regards all image pixels, while whole cluster center need to find.

$$\mathbf{F = \sum min\ (D_{1,S}, D_{2,S}, \ldots\ \ldots\ \ldots D_{M,S})}$$

E. Teacher Phase

This phase was used for the crossover of the chromosomes by the single best solution from the population. Here best solution act as a teacher and its selection is based on the minimum fitness value.

In order to do crossover operation random position cluster center value is copied from the teacher chromosome and it was replaced to the non teacher chromosome. This improves the population quality. Every learner has to interact with any other learner. The best learner identified is considered as the teacher by the algorithm and no algorithm specific parameters are required in TLBO. Sometimes there can be two teachers also and it can be said improved TLBO. Finding the best solution is the purpose of this.

This divergence updates the solution by the expression-

$$C_{new,i} = \text{Difference } (C_{teacher,i}, C_{student,i})$$

Here result is the modified significance of $C_{student,i}$. and $T_{eacher,\ I}$ vectors.

F. Student Phase

In this phase some random group of chromosome were made automatically and then each group was used for the crossover of the chromosomes by the single best solution in that group. Here best solution act as a teacher among other chromosomes and its selection is based on the minimum fitness value. In order to do crossover operation random position cluster center value is copied from the teacher chromosome and it was replaced to the non teacher chromosome. Here each new chromosome was cross verified that either its fitness value improved than previous, if fitness improves then new chromosome is included in the population and older one get removed. Vice versa if fitness value not improves.

- For i = 1: Pn
- Randomly select Ci and Cj as learners, where i is not equal to j
- If f (Ci) < f (Cj) // f is the fitness value of the selected population.
- $C_{j,x}$ = Difference ($C_{i,\ x}$, $C_{j,x}$)
- Else
- $C_{i,x}$ = Difference ($C_{j,x}$, $C_{i,x}$)
- End
- End

Accept Cnew if resultant is a better function value. Once student phase is over in each aspect then learning gets over and the best solution from the on hand population is regarded as the final centroid of this.

G. Final Solution

Once iteration gets completed for the genetic algorithm then proposed solution would come out from the loop and

processed population obtained**.** Now this population was used for finding the final solution on the basis of fitness value. Here solution which has best fitness value classify the input set of images and assign to clusters having similar sentiments. So in this step cluster centre obtained from the proposed work were used to cluster other images in the most similar cluster here each image was test with each cluster centre and pattern having minimum distance from the cluster centre are considered as most similar or matching cluster for the pattern. So in this way whole set of cluster got their respected patterns by the proposed work.

IV. EXPERIMENT AND RESULT

This section presents the experimental assessment of the proposed Embedding and Extraction technique for privacy of image. All algorithms and utility measures were implemented using the MATLAB tool. The tests were performed on a 2.27 GHz Intel Core i3 machine, equipped with 3 GB of RAM, and running under Windows 8 Professional.

A. DATASET

At that point for picture, consider a well known outward appearance informational collection called JAFFE**.** In genuine picture database name JAFFE which is accumulation of 213 pictures records of various outward appearances where six are ordinary expressions while one is outrage. Here posture of ten Japanese young ladies was gathered.

B. EVALUATION PARAMETER

As various techniques evolved different steps of working for classifying *data into appropriate category. So it is highly required that proposed techniques or existing work need to be compare on same dataset. So following are some of the evaluation formula shown which help to judge the classification techniques ranking.*

$$\text{Accuracy} = \frac{\text{Correct classification}}{\text{Correct classification+ Incorrect Classification}}$$

In above the true positive value is obtained by the system where the ranked data is classified in its category. let X and besides the system says that data is in favor of category X. While in case of false positive value obtained by the system when the input data is in favor of category X and system do not rank that data in category X.

C. EXECUTION TIME

As we know that in any procedure the time for execution should be lesser. It is the time period for the algorithm to classify user data on the server. It is highly considerable parameter. Execution time is evaluated in terms of seconds.

D. RESULTS

Sentiment Set	Proposed work	Previous Work[1]
Set1	0.9000	0.5714
Set2	0.7500	0.6250
Set3	0.7500	0.6250
Set4	0.9000	0.8571
Set5	1.0000	1.0000

Table 1. Precision Value for One to all sentiment Comparison.

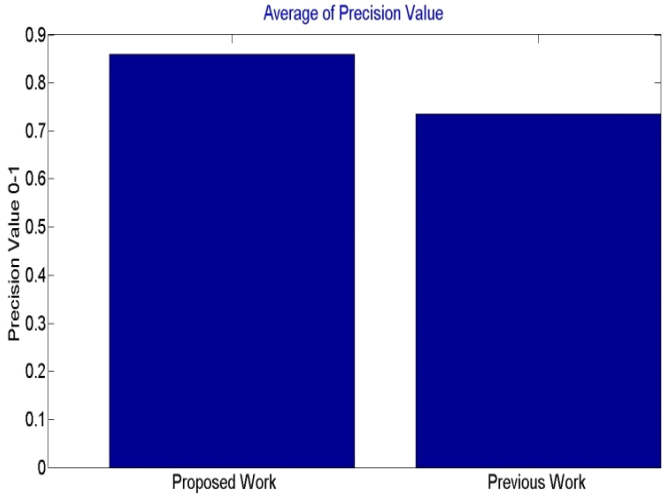

Fig. 2. Precision value (Averages) comparison with regards to proposed and previous work.

Above table 1 and fig. 2 shows that precision value of proposed work was high as compared to previous work. It can be observe that in proposed work centroid selection method is efficient as regarding to the previous. Here iteration in both work increase the precision value but selecting the different set of features for clustering makes high precision value of proposed work.

Table 2. Recall Value for One to all sentiment Comparison

Sentiment Set	Proposed work	Previous Work[1]
Set1	1.0000	0.4444
Set2	0.3333	0.5556
Set3	0.3333	0.5556
Set4	1.0000	0.6667
Set5	0.6667	0.3333

Table 2 shows that recall value of proposed work was high as compared to previous work. It can be observe that proposed work centroid selection method is efficient as compare to the previous. Here reduction in feature vector has improved the accuracy of the proposed work while two phase learning of proposed TLBO algorithm has also improved the recall value.

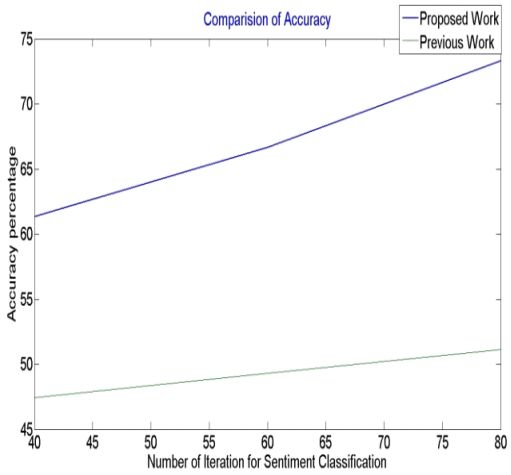

Fig. 3. Accuracy comparison of one to one sentiments.

Table 3. Accuracy Value for One to one sentiment Comparison

Number of Iteration	Proposed work	Previous Work[1]
40	0.6135	0.4744
60	0.6667	0.4932
80	0.7334	0.5111

Above table 3 and fig. 3 shows that accuracy value of proposed work is high as compared to previous work. Here iteration in both work increase the precision value but selection different set of features for clustering make high accuracy value of proposed work.

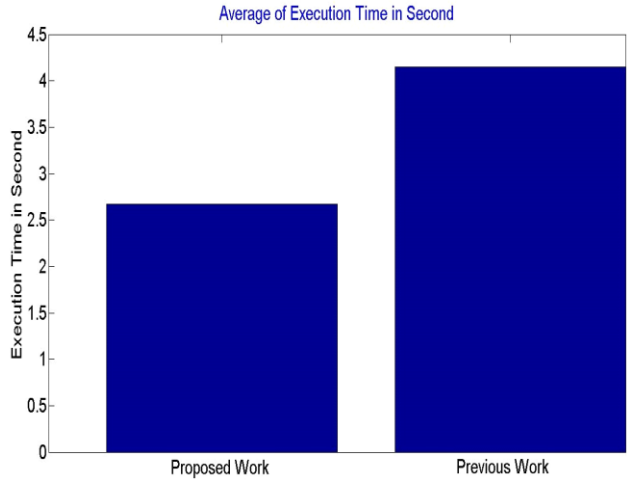

Fig. 4. Average of execution time comparison.

Table 4. Execution time for One to one sentiment Comparison

Number of Iteration	Proposed work	Previous Work[1]
40	1.6135	2.4744
60	2.6667	3.4932
80	3.7334	6.5111

From table 4 and fig. 4 it can be concluded that in proposed work one to many classification for different image sets is better as compare to previous data. Here reduction in feature vector has reduced the execution time of the proposed work.

V. CONCLUSION

As proposed work can proficiently classify all sort of facial expressions present in images. In this field of work many researchers have already done remarkable work but it was focusing mainly on the content cataloging where in this work images are classified. In some proceedings pattern classification was being done on the basis of the background information, but this work prevail over this dependency as well as it classifies all the facial images without having prior knowledge by using genetic algorithm TLBO. It is observable that proposed work centroid selection method is efficient as respective to the previous. Here iteration in both work increase the precision value but selecting different set of features for clustering gives higher accuracy for proposed work. Results shows that using an correct iteration with fix number of centroid for classification proposed algorithm works better than previous work.

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