Recognition and Classification of human reactions with facial features

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Abstract: *This paper compares different algorithms to identify the different emotions from facial expressions. This presents about recognition of 6 basic expressions like Sad, Happy, Disgust, Fear, Surprise, Anger, and Neutral. This paper does a review about various algorithms that effectively recognizes facial expressions with emotions. A survey of database and algorithms were explained along with a partly implementation using Principal Component Analysis (PCA). By this survey it is observed that say Support Vector Machine (SVM) and PCA are efficient than other algorithms. An implementation on Principal component analysis is carried out in this paper to identify the emotions using MATLAB.*

Key words *– (Principal component analysis) PCA, Machine learning, Emotion recognition, (Support Vector Machine) SVM, Expressions.*

I. INTRODUCTION

Facial expressions is an important feature in communication. With the help of facial features, emotions emoted by them can be considered for identification of emotions. For many automated systems, facial recognition and emotion recognition should be automated to make it more efficient. Recognition of facial expressions is an interesting problem which finds its interest in several areas such as eLearning and affective computing.

This is processed in the 2D convolution of shaping the face into 2 dimensions that has two parts (upper part and the lower part). The upper part of the face identifies the eyes and the nose and the lower part shows to identify the mouth part. When compared to the upper part the lower part consumes more to identify the emotion. Some of the data sets are introduced for the comparison of the images. Human emotions are identified from facial expressions by the process of facial emotion recognition.

Similar to the act of human brain recognizing the emotions and expressions automatically, a software is also developed to serve the same purpose. This technology is much needed in the current scenario. As time passes this technology will be more accurate in reading the emotions like human brains. Artificial Intelligence detects human emotions by applying the knowledge of new information presented to thealgorithm. This paper considers the possible algorithms to detect emotion from facial expression and analysis the best among the available methods. Along with this, an implementation on one such algorithm is also carried out.

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II.   RELATED REVIEWS

Shenglan Liu, et al. [1]- This paper proposes (MSE) multi-view spectral embedding algorithm. To detect the Eigen face two methods of (MvLE) multi-view lapalacian eigen maps and (MHON) multi-hidden layer out of sample network was implemented. The implementation is carried out using the RGB-D video emotion and Face emotion dataset. The experiment result indicates the effectiveness of the two datasets by the introduced methods.

HiviIsmatDino , et al. [2] -This paper works based on picture processing. To identify the images, Viola-Jones algorithm is used here. Classifiers such as SVM, K-NN, and MLP are proposed for comparing the image from the extended Cohn-Kanade (CK+) dataset. The accuracy obtained by implementing the methodology was about 93.53%.

Deepak Kumar Jain, et al. [3] - Single Deep convolution neutral networks (DNNs) is the classification methodology used in this paper. This experiment is carried out by comparing the available data sets. By using the softmax classification the facial emotion is recognized. As the result gave better performance.

Nicole N. Capriola-Hall, et al. [4] - This paper proposes machine learning algorithm that compares youth with autism spectrum disorder (ASD) and youth of typically developing (TD) using VT-KFER dataset. The trail images are recognized by the machine based classification which results to the youth with ASD demonstrated poor FER accuracy of 75% and youth with TD group have 87.5% accuracy.

Jingying Chen, et al. [5] -This paper has two stages of frame works based on Difference Convolution Neural Network (DCNN). By using binary CNN fully expressed frames are separated. Then end -to-end is implemented to identify the emotion of the fully expressed frames. For the comparison CK+ and BU-4DEF are used. Result of the projected method achieves 96.28% ofaccuracy.

Bharat Richhariya, et al. [6] The paper proposes a Network process with an Iterative Universum Twin Support Vector Machine. This method   performs the multiclass classification and binary class classification. This method shows the result of presentation with less teaching charge in both binary as well as multiclass classifications.

Anurag Deahis, et al. [7] This paper finds the emotions in human face based on thevariability such as color, position, expression, direction, etc,. Faces are detected from the images using the Hue-Saturation-Value color model. As the result the recognition rate is of 78% on thismodel.

MdFazlay Rabbi, et al. [8] In this paper SMARTLET dynamic design is being implemented. To detect face in android APIs and Haarclassifiers are being employed. As the result proposed architecture provides 97%accuracy in face recognition.

J.A. Domínguez-Jiménez, et al. [9] This paper has developed a method to identify emotions using various wearable sensors. Two bio signals and a SVM classification is to identify the emotions. This paper targets only 3 emotions (pleasure, sadness, and neutral). The galvanic skin response features are used. As the result of emotion recognition is obtained with the accuracy up to 97%.

III.   REVIEW METHODS AND PROCESS

SUPPORT VECTOR MACHINE (SVM)

The aim is classifying the data points by finding a hyper plane in N-Dimensional space. Many possible hyper planes

are chosen for separating the two different classes of data points. A plane which has the margin between the data points of the two different classes is found. The benefit of maximizing the margin provides reinforcement for the better classification of data in future.

DEEP CONVOLUTION NEUTRAL NETWORKS (DNNS)

These algorithms are used in performing powerful image processing. Generative and descriptive tasks are performed in deep learning for image and video recognition along with natural language processing. Traditional neural neural networks requires image of less resolution, so they are not ideal for image processing. Neurons are arranged in such a way that the problems in traditional neural network are avoided.

DIFFERENCE CONVOLUTION NEURAL NETWORK

The difference convolution neural network has a three layers such as hidden layer, input layer and output layer. A convolutional neural network (CNN) is similar to simulated neural network. This uses perceptron's that are machine learning unit algorithm. This is used for supervised learning, to analyze data. Convolutional Neural Network is specially designed for reading pixel values from Images.

HSV (Hue-Saturation-Value)

HSV is illustration of color, hue determines the color you wish, saturation determines however intense the color is and value determines the lightness of the image. This is mainly used in color images

VIOLA-JONES

The Viola-Jones algorithm is used in the process of object detection. The training is done very slowly whereas the identification or detection is done very quickly. Haar basis feature filters are employed in this method. The efficiency of this algorithm is significantly improved by generating the integral image.

SURVEY ON PAPERS

Table 1

PAPER	USED ALGORITHMS	USED DATASETS	RESULT
[1]	(MSE) Multi-View Spectral Embedding Algorithm	RGB-D Face Emotion Dataset	87%
[2]	SUPPORTVECTORMACHINE (SVM)	Cohn-Kanade (CK$^+$) Dataset	98.53%

[3]	Deep Convolution Neutral Networks (Dnns).	Japanese Female Facial Expression (Jaffe)	89%
[4]	Machine Learning Algorithm (ANY)	VT-KFER Dataset	75%
[5]	Difference Convolution Neural Network (Dcnn)	CK^+ And BU-4DEF	96.28%
[6]	Iterative Universum Twin Support Vector Machine (IUTWSVM)	Benchmark Real World DATASET	93%
[7]	Hsv (Hue-Saturation-Value)	Eigen Faces DATASET	78%

IV. IMPLEMENTATION & RESULT

Principal Component Analysis is implemented for the recognition of emotions from images. The algorithm considers the principal features in the image and considers it as important components.

The principal part in face is the lower part of the face. Using the image segmentation technique, the lower part is separated and processed to obtain the emotion. The Figure 1 shows the loading of all the images, which in other words can be said as training the algorithm.

Figure 2 shows the testing part of the algorithm. Initially the images that are provided in the desired folder is being trained to the algorithm. Then a part of trained images are again considered to test it. During this part the test images are compared with the already trained images.
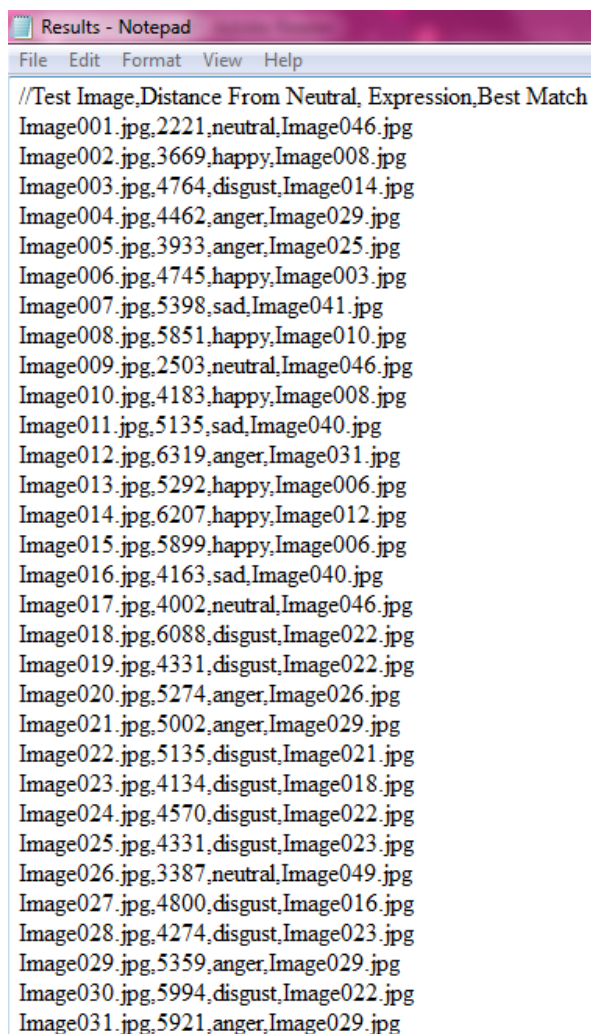
```
This Program is written by A.NAGATEJESWARA REDDY (VANA888060@gmail.com)
Copyleft 2009
Enter Train Folder Name:Train
Enter Label File Name:LabelFile.txt
Enter Test Folder Name:Test
Warning: PACK can only be used from the MATLAB command line.
> In EigenFace at 71
Loading Train Image # 1
Loading Train Image # 2
Loading Train Image # 3
Loading Train Image # 4
Loading Train Image # 5
Loading Train Image # 6
Loading Train Image # 7
Loading Train Image # 8
Loading Train Image # 9
Loading Train Image # 10
Loading Train Image # 11
```

```
Command Window
Loading Test Image # 17
Loading Test Image # 18
Loading Test Image # 19
Loading Test Image # 20
Loading Test Image # 21
Loading Test Image # 22
Loading Test Image # 23
Loading Test Image # 24
Loading Test Image # 25
Loading Test Image # 26
Loading Test Image # 27
Loading Test Image # 28
Loading Test Image # 29
Loading Test Image # 30
Loading Test Image # 31
Done
Output File = .\Results.txt
Press Enter to Quit ...

ans =
```

Figure 1

Figure 2

Figure 3

V. CONCLUSION

Facial expression recognition is the powerful part in human life in communication. As this works on machine learning comparison on different algorithms and their methods are done in this paper. Many algorithms like SVM, HSV, DCNN, and MSE are considered. This paper compares different algorithms with sufficient data sets that show all possible ways to recognize the expression of human face in efficient way. The algorithm that provides utmost efficiency of 89% is Support Vector Machine. As per the study, the implementation is carried out to categorize the emotions using PCA.

VI. REFERENCES

1. Shenglan Liu, ShuaiGuo, Hong Qiao, Yang Wang, Bin Wang, Wenbo Luo, Mingming Zhang, Keye Zhang, Bixuan Du. Multi-view Laplacian Eigenmaps Based on Bag-of-Neighbors For RGB-D Human Emotion Recognition Article in Information Sciences 509 · September 2019.

2. HiviIsmat Dino, Iraq MaiwanBahjatAbdulrazzaq. Facial Expression Classification Based on SVM, KNN and MLP Classifiers. Computer Science Published in International Conference on… 2018.

3. Deepak Kumar Jain. Extended Deep Neural Network for Facial Emotion Recognition. Article in Pattern Recognition Letters 120 · April 2019.

4. Capriola-Hall, Youssef A, Abbott AL. Differences in Facial Emotion Expression in Autism: Evidence for the Utility of Machine Classification. Article in Behavior Therapy · December 2019.

5. Jingying Chen, YongqiangLv, author Can Xu .Automatic social signal analysis: Facial expression recognition using difference convolution neural network.Computer Science Published in J. Parallel Distrib. Comput. 2019.

6. Bharat Richhariya, DeepakGupta, Facial expression recognition using iterative universum twin support vector machine. Applied Soft Computing .2019.

7. Anurag Deahis, NITAgartala, AshimSaha, NITAgartala, A Human Facial Expression Recognition Model Based on Eigen Face Approach.Computer science 2015.

8. MdFazlay Rabbi MasumBillah, Muhammad Abdullah Adnan, SMARTLET: A Dynamic Architecture for Real Time Face Recognition in Smartphone Using Cloudlets and CloudArticle · July 2020.

9. J.A.Domínguez-Jiménez, K.C.Campo-Landines, J.C.Martínez-Santos, E.J.Delahoz, S.H.Contreras-Ortiz, A machine learning model for emotion recognition from physiological. 2019.

10. Michael E. Mavroforakis, SergiosTheodoridis, Support Vector Machine (SVM) classification through geometry.Signal Processing Conference (EUSIPCO), European. 2015.

11. Tara N. Sainath, IBM T. J. Watson Research Center, Deep convolutional neural networks for LVCSR. IEEE International Conference on Acoustics, Speech and Signal Processing. 2013.

12. Rikiya Yamashita, Mizuho Nishio, Kaori Togashi. Convolutional neural networks: an overview and application in radiology.

13. Shweta Taneja,DharnaGureja,CharuGupta An Enhanced K-Nearest Neighbor Algorithm Using Information Gain and Clustering. 2014.

14. P Ganesan, V. Rajini, B.S. Sathish, KhamarBashaShaik, India.HSVcolor space based segmentation of region of interest in satellite images.International 2014.

15. Qian Li, Usman Niaz, Bernard Merialdo An improved algorithm on Viola-Jones object detector.10th International Workshop on Content-Based Multimedia Indexing (CBMI).2012.

16. Wen-yao LU, Ming YANG. Face Detection Based on Viola-Jones Algorithm Applying Composite Features. International Conference on Robots & Intelligent System (ICRIS).2019.

17. B. G. D. A. Madhusanka, T. M. W. Vithanawasam. Face and Upper-Body Emotion Recognition Using Service Robot's Eyes in a Domestic Environment, 2019.

18. Ibrahim A. Adeyanju, Elijah O. Omidiora. Performance evaluation of different support vector machine kernels for face emotion recognition. SAI Intelligent Systems Conference. 2015.

19. P. Swarnalatha, Hari Prasad Mal, Facial expression detection using facial expression model. 2017.

20. SukanyaSagarikaMeher, Pallavi Maben. Face recognition and facial expression identification using PCA.IEEE International Advance Computing Conference 2014.