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Recognition of Emotion Using Frontal Face Image

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***Abstract*: In modern days, emotion detection is dynamic field of research. In this proposed system, emotion recognition is done using three stages preprocessing of images, feature extraction from images and classification of image using a classifier. Wavelet and radon transform is used as a methodology for the decomposition of image resolution and extracting the essential features by applying Radon Transform. The classification of these basic i.e. happy, sad, anger fear, and disgust features are carried by SVM. The system is applied on various databases as YALE face, AR face and FERET face database. The experiment conducted gives good classification result based on the following method.**

***Keywords*: Biometrics, Emotion, Preprocessing, SVM.**

1. Introduction

Emotion detection is an attractive field in Human Computer Interaction. Today, people are looking forward for research in emotion recognition or detection using different ways. Emotion recognition can be done by two ways i.e. Verbal and Non-Verbal. Communication is the way of expressing feeling in two ways verbal and nonverbal form. Thus, detection of emotion from human face is to specify the present state of mind using facial expression and intentions [1]. Human being is full of emotion and emotion uses facial expression for recognizing mental state of human being [2]. In this paper, we will use the simulator as wavelet and radon transformation for getting better result for recognition of emotion from facial expression.

2. Related work

Different method for emotion recognition has been adopted. Different methods give different result after recognising emotion. Dilbagh Singh [3] used neural network for recognition of human emotion and attained 97% accuracy. Arindham Ray et al. [4] has introduced a system in which they have used SVM (support vector machine) for detection of facial expression and neural network based on fuzzy logic as an estimator. Akhil Upadhyay et. al. [5] Principle component ananlysis is used for the recognition of human emotion apart from PCA, data representation technique is also used. Monika Dubey et al. [6] have proposed a system of emotion recognition in which they have used e-learning method for emotion recognition using Adaboost process and SVM (Support Vector Machine) as a classifier. Paweł Tarnowski et. al. [7] designed a system in which features has been recognised using 3D face modelling technique whereas they have used two ways for easy and difficult classification i.e. k-NN classifier and MLP Neural network respectively. According to Jian Yang et al. [8] 2D – PCA (Principle Component Analysis) is compared with PCA technique with different databases and the result obtained by 2DPCA is more accurate than PCA. D. Yang et al. [17] proposed a system in which Haar Cascade method and sobel Edge detection is used for detecting features from images. Thereafter, applied Neural network classifier for classification rate. Zhongkai tong et. al. [18] In this proposed system the PPG(photoplethysmogram) signal is used for feature extraction process from the Deap database, this PPG signals are combined with EEG (electroencephalogram) channel for better feature extraction. These features extracted, are then classified with the help of machine learning algorithms i.e Logistic regression algorithm+ Adaboost algorithm. Faiyaz Mohammad Saif et al. [19] in this paper, facial features such as eye detection, lip detection is detected using Bezier curve detection technique whereas Artificial Neural Network, Naive Bayes and SVM is used for classification of emotion from features extracted from face image. Rupinder Saini and Narinder Rana made a system in which they have adopted universally accepted five different facial emotion for recognition i.e. happy, sad, angry, disgust and surprise. In this paper for facial feature extraction they have used PCA (principle component analysis) or Eigen space projection for linearly projection for feature extraction from image. PCA is combined with SURF methodology for matching the features from the image and obtained good rate of classification by using SVM.

3. Proposed algorithm

The proposed system is made up of preprocessing of image, feature extraction from that image and classification of emotion from preprocessed image. These features obtained from the images are then classified as specific emotion such as happy,

sad, anger, disgust and fear.

The system comprises of two phases training and testing phase. The training phase consist of preprocessing image, then features will be extracted using wavelet decomposition method using radon transformation, further this image passes through classifier for classification using SVM. In this way training phase gets completed. After completion of training phase, testing phase is started in which the compressed image dimension is passed to the classifier for classification of result as recognition of emotion such as happy, sad, anger, fear and disgust.

A. Preprocessing of image

Preprocessing of image is the process in which only the essential part of the image is extracted and rest of features such hair, clothes, background etc. are removed from that image. In this way the essential information of the picture is collected and stored in the database.

For the removal of noise and unessential feature of the image we have to select three points from the image i.e. both the corners of the eyes and the point from the centre of the chin. After selecting it manually connect it to each other to form a triangle with the centroid as 'o' and the distance obtained from the centre to any of the three point is 'd' .Now , taking 'o' as centre and double the distance of the side suppose '2d', a square can be drawn .An image obtained as shown in fig. 1 is the cropped face image which is now ready for passing into the phase of training.

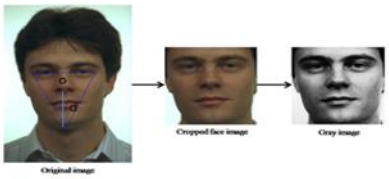

Fig. 1. Preprocessing of image taken from database (Image source [11])

B. Feature Extraction Technique using Wavelet and Radon Transform

The workflow diagram fig. 2 shows the processing of emotion recognition system. First phase is image preprocessing in which images are taken for preprocessing i.e. essential feature is extracted from image with the help of bound box method, triangle method. After reduction on these images, Wavelet and Radon transformation technique is applied for recognition of feature from the specific image. After feature extraction, SVM is applied as classifier for emotion recognition as happy, sad, anger, fear and surprise.

1) Wavelet and Radon Transform

The concept of "wavelets" and "ondelettes" started in early 1980's. This new concept was the combination of different discipline such as Mathematics, Physics and Engineering. Wavelet theory has provided a new method for decomposing of function and signal. Burt and Adelson gave the introduction of multiresolution signal analysis for multi scale image decomposition [13]. In this proposed system fig. 3, "bi-level wavelet decomposition" is applied to the cropped face image, which is transformed in the form of approximate face image. Then in this approximate face image, radon transform is applied. The approximation coefficient obtained are further decomposed and the approximation coefficient obtained after second decomposition is used for feature extraction method. In this way DWT is used for bi-level decomposition of cropped face image. More than two level of decomposition of image will cause loss of information hence only bi level decomposition is used.

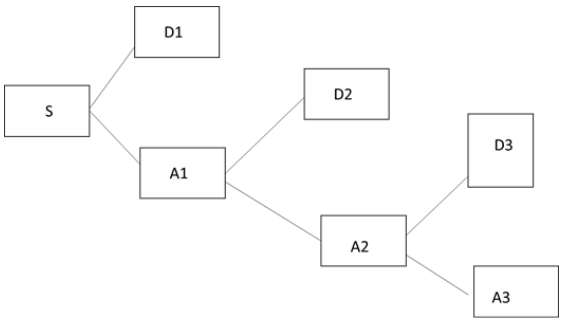

Fig. 2. Decomposition of image using wavelet transform upto three level

Where S is the sample image A1, A2, A3, D1, D2, D3 are the decomposed images using wavelet decomposition. By applying Radon transform, the projection of the image for giving some specific set of angles can be computed. As radon transform carries translational and rotational properties. Therefore, the variation can be seen in pixel intensities.

C. SVM

SVM classifier is a supervised learning machine algorithm. The basic idea of using SVM is to get optimal hyper plan of linearly separable data. The good choice of using SVM as a classifier is, it gives minimum classification errors. It has direct relevance for face detection in gray level images. It handles the face images over wide range and also work in different lightning conditions [15]. SVM works on the principle of structural risk minimization. Training an SVM is equal to solving a problem based on linearly constrained quadratic programming.

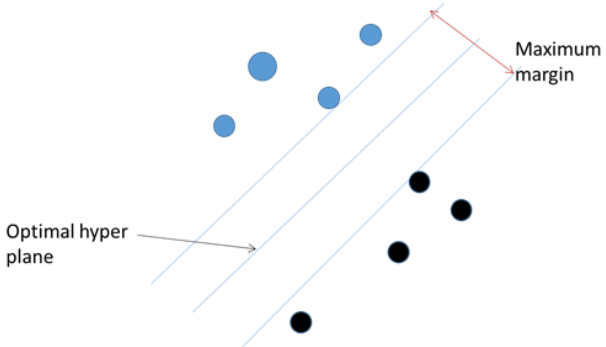

Fig. 3. Separation of two classes in linear constrained using optimal hyper plan (image reference [16])

4. Experiment result

MATLAB is used as a tool in this experiment for computation. The experiment is performed on the Yale face database, AR face database, and FERET face database. The collection of images for FERET face database was done by Phillips and Wechsler whereas for AR face database collection of the images was done by Aleix Martinez and Robert Benavente.

Fig. 4. Database of FERET face

5. Conclusion

In this paper we have proposed a system in which Wavelet and Radon transformation technique has been developed for better recognitions of emotions from facial expressions. The emotion recognition using wavelet and radon transform is much researched topic. The output obtained after the experiment on different databases is much as compared to other technique used for emotion recognition. The algorithm is experimented on different databases such as Yale face database and AR database. The classification rate obtained for Yale face database for some feature is 100%. For emotions like happy, sad, anger, disgust, and fear. The future scope of this research should be that the system can identify emotion using videos also or not only from still images by moving images too.

References

[1] Shivani Gangwar, Shashwat Shukla, Deepak Arora, "Human Emotion Recognition by Using Pattern Recognition Network", Int. Journal of Engineering Research and Application, Sep-Oct 2013.
[2] Shruti V. Kulkarni, Prof. Savita S. Raut, "Emotion Recognitionby using Biomodal Fusion", International Journal on Recent and Innovation Trends in Computing and Communication, IJRITCC, March 2014.
[3] Dilbagh Singh, "Human Emotion Recognition System", I.J. Image, Graphics and Signal Processing, 2012, 8, 50-56 Published Online August 2012 in MECS.
[4] Arindam Ray and Amlan Chakrabarti, "Design and Implementation of Affective E-Learning Strategy Based on Facial Emotion Recognition", S.C. Satapathy et al. (Eds.): Proceedings of the InConINDIA 2012, AISC 132, pp. 613–622. (springerlink.com)
[5] Akhil Upadhyay and Amit Kumar Dewangan, "Performance Evaluation and Implementation of Facial Expression and Emotion Recognition System using Principal Component Analysis", International Research Journal of Engineering and Technology (IRJET) June 2016.
[6] Monika Dubey and Lokesh Singh, "Automatic Emotion Recognition Using Facial Expression: A Review". International Research Journal of Engineering and Technology (IRJET), Feb. 2016.
[7] Paweł Tarnowski, Marcin Kołodziej, Andrzej Majkowski, Remigiusz J. Rak, "Emotion recognition using facial expressions", International Conference on Computational Science, 12-14 June 2017.
[8] Jian Yang, David Zhang, Alejandro F. Frangi, and Jing-yu, "Two-Dimensional PCA: A New Approach to Appearance-Based Face Representation and Recognition."
[9] Yi Huang, Yun Tie, "Human Emotion Recognition using the Adaptive Sub-Layer-Compensation Based Facial Edge Detection," 2013 IEEE.
[10] Mine Altınay GÜNLER Hakan TORA "Emotion Classification Using Hidden Layer Outputs", IEEE, 2012.
[11] Kamaljeet Singh Kalsi and Preeti Rai , "A Classification of Emotion and Gender Using Local Biorthogonal Binary Pattern from Detailed Wavelet Coefficient Face Image".
[12] Choon-Boon Ng, Yong Haur Tay, Bok-Min Goi, "A review of facial gender recognition," Springer-Verlag London, vol 18, no.4, pp. 739-755, November 2015.
[13] Lokenath Debnath, "Wavelet Transform and their applications", PINSA-A, 64, No. 6, November 1998, pp. 685-713.
[14] G. Beylkin, "Discrete Radon Transform", IEEE Transaction Acoustics, Speech and Signal Process, vol. ASSP-35, no. 2, 1987, pp. 162-171.
[15] Edgar Osuna, Robert Fruend, F. Edrico Girosi, "Training Support Vector Machines: An Application to Face Detection", IEEE Computer Society Conference on computer vision and pattern recognition, CVPR'97, Jun 1997.
[16] Yongli Zhang "Support Vector Machine Classification Algorithm and Its Application."
[17] D. Yang, Abeer Alsadoon, P.W.C. Prasad, A. K. Singh, A. Elchouemi "An Emotion Recognition Model Based on Facial Recognition in Virtual Learning Environment," 6th International Conference on Smart Computing and Communications, ICSCC 2017, 7-8 December 2017, Kurukshetra, India.
[18] Zhongkai Tong, Xing Xiang Chen, Zengling He, Kai Tong, Zen Fang, Xianglong Wang, "Emotion recognition based on photo plethysmogram and electro encephalogram" 2018, 42nd IEEE International Conference on Computer Software & Applications.
[19] Faiyaz Mohammad Saif, Jabin Rubayat, Fahmida Sharmin Pranto, Md. Hosne Al Walid and Kazi Mohammed Shahanur Ahammed, "Facial Expressions Recognition Using Bezier Curve and Performance Analysis Using Ann, Naïve-Bayes and SVM Classifiers" 14th Global Engineering and Technology Conference 29-30 December 2017, BIAM Foundation, 63 Eskaton, Dhaka, Bangladesh.
[20] Rupinder Saini, Narinder Rana, "A Hybrid Framework of Facial Expression Recognition using SVD & PCA," International Journal of Computer Science and Information Technologies, Vol. 5 (5) , 2014, 6676-6679.