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Emotive Facial Expression Recognition using CS-LBP and SVM

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Abstract—*In Recent years, facial expression has become very important for computers to understand the emotional state of humans. Developing new methods to improve recognition performance is a major concern of research. In this paper, a facial expression classification algorithm is proposed which uses Center-Symmetric Local Binary Patterns (CS-LBP) for feature extraction and classifies various facial expressions using support vector machine (SVM). This has proved to be a low computational approach and finally a comparison between CS-LBP-SVM & LBP has been shown. The proposed system uses grayscale frontal face images of a Japanese female to classify basic six emotions.*

1. INTRODUCTION

Nowadays, Biometric methods have been considered as the most powerful tool for individual identification. A large variety of disciplines may benefit from the phenomenon, e.g. security, psychologist, etc. Passwords can be stolen and guessed but biological features cannot be misplaced or faked [1]. To authenticate a person's identity, biometric systems such as retina, iris, and fingerprints are used [2].

Among, all identification techniques face recognition system is most important method for the authentication and identification of a person.

Strict specification of the number of facial expression that is used in daily life is not possible due to different surrounding & cultural background. So, the focus is on the six basic emotional expressions (fear, anger, disgust, happiness, surprise and sadness). For such facial activity, the conclusions about their universality have already been made. However, the emotional facial expressions used around the world are much more and some may be the combination of one or two or more.

Face recognition system is the most cost-effective method in comparison to the authentication and identification.

However eyeglasses, micro-expressions, hair style, aging, beards are some common distractions becoming the pitfall for face recognition. The facial recognition process can be divided into three major steps. These are face detection/representation, feature extraction and classification. In face detection, an image is taken as input and the face region is detected. So, here face localization is followed by face alignment. In order to normalize the face region, the facial features such as eyes, nose, mouth etc. are located.

After the face is detected from the video frame or an image, the most unique and informative properties are extracted. This step is called feature extraction. It plays very important role because redundant information affects the performance of classification technique.

Feature vectors are formed from input image using relevant feature rectors. Local binary pattern is local feature extraction method. A local feature extraction method uses neighborhood, region, facial point or patches to derive the required features from the image.

Matching of extracted features of the face images with test image features is called pattern recognition. A test image is matched against each extracted feature vector representing the database images. This is return, gives a distance featuring the similarity between the test image and the database image. Label is designed to the image, most similar to the template of the trained data. Using these features, image is compared to database images, which is done in classification step. The classification unit provides the best match of image with database images.

2. LOCAL BINARY PATTERNS

Operator labels pixels of an image by thresholding the 3*3 neighborhood of each pixel with center value and assigning the result as a binary number. The original LBP system was introduced by Ojala et al.[3].

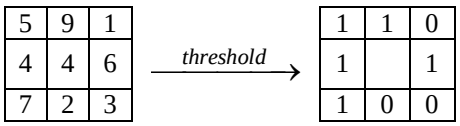
LBP operator is defined as:

$$h\rho,\ R\left(x_c,\ y_c\right) = \sum_{m=0}^{\rho-1} L\left(\left(g_m - g_c\right) \geq 0\right) 2^m, \text{ where,}$$

L(x) is a logical function with, *L(x)* = 1, if *x* is true and *L(x)* = 0 otherwise. Facial image is divided in many blocks.

For each block, LBP operator with specific sampling points and radius is applied. The histograms of all blocks are concatenated in one feature[4].

Then the histogram of the labels can be used as a texture descriptor



Binary : 11010011

Figure 1: LBP operator.

The limitation with LBP is that the size of histograms increases exponentially with the spatial support of the pattern and the number of quantization levels.

3. SUPPORT VECTOR MACHINE

SVMS are supervised learning models with learning algorithms that synthesize data used for classification and regression[5]. Experimental results show that sums achieve higher research accuracy than traditional schemes after four to five rounds of relevance feedback[6].

4. PROPOSED DESIGN METHOD

The proposed algorithm mainly consists of the following steps: feature extraction using CS-LBP, SVM for dimension reduction and facial expression classification.

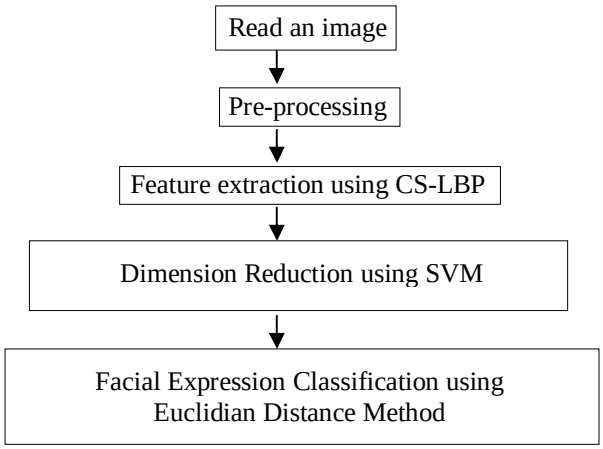


Figure 2: Proposed system for expression recognition

4.1.1 Center-Symmetric Local Binary Patterns (CS-LBP):

CS-LBP aims for small quantity of LBP labels to produce shorter histograms that are suited to be used in region descriptors. It gives better stability in flat image regions[7]. Robustness in flat image region is obtained by thresholding gray level difference.

$$CS-LBP_{R,N,T}(x,y)=\sum_{i=0}^{\frac{N}{2}-1} S\left(g_i-g_{i+\frac{N}{2}}\right)2^r$$

where g_i & $g_{i+(n/2)}$ are gray values of center-symmetric pairs of pixels of N equally spaced pixels[8].

In CS-LBP, pixel values are not compared to the center pixel but to the opposing pixel symmetrically with respect to center pixel [9].

4.1.2 CS-LBP Feature Extraction

There are total 3 parameters of CS-LBP operator that is total number of neighborhood pixels P, radius R, and threshold on the gray level difference H [10]. Experiments results that good values of above parameters are (1, 2) for R, (0, ..., 0.02) for H and (6, 8)for P[11].

4.2. Proposed Algorithm

The work done in this paper is two-fold. The steps are explained below:

(1) Training phase

(a) Read an image

(b) Resize and noise removal

(c) Extraction of sub regions

(d) CS-LBP is applied to extract the local binary features of the image.

(e) Linear SVM is applied for reducing the dimension.

(f) Repeating above steps for all images in database

(2) Testing phase

(a) Read an image

(b) Resize & noise removal

(c) Extract the sub regions from input image

(d) Using CS-LBP features are extracted

(e) SVM is applied for dimension reduction

(f) The distance between each training and test vector is obtained

(g) Finally, best match of testing image with training image is calculated

5. RESULTS & DISCUSSION

The performance is evaluated on Japanese Female Facial Expression (JAFFE) database[12]. The results are compared in terms of recognition rate and time taken for processing. CS-LBP & SVM are used for reducing the dimensions and expressions are classified using distance metric.

The JAFFE database contains 213 gray scale images of 7 facial expressions and has neutral poses by ten models. Every image has four frontal image for every expression.

Each image has been rated on six emotions adjectives by 60 Japanese subjects. The images of ten subjects in database are classified in six different expression class and the results is evaluated using the method proposed.

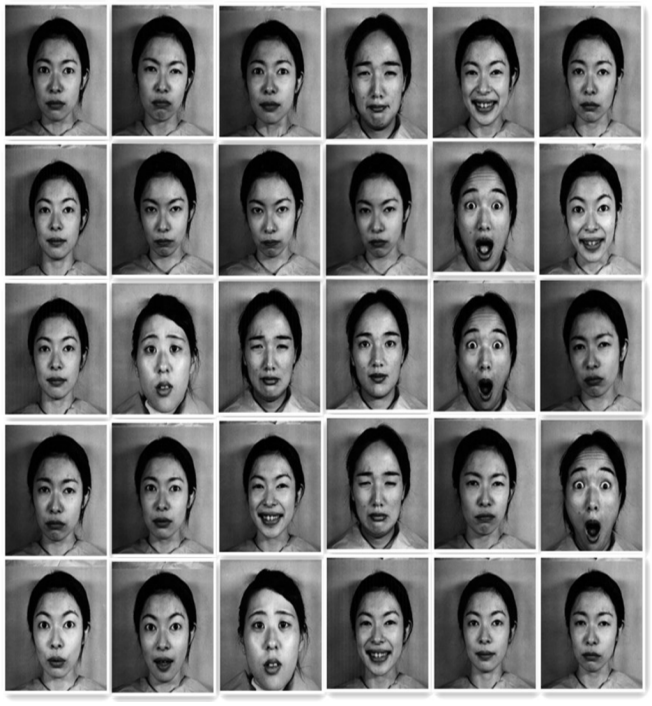


Figure 3: Sample images of JAFFE database.

Comparison of the proposed method with conventional existing local binary patterns is shown below in table 1.

Table 1: Recognition rate (%) comparison of proposed approach with existing method.

Facial Expression	Recognition Rate using LBP[13]	Recognition Rate using Method Proposed
Happy	95	97
Anger	100	71
Sad	90	92
Surprise	95	96
Fear	80	87
Disgust	75	77

6. CONCLUSION

In this paper, efficient & effective approach is developed for facial expression recognition. Combination of two algorithms is implemented and method proposed is effective in recognizing the different expressions as compared conventional methods. In future, research will be extended to 3-D face modelling.

REFERENCES

[1] M. Hassaballah and Saleh Aly, "Face Recognition: Challenges, Achievements and Future Directions", IET Journals of Computer Vision, Vol. 9, No. 4, pp. 614-626, 2015.

[2] A. S. Tolba, A. H. El-Baz, and A. A. El-Harby, " Face Recognition: A Literature Review", International Journal of Computer , Electrical, Automation, Control and Information Engineering, Vol. 2, No. 7, pp. 2556-2571, 2008.

[3] T. Ojala, M. Pietikäinen and T. Mäenpää, "Multiresolution Gray-scale and Rotation Invariant Texture Classification with Local Binary Patterns", IEEE Transactions on Pattern Analysis and Machine Intelligence ,Vol. 24, No. 7, pp.971–987, 2002.

[4] K. Meena , A. Suruliandi, and R. Reena Rose ," Face Recognition Based on Local Derivative Ternary Pattern", IETE Journal of Research, Vol. 60, No. 1, pp. 20-32, Feb. 2014.

[5] Shashi Kant Sharma, Maitreyee Dutta and Kota Solomon Raju, "Comparative Study of Efficient Face Recognition Methods: A Literature Survey", in Proceedings of International Conference on Communication, Computing and Networking (ICCCN), Vol. 2, ISBN:978-8-193-38970-6, pp. 554-559, 2017.

[6] Shashi Kant Sharma, Maitreyee Dutta and Kota Solomon Raju, "Comparative Study of Efficient Face Recognition Methods: A Literature Survey", in Proceedings of International Conference on Communication, Computing and Networking (ICCCN), Vol. 2, ISBN:978-8-193-38970-6, pp. 554-559, 2017

[7] Solomon Raju Kota, J.L.Raheja, Archana Rathi, Shashi Kant Sharma, "Principal Component Analysis for Gesture Recognition using SystemC", International Conference on Advances in Recent Technologies in Communication and Computing© 2009 IEEE DOI 10.1109/ARTCom.2009.177, pp.732-737.

[8] A. Tofighi, N. Khairdoost, S. A. Monadjemi and K. Jamshidi, "A Robust Face Recognition System in Image and Video", I. J. Image, Graphics and Signal Processing, Vol. 8, pp. 1-11, 2014.

[9] Mahesh Kumar Sharma, Shashikant Sharma, NopbhornLeeprechanon, and AashishRanjan, "Wavelet decomposition based principal component analysis for face recognition using MATLAB", Advancement in Science and Technology AIP Conf. Proc. 1715, 020055-1–020055-10; doi: 10.1063/1.4942737, pp. 1-10.

[10] Shashi Kant Sharma, Kota Solomon Raju, "Application of Gaussian Filter with Principal Component Analysis Algorithm for the Efficient Face Recognition", International Journal of Electronics and Communication Engineering & Technology (IJECET), ISSN 0976 – 6464(Print), ISSN 0976 – 6472(Online), Volume 4, Issue 7 (2013) © IAEME, pp.244-251.

[11] Wiskott, L., Fellous, J. M., Kuiger, N. and Von Der Malsburg, C., "Face recognition by Elastic Bunch Graph Matching," Pattern Analysis and Machine Intelligence, IEEE Transaction on, 19(7), pp. 775-779, 1997.

[12] Shashi Kant Sharma, Maitreyee Dutta and Kota Solomon Raju, “Comparative Analysis of Face Recognition using Extended LBP and PCA”, International Journal of Engineering Science & Technology Vol. 8, Issue 10, ISSN: 0975-5462pp.935-942, 2017.
[13] Manish Shankar Kaushik and Aditya Bihar Kandali, “ Recognition of Facial Expression extracting Salient Features using Local Binary Pattens and Histogram of Oriented Gradients”, in IEEE International conference on Energy,
[14] Communication, Data Analytic and Soft Computing (ICECDS), pp. 1201-1205, 2017.