

An Effectual Approach for Facial Expression Recognition Using Adaptive Neuro Fuzzy Classifier

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Abstract: Human facial Expression recognition by computer with high recognition rate is still a challenging and interesting task. A lot of emotional information is conveyed by facial expression alone rather than voice tone and spoken words. Facial expression recognition system plays an important role in many areas such as human-computer intelligent interaction system. In this paper, an Automatic Facial Expressions Recognition System is proposed that would recognize five principal expressions, which are Happy, Sad, Neutral, Angry and Disgusted. The proposed system uses an efficient approach for the recognition of those expressions on the basis of some extracted features. For the detection of the frontal face proposed method uses well known Viola Jones face detection technique. Once face detection is performed, feature of interested region that is eyes and mouth are extracted. In feature extraction, local binary pattern (LBP) is proposed as a feature. After the extraction of the LBP feature for the classification or recognition, the proposed method includes adaptive Neuro Fuzzy Classifier (ANFIS) to efficiently cluster the obtained LBP features. The whole system will implemented on the dataset of 150 images of frontal facial expressions of Happy, Sad, Neutral, Angry and Disgusted from Karolinska Directed Emotional Faces (KDEF) Database by using MATLAB 2013(b) and expected to improve expression recognition efficiency.

Keywords: Facial Expression Recognition, Facial Expressions, Feature Extraction, LBP, ANFIS.

I. INTRODUCTION

In human beings feelings and emotions can be express in a direct and simplest way through facial expressions. Facial behavior is the source of information to determine person's frame of mind and emotions. Human communication contains verbal as well as non-verbal information. Verbal information such as voice tone and spoken words and non-verbal information such as facial expression and body gesture but a lot of emotional information is conveyed by facial expression alone rather than verbally. Facial expressions have been categorized in early 1970s by Ekman's studies. He has stated that humans have six senses where each sense represents a specific emotion such as anger, happy, sad, fear, surprise and disgust [2]. Facial expression recognition system used in many application areas such as Security, robotics, medical, mobile application, human computer communication, face identification, human behavior detection etc. Automatic Facial expression recognition system can easily solves the problem related to face detection and expression recognition and becomes an active area in the field of real life application. Usually facial expression recognition system consist three major components face detection, facial feature extraction and facial expression recognition and all the component performs sequentially to recognize expression.

This paper proposes a new, fast and efficient approach for facial expressions recognition that recognizes five principal expressions Happy, Sad, Neutral, Angry and Disgusted. This recognition system follows a step by step procedure that includes pre-processing, face detection, feature

extraction and expression recognition to recognize and classify the expressions. For the detection of the frontal face proposed method uses well known Viola Jones face detection technique. In feature extraction, local binary pattern (LBP) is proposed as a feature. After the extraction of the LBP feature for the classification or recognition, the proposed method includes adaptive Neuro Fuzzy Classifier (ANFIS) to efficiently cluster the obtained LBP features. The frontal face images are collected from the Karolinska Directed Emotional Faces (KDEF) Database.

II. METHODOLOGY

In this proposed work, an Automatic Facial Expressions Recognition System is proposed that would recognize five principal expressions that are Happy, Sad, Neutral, Angry and Disgusted. The proposed system uses an efficient approach for the recognition of those expressions on the basis of some extracted features. For expression recognition, system follows a step by step procedure that comprises face detection, feature extraction and expression recognition (Classification). For the detection of the frontal face proposed method uses well known face detection technique known as Viola Jones method. Once face detection is performed, feature of interested region that is eyes and mouth is extracted. In feature extraction, local binary pattern (LBP) is proposed as a feature. After the extraction of the LBP feature for the classification or recognition the proposed method includes adaptive neuro fuzzy classifier (ANFIS). The complete process of the proposed technique is shown in figure 1, with the help of flow chart representation.

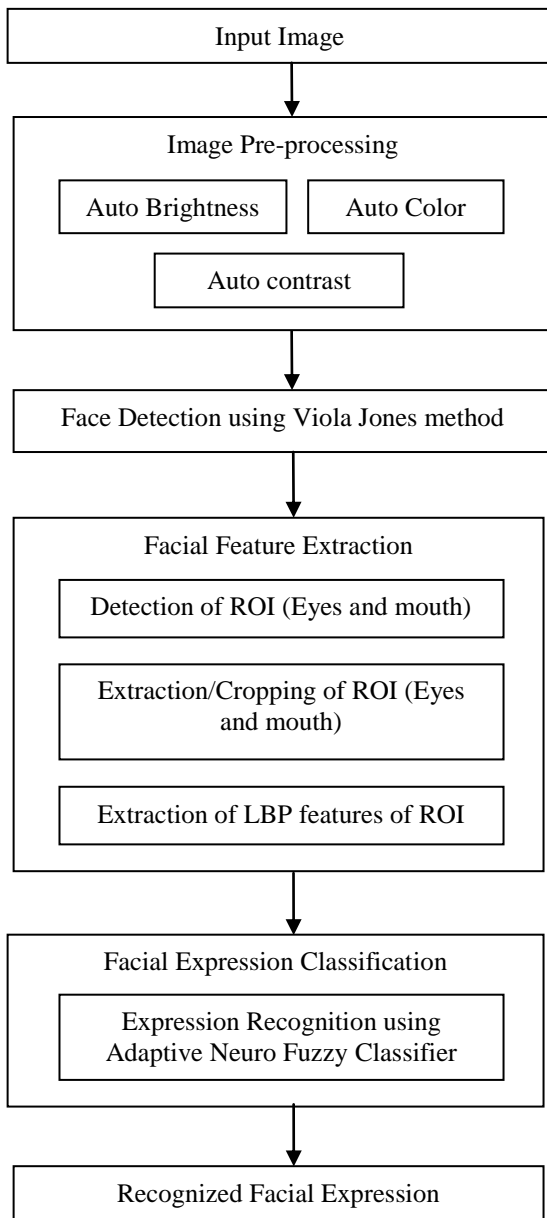


Fig. 1: Flow process of proposed Facial Expression Recognition System

A. PREPROCESSING

Pre-processing is the most important and necessary step of the image processing. It is performed to get uniform image for further processing. This step includes auto brightness function to adjust the brightness of the image, auto contrast function to automatically calculates the favorable contrast for the image that will increase the brightness of the image and auto color function to adjust the color of the image.

B. FACE DETECTION USING VIOLA-JONES METHOD

The basic principle of the Viola-Jones algorithm is to scan a sub-window capable of detecting faces across a given input image. The standard image processing approach would be to rescale the input image to different sizes and then run the fixed size detector

through these images. This approach turns out to be rather time consuming due to the calculation of the different size images. Contrary to the standard approach Viola-Jones rescale the detector instead of the input image and run the detector many times through the image each time with a different size. At first one might suspect both approaches to be equally time consuming, but Viola-Jones have devised a scale invariant detector that requires the same number of calculations whatever the size. This detector is constructed using a so-called integral image and some simple rectangular features reminiscent of Haar wavelets.

C. LOCAL BINARY PATTERN BASED (LBP) FEATURE EXTRACTION

LBP is a type of feature used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990. LBP was first described in 1994. It has since been found to be a powerful feature for texture classification.

The LBP feature vector, in its simplest form, is created in the following manner:

- Divide the examined window into cells (e.g. 4x4 pixels for each cell).
- For each pixel in a cell, compare the pixel to each of its 2 neighbors (on its left-top, left-middle, left-bottom, right-top, etc.). Follow the pixels along a circle, i.e. clockwise or counter-clockwise.
- Where the center pixel's value is less than the neighbor's value, write "0". Otherwise, write "1". This gives an 8-digit binary number (which is usually converted to decimal for convenience).
- Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center).
- Optionally normalize the histogram.
- Concatenate (normalized) histograms of all cells. This gives the feature vector for the window.

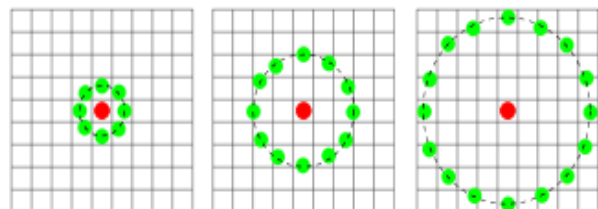


Fig. 2 Circularly symmetric neighbour sets.

In Fig. 2 three neighborhood examples used to define a texture and calculate a local binary pattern (LBP).

D. FACIAL EXPRESSION CLASSIFICATION USING ADAPTIVE NEURO FUZZY CLASSIFIER (ANFIS)

Facial Expression Classification is the final step of facial expression recognition system. For expression classification ANFIS approach is proposed. ANFIS is one of the Neuro-fuzzy models. It has the benefits of both

neural networks and fuzzy logic. A hybrid system named ANFIS has been proposed by Jang. In this paper ANFIS has been proposed to efficiently to classify the LBP features obtained after feature extraction process. The basic idea of this modeling starts from analyzing the practical values of LBP features obtained for different facial expressions. Next the basic steps will take in the modeling process of adaptive neuro fuzzy classifier are:

Step 1: Collection of the LBP features for all the five facial expressions, and making of a complete LBP feature database. **Step 2 :** Training of Adaptive neuro fuzzy inference system for LBP features database and corresponding target.

Step 3 : Testing of developed ANFIS with training data set.

III.EXPECTED RESULT

In this paper, a novel Automatic Facial Expression Recognition System is proposed, which will efficiently recognizes five principal expressions. A complete database of 150 images will utilize during the development and testing of the proposed system. Images are taken from the Karolinska Directed Emotional Faces (KDEF) Database [6]. The complete system will be implemented using MATLAB 2013(b) version and expected to improve the performance of the expression recognition.

IV.CONCLUSION

In this paper, a novel fast and efficient approach for facial expression recognition is proposed which recognizes the five principal expressions happy, sad and neutral. This new approach will gives excellent and effective result. The system will be implemented on the KDEF database that has frontal facial expression color images. It is expected that after successful implementation this approach will provide excellent recognition rate and also effective for the frontal facial expression recognition.

REFERENCES

- [1] Pushpaja V. Saudagare and D.S. Chaudhari, "Facial Expression Recognition using Neural Network- An Overview", *International Journal of Soft Computing and Engineering (IJSCE)*, Vol. 2, Issue-1, pp. 224-227, March 2012.
- [2] R. Ameen, H. Oztoprak, K. Yurtkan, "Analysis of Local Binary Patterns in different color models for person independent facial expression recognition," 2014 IEEE 22nd Signal Processing and Communications Applications Conference (SIU), pp. 1694-1697, 23-25 April 2014.
- [3] M. Nilsson, J. Nordberg, and I. Claesson, I. "Face detection using local SMQT features and split up snow classifier," IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Vol. 2, pp. 589-592, April 2007.
- [4] Y. Sangeetha, P. MadhaviLatha, Ch. Narasimhan and R. Satya Prasad, "Face Detection using SMQT Techniques", *IJCSET*, Vol 2, Issue 1, pp. 780-783, January 2012.
- [5] P. Swarnalatha and Dr. B. K. Tripathy, "A study on Edge Detection techniques in Retinex Based Adaptive Filter," *International Journal of Engineering and Technology*, Vol. 2, No. 6, December 2010.
- [6] Lundqvist, D., Flykt, A., & Ohman, A., "The Karolinska Directed Emotional Faces – KDEF", CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institute, ISBN 91-630-7164-9, 1998.
- [7] P. Ekman, T. Huang, T. Sejnowski, J. Hager, "Final Report to NSF of the Planning Workshop on Facial Expression Understanding", 1992. "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.
- [8] EwaPiatkowska "Facial Expression Recognition System", Master's Thesis Technical Report.
- [9] Kai-biaoge, jing wen, bin fang, "Adaboost Algorithm based on MB-LBP features with skin Color segmentation for face detection" Proceedings of the 2011 International Conference on wavelet analysis and pattern recognition, guilin, 10-13 july, 2011.
- [10] KamarulHawari, Bin Ghazali, Jie Ma, Rui Xiao, "An Innovative Face Detection based on Skin Color Segmentation", *International Journal of Computer Applications (0975-8887)*, Volume 34-No.2, November 2011.
- [11] GJ. Edwards, T.F. Cootes, and CJ. Taylor, "Face recognition using active appearance models", Proceedings of the European Conference on Computer Vision, 1998.
- [12] Aliaa A. A. Youssif and Wesam A. A. Asker, "Automatic Facial Expression Recognition System Based on Geometric and Appearance Features", *Computer & Information Journal*, 2011, Volume 4, Issue 2, Page 115.
- [13] V. Gomathi, Dr. K. Ramar, and A. SanthiyakuJeevakumar, "A Neuro Fuzzy approach for Facial Expression Recognition using LBP Histograms", *International Journal of Computer Theory and Engineering*, Vol. 2, No. 2 April, 2010.