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Results: Recognition of Facial Expression by Digital Image Processing

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Abstract— *Facial expression is one of most important behavioral measure for studies of emotion, cognitive processes, and social interaction. Facial expression recognition has become a promising research area. Its applications in many areas like human-computer interfaces, human emotion analysis, and medical care and cure. Automatic facial expression recognition is an interesting and challenging subject in digital signal processing, pattern recognition, artificial intelligence, etc. In this paper use a new method of facial expression recognition based on local binary patterns (LBP). The LBP features are firstly extracted from the original images of facial expression then face area is divided into small parts from which Local Binary Pattern (LBP) histograms are extracted into a single, spatially enhanced feature histogram efficiently representing the face image.*

Keywords— local binary pattern (LBP), feature extraction, distribution, pattern recognition, histogram, feature vector.

I. INTRODUCTION

Facial expression is most powerful, and Immediate means for human beings to communicate their emotions and indention. Recognition of facial expression identifying the basic emotion like anger, fear, disgust, sadness, happiness and surprise. In communication these can vary in every individual indicated that 7% of message is conveyed by spoken words, 38% by paralanguage and remaining 55% of message is conveyed by facial expressions. Facial expression is one of the powerful, natural and current means for human beings to communicate their emotion. Facial expression recognition is an interesting and challenging problem, and important applications in many areas such as authentication for banking and security system access, and also personal identification. There are two approaches to extract facial features are found: Geometry-based methods and Appearance-based methods. Geometric based method feature extraction system, the shape and location of various face components are considered. The geometry-based methods are accurate and reliable facial feature detection. The geometric feature based method provides better performance than appearance based approach. Automatic facial expression recognition system is useful application like in identifying doubtful persons in airports, railway stations and other places with higher threat of terrorism attacks.

II. ARCHITECTURE OF FACIAL EXPRESSION RECOGNITION SYSTEM

The facial expression recognition system consists of following four steps. The First step is face detection phase that detects the face from a image or database. Second step is normalization that removes the unwanted noise and to normalize the face against brightness and position of the pixel. In third step phase features are extracted through two approaches. In the last step basic expressions are classified into six basic emotions like anger, fear, disgust, sadness, happiness and surprise.

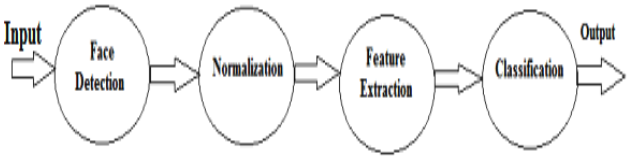

Fig.1: Architecture of facial expression recognition system

Facial expressions show the intention of the person, affective state of the person, cognitive activity of the person, and emotion of a person. In face-to-face communication convey many important communication cues. These cues help listener to understand the meaning of the spoken words. The facial expression recognition also has major application in areas like behavioral science, social interaction and social intelligence.

III. LOCAL BINARY PATTERNS (LBP)

The original local binary patterns operator takes a local neighborhood of around each pixel, thresholds the pixels of neighborhood at the value of central pixel and to use the resulting of binary valued image as a local image descriptor. LBP is able to describe the texture and shape of digital image. This image is done by divided image into several small regions from which the features are extracted. The LBP method provides good results, both in terms of speed and discrimination performance. The LBP method is robust against face images with different facial

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expressions, different lightening conditions, image rotation and different aging of persons.

Fig. 2: A preprocessed image divided into 64 regions

3.1 PRINCIPLES OF LOCAL BINARY PATTERNS

The LBP operator works with the eight neighbors of a pixel, using the value of center pixels as a threshold. If a neighbor pixel has a higher gray value than the center pixel (or the same gray value) than a one is assigned to that pixel, else it gets a zero.

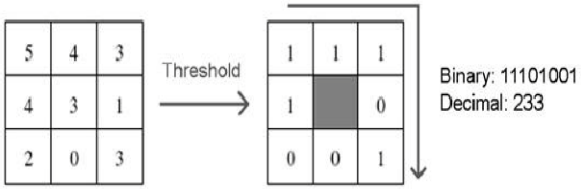

Fig. 3: The Original LBP Operator

Histogram of the labeled image fi(x,y) can be defined as

$H_i = \sum_{(x,y)} [\![I(f_i(x,y)=i), \quad i=0,\ldots\ldots,n-1]\!]$

Where n is the number of different labels produced by the LBP operator and

I(A)= {(1, A is true,
0, A is false)}

The limitation of Local Binary Pattern operator is small 3×3 neighborhood cannot be capture the dominant features with more scale structures. As a result, to deal with the texture at different scales, the operator was later extended to use neighborhoods of different sizes.

3.2 LOCAL BINARY PATTERNS EXTENSION

In the Local Binary Pattern operator has extended to make use of neighborhoods at the different sizes. By using circular neighborhoods and the bilinear interpolation of the pixel values, any radius and number of samples in the neighborhood . The following notation is applied: (P, R) which means P sampling points on a circle of R radius.

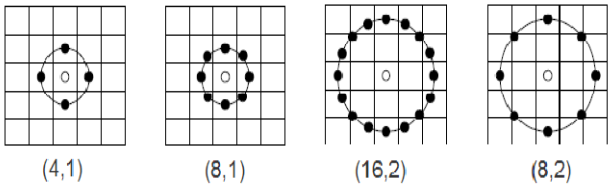

Fig. 4: LBP different sampling point and radius examples

IV. IMPLEMENTATION

All codes are written in MATLAB. In this we use Graphical User Interface (GUI). The JAFFE database has been used. We worked on the JAFFE images of 6 facial expressions Happy, Sad, Angry, fear, surprise and Disgust.

4.1 FACIAL EXPRESSION DATABASE

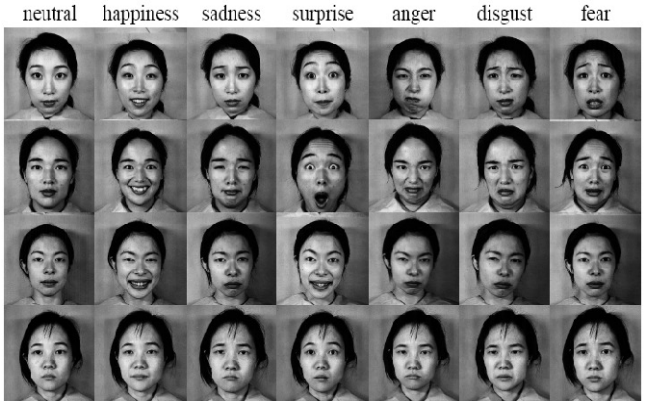

Fig. 5: Facial images from JAFFE database

V. RESULTS

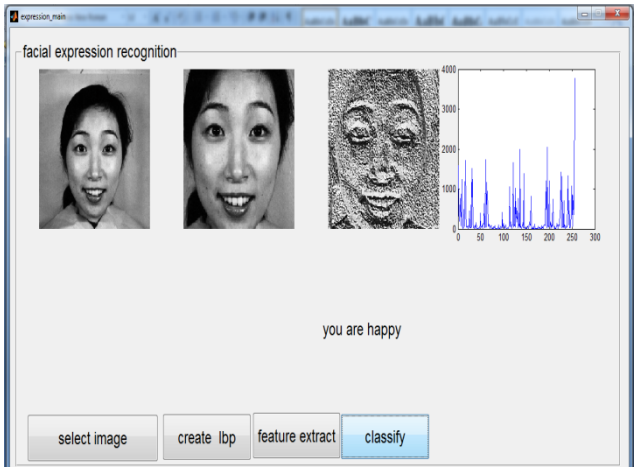

Fig. 6: Results of GUI Facial Expression is happy

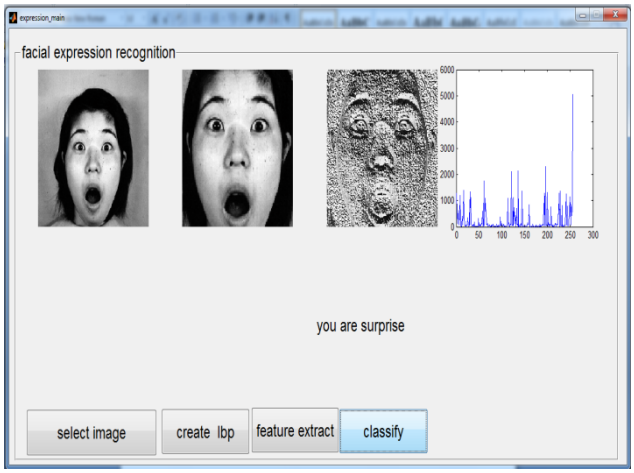

Fig. 7: Results of GUI Facial Expression is surprise

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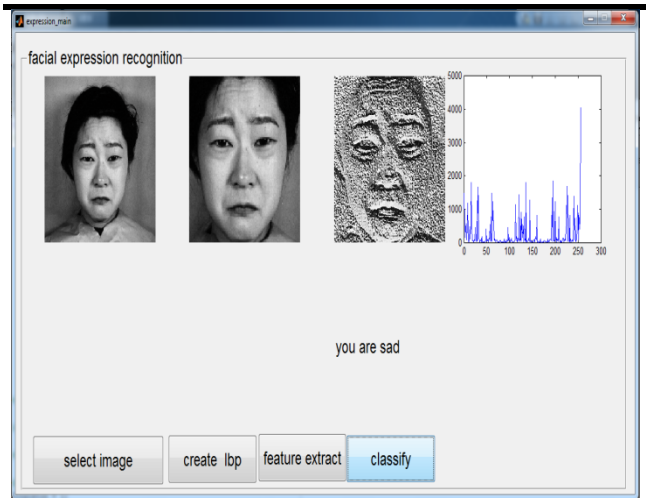

Fig. 8: Results of GUI Facial Expression is sad

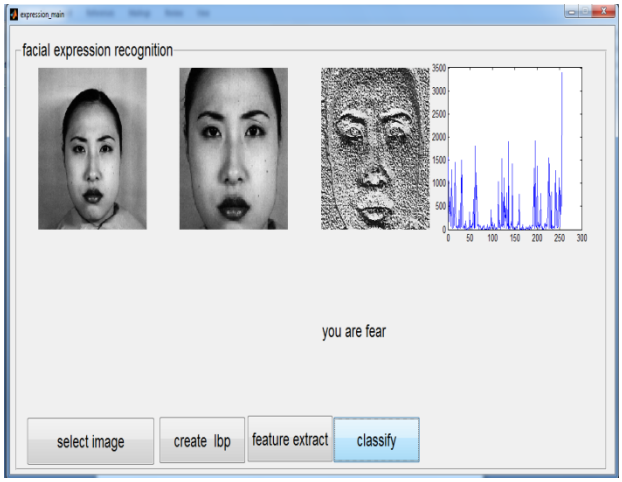

Fig. 9: Results of GUI Facial Expression is fear

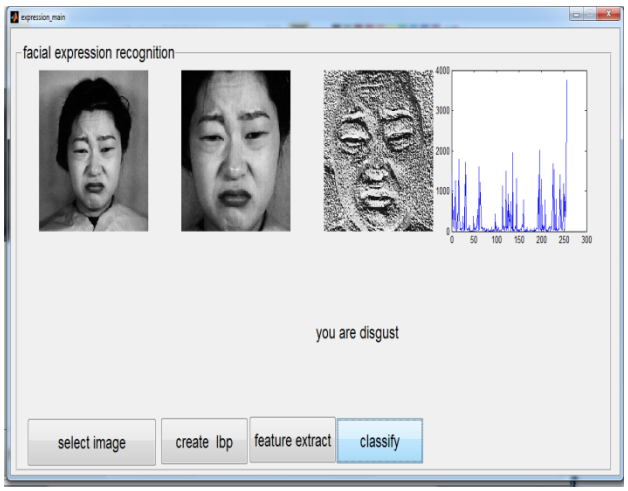

Fig. 10: Results of GUI Facial Expression is disgust

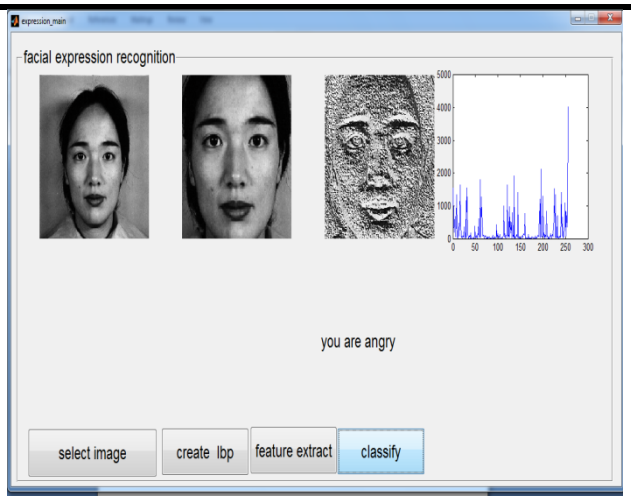

Fig. 11: Results of GUI Facial Expression is angry

VI. CONCLUSION

In this paper the facial expression recognition systems and various research challenges are overviewed. In this we presented a comprehensive study of facial expression recognition based on Local binary pattern. Facial expression analysis has applications in different fields of science and life. In Crime Investigation, In Robotics, Airport security, Identification solution etc.

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