GOLDEN RESEARCH THOUGHTS

ISSN: 2231-5063
IMPACT FACTOR : 4.6052 (UIF)
VOLUME - 6 | ISSUE - 9 | MARCH – 2017

FACIAL FEATURE EXTRACTION USING MODIFIED-LBP

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ABSTRACT:

This paper proposes a facial feature extraction system using improved LBP (hvnLBP). The system first pre-process the input image for illumination changes and noise invariance. Then Face detection is proposed and Gabor filter is also applied to produce magnitude pictures. Finally, the proposed LBP i.e. modified LBP is employed, which conducts horizontal and vertical neighbourhood pixel comparison, to generate a discriminative facial features.

INDEX TERMS : *Matlab, Image Pre-processing, Adaptive Histogram Equalization, Face detection, Feature extraction, LBP, hvnLBP.*

1.INTRODUCTION

Feature extraction is one of the most vital steps involved in image description. Every feature extraction technique has its own merits and demerits. For a particular application a carefully worked fusion of features, extracted using different techniques, can enhance their image description capabilities [1].

This paper proposes a facial feature extraction system using modified-Local Binary Pattern (hvnLBP). In this system first the image is acquired. Then the input image is preprocessed for illumination changes. Face-detection system detects face and crops face portion. Then the proposed LBP is used to extract features of the input image.

A modified LBP operator that conducts horizontal and vertical neighborhood pixel comparison is proposed, in order to overcome the drawbacks of original LBP by retrieving the missing contrast information embedded in the neighborhood to generate the initial discriminative facial representation [2].

2.RELATED WORK

Block Daigram:

Figure 1: Block Diagram

Procedure:

The Facial Feature Extraction as shown in the block diagram is as follows;

1) Acquisition of Image: Image is acquised i.e. the iamge input is taken.
2) Preprocessing: In this stage preprocessing is done for illumination changes. Adaptive Histogram Equalization is performed to enhance the contrast of grayscale image.

3) Face Detection: Here Face detection is processed where the face is detected and it is cropped in particular size.
4) Modified-Local Binary Pattern (hvnLBP): In this stage modified-LBP feature extraction is performed due to which the discriminative facial features are extracted.

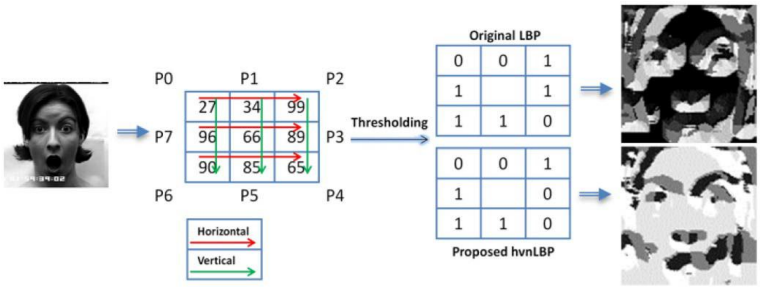


Figure 2: Example of proposed hvnLBP operator in comparison with that of the original LBP.[2]

3.ADAPTIVE HISTOGRAM EQUALIZATION

The Adaptive Histogram Equalization is different from ordinary histogram equalization i.e. it computes several histograms, each corresponding to a distinct section of the image, and use them to redistribute the lightness values of image.

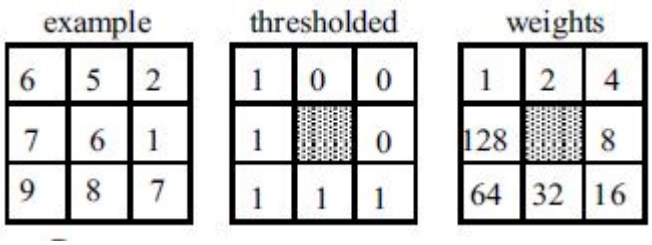
It enhances the contrast of the grayscale image.

4.LBP (LOCAL BINARY PATTERN)

Local binary pattern is created in the following manner:

- Initially it divides the examined window into cells (e.g. 16*16 pixels for each cell).
- For each pixel in a cell, compare the pixel to each of its 8 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 greater 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).
- This gives the facial feature of the image.
- The value of the LBP code of a example pixel (x_c, y_c) is given by;

$$LBP_{P,R} = \sum_{P=0}^{P-1} s(g_p - g_c)2^p \qquad s(x) = 1, \text{ if } x \geq 0 \; ; \; s(x) = 0, \text{ otherwise.}$$



- Pattern = 11110001

- LBP = 1+16+32+64+128
  = 241
- C = [(6+7+8+9+7)/5] – [(5+2+1)/3]
  = 4.7

5.HVNLBP (MODIFIED LOCAL BINARY PATTERN)

As a well-known texture descriptor, LBP [20] employs a circular neighborhood for feature extraction. This original LBP operator performs a comparison purely between the central pixel and the eight surrounding neighborhood pixels, therefore likely to lose the contrast information among the neighborhood pixels. To solve this problem, we propose hvnLBP to capture missing contrast information among the neighborhood pixels. Instead of comparing with the central pixel as in original LBP, hvnLBP employs horizontal and vertical neighborhood pixels for direct comparison to produce the resulting textural descriptions.[2]

As an example, we employ $P = \{p0, p1, p2, p3, p4, p5, p6, p7\}$ to represent the eight neighborhood pixels in LBP, as shown in Fig. 2. In either vertical or horizontal comparison, the values of the vertical or horizontal neighboring pixels are compared with one another. A 1 is assigned to the pixel with the highest value and a 0 is assigned to the remaining pixels. This horizontal and vertical comparison process can be conducted in any order, i.e., horizontal comparison followed by vertical comparison, or vice versa. Moreover, in both vertical and horizontal comparisons, we do not include the center pixel for comparison. Referring to Fig. 2, as an example, for horizontal comparison, we first compare the pixel sets of {*p*0, *p*1, *p*2}, {*p*7, *p*3}, and {*p*6, *p*5, *p*4}. Subsequently, we conduct the vertical comparison with the pixel sets of {*p*0, *p*7, *p*6}, {*p*1, *p*5}, and {*p*2, *p*3, *p*4}.

If a pixel has conflicting outputs in the horizontal and vertical comparisons (e.g., the highest value in the horizontal comparison but not in the vertical comparison, or vice versa), then the highest value (i.e., 1) is used as the final output, since the pixel is regarded as important, which contains valuable contrast information in the dimension that generates the highest value. The mathematical representation of this proposed hvnLBP*p,r* operator is illustrated as follows:

$$\text{hvnLBP}_{p,r} = \{S(\max(I0, I1, I2)), S(\max(I7, I3)), S(\max(I6, I5, I4)), S(\max(I0, I7, I6)), S(\max(I1, I5)), S(\max(I2, I3, I4))\} \quad (1)$$

where *p* is the number of neighborhood pixels, and *r* is the radius. *Li* represents the *i*th neighborhood of pixel *I* while *S* denotes the comparison operation, as follows:

$$S(\max(Ij, Ik, Im)) = \begin{cases} 1 & \text{if maximum} \\ 0 & \text{if non\_maximum} \end{cases} \quad (2)$$

where *Ij, Ik,* and *Im* represent the neighborhood pixels in a row or column.[2]

As we compare conventional LBP with hvnLBP i.e. modified LBP, the results indicates that modified LBP is more capable of capturing discriminative contrast information (corners and edges) among neighborhoods.

RESULTS:

STEP 1: Take any input image with the title original image. We have taken an image as shown below;

Figure 3: Input Image

STEP 2: Here Preprocessing is performed i.e. Adaptive Histogram Equalization is performed;

Figure 4: Adaptive Histogram Equalization

STEP 3: Here Face is detected and extracted from the input image;

Figure 5: Face Detection and Extraction

STEP 4: Features of extracted face are obtained using hvnLBP in comparison with conventional LBP as shown below;

Figure 6: hvnLBP Feature Extraction in comparison with conventional LBP

CONCLUSION

This system uses image processing tools in matlab, extracts the Facial Features of the input image. By developing this system we are providing better feature extraction compared to conventional LBP (Local Binary Pattern).

With all this in view, we have proposed a system in this for feature extraction using improved / modified-LBP i.e. hvn-LBP , which is capable of capturing edges and corners of the facial image.

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