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A Novel Approach to Identify the Facial parts using Local Binary Pattern and Combined LVQ Classifiers

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Abstract:

Security is place a major role in current industry. Authentication of the person is very important in the real world to access the information. One of the best method is Face recognition which is used for human identification and verification. This biometric method have a unique feature from recognizing one person to another in security field. In this paper we propose an algorithm for Face recognition and classification called on Local Binary Pattern (LBP). In static approach, LBP consists of histogram properties for feature extraction. Combined Learning Vector Quantization (LVQ) Classifier is used as Neural Network approach in order to recognize the image form database. The input image is first divided into small regions like eyes, nose, mouth from which Local Binary Patterns (LBP) histograms are extracted and concatenated into a single feature vector. This input vector is calculated using Euclidian distance to generate the output.

Keywords: Face Recognition, Principal Component Analysis, Local Binary Pattern, LBP histogram, Feature Extraction, LVQ classifier.

INTRODUCTION:

Face recognition is a program of computer science to recognize a human face. It identify individual photo from facial appearance. When comparing with other security identification, Face recognition found more passive. So, this face recognition is future divided into Iris scan, nose detection, mouth detection which are more effective in real world application. Due to variation in facial appearances, face identify will be

effected by their measures of geometrical data in the face representation. Fundamental objective of face reorganization system is to divide the quantity of a face in intrinsic shape & color of facial surface from horizontal &vertical pixels. When a person want to enroll in a face reorganization system, video camera takes a series of images of face &then represent by a unique code. That face is verified from the database which is present in the system. It captures the current appearance & compares it with facial code which is already stored in system. In existing face reorganization, the system identifies the only static face image that exactly match with the image stored in database. If the current image of a person is considered different, the facial expression from the image does not recognize the person & hence access will derived. So due to this draw back we considered a new technique called iris face recognition as an important way for security in airport, government buildings, and research laboratories. Iris image contains not only useful parts like eyes but also use full for some irrelevant parts like noise and mouth.

PROPOSED SYSTEM:

When the original image of a person differs from the image of that person stored in database, the system will be able to recognize the new facial parts & identify the person. There are many techniques used in face recognition like PCA but it have few draw backs in using it. Two key disadvantages of PCA are: 1) The covariance matrix is complicated to be evaluated in an exact manner [1]. 2) Even the simplest changes could not be captured by the PCA unless the instruction is given and provides the information [2].

The proposed system is mainly due to use of facial features rather than entire face. To identify the facial features we used LBP (Local Binary Pattern) for face recognition. This new approach determines the location and size of a person face in digital image by extracting region of interest in order to limit search area. This technique automatically reduces the computation.

LBP (Local Binary Pattern):

LBP is a feature of extraction methods and it is possible to describe the texture& shape of digital image. The image is divided into several smaller regions from which the features is extracted which consists of binary patterns. This binary pattern is used to describe the surrounding pixels in a region. This obtained region is concatenated in the single histogram feature. Images is compared by measuring the distance between each histograms. So, LBP for face recognition provides good results both in terms of speed and performance[5]. The image describe is robust against facial images with different face expressions, lighting conditions, image rotation and aging of persons.

Ojala introduced Local Binary Pattern in 1996[3]. This is the first article which is used to describe LBP as an efficient method in feature extraction and texture classification. It was developed as a grayscale invariant pattern by adding complementary information to the texture in the image. So it was introduced as a complementary measures for local image contrast. LBP is suitable for the applications like fast feature extraction and texture classification. Due to its useful power and

computational simplicity, the LBP texture operator has become a popular approach in different applications like visual examination, image recovery, remote sensing, biomedical image analysis, action analysis, environmental modeling, and outside sight analysis. The resulted output is generated with the feature vector of n-dimensions which is used as input to combined LVQ classifier.

METHODOLOGY:

The main idea of this paper to obtain the importances of Neural Network features in order to build a hybrid system. A new method is proposed called LBP and histogram properties. This method have a statistical approach for feature extraction and it combine LVQ classifier as a neural network. Once the features are extracted using both LBP and Histogram properties, an image is transformed into a feature vector and generate the output by combining the classifiers.

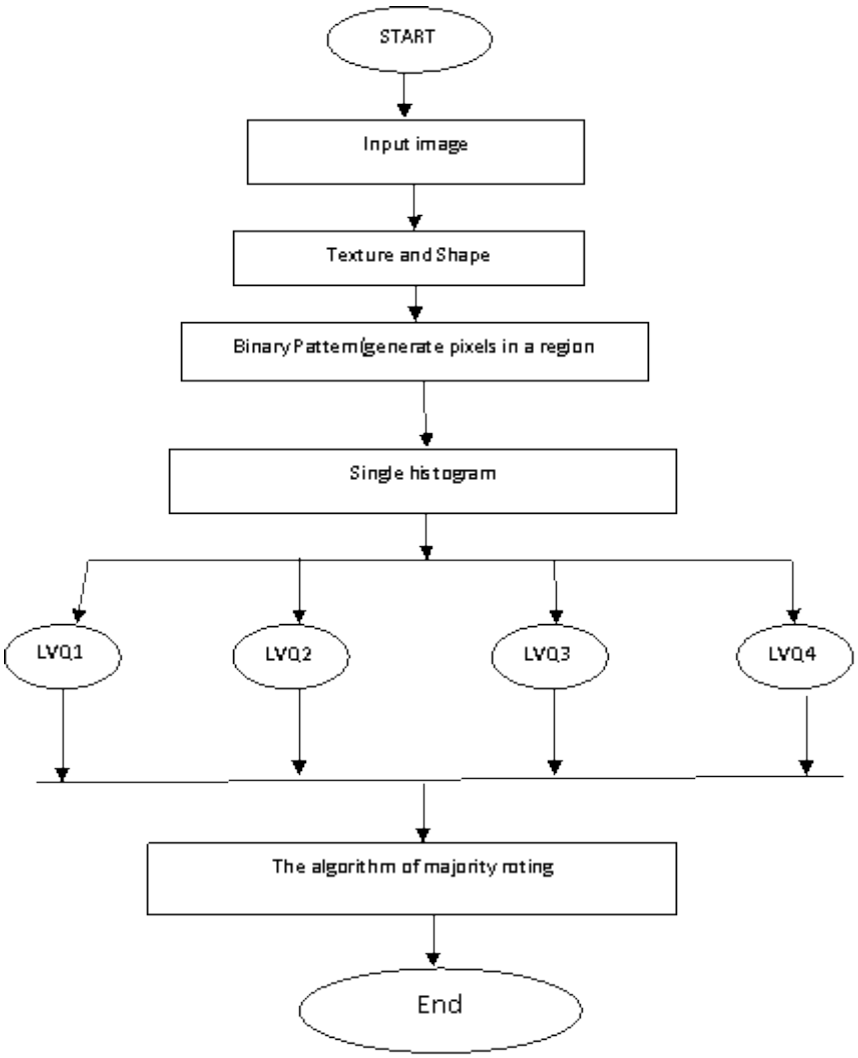

Figure 1: Structure of proposed system

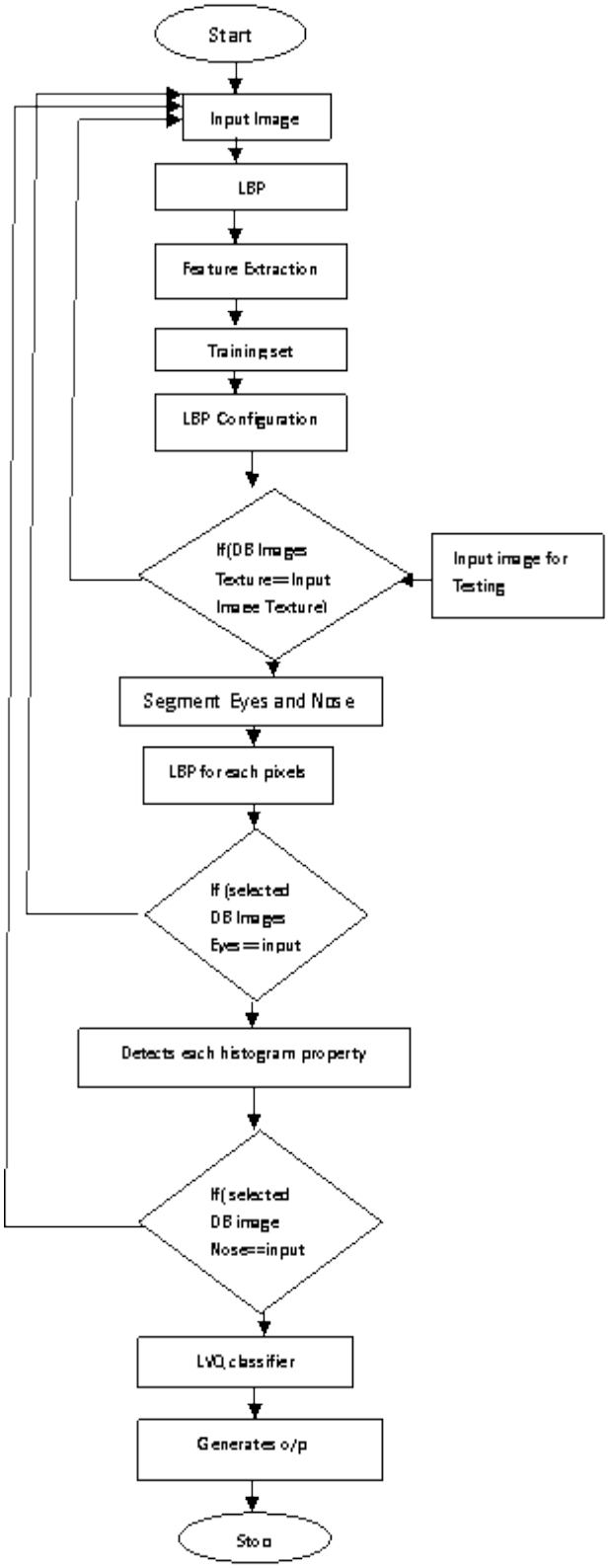

Figure 2: Structural representation of LBP

The figure shows the structure of the proposed method, whereas the input image is processed as a texture and shape of to combined Learning Vector Quantization (LVQ) Classifier. LVQ is nothing but a pattern classification method where each output node is represented as a class. This LVQ is divided into different classifier depending upon the histogram. The LVQ adjust the weights to estimated a theoretical Bayes classifier. Depending upon different classifies the majority of LVQ is selected finally.
The input vector is classified by class label of weight vector which is generated called as codebook vector(CV). The result obtained is depended upon the majority of classifiers among the weak classifiers. LVQ consists of two layers : 1. First layer is input layer which consists of input neurons. 2. Second is output layer which contains output neurons. The main goal of LVQ classifier is to take each input vector for n-neuron to generate the output by using Euclidian distance. This distance determine the weight of each neurons

LBP for eye detection:

Figure 3: Input Eye image

Figure 4: Segmented Image

Algorithm
Step 1: Input images.
Step 2: Preprocessing stages:

- Canny edge detection and HCT are used for localization and segmentation.
- Daugman model is used for Normalizing the image.

Step 3: Extraction stage:
LBP and Histogram properties are used to obtain the feature vector by extracting the normalized image.
Step 4: LVQ Classifier:
The obtained Feature vectors is uploaded to Combined LVQ Classifier.

- Number of Classifier = 3.
- Determine the Minimum Acceptable Classifier Performance.

Step 5 : The exercise and testing for each LVQ Classifier is given by:

- Select a appropriate learning rate.

- Select a appropriate NH(number of hidden neuron)
- Select a appropriate training number.
- Repeat for each LVQ Classifier until number of classifier is 3.

Step 6: The output is based on majority selection among several classifiers.
The algorithm of the major selection is -
For m = 1 to N
For n = 1 to M
Where N= Number of image for test,
M= Number of classes
If(Counter [n])= 0;
End for;
For C = 1 to P
Where P=Number of Chosen Classifier
K= Recognition result [c, m];
If(Counter [K] = Counter [K] + 1);
End for;
Selected Class = Max (Counter) ;
End for.

Crop function create an interactive image by using their position of eyes. Image cropping tool is used to display the image which is called target image crop. This image cropping tool is used to move, resize with rectangular position over the image and perform the crop function using mouse. This cropped image is store in eyes, which is display by using in LVQ classifier. The following are the stages where iris is detected from the database
1st stage: Image is taken from image capture
2nd stage: Eye is detected & adjusted in eye location
3rd stage: Segmentation includes localization of IRIS between eye and eyelids.
4th stage: Once Iris region is successfully segmented from captured image, next process is to fixed the dimensions for the segmented image in order to compare the image from the database. The normalization process will produce the iris region with different conditions but with same characteristics features.
5th stage: Feature extraction includes nose removal from iris image & generating the code.
6th stage: Finally, the matching involves the comparison of iris code with code already saved in database.

MOUTH DETECTION:
In this phase the mouth image is cropped and extracted for feature extraction. This image is stored as a classification of Local Binary Pattern (LBP), where LBP is an image operator which transfer the image into array of integer labels describing small scale appearance. These statistical image histogram are used for further image.

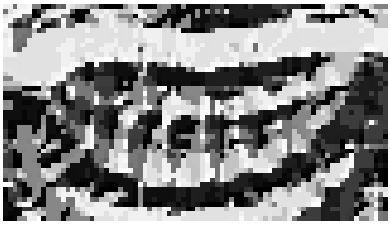

Figure 5: LBP coded image of ROI (mouth)

When considering the face, the image is divided into small non overlapping regions $R_{0,}$ $R_{1,\ ....}$ R_m. The LBP histograms can be calculated by extracting the sub regions and concatenating them into single region. Enhanced feature of histogram is defined as: $H_{i,\ j=} \sum_{x,y} I(f(x,y)\ i)\ I((x,y) \in R_j)$
Where i=0,.. L-1 and j=0, …M-1. The extracted image describes the local texture and global image.

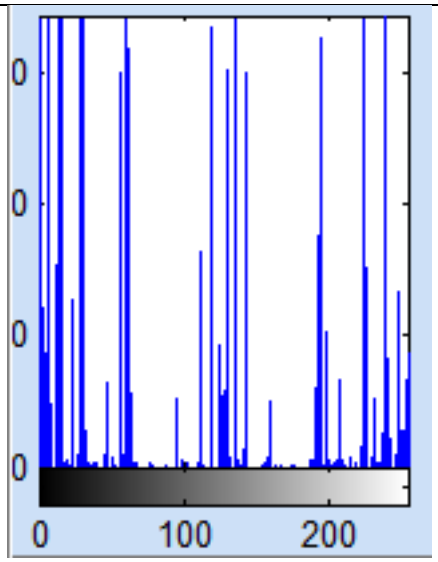

Figure 6: Histogram for eye detection

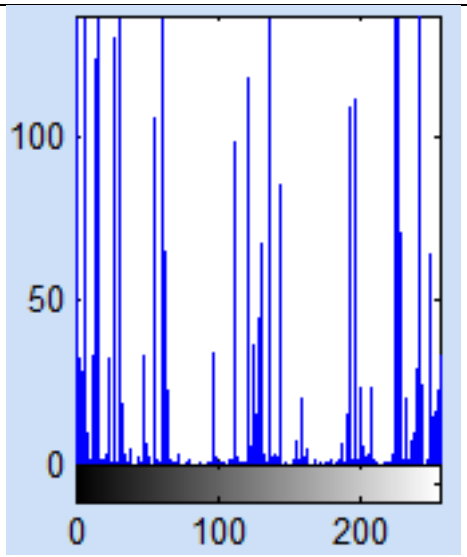

Figure 7: Histogram for eye detection

LBP operator is used to design for monochrome still image. This image is used widely for operator to design still image but it has been extended for color image as well as video and volumetric data. 3×3 pixel block of an image is operated in original version of LBP operator. The pixel values are taken by threshold values by its center pixel values, multiplied by power of two. This value is used to obtain center value label. As the region consists of 8 pixels, a total of 28 = 256 various labels can be obtained depending on the virtual gray values of the center and the pixels in the region. LBP code of each pixel in the image is computed as following:
$LBP_{N,\ R}= \sum_{i=0}^{n-1} s(p-q)^{2i}\ s(x) = 0$ or 1if $x < 0\ or\ x \geq 0$

Where q is the previous value of the central pixel. p is the gray value of with adjacent pixel where i = 0… N-1.
N is the total number of involved adjacent pixels
R is the radius of the adjacent, which determines how far nearest pixels are located away from the central pixel.

RESULTS & DISCUSSION:

This implementation is used to test the performance of the LBP-method on different kind of facial images. Several techniques, like the LBP operator (P and R), non-weighted or weighted regions and the dividing of the regions, are different to see the influence of these parameters on individual performance. In the proposed algorithm, various types of facial images have been recognized. The face image of an unknown identity is compared with face images of known individuals from a large database and we can see the facial images that are stored in the database and compare them with the input facial images. If the input face images are found or the more similarities of facial images are matched in the database then we say that the facial image is successfully recognized with the database.

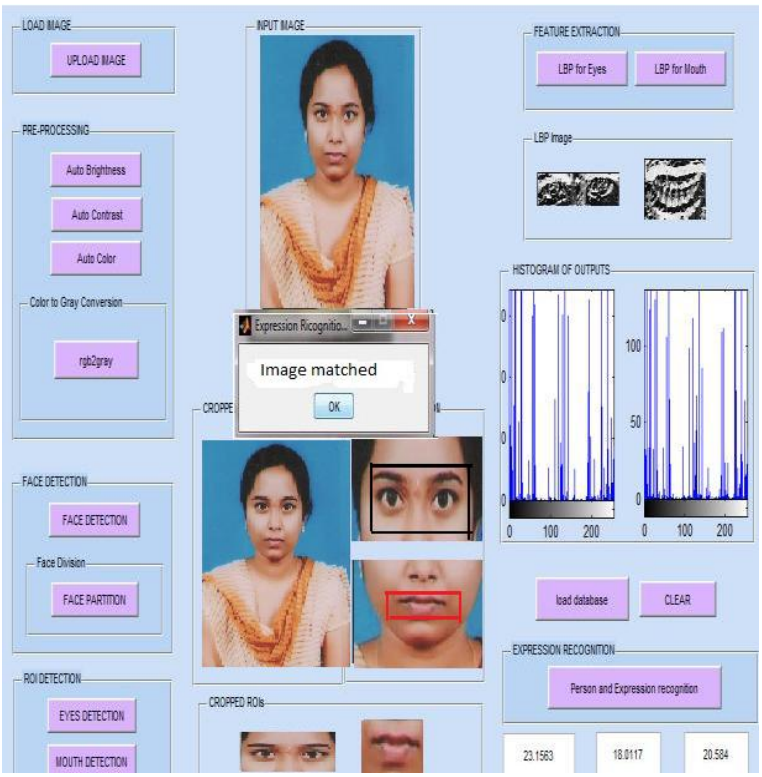

Figure 8: Image matched for same input

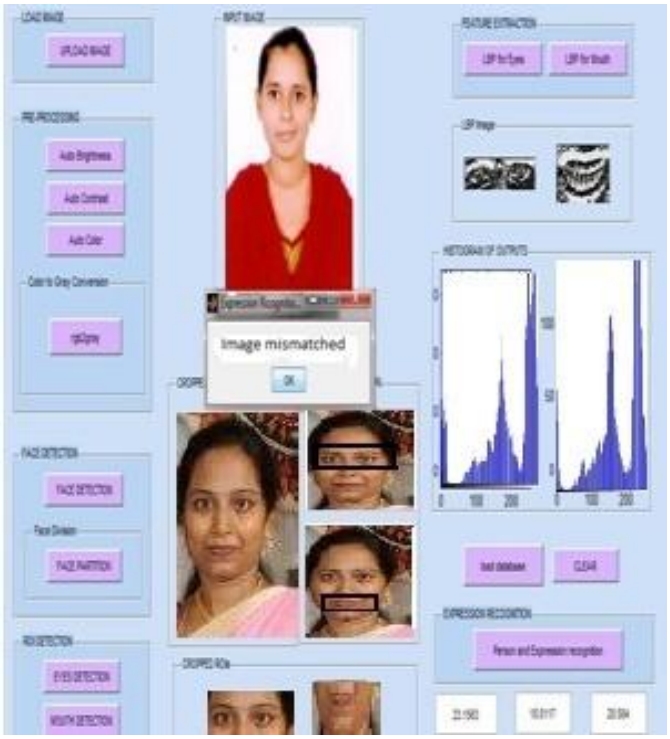

Figure 9: Image mismatched for different input

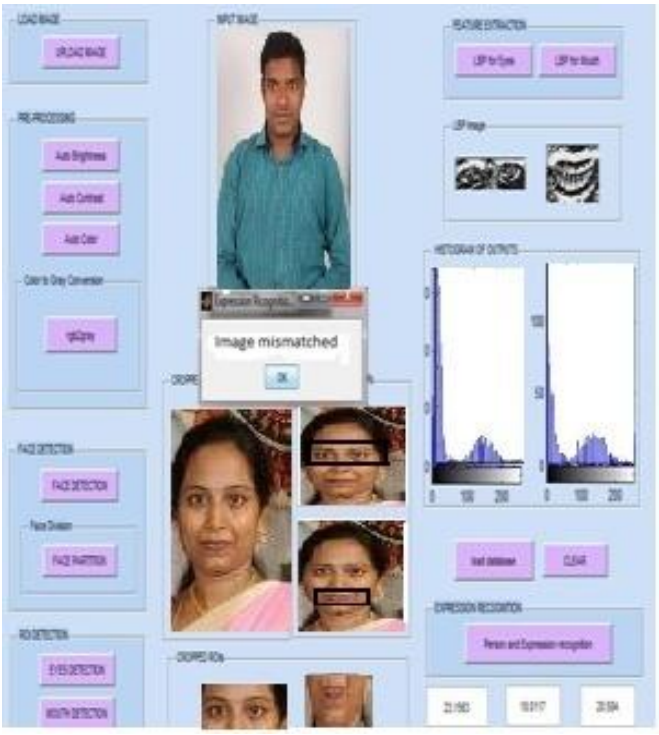

Figure 10: Image mismatched for different input

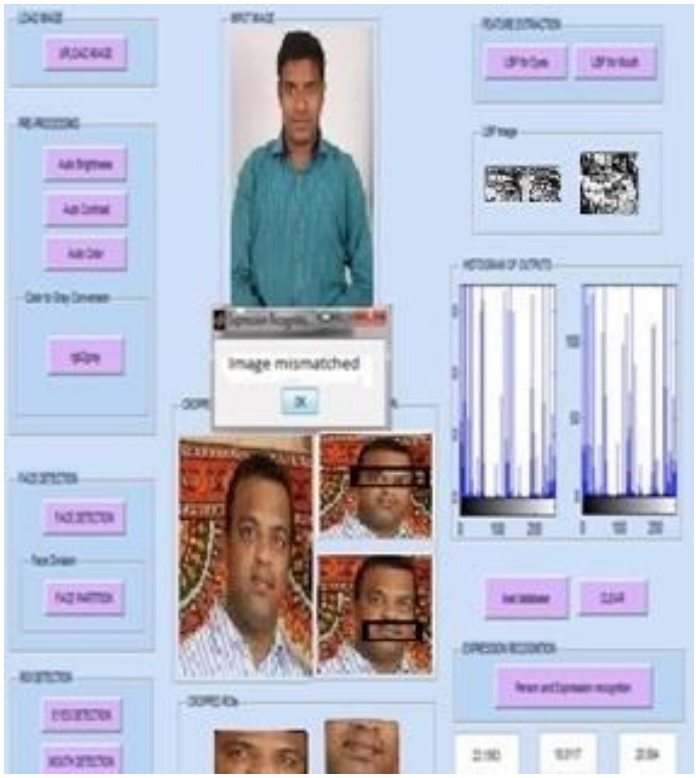

Figure 11: Image mismatched for different input

CONCLUSION:

Facial recognition, as we all know, is a breakthrough in technology world. With an increase in its curious applications, it is proving to be an exciting field of expertise. Through researching and experimenting the existing face and facial feature detection methods, we proposed a technique which perform accurately while consuming less time. This method increased the accuracy of system and decreased consumed time. Some of its major areas of application maybe Criminal identification, finding Missing people, better authentication, etc. There are several key places where this technique may find its use and change the world as we see it.

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