

## GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES LBP AND PCA BASED ON FACE RECOGNITION SYSTEM

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### ABSTRACT

The recognition of persons by means of biological and behavioral characteristics is biometrics field so, in this work we select face trait to do our experimental on it, where many researchers go through this field and everyone gets different results with different techniques. In this work, we conducted Local Binary Pattern (LBP) and Principle Component Analysis (PCA) for extract the feature from the face image. The LBP method gives good result compare with PCA method.

*Keywords: Face Recognition , PCA, LBP, Feature Extraction, Matching*

### I. INTRODUCTION

Face recognition is a process of automatically identifying or verifying a person from a digital image or a video frame from a video source. An image of the face is captured and analyzed in order to derive a template. This analysis may take various forms from plotting geometric points to grey-scale analysis of pixels to determine boundaries, etc [1], [2]. Face recognition was introduced in the 1960s. The US government hired a man named Woodrow W. Bledsoe to create the very first semi-automated face recognition system. The machine located key features on the face and calculated the ratios between them for identification. A decade later, three men named Goldstein, Harmon and Lesk joined forces to enhance the existing machines. They developed a 21-point check for the machines to identify and calculate the ratios between these facial structures. The 21 points included very intricate features of the face such as thickness of the lips and colour of the hair [3]. Some recognition algorithms identify faces by extracting landmarks, or features from an image of the subject's face. For example, an algorithm may analyse the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalise a gallery of face images and then compress the face data, only saving the data in the image that is useful for face detection. A probe image is then compared with the face data. One of the earliest, successful systems is based on template matching techniques applied to a set of salient facial features, providing a sort of compressed face representation [2]. Recognition algorithms can be divided into two main approaches: Geometric and Photometric. In Geometric looks at distinguishing features, and in Photometric, which is a statistical approach that distils an image into values and comparing the values with templates to eliminate variances?

The image acquisition modes of face recognition are sometimes required to a chive with a wide variety of image . The National Institute of Standards and Technology (NIST) give the guidelines for face image acquisition which include Single Image, Video Sequence , 3D Image and Near Infrared which are discuss in [4].

In this paper, we propose face pre-processing, feature extraction and matching to improve the face recognition system The paper is Organized as follows: In section 1 ,Related work of face recognition, in section 2, the methodology are presented , in section 3, The experimental work which is done in this work ,in section 4 , results and analysis of the work, in section 5, finally ,conclusion remarks are given.

### II. RELATED WORKS

A. Harsoyo, et al are utilized the pre-processing of face before face detection steps by using adaptive histogram equalization and they applied LBP on different pose [5]. K. Meena and Dr. A. Suruliandi, Another researcher did the face recognition by using LBP with different databases and with center symmetric local binary pattern which they

implemented and give better result [6]. L. Xianwei and C. Guolong, they applied PCA and SVM to recognize the face image, they used in pre-processing wavelet transform and they give better result compare with others [7]. M.Z.N. Al-Dabagh, they performed combination of two methods like (LBP and FLD) and they use Yale database and achieved recognition rate 92.6667% [8].

### III. METHODOLOGY

The face Recognition process in this work which is done by many steps like :

- 1- Collected the face image which I take it from Yale database which available online which used as training data and testing data in this work
- 2- Detect the face image from each person by resizing and cropping for extract the face region.
- 3- Apply image pre-processing steps for each subject in dataset to enhancement the face image by using adaptive histogram equalization for each image.
- 4- Apply LBP and PCA to output of pre-processing stage and extract the feature from it, the result of it is feature vector, then the feature reduction technique are used to reduce the feature domination for LBP features, the PCA are used.
- 5- Apply all the steps for testing data
- 6- Now we have training vector and testing vector we used the Euclidean distance and threshold for training and testing to generate the similarity matrix which is decided the person's recognized or not.

### IV. EXPERIMENTAL

#### A. Principal components Analysis (PCA)

The PCA is a classical feature extraction technique and it used in pattern recognition and computer vision [9]. Many researcher are used PCA for face recognition one of them use PCA for extracting features and dimension Reduction [10]. In this work the PCA algorithm used to extract the feature from face images (eigenvectors). In the initial stage The face recognition using Eigenfaces is to acquire the training set images and transform it into the eigenfaces with highest eigenvalues and calculate the weight for each image in training set. In the recognition stage we give an Image to be recognized and the same process which applied to training set it will be applied to testing set for recognition with addition to find the Euclidean distance between them.

The recognition is utilized by selected the minimizing the Euclidean distance with threshold if the Euclidean distance is less than the threshold the result is face recognized otherwise the face is not recognized.

#### B. Local binary patterns

Local Binary Pattern (LBP) operator it is one of the texture feature extract and also for shape of gray scale image. It is means a binary code for an image-pixel and tells us about the local neighborhood of that pixel.

The original LBP operator was introduced by Ojala et al. [11]. This operator works with the eight neighbors of a pixel, using the value of this center pixel 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. The LBP code for the center pixel is then produced by concatenating the eight ones or zeros to a binary code as shown in figure 1.

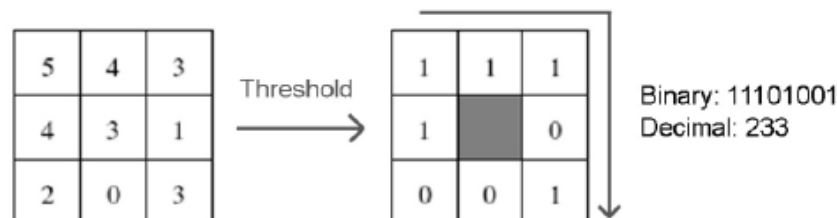


Fig.1: The original LBP operator.

Later the LBP operator was extended to use neighborhoods of different sizes. In this case a circle is made with radius R from the center pixel. P sampling points on the edge of this circle are taken and compared with the value of the center pixel. To get the values of all sampling points in the neighborhood for any radius and any number of pixels. For neighborhoods the notation (P, R) is used. Figure 2 illustrates three neighbor-sets for different values of P and R. Also it is referred as the multiscale LBP or extended LBP.

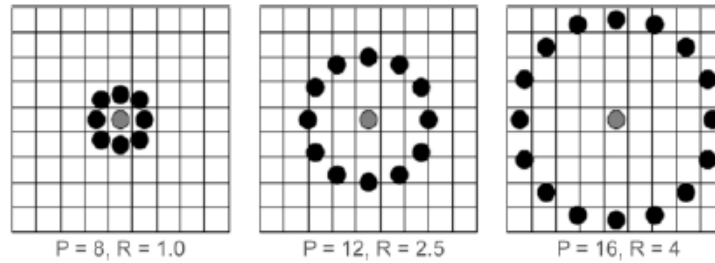


Fig. 2 Circularly neighbour-sets for three different values of P and R.

The feature vector of LBP for every pixel is calculated, the feature vector of the image can be constructed. The face image is divided into k2 regions. In figure 3 a face image is divided into regions. For every region a histogram with all possible labels is constructed and every bin in a histogram represents a pattern and contains the number of its appearance in the region. Finally the feature vector for every pixel are concatenating the regional histograms to one big histogram. For every region all non-uniform patterns are labeled with one single label.

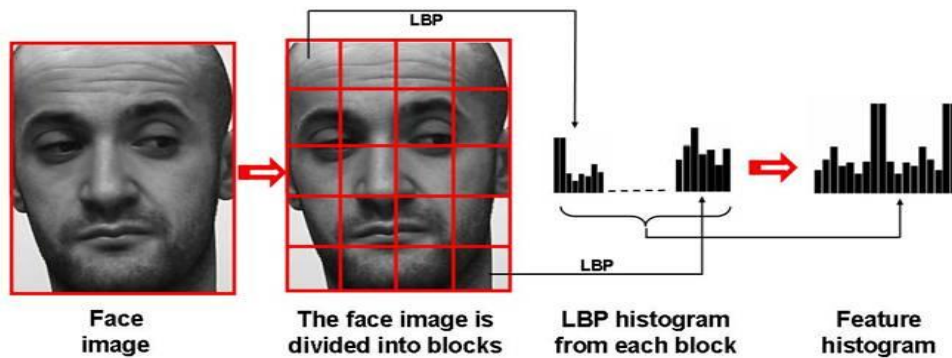


Fig.3:LBP for Face image and divided into regions

V. RESULTS AND ANALYSIS

In this work the Yale face database is used which publicly available online to test our methods. The Yale database has 15 subjects each subject has 11 samples, the total image in database is 165 grey scale images with 100x100 resolution the figure 4 show the sample image from database.



Fig.4 Faces from the YALE Face Database

The first steps after take the image from database is pre-processing which is the process to remove the noise from image and enhance the face image by using adaptive histogram equalization for each image in training set and testing set .

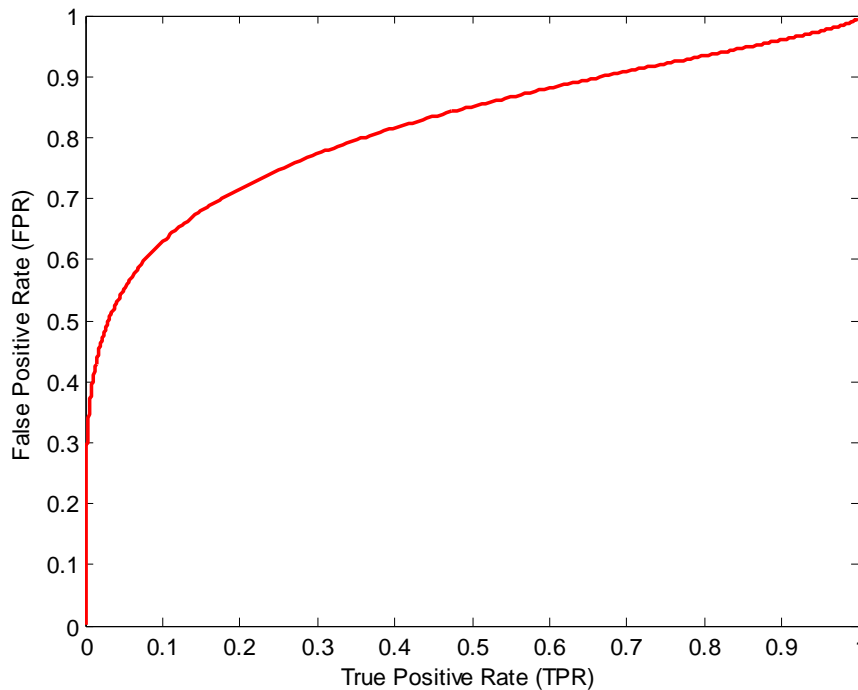
The second experiment is the feature extraction ,here we used two feature extraction methods which are called Principal components Analysis (PCA) and the second one is Local Binary Pattern (LBP).

In the case of PCA the eigenface is used to recognized the person which is a process to take the face image from the training and transform it into eigenface with highest eigenvalues and calculate the weight for each image in training set . In the recognition stage we give an Image to be recognized and the same process which applied to training set it will be applied to testing set for recognition with addition to find the Euclidean distance between them.

The recognition is utilized by selected the minimizing the Euclidean distance with threshold if the Euclidean distance is less than the threshold the result is face recognized otherwise the face is not recognized. The result of PCA is shown in table below:

*Table 1. performance of PCA of face recognition*

Methods	Database	Actual	Correct	Non-correct	Accuracy
PCA	Yale	165	130	35	78.79%



*Fig.5.performance evaluation of PCA Faces recognition on YALE Database*

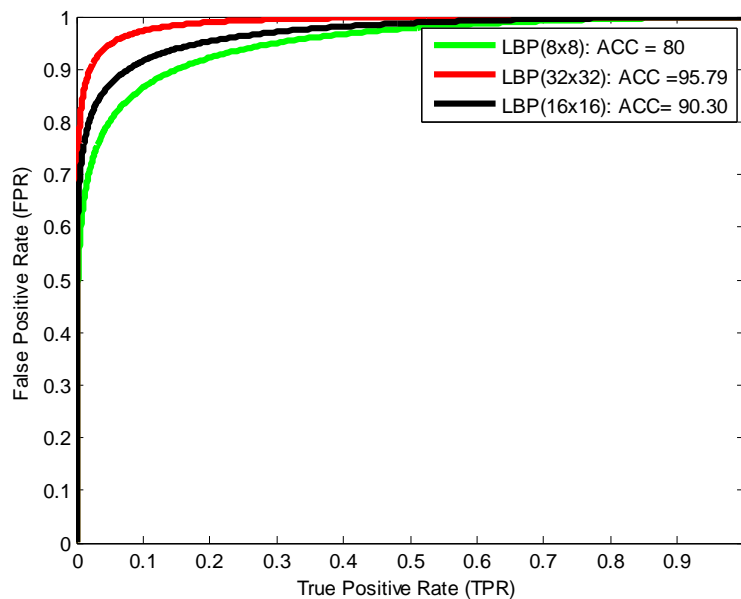
In the case of the Local Binary Pattern for every pixel is calculated, the feature vector of the image can be constructed. For an efficient representation of the face, first the image is divided into k2 blocks.

The face image is divided into 3 block size (8x8,16x16 and 32x32)and every block size has different results the table 2 show the performance of LBP with different blocks. For every block a histogram is obtained and for all

histogram represents a pattern and contains the number of its appearance in the blocks. The feature vector is then constructed by concatenating the blocks histograms to one big histogram.

*Table 2. Performance of LBP of face recognition*

Methods	Database	Block size	Actual	Correct	Non-correct	Accuracy
LBP	Yale	8x8	165	132	33	80%
		16x16	165	149	16	90.30%
		32x32	165	158	7	95.76%



*Fig.6. performance evaluation of LBP in different blocks size for Faces recognition on YALE Database*

## VI. CONCLUSIONS

In this paper, we have implemented a face recognition using two feature extraction methods PCA and LBP. In the case of PCA the Eigenfaces is used which is the simplest and it is holistic approach and whole face images are taken as a feature vector. While, the LBP method is a hybrid approach which makes use sum of local texture descriptors over the entire facial image as the feature vector. From the experiment we see that the LBP give good result compare with the PCA, where the PCA give the accuracy 78.79%, while the LBP give better results depend on the block size 8x8, 16x16 and 32x32, 80%, 90.30% and 95.76% respectively.

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