



Face Recognition by Three Level Face Features Extraction based on Center-Symmetric Local Binary Patterns

Jagvir Kaur¹, Er. Rakesh Singh²¹Master of Technology, ²Assistant Professor^{1,2}Department of Computer Engineering, Punjabi University,
Patiala, Punjab, India

Abstract— Recognition of face expressions of human beings by a computer is an interesting and challenging problem. Everyone have a different facial features and usually used as an identification. Recognizing different faces for humans is not a difficult task but it is difficult to identify different faces and their expressions by a system. Face expressions recognition can be used in a number of applications like authentication, security issues, and surveillance. Recently, Different Local Binary Pattern (LBP) operators have been applied into face recognition successfully. Center-symmetric Local Binary Pattern is a variation operator of LBP, which can reduce the dimensionality of LBP features, and also capture the gradient information better than basic LBP. In this paper, an algorithm is proposed for face recognition based on center-symmetric LBP. The main idea of the algorithm is using the center-symmetric LBP operator three times for extracting three-level face features with the assumption that a gray face image encoded by center-symmetric LBP operator is still a gray image. Since different level face features make different contributions to face recognition, we put appropriate weighting on each level face feature. The experimental results show that the proposed algorithm performances give the good recognition rates on different levels on ORL databases.

Keywords-Center-Symmetric; Local Binary Pattern; face recognition.

I. INTRODUCTION

Face recognition is an active research area, and they can be used in wide range applications such as surveillance, authentication and security. Face recognition system can be used in two modes: Verification and Identification.

In the identification process, the preprocessed image of a person is compared with face images of known individuals from a large database then returns the recognized identity.

In the verification process, the preprocessed image of a person is compared with one face image from a database with the claimed identity. The system then returns the verification status by measuring the similarities between the two images. An efficient face recognition system could replace current identification methods like Personal Identification Number (PIN)-codes, passwords and Identification-cards, which according to could be exposed to security attacks, but also extremely reliable methods of biometric person identification, like fingerprint analysis and retinal or iris scans .In contrast, face recognition system is more accurate and reliable than all the proposed algorithms.

A face recognition system is used to identify and/or verify the identity of a person from a digital image. To identify a face using face recognition system, a digital image passes through three main phases.

- **Face detection:** The face detection block separates the facial area from the rest of the background image.
- **Feature extraction:** In the feature extraction phase, the most useful and unique features (properties) of the face image are extracted.
- **Face recognition:** Once these features are obtained then in recognition phase, the image is then compared with the images in different classes. The image with least distance with the images in classes gets highest matching score and is said to be identical image.

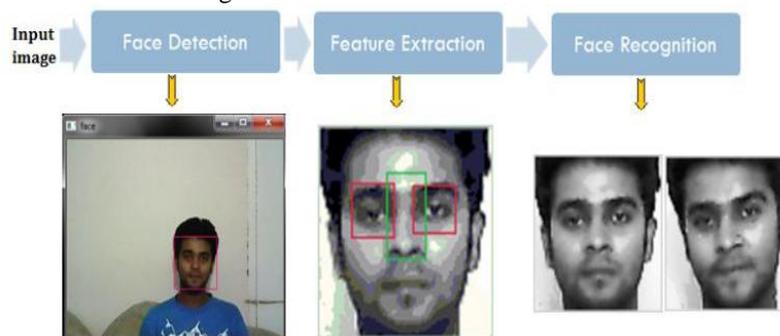


Fig.1: Face recognition system

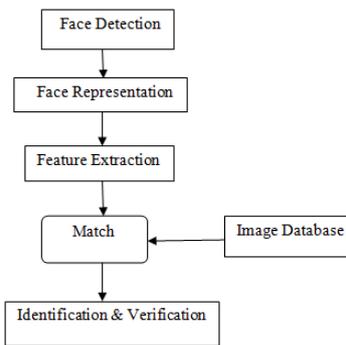


Fig 2: Face recognition step by step

Face recognition system can help in many ways:

- 1) Checking for criminal records.
- 2) Enhancement of security by using surveillance cameras in conjunction with face recognition system.
- 3) Finding lost children's by using the images received from the cameras fitted at some public places.
- 4) Knowing in advance if some VIP is entering the hotel.
- 5) Detection of a criminal at public place.

In this paper, we propose a novel algorithm for face features extraction based on center-symmetric LBP. In our framework, it utilizes center-symmetric LBP three times to extract three-level face features, which include abundant and discriminative texture features. And nearest neighbor classifier is used to choose the minimum Chi-Square difference for testing face images. The experimental results show that the face features extracted by the algorithm are effective.

The remainder part of this paper is organized as follows.

Section I gives an explicit introduction to Face recognition. Section II includes problem definition and section III includes proposed method and face recognition algorithm step by step. Section IV includes experiments on ORL face databases are conducted to evaluate the performance of our algorithm. In Section V, Conclusion and future scope are given.

II. PROBLEM DEFINITION

The problem undertaken for the Research is “**Face Recognition by Three level face features extraction based on Center-Symmetric Local Binary Patterns**”. Face is the most important feature of a human being. Everyone have a different face features and usually used as an identification. Recognizing different faces for humans is not a difficult task for human beings but it is difficult to identify different faces and their expressions by a system. Face expression recognition can be used in a number of applications like authentication, security issues, and surveillance. Face is a complex multidimensional structure and needs a good computing technique for recognition. Various face expression recognition techniques include Local Binary Pattern(LBP), Principal Component Analysis(PCA), Local Discriminate Analysis(LDA), Linear programming. Basic technique used for face expression recognition is local binary pattern. Local binary pattern uses the concept of threshold with the neighbouring pixels. A number of variants of LBP exist like Rotation in-variant LBP, improved LBP, Advanced LBP, and Modified LBP. In this thesis we will implement CS-LBP for face recognition by three level face features.

In framework, it utilizes Center-Symmetric LBP three times to extract Three-level face features, which include abundant and discriminative texture features.

III. THE PROPOSED ALGORITHM

In the face recognition system, face features extraction is a crucial step, how well face features extracted determine the capability of the system. In this section, the proposed algorithm for face features extraction is described.

A. Center-Symmetric Local Binary Pattern:

The major difference between LBP and center-symmetric LBP operators is the way of labeling pixels of an image in a 3x3 neighborhood, the former labels pixels of an image by

Thresholding the neighborhood of each pixel with the gray

Value of the central pixel, the later labels pixels of an image by Thresholding the neighborhood of each pair pixels which are center symmetric as the central pixel. If the gray value of the neighboring pixel is higher or equal, the gray value is set to one, otherwise to zero. Then, both operators concatenate the results binomially to form a decimal number under the specified direction. Figure 3 gives an illustration of the two operators with 3x3 neighborhood.

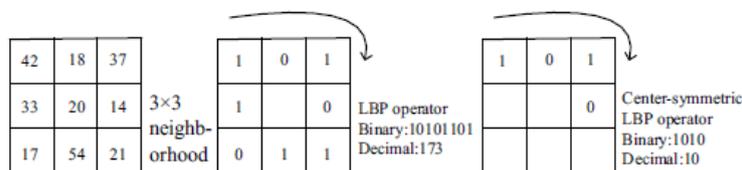


Fig.3: LBP and center-symmetric LBP operators

Through comparative analysis, center-symmetric LBP is similar to the LBP. It should be noted that the gain of center-symmetric LBP over LBP is not only due to the dimensionality reduction, but also to the fact that the center-symmetric LBP captures the gradient information better than basic LBP.

B. Three-Level Face Features

Generally, LBP operator for face features extraction is utilized only once. In that case, texture features extracted by LBP operator are not abundant and informative for face representation, especially, in the smoothness parts of the face (e.g., forehead, cheek). In order to resolve this issue, we assume that a face image encoded by LBP operator is still a gray image. Therefore, more abundant and discriminative texture features are extracted by utilizing LBP operator more times. Here, we utilize center-symmetric LBP three times to extract three-level face features. Figure 4 illustrates the three-level face features.

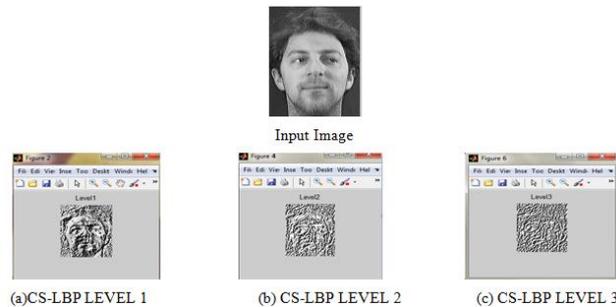


Fig.:4 three level features extraction

- **The first level face feature:** Figure 4(b) shows that the first level face feature extracted by center-symmetric LBP from the original face image Figure 4(a).
- **The second level face feature:** Based on Figure 4(b), center-symmetric LBP is used again to extract the second level face feature. See Figure 4(c).
- **The third level face feature:** Likewise, Figure 4(d)

is the third level face feature. As shown in Figure 4, the second and the third level face features provide more abundant and discriminative texture characteristics than the first level face feature, which play an important role in face representation. Moreover, different level face features are complementary in different parts of face. In view of these advantages, we combine different level face features for better face representation.

C. Face Recognition Algorithm (Methodology)

- 1) Extract three-level face features LBP using Center-symmetric LBP from each face image in the training and testing sets.
- 2) Calculate the histogram of each LBP image.
- 3) In classification phrase, the chi-square distance between test samples and training samples are calculated, and the minimum value determine the classes of test samples.
- 4) Compare the recognition rate of each level.

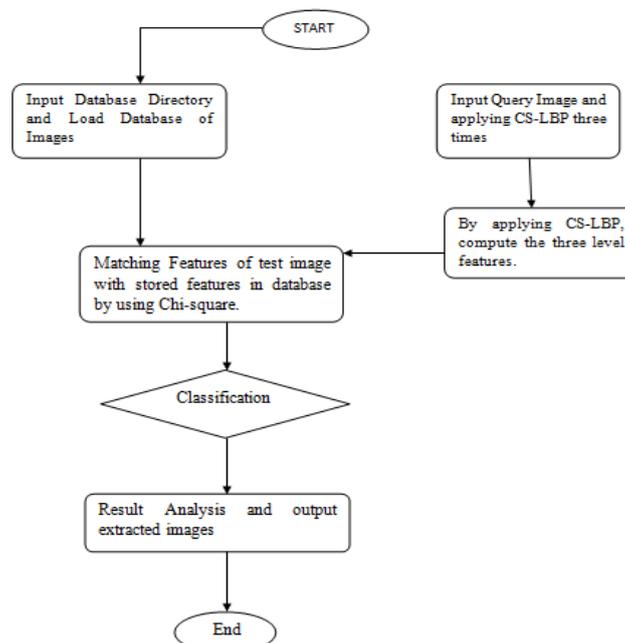


Fig.:5 Methodology flowchart

IV. RESULT ANALYSIS

In this section, experimental results on ORL face databases are shown. Our first experiment is performed on the ORL face database. ORL contains 400 images from 40 individuals (10 images for each person), with variations in pose, facial expression and a certain amount of scale and viewpoint (See Fig.6). The performance of our approach is showing in Table 1, in comparison between three levels.



Fig.:6 ten face images of a person in ORL database

For implementing the “Face Recognition by Three level face features extraction based on Center-Symmetric Local Binary Patterns” we have used MATLAB software because MATLAB provides a simple and easy to use technique for modeling. A user friendly interface is generated.

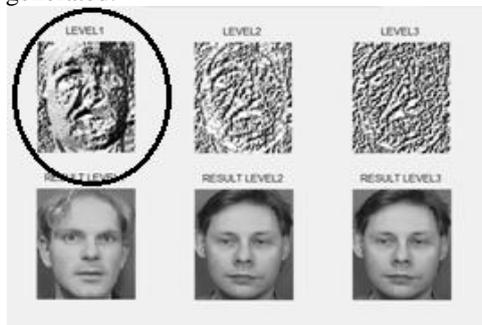


Fig.:7 first level feature extraction

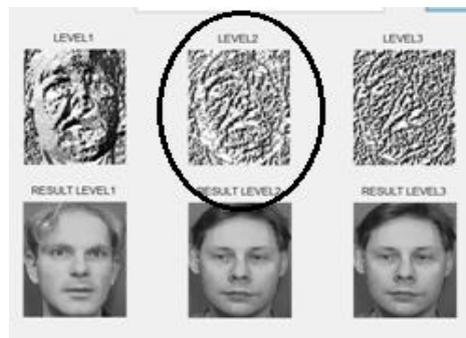


Fig.8: second level feature extraction

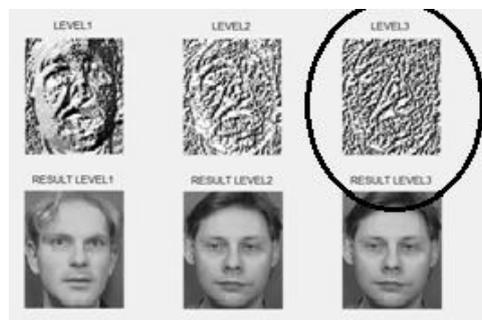


Fig. 9: Third level feature extraction

Table I: Face recognition rate for each level with different poses

Image Poses	Recognition rate for level 1(%)	Recognition rate for level 2(%)	Recognition rate for level 3(%)
Smiling Pose	98%	50%	30%
Normal Pose	96%	52%	26%
With glasses	90%	60%	32%

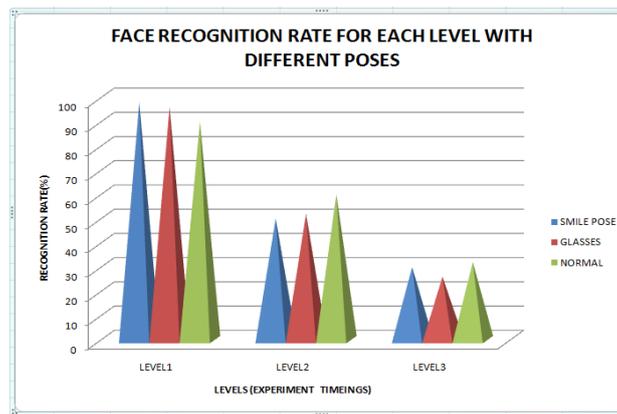


Fig10 : Face recognition rate for each level with different poses

V. CONCLUSION AND FUTURE SCOPE

In this Paper, face recognition has been implemented using Center symmetric local binary pattern & a survey on local binary pattern for face recognition has been studied in detail. Also the performance is compared using recognition rate of different levels based on Chi Square method. Also different variants of LBP have been presented. Various methods of face recognition have also been presented. Face recognition is becoming a popular topic in various applications like security, surveillance etc. In this thesis, we presented a novel approach for face recognition. The main idea of the approach is utilizing center-symmetric LBP three times to extract three-level face features, which contain more abundant and complementary texture information. Sometimes there is a problem in face recognition system is that it may not correctly recognize the face with different poses on first level, so we conclude that three level face feature extraction using CS-LBP gives good recognition rates. In the classification phrase, a nearest neighbor classifier is used to select the minimum chi-square to the query test face images. The proposed approach achieves perfect results on the ORL face database and recognition rate of 98% on the ORL face database, which shows the superiority of the proposed technique. A number of variants of LBP exists like Rotation in-variant LBP, improved LBP, Multi-variant LBP, Center symmetric LBP, Centralized LBP etc. this can be concluded that local binary pattern for face recognition has been getting popular very fast day by day, because of its many advantages over other operators like robustness, more accuracy, simple computations etc.

VI. FUTURE SCOPE

Work done in this dissertation can be extended in future with little variations. We will try to implement various variants of LBP to enhance the features and gain more accuracy, because of for some images CS-LBP is not correctly recognize on three levels too, so there is an another variant of LBP is orthogonal LBP which is worked on Angle base, Some of the future directions to this work are like:

- I. We can improve recognize rate using Orthogonal LBP Variant.
- II. Using Local ternary patterns we could Improves the robustness.
- III. Volume LBP is used to Extending to 3D.

There are a no. LBP Variants, which have advantages and disadvantages. We can use these Variants; can improve accuracy, run time and recognition time by experiments on different Databases.

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