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Research paper

Local Binary Pattern and PCA Approaches: Towards for Developing Face recognition system

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Abstract

`Face recognition is one of biometrics system used for surveillance purpose. It use to discovery criminals, suspected terrorists and missed children. The face recognition is term to identify human by using algorithms. In this paper, Local Binary Pattern (LBP) approach has applied to extract features for face recognition. LBP approach is one of powerful and robust method for extraction features from face. Main contributions of this present research work are: First LBP approach used to extract importance features from face. Second: Feature selection methods, Principal Component Analysis (PCA) has employed to remove irrelevant features for increase accuracy of classification. For face recognition the most significant features are necessary due to the face has more dimensionality. Third, Classification, Two classifiers are applied for recognition purpose. Support Vector Machine (SVM) and Linear Discriminates (LD) algorithms have used to classify the features vector which has obtained by LBP method for face recognition. For experimental analysis , the Olivetti Research Laboratory (ORL) standard data has been used to evaluate the proposed system. The empirical analysis results of proposed system show that it is better in terms of accuracy performance measures. A Comparative analysis results between the classifiers with all features and with PCA method is presented. It is observed that the performance of classifiers with whole features is better. However, the classifier with PCA method is better in cost of time. Finally, it concluded that the proposed system is more robust and better for face recognition.

Keywords: *PCA, LBP, Olivetti Research Laboratory*

1. Introduction

A solid character administration framework is a basic part in a few applications that give administrations to just real clients. Cases of such applications incorporate sharing organized PC assets, conceding access to atomic offices, performing remote money related exchanges or loading up a business flight. The expansion of electronic administrations (e.g., internet saving money) and the arrangement of decentralized client benefit focuses (e.g., Visas) have additionally improved the requirement for dependable character administration frameworks. Generally, information based (e.g., passwords) and token-based (e.g., ID cards) plans have been utilized to build up the character of a man meaning to get to the administrations offered by an application (e.g., internet managing an account) or an office (e.g., amusement stop). However these surrogate portrayals of personality have a few restrictions. For instance, passwords can be unveiled to unapproved clients bringing about bargaining the planned security; in addition straightforward passwords can be effortlessly speculated by a fraud while complex passwords can be hard to remember for a honest to goodness client. Then again, ID cards can be effectively lost, lost, fashioned or stolen accordingly bringing about a break of security. In this way it is important to use exchange techniques for confirmation in light of your identity, as opposed to by what you recollect or what you have.

Biometrics offers a natural and reliable solution to recognize individuals based on their biological characteristics. As these biometric traits are inherent to an individual, it is more difficult to manipulate, share, or forget them [1]. Biometrics offers advantages like negative recognition and non-repudiation over tokens and passwords. Negative recognition is the process which determines whether a particular person is already known to identity management system, although the person might deny it. This is useful in preventing a person from claiming multiple benefits (e.g. welfare disbursements) using different names. User cannot make false repudiation claims as biometric system requires a person to be physically present for authentication. Non-repudiation makes sure that a person who accesses a particular service cannot later deny using it. Due to these reasons, biometrics are increasingly employed in several government and civilian identity management applications either to replace or enhance security offered by tradition knowledge-based and token-based schemes. Some applications may use biometrics in addition to ID cards and passwords imparting higher level of security. This is called dualfactor authentication scheme [2]. Biometrics establishes the identity of an individual based on the unique physical or behavioral characteristics of the person. These characteristics are called as traits or modalities.

Face recognition are the most generally utilized biometric trademark by people to remember each other. Face acknowledgment is a nonintrusive technique and its applications run from static ("mug shots") to dynamic, uncontrolled face distinguishing proof in a jumbled foundation (metro, airplane terminal) [3]. Face acknowledgment strategies are sorted into two kinds: include based and appearance-based. In the appearance-based methodologies, entire face picture is viewed as opposed to simply neighborhood highlights. Highlight based methodologies consider the area and state of facial characteristics, for example, the eyes, eyebrows, nose, lips, and jaw, and their spatial connections. While the exe-

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cution of the face acknowledgment frameworks that are monetarily accessible is sensible, they force a few limitations on how the facial pictures are acquired, frequently requiring a settled foundation with controlled light. These frameworks likewise experience issues in perceiving a face from pictures caught from two extraordinary distinctive perspectives and under various enlightenment conditions. To function admirably, confront acknowledgment framework ought to naturally: 1) identify whether a face is available in the gained picture; 2) find the face on the off chance that it is available; and 3) perceive the face from any posture. Deep neural techniques have been applied in the past to face detection [4], face alignment [5] and face identification [6]. Inthe unconstrained domain, Huang et al. [6] applied LBP for extraction features for developing face recognition system. traditional methods. Histograms of Oriented Gradients (HOGs) [7] are image descriptors invariant to 2D rotation which have. Nor'aini [8] used namely Zernike moment (ZM) for developing a human face recognition system using an. They applied Nearest Neighbor algorithm for classification. It observed that the performance of the classification was good. Chandan Singha [9] introduced namely Zernike moments (ZMs) and Complex Zernike moments (CZMs to extract features from face recognition.

In this research work two feature extraction has used to extraction patterns. PCA method has applied for section sub features from the original features. The paper is organized as follows: section 1 is an introduction. The proposed system is introduced in section 2. In section 3 is presented theExperimental setup. Finally, the paper is closed with conclusion in section 4.

2. Proposed System

Figure 1 illustrates the proposed system for face recognition system. The present research work has used ORL database.The LBP features extraction method has applied to extractfeatures for classification purpose. The PCA method has been employed to select subset features from the all feature vectorswhich has obtained from featureextraction method. These subset features vectors have been processed by Support Vector Machine (SVM) and Linear Discriminates (LD) algorithms. It is observed that the proposed system increases the accuracy and the time of classification. Finally a comparative analysis of results between the proposed system with all features and with PCA method is presented. The detailed description of eachsteps used in the proposed system is presented in the subsequent subsection.

2.1 Database :

The Olivetti Research Laboratory (ORL) database is face recognition dataset. It contains 400 grey-face images. This database collected in 1992 from 40 people. The dimensionality size of each image is 92×112. 8, from each 30 persons were used in this experiment. Figure 2 displays all face in database.

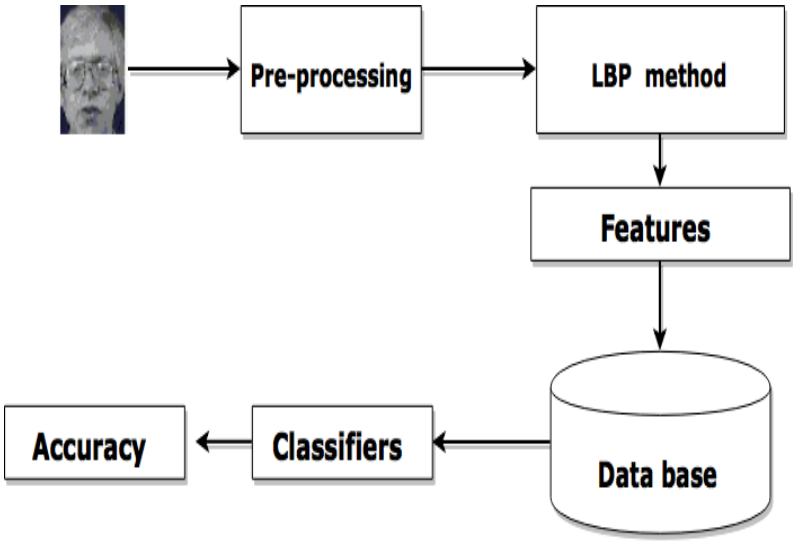

Fig 1. Proposed system

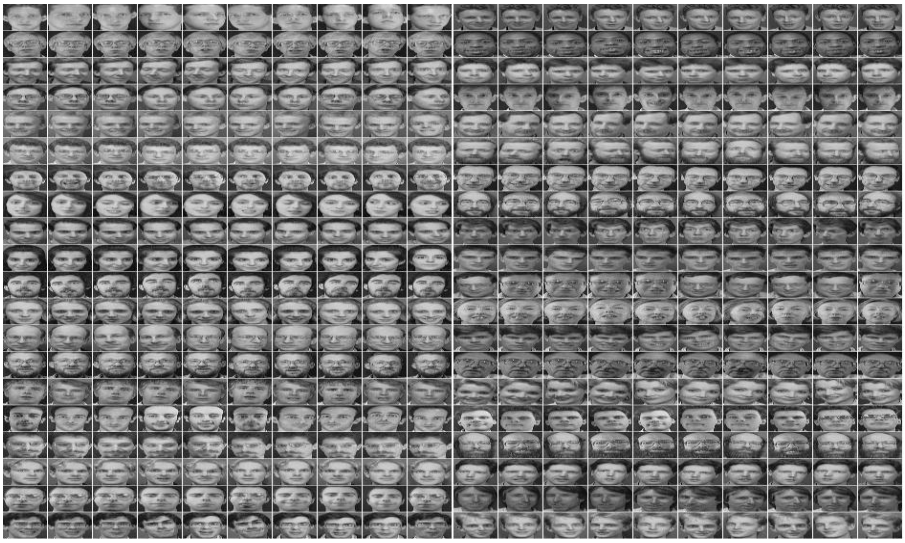

Fig 2. ORL database

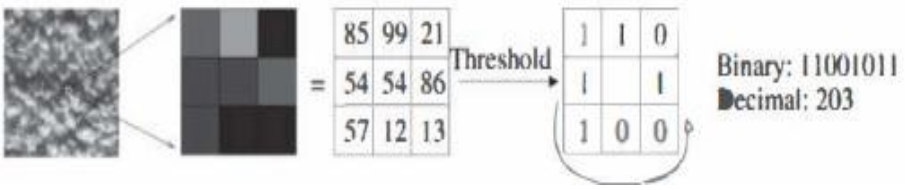

Fig 3: The basic local binary pattern method

2.2 Pre-processing

In pre-processing steps LBP features extraction method has applied. The detailed description of these methods is as follows:

2.2.1 Local Binary Pattern (LBP)

Local Binary Patterns is one of significant method for extracting the most useful features from face images. Local Binary Patterns method introduced in 1996 by Ojala et al. [5]. It is use to illustrate the texture and shape of image, and dividing an image into a number of small regions from which the features are obtained. Figure 3 displays central pixel with 8-neighbor.When the central pixel value lower than neighbor values than the central pixel will be zero. When the neighbor values are lower than central pixel than the neighbor values will be one. When it applied LBP method 120 features has obtained. This feature has been used for classification purpose for developing face recognition system.

2.2.2 Principal Component Analysis (PCA)

Principal component analysis (PCA) is a very significant approach for face recognition. Numbers of research has used PCA approach for dimensionality reduction of face features. When faetuesexteacted from face, this features have the a large number of redundant irrelevant features. In order to face recognition system the PCA is worked by transforming the feature to a new sub set features of ordered variables. Therefore the first few features retain most of the variations in whole of the all features. The least square decomposition is used by PCA approach for converting linear projection of multivariate high dimensional data onto low-dimensional subspace.The main target of principal component analysis approach is used to discover the orthogonal directions of strong variability in data.The PCA has applied in the present system for dimensionality reduction.It is reduce the features into 64 from all 120 features. These features have more useful information among another features. Given a set of features d-dimensional independent data vectors x_i where $i \in 1,\cdots,n$ the orthogonal projection is executed by

$$Y_t = A^T(x_t - \mu) \quad (1)$$

The transformed data is y where μ is the sample mean of the observe data. The sample covariance matrix is as follows:

$$S = \frac{1}{n}\sum i = 1_{(}^{n} x_i - \mu)(x_i - \mu)^T \quad (2)$$

The reconstruction error is computed by E_r:

$$E_r = \left\| x - \mu - y_{A_q} \right\|^2 \quad (3)$$

2.3. Classification Algorithms

Two classification namely Support Vector Machine and Linear discriminate have applied for recognition purpose.The detailed description of these classifiers is presented [15].

3. Experimental Setup

The proposed system is implemented by using Mat lab R2015 with 64 windows 10 Ultimate with the core i7 processor and 8 GB RAM. In this experiment, table 1 shows the performance of the proposed system. It is observed that the proposed system gives good performance with compare with existing system . To improve the proposed system, it a decision is made to use PCA method. The PCA feature selection method has applied for dimensionality reduction.64 features have been selecting from whole features which has more ranking. The subset features have been employed for classification by using Support Vector Machine and Linear discriminate algorithm. It is observed that the SVM with all features obtained 98.13% whereas (SVM) with PCA method obtained 97.44% . When Linear Discriminate (LD) was applied with all features obtained 99.10 % whereas with PCA 97.98%.Acomparativeanalysisoftheresults obtained on reduced features set and all features are presented. The results shows that the performance of SVM and Linear discriminate classifiers with the reduced attributes PCA is better in cost of time.

Table 1. Results of classifiers for face recognition

Classifiers	Features vector	Time\second	Accuracy (%)
Linear discriminate	All features	164.12	99.10%
	PCA	30.18	97.98%
SVM	All features	198.67	98.13%
	With PCA	69.56	97.44%

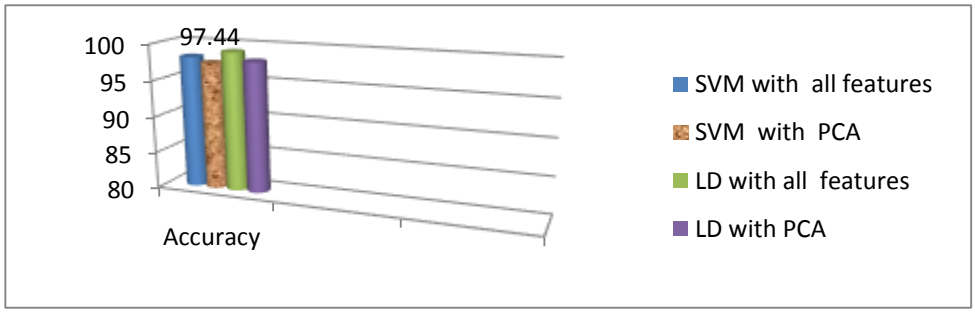

Fig 3: Performance accuracy of proposed system

Figure 3 displays performance of the proposed system in comparison SVM and LD classifiers with all features and with subset feature generated by PCA. Finally, it is concluded that the proposed system can classification face best accuracy.

4. Conclusion

The main target of present study is to develop system for face recognition. In this work Local Binary Pattern (LBP) approach has employed for obtained significant features from face. The LBP method has proven that is influential and effective method for representation features of face. It is investigated that the recognition rate is increase with using LBP. The face has more dimensionality reduction problem in order to improve this dimensionality, PCA method is implemented to remove redundant and irrelevant features for enhancing the classification performance. . The PCA method has selected 64 features most significant subset features from the whole features. The propose system has used theses subset features for face recognition. Support Vector Machine (SVM) and Linear Discriminates (LD) algorithms have proposed for classification obtained features. The empirical results of proposed system is compared. The accuracy of proposed system with all features are 99.10% and 98.13 where as the accuracy with PCA method are 97.988% and 97.44% obtained by LD and SVM classifiers respectively. . It is concluded that the proposed system has outperformed the all features. However, the classifiers with PCA pay of better in cost of time of building the system. In future, the researcher will try to use different types of features extraction methods.

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