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ORIGINAL ARTICLE

ROBUST FACE RECOGNITION USING LBP AND SVM TECHNIQUES

IMRAN I. KAZI AND BABASAHEB J. MOHITE

Asst. Professor
I/C Director
Sinhgad Institute of Business Management(MCA), Kamlapur
Tal:- Sangola Dist:- Solapur, Maharashtra, India

Abstract:

Face recognition is the process of identifying or verifying the identity of person. Face recognition is an important part of many biometric, security, and surveillance systems, as well as image and video indexing systems. Face Recognition Problem is an example of Pattern Classification Problem. Like any Pattern Classification problem, Face recognition also consists of two key points, feature extraction and pattern classification. LBP (Local Binary Pattern) is very simple but efficient texture operator for feature extraction. The feature extraction can be performed using LBP. SVM (Support Vector Machine) is superior classifier than other classifiers such as RBF (Radial Basis Function), k-nearest neighbor, Fisher linear discriminant etc. The pattern classification can be performed using SVM.

KEYWORDS:

SVM, LBP, Face recognition, Feature extraction, Pattern Classification.

INTRODUCTION

Face recognition is a biometric technology to identify or verify the identity of person. It is very popular and useful application of image analysis. An example of face recognition application is identification or verification of person at airport by custom authorities. Face recognition system can replace current identification methods like passwords, ID-cards and even it can replace the other reliable biometric technologies used for identification such as Fingerprint Identification, Iris Identification. Because these methods are dependent on cooperation of participants

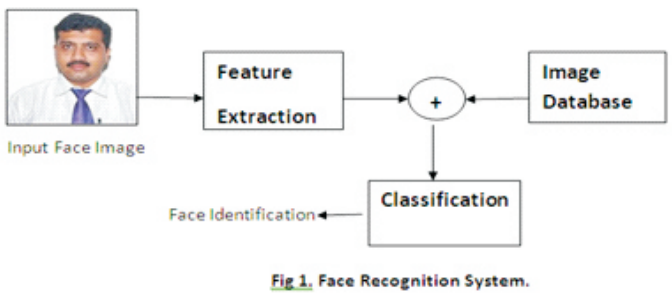

Fig 1. Face Recognition System.

whereas the Identification based on Face image does not depend on participant's cooperation or knowledge.

Fig.1 shows how face recognition system works. There are two main phases in that. In first phase the most useful and unique features are extracted from face image and in second phase with these obtained

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features image is compared with the images in database. This is called as Pattern classification. At this moment already many commercial face recognition systems are in use, they work well in simple environment but they give worst performance when variations in different factors are present, such as facial expressions, pose, viewpoint, time and illumination. In this research paper, we proposed robust face recognition using LBP and SVM.

2. Local Binary Pattern (LBP)

2.1 Why LBP?

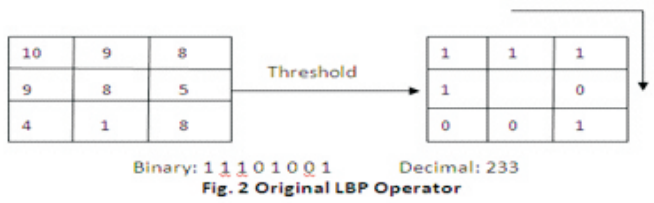

Fig. 2 Original LBP Operator

Later on LBP operator is 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. For neighborhoods the notation (P,R) is used.

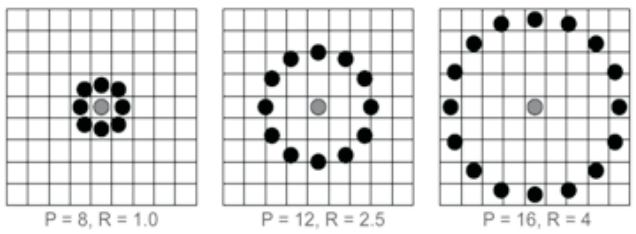

Fig. 3 Circularly neighbor-sets for three different values of P and R.

Fig. 3 shows three neighbor-sets for different values of P and R. Another extension to LBP is to use uniform patterns. A local binary pattern is defined uniform if it contains at most two bitwise transitions from 0 to 1 or vice versa when the binary string is considered circular.

For example, 00000000, 00011110, and 10000011 are uniform patterns and 11001001 and 01010011 are not.

2.3 Feature Extraction using LBP

As we know LBP is straightforward & efficient texture operator which can be used for feature extraction. The main idea here is that for every pixel of an image the LBP code is calculated. The occurrence of each possible pattern in the image is kept up. Once the LBP code for every pixel is calculated then the feature vector of an image can be constructed. For an efficient representation of the face, first the image is divided into K*K regions.

Fig.4 Face image divided into 49 regions, with for every region a histogram.

In Fig. 4 the face image is divided into 7*7=49 regions. For every region a histogram with all possible labels is constructed. This means that every bin in a histogram represents a pattern and contains the number of its appearance in the region. The feature vector is then constructed by concatenating the regional

histograms to one big histogram. The concatenated histogram gives a global description of face.

3. SUPPORT VECTOR MACHINE (SVM)

Support vector machine is a learning algorithm for pattern classification, regression and density estimation. SVMs (Support Vector Machines) are a useful technique for classification. SVMs offer better performance as compared to other classification techniques such as k-nearest-neighbor, Fisher linear discriminant, neural network etc. The basic training principle behind SVMs is finding the optimal linear hyperplane such that the expected classification error for unseen test samples is minimized.

4. FACE RECOGNITION USING LBP AND SVM

In this research paper, we have proposed a method for face recognition. In this method the feature extraction is done by the efficient and simple texture operator called as Local Binary Pattern (LBP). As the LBP does not require training and it is less sensitive to illumination variations in face images, it can be used for feature extraction. So in the first phase the feature extraction is done by using the LBP and feature vector is created. Then in the second phase the classification (face recognition) is done by using supervised classifier called as Support Vector Machine (SVM).

5. STRENGTH OF LBP AND SVM

For feature extraction generally methods like principle component analysis (PCA), Linear Descriminant analysis (LDA)etc. are used. But these feature extraction methods have some limitations like requirement of training; they are sensitive to illumination variation in images on the other hand LBP is simple but efficient technique for feature extraction which don't require training at all and it is less sensitive to illumination variation in images as compare to the traditional feature extraction method.

For pattern classification traditional techniques like Neural Networks, K-Nearest neighbor, linear discriminant etc. were used. SVM is supervised classifier which can be used for pattern classification and it offers better performance as compare to other classification techniques.

6. CONCLUSION

We have proposed a method for face recognition by combining the powerful LBP based face extraction/description with supervised classifier SVMs. The LBPs are simple but efficient for feature extraction. And SVMs are superior than other classifiers. So this face recognition method based on LBP and SVM is robust and offer better performance as compared to other methods.

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