IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 20, Issue 5, Ver. II (Sep - Oct 2018), PP 01-06
www.iosrjournals.org

Texture Based Approach For Face Image Recognition Using Low Resolution Images

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Abstract: *Face recognition based on Euclidean distance and texture feature. A method for face recognition by using the GLCM (Gray Level Co-occurrence Matrix) and texture features. Euclidean distance classifier is used for the matching between the training and testing images. In this paper purpose of the research is to improve the accuracy for the low resolution images. By analysing various approaches for face recognition there is need to develop a new approach which can provide better results using texture features for blurred images.*

Keywords*: EULBP, False Acceptance Rate, False Recognition Rate, Face Recognition.*

Date of Submission: 23-09-2018 Date of acceptance: 08-10-2018

I. Introduction

1.1 Face Recognition: With increased need for reliable authentication schemes, the use of automatic identity verification systems based on biometrics has become widespread. Several airports are now equipped with biometric products. Face and iris recognition systems are among the top choices; because face recognition is friendly and non-invasive whereas iris recognition is one of the most accurate biometrics [7][11]. However, there are a number of practical issues that still need to be solved with both systems. The accuracy of face recognition is affected by illumination, pose and facial expression [15]. In many applications, face identification systems must be robust to these variations. In the case of iris recognition, the user must be cooperative. Further, iris images must meet stringent quality criteria, so the images of poor quality (e.g., iris with large pupil, or off center images) are rejected at the time of acquisition. Consequently, several attempts may be necessary to acquire the iris image, which not only delays the enrollment and verification, but also annoys the user. The rate of rejection of poor quality images is termed as the failure to enroll rate (FTE). Like any other biometric, the iris can change (e.g., as a result of eye disease), in which case, even a very good iris based identification system can fail. Some of the above problems can only be solved, or at least their impact reduced, by fusing several biometric identification systems, such as face and iris recognizers. In general, by fusing several classifiers, the overall error rate (the false accept rate and the false reject rate) is known to go down [6]. This also reduces spoof attacks on the biometric system. The population coverage of a combined system is, in general, larger than the coverage of a standalone biometric, regardless of the accuracy of the latter; people with various disabilities may only be able to provide certain biometrics and not others. Thus, combining classifiers increases the number of people that can use the system. While it is true that a combined classifier requires the user to provide several biometrics during the acquisition stage, the combination of face and iris allows for simultaneous acquisition of face and iris images. Thus, in this particular case, no additional inconvenience is introduced. Finally, the use of the face recognizer in addition to the iris classifier, may allow people with imperfect iris images to enroll, reducing the enrollment failure rate. There has been a substantial amount of work done on the combination of multiple classifiers [8] [13]. Most of such work focuses on fusing 'weak' classifiers, for the purpose of increasing the overall performance. However, the advantages outlined above warrant the combination of existing 'strong' classifiers, for purposes other than increased performance. Not much work has been done in this direction. In this paper we develop a fused face-iris verification system which overcomes a number of inherent dif- ficulties of the standalone classifiers. We compare the results of the combined classifier with the results of the individual face and iris classifiers.

1.2 Challenges In Face Recognition

- **Scale:** The scale of a face can be handled by a rescaling process. In Eigen face approach, the scaling factor can be determined by multiple trials. The idea is to use multi scale Eigen faces, in which a test face image is compared with Eigen faces at a number of scales. In this case, the image will appear to be near face space of only the closest scaled Eigen faces. Equivalently, we can scale the test image to multiple sizes and use the scaling factor that results in the smallest distance to face space.

- **Variation in Poses:** Varying poses result from the change of viewpoint or head orientation. Different identification algorithms illustrate different sensitivities to pose variation.

- **Variation in I luminance:** To identify faces in different illuminance conditions is a challenging problem for face recognition. The same person, with the same facial expression, and seen from the same viewpoint, can appear dramatically different as lighting condition changes. In recent years, two approaches, the fisher face space approach and the illumination subspace approach, have been proposed to handle different lighting conditions. The fisher face method projects face images onto a three-dimensional linear subspace based on Fisher's Linear Discriminant in an effort to maximize between-class scatter while minimize within-class scatter. The illumination subspace method constructs an illumination cone of a face from a set of images taken under unknown lighting conditions. This latter approach is reported to perform significantly better especially for extreme illumination.

- **Facial Expression:** Different from the effect of scale, pose, and illumination, facial expression can greatly change the geometry of a face. Attempts have been made in computer graphics to model the facial expressions from a muscular point of view.

- **Disguise:** Disguise is another problem encountered by face recognition in practice. Glasses, hairstyle, and makeup all change the appearance of a face. Most research work so far has only addressed the problem of glasses.

1.3 Equalized Uniform Local Patterns

Conventional LBP is a very powerful texture descriptor. However, it only employs the difference between the central pixel and its neighbors, and doesn’t make full use of the central pixel. Propose a novel LBP operator which overcomes the above shortcomings of exiting LBP operator. Particularly, aiming at the disadvantage (1), we introduce a double one-dimensional pattern to reduce the dimension of the LBP histogram. Aiming at the disadvantage (2), we consider the effect of the central pixel of the local region. Furthermore, in order to improve the robustness to small perturbation (deformation) due to face expression, we introduce the Image Euclidean Distance (IMED) [9] and embed it in EULBP. The features extracted by EULBP embedded with IMED (EULBP-IMED) have several advantages, such as much low dimensionality and high discriminative power. Experiments on two well-known face databases show that our proposed method is superior to the conventional LBP and uniform LBP.

II. Review Of Literature

Jian Yang, YongXu and Jing-yu Yang [8] proposed an algorithm the works same as that of the 2DPCA in this method the coefficients are more than that of the PCA. So this leads the slow classification speed and large storage requirements for large scale database. In this algorithm to overcome this problem the 2DPCA compression is done twice the first one in horizontal direction and second one in the vertical direction. By using this approach classification speed of the algorithm increases and the storage requirements decreases for the large scale databases. In the whole process, the first 2DPCA transform B=AU performs the compression of 2D-data in horizontal direction, making the image energy pack into a small number of columns. While the second 2DPCA transform C=transpose of V*B performs the compression of 2-D data in vertical direction, eliminating the correlations between columns of image Band making its energy further compact into a small number of rows.

O. D_eniz, M. Castrill on, M. Hernandez [9] proposed a combination of two techniques used in the face recognition. Support vector machines (SVM) and independent component analysis (ICA)are two powerful and relatively recent techniques. SVMs are classifiers which have demonstrated high generalization capabilities in many different tasks, including the object recognition problem. ICA is a feature extraction technique which can be considered a generalization of principal component analysis (PCA). ICA has been mainly used on the problem of blind signal separation. In this technique the combination of these two techniques for the face recognition problem is used. Experiments were made on two different face databases, achieving very high recognition rates. As the results using the combination PCA/SVM were not very far from those obtained with ICA/SVM, our experiments suggest that SVMs are relatively insensitive to the representation space. Thus as the training time for ICA is much larger than that of PCA, this result indicates that the best practical combination is PCA with SVM.

Alessandro L. Koerich, Luiz E. S. de Oliveira [10] proposed a new technique 2DPCA using coefficients. The results reported using 2DPCA techniques have demonstrated that it has an enormous potential as feature extractor for face recognition. However, the main drawback is the high number of coefficients produced. In this method author propose to use a feature selection algorithm to analyze and to discard coefficients that are not relevant to the face recognition task. Experimental results on the ORL and the Yale databases have shown that the number of coefficients extracted by the 2DPCA can be reduced in about ten times while improving recognition rate.

Yue ZENG, Dazheng FENG, Li XIONG[11] proposed a new approach for symmetry of face, the Characteristic of PCA (Principal Component Analysis) and 2DPCA (2-Dimensional PCA). It is proved that the covariance matrix of 2DPCA is equivalent to the average of the main diagonal of PCA and the covariance of 2DPCA eliminates some covariance information that is useful for recognition. An algorithm of face recognition based on the variation of 2DPCA (V2DPCA) is proposed which make the most useful of the discriminate information of covariance, and use the fewer coefficient to representing an image. Experiments on the ORL and YALE face bases show improvement in both recognition accuracy and recognition time over the original 2DPCA, and are also superior to the traditional Eigen faces, ICA (Independent Component Analysis) and Kernel Eigen faces in terms of the recognition accuracy.

III. Methodology

Face recognition is the process that has been used for recognition process on the basis of features. Face features have been extracted from the images on the basis of feature extraction approach. In the proposed work texture features have been used for recognition process. Texture features provide information about the different aspects of the face view. In the process of face recognition various processes has been executed that has been illustrated below.

- **Image acquisition**

In the first process of face recognition face image has been acquired by using image acquisition toolbox. Image has been stored in the memory so that image pixel values can be used for extraction of features from the image.

- **Preprocessing**

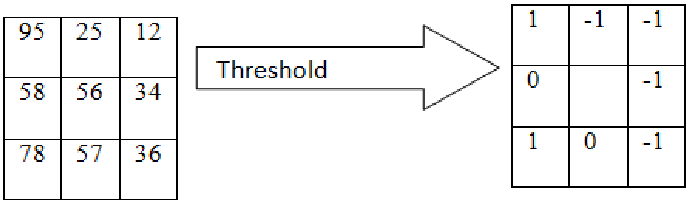
After process of image acquisition image pre-processing has been done that has been done to resize image and convert image into gray scale so that texture features from gray scale image can be extracted in efficient manner. After conversion of the image into gray scale image various pre-processing tools have been implemented so that filtration and noise removal process can be done and normalized image can be extracted and used for feature extraction.

- **Feature extraction**

Texture features based on LBP are used for face recognition provided highly discriminative features for texture classification. LBP was proven high accuracy during variation in lightening effects and pose variations. But due to negligence of center pixel value in computation of feature subspace this prone to sensitive to noise, particular uniform regions and smooth weak illumination gradients. So to overcome these effects a novel approach had been purposed that use a threshold value for computation of feature subspace. This approach use center pixels information in the feature vectors so that improved features can be evaluated from uniform regions. In this process of 3-valued code has been generated for feature sub space. These codes have been known as local ternary codes. In this process three valued codes that are -1, 0 and 1 has been assigned as a label for pixels available in the window. After this process these codes have been divided into upper ternary codes and lower ternary codes so that feature values from these codes can be evaluated.

$$s'(u, I_c, t) = \begin{cases} 1, & if\ u \geq I_c + t \\ 0, & if\ |u - I_c| < t \\ -1, & if\ u \leq I_c - t \end{cases} \qquad (1)$$

Where t is user defined threshold value that has been used for computation of ternary codes for a patch of face image.



Ternary code: 1(-1)(-1)(-1)(-1)010

Fig 1 Ternary code using IELUBP

After implementation of IELUBP on image patch ternary code that contains positive and negative value has been generated this code has been converted into upper and lower codes so that feature vector has been generated. (Shown in fig 2)

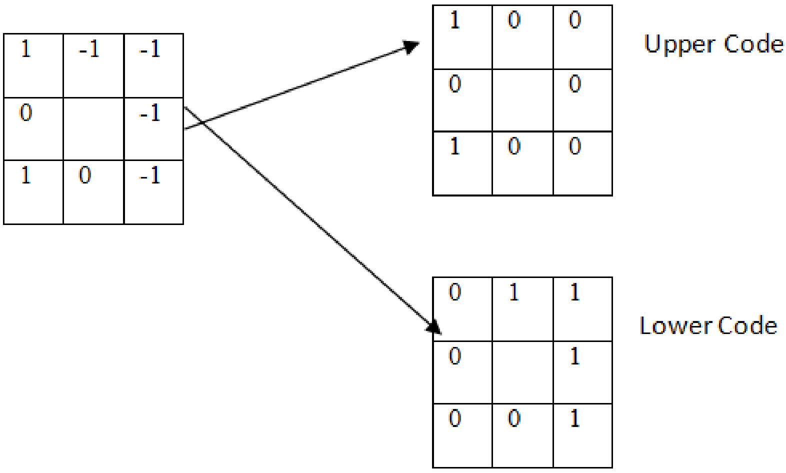


Fig 2 Separation of IELUBP code to Upper and Lower Codes

These codes have been concatenated for all the patches of the image so that feature vector can be developed that can be used for recognition process using chi-square distance classifier. On the basis of distance classifier matching between dataset images to query image has been done.

IV. Results

In the face reorganization various images has been taken to develop a biometric authentication system. Various images have been used for the authentication process .In this Image textile feature has been extracted using IEULBP approach. In this approach the textile feature is calculated using mask that move on each region of the image and histogram calculated of the entire region to develop feature vector. Feature matrix is developed using feature calculation of all the images. These features are matched with the features of the database images that are stored in the mat file. These features have been matched on the basis of the chi-square classifier which is used to find out the matrix distance between the two feature matrixes of the input image. This classifier calculates the distance between the input image feature matrix and database images feature matrix. This classifier calculates the distance between input image feature and each database image feature matrix. A matrix of the distance between all the database images and input image is created. From this matrix of distance calculated the min distance with which image is found that will the most matched image with test image.

In this work after the completion of recognition process the parameters for the performance evolution has to be calculated. The parameters FAR (False Acceptance Rate) and FRR (False Rejection Rate) are calculated by using different number of images for the datasets and testing sets. These parameters provide information about the performance of the system. The less will the FAR of a system and more be the FRR of the system assured a secured biometric system. The more secure system can be implemented for the security applications and surveillance systems. On the basis of these parameters the purposed system is compared with the existing systems.

The results of purposed system have been comparing with the existing approach for face recognition. The purposed system provides the more recognition rate and more accuracy than the existing based face recognition system.

- **Accuracy**

Accuracy is calculted on the basis of matched images and mis-matched images from the databse. In this the all the images of database at different resolutions has been tested for martching with database images. On the basis of the mismatching the accuracy of one system has been computed. Total 160 images has been taken for testing of purposed sytem out of 400 face images. The test for calculation of matched and mismatched images has been done by using both Equilized Uniform Local Binary Pattern approach and LBP approach at different resolutions.

Table 1 Matched Images Using IEULBP approach

Resolution of Test Image	Total Test Images	No. of Matched Images	No. of Mis-matched Images
112 X 92	160	146	14
64 X 64	160	148	12
32 X 32	160	142	18

Table 1 illustrate the no of images that matched with database images and the no. of images that have been mis-matched with database images. This test has been performed by using Equilized Uniform Local Binary Pattern approach on the face recognition system.

Table 2 Matched Images Using EULBP approach

Resolution of Test Image	Total Test Images	No. of Matched Images	No. of Mis-matched Images
112 X 92	160	136	24
64 X 64	160	140	20
32 X 32	160	135	25

Table 2 illustrate the no of images that matched with database images and the no. of images that have been mis-matched with database images. This test has been performed by using Local Binary Pattern approach on the face recognition system.

The accuracy of the perposed system is computed by analysing best match done by purposed work. Thw no of matched images has been computed by using proposed approach. These images has been tested at different levels of resolution. These images has been tested at low resolution and at high resolution.

Accurarcy=[100-(Mis-match Images/Total test images*100)]

Table 3 Comparision Table of Accuracy

Resolution of Test Image	IEULBP	EULBP
112 X 92	91.25 %	85 %
64 X 64	92.50 %	87.5 %
32 X 32	88.70 %	84.37 %

Table 3 illustrate the accuracy given by different approaches of face recognition. Accuracy has been computed on the basis of the different resolution of images has been taken for performance evolution of the system for low resolution images

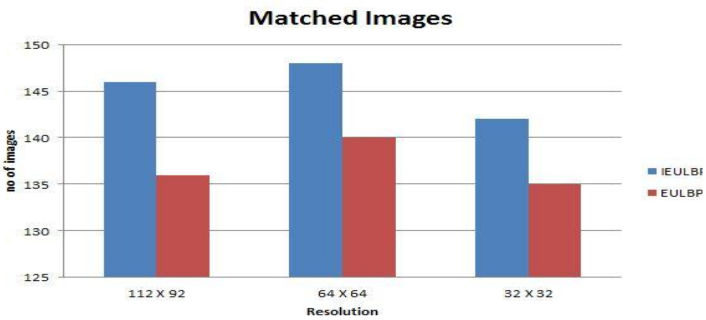


Fig 3 Matched images froom 160 test images

This figure reppresents total succesfully matched images that provide similar matching in face recognition system. 160 images have been tested for face recognition process that has been done using IEULBP and EULBP approach. On the basis of these approaches proposed approach has high number of facial images that matched accutaly with dataset images.

V. Conclusions

As Biometric trend is increasing in the security, surveillance and identification applications. The much faster and better recognition method has to be used for these applications. But the change in light, poses effect the face recognition accuracy and the recognition rate. This is major concern to increase the recognition accuracy and the recognition rate. By applying the EULBP approach for face recognition the conclusion represents that these approaches provide better performance than that of the PCA, ICA approaches. These approaches takes less time for the computation and the storage required for the coefficients of the covariance matrix is less as compare to the PCA. Feature extraction by using the EULBP approaches is easy and accurate than PCA. The recognition accuracy and recognition rate is better by using these approaches.

References

[1]. Anil K. Jain, Fellow, IEEE, Arun Ross, Member, IEEE, and Salil Prabhakar, Member, IEEE-An Introduction to Biometric Recognition. IEEE journal January 2004.
[2]. Kyungnam Kim "Face Recognition by using Principal Component Analysis" International Journal of Security and Its Applications
[3]. Pong C. Yuen, J.H. Lai "Face representation using independent component analysis" the journal of Pattern Recognition society, Pattern Recognition volume 35 (2002) Page No.1247–1257.
[4]. Jian Yang, Davis Zhang, Alejandro F. Frangi and Jing Ju Yang "Two-Dimensional PCA:A New Approach to Appearance-Based Face Representation and Recognition" IEEE Transactions On Pattern Analysis And Machine Intelligence, Vol. 26, No. 1, January 2004
[5]. Timo Ahonen, Abdenour Hadid, and Matti Pietikainen "Face Description with Local Binary Patterns: Application to Face Recognition" IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 28, No. 12, December 2006.
[6]. Niloofar Amani1, Asadollah Shahbahrami2 and Manoochehr Nahvi1 "A new approach for face image enhancement and recognition", International Journal of Advanced Science and Technology Vol. 52, March, 2013.
[7]. Dong-Ju Kim, Sang-Heon Lee and Myoung-Kyu Sohn "Face Recognition with Local Directional Patterns" International Journal of Security and Its Applications Vol. 7, No. 2, March, 2013
[8]. Jian Yang ,Yong Xu and Jing-yu Yang "Bi-2DPCA: A Fast Face Coding Method for Recognition"
[9]. O. D_eniz *, M. Castrill_on, M. Hern_andez: "Face recognition using independent component analysis and support vector machines"
[10]. Alessandro L. Koerich, Luiz E. S. de Oliveira " Face Recognition Using Selected 2DPCA Coefficients" IWSSIP 2010 - 17th International Conference on Systems, Signals and Image Processing
[11]. Yue ZENG, Dazheng FENG, Li XIONG "An Algorithm of Face Recognition Based on the Variation of 2DPCA" Journal of Computational Information Systems 7:1 (2011) 303-310
[12]. A.M. Martinez and R. Benavente, "The AR Database" CVC Technical Report, no. 24, June 1998.
[13]. A. Georghiades, P. Belhumeur and D. Kriegman, "From Few to Many: Illumination Cone Models for Face Recognition under Variable Lighting and Pose", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 23, no. 6, **(2001)** June, pp. 643-660
[14]. T. Sim, S. Baker and M. Bsat, "The CMU Pose, Illumination, and Expression Database", IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 25, no. 12, **(2003)** December, pp. 1615-1618.

IOSR Journal of Computer Engineering (IOSR-JCE) is UGC approved Journal with Sl. No. 5019, Journal no. 49102.

Heena Goyal " Texture Based Approach For Face Image Recognition Using Low Resolution Images" IOSR Journal of Computer Engineering (IOSR-JCE) 20.5 (2018): 01-06.