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LBP Based Fusion of Face and Iris Images using Support Vector Machine

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ABSTRACT
In this paper proposed system to perform face and iris features are extracted by using local binary pattern (LBP) feature extraction algorithms, which generates the training dataset and testing dataset that contain root mean square, mean square, and Euclidean distance. Face feature and iris feature are first extracted respectively and fused in feature-level. Then support vector machine (SVM) classifier is used for the classification stage .Performance was measured for both verification and identification scenarios. Support Vector Machines (SVMs) have been recently proposed as a new technique for pattern recognition. In this paper, the SVMs with a binary tree recognition strategy are used to tackle the face and iris recognition problem. We illustrate the potential of SVMs on the Cambridge of ORL face database and IIT Delhi iris database.
Keywords – Face, Iris, LBP, Feature extraction, SVM.

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I. INTRODUCTION

In recent year it's difficult to stay your data secure, there are possibilities because it is accessible by anybody. As the day passes information is getting to be increasingly unreliable to supply more information security we can take offer assistance from progress security frameworks like multibiometric framework. And can be controlled with unimodal or multimodal biometric frameworks, as they perceive an individual uniquely.

BIOMETRICS is the measurement of biological data. The term biometrics is commonly used today to refer to the autheticatiction of person human characteristics is the best solution compared to others authentication. Since many physical and behavioral characteristics are unique to an individual, biometrics provides a more reliable system of authentication than ID cards, keys, passwords, or other traditional systems. The word biometrics comes from two Greek words and means life measure. To provide a comprehensive survey, we not only categorize existing biometric techniques but also present detailed of representative method within each category. Any characteristics can be used a biometric identifier if (1) every person possesses the characteristics, (2) it varies from person to person, (3) its properties do not change considerably over time and(4) it can be measured manually or automatically. Physical characteristics commonly used in biometric authentication include face, fingerprint, handprint, eyes, and voice. Biometrics authentication can be used to control the security of computer network, electronic commerce and banking transactions, and restricted areas in office buildings and factories. It can help prevent fraud by verifying identities of voters and holders of driver's license or visas. In authentication, a sensor captures a digital image of the characteristics being used to verify the user's identity. A compute program extracts a pattern of distinguishing features from the digital image. Another program compares this pattern with the one representing the user that was recorded earlier and stored in the system database. If the patterns match well enough, the biometric system will conclude that the person is who he or she claims to be. Biometrics is the specialized term for body estimation and calculations and broadly utilized for programmed confirmation of human. Biometrics identifiers are frequently categorized as physiological versus conduct characteristics. Face and iris acknowledgment frameworks are among the best choices; since face recognition is inviting and non-invasive though iris acknowledgment is one of the most precise biometric. In a multibiometric framework, two or more person biometric modalities are combined together to shape a secure and superior execution framework. Individual recognizable proof plays an exceptionally vital part in get to of physical offices like buildings, air terminalss or to get to offices like ATM or asset in a computer framework. Passwords, Stick, shrewd cards were the conventional strategies of get to control, which are not exceptionally secure as it can be copied, misplaced or stolen

II. LITERATURE SURVEY

The fusion of face and iris modalities is a biometric approach that has gained increasing attention over the past decade, likely due to the popularity of the individual modalities, as well as the natural connection between them. Despite this recent trend, very few studies have been done on fusion of face and iris biometrics from a single sensor. The most common method of multi-biometric fusion is score-level fusion. Zhang et al. approach the problem of fusing face and iris biometrics under near-infrared lighting using a single sensor [24]. Frontal face images are acquired using a 10 megapixel CCD camera. Eye detection and face alignment are performed using Local Bit Pattern histogram matching as described in Li et al. [9]. The eigen face algorithm and Daugman’s algorithm are used to perform face and iris recognition, respectively, and score-level fusion is accomplished via the sum and product rules after min-max normalization. Numerous other score-level fusion approaches have been tested on chimeric datasets. Chen and Te Chu use an unweighted average of the outputs of matchers based on neural networks [4]. Wang et al. test weighted average, linear discriminant analysis, and neural networks for score fusion [22]. Another common approach to biometric fusion is feature-level fusion through concatenation. Rattani and Tistarelli compute SIFT features for chimeric face and iris images and concatenate the resulting feature vectors [14]. The number of matching SIFT features between two vectors (measured by Euclidean distance) is used as a match score for that comparison. Son and Lee extract features for face and iris images based on a Daubechies wavelet transform [18]. Concatenation is used to form a joint feature vector, and Euclidean distance between feature vectors is used to generate match scores. The Multiple Biometrics Grand Challenge (MBGC) provided a collection of face and iris data to researchers in order to provide a standard tested for comparing matching and fusion techniques [12],[13]. The MBGC data included a subset of the near-infrared videos used in the experiments being presented in this chapter, as well as face stills, high-quality color face video, iris stills, and iris video. In general, results showed that fusion of face and iris biometrics offered improved accuracy over either biometric alone. The near-infrared videos released as part of the MBGC are also used by Yang et al. [23]. Yang et al. investigate the use of SIFT features to perform alignment between the partial faces present in the dataset in order to facilitate face matching, but do not incorporate these results into a multi-biometric experiment.

III. FUSION OF FACE AND IRIS

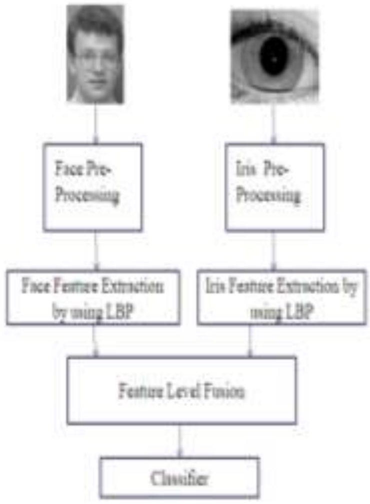

Figure 1. The Framework of the proposed system

a) face recognition

A facial recognition methodology is a way to automatically verify person by matching his digital image with the database of images. Nowadays the security of person, information or assets is becoming more difficult and important. The crimes like credit card misuse and computer hacking or security breach in organizations are increasing day by day. The face recognition technology is a branch of biometrics through which the humans are identified [1]. To implement the face recognition in this research work, we proposed the Local Binary patterns methodology. Including face recognition and face detection. Initially, face research focused on face recognition. Face as a biometric feature is less reliable due to variations in illumination conditions, poses, and expressions. 3D facial recognition methods resolved the reliability issues like pose change and lighting. Segmentation groups pixel into regions, thereby definings the boundaries of the region of interest. Feature extraction and selection provides the measurement vectors. Feature extraction is followed by presentation or classification and is performed by estimating diff erent features of the segmented region.

LBP

In this chapter will be explained how the LBP-method can be applied on images (of faces) to extract features which can be used to get a measure for the similarity between these images. The main idea is that for every pixel of an image the LBP-code is calculated.

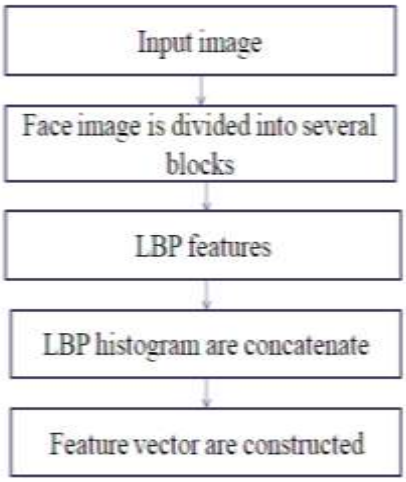

Figure 2: flowchart of LBP

There exist several methods for extracting the most useful features from (preprocessed) face images to perform face recognition. One of these feature extraction methods is the Local Binary Pattern (LBP) method. This relative new approach was introduced in 1996 by Ojala et al. [5]. With LBP it is possible to describe the texture and shape of a digital image. This is done by dividing an image into several small regions from which the features are extracted (figure1.2). These features consist of binary patterns that describe the surroundings of pixels in the regions. The obtained features from the regions are concatenated into a single feature histogram, which forms a representation of the image. Images can then be compared by measuring the similarity (distance) between their histograms. According to several studies [2, 3, 4] face recognition using the LBP method provides very good The occurrence of each possible pattern in the image is kept up.

For avoid non-face part in the image.

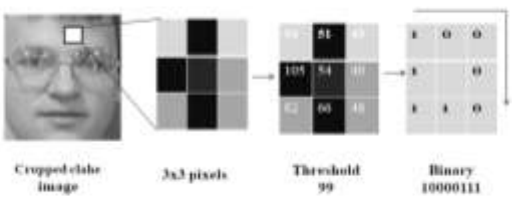

Figure 3: LBP computation

$$LBP(X_C,Y_C)=\sum_{P=0}^{7}S(g_P-g_C)2^P,\ S(X)=\begin{cases}1, X\geq 0\\ 0, X\leq 0\end{cases}$$

LBP code obtained by using this formula

g_P=central pixel

g_C=neighborhood

$$LBP(X_C,Y_C)=\sum_{P=0}^{7}f(g_P-g_C)2^P,\quad f(X)=\begin{cases}1, X\geq 0\\ 0, X\leq 0\end{cases}$$

For,

g_7 =94, f(94-54), f(40) =1 b7=1

g_6 =51, f(51-54), f(-3) =0 b6=0

g_5 =43, f(43-54), f(-11) =0 b5=0

g_4 =40, f(40-54), f(-10) =0 b4=0

g_3 =48, f(48-54), f(6) =0 b3=0

g_2 =66, f(66-54), f(12) =1 b2=1

g_1 =82, f(82-54), f(28) =1 b1=1

g_0 =105, f(105-54), f(51) =1 b0=1

Figure 4: LBP coded block

b) Iris recognition

Iris recognition is a biometric technology for identifying humans by capturing and analyzing the unique patterns of the iris in the human eye.[1] Iris recognition can be used in a wide range of applications in which a person's identity must be established or confirmed. In the iris pre-processing there are two important steps are 1)iris localization/segmentation and 2)iris normalization.

In the iris localization and segmentation:-The first stage of iris recognition system is to isolate the actual iris region in a digital eye. The purpose of iris localization is to localize an acquired image that corresponds to an iris.to localize the eye with a series of steps, by using of this algorithm with circular Hough transform(CHT) and canny edge detection can achieve good results. The first step in iris localization is to detect the pupil, which is the black circular part surrounded by iris tissues. As pupil is the largest black area in the intensity image, its edges can be detected easily from the binarized image by using suitable threshold on the intensity image. To specify the unwanted region of an iris image, canny edge detection is presented with different threshold values between 0.2 to 0.7. The range of radius values set manually and the values of the iris radius range from 85 to 140 pixels, while pupil radius ranges from 25 to 74 pixels. The eyelids and eyelashes are normally occluding the upper and lower parts of the iris region. Eyelids and eyelashes are isolated from the detected iris image by considering them as noise because they degrade the performance of the system.

Iris normalization:- Daugman's Rubber Sheet Model is used for iris normalization in this study. Daugman has designed a rubber sheet model (See figure 3-14) which aims to reset each point inside the iris region on a pair of polar coordinates (r, θ), where r ranges from [0, 1], and θ ranges from [0, 2π].

$$I\left(x,(r,\theta),y(r,\theta)\right) \rightarrow I(r,\theta)$$

With

$$x(r,\theta) = (1-r)x_p(\theta + rx_1(\theta))$$ &

$$y(r,\theta) = (1-r)y_p(\theta + ry_1(\theta))$$

Where I(x, y) is the iris region image, (x, y) are the original Cartesian coordinates, (r, θ) are corresponding normalized polar coordinates, and xp, yp and xl, yl are the coordinates of the pupil and iris boundaries along the θ direction. For normalization of iris regions, a technique based on Daugman's rubber sheet model was employed in the proposed system. The centre of pupil was considered as the reference point and radial vectors pass through the iris region (Masek, 2003).

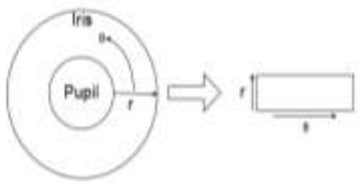

Figure 5: Daugman's Rubber Sheet Model

Iris feature extraction by using LBP, LBP approach has become a popular technique in feature extraction field from the patterns, because of its computational simplicity and it has a discriminative power, therefore; it performs analysis on the patterns in real time settings. On other hand, the most important attribute of the LBP approach in its applications is its ability to control in gray-scale changes, such as illumination variations. The LBP texture analysis operator is defined as a gray-scale invariant texture measure derived from a general definition of texture in a local neighborhood. A LBP code for an eight neighborhood of a pixel is produced by multiplying the threshold values with weights given to the corresponding pixels and summing up the result. Since the LBP, by definition was invariant to monotonic changes in gray scale, it was supplemented by an orthogonal measure of local contrast. The average of the gray levels below the center pixel is subtracted from that of the gray levels above (or equal to) the center pixel. The 256 bin histogram of the labels computed over an image can be used as a texture descriptor. Two dimensional distributions of the LBP and local contrast measures are used as features. Each iris images can be considered as a composition of micro-patterns which can be effectively detected by the LBP operator.

Fusion of face and iris by using SVM(Support Vector Machine)

feature level fusion

In feature level fusion, the data obtained from each biometric modality or sensor is utilized to compute a multimodal feature vector. The feature vector obtained from different biometric modality can be concatenated to produce a new feature vector. The result new feature vector is high dimensional vector having more feature information of decision requirement.

After the feature level fusion, the multimodal feature vector Let x and y be a set of input feature vector and the class label respectively. The pair of input feature vectors and the class label can be represented as tuples {xi,yi} where i =1,2,…,N and y =±1 . In the case of linear separable problem, there exists a separating hyperplane which defines the boundary between class 1 (labeled as y = 1) and class 2 (labeled as y = -1). It is the property which equips SVM with a greater ability to generalize itself to solve various classification problems, which is the basic goal in statistical learning. Initially SVM was developed only for classification problems but later on, it has extended to regression also. In comparison to the other classifiers, SVM has provided better performance.

IV. EXPERIMENT AND RESULT:-

The goal of in our approach LBP feature of face and iris image is extracted and matching using SVM classifier. In this approach we take few images to train SVM classifier. The key to successful multibiometric system is in an effective fusion scheme. The goal of fusion is to determine the best set of experts in a given problem domain and devise an appropriate function that can optimally combine the decisions rendered by the individual experts. So we employ an efficient fusion of two biometric traits; iris and fingerprint since they are the two unique biometric trait of any individual. Even though each of the traits is unique we are accepting the fusion of two because in order to overcome the fraudulent attack we need an efficient system.

The LBP is applied for detected face regions. Now histogram is computed independently for face regions as a uniform texture features. The number of rotation invariant uniform LBP texture features occurrences is measured for each of the bin. It was observed that, each bin has discriminative texture histogram value for different expressions. The histogram bin values have excellent discriminative variations for each of the expression. For our proposed system we had selected LBP and Global feature extraction methods. Face features are extracted using Local binary Pattern (LBP) for SVM classification technique.

For feature of face are root mean square , mean square and distance in between two histogram i.e.(input image histogram and output image histogram).

Table 1:calculations of the face features values

Image	LBP code	RMS	Mean	distance
Image 1(112*92)	60	366.9373	1.3429e+05	5.8632e+03
Image 2(112*92)	14	364.5290	1.3288e+05	5.834e+03
Image 3(112*92)	124	370.9367	1.3759e+05	5.9350e+03
Image 4(112*92)	28	368.8574	1.3606e+05	5.9017e+03
Image 5(112*92)	2	366.0123	1.3397e+05	5.8562e+03
Image 6(112*92)	60	360.8555	1.3045e+05	5.7789e+03
Image 7(112*92)	254	366.4780	1.3431e+05	5.863e+03
Image 8(112*92)	58	359.9660	1.2957e+05	5.7594e+03
Image 9(112*92)	30	363.4973	1.3213e+05	5.8160e+03
Image 10(112*92)	242	370.6433	1.3738e+05	5.9303e+03

For iris :-After the completion of the normalization process for iris part, iris pattern is ready for feature extraction stage. Extracting features from the iris image is the most important stage in iris recognition system; especially this system depends on the features that are extracted from iris pattern. Extracting the feature by using LBP. These approaches differ from each other in terms of method of extracting features. The iris has a particularly interesting structure and provides abundant texture information. In order to recognize the individuals accurately, the most discriminating features that present in the region must be extracted. Only the significant features of the iris must be encoded. After LBP is computed , a set of histogram features is computed together for LBP to construct the feature vector. LBP code is obtained from the reference and test iris image are compared using the normalized Euclidean distance.

Table 2 calculations of the iris features values

Image	LBP code	Circle of pupil	Circle of iris	distance
Image 1 (320*240)	94	(145,132,43)	(148,130,103)	0.1991
Image 2 (320*240)	0	(121,156,50)	(123,153,110)	0.0621
Image 3 (320*240)	254	(109,182,32)	(110,178,113)	0
Image 4 (320*240)	2	(103,155,43)	(128,155,115)	0.0746
Image 5 (320*240)	252	(78,162,47)	(103,150,100)	0.0377
Image 6 (320*240	238	(122,140,70)	(80,158,108)	0.0701
Image 7 (320*240)	226	(107,177,48)	(108,158,103)	0.0538
Image 8 (320*240)	100	(135,155,43)	(108,175,103)	0.1334
Image 9 (320*240)	224	(117,120,48)	(113,118,108)	0.0610
Image 10 (320*240)	254	(94,152,33)	(88,150,108)	0.0326

Features Extraction & Classification

In this module, the classification of features is done by using the feature values. All the face and iris features are calculated and stored in a feature vector. The feature vectors of all the trained images are labeled by its class and stored in a .mat file. The new feature vector of test image is compared with the stored feature vectors & finally according to the labeled class. Output of the feature level fusion algorithm is first converted to LIBSVM format. Now SVM model RBF kernel is selected, After this grid search in cross validation is done to find the best parameter values are C& γ. We are finding the true positive, true negative, false positive , false negative by using the confusion matrix. Confusion matrix is a table is often used to describe the performance of a classification model on the set of test data for which true values are known

Class no1	Accuracy	Precision	F1_score	Sensitivity	Specificity
Class 1	1	1	1	1	1
Class2	1	1	1	1	1
Class 3	1	1	1	1	1
Class 4	1	0.975	0.9657	1	1
Class 5	1	1	1	1	1
Class6	0.966667	1	1	0.96667	1
Class 7	0.96667	1	0.8	0.96667	0.9629
Class 8	1	0.975	0.9657	1	1
Class 9	1	1	1	1	1
Class 10	1	1	1	1	1

V. CONCLUSION

This chapter presents an investigation into the fusion of face and iris biometrics from a single sensor, a surprisingly understudied problem in current literature. The previously described multi-biometrics framework utilizes multi-sample, multi-instance, and multi-modal fusion techniques to improve recognition rates from a single sensor. The recognition accuracy obtained for fusion of face and iris using SVM is 96.67% we achieved higher percent of accuracy.

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