MULTIMODAL BIOMETRIC RECOGNITION USING USING HUMAN EAR AND PALMPRINT

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ABSTRACT: In this paper, we proposed fusion of ear and palm print recognition approach at feature level. Combining multiple human trait features is a proven and effective strategy for biometric-based personal identification. Ear and palm print patterns are characterized by a rich and stable structure, which provides a large amount of information for discriminating individuals. Local texture descriptors, such as local binary patterns, Weber local descriptor, and binarisedstatistical image features, it uses a method to extract the discriminant features for robust human identification.

Keywords: Biometric, Ear andPalm print

I. INTRODUCTION

A biometric system is a mainlyillustrationof pattern recognition system which recognizes a user and determining the authenticity of a precise anatomical or behavioral function possessed via the user. Numerous critical issues should be considered in designing a realistic biometric device [1]. Template is securely stored in a central database. This template is used for matching, when person needs to be recognized. Depending at the context, a biometric gadget can perform either in authentication or an identity mode.

Biometric systems deployed in the real word programs are unimodal, which depend upon the evidence of single source of data for authentication including fingerprint, face, voice, palm print andFinger Knuckle Print. These structures are risky of type of troubles including of noisy facts, intra elegance variation, inter class similarities, non-universality and spoofing. That leads to extensively high false attractiveness price and False Rejection Rate, limited discrimination capability, top bound in overall performance and shortage of permanence. Some limitation imposed by unimodal biometric structures can be overcome by using including a couple of assets of information for putting in identity.

Those structures allow the combination of two or more forms of biometric structures referred to as multimodal biometric systems. Because of multiple independent biometrics, systems are more reliable.

It deployed to design safety and decrease financial fraud. Some application uses biometric trait to acquire better safety and to deal with failure to sign up situations for some clients. Biometric authentication is the have a look at of strategies for spotting humans primarily based on one or greater physical or behavioral trends [3]. Palm print is a unique biometric characteristic and palm print recognition is more attracting because of its attributes along with high accuracy, high speed, high consumer friendliness and low cost, there's lots room to improve the palm print systems.

II.RELATED WORK

Nabil Hezil, Abdelhani Boukrouch proposedMultimodal biometric recognition using human ear and Palm print[1], combining more than one human trait is a proven and effective method for biometric primarily based personal identification. In which, authors look at the fusion of two biometric modalities, that is ear and palm print. Ear and palm print patterns are characterized by using a wealthy and stable structure.

Javier Vıa, Ignacio Santamarıa and Jesus Perez proposed Canonical correlation analysis algorithms for multiple data sets application, the biometric identity structure, input records compared with each entry records in the database. That exhaustive matching procedure extended the response time of the gadget, the rate of errorless identity. In that proposed technique, the input biometric information became first matched in opposition to a small set of reference pics. The set of resulting match rankings became used as an index code.

Shutao Li, Dayi Gong, Yuan Yuan “Face recognition using Weber local descriptors"[3],have proposed a biometric fusion using palm print and face photograph. Biometrics based totally non-public identification become seemed as a powerful approach for automatically recognizing, with an excessive confidence identity. The system designed for program and training facts contains face and palm print.

Mamta, Hanmandlu, M"Multimodal biometric system built on the newentropy function for feature extraction and the refined scores as a classifier[4], presents multimodal biometric system. Comprising IR, ear face, to cater for surveillance applications proposed new entropy function. In this paper author proposed a Refined Score method to handle the erroneous code. Entropy feature show good performance.

Ross, A., Jain, A.K "Multimodal biometrics: an overview"[5], discussed about unimodal biometric system. Unimodal biometric systems have some problems. Overcomes the problem of unimodal biometric system deploying multimodal biometric system.

Jing, X.Y., Zhang proposed"A face and palm print recognition approach based on discriminant DCT feature extraction"[6], discrete cosine transform (DCT) and linear discrimination these two technique are widely used for image processing and recognition. This paper present a new palm print and face recognition approach and it improve the recognition rates for face and palm print data and reduce the dimension.

Xu,Y.,Lu,Y"Adaptive weighted fusion: A novel fusion approach for image classification"[7], designed an adaptive weighted fusion approach. Adaptive weighted fusion approach automatically determines optimal weights and no any manual settings are used. This paper shows the proposed system approach very simple and easy.

Jing, X.Y , Yao, Y.F , Zhang, D , ″Face and palmprint pixel level fusionand Kernel DCV-RBF classifier for small sample biometric recognition" [8], proposed a novel fusion approach for image pixel level. In which combines two type of biometrics and then perform Gabor transform on biometrics. This paper shows that the proposed biometric fusion recognition approach is an effective solution for small recognition problem.

Ross, A "Fusion, feature-level", in "Encyclopedia of Biometrics"[9], presented a novel technique to present fusion of two biometrics modalities face and hand geometry.Selecting this feature set typically requires the use of dimensionality reduction methods and, therefore, feature-level fusion assumes the availability of a large number of training data. Feature-level fusion algorithms can also be used for template update or template improvement.

III.PROPOSED SYSTEM

3.1. Proposed work

As we have proposed a multimodal biometric recognition system which is combination of ear and palm.

3.1.1 Palm print

The palm print recognition machine consists four stages:

Palm print Preprocessing, function extraction and matching as shown in Fig 1. Feature extraction obtains discriminating features from the preprocessed Palm prints. The matching compares the captured image features with the saved templates.

The inner part of a palm image is considered as palm print. It includes ridges, minutia, principle line, delta points and rich palm print texture in abundance. These features are assumed to be stable and unique. Binary featuresare extracted using several textures as well as statistical and structural properties. Stability of palm print features is not yet critically studied.

Advantages:Palm print can be captured using the low cost sensorsin a touch-less manner. The extracted palm ROI is large and contains discriminative and unique features.

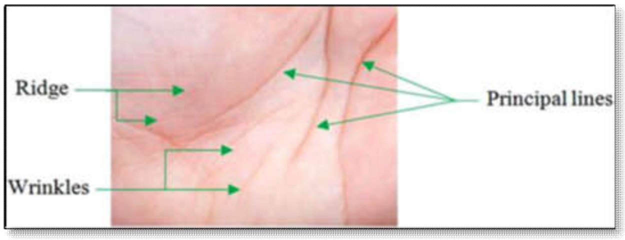

Fig 1. The human Palm print

Features of Palm print:

A Palm consists of Principal lines: The heart line, the life line and the head line.

- Regions: Finger-root (I), inside region (II) and outside region (III)
- Datum points: End-points across the palm and their mid-point.

Other features:

- Geometry features:Width of the palm, length of the palm and the area of the palm.
- Wrinkle features:These are lines other than the principal lines. They tend to be thinnerand more irregular. They are classified as coarse wrinkles and fine wrinkles.
- Delta point features: These are defined as the center of a delta-like regionin the palm print.
- Minutiae features: similar to finger print type of features.
- Datum point determination: To locate the endpoints of each principal lines.

In general, the geometry features, principalline features and wrinkle features can be obtained by some image processing techniques from the image.

3.1.2Ear print

Like other biometric traits, ear print contains robust, unique and discriminative line based features. In an ear recognition system, ear is segmented from the raw profile face image. Features obtained from ear are matched against those and stored in database. The major disadvantage of ear is the occlusion which occurs due to hair or any other foreign body such as ear ring, cap,ear phones etc.

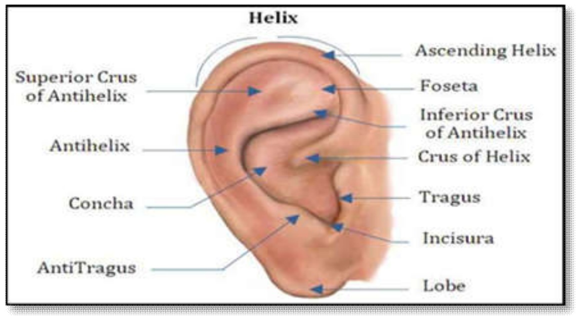

Fig 2. The human ear

External ear canal or acoustic or auditory meatus.Some ears have nicely shaped lobes, whereas othershave almost none.Researchers have recently investigated the use of 2D and 3D ear shape. Ear has a precise structure similar to the face. As shown in Fig 2the form of the ear tends to be dominated by the outer rim or helix, and additionally the shape of the lobe. There's also an inner helix or antihelix which runs roughly parallel to the outer helix but forks into branches on the top extremity. The inner helix and the lower of those branches form the top and left side of the concha, named for its shell like appearance. The bottom of the concha merges into the very typical intertragic notch. Observe also the crus of helix wherein the helix intersects with the lower branch of the antihelix. This is one of the factors used by Iannarelli as a reference point for his measurement machine, the other point being the antitragus or the little bump at the left of the intertragic notch.

3.2 Proposed flow of system

3.2.1 Image Preprocessing

Capturing the data of the palm print and ear, preprocessing is formed on image. In data pre-processing stage, image data are pre-processed to make it noise free or clearer for feature extraction process. Image processing is the technique that would enhance image quality for preparing images for measurement of the present features.

Feature extraction is observed through pre-processing. We are converting image into gray scale image which is input to the local binary descriptors. These functions are helpful for identification or verification of character.

3.2.2 Feature Extraction

In feature extraction stage from preprocessed image features are extracted to make the recognition task easier as well as accurate. Extracted features are then stored in the database for the database images, which will be used to match with the features of the input image to search the similar image.In this we are using 3 techniques for feature extraction.

We have extracted features of both biometric. We will get LBP (Local Binary Pattern) feature from images. This is a texture feature algorithm. We get the array of this feature from image.

After this we will use WLD (Weber local descriptor) feature from images. This is a texture feature algorithm. This work on each pixel to getting neighbor values.

Finally, we will use BSIF (Binarised statistical image features) feature from images. This feature gives encode each pixel to get the binary string as result.

3.2.3 Feature Fusion

Canonical correlation analysis (CCA) and the serial feature fusion (features concatenation) methods.CCA is a powerful statistical analysis technique, which has been widely used to explore the relationships between two multivariate sets of variables. Finally the fusion of all the three feature which are already calculated.

3.2.4 Classification

KNN(K-Nearest Neighbour) is a classifier. This work on finding nearer value based on training data. On the basis on training and testing file we get the result.

Step 1: Calculate Similarity based on distance function.

There are many distance functions but Euclidean is the most commonly used measure. It is mainly used when data is continuous. The idea to use distance measure is to find the distance (similarity) between new sample and training cases and then finds the k-closest customers to new customer in terms of height and weight.

Step 2: Find K-Nearest Neighbours:

Let k be 5. Then the algorithm searches for the 5 customers closest to Test data, i.e. most similar to Test data in terms of attributes. Then we calculate the distance of each data to test data. The result will be found with data which has highest match value.

To measure the distance between points A and B in a feature space, various distance functions have been used in the literature, in which the Euclidean distance function is the most widely used one. Let A and B are represented by feature vectors $A = (x_1, x_2, \dots, x_m)$ and $B = (y_1, y_2, \dots, y_m)$, where m is the dimensionality of the feature space. To calculate the distance between A and B, the normalized Euclidean metric is generally used by

$$dist\,(A,B) = \sqrt{\frac{\sum_{i=1}^{m} (x_i - y_i)^2}{m}}$$

SVM (Support Vector Machine): Support Vector Machine” (SVM) is a supervised machine learning algorithm which can be used for both classification and regression challenges.A classification task usually involves with training and testing data which consist of some data instances.Each instance in the training set contains one target values and several attributes. The goal of SVM is to produce a model which predicts target value of data instances in the testing set which are given only the attributes.Classification in SVM is an example of Supervised Learning. Known labels help indicate whether the system is performing in a right way or not. This information points to a desired response, validating the accuracy of the system, or be used to help the system learn to act correctly. A step in SVM classification involves identification as which are intimately connected to the known classes. This is called feature selection or feature extraction. Feature selection and SVM classification together have a use even when prediction of unknown samples is not necessary. They can be used to identify key sets which are involved in whatever processes distinguish the classes.

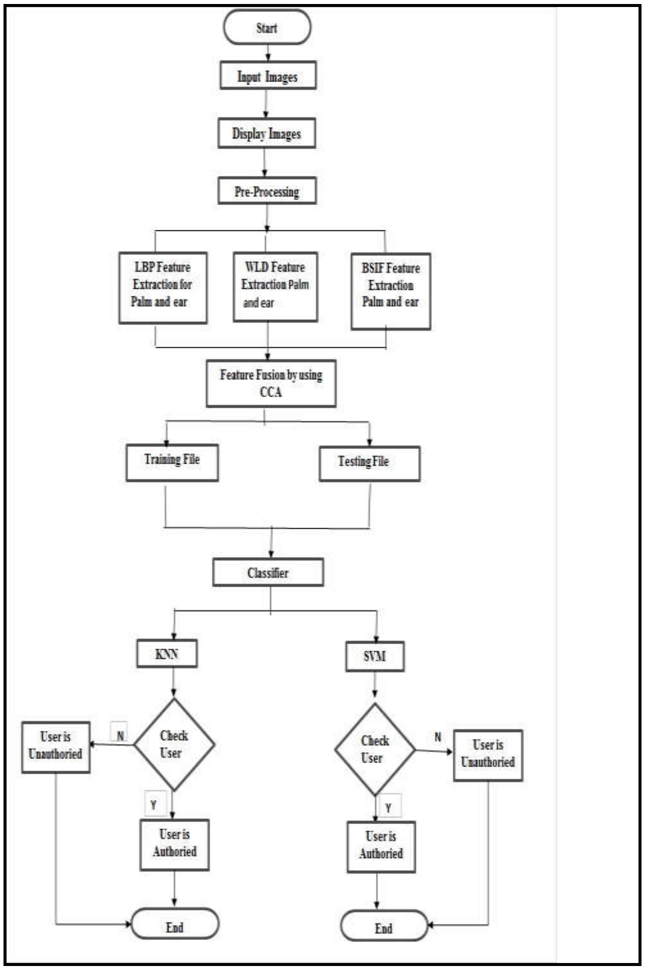

Fig 3. Flowchart of Multimodal System

3.3 Algorithm

3.3.1 LBP (Local binary patterns):

LBP are designed for monochrome still images[1].

Step 1: Calculate LBP code for each pixel x in original image

Step 2: Define a constant T=1, 2,8 that is used to count the total number of neighbor pixels, which the gray Value equivalent or larger than that of center pixel;

Step 3: Then we define a variable Num to record real number of neighbor pixel that have been stated in step 2.

Step 4: If Num $\geq$ T, each site in the code we have obtained in step 1 is set as 0, otherwise, the code remains Unchanged.

Step 5: Finally we obtain spectrum for all training samples.

3.3.2WLD (Weber Local Descriptive): We used a WLD for extraction according to the characteristics ofimages[1].

Step 1: Input: Image I.

Step 2: Compute its differantial excitation α , $\alpha \epsilon [-\frac{x}{2}, \frac{x}{2}]$.

Step3: Compute the linearly quantified differantial excitation ξ_i .

Step 4: Compute is gradient oriantation θ , $\theta \epsilon [-\frac{x}{2}, \frac{x}{2}]$.

Step 5: Map θ to θ' , $\theta' \epsilon [0, 2\pi]$

Step 6: Compute the linearly quantified orientation ψ_j .

Step7:Construct the 2D concatenated histogram$\{WLD(\xi_i, \psi_j)\}$

and then encode it into 1D feature vector H.

Step 8: Output: the WLD feature vector H

3.3.3 BSIF(Binarised statistical image features):

Step 1: Encodes each pixel of the given biometric image in terms of binary strings based on the pre-learnt filter response.

Step 2: Presents encouraging results for comparing the texture in natural images.

Step 3: Recognition of faces.

Step 4: An image X of size l × l pixels and a linear filter*Wi*of the same size, the filter response *Si*is obtained by

$s_i = \sum_{u,v} W_i(u,v) \times (u,v)$…………… (1)

3.3.4 CCA(Canonical Correlation Analysis):

Wewill use CCA algorithm for fusion of the two modalities [2].

Step 1: Initialize $P_k(0) = \delta^{-1} I$, with$\delta \ll 1$ for $k = 1, \ldots, M$.

Step 2:Initialize $h^{(i)}(0), c^{(i)}(0) = 0$ and $p^{(i)}(0) = 0$ for $i = 1, \ldots, p$.

Step 3:For $n = 1, 2 \ldots,$ do

Step 4:Update $K_k(n)$ and $p_k(n)$with $x_k(n)$ for $k = 1, \ldots, M$.

Step 5:For $i = 1, \ldots . p$ do

Step 6: Obtain $z^i(n) \tilde{z}^{(i)}(n)$and $e^{(i)}(n)$

Step 7:Obtain $\beta^i(n) h^{(i)}(n)$ and update $c^{(i)}(n)$

Step 8:Estimate $\beta^i(n) = \| \beta^{(i)}(n) h^{(i)}(n) \|$ and normalize $h^i(n)$

Step 9:End for

Step 10:End for

IV. RESULTS AND DISCUSSIONS

4.1 Multimodal Biometric Database:

The performance of the proposed system was assessed by conducting the experiments on database. The ear images were selected from the benchmark IIT-Delhi-2 database. The IIT Delhi database consists of ear images collected from students and staff at IIT Delhi campus, India. All the images were acquired from a distance in an indoor environment. The currently available database contains data from 120 palm and 70 ear images for training and 48 image of palm and 24 image of ear for testing dataset. The subjects are in the age range of 14 to 58 years. The resolution of the palm images is 1600 ×1200pixel and ear image is 300 × 400 pixel and Image format is .jpg.

The Experimental Results are as follows:

As we have proposed 3 features extraction techniques.

We have found accuracy results of LBP, WLD, BSIF and CCA Fusion with KNN and SVM classifier. Firstly, we extract LBP features from all i.e. from two palm images and one ear image and then perform CCA fusion and calculate result with both KNN and SVM classifier.

Second, we extract WLD features from all i.e. from two palm images and one ear image and then perform CCA fusion and calculate result with both KNN and SVM classifier.

Third, we extract BSIF features from all i.e. from two palm images and one ear image and then perform CCA fusion and

Calculate result with both KNN and SVM classifier.

Finally, Features are extracted from LBP, WLD, BSIF, we obtain single feature vector, which is more compact and more discriminative, and this method can reduce extra computation and also provide improvement in accuracy. And Calculate result with KNN and SVM classifier.

Performance accuracy of palm and ear recognition with respect to KNN and SVM is shown in Table 1

Table 1: Accuracy of Palm print and Ear Recognition

Algorithm	**KNN Accuracy (%)**	**SVM Accuracy (%)**
Local Binary Pattern(LBP)	62	81
Weber local Descriptor (WLD)	75	90
Binarised Statistical Image Feature(BSIF)	72	91
CCA Fusion	70	92

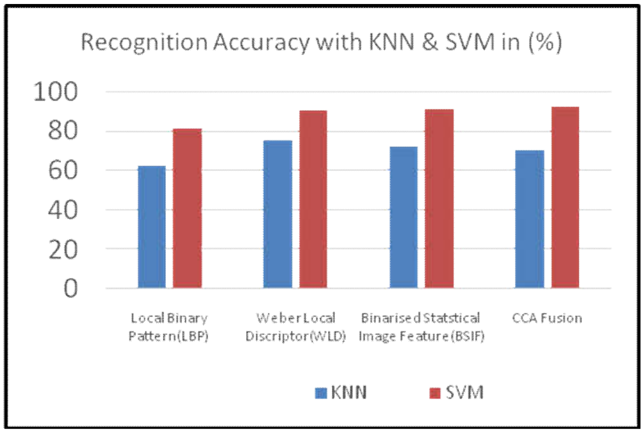

Fig 4: Recognition Accuracy with KNN & SVM in (%)

Also, we have calculated recognition time in milliseconds for each algorithm with KNN and SVM classifier. Time required for recognition is shown below in Table 2.

Table 2: Time Required For Palm print and Ear Recognition

Algorithm	KNN (ms)	SVM (ms)
Local Binary Pattern(LBP)	45	15
Weber Local Descriptor(WLD)	28	7
Binarised Statistical Image Feature(BSIF)	49	11
CCA Fusion	44	17

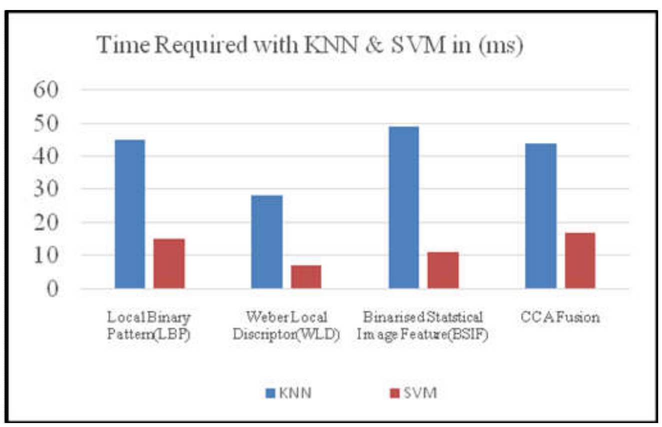

Fig 5 : Time Required with KNN & SVM in (ms)

V. CONCLUSION

In this paper, we have proposed an approach for multimodal earand palmprint biometric recognition using local texture descriptors namely LBP, WLD and BSIF. The advantageof fusion at this level is that existing and proprietarybiometric systems do not need to be normalized or modified.The main goal of project to prove that design a system that achieves the desired performance when using two types of biometrics.With CCA fusion with KNN gives 70% accuracy with time 44 milliseconds and CCA fusion with SVM gives 92% accuracy with time 17milliseconds. SVM gives greater accuracy in less time.

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