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A Review On Palmprint Recognition

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Abstract— Palmprint biometric is said to be stable, unique and reliable personal characteristics. Palmprint recognition is to identify the person using palm. Palmprint-based biometric systems have less distortion, rich features, and easy self-positioning [1]. The recognition of palmprint consists of high accurate recognition rate along with fast processing speed. This paper discusses about the research works based on various palm print recognition. The study on palm print recognition focuses on verifying the palm print as follows: Palm print fusion, Authentication, Verification, Preprocessing. An introduction of palm print feature and several approaches used in low resolution images are studied and biometric features such as palm vein, face, iris, hand shape fused with palmprint are mentioned. Various palm print authentication methods are compared based on texture, line and appearance approaches. For recognition purpose verification methods are also studied.

Keywords— Fishers linear discriminant , Gabor filter, Independent component analysis, linear discriminant analysis, Principle component analysis.

I. INTRODUCTION

The palm contains rich features such as creases, ridges, minutiae, principal lines and creases. The palm print contains three flexion creases, called principal lines and the secondary creases called wrinkles. The palm print features of identical twins are said to be different [2]. Palm print can be classified as either high resolution or low resolution images. High resolution images are used in forensic applications to detect criminal, it refers to 400 dpi or more. The features such ridges, singular points and minutia points are extract from high resolution. Low resolution images are used in civil and commercial applications, it refers to 150 dpi or less. The principal lines, wrinkles and texture are extract from low resolution images. Many approaches are used in low-resolution palm print recognition such as texture based, palm line based, subspace learning based, orientation coding based, correlation based, local image descriptor based, and multi-feature based.

Wrinkles and ridges are the features associated with palm print. The geometry features in the palm are area length, width. Based on stability and uniqueness, different individuals are been distinguished .In the palm print the thin and irregular lines and curves are said to be different from principal lines of wrinkle. Delta point features, geometry, datum points are the distribution of palm print features. The delta region in the palm print are located in outside and root region. Measurability, universality, uniqueness, permanence, circumvention, acceptability and performance are the properties of palm print [37].

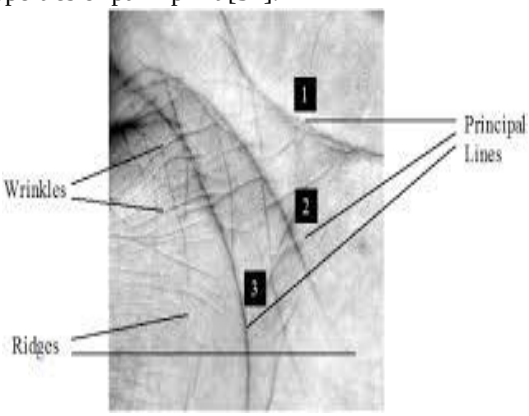

Fig1:Inner surface of palm

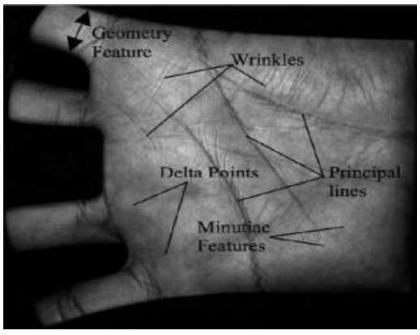

Fig2:Palmprint features

Basically recognition system consists of palm print scanning, preprocessing, feature extraction, matcher and database. The palm print scanner collects palm print images and preprocessing is used to align palm print images. Feature extraction is used to obtain effective features from preprocessed palm prints. A matcher compares two palm print features and a database stores registered templates. The rest of this paper is organized as the follows. Section II reviews preprocessing, section III lists palm print authentication, section IV palmprint related fusion, Section V lists verification algorithm, section VI lists future work, Section VII conclusion.

II. PREPROCESSING

The palmprint images are aligned and segmented using preprocessing. Preprocessing involves five steps, binarising the palm images, extracting the contour of hand and fingers, detecting the key points, establishing a coordination system

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and extracting the central parts. Preprocessing is also used to crop the region of interest for feature extraction and correct distortions. When capturing a palm print image, its direction, stretching degree and position, vary from time to time.

In order to align the palmprints [36], we define a right-angle coordination system, which is based on three key points between fingers. Palm print image preprocessing consist of five steps, they are: i)A low -pass filter is applied to the original image. Then threshold is used, to convert the original image into binary image. A Gaussian filter is used to smooth the binary map. ii) Boundary tracking algorithm is used to extract the boundaries of the holes, between fingers. iii) The center of gravity of each hole is computed. iv)Line up key points *k1* and *k2* to get the Y-axis of the palm print coordinate system and make a line through their mid point which is perpendicular to the Y-axis, which is used to determine the origin of the coordinate system. V) On the basis of coordinate system a sub image is extracted with the fixed size.

III. Method For Palm Printauthentication

The palm print authentication method is been classified into three approaches texture based, line based, appearance based. The texture based approach uses the method such as Gabor filter [16,17], Laws mask[18], Discrete Fourier transform [19],Discrete cosine transform [20] Wavelets.The line based approach uses the method such Line matching [21], Line detection [22], Crease detection [23]. The Appearance-based approach uses the method such as Principal component analysis [24], Linear discriminant analysis [25].

The texture features extracted using Gabor filters have been successfully employed in palmprint verification, fingerprint classification, handwriting recognition. An even-symmetric Gabor filter is a Gaussian function modulated by an oriented cosine function which is used in spatial domain. The feature extracted based on line based approach said to be powerful and provide high accuracy. The line detectors are used to find palm print creases and lines oriented at each of the four directions. The four images are combined by voting of gray-level magnitude from corresponding pixel position. The combined image represents the combined directional map of palm-lines and creases in the palmprint image. The information content of palm print image also consists of certain local and global features that can be used for identification. This information can be extracted by registering the variations in an ensample of palmprint images, independent of any judgment of palm print lines or creases. The Principle component analysis (PCA) which generates a set of orthonormal vectors that can optimally represent the information in the training dataset.

A 2-D Gabor filter is used to obtain texture information and two palm print images are compared in terms of their hamming distance. Palm print authentication has several advantages: 1) low-resolution imaging; 2) low intrusiveness; 3) stable line features and 4) high user acceptance. Palm print authentication system can operate in two modes, enrollment and verification [38]. In the enrollment mode, a user is to provide several palm print samples to the system. The samples are captured by our palm print scanner and passes through preprocessing and feature extraction to produce the templates stored in a given database. In the verification mode, the user is asked to provide his/her user ID and his/her palm print sample. Then the palm print sample passes through preprocessing and feature extraction. The extracted features are compared with templates in the database belonging to the same user ID. Gabor filter, Gabor filter bank, Gabor transform and Gabor wavelet are widely applied to image processing, computer vision and pattern recognition.

IV. Palmprint Related Fusion

In multimodal biometric system, the information obtained from each individual is fused [6,7]. Fusion approach increases the accuracy of systems. Here many biometric traits including fingerprint, palm vein, finger surface, face, iris, and hand shape have been combined with palmprints at score level. Combining other hand features such as hand geometry and finger surface with palm prints allows these features and palm prints to be extracted from a single hand image. Fusion of Palm print and Face[3], palm print inner surface containing minutiae points and principle lines[5], ridges apart from these features eigen palms [8], fisher palms [4,9] and 2D Gabor phase encoding are used. Fishers linear discriminant(FLD) [30] is an efficient approach to extract the algebraic features that have strong discriminability. FLD, is based on linear projections, seeks the projection directions that are advantageous for discrimination.

For palmprint recognition, the palm images are first preprocessed which involves gaussian smoothing and contrast enhancement. the two stable points, known as hand contour, which is the gap between the little finger and the ring finger, and the gap between the index finger and the middle finger are found . Hexogonal area is determined based on the stable points of contour. For face recognition the eigen faces [10], fisher faces [10] and also support vector machines [12,11] and elastic graph matching [13]. Face normalization consists of geometry normalization, background removal and lighting normalization which uses histogram fitting [14]. The eigen face technique based on the K–L transform applied to a set of facial images. The fusion is performed at the matching-score level. The palm print-matching scores and the face-matching scores come in different ranges, a normalization has to be performed before they are combined.

Feature of hand shape and palm print [15], the palm print and hand-shape recognition has only emphasized on feature extraction and classification. Feature subset selection used for better performance with small number of features. The binary image depicting hand shape and gray-level region of interest (ROI) depicting palm print texture. The features which is been extracted from palm print and hand-shape images are concatenated and normalized before being fed into the classifier. The palm print matching is performed using texture-based, line-based, and appearance-based methods. The discrete cosine transform (DCT) are used for the purpose of

data compression, feature extraction, and recognition. Hand-shape representation is features based on geometrical information.

Fusion can be classified into three levels [39]. They are fusion at the feature extraction level, fusion at the matching score level and fusion at the decision level. In the feature extraction level, the data obtained from each sensor is used to compute a feature vector. The features extracted from each individual is said to be different. The feature reduction technique is used to extract features from the larger set of features. In the matching score level, each system provides a matching score indicating the proximity of the feature vector with the template vector. In the Fusion at decision level, multiple biometric data can be captured and the resulting feature has been classified into Each sensor can capture multiple biometric data and the resulting feature are classified into two classes, they are accept or reject.

In the score level fusion, matching score are said to be increased in performance. The performance of Sum, Max, and Product rules on the matching scores from the palm print and hand-shape was observed that the performance of these three fusion strategies gives different results. The two hands palm print matching score enhance the score level performance. Using, sum rule the palm print matching scores are consolidated. These consolidated matching scores are combined hand-shape using Product [28s].

V. Verification Algorithm:

For recognition purpose verification algorithms are used, which is been classified into line-based approaches, subspace-based approaches and statistic-based approaches. In the line based approaches [34], the palm lines are extracted using edge detection. It consist of first order derivative and second order derivative, both can be obtained by rotating two standard marks. Second order derivative consists of magnitude of lines. Wrinkles are included in the edge map, the principle lines are dependent. The subspace based approaches, use independent component analysis (ICA)[35], principal component analysis (PCA) and linear discriminant analysis (LDA).Here the coefficients of subspace are regarded as features. In the statistic based approach, use either global or local statistical approaches. In Local statistic approaches, the images are transformed into another domain and divide them into several small regions. The methods such as Gabor, wavelets and Fourier transforms have been applied. In the Global statistical approaches, from the transformed images extract the features. Moments, centers of gravity and density have been regarded as the global statistical features.

The tangential angles between the principal lines and the extended skeletal lines are considered as features. The root mean square deviation is used to measure the differences between two features. The line profiles from preprocessed palm prints and three fingers and wavelets to compute low frequency information. The Gabor filters are used to assign line-content scores to different regions of palm prints.

A specific number of regions with top line content scores are selected to train correlation filters [31]. The optimal tradeoff synthetic discriminant function (OTSDF) filter used as a classifier. To optimize verification performance, several user-specific techniques are used such as user specific segmentation and user-specific threshold. The Band-limited phase-only correlation (BLPOC) is used to compute the similarity of two images [32].BLPOC only considers low to middle frequency information. An complex-wavelet structural similarity (CW-SSIM) index for measuring the local similarity of two images. The overall similarity of two palm prints is estimated as the average of all local modified CW-SSIM [33].

Coding approaches encode the filter coefficient as feature using Gabor filters. Palm code uses a single Gabor filter to extract the local phase information of palm print. Palm code and fusion code employ quantized phases as features and the hamming distances as matches. The first version of competitive coding scheme uses multiple two dimensional Gabor filters to extract orientation information from palm lines. This information is then stored in a feature vector called the competitive code.

The angular distance is used for comparing two codes. The three orientation coding-based algorithms [26] are Comp Code, POC and RLOC. The features which is been extraction from a palm print image, contain particular information about the orientation of palm lines, usually involves the application of a group of filters with different orientations. Different orientation coding-based palm print verification approaches have used different filters. Comp Code has used the Gabor filter, POC has used directional templates, and RLOC has used MRFAT.

Feature extraction plays an important role in image identification and verification. There are many features exhibited in a palm. There are three principal lines caused by Flexing hand and wrist in the palm, which are named as heart line, head line and life line. Line features include both curves and straight lines. So far there have been many methods proposed to detect lines [29].To extract principle lines of palm print, edge detection technique is used which detects strip line segment. The non-linear filters can be used to detect thin vertical lines and the extension of these filters can be applied to extract both thick and horizontal lines.

TABLE 1: Comparison of various authentication methods

APPROACHES	PALM PRINT FEATURES	COMPONENT ANALYSIS
Line based approach	Palm lines	First and Second order derivative
Subspace based approach	Subspace coefficient	PCA,LDA,ICA
Local statistical approach	Minutiae points, ridges	Gabor, wavelets and Fourier transforms
Global statistical approaches	Moments, centers of gravity and density	Gabor, wavelets and Fourier transforms
Coding approaches	Filter coefficient	Gabor filter

VI. FUTURE WORK

The multi biometric systems are the fusion of two or more single biometric systems. Due to the presence of multiple independent features these systems are expected to be more reliable.The multi biometric systems consist of several advantages such as greater flexibility and security, good accuracy. In the proposed system, construct a palm print and retinal based multi biometric cryptosystem (MBC). Triangulation is used for dividing a region of space into multiple smaller triangular regions which is applied for both palmprint and retinal images. By using this Delaunay Triangulation method, the feature vectors are extracted from path palm print and retina. In first level encryption the templates are transformed. To form a transformed template, the hash function is applied. If the length of H1(.) is l, we can use fuzzy vault Vsub to bind the transformed template Trans (SVT) with a sub-key. As the sub-keys will be used as the input of the second level secure sketch. The proposed MBC provides stronger security and better authentication accuracy.

VII. CONCLUSION

In this paper, the various existing methods used for palm print recognition system have been reviewed. Palmprint recognition is an emerging field and new methods have been introduced to reduce the error rates to improve the accuracy and speed of the system. Fusion approach increases the accuracy, in which the biometric features obtained from each individual is fused. In the future work, the palm print and retina features can be fused to provide better accuracy and security. Since the crypto-biometric system will be resilient to many attacks such as man-in-middle attacks, known- key attacks, replay attack etc, this approach provides an effective solutions by ensuring better security using cryptographic key during message transmission over an insecure network channel.

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