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Various Feature Extraction Techniques in Palmprint Authentication System: A Review

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ABSTRACT: The solar inverter is made up of thousands of components that's why it is very complex. Nearly 80% of losses come from a switching device and AC inductors. One of the most critical components within PV inverter is this "switching device" or semiconductor device being used to perform DC to AC conversion. Historically, the solar industry has relied on MOSFET for this device. The MOSFET is the heart of the PV inverter where power conversion really takes place. Efficient conversion of DC power to AC requires the inverter to store energy from the panel while the grid's AC voltage is near zero, and then release it again when it rises. This requires considerable amounts of energy storage in a small package. The MOSFET is the heart of the PV inverter where power conversion really takes place. We have design the high efficient MOSFET based solar converter. We design this converter with the help of MOSFET and diodes. This implementation is done by using MATLAB Simulink. By changing the internal parameters we improve the efficiency of the system i.e. 98.18%.

KEYWORDS: Biometric recognition system, security, authentication, Palmprint recognition.

I. INTRODUCTION

A pattern-recognition system is used for identification or authentication of users based on their unique physical properties [1]. Biometric systems provide different types of benefits than conventional authentication techniques such as ID card systems [2]. In conventional verification or verification systems like ID cards or passwords have been allocated for users to recognize them uniquely. These techniques are contained in a variety of applications such as border security, time or attendance control, online web applications, airport security, online banking, security of restricted areas, etc. However, these different varieties of recognition techniques have some disadvantages. The passwords or ID cards are not too much secure for all applications which are modified by strangers. This will start the need for enhanced and high-security techniques in recognitions or authentication systems, and it has been resulting in biometric related systems [3].

In information technology, in particular, biometrics is used as a form of access control. Biometric systems are becoming the basis of extremely secure identification and individual verification solutions [4]. With an increase in level of security violates and transaction frauds, the need a greatly secure identification and verification is becoming clearly. The major benefit of biometric system over conventional techniques is that they are normally unique for each person and cannot be forged [5]. Since, compare to other advanced technologies the function of biometric systems are stronger to preserve the security of citizens. Biometrics is used as recognition systems that identify an unknown person or as verification systems that authenticates an individual by comparing one exact pattern stored in the database.

In general, all the recognition techniques in biometric systems are classified into three types namely physiological, behavioural, and chemical [6]. In this, physiological biometric systems include Fingerprint recognition, Palmprint recognition, Facial expression recognition, Iris recognition, Hand geometry recognition. The behavioural biometric systems include Signature, Voice and Keystrokes recognition. Among that physiological biometric systems due to use of inherent features are more reliable [7]. Seven factors that involve on a physiological characteristic received as a biometric feature such as universality, uniqueness, circumvention, acceptability, permanence, collectability and

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performance [8]. In biometrics there are two types of identity matching are established namely identification and verification. Identification is a one-to many relationship of an individual's biometric model against a pattern database of before gathered samples. Authentication refers to a one-to-one comparison between a previously obtained template of a person and a sample which desire to authenticate.

Among the various types of biometric techniques, palmprint recognition is one of the most trustworthy techniques [9]. Palmprints have several advantages compare to other hand-based biometric technologies, for instance fingerprints and hand geometry. Counterfeiting or forging a palmprint is very complex when compare to a fingerprint because the palmprint texture is more complicated. Palmprint is unique, easily captured by low resolution apparatus and includes additional features such as principal lines, wrinkles and ridges [10]. Hence, it is appropriate for everyone and it does not need any personal information of the user. In general, Palm is the inner surface of the hand between the wrist and fingers which includes three flexion creases (principal lines), wrinkles, ridges, minutia points and singular points. The three major principal lines are genetically dependent; most of other lines are not dependent [11]. Even identical twins also have different palmprints. These non-genetically deterministic and difficult patterns are very useful in personal identification.

II. LITERATURE REVIEW

Normally a palmprint recognition system can be grouped as below: palmprint scanner, pre-processing, feature extraction and matcher [12]. Pre-processing is a placement of co-ordinate system to adjust the palmprint images, and to separate a division of the palmprint for feature extraction. Feature extraction is to implement proficient features from the pre-processed palmprints. Finally, a classifier or matcher calculates the two features of palmprint. Research on feature extraction and matching algorithms are classified such as Line based, subspace based, Statistical based and coding based techniques which includes transform domain, principal component analysis, texture features and hybrid feature extraction.

A) Transform domain features

A frequency domain feature extraction scheme for palm-print recognition is proposed in [13], which effectively increases the local spatial deviations in a palmprint. The whole image is segmented into some narrow width spatial bands and a palm-print recognition approach is implemented based on extracting dominant spectral features from each of these bands using two-dimensional discrete cosine transform (2D-DCT). The proposed dominant spectral feature selection algorithm provides a benefit of low feature dimension and it is competent of capturing exactly the detail variations within the palm-print image, which results in a very high within-class density and between class separability of the extracted features.

A real time personal recognition based on Fourier transform (FT) for palm-print recognition is presented in [14]. A hand gesture segmentation approach is implemented first and after the segmentation, a adapted Fourier transform are utilized for processing of the image. Machine learning based trainings are developed to obtain the palm print training database. A spectral feature extraction algorithm is used for palm-print recognition, which is effectively capturing the detail spatial deviations in a palm-print image in [15]. The image is divided into several narrow-width bands and the task of feature extraction is processed in each band using two dimensional Fourier transforms. It was shown that the proposed dominant spectral feature extraction procedure is capable of capturing the variation.

A contactless Palmprint recognition using palm print principal line-based feature extraction approach has been presented [16]. The distinguish Palmprint features are extracted from a pre-processed obtained images using easily accessible and low cost camera. Distances two endpoints and point of interception to endpoints were calculated and transformed to frequency domain by the application of Discrete Fourier Transform approach. The extracted K-points DFT coefficients has been used as the discriminating features for identification and classification purposes using correlation method, power spectral matching and Euclidean distance based matching.

A technique is proposed for palmprint identification using Transform Domain and Spatial Domain Techniques (PITS) in [17]. Histogram equalization is used on palmprint to improve contrast of an image. The DWT is applied on

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Histogram equalized image to create LL, LH, HL and HH bands. The LL band is transformed into DCT coefficients using Discrete Cosine Transform. QPCA is applied on DCT coefficients to produce features. The analysis and training database palmprint features are compared using Euclidean Distance based matching algorithm.

An approach high palmprint recognition performance algorithm based on the dual tree complex wavelet transforms (DT-CWT) and compressed sensing (CS) is proposed [18]. Initially, DT-CWT which offers both approximate shift invariance and good directional selectivity is engaged to denote the palmprint image with better preserving the differentiable features with fewer redundant and computationally proficient. Then, the Principal Component Analysis, based on linearly projecting the image sub-band coefficients space to a low dimensional feature subspace, is applied to extract the feature of the palmprint images.

An improved square-based segmentation method for palmprint alignment and extraction is presented [19]. A hand contour tracing based on Moore's algorithm has been used to obtain the hand contour without holes. The ROI has been detected using a set of reference points obtained using curvature scale space corner detector with an adaptive threshold and dynamic region of carry to high accuracy. The extracted palms were aligned and resized for future use in feature extraction and identification steps. Classification is obtained based on ANN using features from Radon transform have shown that the technique has led to improved identification ratios.

A multi-resolution feature extraction technique for palm-print recognition is presented based on discrete wavelet transform (DWT) which effectively develops the local spatial deviations in a palmprint Image in [20]. The entire image is divided into several small spatial segments and the result of modularization based on the entropy substance of the palm-print images has been implemented. A palm-print recognition scheme is developed based on extracting dominant wavelet features from each of these local modules.

B) Texture features

An enhanced Gabor-based region covariance matrices (EGRCM) approach for palmprint recognition is proposed [21]. The Gabor magnitude and the Gabor phase of a required image have effective information for image feature extraction; they are used concurrently to build the proposed EGRCM image descriptor for palmprint recognition. The simulation results show that the recognition accuracy of 91% using the proposed EGRCM approach.

A detail research for palm print identification that aims to get high recognition accuracy is proposed [22]. In this, feature extraction is done using line based methods such as Gabor, Canny filters and Modified Finite Radon Transform to represent palm lines. Radon coefficients are used as input features vector, two classification techniques are used namely matching by correlation and Support Vector Machines. The entire process is applied on two types palm print data bases CASIA and PolyU.

A personal recognition system based on the Gabor features of colour palmprint images is proposed [23]. The features are extracted using a bank of Gabor filters from the palmprint region denoted by three primary spectral components such R, G and B. The scheme, based on fusion at the matching-score level, is developed to improve the recognition accuracy.

A multi-spectral palmprint recognition method based on oriented multi-scale log-Gabor filters and bitwise competitive coding is proposed [24]. Also, presented a new matching process that applies the bitwise Hamming distance and the KL divergence allowing us to capture efficiently the similarities between palmprint feature maps generated using 2D log-Gabor filters with bitwise competitive code. Secondly, the two fusion methods of feature maps for matching step in order to remove the inherent redundancy of features of neighbouring spectral bands. The experimental results on MS-PolyU database have shown that the proposed technique obtains enhanced mono-spectral and multi-spectral performances for both verification and identification types.

A new method is proposed to palmprint recognition based on local Haralick features [25]. These features are estimated from the grey-level co-occurrence matrices (GLCM) created on the $d \times d$ pixels sub-images of the $D \times D$ pixels palmprint region. In order to identify a person, the matching procedure between the live template and the templates from the scheme database is performed in N matching methods. Fusion at the score level is used and the decision is made based on the basis of the maximum of the total similarity measure.

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A novel method is proposed for person identification by extracting the features of multispectral palmprint images in region of interest after pre-processing of multispectral palmprint images [26]. Here, 2D-Gabor filter is used since it is an effective tool for texture analysis and more robust to brightness for feature extraction. The extracted feature is merged at score level and image level. At last, the Euclidean distance is used for matching of palmprint features in the database.

C) Principal Component Analysis

An effective palmprint based human recognition system is proposed [27]. Each and every palmprint is divided into some square overlapping blocks. Restoration error using principle component analysis (PCA) is used to classify these blocks into a good block or a non-palmprint block. Features from each good block of a palmprint are achieved by binarizing the phase-difference of horizontal and vertical phase. The Hamming distance is used to estimate the matching score between the features of related good blocks of recognized and live palmprint. These matching scores are merged using weighted sum rule, where weights are based on the average discerning level of a block relative to other blocks.

A two steps centre of mass moment method for ROI selection of palmprint with PCA and hausdroff distance method is proposed [28]. The experimental results are obtained with accuracy as high as 98.781%. Also, the result shows that the performance of the system relatively stable and the database size is increased. Furthermore, the results show the best identification among the various compared methods without satisfying the verification accuracy.

A new Gabor-based kernel principal component analysis (PCA) approach by combining the Gabor wavelet representation of palm images and the kernel PCA technique for palmprint recognition is proposed [29]. In this approach, Gabor wavelets first derive attractive palm features characterised by spatial frequency, spatial locality, and orientation selectivity to manage with the variations of illumination. The kernel PCA method is then applied to project palmprints from the high-dimensional palmprint space to a considerably lower-dimensional feature space, in which the palmprints from the different palms can be discriminated much more efficiently.

D) Hybrid features

A Hybrid (DWT-DCT) Transform is proposed in [30] for palm-print recognition and performance comparison is prepared with DCT and DWT transforms. In the Hybrid DWT-DCT domain, initially the DWT is applied on image, then segmented the approximated coefficients (LL) and finally, the DCT is applied on each approximation band to create DCT coefficients and the formation of feature vector is same as in DCT domain. The test features are compared with the features of each image in the IIT Delhi Palm print database using Euclidean Distance. From the result analysis and comparison, it is showed that the proposed Hybrid (DWT-DCT) method obtained better palm-print accuracy with reduced computational cost in comparison to DCT and DWT.

A multimodal biometric personal identification system based on features extracted from palmprint images is proposed [31]. The feature extraction processes use the HOG descriptors. Also, three different classifiers from each palmprint modality were used. The classifiers are trained with the HOG features from all palmprint images. The simulation results, achieved very high identification accuracy. They also show that integrating different classifiers does significantly perform the accuracy of the biometric identification task.

A personal recognition system is proposed [32], which based on the central part of hand. The System makes use of 2D-Gabor filter for feature extraction and then apply Principle Component Analysis (PCA) along with LDA for dimensionality reduction process. Finally, system applies Euclidean distance on a reduced set of palm print features for their classification. The performance of the system is tested on IITD and CASIA databases and proves that system achieves 91% of accuracy with high true recognition rate and computation time.

A hybrid technique by using combination of 2D-LPF, PCA and Gabor filter approaches are proposed [33]. In this proposed approach, they offer better accuracy with less complexity in recognition of palm print. Also, they introduce a method that reduces the issue of PCA based palm print recognition system. In this proposed technique first pre-process the palmprint database because central part of palm is discriminatory for different person. Then, extract ROI (Region of

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Interest) and eliminate other portion of palm area and pre-process it for further feature extraction. Various features based on PCA and Gabor filter are extracted from the pre-processed image and best matching is performed on existing database template. The classification of extracted feature vectors is done by K- Nearest Neighbour (KNN) classifier.

A novel approach is proposed in [34] for personal identification based on palmprint. Initially, ROI of obtained palmprint is extracted and then was given to Gabor filter bank includes four filters. To extract textural information from phases, they used BSIF code. The four BSIF codes are linearly mixed together with equal weights to achieve final BSIF code. Then, the normalized histogram of BSIF code was acquired and six features from histogram were extracted. At last, KNN classifier was used to personal identification. Experimental results show that proposed algorithm obtains the higher performance in palmprint identification.

III. CONCLUSION

Palmprint recognition has an important approach in personal identification technique as it has most of the discriminative features such as principal lines, wrinkles and ridges which are very helpful in biometric security. In this paper, the various existing techniques used for palmprint recognition system have been reviewed. Hybrid feature extraction technique increases the accuracy, in which the biometric features acquired from each person. In the future work, the palmprint recognition system with a novel hybrid feature extraction can be used to provide better accuracy and security. Since, the crypto-biometric system will be resilient to many attacks like man-in-middle attacks and this technique provides an effective solutions by ensuring better security.

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