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DYNAMIC ALGORITHM FOR BIOMETRIC PALM PRINT VERIFICATION

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***Abstract---*Most of the existing techniques for palm print recognition are based on metrics that evaluate the distance between a pair of features. In this paper, a new technique for palm print verification based on a dynamical system approach for principal palm lines matching is used. In a Pre-processing phase, noise is reduced by proper filters and the ROI is obtained .From the ROI image, the principal lines have been extracted which undergo dynamical approach for palm print matching. The proposed dynamic algorithm is recursive and the procedure iteratively erodes both of the images to be compared, by eliminating points in each image that do not have enough close neighboring points both in the image itself and the comparison image. As a result of the iterations, only the points that have enough neighboring points in both the image itself and in the comparison image can survive. Thus, the output of the dynamical system converges either to zero, when a deep mismatch exists between the two images and high value, when a good matching is observed. The main advantage of the approach is its robustness and images corrupted with noise are easily recognized, while a randomly generated image is rejected even when compared with itself.**

***Keywords---* Biometrics, dynamic algorithm, line matching, palm print, principal lines.**

I.INTRODUCTION

Palm print is the unique inner surface pattern of human hand, including a number of discriminating features, such as principal lines, wrinkles, ridges, minutiae points, singular points, texture. Biometrics makes use of the physiological or behavioural characteristics of people such as fingerprint, iris, face, palm print, gait and voice, for personal identification which provides advantages over non-biometric methods such as password, PIN, and ID cards. It is an essential technology for many mission-critical applications, such as homeland security, e-commerce, banking,. In recent years, low-resolution palm print recognition has attracted a wide range of attention due to its potential for civilian applications. Compared with face, fingerprint, and iris based biometrics systems, low-resolution palm print based biometrics system has several special advantages such as stable and rich line features, small distortion and easy self-positioning. It is well known that palm lines, including principal lines and wrinkles, are essential features in low resolution palm print image. Compared with ridges and wrinkles, principal lines are usually the consequence of genetic effects: therefore, they are the most significant features in palm print images and have good permanence.

However, principal lines may be similar in different individuals, which makes their distinctiveness relatively low; for this reason, palm print recognition is a challenging problem. To address this challenge, a method has been proposed.

1) A region of interest (ROI) extraction phase, which follows the typical sequence of steps to face different issues mainly due to nonlinear distortion, such as rotation and translation of the palm with respect to the image and nonuniform illumination.

2) An unconventional feature extraction phase based on the principal lines of the palm print.

3) A novel approach to palm print matching based on a *dynamic algorithm*. The algorithm involves a positive linear dynamical system, whose evolution is determined by the matching level between the two input images: its output converges to zero when the two images have a deep mismatch, while it reaches a high value in the case of good matching.

Methods based on dynamical systems have been successfully exploited to improve the performance of algorithms.

Here the proposed dynamic algorithm, included as a step in the matching phase, confers more robustness to palm print recognition techniques, especially when low resolution and noisy images are involved: the impact of noise, such as salt and pepper noise, is effectively reduced, avoiding both false rejection of images corrupted by noise and false acceptance of randomly generated images.=

II.PROPOSED METHODOLOGY

A.pre-processing:

Before the feature extraction step, a pre-processing is essential in order to obtain a sub image denominated ROI from the captured palm print image. In fact, usually palm print images can have different orientation and size, and are also subject to noise. Moreover, the region of not-interest (e.g., fingers wrist, and image background) may affect the accuracy in processing and verification performance.

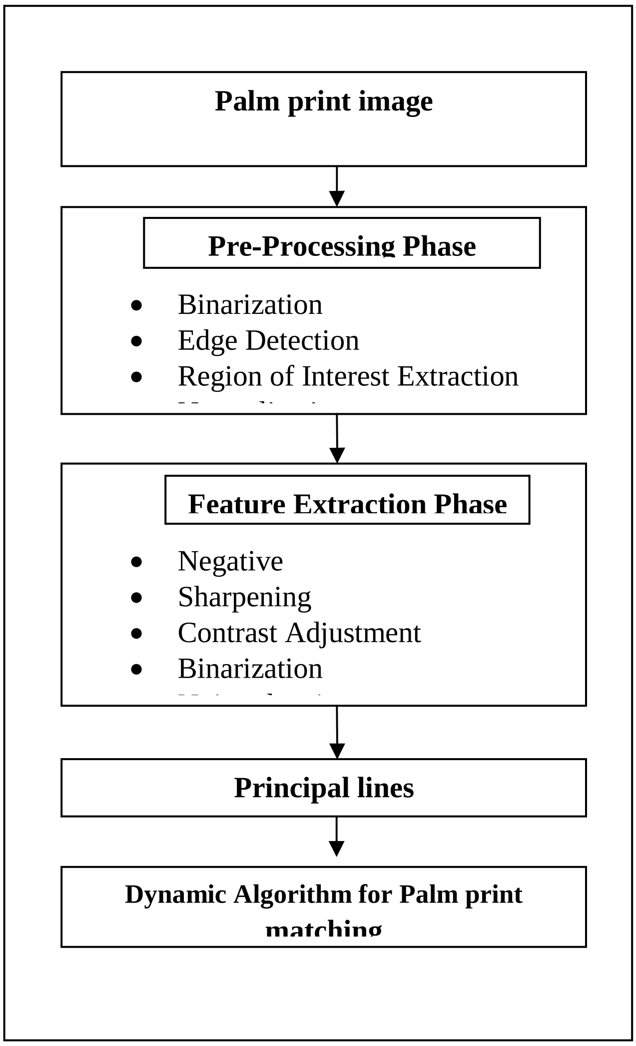


Fig1. Block Diagram of Palm print verification

1) Binarization: Binarization converts a gray level image *I(x, y)* into a binary image *B(x, y)*, where the hand is the foreground and the rest is background. Thus, a local adaptive thresholding can be applied to binarize the image

2) Edge Detection: To detect the hand edge, the segmented binary image is filtered by using the Cannyoperator. This edge detector ensures good noise immunity and at the same time detects true edge points with minimum error

3) Region of Interest Extraction: In this last step, the palm print image is aligned in a standard pose, to reduce issues due to nonlinear factors, such as nonuniform illumination, rotation, and translation. In order to extract the central part of the palm print images, first detect two reference points between the fingers .These points are used to construct a reference line for aligning the different palm print images, and the middle point between them is used to determine the central position of the ROI. Finally, the ROI can be extracted

4) Normalization: In order to have a prespecified mean and variance for all palmprint images, the extracted ROI images are normalized to reduce the possible nonuniform illumination and noise.

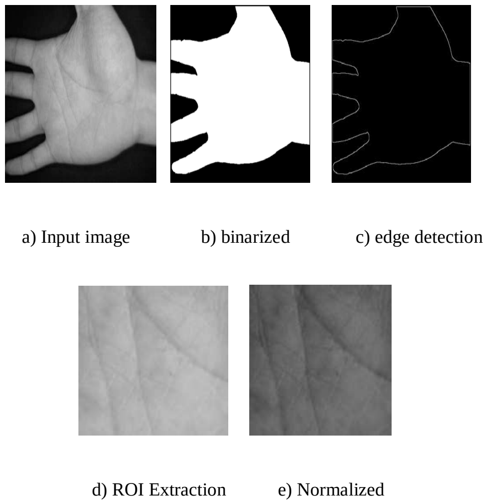


Fig2. Pre-processing

A. Feature Extraction

Once the central part (ROI) is segmented, features can be extracted for matching. The feature extraction phase plays an important role in image identification and verification. There are many features exhibited in a palm, such as the three principal lines caused by flexing hand and wrist in the palm, which are denominated as heart line, head line, and life line, respectively.

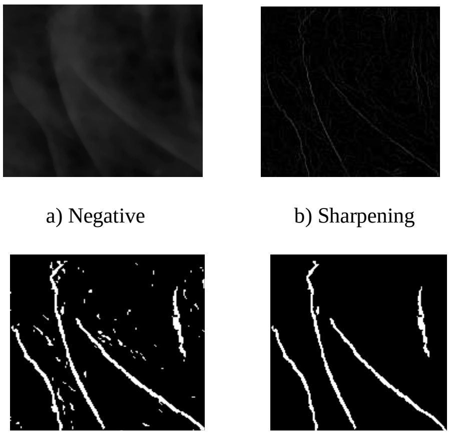
1) Negative: After normalization in the pre-processing phase, the resultant enhanced ROI image I(x; y) is converted to its negative image.

2) Sharpening: To correct uneven illumination, first use a Top-Hat transform, then apply a linear contrast enhancement to the output image. The Top-Hat transform enables us to extract small bright objects from a varying background.

3) Contrast Adjustment: In order to improve the contrast of the image, a linear contrast enhancement is applied by stretching the range of intensity values it contains to a specific range of values. Before applying the linear scaling function it is necessary to identify the lower and upper bounds from the histogram, which are the minimum and maximum brightness values in the image.

4) Binarization: A global thresholding is applied at the gray level image resulting from the previous sharpening filter and linear contrast adjustment.

5) Noise Cleaning: As a last step in the feature extraction phase, a median filter is used in order to remove noise and trivial lines from the image



a) Negative b) Sharpening

c) Binarization d) Principal lines

Fig3. Feature Extraction

B. Dynamic Algorithm for Matching

The proposed dynamic algorithm is recursive and involves a positive linear dynamical system, whose evolution depends on the matching level between the two input images. In a pre-processing phase, the procedure iteratively erodes both of the images to be compared, by eliminating points in each image that do not have enough close neighboring points both in the image itself and the comparison image. As a result of the iterations, only the points that have enough neighboring points in both the image itself and in the comparison image can survive. Thus, the output of the dynamical system converges either to zero, when a deep mismatch exists between the two images, or to a high value, when a good matching is observed.

Given two images of x, y of equal dimensions .For our palm print verification purposes, first the matching level between two initial images should be found. By denoting the active pixels in the image as 1, the matching index has been defined. In order to obtain the matching level of two images, the intersection operator should be associated with AND logic function.

An approach that rejects noise and, to this aim, assume that the matching of "isolated spots" is not as significant as the matching of wide "stripes" or "islands," even if the number of matching isolated spots is very high. The operator *f* must then be chosen so as to set to 0 all the pixels without a sufficient number of neighboring 1 pixels, both in the image itself and in the comparison image: only significant clusters of pixels that have a corresponding cluster in the complementary image must remain active.

A considerable advantage of our dynamic approach is its robustness with respect to noise. Images corrupted, e.g., with salt and pepper noise are easily recognized, while an image randomly generated is rejected even if compared with itself.

III.EXPERIMENTAL RESULTS

The performance of the proposed palm print verification system has been tested upon two databases that have been worldwide shared for research purposes: 1) *CASIA palmprint database* and 2) *PolyU palmprint database II* .The equal error rate (EER) is obtained as,

Method	CASIA	POLY U
Comp code	0.0201	0.0122
Palm code	0.0367	0.0432
Ordinal code	0.0175	0.0150
MFRAT	-	0.0092
Proposed method	0.0123	0.0071

The computational times required for pre-processing, palm line extraction, and palmprint matching are 376, 49, and 295 ms, respectively, thus the average response time for verification is about 0.72 s, which is more suitable for a real-time biometric verification system rather than a real-time biometric identification system.

IV.CONCLUSION

In this paper, a novel approach has been presented to authenticate individuals based on their palmprint features. As a main contribution, a new recursive, dynamic algorithm has been applied for the matching of features. A noticeable advantage of such an approach is its robustness with respect to noise: for instance, images corrupted with salt and pepper noise are easily recognized, whereas an image randomly generated is rejected even when compared with itself. Moreover, it works quite accurately with low resolution palm images, thus reducing the computational cost

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