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Authentications of Myanmar National Registration Card

Myint Myint Sein[1], Zin Mar Win[2], Ei Phyo Wai[3]
Research and Development Department, University of Computer Studies, Yangon, Myanmar
Corresponding author, e-mail: myintucsy@email.com; zmw@gmail.com; eiphyowai.ko@gmail.com

Abstract

The automatic identification system of Myanmar national registration card (NRC) holder is presented in this paper. The proposed system can be handled the identification by the extracted low quality face image and fingerprint image from Myanmar NRC. Both of the facial recognition and fingerprint recognition system are developed for Myanmar citizenship confirmation. Age invariant face recognition algorithm is performed based on combination of DiaPCA (Diagonal principal Component Analysis) and KNN (K^{th} nearest neighbor classifier) approaches. An algorithm of the fingerprint recognition is proposed for recognition of the poor quality fingerprint image with fabric background. Several experiments have been done for confirming the effectiveness of the proposed approach.

Keywords: *myanmar national registration card, diagonal principal component analysis, K^{th} nearest neighbor classifier, authorized person confirmation, age invariant face recognition algorithm, fingerprint recognition*

1. Introduction

For security purpose, National Registration Card is issued for each citizen in all over the world. The smart registration cards and e- registration cards are mostly used in many countries. All national registration card contains the important personal information of holder such as face photo, name, date of birth and place; fingerprint image, iris image, signature, nationality, date of issue authority and so on. The ID card is very useful for authorized person confirmation. Generally, face image and fingerprint image are used for identification. Now a day, the face image and fingerprint image are widely used not only for registration card but also for personal confirmation in school, universities, companies, societies memberships and others permission of authorized person access.

The front view contain face image and back view contain the fingerprint image of NRC card are illustrated in Figure 1(a) and Figure 1(b), respectively.

a) Front side b) Back side

Figure 1. Sample of Myanmar National Registration Card

The objectives of this system are to develop a simple and fast face recognition, finger print recognition and identification system for personal identification to prevent the criminal and provide the security system. The recent research result related to the identification system of Myanmar national registration card holder is presented. The proposed system is developed based on the invariant features of a face without depending on age progression and low quality fingerprint image recognition.

The system overview is described in Section 2. Section 3 is the theoretical consideration of the proposed personal identification system. The extracted face region is segmented into sixteen parts.

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The proposed fingerprint recognition system is explained in Section 4. Several experiments have been done for confirming the propose approach works adequately. The experimental results are illustrated in Section 5 and the summarization of this research and future work are discussed in Section 6, respectively.

2. System Overview

The automatic identification system is developed for authorized person confirmation using Myanmar NRC card. The processing steps for the proposed system are shown in Figure 2. Firstly, the face recognition process between the real time face image and face image extract from NRC has been done by using the developed age invariant face recognition algorithm. The detail description about this algorithm is in Section3. If the face recognition is confirmed, the fingerprint recognition is processed continually. The live scan fingerprint image is grabbed by the eyeD fingerprint scanner. Then the recognition between the live scan fingerprint and fingerprint image extracted from NRC has performed. The detail explanation of the fingerprint recognition is described in Section 4. According to the facial and fingerprint recognition results, authorized person or unauthorized has been examined finally.

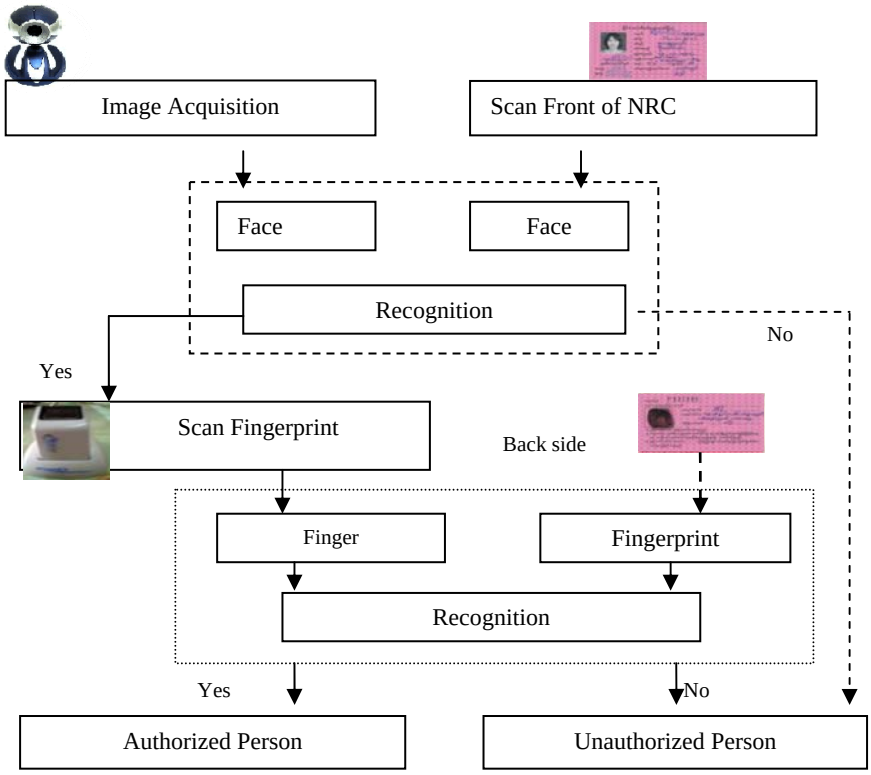


Figure 2. Processing Steps of the Proposed System

3. Age Invariant Face Recognition

The age invariant face recognition system is developed for recognizing the time lapsed images. This approach is based on the invariant face features [1-5]. Due to the situation of ID card, the time lapse between the registration period and current is very large. For identify the Myanmar NRC holder, the invariant structure of the face are adapted for the age invariant face recognition system. The face image of NRC and current image are obtained by image acquisition devices. The morphological processing is applied in image enhancing which contains image resizing, noise filtering, gray scale converting, binarilization and normalization. The skin detection algorithm is developed by integrating the RGB, HSV and YCbCr color

spaces. The developed skin detection system works adequately for detecting the skin region under dark and bright illumination conditions. Using this detected skin region, the exact face region is cropped from the face image. The relation of twenty-four connected neighborhood is applied to obtain the accurate position of eyes, nose and mouth center.

Now the face region segmentation is considered by the invariant features of a face. The eye region, nose region and mouth region are extracted by using the face template and ratio of the face. The canny edge detection and morphological processing are applied for the eye center points, nose center point and mouth center point, respectively. The midpoint of the left and right eye centers is also computed. Two horizontal lines and three vertical lines are drawn passes through these five feature points. The first horizontal line passes through the left and right eye centers. The second line passes through the nose center and parallel with the first line.

Similarly, the first and third vertical lines pass through the left and right eye center and second vertical line pass through the midpoint of eye centers. The twelve segmented parts are obtained from these regions of lines. The left and right eye regions, nose region and mouth regions are extracted by their center positions. The sixteen segmented parts are illustrated in Figure 3.

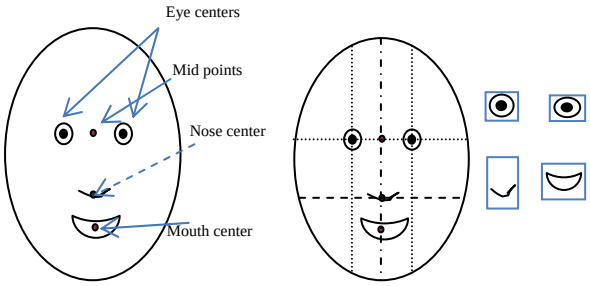


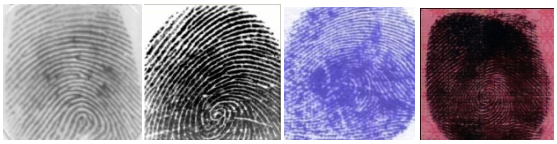
Figure 3. Illustration of the Segmentations.

The integration of Diagonal Principal Component Analysis (DiaPCA) and K^{th} nearest neighbor classifier (KNN) approaches are applied for confirming the matching of each segmented part pairs.

4. Fingerprint Recognition System for Low Quality Image

Fingerprints have been used for centuries for identification purposes. Nowadays fingerprints are widely used in security works such as computer/network logins, attendant, access control and access door lock for personal identification. The qualities of fingerprint images are mainly depend on the acquisition devices. An efficient algorithm of the fingerprint recognition is developed to identify the low quality fingerprint on Myanmar National Registration Cards (NRC).

The proposed system is tested on four different types of fingerprint. The type A is good quality image obtained from standard database (see in Figure4(a)). The type B is also good quality image acquired by digital fingerprint scanner. Type C is the low quality ink image and type D is obtained from NRC card. Figure 4(b), Figure 4(c) and Figure 4(d) are illustrated the fingerprint type B, type C and type D, respectively.



(a) (b) (c) (d)

Figure 4. The Different Types of Fingerprint

In many existing fingerprint recognition systems, fingerprint matching is performed for same types of type A and Type B of fingerprint images. The type D fingerprint of NRC is differed from others. It is noisy, low quality and its background pattern of image is very complex and can't be seen clearly the ridge of the fingerprint. The proposed system can identify not only the same types of images but also the different types of fingerprints.

The orientation features and skeleton features of the fingerprint are applied for matching. The extracted orientation fields and the skeleton features are provided for matching of the live-scan fingerprint and fingerprint of NRC card. The ridges and valleys in a small local neighborhood have well defined local frequency and local orientation properties. A set of band pass filters can remove the undesired noise and preserve true ridge structures. Gabor filters are used to remove the noise and preserve true ridge/valley structures. The filter applied at each pixel [*x*, *y*] has the form:

$$g(x, y : \theta, f) = e^{\left(\frac{-(x+y)^2}{2\delta^2}\right)} \cos[2\pi . f . (x.\sin\theta + y.\cos\theta)]$$

,

Where θ and f are the corresponding local orientation and frequency.

5. Experiments and Results

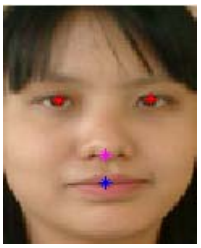
The National registration card and face images and fingerprint images are obtained from the 200 volunteer. The frontal views of the face are applied in our experiment. Figure 5(a) is the face image from NRC card and Figure 5(b) is the recent face image taken by a camera, respectively. Figure 6(a) and Figure 6(b) illustrated the feature points of eye center, nose center and mouth center position.

(a)

(b)

Figure 5. Acquired Images from NRC Card and Camera

(a)

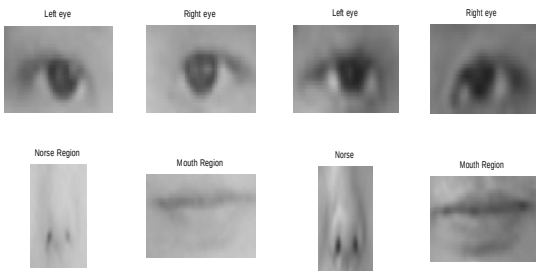


(b)

Figure 6. Feature Points Extraction

According to these feature points, the twelve segmented parts and two eyes regions, norse region and mouth region are segmented from each face image. Figure 7 (a) and Figure 7(d) are the segmented parts of NRC face and Figure 7(b) and Figure 7(d) are the segmented parts of the current face image, respectively.

(a) (b)



(c) (d)

Figure 7. The Sixteen Segmented Parts

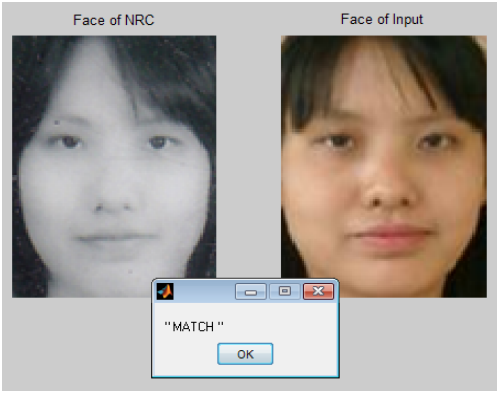
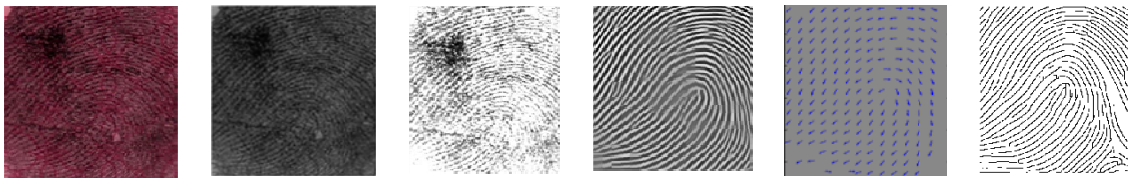


Figure 8. The Result of Facial Recognition

By the developed diagonal principle analysis method, the matching process of the each face part pair is performed for examining the two faces are match or not. This can be decided by the matching results of sixteen parts of a face. The recognition result is illustrated in Figure 8.

The effective enhancement algorithm is developed for low quality fingerprint recognition. The fingerprints on NRC cards are complex with fabric background. The preprocessing steps such as region extraction and background removal is performed to get only fingerprint without fabric background. To remove fabric shadow, the color image processing using color components analysis. Figure 9 (a) show the fingerprint image with farbic background and Figure 9(b) is the gray image. Figure9(c) is the extracted rib image from background. Gabor filters have both frequency-selective and orientation-selective properties and have optimal joint resolution in both spatial and frequency domains. The filtering image is shown in Figure9 (d) and Figure9 (e) shows the orientation of the ribs. The thinning result by the two-pass thinning algorithm is illustrated in Figure 9(f).

If the two fingerprints, fingerprint of NRC and live-scan fingerprint, are the same identity, the authentication is success and the NRC card holder is right person.



(a) (b) (c) (d) (e) (f)

Figure 9 Orientation of the Extracted Ribs of Fringerprint Image

The accuracy is calculated by the number of test and number of true results as follow:

$$Accuracy = \frac{no\_true\ \mathrm{Re}\ sult}{no\_test} \times 100\%$$

FRR (False Reject Rate) is defined as follows:

$$FRR = \frac{no\_reject}{no\_test} \times 100\%$$

Figure 10 illustrated the accuracy rate of the experiments.

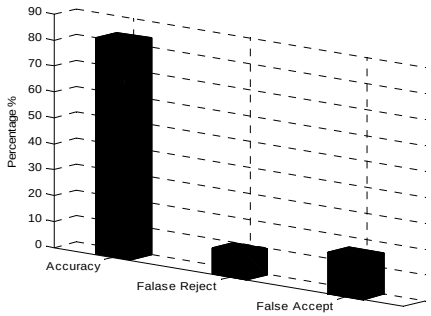


Figure 10. Experimental Results for Accuracy.

6. Conclusion

The authentication system of the Myanmar National Registration card (NRC) holder is proposed in this research. The proposed age invariant facial recognition system can determine the matching of the recent face and low quality face image of NRC issued last 10 year above. The diagonal principle analysis method is applied for sixteen segmented parts of a face. The fingerprint recognition is performed for the matched person of facial image. The main contribution is to solve the recognition problem between different impressions of fingerprints such as low quality images and high quality images of live-scan fingerprint. The authorized person or unauthorized person of NRC can detect by these matching results. The accuracy rate of the authentication is 83.5294%; false accept rate is 9.4118% for 170 testing. Through these results, the effectiveness of the proposed can be confirmed.

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