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RESEARCH ARTICLE

A METHOD FOR PALM VEIN AUTHENTICATION SYSTEM

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ABSTRACT

Biometric authentication is one of the newest authentications techniques researched today. The vein information is hard to duplicate since veins are internal to the human body. The palm vein authentication technology offers a high level of accuracy. This paper presents a novel idea on the biometric authentication system using palm vein authentication that uses vein patterns as a personal identifying factor and ear based authentication as a secondary approach towards authentication.

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INTRODUCTION

Palm vein authentication uses the vascular patterns of an individual's palm as personal identification data. Compared with a finger or the back of a hand, a palm has a broader and more complicated vascular pattern and thus contains a wealth of differentiating features for personal identification. Ear biometrics is a subset of Biometric Authentication System which is gaining popularity and research view point. The importance of biometrics in the current field of Security has been depicted in this work. We have also outlined opinions about the utility of biometric authentication systems, comparison between different techniques and their advantages and disadvantages in this paper. Several banks in Japan have used the palm vein authentication technology for customer identification since July 2004. In addition, Fujitsu has integrated the technology into the access control of electronic door lock systems. Fujitsu plans to further expand applications for this technology by downsizing the sensor and improving the verification speed. Palm Vein Authentication has a greater level of recognition accuracy due to the uniqueness and complexity of vein patterns of the palm. A Palm Vein characteristic has gained more interest in authentication because of its uniqueness even between twins. It is difficult to forge as it is presented internal to the body. Furthermore, it will not vary during the person's lifetime and impossible to read or copy since it lies under the skin. The most important advantage of palm vein is that it is exist only for live humans. Palm vein is the technology which is more secure as it is present internal to the body so it is quite difficult to forge and also it doesn't contain hairs which can create the obstacle in the path of photographing the blood vessel of the palm.

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Literature review

In the proposed method by Jing-Wein Wang, *et al*. use three phases of processing the palm vein image to get result (Jing-Wein Wang and Tzu-Hsiung Chen, 2011). First phaseis pre-processing in which the various steps are carried out to improve the image quality such as image enhancement, abi-level thresholding, noise removal. Second phase is feature extraction in which the vein features are extracted by "pixel by pixel" scanning in order to identify connected pixel regions. Third step is post-processing in which thinning is done to remove the unnecessary information the performance of accurate extraction ratio is very good but the error extraction due to bad quality of palm vein pattern images may lead to the fatal errors of the process.

Huan Zhang, *et al*, proposed a capturing device, a JAI AD-080 CL 1/3'' CCD near-infra camera is used (Huan Zhang and Dewen Hu, 2010). Image is then smoothed by the Gaussian smooth filter; local contrast enhancement is used to enhance the ROI image. Then the vein patterns are extracted by technique which includes vein length and minutiae for recognition and matching. The advantage of this paper is Equal Error Rate (EER) is 1.82% but performance is not good. A paper published by researchers on Palm Vein Extraction and Matching for Personal Authentication in which they propose low cost CCD camera to capture the infrared palm images. Then Region of Interest is located to extract the features. Features are extracted by multi-scale filtering. In last matching is done using Template Based Matching. In this the recognition rate is good but the image quality is bad or poor quality (Ajay Kumar *et al*., 2003; Debnath Bhattacharyya *et al*., 2009; Daniel Hartung *et al*., 2011; Gin-Der Wu and Zhen-Wei Zhu, 2013). Some researchers propose a finger vein imaging device with near-infrared (NIR) light source. Then they do pre-processing of the image in which they use gradient operator, size and brightness normalization for feature extraction and final matching. Furthermore, finger vein LDC is proposed and performed, which creates a structured feature image for each finger vein. Here the robustness and recognition rate is high but database is small (Goh Kah Ong Michael *et al*., 2010; Ishani Sarkar *et al*., 2010).

Debnath Bhattacharyya, *et al* proposed three algorithms for pre-processing area. Vascular Pattern Marker Algorithm (VPMA); in which the two pass masking is used such as horizontal and vertical kernels to smoothen the image b. Vascular Pattern Extractor Algorithm (VPEA); in which thresholding is done for converting a grey scale or color image to a binary image based upon a threshold value. If a pixel in the image has an intensity value less than the threshold value, the corresponding pixel in the result antimage is set to black. Otherwise, if the pixel intensity value is greater than or equal to the threshold intensity, there sulting pixel is set to white. Thus creating a binary image, or an image with only 2 colours, black (0) and white (255). Vascular Pattern Thinning Algorithm (VPTA) in which thinning is done for capturing the Vascular Pattern of hand Palm of an individual. The resultant Images will bestored in a Database, as the vascular patterns are unique to each individual, so future authentication can be done by comparing the pattern of veins in the palm of a person being authenticated with a pattern stored in a database. Here the threshold value is assumed which is not always the criteria (Debnath Bhattacharyya *et al*., 20009).

Some of the researchers proposed a system for authentication using Palm Vein based on using principle component analysis (PCA) for feature extraction. Palm vein images of dorsa captured using infrared camera. PCA is applied to generate vector of features that represent the highest detailed variant information. A matching process is then applied to find the best match from the data base to recognize and authenticate the person. Experiments show that there system is able to recognize human with accuracy 85% in real-time based on supervised recognition (Jing Liu *et al*., 2011). Other researchers proposed an analysis of palm vein pattern recognition algorithms, techniques, methodologies and systems. It discusses the technical aspects of recent approaches for the following processes; detection of region of interest (ROI), segment of palm vein pattern, feature extraction, and matching (Masaki Watanabe *et al*., 2005).

Proposed Method

Primarily the feature extraction is to be done with greater accuracy. For matching the acquired image with the image present in the database, the matching percentage should be nearly 100 percent. In order to achieve this pre-processing on the acquired image should be done properly. In this paper we have made an effort to overcome these problems. The basic methodology is given Figure 1.

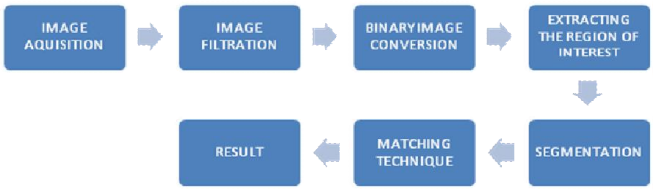

Figure 1. Block diagram of the Proposed Method

Palm vein authentication technique is one of the most appropriate authentication techniques in recent times. In this technique a sensing device is needed to capture the image of an individual's palm. This device uses infrared radiations to sense the palm veins of a person. The input image is shown in figure 2. After the image is acquired it might contain some sort of noises as a result of the sensing device. It should be removed from the image before proceeding with the authentication process. This will improve the image quality and as well as enhance the result accuracy. So in order to accomplish this median filter is applied to remove the noises from the acquired image. The median filter is a non-linear digital filtering technique, often used to remove the noise. The median filter runs through part by part of an image and replaces each entry with the median of neighbouring values.

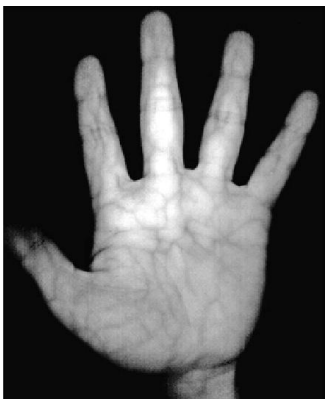

Figure 2. Input image after removing noise

After removing the noise, the next step will consist of extracting the Region of Interest (ROI) because the image obtained by palm vein imaging/scanning device obtains the sample of whole human hand. The palm vein matching

algorithm has to work with palm area of the hand only, so there is need to extract the region of interest from the sampled image. This is done by first changing the image into a binary image which makes it easier to detect the boundaries of the image. This is followed by cropping the palm area of the hand from the image. The cropping parameters which are already set in the algorithm are decided on the basis of the average palm size of human beings. ROI of image is shown in Figure 3.

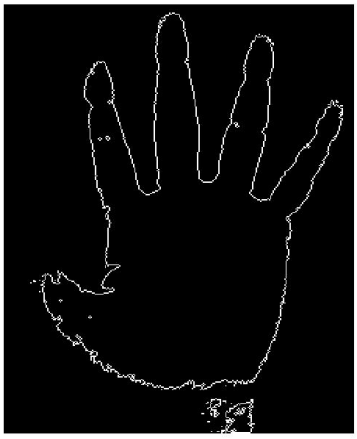

Figure 3. ROI of the Input Image

After extracting the Region Of Interest (ROI), segmentation of the image is done by applying our proposed algorithm. This algorithm first calculates the threshold value of the image and then segmentation is performed on the basis of this threshold value. Threshold value of the image is calculated by performing an iterative process of finding out the mean of all the values of the image. Finally a single value is obtained as the threshold of the image. The resultant image contains only the veins pattern of the palm.

Proposed Algorithm

1. Read an image a
2. Convert it to grayscale image b
3. If b(i)(j)<127
   Set c(i)(j)=b(i)(j)
   Else Set d(i)(j)=b(i)(j)
4. Calculate the mean value of c(i)(j) k
5. Calculate the mean value of d(i)(j) l
6. M=(k+l)/2
   // if the desired result is obtained, the process is stopped here. Otherwise this same process is carried on further to obtain the required value of threshold.
7. Stop

After getting the vein pattern of the palm, it is being matched with the original image from the database by applying a string matching algorithm. This algorithm matches each vein string individually and then displays the result. If all the strings get matched then the image is a authenticate one. Otherwise the corresponding error message is displayed. A detailed literature survey on all of the above mentioned techniques or methods would be studied to understand them at the core. Then the proposed algorithm flow would be reviewed and improved in case any changes are required. The experiment results would be thoroughly analyzed and compared with the existing algorithm results. This is also very important to get the information about the other parameters used for palm vein matching and analysis. A thorough performance and feature testing approach would be designed and applied to evaluate the performance of the simulated palm vein recognition algorithm to detect the errors and to recover them. Afterwards, the experiment results would be thoroughly analyzed and compared with the existing palm vein recognition techniques to examine the performance of the new palm vein recognition algorithm.

Conclusion

In the above methodology a proposed algorithm is defined for palm vein authentication process. This algorithm will stand strong in variety of situations depending upon the number and type of images obtained. But if the image acquired is of very low quality then the authentication process cannot be completed. Hence the sensing device should be appropriate and should sense the palm vein pattern accurately. As authentication process is a vast area to work on, future research work can be done on this topic. Further improvements in the proposed algorithm will be appreciated. Also they can propose a new technique based on proposed model with higher accuracy and robustness.

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