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HIGH PROTECTION AUTHENTICATION USING FINGER VEIN WITH CNN

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ABSTRACT:

Biometric identification is the study of physiological and behavioral attributes of an individual to overcome security problems. Finger vein recognition is a biometric technique used to analyze finger vein patterns of persons for proper authentication. This also makes finger-vein biometrics a more secure alternative without being susceptible to forgery, damage, or change with time. In conventional finger-vein recognition methods, complex image processing is required to remove noise and extract and enhance the features before the image classification can be performed in order to achieve high performance accuracy. In this paper we are going to propose a method for finger vein recognition using SPIHT for image feature extraction and SVM classifier for recognition . In conventional finger-vein recognition methods, complex image processing is required to remove noise and extract and enhance the features before the image classification can be performed in order to achieve high performance accuracy. In this regard, a significant advantage of the CNN over conventional approaches is its ability to simultaneously extract features, reduce data dimensionality, and classify in one network structure.

Keywords:Biometric authentiction,Finger vein,Convolutional neural network

1.INTRODUCTION:

Accurate recognition of human identity for security and control is a major issue of concern. Hence automatic authentication systems for control have found application in criminal identification, automated banking, etc..Biometric identification is the study of physiological and behavioral attributes of an individual to overcome security problems. There are several types of biometric techniques available such as finger print ,palm print, hand

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veins, finger veins, palm veins, foot vein, iris. Vein-based biometrics is a newly developed method for personal recognition.

Vein object extraction is the first crucial step in the process. The aim is to obtain vein ridges from the background. Recognition performance relates largely to the quality of vein object extraction. The standard practice is to acquire finger vein images by use of infrared spectroscopy. When a finger is placed across near infra-red light rays of 760nm wavelength, finger vein patterns in the subcutaneous tissue of the finger are captured because deoxygenated hemoglobin in the vein absorb the light rays. The resulting vein image appears darker than the other regions of the finger, because only the blood vessels absorb the rays. The extraction method has a direct impact on feature extraction and feature matching. Therefore, vein object extraction significantly affects the effectiveness of the entire system

In addition to unicity, universality, Performance and measurability,the finger venous network are much more robust against fraudulent reproduction than other biometric systems.Finger veins patterns are captured by LED and CCD camera.LED is located above the finger and CCD is placed in below the finger.By detecting the strength of near infrared,the vein positions can be identified.The finger vein identification technology invented by Hitachi Ltd.

Finger veins pattern inside human fingers that makes person’s identity unique . Previous research works has shown that the accuracy of finger vein biometric verification and recognition system lies on enhancement of quality image vein pattern and extraction of accurate various features in order to use finger vein as a factor for personal recognition system in multimodal system, as well as detecting fake finger veins. It can sometimes show some irregularity shadings and highly saturated regions, thus caused noise. It can also lead to increasing processing time during finger vein extraction, which is eventually cause an inaccuracy of matching or verification system.

1.1 WHY BIOMETRIC AUTHENTICATION?

Biometric authentication is a security process that relies on the unique biological characteristics of an individual to verify that he is who is says he is. Biometric authentication systems compare a biometric data capture to stored, confirmed authentic data in a database. both samples of the biometric data match, authentication is confirmed. Typically, biometric authentication is used to manage access to physical and digital resources such as buildings, rooms and computing devices. In addition to the security provided by hard-to-fake individual biological traits, the acceptance of biometric verification has also been driven by convenience: One can’t easily forget or lose ones biometrics.

1.2 FINGER VEIN RECOGNITION:

Finger vein recognition is a process wherein a person's finger vein patterns are used as a basis for biometric authentication. Images are taken of one's finger vein patterns and then verified through pattern-recognition techniques. It has recently gained attention and favor owing to its high authentication accuracy, so much so that it has received wide acceptance as a security measure in banks. This process is largely considered to be safer than fingerprint recognition, as it cannot be replicated or fooled since the pattern is hidden.Finger vein recognition is also known as vein matching or vascular technology Fig1.1.1 Shown in below

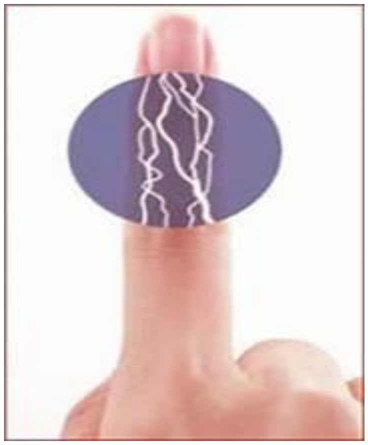


Fig 1.1 Finger vein image

- Accuracy of recognition is high.
- Convolutional Neural networks gives deep comparison of features compared to state of art method.

2. LITERATURE REVIEW:

Feature extraction represents one of the most crucial and major steps of FVR. During this step, the quantifiable property of the basic biometric trait is created, called the template, which is helpful for identifying the individual. For example, in a fingerprint biometric system , position and orientation of minutiae points in a fingerprint image is the key feature which needs to be different from another person. An efficient feature extraction technique is a step which enhances the precision of finger vein recognition. Numerous feature extraction techniques have been presented, and this paper discusses four groups of feature extraction methods, i.e., vein-based method, local binary-based method, dimensionality-based method and minutiae-based method.

Gabor filtering is an impressive feature extraction technique in snatching texture characteristics from an image and is therefore employed in various pattern recognition applications i.e., finger print identification, hand vein identification and iris identification . Gabor filtering is also valuable for finger vein extraction due to its directional acuteness, detecting oriented feature capability and fine tuning to a specific frequency. The General form of Gabor filtering can be represented as:

$$(x, y, f, \varphi) = \frac{1}{2\pi\sigma_x\sigma_y} \exp\left[-\frac{1}{2}\left(\frac{x_{\varphi^2}}{\sigma_{x^2}} + \frac{y_{\varphi^2}}{\sigma_{y^2}}\right)\right] \cos(2\pi f x_\varphi) \quad (1)$$

Here, x, y represent the image xϕ and yϕ where ϕ represent the orientation and f show the frequency of a sinusoidal plane. There are some Gabor filter-based FVR techniques. Kumar et al. Used multi-orientation for finger vein pattern extraction. Yang et al. proposed multi-channel Gabor filter and a bank of even-symmetric Gabor filter with eight orientations to get information about vein vessel . In References , 2D Gabor filter was applied to extract direction texture and phase feature from finger vein image, and good recognition results were obtained. Xie et al. proposed guided Gabor filter method which obtained vein pattern without involving any segmentation process . Multi-orientation Gabor filter was used for FVR in Reference [60]. Sapkale et al. presented fractal dimension, lacunae extraction and Gabor filter algorithm for texture and edge feature extraction. In Reference , Gabor filter was applied to choose the characteristics texture extraction of vein images that capture the local orientation and the information of the frequencies of the vein network. Repeated line tracking is also a vein pattern extraction technique that tracks vein patterns a particular number of times. Line tracking operation recognizes the local dark line (finger vein pattern) and executes pixel by pixel along black lines. If a black line is not detected, the new tracking point starts randomly at another position. In such a way, repeated line tracking operation tracks all the black lines in the image. Finally, a vein pattern of the finger is obtained. The repeated line tracking method has been proposed by Miura et al to obtain the finger vein pattern from an ambiguous image. However, the algorithm proposed in Reference contains some drawbacks such as low robustness and complexity. Robustness and efficiency of the repeated line tracking algorithm relate to parameter pn0 described in Reference , pn0 is the point used to start the line tracking, to select the useful point for line tracking, and revise the parameter for finger vein image according to the width of vein for different images. In multimodal biometric recognition system, repeated line tracking technique was also implemented to obtain feature extraction. In Reference the repeated line tracking approach with feature-level fusion using fractional firefly (FFF) optimization was employed to extract features from finger knuckle and finger vein images. Maximum curvature method is another excellent method to extract finger vein patterns. It utilizes the fact that vein patterns appear like a valley with high curvature in the cross-sectional profile. The curvature of finger vein is computed and only the centerlines of veins are saved. the images with various widths and brightnesses . The centerlines are detected by searching for positions which have the locally maximal curvatures of a cross-sectional profile

The mathematical form of curvature, k(z) as follows:

$$K(z) = \frac{d^2Pf(z)/dz^2}{\{1+(dPf(z)/dz)^2\}^{\frac{3}{2}}} \quad (2)$$

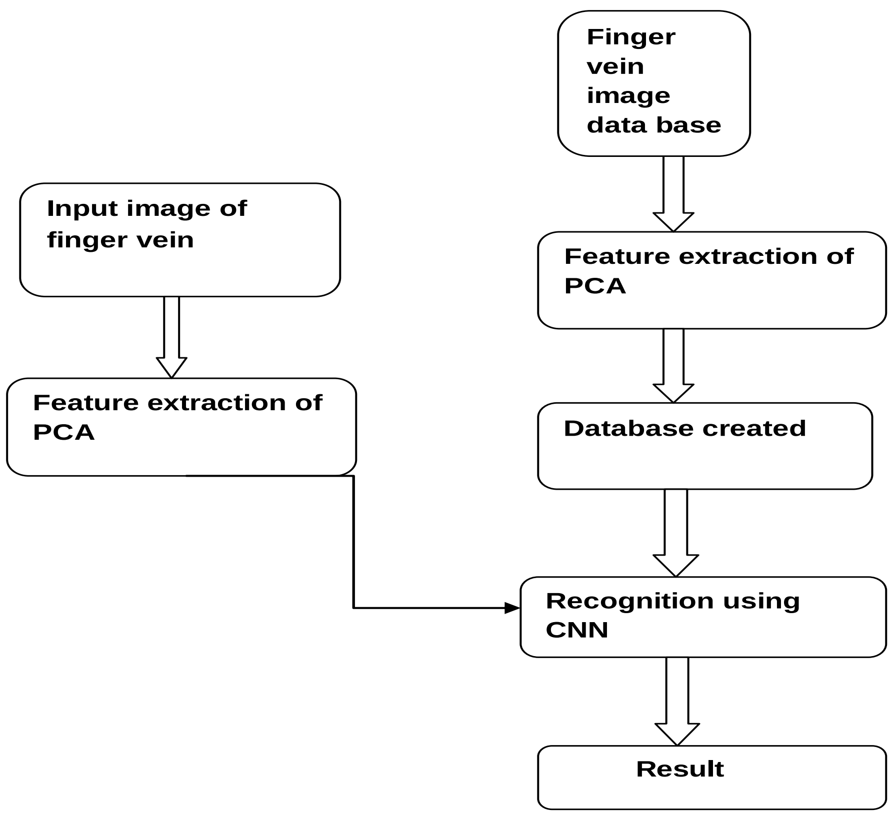
Pf(z) represents a cross-sectional profile acquired from an image at any position.

2.1 Local Binary-based Methods:

Local Binary Pattern is a local feature descriptor used to represent the finger vein local feature information. The LBP code may be described as an ordered set of binary values determined bycomparing the gray value of a central pixel with its neighboring pixels. In Reference , the ordered set of binary values can be represented in a decimal

$$\text{LBP}(x_c, y_c) = \sum_{n=0}^{7} S(i_n - i_c)2^n \quad (3)$$

3.FUNCTIONAL BLOCK:



STEPS:

Preprocessing:

Pre processing is an data mining process.Particularly applicable for data mining and machine learning methods.

Image Restoration:

Restoration process attempts to reconstruct or recover an image that has been degraded by using priori knowledge of the degradation phenomenon.

Image Segmentation:

Before we extract the information the image has to be subdivided into parts.

Image Enhancement:

Process of adjusting digital image so result are more suitable for display or further image analysis.

Recognition:

Process of categorization of given input data to identifiable class using salient feature extracted from data.

Image Enhancement:

Process of adjusting digital image so result are more suitable for display or further image analysis.

4. CONVOLUTIONAL NEURAL NETWORK:

In recent years, applications of deep-learning-based meth- ods, such as CNN, have been introduced in vein-based recognition scenarios, as summarized in Table IV. Biometric identification using CNN has been studied by Radzi et al. The employed network is based on the one proposed in , in which convolution and sub-sampling layers are fused into one layer, resulting in a reduced-complexity four-layer CNN.

As mentioned earlier, the proposed CNN architecture is based on a design that consists of fused convolutional and subsampling layers as first proposed by Simard et al. The method dispenses does away with complex operations, such as momentum, weight decay, structure-dependent learning rates, averaging layers, extra padding on the input, tangent prop, and even the fine tuning of the architecture, which are otherwise needed in conventional CNN solutions . Shows the proposed CNN architecture for finger-vein biometric recognition. The CNN consists of four layers (namely C1, C2, C3, and C4 convolutional layers), and this does not include the input layer. We refer to this architecture as the 5-13-50 model, implying that there are 5, 13, and 50 feature maps in layers C1, C2, and C3, respectively. Layer 4 (i.e. the output layer) is fixed 1868 at 50 neurons since the target number of categories to classify is 50 subjects; hence, this information is implicit and therefore unnecessary to include in the model referencing name. The cross-validation technique, a popular empirical method for estimating the generalization accuracy of a NN , is applied to find the best model configuration, in which we determine the best number of feature maps and the best connection schemes to implement. We will discuss this best model selection process.

5. RESULT AND DISCUSSIONS:

In deep learning-based method, finger vein image is transformed into a low dimensional space by dimension reduction, in which the discriminating information is kept and noises are discarded. Mostly feature extraction technique in this kind of method requires a training process to learn the transformation matrix, and a classifier is employed in the matching process. During image acquisition, the residual information is also obtained such as pose variation, shades of finger muscle and bone around the vein, which may affect the accuracy of the identification system. In order to remove these problems, Liu et al. presented Orthogonal Neighborhood Preserving Projection (ONPP) manifold learning method for the first time to handle the pose variation problem in finger vein image and obtained 97.8% recognition rate. Due to the acquisition devices, torsion, translational and other deformation in the local area, the traditional approach achieved very low identification precision. Guan et al. proposed a feature extraction method named Bi-directional Weighted Modular B2DPCA (BWMB2DPCA), which obtained a better result than the traditional techniques. The BWMB2DPCA method shortened the size of image feature matrix, which also decreased the recognition accuracy as different feature vectors effect identification efficiency. Additionally, the experimental result of BWMB2DPCA was not conclusive because the eigenvectors of column are ignored.

6.CONCLUSION:

Accurate extraction of finger vein pattern is a fundamental step in developing finger vein based biometric authentication systems. Finger veins have textured patterns, and the directional map of a finger vein image represents an intrinsic nature of the image. The finger vein pattern extraction method using oriented filtering technology. Our method extends traditional image segmentation methods, by extracting vein object from the oriented filter enhanced image. Experimental results indicate that our method is a better enhancement over the traditional method and has good segmentation results even with low-quality images. The addition of oriented filter operation, extracts smooth and continuous vein features not only from high quality vein images but also handles noisy low quality images and does not suffer from the over-segmentation problem. However, it requires a little more processing time because of the added oriented filter operation. Topology is an essential image property and usually, even an inflection point may contain plenty of accurate information. Finger-vein recognition is faced with some basic challenges, like positioning, the influence of image translation and rotation etc. Finally combine the features for matching and recognition. Experimental results indicate that the method can accurately recognize finger-vein, and to a certain degree, overcome the influence image translation and rotation. Furthermore, the method resolves the difficult problem of finger-vein positioning. It is also computationally efficient with minimal storage requirement, which makes the method of practical significance. However there are still problems of non- recognition and false recognition. Besides, pre-procession is an import requirement for this method and the accuracy of preprocessing influences recognition result significantly. In view of this, further research will be done on the pre-procession method, to improve the image quality and the accuracy of feature extraction, and subsequently improve system reliability. This chapter discussed recent approaches to solving the problem of varying finger lengths and proposed using a set of images of same size interval in a selected sub-block approach. For each image sub-block, wavelet moment was performed and SPIHT features extracted. SVM transform is performed, and the two features were combined for recognition. Formatching and identification, we proposed a method of fuzzy matching scores. Experimental results show that wavelet moment SPIHT method achieved good recognition performance.

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