ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Survey on Vein Visualisation and Biometric Techniques.

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ABSTRACT

In today's society with the rapid growth in the field of electronics and its deployment in every field, Vein identification plays a vital role in the field of both biometrics and clinical area. In this paper, we present a review of various biometric techniques and vein visualization techniques proposed by various authors. Inorder to enhance the visibility of the nerve, researches proposed techniques which includes extraction of ROI, segmentation, normalization, filtering, enhancement and feature extraction.

Keywords: Vein Visualization, Biometric, Vein pattern, ROI extraction.

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ISSN: 0975-8585

INTRODUCTION

Due to the advancements in electronics, identification and authentication of an individual is very easy. The technique used is called Biometric technique. The technique variation will depend upon the ROI (region of interest). Effective vein visualization is equally important in many real time circumstances such as needle insertion, to identify and it is also a modern biometric technique, which employs vein pattern in the human palm to verify the person. However various approach such as, near infrared spectroscopy, ultrasound imaging is used. Since the vein pattern is unique for every individual, it's quite a big challenge to identify the suitable vein. The traditional vein visualization techniques contain various disadvantages and the output is not so accurate.

BIOMETRIC TECHNIQUES

There are many biometric techniques which are used in various fields. Some of them are finger print, hand geometry, retina, iris, face, signature, voice etc.

Finger print recognition

Finger print is the impression of the minute ridge that is extracted from the finger, which is called as dermal. These ridges are unique and unalterable. Now a days live finger print reader using optical, silicon, thermal, ultrasonic approach are used instead of old method of using ink to capture the finger print. Finger print identifications are based on minutiae or location and direction of the ridge endings and bifurcations along its path. Pattern matching and minutiae based matching are the commonly used matching techniques. Minutiae matching relies on minutiae points i.e., direction and location of every single point.

Based on this knowledge Zin Mar Win et al. used a finger recognition system based on correlation. The scheme also uses Gabor filters for finger print feature extraction. The test results of low FAR, FRR and 97% accuracy is reported. But Zhifan GAO Et Al. (2002) released a new technique for finger print using neighbour local graphical structure to match the point in a pattern and global matching to have a solution for the problem of noisy data. In later years, G.Danese et al. presented a fast finger print matching algorithm using a parallel architecture based on BLPOC (spatial correlation with only band limited phase). Then Zhu Le-Qing proposed a recognition scheme based on Speeded Up Robust Features (SURF) algorithm and knuckle print. The poly U FKP database test results shows accuracy of 96.91% and 0.106 as an average matching time for identification. But Fernando Cornelio Jimenez Gonzalez et al. explains a method to liftup the problem of controlled pressure and humidity while acquiring image. The proposed method uses non-stationary analysis and negative Laplace filter of short time Fourier transform and the respective algorithm which finds match percentage in the verification process. Later Yun Yang and Jiami together designed an ATM terminal based on finger print. This respective system ensures enhanced and advanced security for reliability and stability. Gabor filter bank is used in image enhancement from the original image. But Wenzhou Lin et al. brings to notice a novel idea on which the registered fingerprint is stored into IC cart via microcomputer system of the respective ID card. Later the stored value is matched with the information of the holder whenever it is required. The scheme ensures reliable performance, easy to use and higher security. Finally, Kaishang Zhang et al. proposed an automatic finger recognition system. The technique utilises embedded hardware, open source LINUX operating system and related tools.

Gesture

Gestures are represented as the most natural communication form between human and computer in virtual system. Usage of gestures as an intellectual interface benefits as a motivation for analysing, modelling, simulation and recognition of gestures.

Hand gesture technology:

For any system in this respective technology, the initial process is to collect the necessary data in-order to accomplish a specific task. A vast variety of technologies are available to capture input data in hand gesture recognition. vision based, instrumented glove and coloured marker approaches are the three different recent technologies in hand gesture technology.

Vision based approaches:

In this method the system requires only camera to capture the image required for the natural interaction between human and computers and no extra devices are needed. These approaches are simple but a lot of gesture challenges are raised such as the complex background, lighting variation and other skin colour objects besides the requirements such as velocity, recognition time, robustness and computational efficiency.

Instrumented glove approach:

Unlike vision based approach, it uses sensor devices for capturing hand motion and position. These approaches can provide exact coordinates of palm and fingers location and orientation. These approaches requires the user to be connected with the computer physically which obstacle the ease of interaction between users and computers.

Coloured marker approaches:

Marked gloves or coloured markers are a type of gloves that worn by the human hand with some colours to direct the process of tracking the hand by locating the palm and the fingers. The ability of this is to extract geometric features necessary to form hand shape. The color glove shape will consists of small a region that contains different colours or as applied in three different colours which is used to represent the fingers and palms, where a wool glove was used.

Iris

Iris recognition is a method of recognizing a person by analysing the iris pattern. Six months later the child birth, these iris patterns are formed. It remains stable after a year and remains the same for the entire life time that means it does not have aging effect. Iris pattern of identical twins differ and a person's left and right eyes have different patterns. Iris recognition consists of the following modules.

1) Image acquisition
2) Iris segmentation
3) Normalisation
4) Feature extraction
5) Matching

Initially, Chun Wei Tan et al. presented a joint strategy which will extract both the global and localized features are acquired for accurate iris recognition from the distantly acquired face or eye images for both NIR and visible imaging and later those are combined. For image enhancement, binarisation and histogram are used and an algorithm called as random walker is used for coarse segmentation. Global iris bit stabilization encoding and a localization ZMs phase based encoding strategy is used to recover the iris features. On the other hand, Wenzhi Bin et al. presented a technique in which a geometric key which is of coordinated pair is used to deal with significant image variations and influence from multiple noise sources. Encoding of the iris features are defined using the geometric key from the similar localized iris region pixels. The strength of localized iris encoding strategy is better in accommodating the imaging variations, whereas the strength of global iris encoding strategy is in encoding of less noisy iris region pixels. In contrast to that, Himanshu Rai and Anamika Yadav used circular transformation which in turn used for segmentation. Trimmed median filter and parabolic transformation are used for eyelid detection. Haar wavelet and 1D Log Gabor filter is used for iris pattern recognition and feature extraction using a combination of hamming distance classification and support vector machine. However, Yun Song, Wei Cao and Zun Liang Hee presented an approach in which all the training images are concatenated as a dictionary later, the iris recognition task is an optimization problem which has to seek a sparse representation of the test sample in terms of the concatenated dictionary and a sparse error correction is used to work with spatially localized errors and gross.

Signature

Unlike finger print and iris, signature recognition is a behavioral biometric. The system needs to pre-process the data. The major steps include

1) Data acquisition
2) Signature pre-processing
3) Feature extraction
4) Enrolment and training
5) Performance evaluation

To elaborate the idea of behavioral biometric, Pradeep Kumar and Shekar Singh proposed an idea to describe how a HMM are stochastic models and it has the ability to acquire pattern similarities and differences. The analysis of the testing results is obtained by varying the number of HMM states and their respective state transition topology is described. But Ashwini Pansare and Shalini Bhatia describes that the neural network is a widely used approach because of the power of usage and simplicity. Initially extracting a feature set which represents the signature and in second step involves finding out the relationship between signature and its class. After determining the relationship, it gives the results proposing test signature belongs to particular signer. In addition to that, Ashwini Pansare and Shalini Bhatia focused on the support vector machines (SVMs). These are machine learning algorithms. These algorithms uses a high dimensional feature space to derive unseen data by calculating differences between classes of given data. Several attributes of signature such as grid features and directional are used. In contrast, Hemant Saikaiaand and Kanak Chandra Sarma proposed a simpler approach which is called as the template matching approach. In case if the patterns are distorted then it fails in signature recognition. There is a large intra class variation in signature patterns. Nevertheless detection of light distortion will be successful. The template matching methods are sub-divided into several forms such as geometric feature extraction, stroke analysis and graphics matching depends on different features.

Voice

Voice recognition system is also called as speaker recognition system (SRS). Automated speaker recognition is the computing task of validating a user's claimed identity using characteristics extracted from their voices. In automated speaker recognition the speaker specific information is extracted from the processed speech signal. This speaker specific information is used to generate voice print which cannot be replicated by any source except the original speaker.

There are two methodologies used in speaker recognition system architecture. They are

1) SIS (Speaker Identification System)
2) SVS (Speaker Verification System)

Vein Recognition

The most common methods used for vein pattern visualization are NIR spectroscopy, ultra sound imaging, infrared laser excitation, line/curve matching using vessel extraction. It can also be done using various types of filters in addition to post image processing algorithms. A series of techniques are followed, they are image segmentation and normalization, image enhancement, filtering techniques, feature extraction. Post image processing techniques are followed to improve the image contrast while reducing the noise.

EXISTING SYSTEM

3 kinds of vein images are applicable for individual authentication and identification. But in clinical applications precise vein should be identified. Considering the public hygiene, the finger vein recognition system or vein image acquisition system is designed non-contact. Bank ATM, driver identification are best examples for vein recognition. In the survey of vein identification for biometric purpose, the following stages are in common. They are

1. Enrolment
2. Authentication
3. Identification
4. Decision

The initial stage of vein identification in biometric applications is enrolment which is otherwise called as registration. It is composed by various operations such as vein image acquisition, image processing and feature extraction. Then the general templates are stored in database. Authentication is the next stage; it is also called as verification. Similar image processing operations as those in enrolment is used in authentication process. It is defined as a one to one matching process. Identification is the third step, which is also called as one to many processing. Similar operations are used in this step. The final step is Decision. The main procedure to be followed in decision making is feature extraction i.e. calculate the similarity between the query feature template and the counterparts readout from database one by one. Then the decision judgement is made based on the computed similarity.

PRINCIPLE OF VEIN IDENTIFICATION

A wavelength of 740-960nm infrared light can pass through the human skin and get absorbed by the haemoglobin in the vein. As the reflections of the surroundings are higher than the veins, the vein patterns can be viewed with the IR sensitive CCD (Charge Couple Device). This principle makes the vein identification possible. In some cases, far infrared light is also used to demonstrate the vein identification.

VEIN VISUALIZATION MATHEMATICAL APPROACH

Various filter types are used in vein identification process. Filters such as Wiener filter, Gabor filter, Laplacian of Gaussian (LoG) filter are used. The mathematical expressions of these filters are as follows.

Gabor Filter

These filters are special kind of band pass filters. A Gabor filter set in the specific given direction will deliver a strong response for the locations of target images that have the respective structures in this given direction. Gabor filters used in edge detection, texture analysis, feature extraction, disparity estimation (in stereo estimation).

The working of this filter is similar to other filter operations. Mask (convolution kernel) that represents the filter is used. A mask is an array of pixels, where each pixel is assigned to a weight or value. Then the array is slid over every pixel of the image and a convolution operation is performed.

D Gabor filter:

$$f(x,w,\mu)=1/\sqrt{(2\pi\mu)}\ e^{((-x^2/(2\mu^2)+jwx))}$$

D Gabor filter:

$$f(x,y,w,\theta,\mu_x,\mu_y)=1/(2\pi\mu_x\mu_y)e^{\{\{(-1)/2[(\ 〚x/\mu_x)〛^2+(\ 〚y/\mu_y)〛^2+jw(x\cos\theta+y\sin\theta)]\}}$$

Where,
μ refers to spatial spread
w refers to frequency
ɵ refers to orientation.

B. LoG filter

This filter is mostly used in image sharpening i.e. to see fine details in image. First order filters are best for finding edges in images but laplacian operator is a second order derivative. Laplacian operator is works goods in finding fine detail of an image. Any feature like sharp discontinuity (such as noise) that will be

enhanced by a laplacian operator.

LoG(x,y)= (-1)/(πμ^4)[1-(x^2+y^2)/(2μ^2)]e^(-((x^2+y^2)/(2μ^2)))

RELATED WORK

In a paper proposed by Jae Hee Song, Choye Kim and YangmoYoo (March-2015), states that a method based on multi spectral wiener estimation to identify the vein. In this method, a conventional RGB camera is used to acquire reflectance information from veins. Weiner estimation is then applied to extract the multi spectral information from the veins. Using a color calibration chart, an experiment was conducted to evaluate the performance. Along with it, an in vein imaging experiment using vivo subcutaneous was performed to explore the clinical performance of the smart based wiener estimation. The veins from various sites were localized successfully using the multispectral reconstructed images and these results are confirmed by B-mode ultrasound and color Doppler images. Furthermore, Simon Juric, Vojko Flics, Andreas Holzinger, Matjas Debevc and Borut Zalik (April-2014) stated that a low cost mobile heath solution for subcutaneous vein detection using near infrared spectroscopy. Their objective of this is to identify the near infrared spectroscopy commercial systems which are employed, which is being conducted using the PubMed database. The technology used was vein detection using IR and ultrasound imaging. The main motto was to conceptualize an educational mobile medical application in-order to help and improve decision-making capabilities of health care individuals in vein puncture. But Wen Xiong Kang, Yang Liu, Qiuxia Wu and Xishun Yue (December-2013) proposed that a novel recognition approach for contact free palm vein recognition that performs feature extraction and matching of the vein textures which are distributed over the palm surface, including palm veins and finger veins, that is because to minimize the loss of information. A hierarchical enhancement algorithm, which combines histogram equalization and DOG filter, that is adopted to alleviate uneven illumination of veins in the region of interest and to highlight the particular vein textures. In addition to that, RootSIFT, much stable feature extraction method which is local invariant in comparison to SIFT, that is adopted to overcome the contact free mode's projection transformation. To improve the accuracy of feature matching, LBP histograms and a hierarchical mismatching removal algorithm (novel) which is based on neighborhood searching are adopted. However, Vishal U. Bhosale, Onkar S. Kale, Mahesh W. Pawar, Roshan R. Patil and Pritam S. Patil(March-2014) followed key steps such as, infrared palm image capture detection of Region Of Interest (ROI), pre-processing, palm vein pattern extraction, feature extraction and feature matching. Three image processing algorithms are used. They are Pattern marker algorithm, Pattern extractor algorithm is used to perform thresholding and grayscaling. Thresholding is done for image segmentation. The third algorithm used for vein extraction is pattern thinning algorithm. On the other hand, Koji Kashihara (2013) referred that low cost infrared cameras could capture vein images non-invasively. Then the obtained image may have low contrast and a low SNR, this SNR rate is improved sufficiently by filtering process. Therefore an efficient filtering method is used to estimate minute changes which will enable the early detection of disease. Here a novel filtering method that is based on the Genetic Algorithm (GA) along with the expectation maximization (EM) algorithm is proposed for the visualization of venous shapes and its effectiveness is evaluated by images obtained from a near infrared wavelength of 780 nm charge coupled device (CCD) camera. The novel filter was designed by the GA to efficiently improve the worse SNR of venous images, even with an unknown correct image answer. In contrast, M.Deepamalar and M.Madheswaran(June-2010) et al proposed that, this system is based on multiple feature analysis which is parallel in mode and multilevel fusion. The directional information of the palm vein has been considered for better analysis. The matching error rate in newly proposed multimodal palm vein recognition system is very low and has a false acceptance or rejection rate. The shape and texture features have been used to classify the vein patterns for making necessary decision. Moreover, Anagha B Bawase, S D Apte (2015) proposed that both far infrared imagining technique and near infrared techniques are used to detect hand veins in their paper. In later years, Ying Bo Zhou and Ajay Kumar, presents two new approaches to improve the performance. The proposed approach attempts to more effectively accommodate the potential deformations, rotational and transformational changes by encoding the orientation, preserving features and utilizing a novel region based matching scheme. They evaluated the improvement in performance and the scenarios of recognition and analyze the influence of enrolment size on the performance. In this context, the proposed approaches are compared for its superiority using single image enrolment on two different databases.

CONCLUSION

In brief, biometrics techniques are ancient but still in use technology. There are various disadvantages

in the existing method such as fraud ability, mishandling, etc. Therefore biometric technique using veins is suggested from this survey.

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