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Fingerprint detection using AFIS and NFIQ with the help of blood flow and hand vein signal

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Abstract: In biometrics, a human being needs to be identified based on some characteristic physiological parameters. A wide variety of systems require reliable personal recognition schemes to either confirm or determine the identity of an individual requesting their services. The purpose of such schemes is to ensure that the rendered services are accessed only by a legitimate user, and not anyone else. By using biometrics it is possible to confirm or establish an individual's identity. When finger pressed against a flat plate & deformed blood inside finger moves away from deformed area. This cause finger to change its appearance from reddish to white. As finger leaves the plate, blood come back & its looks reddish again. To use this color change to distinguish genuine fingers from artificial ones for un-attended fingerprint identification system. This blood related signal may reflect the stiffness the peripheral blood vessels & it may be correlated with some health conditions such as blood pressure. Use fingerprint sensor base on scattered light detection. Because of spectra of light scattered by deformed fingers show large changes mostly in green portion, an LED emitting peak strength use. First compare series of fingerprint images acquired during a normal input action & those obtained blood flow. The occluded finger required large force to exhibit a similar change for pixel values.

Problems of detecting blood vessels in retinal images. Blood vessels have poor local contrast & the application of existing edge detection algorithms yields results which are not satisfactory. Operator for feature extraction based on optical & spatial properties objects to be recognized. The gray-level profile of cross section of a blood vessel is approximately by a Gaussian shaped curve. The concept of matched filter detection of signals is used to detect piecewise linear segments of blood vessels in these images. The automatic detection of blood vessels in the retina could help.

Index: ROI, FAR, FRR, HAND VEIN.

I. Introduction

Automated algorithms for fingerprint recognition have long been a problem studied in computer science. Since every person has a unique set of fingerprints this method has become common for personal identification. Databases consisting of millions of fingerprints are stored on file for this purpose.The hope to be able to provide significant speed improvements in the fingerprint matching phase.The order to implement a successful algorithm of this nature. It is necessary to understand the topology of a fingerprint.

A. Motivation

Biometric is the most secure and convenient authentication tool. Biometrics measure individual's unique physical or behavioral characteristics to recognize or authenticate their identity. Common physical biometrics includes fingerprints, hand or palm geometry. Biometrics refers to the identification of humans by their characteristics or traits. Fingerprint images captured by touch-less sensors are very different from fingerprint images captured by traditional touch based sensors. Typically, such kinds of images are noisier, the ridge pattern is less visible and the colors of the sky can significantly change. Moreover, defocusing problems well blur effects due to the movements of the finger can be present. The biometric system designed for touch-less fingerprint images the feature extraction and image processing methods must be carefully selected and tuned taking into account the presence of the septic noise type related to the biometric samples. There are several biometric recognition systems designed for touch-less fingerprint images. The majority of these systems are based on multiple finger images, or single images. Unfortunately the real accuracy of such system is not comparable to the one achieved by touch based fingerprint recognition systems. The performances are far to be sufficient for real applicative contexts, especially for systems working with a single image of the finger.

Preliminary results in this research field show that systems based on multiple views of the finger (including multiple view

and structured light three-dimensional systems) show a more accurate behavior, but, on the other side, they need more complex setups (more cameras and /or special illumination systems) and specific software modules to deal with the complexity of their image inputs.

B. Overview of the Project

Biometric is the most secure and convenient authentication tool. Biometrics measure individual's unique physical or behavioral characteristics to recognize or authenticate their identity. Common physical biometrics includes fingerprints, hand or palm geometry characteristics.

a. Biometric Technologies

There are many biometric technologies to suit different types of applications. To choose the right biometric to be highly fit for the particular situation, one has to navigate through some complex vendor products and keep an on future developments in technology and standards.

b. Fingerprint Authentication

A fingerprint looks at the patterns found on a fingertip. There are a variety of approaches to fingerprint verification, traditional police method, using pattern-matching devices, and things like moiré fringe patterns and ultrasonic. Identification by fingerprints relies on pattern matching followed by the detection of certain ridge characteristics also known as Galton details, points of identity, or minutiae, and the comparison of the relative positions of these minutiae points with a reference print[2], usually an inked impression of a suspect's print. There are three basic ridge characteristics, the ridge ending, the bifurcation and the dot. Identification points consist of bifurcations, ending ridges, dots, ridges and islands. The single rolled fingerprint may have as many as 100 or more identification points that can be used for identification purposes. There is no exact size requirement as the numbers of points found on a fingerprint impression depend on the location of the print.

The example area immediately surrounding a delta will probably contain more points per square millimeter than the area near the tip of the finger which tends to not have that many points. Image 1 sees part of a fully rolled fingerprint that the edges are cut-off so you can safely assume that this is not a fully rolled impression. If you take a look at image 2 you can see that I have sectioned out the centre portion of this impression and labeled 10 points of identification. That was not all the points found but simply the ones that could be mapped easily without cluttering up the image. First image 1 and image 2 are both taken from the same image. The real life you would have impressions made at separate times and subject to different pressure distortions. Secondly, these images are relatively clean and clear where many of the actually crime scene prints are anything but clear. Last you have to consider that this is an easy comparison because you are blessed with having a core pattern and a delta when in some cases you may have a latent that could be a fingertip, palm or even foot impression.

c. Palm Vein Recognition

Palm vein authentication uses the vascular patterns of the palm as personal identification data. Palm vein information is hard to duplicate because veins are internal to the human body. Palm vein authentication technology offers a high level of accuracy, and delivers the following results a false rejection rate (FRR) of 0.01% and a false acceptance rate (FAR) of less than 0.00008%, using the data of 150,000 palms. Several banks in Japan have used palm vein authentication technology for customer identification since July 2004. This technology has been integrated into door security systems as well as other applications

Figure 1. Palm Vein Recognition

Palm Vein authentication is one of the vascular pattern authentication technologies. Vascular pattern authentication includes vein pattern authentication using the vein patterns of the palm, back of the hand, or fingers as personal identification data, and retina recognition using the vascular patterns at the back of the eye as personal identification. The vascular pattern used in this authentication technology refers to the image of vessels within the body that can be seen as random mesh at the surface of the body. Everyone has vessels; vascular pattern authentication can be applied to almost all people. The only difference would be whether the feature is at the surface of the body. Consequently, vascular patterns cannot be stolen by photographing, tracing, or recording them. This means that forgery would be extremely difficult under ordinary conditions.

Figure 2. Palm Vein near Image

Vein Patterns are unique to each individual even identical twins have different vein patterns. The vein patterns do not change within a human lifetime except in the case of injury or disease. Voice authentication is based on voice-to-print authentication, where complex technology transforms voice into text. Voice biometrics requires a microphone, which is available with PCs nowadays. Voice biometrics is to replace the currently used methods, such as PINs, passwords, or account names. But voice will be a complementary technique for finger-scan technology as many people see finger scanning as a higher authentication form.

II. Problem definition

The images related to different views can be captured simultaneously by using N cameras or in a time sequence by using a single camera that captures a frame sequence of the finger by different point of views. Most of the identity comparison methods based on the fingerprint biometric trait use information related to minutiae. These methods typically consider each minutia as a 3-tuple composed by the coordinates and the angle of the ridge in the minutia point. Usually, the minutiae type is not considered because different pressures of the finger on the acquisition sensor can modify bifurcation in termination and vice versa. The identity comparison methods designed for images captured by classical touch-based sensors cannot be directly applied on touch-less fingerprint images. The images related to different views can be captured simultaneously by using N cameras, or in a time sequence by using a single camera that captures a frame sequence of the finger by different point of views. The first step is pre-processing. In this step the noises of the images are removed and clear ROI is obtained. Considering two minutia points extracted from two fingerprint images, this system is capable to estimate if these two points belong to the same minutiae in the real finger.

In this approach, the images captured by touch-less sensors are first enhanced and segmented, in order to improve the visibility of the ridge pattern and reducing the presence of noise. Second, the minutiae positions are estimated with an algorithm that is well known in the literature. Last and the final comparison is processed by using a trained neural network that evaluates the differences between the local features of the candidate minutiae pairs. In this method [8], neural network that used to compare two real fingerprint images of the same finger. After that the fingerprint image is compared with database, if the fingerprint matches its authenticated, but this process causes time constraint.

III. Plan of Project

A. Proposed Framework

Contact-based sensors are the traditional devices used to capture fingerprint images in commercial and homeland security applications. Contact-less systems achieve the fingerprint capture by vision systems avoiding that users touch any parts of the biometric device. Typically, the finger is placed in the working area of an optics system coupled with a CCD module.

The captured light pattern on the finger is related to the real ridges and valleys of the user fingertip but the obtained images present important differences from the traditional fingerprint images. These differences are related to multiple factors such as light, focus, blur, and the colour of the skin. Unfortunately, the identity comparison methods designed for fingerprint images captured with touch-based sensors do not obtain sufficient accuracy when are directly applied to touch-less images.

Recent works show that multiple views analysis and 3D reconstruction can enhance the final biometric accuracy of such systems. The new method is proposed for the identification of the minutiae pairs between two views of the same finger, an important step in the 3D reconstruction of the fingerprint template. The method is divisible in the sequent tasks first, image pre-processing step is performed second, a set of candidate minutiae pairs is selected in the two images, then a list of candidate pairs is created last, a set of local features centred around the two minutiae is produced and processed by a classifier based on a trained neural network[4].

The output of the system is the list of the minutiae pairs present in the input images. Experiments show that the method is feasible and accurate in different light conditions and setup configurations. The proposed system builds a set of local features centered on the selected minutiae and then a classifier based on a trained neural network estimates if each candidate pair is valid or not. The output of the system is the list of the minutiae pairs present in the input images. In this context, the generalization capability of the neural network permits to efficiently and effectively learn the complex relationship needed to classify if a pair of minutiae extracted from two different images belongs to the same real minutiae point of the finger.

IV. Analysis and Design

A. Analysis

The complete process of a fingerprint image analysis (comparison of patterns) can be divided into six steps

1. Scanning of a fingerprint image. The quality of the scanned image is the decisive factor for automatic identification purposes. It is desirable to use a high-definition fingerprint scanner which is able to tolerate different skin types, damages, dryness, as well as the humidity of the finger surface.
2. Image quality improvement. By using image quality improvement, an optical improvement of the structures (ridges) on the scanned image can be achieved.
3. Image processing. Image processing means the preparatory phase for feature extraction and classification purposes.
4. Feature classification. Fact is that all fingerprints show certain global similarities, which allow for rough classification into three principal finger classes. However, classification is a rather difficult process both for algorithm-based decisions as well as for man-made decisions since some fingerprints cannot be clearly allocated to a concrete finger class. Nowadays, pattern classification is only used in dactyloscopic systems, e.g. AFIS (Automated Fingerprint Identification System) of the Federal Office of Criminal Investigation (BKA). This method is not feasible for access systems.
5. Feature extraction. In this phase, the location of the minutiae (ridge bifurcations and ridge endings) in the fingerprint is detected and extracted. In practice, scanned fingerprint images show differing qualities. The algorithm performance is negatively influenced by a poor image quality.
6. Verification phase. In the verification phase two feature vectors are being compared. The algorithm performance strongly depends on the quality (significance) of the extracted minutiae and on the comparison process.

B. System Design

Design Engineering deals with the various UML [Unified Modeling language] diagrams for the implementation of project. Design is a meaningful engineering representation of a thing that is to be built. Software design is a process through which the requirements are translated into representation of the software. Design is the place where quality is rendered in software engineering. Design is the means to accurately translate customer requirements into finished product.

V. Conclusion

Current electronic security systems, which rely primarily on passwords, personal identification numbers, and authentication tokens (smart cards) to ensure that a client is an authorized user of a system, all have a common vulnerability,: the verification can be lost, stolen, duplicated, or guessed. With the use of biometric technology, this vulnerability can be

nearly eliminated. A vein print is extremely difficult to forge and therefore contributes to a high level of security, because the technology measures hemoglobin flow through veins internal to the body. Contact less technology even ensures hygiene and makes it acceptable to use in public places. The opportunities to implement palm vein technology span a wide range of applications. The proposed a new method to extract feature of the same finger. This task is an important step in the 3D reconstruction of the fingerprint images. The method is as follows. After an enhancement step of the input image, the candidate features are selected in two fingerprint images by a classical method, and a list of candidate pairs is created. The output of the system is the list of the analysis of. The feature set. Experiments showed that the method is feasible and accurate also in different light conditions and hardware configurations

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