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Palm Vein Recognition System Based on Derived Pattern and Feature Vectors

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ABSTRACT

Biometrics is a technology for recognition under which Palm vein recognition stems. They are of crucial importance in various applications of high sensitivity. This article develops a palm vein recognition model, based on derived pattern and feature vectors. All the palm print images used in this work were obtained from CASIA Multi-Spectral Palmprint Image Database V1.0 (CASIA database). First, a Region of Interest (ROI) was identified and extracted from the palm print images. Next, Histogram Equalization was used to enhance the area of the palm print image in the Region of Interest. The enhanced image obtained was subjected to the Zhang Suen's Thinning Algorithm to extract appropriate features in the palm print images needed for authentication. The features derived based on this vascular pattern thinning algorithm which are then compared and evaluated to carry out 'matching'. The Pattern Matching itself was done using the Euclidean Distance for subsequent matching. The model was designed using UML, and implemented with C# and MS SQL on Microsoft Visual Studio platform. The developed system was evaluated based on False Acceptance, False Rejection and Equal Error Rate (EER) values obtained from the system. The results of testing and evaluation show that the developed system has achieved high recognition accuracy.

1. INTRODUCTION

Authentication is the process of determining whether someone or something is, in fact, who or what it has declared (him)itself to be. According to Lauber (2003), authentication comes in three forms.

The first is 'something you know', and this refers to authentication that utilizes tools such as passwords, and Personal Identification Numbers (PIN). Passwords and PINs could be issued directly to users in real time via digital means like email and text messages on mobile phones.

The second, 'something you have', refers to items the user may posses, such as smart cards or tokens. These items has to be carried about for usage.

The third type of authentication is something you are, which in other words refers to biometrics.

Chowdary et al. (2014) defined Biometric Technology as a pattern recognition system which depends on physical or behavioral features of a person being identified. Biometrics has a higher level of security when compared the other forms of authentication, because it cannot be lost, borrowed, stolen or forgotten.

Commonly implemented biometric modalities include fingerprint, face, iris, voice, and hand geometry.

Over time, personal authentication methods have evolved to the use of inner/inward physiological traits of individuals, such as the vein patterns in the human fingers and palms. Veins are internal in the body and have a wealth of differentiating features, hence attempts to forge another person's identity is difficult. This, thus enables a higher level of security.

In palm vein recognition, vital information is extracted from the vein patterns to be used in the authentication process. The singularity and intricacy of palm vein patterns enables a high level of authentication accuracy as in Aj-juboori et al. (2014), unlike in other biometric approaches. In addition, a palm vein pattern is difficult to forge because it is internal to the body.

Palm vein recognition system consists of these key steps: Palm Vein Images Capture, Detection of Region of Interest (ROI), Pre-processing, Palm Vein Pattern Extraction, Feature Extraction and Matching (Prabu and Sivanandam, 2013).

2. LITERATURE REVIEW

The Biometrics System: According to Wayman et al (2005), Biometrics technologies are "automated methods of verifying and recognizing the identity of a living person based on a physiological or behavioral characteristic." When compared with traditional authentication, such as passwords or encrypted codes, biometrics exhibits greater security and reliability because its feature is difficult to duplicate and forge (Kang et al, 2014). They are fast becoming the 'foundation of an extensive array of highly secure identification and personal verification solutions' (Yeung, 2016).

Veins: Veins are blood vessels that carry blood towards the heart. Vein patterns use is highly secure because they lie beneath the skin, they are invisible to the naked eyes and they cannot be duplicated (Swapnali and Gurjar, 2016). Human vein characteristic stay constant throughout one's lifetime, and has a strong resilience against impostor attacks because the veins are internal to the body and only functional when the human is alive (Kang et al, 2014). The merits of palm vein on classical biometric (e.g. fingerprint, iris, face) are a low risk of falsification, difficulty of duplicated and stability (Aj-juboori et al, 2013).

Palm Vein Image Sources: Various biometric database exist for biometric research and development in cases where the prints vannot be captured directly. Some of these sources are: CASIA Multi-Spectral Palmprint Image Database V1.0 (CASIA, 2016), The Idiap Research Institute VERA Palmvein Database and PolyU Multi-Spectral Palmprint Database (PolyU database).

3. RELATED WORKS

An improved palm vein recognition system using multimodal features and NN classifier was done by Deepamalar and Madheswaran, (2010) focusing majorly on the directional information of the palm vein for better analysis. This multimodal recognition system was based on the convolved shape and texture features in a multiple feature set, skeleton, bifurcation and ending points of the palm vein

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