Review On Improvement Of Fingerprint Matching By Removing Distortion

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Abstract - ***O*ne of the open come outs in fingerprint confirmation is the lack of robustness against image quality degradation. Poor-quality images result in specious and missing features, thus degrading the performance of the overall system. Therefore, it is very important for a fingerprint acknowledgement system to estimate the quality and validity of the captured fingerprint images. Also the elastic distortion of fingerprints is one of the major causes for false non-match. While this problem impacts all fingerprint acknowledged applications, it is especially unsafe in negative recognition applications, such as watch list and reduplication applications. In such applications, malicious users may purposely distort their fingerprints to elude identification. In this paper, we proposed novel algorithms to detect and rectify skin distortion based on a individual fingerprint image. Distortion notification is viewed as a two-class classification problem, for which the registered ridge orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is prepared to perform the classification task. Distortion rectification (or equivalently distortion field estimation) is considered as a regression problem, where the input used is a distorted fingerprint and the output is the distortion field. In order to resolve this problem, a database (known as reference database) of various distorted reference fingerprints and corresponding distortion fields is built in the offline stage, and then in the on-line stage, the nearest neighbor of the input fingerprint is encountered in the reference database and the corresponding distortion field is used to transform the input distorted fingerprint into a normal one.**

Key Words: Fingerprint, distortion, registration, Nearest neighbor regression, rectification, classifiers.

1. INTRODUCTION

Although automaton like fingerprint recognition technologies have speedily advanced during the last forty years, there still exist several challenging research problems, for example, recognizing low quality fingerprints [2]. Fingerprint matcher is very sensitive to image quality as watched in the FVC2006 [3], where the matching accuracy of the same algorithm alters significantly among different data-sets due to fluctuation in image quality. The difference betwixt the accuracies of plain, rolled and latent fingerprint matching is even bigger as observed in technology evaluations conducted by the NIST [4].The issue of low quality fingerprints is dependent on the type of the fingerprint recognition system. Basically there are two types of recognition systems that is: positive recognition system and negative recognition system. In a positive recognition system, i.e physical access control systems, the user is supposed to be cooperative and wants to be identified. In a negative recognition system, such as identifying persons in watch lists and detecting multiple enrolment under different names, the user (e.g., criminals) is supposed to be uncooperative and does not want to be identified. In a positive recognition system, degraded quality causes false reject of legitimize users and thus bring inconvenience. The issue of low quality for a negative recognition system, however, is much more serious than positive recognition system , since malicious users may purposely degrade fingerprint quality to preclude fingerprint system from finding the true identity [6]. In point of fact, law enforcement officials have found a number of cases where criminals attempted to avert identification by damaging or surgically changing their fingerprints [7].Hence it is especially important for negative fingerprint recognition systems to find degraded quality fingerprints and amend their quality so that the fingerprint system is not compromised by malicious users. Degradation of fingerprint quality can be of two types that is: photometric or geometrical. Photometric degradation is usually caused by non-ideal skin conditions, dirty sensor surface, and complex image background (especially in latent fingerprints).

2. RELATED WORK

Due to the importance of recognizing distorted fingerprints, Researchers have proposed a number of methods and several fingerprint matching approaches. Few of them are as follows:

Xinjian Chen, Jie Tian suggested Algorithm based on Normalized Fuzzy Similarity Measure for Distorted Fingerprints Matching. This paper suggests a novel algorithm, normalized fuzzy similarity measure (NFSM), to handle the nonlinear distortions. The proposed algorithm consists of two main steps. In the first step, the template and input fingerprints were lined up. In this process, the local topological structure matching was presented to amend the robustness of global alignment. In the second step, the method NFSM was presented to compute the similarity betwixt the template and input fingerprints.

In Luo's method, an uncertain bounding box was used during the matching process. The process is robust to nonlinear deformations betwixt the fingerprint images. However, the distortion among the fingerprints from the same finger are captured from the Cross Match sensor is too large. In order to endure matching minutiae pairs that are further obscure because of distortions, the size of the bounding boxes has to be increased. However, as a side effect, it gives a very high probability for those non matching minutiae pairs to get paired, which results in a higher false acceptance rate.

The suggested algorithm was assessed on fingerprints databases of FVC2004. Disadvantage of this system: the algorithm used leads to false acceptance which occasionally happens. It depicts a similar pair although it is of some different fingerprint. Fernando Alonso-Fernandez and Javier Ortega-Garcia, proposed a relative study of Fingerprint Image-Quality Estimation Methods. In this work, existing approaches have been divided into three parts. First, those that uses local features of the image. Second, those that use global features of the image. The consequence of low-quality samples in the verification performance is also studied for a widely available minutiae-based fingerprint matching system. Experimental results show high correlation betwixt genuine scores and quality, whereas almost no correlation is encountered betwixt impostor scores and the quality measures.

As a final result, the highest betterment when rejecting low-quality samples is obtained for the purpose of false rejection rate at a given false acceptance rate. High correlation is found betwixt quality measures in most cases. However, different correlation values are obtained depending on the sensor. Disadvantage of this system; they suggest that quality measures work differently with each sensor. Due to their different physical principles, some quality measures could not be suitable for a certain kind of sensor. Jianjiang Feng, Jie Zhou proposed work for Orientation Field Estimation for Latent Fingerprint Enhancement. In this case, identifying latent fingerprints is of critical importance for law enforcement agencies to arrest criminals and terrorists. The image quality of latent fingerprints is much lower, with complex image background, unclear ridge structure, and even overlapping patterns as compared to live-scan and inked fingerprints. A robust orientation field estimation algorithm is essential for enhancing and recognizing poor quality latent. However, conventional orientation field approximation algorithms, which can process most live-scan and inked fingerprints, do not provide satisfactory results for most latent.

We believe that a major limitation of conventional algorithms is that they do not utilize anterior knowledge of the ridge.

3. PROPOSED SYSTEM

In this paper, we have tried to enforce robust method for detection and rectification of distorted fingerprints. Distortion detection is believed as a two class classification problem, where the registered ridge orientation map and period map of a particular fingerprint are utilized as the feature vector and a SVM classifier is trained to execute the classification task. Distortion correction (or equivalently distortion field estimation) is considered as a regression problem, the input is a distorted fingerprint and the output is the distortion field. To solve this problem, a database of several distorted reference fingerprints and accompanying distortion fields is made in the offline stage, and then in the online stage, the closest neighbour of the input fingerprint is found in the database of distorted reference fingerprints and the corresponding distortion field is used to correct the input fingerprint.

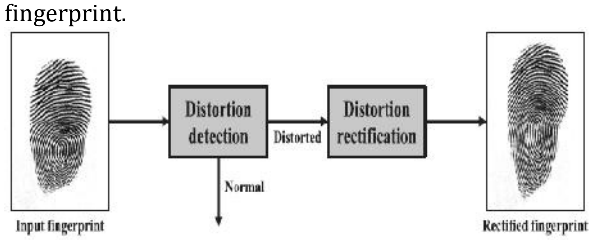

Fig.systm model

4. EXPERIMENTAL EVALUATION

4.1 Fingerprint distortion detection

Fingerprint distortion detection can be considered as a two class classification problem. We have used the registered ridge orientation map and period map as the feature vector, which is further classified by SVM classifier.

4.2 Fingerprint Registration

In order to take out meaningful feature vector, fingerprints have to be registered in a secure coordinate system. We suggest a multi-reference based fingerprint registration approach in which we depict how the reference fingerprints are prepared in the offline stage, and how to register an input fingerprint in the online stage.

4.3 Reference Fingerprints

In order to acquire statistics of realist fingerprint distortion, we gathered a distorted fingerprint database called Tsinghua distorted fingerprint database. A FTIR fingerprint scanner with video capture functionality was used for data accumulation. Each participant is asked to press a finger on the scanner in a usual way, and then distort the finger by applying a sidelong force or a torque and bit by bit increase the force. In the online stage the online fingerprint registration, given an input fingerprint, we execute the registration w.r.t. registered cite fingerprints.

4.4 Statistical Modeling of Distortion Fields

The distortion field between a pair of fingerprints can be approximated based on the corresponding minutiae of the two fingerprints. Unfortunately, due to the terrible distortion between paired fingerprints, existing minutiae matchers cannot find corresponding minutiae dependably. Hence, we extract minutiae in the first frame using Verifier and execute minutiae tracking in each video. Since the relative motion between adjacent frames is little, reliable minutiae correspondences between the first frame and the last frame can be found by this method.

4.5 Distorted fingerprint rectification

A distorted fingerprint can be thought of being generated by applying a strange distortion field to the normal fingerprint, which is also strange. If we can calculate the distortion field from the given distorted fingerprint, we can easily correct it into the normal fingerprint by applying the inverse of d. So we need to turn to a regression problem, which is quite hard because of the high dimensionality of the distortion field (although if we use a block-wise distortion field). We use nearest neighbour regression approach for this job.

4.6 Distorted Reference Fingerprint Database

The distortion fields are brought forth by uniformly trying the subspace spanned by the initial two principle components. For each basis, 11 points are uniformly sampled in the interval. For visualization purpose, only one reference fingerprint (the fingerprint located at the origin of the coordinate system) is utilised to generate the database of distorted reference fingerprints, and for each basis, five points are sampled. In reality, multiple reference fingerprints are used to achieve better execution.

4.7 Distortion Field Estimation by Nearest Neighbour Search

Distortion field approximation is equal to finding the nearest neighbor among all distorted reference fingerprints. The quality of being similar is measured based on level 1 feature of fingerprint, viz. ridge orientation map and period map. We speculate that distortion detection and rectification of human experts also depends on these features instead of minutiae.

5. CONCLUSION

False non-match rates of fingerprint matchers are very high in the case of severely distorted fingerprints. This generates a security hole in automatic fingerprint recognition systems which can be utilized by criminals and terrorists. For this reason, it is necessary to develop a fingerprint distortion detection and rectification algorithms to fill the hole. This paper described a novel distorted fingerprint detection and rectification algorithm. For distortion detection, the registered ridge orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is trained to classify the input fingerprint as distorted or normal. For distortion rectification (or equivalently distortion field estimation), a nearest neighbor regression approach is used to predict the distortion field from the input distorted fingerprint and then the inverse of the distortion field is used to transform the distorted fingerprint into a normal one.

The experimental results on FVC2004 DB1, Tsinghua DF database, and NIST SD27 database showed that the proposed algorithm can improve recognition rate of distorted fingerprints evidently. The proposed algorithm based on the features extracted from the orientation field and minutiae satisfies the three essential requirements for alteration detection algorithm

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