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Various Fingerprint Enhancements and Matching Technique

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Abstract

Identification and Verification of person on the basis of biometric features has become known in our society. When the biometric systems are connected to a person's body remarkably decreases the possibility of fraud. A biometric system basically is a pattern recognition system and to recognize the pattern or the image is not an easy task. From the various biometric techniques, recognisation done by fingerprint technique is best. Due to various qualities of fingerprint technique like easy to use, reliabilty, high stability, high acceptance in indentification and authentification, fingerprint technique is used mostly. The use of such technique ensures that the facilities provided are used by a authenticated user and no one else. Examples of such applications include secure access to buildings, computer systems, laptops, cellular phones, and ATMs. In security applications, biometrics are most often used to verify a person's identity for the purpose of granting access to property or information. There are two different ways to resolve a person's identity: Verification and Identification. Identification means establishing a person's identity and Verification involves confirming or denying a person's claimed identity. Each one of these approaches has it's own complexities and could probably be solved best by a certain biometric system. In the absence of more advanced techniques of personal recognition schemes, this technique is very much useful. Various Enhancement techniques will be discussed by which the image quality is enhanced and Fingerprint Matching techniques are applied and it will contribute to recognize the person and authentic on the basis of physiological or behavioural characteristic possessed by the user. With the help of this technique we will prepare a system which is helpful to identify watermarked fingerprints. The proposed method, technique used will give good result and better performance and used robust preprocessing methods are used to reduce the enhancement errors and will improve the quality of images.

Keywords: Patern Recognisation, enhancement, Matching, Quality, Minutiae.

Introduction

A biometric is any unique biological characteristic that can be used to identify a person."Bio" in the name refers to the an account of the series of events making up a person's life physiologically that are measured, while "metrics" refers to the system of measurement related to the quantitative analysis that provides a positive identification of a unique individual. During registration, physical and behavioural samples are captured by either fingerprint scanner or video camera. Biometric authentication requires comparing registered biometric sample against a newly captured biometric sample. This process generally consists of four-step process: Capture, extraction, Comparison, Match/non-match followed by a Verification and identification. In the 21st century, it seems almost intuitive to think of our bodies as natural identification systems for our unique selves. Biometrics involves using the different parts of the body, such as the fingerprint or the eye, as a password or form of identification. Currently, Federal Bureau of Investigation uses the fingerprints from a crime scene to find a criminal. A fingerprint is the pattern of ridges and valleys on the finger tip. The pattern of curving line structures called ridges, where the skin has a higher profile than its surroundings, which are called the valleys. A fingerprint is thus defined by the uniqueness of the local ridge characteristics and their relationships. In order to ensure that the performance of the minutiae extraction algorithmic feature will be robust with respect to the quality of fingerprint images, an enhancement algorithm which can improve the clarity of the ridge structures is necessary. Extracting features out of poor quality prints is the most challenging problem faced in this area. Various Enhancement methods are studied to enhance the quality of the fingerprint images. Mostly, the minutiae sent to the final matching phase are extracted from the Skelton images. The accuracy of the minutiae extraction depends on the quality of the Skelton image. Both reference point and image alignment are determined to estimate the orientation point and that effect is smoothen by choosen window in order to minimize the effects of noise and matching with a similarity measure. Matching is performed by comparing two fingerprint images and return either a degree of similarity or a binary decision of matched or not matched. Most fingerprint matching system is based on matching minutiae points between two fingerprint images. Fingerprint matching is the key to the system and effects on the precision and efficiency of the whole system directly.

Related Work

Fingerprints have been used by humans for personal identification for a very long time [1]. Modern fingerprint matching techniques were initiated in the late 16th century [2]. Time line important event that has established the foundation of modern fingerprint based biometric technology found in. The individuality and uniqueness of fingerprints is discovered by Henry Fauld, in 1880.And the credit for being the first person to study the persistence of friction ridge skin goes to Sir illiam James Herschel [1]. This discovery established the foundation of modern fingerprint identification. In the late 19 century, Sir Francis Galton has published the book called fingerprints [3] in which detailed fingerprint analysis and identification is discussed. He introduced

the minutiae features for single fingerprint classification in 1888. The discovery of uniqueness of fingerprints caused an immediate decline in the prevalent use of anthropometric methods of identification and led to the adoption of fingerprints as a more efficient method of identification. An important advance in fingerprint identification was made in 1899 by Edward Henry, who (actually his two assistants from India) established the famous "Henry system" of fingerprint classification [4]an elaborate method of indexing fingerprints very much tuned to facilitating the human experts performing (manual)fingerprint identification. In the early 20 century, fingerprint identification was formally accepted as a valid personal identification method by law enforcement agencies and became a standard procedure in forensics. Fingerprint identification agencies were setup worldwide and criminal fingerprint databases were established. A fundamental problem in image processing is to remove the additive white Gaussian noise (AWGN) without blurring the fine details of the images. So we need an enhancement algorithm which will improve the clarity of the ridge/valley structures. Based on the survey related to fingerprint enhancement, it had been observed that most of the existing works are based on the minutiae sets, singular points and other techniques. In this section, some of these are reported and their advantages and disadvantages are discussed in brief is shown in Table 1.

Table 1: Fingerprint Enhancement Technique

S.No.	Authors	Technique	Extract	Advantages	disadvantages
1.	Hung[8]		information about the local ridge/valley structures	all of these techniques make an assumption that the local ridge/valley orientations can be reliably estimated from input fingerprint images	this assumption is not true for fingerprint images of poor quality.

2.	Aladjem and Daniel Kogan[11]	Two different methods are used for fingerprint ridge image enhancement. The first one is using local histogram equalization, Wiener filtering, and image binarization.The second method uses a unique anisotropic filter for direct gray-scale enhancement.	Fingerprint ridge	The results attained are compared with those obtained through some other methods. Both methods show some improvement in the minutiae detection process in terms of time required and efficiency.	-
3.	Eduardo Blotta[12]	differential hysteresis processing based on morphological filters & highpass Gaussian Convolution filters			-
4.	Jianwei Yang[13]	Modified Gabor filter combines the advantages of an anisotropic filter and an oriented low pass filter		This method gives good efficiency	both fails when image regions are contaminated with heavy noises.

5.	Venu Govindaraju	a composite filter which integrates the advantages of both directional median filter (DMF) and anisotropic filter.		Comfortable with little noise	This algorithm may fail when image regions are contaminated with heavy noises
6.	Anil Jain[15[16]	A Band Pass Filter	ridges	to remove the noise and preserve true ridges/structures	Fails with heavy noise
7.	Jain, A.K.; Lin Hong;[17]	improved minutiae-extraction algorithm		ability to compensate adaptively for the nonlinear deformations	-
8.	Josef Bigun[18]	image-scale pyramid and directional filtering	local ridge-valley	Linear symmetry features are thereby used to extract the local ridge-valley orientation	-
9.	Wang[20]	fast fingerprint enhancement algorithm	minutiae	improve the performance of the minutiae extraction	Enhancement of singular point is very bad
10.	Sun Park[21]	STFT enhanced image-based on tessellated invariant moment features for fingerprint verification algorithm	determination of ROI by using the least mean square (LMS) orientation estimation algorithm	highly robust to poor-quality fingerprint images and improves the matching accuracy.	-

11.	S. Koc [22]	Wiener filter		no extra memory is needed. the proposed method has better performance over spatial domain Wiener filter	-
12.	Venu Govindaraju[26]	contextual filter	Local minutiae	The local information is captured by using this filter and uses them efficiently to remove the undesired noise.	-
13	Ching-Tang Hsieh[27]	wavelet transform	ridge	much improve the clarity and continuity of ridge structures	-

Various fingerprint matching algorithm have been proposed in literature. Most of the algorithm has no difficulty in matching good quality fingerprint but matching low quality fingerprint remain a challenging problem. In this section, some of Fingerprint Matching Technique are reported and their advantages and disadvantages are discussed in brief is shown in Table 2.

Table 2: Fingerprint Matching Technique

S.No.	Authors	Technique	Matching Point	Advantages	disadvantages
1.	Anil K. Jain [28]	bank of Gabor filters	The fingerprint matching is based on the Euclidean distance between the two corresponding Finger Codes	Very fast	-

2.	Ratha [30]	an alignment-based elastic matching algorithm	minutia	has the ability of adaptively compensating for the nonlinear deformations	-
3.	Jie Tian [31]	fingerprint image enhancement algorithm & variable sized bounding box during the matching process	uses ridge	more robust to non-linear deformations between two fingerprints	-
4.	Arun Ross [32]	A set of 8 Gabor filters and hybrid fingerprint matching scheme	uses both minutiae and ridge flow	The hybrid matcher is observed to perform better than the minutiae matcher.	-
5.	Weiguo Sheng[33]	memetic fingerprint matching algorithm	aims to identify the optimal or near optimal global matching between two minutiae sets	faster than the traditional GA-based global fingerprint matching method	
6.	Xinjian Chen[34]	GA-based search procedure is used and tries to identify the optimal global matching	local features of minutiae	The algorithm can achieve accurate matching results faster than the traditional GA-based global fingerprint matching method	
7.	Venu Govindaraju[35]	correlation matching method	minutiae		

8.	Raffaele Cappelli[36]	fingerprint matching algorithms	minutiae (i.e., ridge ending and bifurcations). Local minutiae structures can be classified into nearest neighbor-based and fixed radius-based	better than nearest neighbor-based approaches very fast simply coded in hardware allows its porting on inexpensive secure platforms	
9.	Sharat Chikkerur[37]	CBFS (Coupled BFS) a new dual graph traversal algorithm	local neighborhood of each minutia	the local neighborhood matches and analyze its computational complexity	

Proposed Work

In research work, the model is proposed shown in Fig 1, two models work simultaneously. Firstly input is given as a offline signature then it undergoes through signature matching process, after that its output is matched with the given input.When the Input matches with the output offline signature then the second model starts working.In this process firstly the offline fingerprint image is scanned. Along with the advancement of facilities in the field of multimedia there are larger threats introduced during the authentication, licensed and protection process against illegal use of data. Therefore, the need of security model arises i.e watermarking which protect the image or data from hackers or the third party secure model i.e invisible watermark is used. Watermarking can be done by two ways either visible or invisible Water Marking. Visible Watermarking has been used since very long time which is not secure watermarking. This type of Watermarking could use only for owner identification process but in invisible watermarking the embedded data is not detectable, but may be extracted or detected by a computer program. The fingerprint image consists of ridges which are incorporated with minutiae. This fingerprint image goes through embedded process. In this process, the image containing copyright information will get marked then after the decording process the image will be retrieved and then it will be sent to recognisation media at the end fingerprint watermark image is achieved. After the retrieval of fingerprint watermark image, the minutiae is extracted

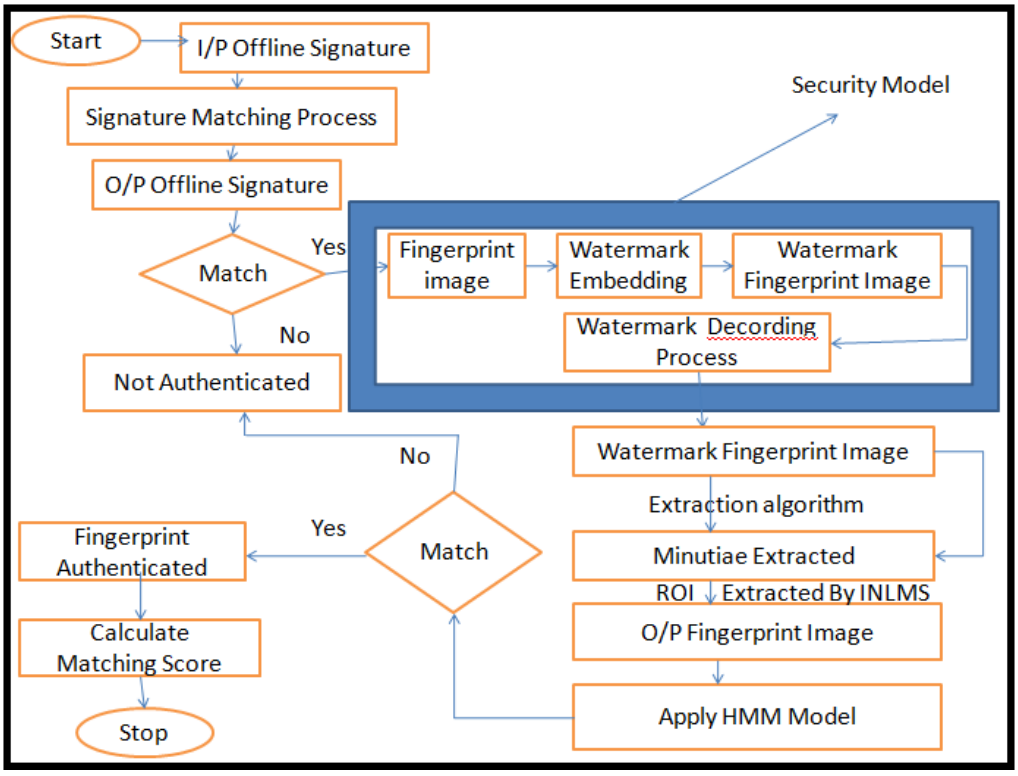

Figure 1: Proposed Model

Enhancement algorithm is used whose aim is to enhance the image quality by removing the noise present in the poor quality images without blurring the fine details of the images.I will work on non-stationary ridges by using STFT or any other advanced methods like Wavelet etc with which improve its performance and also helps to achieve better results.Work will also to be done on mixed filters which will be use to remove environmental noise.Robust preprocessing methods will be used to reduce enhancement errors.

NLMS or INLMS Algorithm is used to find the accurate orientation point with which matching can be done precisely and accurately. This algorithm will improve the matching accuracy. For the matching of obtained fingerprint image with the watermarked fingerprint image; I will apply most accurate and suitable hidden markov model. Fingerprint matching is the key to the system and effects on the precision and efficiency of the whole system directly. When minutiae and Finger Print ridges are enhanced with the help of BFS & STFT or any other advanced methods like Wavelet techniques and matching can be done with the help of Hidden Markov model.

HMMs are widely used in including language independent training and recognition methodology; automatic training on non segmented data and simultaneous segmentation and recognition etc. The comparison of both BFS and STFT or any other advanced methods like Wavelet Techniques will be done afterwards. Hence the

matching of fingerprint ridges with minutiae will take place only when one input offline signature is authenticated with output offline signature otherwise the authentication of the system cannot be done.

At last, I summarize the propose research work in steps as:

1. Offline Signature is Authenticated
2. Afterwards, Security Model will run.
3. After adding the watermark feature to the above step will protect one more layer of the fingerprint.
4. At last matching is carried out.

With the help of this technique we will prepare a system which is helpful to identify watermarked fingerprints

Conclusion

Indentification can be done via various types of Biometric that are Fingerprint, iris, hand Geometry, Gestures, Signature etc. Within biometric methods, automatics Signature Recognition are an important research area due to the social, legal and wider acceptance of handwritten signature as means of identification. Offline Signature recognition system is used in the proposed model. Recognition decision is usually based on local or global features extracted from signature under processing. Excellent recognition results can be achieved by comparing the robust model of the query signature with all the user models using appropriate classifier. After the authentication of the signature, invisible watermark fingerprint recognisation is proceed by going through enhancement techniques which will improve the quality of the fingerprint, reduce the enhancement errors. Orientation point is extracted either by NLMS/INLMS which will help in matching accuracy by getting the optimal point.Then matching of both input image and output image will be carried out if the images are matched. Then it is authenticated otherwise authentication cannot be done. Hence High Recognition rate is first requirement of an effective signature recognition system which depends upon the techniques adopted in training and classification of signatures. It also depends on the extracted features. Among various stochastic approaches, HMMs have proven very effective in modeling both dynamic and static signals.

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