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Research Article

Vein Pattern Uncovering and RPPVSM based Personnel Recognition System using Skin Images

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Abstract

Face Recognition is not possible in certain scenarios to identify persons, due to unavailability of sufficient face data. The same challenges are encountered in the cases of child sexual abuse where pedophiles' faces and tattoos are rarely visible in the evidence images or purposely blurred to avoid recognition. In order to identify criminals, the RPPVSM automated identification system consists of skin segmentation, the detection of RPPVSM and matching algorithms of RPPVSM in these skin pictures. The identification system RPPVSM has been evaluated on background images of certain topics and it is shown that our detection algorithm RPPVSM produces stable patterns of skin marks to detect skin marks compared with other methods. The system achieved high precision in identification.

Keywords: *Skin marks, Vein Pattern, Relatively Pigmented Mask.*

1. Introduction

In scenarios like criminal investigation, it is sometimes not possible to obtain established biometric features like face, fingerprint etc. In such scenarios, vascular pigments and skin marks can be of great aid. Especially in crimes related to children, sexual abuse etc. Skin recognition system is a computer application which can identify or verify a person from a video source using digital image or video. A contrast of the specific skin characteristics of the body and face database is one way to do this. Typically used in safety systems it can be compared with other biometrics such as fingerprint or eye iris. It has also recently gained popularity as a marketing and business identification tool. Some facial recognition algorithms identify face characteristics by extracting landmarks or characteristics from an image of the subjects. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition. A probe image is then compared with the face data. One of the earliest successful systems is based on template matching technique applied to a set of salient facial features, providing a sort of compressed face representation. Recognition algorithm can be divided into two main approaches, geometry, which looks at distinguishing features, or photometric which is statistical approach that distills an image into values and compares the values with templates to eliminate the variances.

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Relatively Permanent Pigmented or Vascular Skin Marks (RPPVSM) were recently introduced as a biometric trait for identification in cases where the evidence images show only the non-facial body parts of the criminals or victims, such as in child sexual abuse and riots. As manual RPPVSM identification is tiring and time consuming, an automated RPPVSM identification system is proposed.

2. Literature Review

L.Chen et.al suggested a framework where human recognition and identification can be made based on characteristics derived from finger-venous pictures. He also suggested a system where the identity of persons with self-adaptive illuminance can be calculated. The creation of an infrarouge (NIR) finger vein picture personal recognition device. Through integrating advanced technologies, including contrast constrained adaptive histogram pictures (CLAHE) and median filter, they improving the low-resolution photographs.

H.A.Quigley et.al proposed "Integrated responses from texture characteristics," in the report. suggested a novel approach for identifying local and foreign characteristics using Combined Texture Responses (IRT) from the finger veins that increases system precision and makes rotations invariant. Therefore, it is proposed to use an effective feature extraction technique called the blended texture responses using local binary patterns, in which specific textures with LBP resolution levels are merged to create an entire set

of features that more specifically represent local and global features.

One of the earliest works was by J.Pierrard et.al who introduced a new mechanism for locating prominent facial skin abnormalities in photos, particularly nevi (moles, marks of birth). They encrypt the identity of the individual irrespective of position and lighting by their signature arrangement over a nose. This approach stretches traditional forms of identification, which typically ignore these minor distinctions and thus neglect inherently unequal characteristics. Through a very smart, multi-scale matching process, our program senses possible nevs. The points of candidates are evaluated by two complementary approaches according to their biased capacity. One of these is a modern skin segmentation system, which is focused on the study of gray textures, we have built for outer face identification. The second is a saliency measure for local residents to convey the specific characteristics and confidence which take account of the neighborhood's texture. The suitability of identified features for recognition of various locations and lightings on the FERET face database subset is tested experimentally.

X.Li et.al provided an algorithm for the identification of dorsal hand vein patterns. The separation of the venous skeleton with low distortion is very important to increase the identification ratio. Next, the algorithm acquires a clear single pixel-broad skeleton with low distortion, following a variety of processes: scale and gray normalization. Gaussian low passing and average filtering. The local NiBlack dynamic threshold segmentation. Next, a function vector is derived from the seven modified moment invariants of the vein skeleton. The authors conducted several experiments and showed that algorithm gives a higher recognition ratio of 95.5%.

Criminals and victims are a difficult challenge to recognize in pictures with evidence, where their identities are obscured or blurred. In the field of litigation, Craft and Kong used nevi in order to classify the pedophile in testimony pictures and classify an expert in the case of the United States vs. Michael Joseph Pepe (2008). Their expert opinions were questioned, partly because nevi visibility was adversely affected by blocking objects created by the standard JPEG algorithm. In comparison, an immense amount of pornography is posted online every day in JPEG compressed images. While several strategies for eliminating blocking tools have been suggested, for our target application they are unsuccessful. C.Tang et.al proposed a knowledge-based algorithm that prevents JPEG blocking devices simultaneously and retrieves skin properties. Infer initial blocks of compressed proof images utilizing this previous knowledge. Provided a training dataset that has initial, compressed skin images, it is possible to create a relationship between the initial blocks and the compressed blocks. There is also a suggested indexing method for effective storage of large data sets. In photographs with different characteristics and compaction ratios detailed studies are performed. The empirical and analytical assessment also suggest that the algorithm proposed is more efficient than other approaches.

Recent technical advances have caused digital photographs which may be used in crimes to proliferate. This may be difficult to use such images as evidence in court proceedings such as child pornography and concealed guns, as victims typically don't see their faces. We suggest a biometric function consisting of a collection of symbols, including but not limited to nevi, lentigins, cherry hemangiomas and seborrheal keratosis, to carry out personal recognition in such photos. A. Nurhudatiana et.al classified the "Relatively Permanent Pigmentation or Vascular Skin Signs" as RPPVSM due to their biological characteristics. 144 Caucasian, Asian, Latino males gathered torso images, and their RPPVSMs were classified manually by a help of professional specializing in dermatology. The observational findings indicate that Caucasians appear to have more RPPVSMs than Asians and Latinos and that RPPVSM variations are spread separately and uniformly across 80 percent.

Although large skin marks and scars are used, in some legal cases they are useless because there are no markings and no skin marks for identification on the skin exposed in evidence images. Vein markings for the forensic analysis were historically difficult to use, since they were not visible in colored images. This paper provides an algorithm to discover patterns for personal identity from the skin revealed in color pictures. Vein markings for the forensic analysis were historically difficult to use, since they were not visible in colored images. For personnel identity C.Thang et. proposed an algorithm for uncovering vein structures from the skin revealed in color imagery. The authors model the reverse phase of skin color formation in an image and derive spatial distributions of biophysical parameters from color photographs, in which vein patterns can be detected, using the concepts of optics and skin biophysics. Experimental results are strongly promising. The clearness of vein shapes is equal or greater than that of almost infrared representations in the resulting images.

Criminals typically take care to conceal or mask their identities and scars in cases of child trafficking and sexual assault, making identification impossible. Natural skin marks can also be found in close-up views of their neck, chest and buttocks, usually in fact. Identifying manual RPPVSM can be cumbersome and time consuming. A proposed automatic RPPVSM recognition method, consisting of the detection of RPPVSM and matching algorithms. A.Nurhudatiana et.al. Three learning-based algorithms for detecting RPPVSMs in color images have been developed automatically. Experiments on 216 back torso photographs of 118 people were conducted to test these algorithms. The results show that good identification accuracy is feasible, as well as high

potential for criminal examinations with the new RPPVSM identification method.

A easy and fast algorithm to detect face was suggested by X.Hu et.al. Initially, certain points of interest that mark skin areas are searched using only chrominance Cr information, instead of chrominance Cr and Cb simultaneously. Instead, a traditional and popular AdaBoost algorithm was used to determine whether there was a face around the identified points of interest, and whether there was a face. 400 facial patches have been converted into the YCbCr vacuum, and it has been found from 400 facial patches that a little overlapped with the Cr histogram, which is non-skin, and has been cut to 137. Another 215 facial photographs from the LFW archive were randomly selected from 108 participants to check the approach suggested. The single Cr method of detection would detect not just all the face regions but also the amount of interest points detected was the least and the overall time of detection was also the least compared with other interest detection methods. The suggested approach was thus can be termed as a successful form of facial detection.

H.Alsufyani et.al presented a modern paradigm to explore the possibility for the biometrical recognition of individuals with textured details from facial skin regions. Such details are of useful benefit where the entire picture of the face is not available, such as criminal examinations, to identify persons. Four facial regions (forehead, ear, ear, and chin) have been studied here, as they are presumably visible even in partially occluded facial pictures and can be identified relatively easily. In order to identify regions with substantial skin material is used a skin identification technique. The features focused on Local Binary Patterns and Gabor wavelet filters are configured separately for each skin region. Until image classification, attribute fusion of sub-regions is used. The Skin Segmentation database was used to check the efficiency of the skin identification technique and biometric identification respectively. The findings show the equivalent performance of the skin detection algorithm to other specialized techniques.

From images of skin of various body parts, the recognition of suspect and offenders is a new and challenging task, as suggested by Y.Peng et.al. In this scenario, the person identification is not true in practice, because the skin photographs do not reveal visible characteristics, particularly in some forensic situations, and neither faces nor body marks can be identified. Many approaches based upon patterns of skin marks and blood vessels are suggested to address this issue, but these approaches neglect the fact that the picture is not necessarily in high detail, skin marks and blood vessels are always inaccurate. Androgenic hair variations are in low resolution efficient but synchronization has not been taken into account and the match is not stable for changes of point of view. The definition of contour line in the geography was suggested to be based on a new feature pattern focused on the propagation of the skin texture phenomenon. A sliding block framework is designed to enhance the ability to discriminate and rotate. The experimental results reveal that the proposed algorithm is efficient and has a certain increase in rotational invariance.

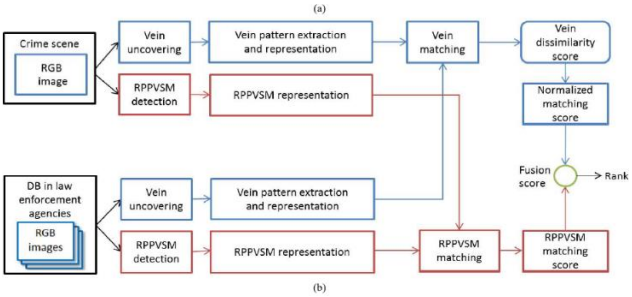

Figure 1: Proposed Methodology

Figure 1 above shows the block diagram of the proposed approach. This system consists of a vein cover pattern analysis unit, modulation unit, and segmentation unit. The overall system ability for retrieving the input sample and correspond relating to its training data sets is the major objective of the system. The pattern analyses in our system is enhanced with pigment analysis and extraction, this improvement is extended up to the higher level of organ analysis involving back images.

The system architecture consists of system train data sets, acquired from the user under suspecting i.e. criminals in jail and under remand, these trained data sets are stored and are preserved under protected area. The system collected the input samples from the spot of crime and is given as an input to the system for processing. The processing is taken place in MATLAB environment for better understanding; we have retrieved and performed the data sample analysis. The system also consists of decision-making unit for analyzing and extracting the patterns from the sampled input.

3. Results & Discussions

The proposed algorithm has been implemented using MATLAB. Images have been obtained from the internt consists of back images of Asian people.

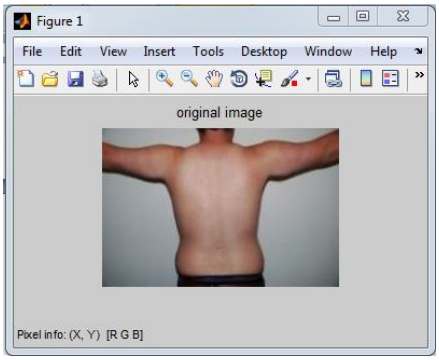

Figure 2: Original Back Image

Figure 3 shows the original back image from the dataset. It undergoes several processing stages.

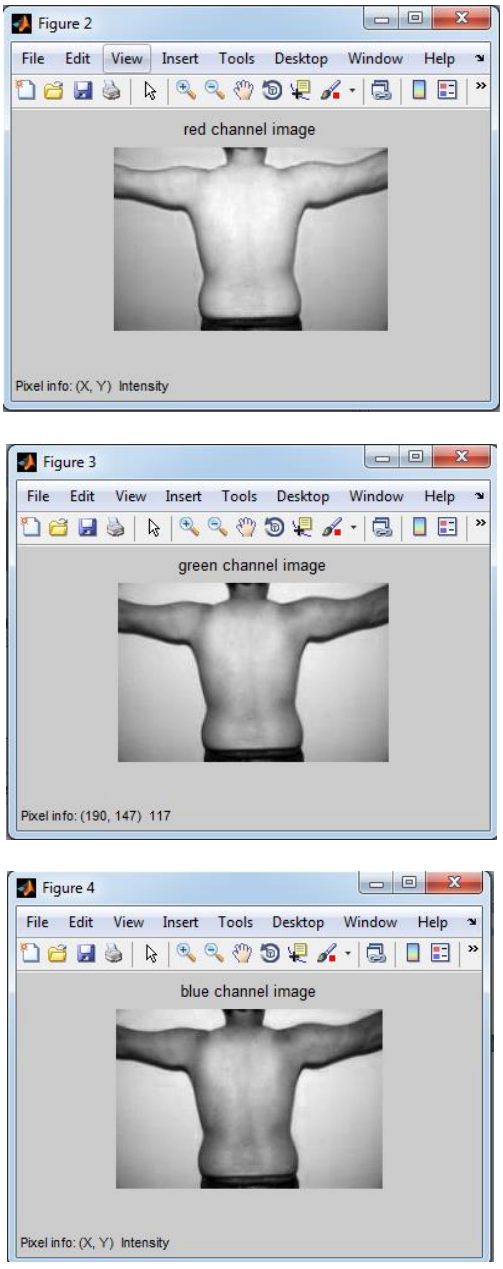

Figure 3: RGB Channel image

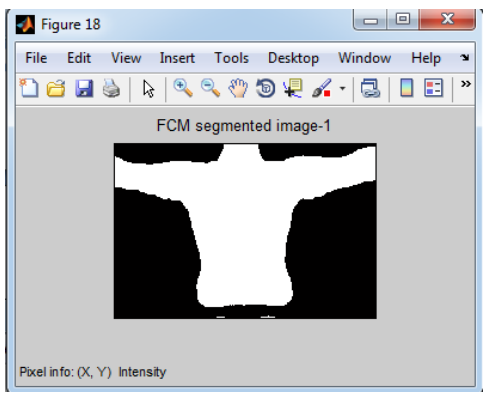

Figure 4: FCM segmented Image

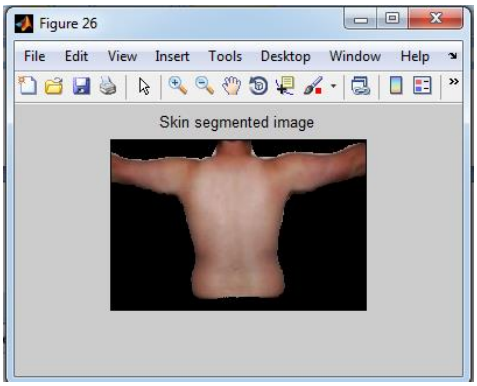

Figure 5: Background removed Skin segmented Image

Several techniques have been applied to obtain enhanced image for uncovering vein pattern. Figure 4 shows the extracted RGB channel images and figure 5 mask image for skin part segmentation. Figure 6 shows the background completely removed and skin segmented image. This image is further used to uncover the underlying pattern of veins in the image.

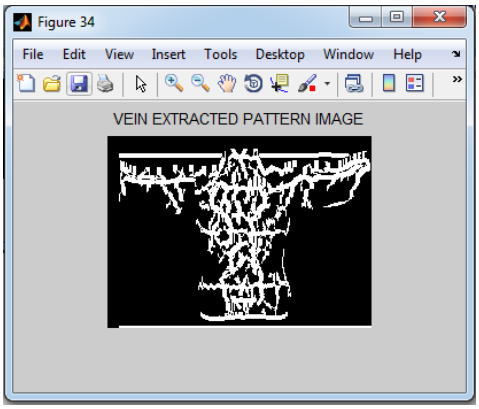

Figure 6: Extracted Vein Pattern

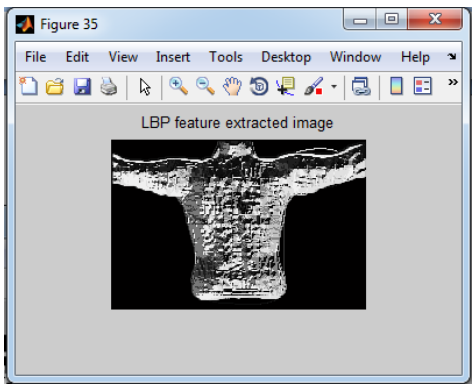

Figure 7: LBP features extracted image

The features obtained from Vein pattern and LBP pattern are then stored in the database. The same process is then performed on any test image. Figure 7 shows the LBP features extracted and overlapped with the skin image. Figure 8 shows the results when the test image is found to be not matched with the existing database images.

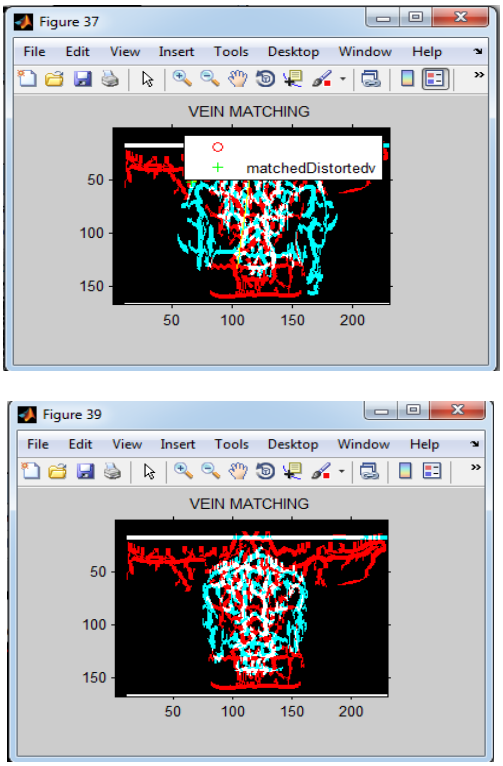

Figure 8: Vein Matching

Table I: Performance evaluation

Person	Accuracy
Person 1	96.7742%
Person 2	95.1613%
Person 3	96.7742%
Person 4	95.1613%

Conclusion

Although in video photos of child sexual exploitation, armed attackers and riots, the identities of the offenders are seldom seen, their nonfacial pieces are frequently visible. In this paper, an automated identification system for RPPVSM, including skin dividing, RPPVSM detection and RPPVSM algorithms, is suggested in order to identify criminals in these skin images. Various images of the same person were matched and we achieved high accuracy and recognition. LBP features are extracted post vein pattern uncovering. The results are encouraging on using SVm for classification with an accuracy of around 96%.

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