Hand based recognition systems using local descriptors

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Abstract— *The world knows an explosive growth of digital applications and transactions, the security of identity presents a real challenge today. It has become necessary to adopt new concepts, to ensure reliable and robust recognition mechanisms. Biometrics is presented as one of the most promoter concepts. This concept is an evolving technology which is used in various domains like security systems, forensics and secured areas. Various human physical characteristics like fingerprints, voice, face, iris and hand geometry show a distinctive features between persons. These features can be used to provide authentication schemes for security process like ATM, cellular phones, secure access.But, the most accepted recognition systems are still based on hand modalities. In this paper, we present a summary of our works. Theses works concern palmprint and finger knuckle print recognition systems with a recognition rates overcoming 97 %.*

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Index Terms— biometrics, Local features, fusion, uniform local binary pattern, compound local binary pattern, recognition system, local discriptors.

1 Introduction

The evolution process of the technological world is well underway in the digital way. Thereby, all daily transactions will know a digital migration of procedures. In order to secure these procedures against the potential risks that will be associated with the theft of personal identity, the insurance of the identity prevention has become capital. In this sense, biometrics is proposed like a technological key, using a particular biological aspect of the human body, to recognize a person for security in various applications [1]. During the past decades, several researches are developing to construct effective recognition systems. Researchers have experimented multitude of biometric modalities, including fingerprint, voice, iris, face, hand, etc. [2,3]. One of the most important factors to consider is intrusiveness [4]. The acceptance and convenience of biometric mechanisms play a key role in success of recognition systems. For these reasons, researchers were often attracted by the apparent potential of systems using hand-based descriptors. In the literature, several hand-based biometrics e.g., fingerprint [5], palmprint [6], hand [7], and finger knuckle print [8] have been extensively studied. Therefore, several recognition systems for authentication have been successfully created and employed in different domains.

We have oriented our research toward palmprint and finger knuckle print (FKP) recognition schemes. palmprint modality presents many advantages; it contains more features than fingerprint, which makes it more distinctive [9], because the palmprint offers additional distinctive features such as principal lines and wrinkles on a large surface, and that can be extracted from low resolution images (advantage for large database). Furthermore, we can use a simple device to capture these features, thus much cheaper and affordable than other sensors like iris sensor [10]. These advantages and especially the presence of additional distinctive features (wrinkles and folds) have oriented many researchers to use local methods for extracting features from palmprint [11].

In this paper, we have resumed our approaches and results, using local features to construct an efficient recognition schemes and optimizing the computational complexity. We have used Uniform Local Binary Pattern (ULBP) [12] and Compound Local Binary Pattern (CLBP) [13] for extraction process, then for evaluating this approach and producing the best classification results, we have tested our scheme on different block sizes. For classification, we have employed distance based classifiers and considered the use of three variant measures: Euclidean Distance, City-Block and Jeffrey Divergence.

2 Unimodal palmprint recognition system based on ULBP

We have tested our method with classifier based on eucildian distance and city-block to confirm the superiority of the classifier based on city-block and we have proceeded to comparative study with others methods, this study are shown in Table I.

TABLE I. COMPARATIVE STUDY

	Block Size			
Methods	***8x8***	***16x16***	***32x32***	***128x128***
Statistics feature [14]	65.6%	61.2%	53.2%	11.8%
Fourier transform [14]	70.0%	71.2%	57.4%	7.8%
DCT transform [14]	64.8%	59.8%	48.2%	8.2%
Gabor transform [14]	**86.2**%	85.0%	84.8%	45.2%
LBP (8, 1, u2) [14]	69.8%	**85.6**%	88.8%	46%
LBP (8, 2, u2) [14]	63.2%	85.2%	**91.0**%	**46**%
Proposed method	**99,4**%	**99,4**%	**97,0**%	**61,8**%

Table I shows the superiority of different methods according the block size chosen. When compared to the Gabor transform for block size 8x8, LBP (8, 1, u2) for block size 16x16 and LBP (8, 2, u2) for block size 32x32 and 128x128, which present the best performance, we note that proposed method provide the best result and show 13,2%, 13,8%, 6% and 15,8% gain on rate for block size 8x8, 16x16, 32x32 and 128x128 respectively.

3 FKP RECOGNITION SYSTEM BASED ON CLBP

The robustness of the system, computation time and especially recognition rate are the important factors for achieving an effective result. Hence, the proposed approach aims to satisfy these constraints. To prove the reliability of our scheme and provide qualitative evaluation to our method, we have made comparisons with existing experimental results reported in the literature [15].

TABLE II. COMPARATIVE STUDY

	Fingers			
Methods	***Left index***	***Left middle***	***Right index***	***Right Middle***
PCA+LDA [15]	50.64 %	47.00 %	51.08 %	54.68 %
Gabor+PCA+LDA [15]	68.48 %	67.27 %	67.07 %	73.93 %
Intensity+Gabor [15]	89.90 %	88.59 %	89.49 %	88.48 %
CLPP [15]	86.58 %	86.43 %	85.89 %	86.16 %
OCLPP [15]	87.87 %	87.49 %	86.94 %	87.38 %
MSLBP [15]	93.80 %	94.70 %	92.20 %	94.80 %
Proposed method	**98,18%**	**99,29%**	**98,48%**	**98,89%**

Table II shows the superiority of our proposed method compared to the other methods. When compared to the MSLBP, which present the best performance, we note that proposed method provide the best result and show 4,38%, 4,59%, 6,28% and 4,09% gain on rate for Left Index, Left Middle, Right Index and Right Middle, respectively.

4 MULTISPECTRAL PALMPRINT RECOGNITION SYSTEM

In this experimental part, we will evaluate the performance of fusion at score-level using sum rule with Jeffrey divergence, City-block and Euclidian distance for multi-samples combination MPP (Multi-spectral palmprint image) and PP (normal palmprint image). The recognition rates of different combination are presented in Table–III and Table–IV.

TABLE III. RECOGNITION RATE WITH FUSION - LEFT MPP AND PP

	Recognition rate obtained by fusion		
Block size	***Euclidian distance***	***City-Block***	***Jeffrey divergence***
11x11	99,00 %	**100 %**	**100 %**
16x16	99,50 %	**100 %**	**100 %**
24x24	98,50 %	**100 %**	**100 %**
32x32	98,00 %	**100 %**	98,50 %
48x48	97,00 %	98,50%	97,50 %
64x64	96,50 %	97,50%	96,50 %

TABLE IV. RECOGNITION RATE WITH FUSION - RIGHT MPP AND PP

	Recognition rate obtained by fusion		
Block size	***Euclidian distance***	***City-Block***	***Jeffrey divergence***
11x11	**100 %**	**100 %**	**100 %**
16x16	**100 %**	**100 %**	**100 %**
24x24	**100 %**	**100 %**	97, 00%
32x32	99,00 %	**100 %**	94, 00%
48x48	97,00 %	96,00%	93, 00%
64x64	93,00 %	94,00%	93,00 %

Observation of these two tables shows a reliable recognition rate for all combinations and especially for small blocks (11x11, 16x16 and 24x24). This system based on the fusion of the scores of two samples (multi-samples system) can be an effective recognition system.

5 CONCLUSION

In this paper, we have evaluated the performance of the local descriptors ULBP and CLBP. To improve efficiency and accuracy, we have proposed many approachs based on different modalities. The experimental results on the Casia multispectral palmprint database, the FKP PolyU database and PolyU palmprint database show clearly that the proposed approachs increase the recognition rates and it reduces the security risks that can arise with the reproduction of FKP andpalmprints. Thereby, we can conclude that this approachs has allowed a noticeable performance improvement and it can be usefully employed for reliables palmprint and FKP recognition systems.

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