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A Multimodal Biometric System using Iris and Palmprint

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Abstract*: *A biometric system is basically a system of image recognition that uses bio metric characteristics to identify individuals.* The thesis introduces a biometric multimodal system that is based on iris-based Palm Print verification and fusion. *We suggest an approach to extracting features from each modality using four-level decomposition of the wavelet packet. It includes 256 packets capable of generating a simple binary code. Dictate standardized thresholds based on the first three highest energy peaks that would impact 0 or 1 for each wavelet packet. Specific fusion approaches were evaluated at different levels: character level, score level and error level. Its first fusion is an iris and palm print application, actually. For matching ratings the next one uses a weighted sum law. The next applies to the Hamacher t-norm's deficiencies. The standard database is used for testing the program proposed. The current approach and then each fusion method was checked for The consistency about the database of Casia iris merged with the database of Casia palm print. With each fusion process, the proposed solution to the multimodal biometric system achieves an increase in identification.

Keywords: Iris Pattern, Palm print Pattern, Wavelets Packets, Feature Fusion, Weighted Sum Rule.

I. INTRODUCTION

Normally, the biometrics system works to identify individuals. Multimodal biometric systems provide additional information that improves accuracy recognition quality by compensating for the limitations of single biometrics. Two biological features are of interest to us: iris and identity authentication palm print. The iris biometric identification ability is now well established and accepted. This is because of its unique features, such as defense (by a cornea), individuality (Any two irises could not be the same), fake-proof (because the true iris responds to the light) [1]. Typically the word iris is used to denote the eye's colored part. This is a complex process involving musculature, organs and blood vessels [2]. The picture quality could be determined by measuring the pixels in the picture [3]. Therefore, The human iris image is a legitimate biometric signature for authentication or verification of your personal identity. Certain iris properties for automated recognition systems that make it superior to fingerprints include, but are not limited to, the complexity of medically adjusting its risk-free shape, Its inherent protection and isolation from the physical environment, and its simple physiological response to ligh[4]. Specific technological advantages over fingerprints for automated representation processes included the convenience in optically capturing the iris without contact. The method of extracting variations is easier in relation to the above fact, due to its intrinsic polar geometry. The pairing of the left and right palm print pictures has become one of the popular verification techniques [5]. Palm print and a range of improvements over other features. In particular there are many features in the palm region such as main lines, symmetry, wrinkle, delta point, minutiae, date point, and texture [6]. Due to its reliability and simplicity, Palm print has been used for criminal recognition as a powerful tool in law enforcement. The rationale for selecting hand features as a basis for identity verification stems from its user friendliness, flexibility of the environment and discriminatory ability. We present a single algorithm for each biometric modality that allows primitives to be extracted and these traits to be fused at different levels: feature, score and decision.

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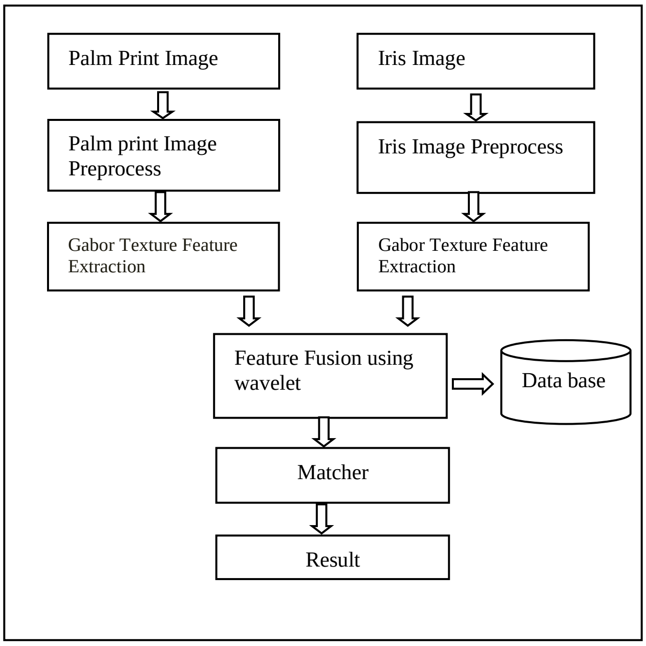
II. RELATED WORK

Work on the fusion of hyperspectral objects is also developed for high performance work. On extracted functions, recursive filtering is used. Xudong Kang et al are doing this [7]. This reduces the complexity of computations and improves the precision of classification of hyperspectral objects. This reduces the complexity of computations and improves the precision of classification of hyperspectral objects. David Zhang et al. [8] concentrated on an identification of online palm printing, using low-resolution palm print images. Sheng Zheng et al. propose 2-D gabor filter, multi-source image fusion process with help value transform [9]. The classification of SVMs (Support Vector Machine) is used to measure object help values. 2-D DWT (Discrete Wavelet Transforms) is used for Parmeshwar Manegopale multi-determination highlight extraction [10]. A biometric identification device for palm print used by Sumalatha K.A et al. to collect palm print images using a minimal-resolution camera [11]. K.Grabowski et al. have developed a different approach for the extraction of iris features.

The hair wavelet-based DWT transform is used in their paper [12]. J.Daughman had already established Gabor wavelet analysis [13] to synthesize iris image characteristics, iris signature, phasors and their position on a complex plane are analyzed and coded. Havlicek et al. sampled binary evolving frequency distributions using the corresponding Hamming distance [14] to form a vector function. Boles and Boashash used a zero-crossing technique that describes the transformation of the one-dimensional wavelet at various levels of resolution to explain the iris texture [15].

III. PROPOSED METHOLOGY

Two biometric characteristics which are palm print and iris have been fused together in the proposed system. Specific features erase the palm print and the iris. By Gabor texture feature extraction the score of extracted features is determined and Such scores are combined using wavelet fusion method. It is therefore possible to change the current algorithm and analysis to other applications of multimodal biometric fusion.



- Join the image of the palmprint and iris as input.
- Pick the extraction function using texture of the gabor.
- The function is merged by using the wavelet fusion function.
- The nearest distance-calculated neighborhood algorithm is used for object classification.

Classify the text image and calculate the matching score and take the matching image as output.

A. Palm print

Using the Gabor filter, palm print elements are extracted [16]. 2-D The Gabor filter is used to measure palm print image texture quality. Texture characteristics are measured at various Palm printing speeds and orientations [17].

$$G(x , y)= (\exp (x' + y^2 .y^2)/ -2_{\sigma}^2) \cos(2\pi(x'/y)) \quad (1)$$

Where

$x' = x \cos\theta + y \sin\theta$, $y' = -x \sin\theta + y \cos\theta$

σ denotes variance

θ denotes orientation

Iris characteristics are taken with haar wavelet transform, that is one of the simplest wavelet transformations efficient of expressing more knowledge sets to relatively smaller representations. The differential equation is transformed into a series of algebraic equations. The hair wavelet decomposes the picture to K = 1, 2, 3,4 etc. This determines at each point the horizontal, vertical, and diagonal orientation.

The function of haar wavelet is defined as: $h_0(x) = 1/\sqrt{m}$ (2)

$$h_i(x) = \begin{cases} 2^{j/2}, & (k-1)/2^j \leq x \leq k - ½ / 2^j \\ -2^{j/2}, & (k - ½)/2^j \leq x \leq k / 2^j \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

Where

M=2j (j = 0, 1, 2, 3, 4, ...) shows the level of the wavelet i= 0, 1, 2, 3, 4, ... m-1 as the parameter for translation.

Gaussian filter used to measure middle and radius of the pupil. The frame gives a corresponding score which shows the vector's similarity to the model vector. Using weighted fusion method, these values are combined. And equate these fused score to the threshold value. A case-based learning approach is the KNN (k-nearest neighbors) The classifier used to know the identity of the person. The database of all 50 images is included in the training dataset. This tests the distance to the Euclidean from each point, and finds the closest point.

$$d_{2st} = (x_s - y_t)(x_s - y_t)' \quad (4)$$

Where measures are equal distances between x_S and y_t.

B. Iris

The eye iris seems to be the vibrant region surrounding the pupil. Remove the extra portion after the iris photo has been taken, and then calculate the histogram. Used the 2D distribution function, the Gaussian filters removes the object noise. The canny edge detector will give best result compare to all edge detection.

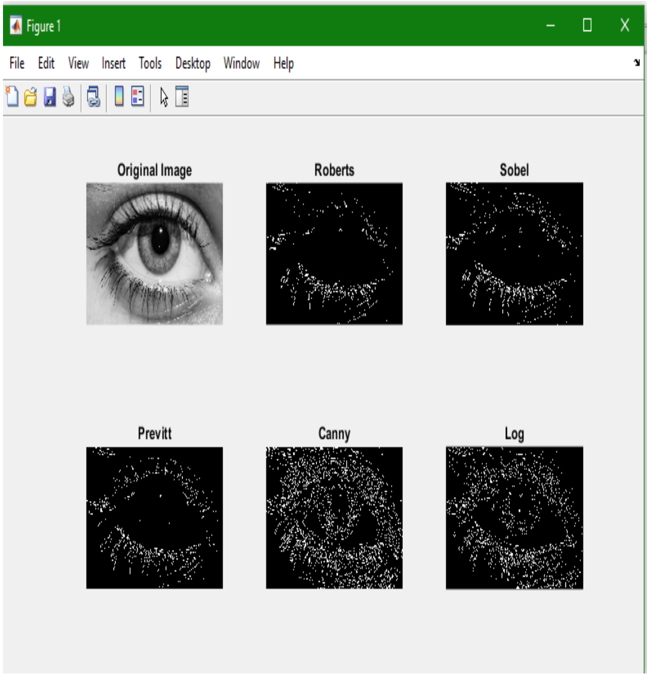


Fig.1 Edge detection of Iris

The haar wavelet will be used for extracting of the iris feature. It turns huge data sets into representations. Using wavelet transform, it de-composes images at different levels. The measure of energy is given as,

$$E= \sum_{j,k}^{y} si\,(j,k)^2 \qquad (5)$$

Here the wavelet energy of each iris sub-image is used to measure the threshold for encoding the sub-images. The [T] threshold is set as,

$$K= \mu(E_1,E_2 \ldots\ldots E_n) / Max(E_1,E_2 \ldots\ldots E_n) \qquad (6)$$

Where K is consistent, the sub-picture wavelet energies 1 .... N sub-pictures and μ (E1,E2 ....) are mean vitality top qualities for wavelets. Endless supply of highlights from every one of the three properties, these appraisals are combined and ordered utilizing the KNN classifier. The KNN classifier is the least complex grouping framework wherein its tends asymptotic to the perfect Bayes classifier under mellow suppositions on k and N. Since a legitimate preparing stage isn't required. It figures an euclidean separation between two of the closest vectors. The dependability of the framework is controlled by the estimation of an inappropriate acknowledgment rate and the bogus dismissal pace of the most extreme framework. Scores are utilized to mirror the higher closeness of the formats. At that point, for the candidate to fluctuate from the imposer, a solitary farthest point is set.

IV. RESULT AND DISCUSSION

We chose to utilize the three combination techniques to show combination of data from various biometric modalities [18] dependent on: feature, score and decision. The primary objective of a Content Based Image Retrieval (CBIR) method should be to obtain the graphical qualities of such a picture as either color, form, shape or other mixture [19,20].

A. Feature Fusion

Consolidate the element vectors of every methodology (iris and palm printing) to make a composite vector trademark that is additionally used to coordinate. Trademark vectors of the iris are linked with separately palm print vectors Casia[21]. The iris and Casia palm print include combination yielded preferred outcomes over each element taken independently in light of the fact that we had a FAR of simply 0.5 percent for a 100 percent GAR (typically required by such a framework). This shows intertwining the component level with that database was less viable.

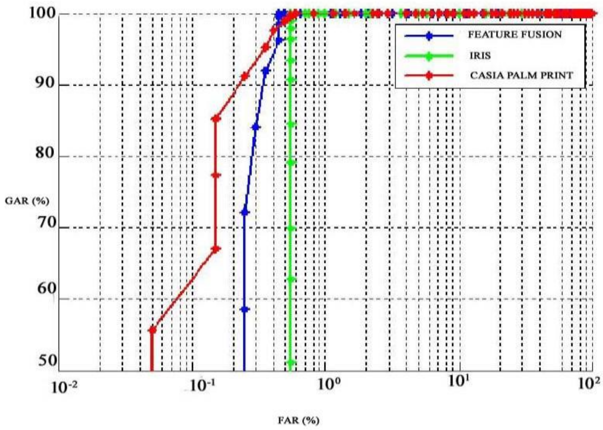


Fig.2 Iris, Casia palm print and Fusion feature

B. Score Fusion

Score fusion analyzed them separately instead of merging feature vectors, and individual matching scores are then combined to make decisions. By using a simple weighted sum-rule method described below [22,23], we achieved this fusion.

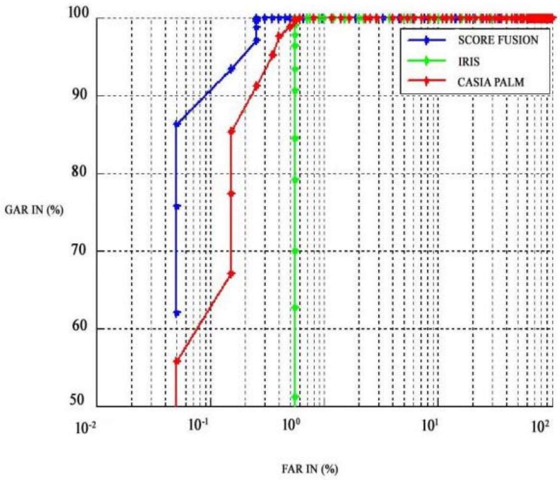


Fig.3 Iris, Casia palm print and Fusion score

$$S_f = \alpha_1 S_{IRIS} + \alpha_2 S_{PALM} \qquad (7)$$

Including

$$\begin{cases} \alpha_1 = ERRIRIS / (ERR_{IRIS} + ERR_{PALM}) \\ \alpha_2 = ERRPALM / (ERR_{IRIS} + ERR_{PALM}) \end{cases} \quad (8)$$

$\alpha_1, \alpha 2 \in [0, 1]$

Condition 7 shows that the last score is produced utilizing even a straight blend of both the iris and the palm scoresFor iris and Casia database we have similar loads: a 1 = a 2 = (0.5). We accomplish a 100% GAR at FAR=0.35 percent. We got a GAR of 100 percent. From these obviously score combination beats work combination.

C. Decision Fusion

Decision level combination turns out to be less recorded and is commonly viewed as lower than score-level combination, since choices have less data content than "awful" scores consolidated. Numerous strategies are utilized, for example, Bayesian choice fusion[24], Dempster-Shafer verification theory[25], all of which change the choices into scores, with the transformation parameters gained from a preparation set. In our exploration, we use blunder combination which is additionally a sort of combination of choices in which mistake rates accept the job of choices. In the wake of normalizing the blunder rates FAR and FRR, we can join any two mistake rates x and y with t-standards, for example, the Hamacher t-standards. The utilization of these benchmarks for blunder level combination isn't yet attempted in the writing. T-standards applicable for combination are talked about in [26]. Triangular standards [27,28] (t-standards) and tconorms give off an impression of being the most widely recognized guardians of parallel capacities, meeting the criteria of the combination and disjunction administrators, separately. Such T(x, y) and S(x, y) t-conorms are two spot capacities which change the unit square into the unit interim; for example T(x, y): [0,1].[0,1]?[0,1] and S[x,y] : [0,1].[0,1]?[0,1] . Specifically, t-standards may not allow the suspicion that the strategies to be melded are provingly autonomous. These are repetitive, commutative, and acquainted capacities. In this paper we utilized a Hamacher t-standard (with parameter r = 2) additionally named by condition (9) and the Einstein result illustrated.

(x y/2-x-y+xy) (9)

We accomplished 100% GAR and 0.0210 FAR with the assistance of Einstein's t-standard. ROCs with different information base combinations. Clearly we have better outcomes for each degree of combination.

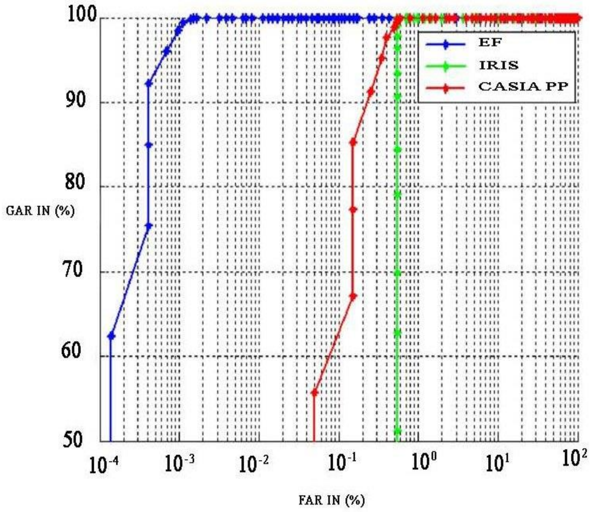


Fig.4 Iris, Casia palm print and Fusion error

Table 1: FAR and GAR at the various fusion level.

Sr. No.	Leval of Fusion	FAR In percentage	GAR In percentage
1:	*Feature Fusion*	0.50	100
2:	*Score Fusion*	0.35	100
3:	*Decision Fusion*	0.0210	100

V. CONCLUSION

A point of the whole work was to investigate the blend of iris and palm printing attributes, and subsequently accomplish the best yield that couldn't be accomplished with a solitary biometric indicator alone. The proposed highlight extraction technique is basic and adaptable, since it depends on breaking down wavelet bundles with basic parallel coding. The outcomes got were significant for each biometric include which was taken separately. Our outcomes additionally demonstrated that the merger of iris and palm print at various levels ordinarily yielded better outcomes, aside from the component combination strategy. That could be because of the somewhat straightforward combination process (connection) utilized here. It shows the viability of our procedure for each biometric methodology, with explicit combination strategies. One bit of leeway of our multimodal approach is the single device used to remove characteristics from two diverse biometric modalities. Regardless of whether the size of the image is unique, we are getting a similar size for each code. The examination of these codes is performed for every database utilizing a particular separation, the "Hamming separation," which causes us to lessen the calculation time. In the end, our outcomes indicated that the choice level combination with the t-standard had given the best productivity.

REFERENCES

1. J. Daugman , 'High Confidence Recognition of Persons by Rapid video Analysis of Iris Texture' , european show on security and identification , pp.- 244-251,16 – 18-May-1995.
2. John Daughmans, 'Complete Discrete 2-D Gabor Transforms by Neural Networks for Image Analysis and Compression' , IEEE exchanges on acoustics, discourse and sign handling, vol.- 36, No.- 7 , July-1988.
3. Nitya Khare, Mohd. Saif Wajid 'An Image Resolution: A Survey' International Journal Of Scientific Engineering and Research (IJSER), ISSN: 2347-3878.
4. Sumaiya Ishtiaque, Mohd. Saif Wajid ' A Review of Medical Image Compression Technique ', e – ISSN : 2278-0661 , p - ISSN: 2278-8727 volume 18, Issue 2, ver (deface apr 2016).
5. Roli Bansal, Punam Bedi and Priti Sehgal , ' Minutiae Extraction from Finger print Images - a Review ' , IJCSI International Journal of Computer Scienc Issues vol. 8-issue 5-no 3-Sept. 2011.
6. Robert K Rowe , Meltem Demirkus, Umut Uludag, Anil K. Jain, Sujan Parthasaradhi , 'A_multispectral_whole-hand_biometric authentication_system' , biometrics-symposium baltimore-pp-1-6 11-13 , Sept-2007.
7. Xudong Kang, Jon Atli Benediktsson , Shutao Li, 'Highlight Extraction of Hyperspectral Images with Image Fusion and Recursive Filtering', IEEE-trans. On geosciences and remote detecting, vol.- 52, no.- 6 June-2014.
8. David Zhang, Michael Wong , Jane You, Wai-Kin Kong , 'Online Palmprint Identification' , IEEE-trans. On Pattern Analysis And Machine Intelligence - vol. - 025 , no.- 9-Sept-2003.
9. Sheng Zheng, Guang-Xi Zhu , Jian Liu, , Jin Wen Tian, Wen-Zhong_Shi 'Multisource Image Fusion Method Using Support Value Transform', IEEE-trans.- on-picture preparing vol.- 16 no.- 7 July-2007.
10. Parmeshwar Manegopale, 'A Survey on Palm print Recognition', International Journal of Innovative Research in Science , Engineering and Technology - vol.- 3, issue - 2 – February-2014.
11. Sumalatha K.A, Harsha H, 'Biometric Palmprint Recognition System', A Review International Journal of Advanced Research in Computer Science and Software Engineering vol.- 4, issue 1-January-2014.
12. W. Sankowski ,K. Grabowski , 'Iris Recognition Algorithm Optimized For Hardware Implementation' , IEEE-2006.
13. John Daughman, ' How Iris Recognition Works' IEEE Transactions on Circuits and Systems for Video Technology , vol.14-No.- 1, January-2004.
14. J. Harding , D. Bovik, Havlicek , A. 1996. ' The Multi-Component AM-FM Image Representation' IEEE-Trans. Picture Processing . 5: 1094-1100.
15. Boles, W. , Boashash, B. 1998 'A Human Identification Technique Using Images of the Iris and Wavelet change'. Signal Processing, IEEE-Transactions-46(4): 1185-1188.
16. Verma Satya, Chandran, S.: 'Contactless Palmprint Verification System Using 2-D Gabor Filter and Principal Component Analysis', International Arab Journal of Information Technology, 16(1) , 23–29 (2019).
17. S. Verma and S. Chandran, 'Investigation of Sift And Surf Feature Extraction in Palmprint Verification System', Proceedings of International Conference on Computer, Communication and Control Technology IC4T, pp. 27–30, Lucknow, India, November 2016.
18. Ross , A. Jain. ' Information Fusion In Biometrics ' Pattern Recognition Letters-Vol.- 24, 2003-2115-2125.
19. Deepali Verma, Mohd. Saif Wajid ' Sketch Based Image Indexing and Retrieval' e-ISSN: 2278-0661, Issue 2, ver.1(mar-apr 2016).
20. S. B. Verma and C. Saravanan, 'Execution Analysis of Various Fusion strategies in Multimodal Biometric' 2018 International Conference on Computational and Characterization Techniques in Engineering and Sciences (CCTES), Lucknow, India, 2018-pp - 5-8. doi: 10.1109/CCTES.2018.8674156
21. Erfu Wang , Qun Ding , Zhifang Wang , Shuangshuang Wang : 'Multimodal Biometric System Using Face-Iris Fusion Feature' . Diary of Computers, vol.- 6, no.- 5, may-2011.
22. Arun Ross and Anil K. Jain : 'Learning User-explicit Parameters in a Multibiometric framework' , International Conference on Image Processing (ICIP), Rochester , New York , September-22-25, 2002.
23. Ola M. Aly , Gouda I. Salama , Tarek A. Mahmoud, Hoda M. Onsi , ' Multimodal Biometric System utilizing Iris, Palm print and Finger-Knuckle' , International Journal of Computer Applications (0975 – 8887) Vol.- 57, No.- 16, November 2012.
24. Hakan Altnay, ' On guileless Bayesian combination of ward classifiers' Pattern Recognition Letters, vol.- 26, no.- 15, pp.- 2463-2473, 2005.
25. A Ani and M. Deriche, 'another method for consolidating Multiple classifiers utilizing the Dempster Shafer hypothesis of proof' , Journal of Artificial Intelligence Research, vol.- 17, no. 1, pp.- 333-361, 2002
26. Madasu H. , Shantaram V. ,Jyotsana G , Hari Mohan G., ' Error Level Fusion of Multimodal Biometrics', Journal of Pattern Recognition Research, 2 (2011)- 278-297.
27. V. Nov'ak, W. Pedrycz, 'Fluffy sets and t-standards in the light of fluffy rationale', International Journal of Man-Machine Studies, vol.- 22, no.- 2 pp.- 113-127, 1988.
28. Klement, Mesiar, Radko, Erich Peter and Pap, Endre (2000),Triangular Norms. Dordrecht : Kluwer. ISBN 0-7923-6416-3

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