COMPUTATIONAL RESEARCH PROGRESS IN APPLIED SCIENCE &ENGINEERING (CRPASE)

CRPASE: TRANSACTIONS OF ELECTRICAL, ELECTRONIC AND COMPUTER ENGINEERING

Journal homepage: http://www.crpase.com

CRPASE: Transactions of Electrical, Electronic and Computer Engineering, Vol. 06(03), 146-152, September 2020 ISSN 2423-4591

Research Article

Multi-biometric Sustainable Approach for Human Appellative

Shahzad Ashraf[1*], Zeeshan Aslam[2], Sehrish Saleem[3], Syed Afnan[4], Muhammad Aamer[5]

[1]*College of Internet of Things Engineering, Hohai University Changzhou Jiangsu, China*
[2]*Petroweld Kurdistan Erbil, Iraq*
[3]*Muhammad Nawaz Sharif University of Engineering & Technology Multan Pakistan*
[4]*Hilal Foods Private Limited, Karachi Pakistan*
[5]*Department of Electronics and Electrical Systems, The University of Lahore, Lahore Pakistan*

Keywords

Biometric recognition, Unmatchable, Hassle, Skillfull, Modalities, Perspicacious.

Abstract

The persons' identification is a unique phenomenon and getting much attention in different walk of life. The body part plays the crucual role during recognition. Each person have unique body parts with unmatchable body marks. The technology utilize these body marks to determine the uniqueness of each person. How efficient this system is? Does every body mark can provide accurate identification? Several developments have been undertaken but challenges in relation to data and images received not up to the standard sometimes create big hassle. To handle such challenges, the Multi-biometric Sustainable Approach (Mb-SA) has been proposed that take into account two different modalities such as, foot and iris. This methodology skillfully recognizes and renders super identification of individuals, and indicates a perspicacious outcome that is above all better than the conventional biometric method.

1. Introduction

From a physiological and behavioral point of view, the biometric method is becoming common for the recognition and authentication of individuals. When the conclusion is the correct, the evaluation screen fits with images already stored-in and the visualization is checked thereafter [1]. In order to locate the test picture in the stored database, the user is marked or does not know if it is just one of several mapping schemes. With the abundance of data and confidential details stored in personal electronic devices, it is important to secure them from unauthorized access. Deficiencies in protection may contribute to theft the identification or details. Theft of identity is the manipulation of identity while copying the secure data is obtained from the information theft [2]. There are three level of human security, out of which number third level implements greater difficulty of the user's personal property in an authentication scheme [3]. It uses the features of the individual's physiological or mental, called biometrics. With the assistance of fully or semi-automatic systems it provides a potential solution for identity management. Many of the advantages of biometric systems relative to other authentication method relying on token and information are given below.

- *Unique:* It is assumed that biometric properties are special. Having special to an entity and define a person's unique characteristic.
- *Convenient:* The use of biometrics is easy because the customer does not need a key or hidden information to be processed. The customer often has physiological or behavioural characteristics that can not be incorrectly put, misplaced or overlooked.
- *Hard to forge:* Difficult to forge biometric characteristics. An attacker may use a spoofing technique to strike him, however the simultaneous usage of more than one biometric attribute greatly reduces the risk of forgery.
- *Requires Physical Presence:* After verification a biometric program collects live biometric samples. The

* Corresponding Author: Shahzad Ashraf
E-mail address: nfc.iet@hotmail.com

Received: 14 July 2020; Revised: 11 August 2020; Accepted: 13 August 2020

Please cite this article as: S. Ashraf, Z. Aslam, S. Saleem, S. Afnan & M. Aamer, Multi-biometric Sustainable Approach for Human Appellative, Computational Research Progress in Applied Science & Engineering, CRPASE: Transactions of Electrical, Electronic and Computer Engineering 6 (2020) 146–152.

physical appearance of the consumer is also necessary. It instills a sense of belonging with the benefit of non-repudiation; that is, the individual can not refuse his involvement in authentication at a later point in time.

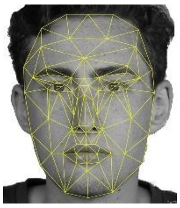
Some in practice biometric identification technique have been described in Table 1.

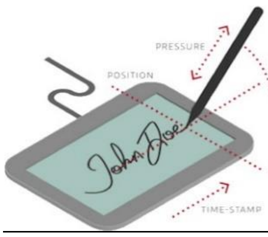
Usually, all biometric results are being taken in two steps; either thorugh training process or by testing process. The briefe discussion is given as:

Training process:

- ✓ Camera captures or acquires input image.
- ✓ Preprocessed picture requires file redimensioning, reformatting.
- ✓ Extraction function is carried out.
- ✓ Built-in data corpus.

Table 1. Current biometric techniques, comparasion and challengs

Biometric technique		Process	Challenges
	*Finger print thumb impression*	Indeed, its a most appropriate and common method of human identification a individual over the last decade. The system uses a magnetic ink to get the print on paper with finger or thumb. Its a pattern with ridges and valleys on the finger skin layer. Certain patterns emerge during the formation of the fetus and remain constant throughout the course of life. The fingerprint design has been divided into five classes, including Ark, Tented Arch, Left Loop, Right Loop and Squirrel. Discontinuity points in the ridge are called minutiae and are considered to be very useful for identification.	It needs an sufficient number of characteristics (minutia), true characteristics and their consistency. It also demands the consumer to collaborate strongly, to spoof and to decrease the consistency of the sample obtained.
	*Face recognition*	The facial or face recognition is a technology in which a individual is recognized and instantly checked via digital picture. This non-invasive data processing is one of the key benefits of the face over other techniques. The Facial Recognition Method has two key parts: I the position of the face in the picture and (ii) the identification of the object. Holistic facial recognition methods utilize anatomical differences between facial traits such as pupils, nose, mouth and eyebrows as attributes. Many feature-based methods use global picture recognition to depict the face as orthonormal base vectors.	Non-cooperative behaviour of users, changes in background lighting, illumination, exposure, expressions, occlusions, ageing, etc.
	*Ear biometry*	Ear biometry utilizes attributes or traits of the ear for matching. It's secure and doesn't shift with age. This has long been seen in the investigative area as a form of individual identification. The ear form is constant and does not shift with time. With time. This has no expression as compared to face. The light pattern is always standardized.	Hair or some other international object such as the earring, hat, earphones etc. are the biggest annoyance of the ear. Ear is significantly influenced by the changes of positions, although from the front photo it is not noticeable. Small heads have less features

	*Hand geometry*	It includes the calculation and study of the form of the hand of the consumer. This is a fairly quick, easy to use and cost-effective method. It can be easily integrated with other devices or system even if it requires special hardware to be used. Factors such as dry skin have little impact on the system's efficiency.	Jewellery or agility can present a problem in proper geometry extraction. Some of the main drawbacks is the poor differential potential of hand geometry.
	*Palmprint*	It contains folds, key lines, shape, ridges, delta points, local minutiae points, etc. It is important to use all such details for acknowledgment. Even in monozygous twins, the palmprint patterns are found to be unique, but the stability of palmprint features is not yet critically studied. The camera used to get the picture by hand is low cost and user friendly. Palmprint region is wide and it gathers more details than a fingerprint. Low cost sensors can be used to capture palmprint image in a touch-less manner.	The scanners used to obtain the palmprint are bulkier and due to the wide capture region it requires more computing capacity. The amount of features in a palmprint image is lower, so it is challenging to remove due to rough palm surface.
	*Voice recognition*	Every individual person possessed specific tone, pitch, and speaking style under the behavioral characteristics of voice biometric system therefore its a speedy method of identification which requires no specific tool or system. The voice character requires properties including fundamental pitch, nasal sound, cadence, inflection, etc. A voice recognition method contains three stages (i) the acoustic data obtained by an individual's speech (ii) it is converted into a single digital signal and (iii) the signal is enrolled / matched. Voice detection is non-intrusive and generally appropriate to community.	Voice can be captured quickly, and unauthorized access is likely. The speaker can alter a person 's speech and may find speech identification challenging, such as noise, sickness, gender, mental and physical conditions.
	*Signature identification*	Handwritten signatures in other fields, such as banking and legal documents, are also used for offline device authentication. Wide signature database availability renders it one of the most-needed automated authentication schemes.	One of the biggest challenges of this technology is poor permenence characteristics due to high levels of variability in handwriting with time. An impostor can reproduce a signature easily. Since not everyone can sign, lack of universality is a prime factor as well.

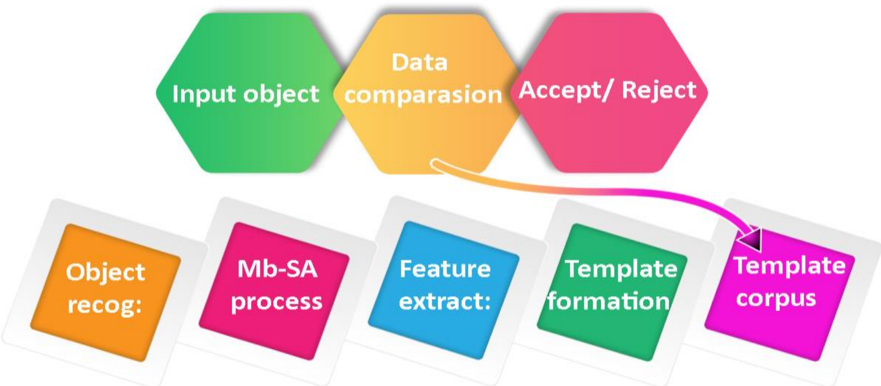


Figure 1. Meticlous testing process

Testing Process: It is closer but balanced at the planning point [4]. The preparation and assessment procedures are illustrated in Figure 1. There are numerous challenges hindring the traditional and in practice biometric system.
There are numerous challenges faced by the Uni-biometric system such as:

- Noise
- Intra-class variations
- Non-universality
- Spoof attacks

Multi-biometrics provide incentives to carry in more than two biometric functions, integrate them to address unimodal shortcomings of the biometric method and obtain optimum performance **[5].** In a multibiometric interface we used two modalities such as, foot and iris. Sprints are being developed whereas, iris is unique and not altered as a transparent layer structure during a person's life.

The rest of the finding are arranged as: Related work is given in section 2, proposed system is explained in section 3, while section 4 have been highlighted with performance evaluation and section 5 is summirized with conlcuding remarks.

2. Related Work

Several studies have made important contributions [6], that biometrics are being more widely utilized in different locations via numerous biometric tools such as banks, institutes, airports. In authentication-based image processing applications multi-biometric is preferred. The authors [7], developed a multi-modal method for individual recognition that relies on physiological and demographic details.

A biometric method for identification of individuals was added to connect the transparent overlaying panel of Michail et al [8], demonstrating the accuracy of the device. Another work experiment was reported on the face and ear hybrid system [9]. This method is used to compact and index images in Iterated Feature definition. Author et al [10], developed a multi-biometric device that blends face modalities and foot modalities using PCA [11], a foot transforming face and wavelet classifier and concatenated after the normalization cycle to achieve a corresponding score and to make a judgment.

Another author, Davrondzhon [12], proposed a biofilm multimodality system, that combines face, ear, and iris using PCA, Eigen [13], and hamming [14], a classificator for feature extraction. They implemented the identification of individuals using multiple biometric traits and their advantages, such as high accuracy and robustness, that increased identification efficiency. Herbadji et al [15], have developed a multi-biometric system that combines decision-making facial and foot modalities using the PCA classifier for the foot face and wavelet transformer and concatenated to obtain matching score after the normalization process.

3. Methodology

The body components may be combined with certain body items in a variety of different forms, contributing to a broad range of computer architectures. The Iris footprint can be combined especially in parallel or cascade, thus arranging more findings as follows:

3.1. Iris Biometric Tecognition Technique

It operates on the colored portion of the body accompanied by pupils called iris [16]. The picture of Iris is captured using a high resolution sensors. The computation method for patterns is very complicated however, it is processed in a bit format. The hamming form is used for the distance estimation between test image and stored template [17]. If a null difference suggesting a study picture is essentially the same, and the testing image, all pictures can be different. There are stereotypical patterns like furrows, ridges, crypts inside the iris. It is fitting to distinguish humans with the distinctive pattern of variable iris texture [18].

3.2. Hamming Distance Method for iris

With a similar iris model noise masking is used in the hamming distance solution [19]. The distance between the two iris templates is calculated as bits and the distance between two iris templates is calculated if the distance indicating the iris is minimum, because iris is unassembled [20], which confirms that the hamming distance is reliable and precise when iris is identified. The process of segmentation and normalization is illustrated in Figure 2.

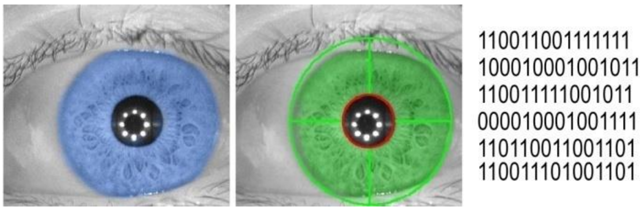


Figure 2. Bits formation from extracted iris segment

3.3. Footprint Biometrics

Identifying peoples through fingerprint is a wonderful achievement. Measuring such functionalities does not constitute a complicated operation, for example furrier, which provides hair [21]. Both leg photographs are used for identification with increasing parson's entirely different specifications. More techniques such as cropping and resizing are required to capture a foot picture. Figure 3, displays the camera shot image that is transformed into gray scale in the RGB picture after it is resized for database planning.

(a) (b)

Figure 3. Information retival process from foot segments

3.4. Sequential Modified Haar Transform Technique

The sequential updated haar wavelet [22], is based on the mapping technologies by way of object retrieval, where

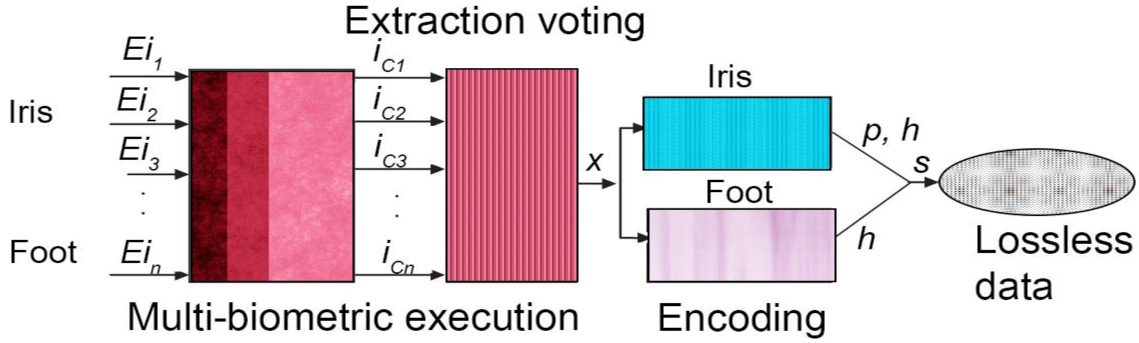


Figure 4. Proposed multi-biometric recognition process

integer weighted signals are maps. Each decimal value of the wavelet-coefficients required 8 bytes to store the haar value.

3.5. Multi-biometic Approach: The samples of visual images are considered as inputs to the system and iris templates as output are generated. The discrete bits form the image during segmentation and normalization stages [23]. The proposed system produces *n* number of iris codes out of *n* number of eyes tests performed at various time periods from the same person. Using majority voting scheme, a unique iris code *x* is built from the *n* number of iris code. The suggested framework operates on *x* and generates codewords, known as Error Corrected Iris Code (ECIC) [24].

These ECICs are composed of iris coding and parity regulation *p*. The hash *h* is also created from code *x*. Eventually, parity regulates *p* of the ECIC, matrix *h* of parity and hash-h render code that are embedded in digital images by transformation of the integrated wavelet and incorporation processing threshold illustrated in Figure 4. The new and unique feature of the multi-biometric is the speed and precise segmentation of irises. The iris image is collected in order to minimize the estimation of defects, to generate a vector with distinctive texture characteristic

s and a proper dimension to boost detection and computational efficiency [25]. In this segmentation method, the sagacious edge detection and the Hough circular cycle are used.

The segmented iris is standardized and phases are extracted using Log-Grabor [26] filters and shrewdly encoded for generating refined vector characteristics by phase process [27]. After segmentation, normalization and quantization, the iris has been separated from the actual eye specimen. The next stage is to transform the iris area such that dimensions have been set to make the comparison [28], because the iris region has been effectively removed from the eye target. Dimensional variation between the eye photos is primarily attributed to the iris widening of students from varying degrees of illumination. Many incoherence causes involve a separate angle, camera movement, head tilt and eye movement within the eye socket [29].

The effects of the person iris code *x* of n iris code are produced through a specific process known as the extraction test. Multi-biometric codes are represented by the sparse parity check matrix. Such tiny matrix is also generated by

Table 2. Foot and Iris related parameters

Traits	Genuine Score	Imposter Score	Threshold Value
Iris	1.7121E+04	1.9082E+04	1.7330E+04
Foot	2.2277E+04	2.6613E+04	2.2325E+04

chance, according to the limits of sparsity. Reffering to Figure 4, once the requirement is satisfied by removing polling, correct message bits are handled during the multibiometric step. Each column in iris codex is known to be a multi-biometric encoding and encoded to make ECIC with the support of generator values after the development of

Table 3. Iris and foot related FAR & FRR parameters

Traits	FAR	FRR
Iris	1.1010E+00	9.8793E-01
Foot	1.1921E+00	9.9785E-01

the iris code *x*. The basic iris code x is translated into hash h, also called cancellable iris code. For object 1 and 2, the

Table 4. Iris and foot weightages

Traits	Weight
Iris	0.89
Foot	0.83

Table 2, indicates truthful value, impostor value and threshold meaning. False acceptance rate (FAR) [30], and False rejection rate (FRR) [31], of Iris and foot are checked separately, and therebt Table 3, indicates False acceptance rate (FAR). Table 4, has measured the weight of both iris and foot forms. Algorithms for identification of iris and foot detection culminated in discrepancies [32]. The Min-Max standardization method [33], has been used to transform all the various data to the same data as given in Table 5. Continueuing to Table 6, illustrated a matching score for the combination of iris and foot traits. This is determined in two modalities with its weight.

Table 6. Comulative matching score

Traits	**Score**
Iris + Foot	0.57

Table 5. Iris and foot normalized Scoring factor

Traits	Normalized Score
Iris	0.05
Foot	0.07

4. Performance Evaluation

Around 100 (eye and foot) sampling items were considered for output tests from 500 image samples. Throughout the authentication method, the existing image of the iris is connected to the other iris. Arround (500 x 499)/2 = 124,750 comparisons are simulated, of which 345 matches

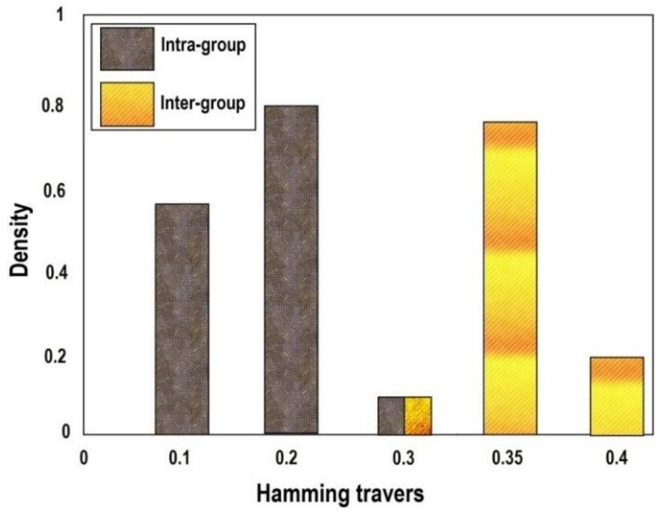


Figure 5. The distribution record during Intra and Inter-group

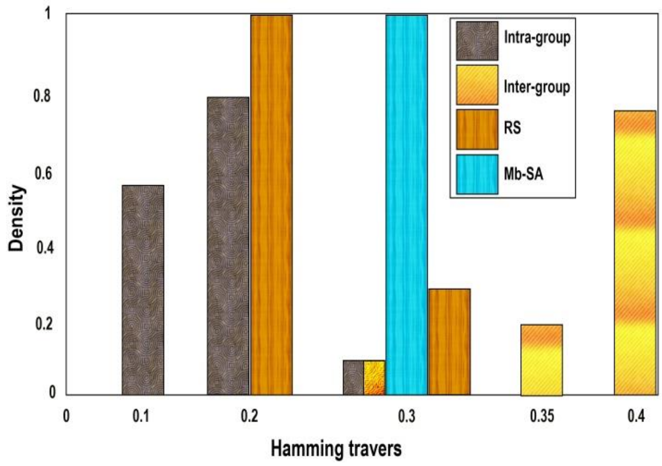


Figure 6. Proposed error correction determination

were found in the intra-groups and 116,602 inter-group matches were registered. Figure 5, indicates a cumulative distribution between intra-group and inter-group[34] distribution. It was found that traverses between intra-group and inter-group are exorbitant, and the portion that exists between intra-class and inter-class is very negligible, resulting in approximately 100 percent of the valid recognition rates. The Reed Solomon (RS) [35], is being implemented to assess the Mb-SA error correcting potential and produces the results as seen in Figure 6. The chosen RS and Mb-SA bar overlays the real uniform HD distributions [36], with the impostor. Even the bar indicates slightly smaller than Mb-SA, are pertaining the RS adjustment. The encoding of RS is less granular than the Mb-SA, in contrast. With the False Rejection Rate (FRR) and the False Acceptance Rate (FAR) levels, it leads to efficiency loss.

5. Conclusion

The multibiometric device used biometric iris and foot characteristics. Weight of each biometric item was determined for hamming archways and sequentially adjusted haar transformation classifier approaches. Knowledge was incorporated following normalization. The Iris comprises of a simple and clear method focused on the Sagacious Rim Detector and the Hough Advance. The present FRR and FAR are 2.0% and 0.38%, while the revised Mb-SA, FRR and FAR are 1.87 and 0.365%. Mb-SA codes have shown greater identification efficiency than RS codes due to increased steepness and granularity. For lower FRR and Back, the system uses Mb-SA codes. In addition , the proposed technology obtained 98 percent exact and precise efficiency in terms of durability, accuracy and consistency relative to other recorded technologies.

References

[1] F. G. M. Morooj K. Luaibi, F. G. M. Morooj K. Luaibi, Facial Recognition Based on DWT – HOG – PCA Features with MLP Classifier, J. Southwest Jiaotong Univ. 54 (2019).

[2] S. Ashraf, D. Muhammad, Z. Aslam, Analyzing challenging aspects of IPv6 over IPv4, J. Ilm. Tek. Elektro Komput. Dan Inform. 6 (2020) 54–67.

[3] S. Ashraf et al., Challenging strategic trends in green supply chain management, Int. J. Res. Eng. Appl. Sci. JREAS 5 (2020) 71–74.

[4] The false rejection rate (FRR)? Valuable answers from Webopedia. [Online]. Available: https://www.webopedia.com/TERM/F/false_rejection.html. [Accessed: 31-May-2020].

[5] S. Ashraf et al., Efficient Node Monitoring Mechanism in WSN using Contikimac Protocol, Int. J. Adv. Comput. Sci. Appl. 8 (2017).

[6] Unlocking new possibilities for biometrics, Spartan researchers help create smarter, safer applications for a connected world. [Online]. Available: http://msutoday.msu.edu/feature/2018/unlocking-new-possibilities-for-biometrics/. [Accessed: 31-May-2020].

[7] The essence of eigenvalues and eigenvectors in Machine Learning. [Online]. Available: https://towardsdatascience.com/the-essence-of-eigenvalues-and-eigenvectors-in-machine-learning-f28c4727f56f. [Accessed: 31-May-2020].

[8] M. N. Giannakos et al., Multimodal data as a means to understand the learning experience, Int. J. Inf. Manag. 48 (2019) 108–119.

[9] J. F. Doriguello, A. Montanaro, Quantum sketching protocols for Hamming distance and beyond, Phys. Rev. A 99 (2019) 062331.

[10] N. Kak, R. Gupta, S. Mahajan, Iris Recognition System, Int. J. Adv. Comput. Sci. Appl. IJACSA 1 (2012).

[11] False Acceptance Rate and False Recognition Rate. [Online]. Available: https://www.bayometric.com/false-acceptance-rate-far-false-recognition-rate-frr/. [Accessed: 31-May-2020].

[12] S. C. Hoo, H. Ibrahim, Biometric-Based Attendance Tracking System for Education Sectors: A Literature Survey on Hardware Requirements, J. Sens. (2019) 1–25.

[13] A. Melamed, 2018 biometric predictions: advanced biometric technologies take off, Biometric Update. [Online]. Available: https://www.biometricupdate.com/201801/2018-biometric-predictions-advanced-biometric-technologies-take-off. [Accessed: 31-May-2020].

[14] J. Pandya, Hacking Our Identity: The Emerging Threats From Biometric Technology, Forbes. [Online]. Available: https://www.forbes.com/sites/cognitiveworld/2019/03/09/hacking-our-identity-the-emerging-threats-from-biometric-technology/. [Accessed: 31-May-2020].

[15] W. Yang, J. Hu, S. Wang, Q. Wu, Biometrics Based Privacy-Preserving Authentication and Mobile Template Protection, Wireless Communications and Mobile Computing. [Online]. Available: https://www.hindawi.com/journals/wcmc/2018/7107295/. [Accessed: 31-May-2020].

[16]

S. Ashraf, T. Ahmed, A. Raza, H. Naeem, Design of Shrewd Underwater Routing Synergy Using Porous Energy Shells, Smart Cities 3 (2020) 74–92.

[17] Y. Jain, M. Juneja, M. Student, Ridge Energy Based Human Verification Using Iris and Palm Print 5 (2018) 7.

[18] S. Ashraf, S. Saleem, T. Ahmed, Sagacious Communication Link Selection Mechanism for Underwater Wireless Sensors Network, Int. J. Wirel. Microw. Technol. 10 (2020) 22–33.

[19] A. Herbadji et al., Combining Multiple Biometric Traits Using Asymmetric Aggregation Operators for Improved Person Recognition, Symmetry 12 (2020) 444.

[20] S. Ashraf, D. Muhammad, M. Shuaeeb, Z. Aslam, Development of Shrewd Cosmetology Model Through Fuzzy Logic, J. Res. Eng. Appl. Sci. 5 (2020) 93–99.

[21] R. Kushwaha, N. Nain, G. Singal, Detailed Analysis of Footprint Geometry for Person Identification, in 2017 13th International Conference on Signal-Image Technology Internet-Based Systems (SITIS) (2017) 229–236.

[22] J. T. Pontalba et al., Assessing the Impact of Color Normalization in Convolutional Neural Network-Based Nuclei Segmentation Frameworks, Front. Bioeng. Biotechnol. 7 (2019) 300.

[23] S. Ashraf et al., USPF: Underwater Shrewd Packet Flooding Mechanism through Surrogate Holding Time, Wirel. Commun. Mob. Comput. (2020) 1–12.

[24] P. Campisi, E. Maiorana, A. Neri, Signature Biometrics, in Encyclopedia of Cryptography and Security, H. C. A. van Tilborg and S. Jajodia, Eds. Boston, MA: Springer US, 2011, 1208–1210.

[25] S. Ashraf, A. Ahmad, A. Yahya, T. Ahmed, Underwater routing protocols: Analysis of link selection challenges, AIMS Electron. Electr. Eng. 4 (2020) 234–248.

[26] Log-Gabor Filters. [Online]. Available: https://www.peterkovesi.com/matlabfns/PhaseCongruency/Docs/convexpl.html. [Accessed: 20-Jun-2020].

[27] S. Ashraf, Z. Aslam, A. Yahya, A. Tahir, Underwater Routing Protocols Analysis of Intrepid Link Selection Mechanism, Challenges and Strategies, Int. J. Sci. Res. Comput. Sci. Eng. 8 (2020) 1–9.

[28] D. Gafurov, Emerging Biometric Modalities: Challenges and Opportunities, in Security Technology, Disaster Recovery and Business Continuity, 122, T. Kim, W. Fang, M. K. Khan, K. P. Arnett, H. Kang, and D. Ślęzak, Eds. Berlin, Heidelberg: Springer Berlin Heidelberg (2010) 29–38.

[29] S. Ashraf, T. Ahmed, Machine Learning Shrewd Approach For An Imbalanced Dataset Conversion Samples, J. Eng. Technol. JET 11 (2020).

[30] S. Möller et al., Evaluation of Multimodal Interfaces for Ambient Intelligence, in Human-Centric Interfaces for Ambient Intelligence, Elsevier (2010) 347–370.

[31] P. Kapoor, D. Lee, B. Kim, S. Lee, Computation-Efficient Quantization Method for Deep Neural Networks (2018).

[32] S. Ashraf et al., Underwater Resurrection Routing Synergy using Astucious Energy Pods, J. Robot. Control JRC, 1 (2020).

[33] I. S. Reed, X. Chen, Reed-Solomon Codes, in Error-Control Coding for Data Networks, I. S. Reed and X. Chen, Eds. Boston, MA: Springer US, (1999) 233–284.

[34] S. Ashraf, T. Ahmed, Dual-nature biometric recognition epitome, Trends Comput. Sci. Inf. Technol. 5 (2020) 008–014.

[35] S. Ashraf, Z. A. Arfeen, M. A. Khan, T. Ahmed, SLM-OJ: Surrogate Learning Mechanism during Outbreak Juncture, Int. J. Mod. Trends Sci. Technol. 6 (2020) 162–167.

[36] S. Ashraf, T. Ahmed, S. Saleem, Z. Aslam, Diverging Mysterious in Green Supply Chain Management, Orient. J. Comput. Sci. Technol. 13 (2020) 22–28.