

A Proposed Hybrid Biometric Technique for Patterns Distinguishing

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In recent security systems, biometric pattern recognition developed as a major research area. It is of high importance in the process of authentication regarding virtual reality as well as real world entities for the purpose of allowing the system to create an informed decision regarding offering specialized services or allowing access privileges. Recently, the field of security has been a major focus area. The requirement for accurate authentication related to individuals is considered as a main issue in the security field. Old-style approaches of setting up the identity of individual including identification cards, passwords and keys, however, these ways for representing the identity could be easily stolen, lost, manipulated or shared, thus causing security damage. Biometrics traits including voice/face verification, signatures and fingerprints offer a trustworthy choice for identifying or verifying identities and better user acceptability rate. There are two major classes used to represent biometric characteristics; the first is Physiological type that is associated to the body shape such as iris and face recognition, and fingerprints, the other is the behavioural type that is associated to the individual's behaviour such as voice, signature and gait. The paper aims to identify a person by using different multi biometric traits with different technique. This paper handles the two through presenting novel method to the biometric pattern recognition, depending on training neural network (NN) and implements efficient features extraction approach based on SVD, wavelet energy and PCA. Fourth step is the fusion, in this step the three vectors of features that we obtained from the previous step we collect in one vector. The fifth step is testing. In the sixth step, we will compare the database of feature with database this step is called matching and see if the person is existing or not. The quality and accuracy of the identification and recognition of the person are measured in this system by computing the Peak Signal to Noise Ratio (PSNR) and the Mean Square Error (MSE) for face, fingerprint and signature images. The recognition rate of the system is more than ninety. the desired goal of recognizing and identifying a person through his fingerprints, face and signature images. It also shows how the system managed to provide the highest ratio of recognition.

Keywords: artificial neural network, automated teller machine, singular value decomposition, personal computer, mean square error, peak signal to noise ratio

1. INTRODUCTION

Mounting attempts are dedicated for implementing and developing novel systems of security, which are on the basis of biometric features. The objects of the system might be

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virtual reality or human entities, also they are rejected or accepted via the system according to behavioural or biological biometric features. Biometric pattern recognition involves the recognition of iris, gait, face, signature, fingerprint, ear, voice, or additional behavioural or physiological features. Facial biometrics is highly important in user authentication since it is vital biometric feature. It involves set of high dimensional vectors signifying texture, topological, or color information. The feature set could comprise hundreds of features and it is extremely complex. Therefore, it is considered complex biometric pattern recognition problem to manage [1, 2]. Feature based approaches are considered the base for a lot of the previous face recognition algorithms. These approaches recognize a collection of the face's geometrical features including nose, eyes, mouth and eyebrows [3]. The relations and the properties between feature points, including angles, distances and areas are utilized as descriptors for face recognition process.

The number of dimensions is typically lowered via the use of statistical approaches; though, no universal answers exist to the problem regarding the number of points that offer the optimum performance [4]. Biometric characteristic might be defined as a biological phenomenon behavioural or physical characteristic, which might be utilized for recognizing the phenomenon. Concerning narrower perspective related to biometrics physical characteristics are genetically implied (perhaps environmental affected) characteristics such as individual's vascular structure, retina, face, finger, iris and so on. The psychological or behavioural characteristics are what the individual learn or acquire throughout their lifetime such as voice characteristics, individual's gait, typing dynamics and handwritten signatures. Biometric structure can be defined as a distinct feature related to some biometric characteristic, which could be applied for recognition process, for instance the biometric structure related to the individual's biometric characteristic finger is the structure regarding papillary lines and minutiae, and for the individual's biometric characteristic gait it is the structure of the movement of the body during a human way of walking *etc.* [5].

2. BIOMETRIC TECHNOLOGY

This technology is mostly applied for access control and authentication process or for individuals' identifying. Biometric authentication mean that every person has distinctive pattern and the person could be recognized via her or his behavioural or physical characteristics [6].

Mainly, there are two processes related to the biometric recognition system. the first process is the enrolment process as the system carry out one-to-one comparison regarding the captured biometrics, the second process *i.e.* recognition individual's data is compared with the specified template *i.e.* nothing but a matching and system carry out one to many comparisons for the purpose of detecting an unidentified person if exists [7].

A. The main advantages related to the biometric System [6]

- (1) Stolen or forgotten passwords will not exist anymore
- (2) High Accurateness and definite
- (3) Maximum security levels
- (4) Deliver modality
- (5) It cannot be forged
- (6) Operates as a key which might not be transferred

B. Biometric Features [8]

- (1) Uniqueness: An undistinguishable attribute that will not be seen in 2 persons.
- (2) Universality: The pattern's existence is reliable during the universe.
- (3) Performance: It will not be altered such that it remains the same for life.
- (4) Measurability: It can be measured by using plain technical tools.

3. TYPES OF BIOMETRICS

As shown in Fig. 1, various behavioural or physical characteristics are utilized by the biometric systems for recognizing the individual's identity, such as DNA information, face, gait, ear, fingerprint, odour, palm print, finger/hand geometry, hand vein, iris, voice pattern and retina. Single biometric is likely to efficiently satisfy all the necessities (cost, accuracy and practicality) forced via the applications (welfare distribution, Digital Rights Management (DRM) and access control) [9].

That is to say, there is no ideal biometric, however, some of them are acceptable. The relation related to particular biometric to an application is created based on the necessities and nature of the application as well as the features related to the biometric characteristic [10].

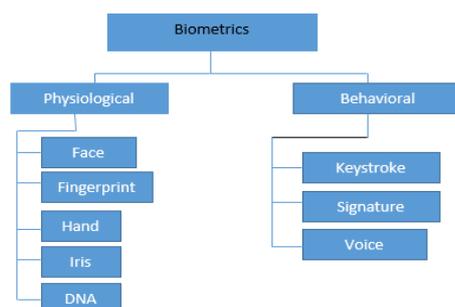


Fig. 1. Types of biometrics.

4. CLASSIFICATION OF NEURAL NETWORKS

The artificial Neural Network (ANN) might be defined as an information processing paradigm which is motivated via how the biological nervous system operates like the way the information is processed by the brain. It does have extremely interconnected processing elements [11, 12]. Therefore, the expression 'Neural Network' denotes two different notions *i.e.* biological neural network which is a plexus of functionally related or connected neurons in the central or peripheral nervous system. Concerning neuroscience, usually it is referring to set of neurons from nervous system, which is suitable for research laboratory analysis [19]. The fact that information processing ability regarding Neural Networks is found through their architecture have a lot of solid engineering and biological prove for the purpose of supporting this fact [13]. A great deal of studies has been genuine to find the optimum ANN architecture through the use of various algorithms, such as EAs. Yet, many real-world issues are considered extremely complex and

extremely large for one ANN to work out in practice [14]. There are enough examples of each of the natural and artificial systems which turned out to be that an integrated system which consist of various sub-systems have the ability to decrease the entire complexity of the system while satisfactorily solution to a complex problem [15].

Instead of applying single network for solving difficult problem, ANN band gathering is used which is considered as group of ANNs, which learn to split the problem to sub problems and solve the problems worthily. The ANN's band offers various features over one ANN [16, 17]. The first one is leading to various tasks from any of its elements (single ANNs in the band). The second one is that the entire system could be uncomplicated to understand and modification. Lastly, it has more effectiveness than one ANN, and could offer agile deterioration of performance when just a sub-set of ANNs in the band execute properly, the NN's structure is shown in the figure below [18].

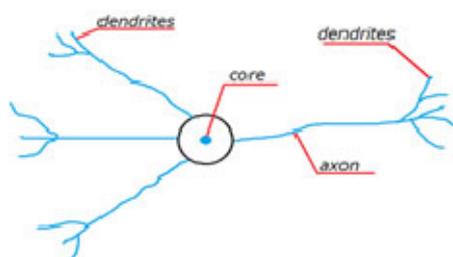


Fig. 2. Structure of a neural cell in the human brain.

5. THE FUSION

The technique that used to integrate the results of classification from every one of the biometric channels is termed as the Biometric fusion. Multi-modal biometric fusion mix between the aspect from various biometric features to improve the strengths and decreasing the limitations of the Training.single aspects. The competence of the fusion method dramatically affects the precision of a multi-modal biometric system. There are many levels of fusion (feature level fusion, match score level, sensor level fusion, the decision level fusion, and rank level fusion), in this paper we used the feature level fusion. The feature vectors extracted from the signature face, and fingerprint methods can be fused for the multimodal system. The feature groups that are extracted from different biometric channels can be fused using a specified fusion algorithm to form a complex feature set. The feature level fusion is the extraction of related feature from the different methods and in naturally identifies a notable group of features that can improve recognition reliability. This feature level fusion is likely to achieve excellent result when we compared it with other level of fusion. The features groups of various methods agree to extract the lower feature set from the high-dimensional feature vector.

6. TRAINING PHASE

In this phase, the initial image is obtained from features and this feature vector is given as an input to the NN. In the beginning, the nodes are given weights randomly.

Due to the fact that the result is already known in the phase of training, the result which has been obtained from the NN is compared to the original and the weights are altered in order to minimize the error. This procedure is performed for large data for the sake of producing a stabilized system with specified weights in the nodes. NNs have a great capability for extracting meaning from complex or inaccurate data; might be utilized for the extraction of patterns and observation trends, which are very complicated to be observed by humans or other digital techniques. We can consider the trained neural network as an “expert” in the information category it was given to analyze. Backpropagation is a very powerful method of learning.

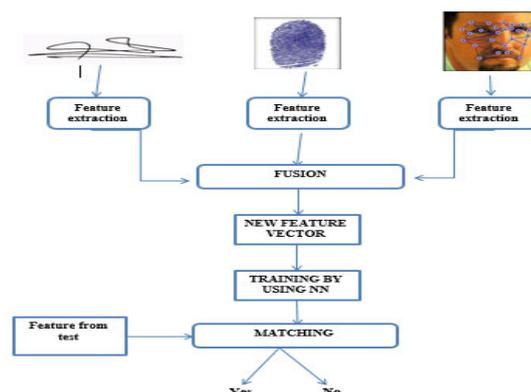


Fig.3. The fusion level and neural network.

This approach is very successful in training multi-layered NNs. The network is not merely given strengthening for the way it is doing on a task. Information concerning errors as well filtered back via the system and is utilized for amending the links between layers, which improve the action the figure below the fusion level and neural network training.

7. RESULTS

For each person there are distinctive characteristics that can be extracted them in the phase of feature extraction and use these features in the recognition phase. We used singular value decomposing (SVD) and energy wavelet to find the features. Out product has been utilized for multiplying the resulted vector with its transpose vector for two significant reasons. First, for obtaining a 2-D matrix and second, when utilizing SVD a correct value for the matrix has been obtained due to the fact that without this step it has been found that the operation of SVD will produce a single value. In this phase we obtain three vectors represent the features of face, fingerprint and signature. According to the operations mentioned above the proposed system is going through two stages, training and testing. In this section, the result that has been obtained from each of the two phases is evaluated based on measurement metrics of biometric performance. Fig. 4 shows the obtained recognition rate, peak signal to noise ratio (PSNR) and mean square error (MSE), for signature, fingerprint and face.

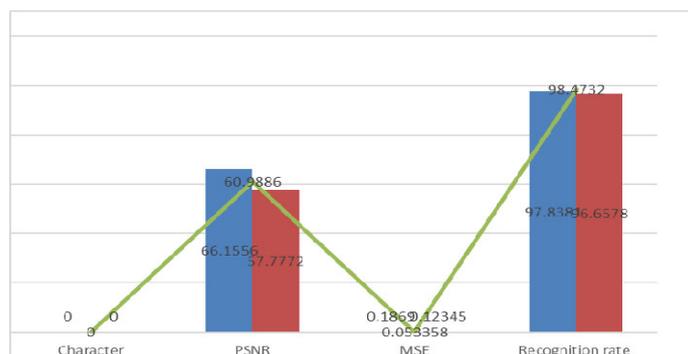


Fig. 4. MSE, PSNR and recognition rate of the system.

The MSE and PSNR are calculated when the samples are tested. The quality and accuracy of the identification and recognition of the person is measured in this system by computing the PSNR and the MSE for face, fingerprint and signature images. Two types of error (MSE and PSNR) have been calculated to the face fingerprint and signature images of 10 persons, each has three images. The value of both PSNR and MSE is shown in Fig. 5. The time of 10 test is shown in Fig. 6.

The reason behind this is that the brightness and contrast differ between these two images. This difference is caused by the light where the image was taken and the distance between camera and person. The light of the second image was higher than the fourth one, which gave effecting on the result. The better matching is happened when the MSE is decreased and the PSNR increase, the better matching is happened when the MSE is decreased and the PSNR increase, The FAR of the system is 0.1 and the FRR = 0.

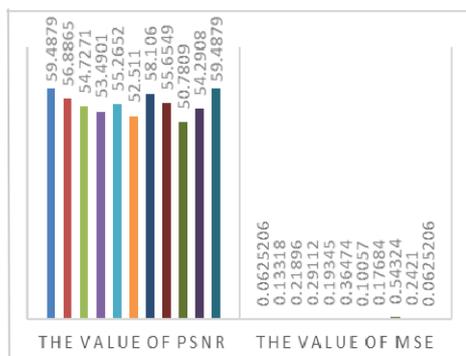


Fig. 5. The value of PSNR and MSE.

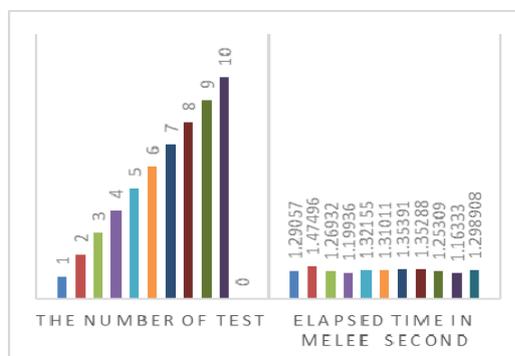


Fig. 6. The elapsed time.

8. CONCLUSIONS

In reality that the combine of multi biometric measures help us to have a greater percentage of reliability and authentication because these measures covered the weakness of the others within a system. The using different biometric measures give us very

good percentage recognition compared to with when we use a single biometric measure and the system becomes more secure. One of the problems faced during the implementation of the program, it was to collect data and how to address them in the post, especially in the fingerprint.

9. FUTURE WORKS

In this work we used hybrid biometric, in future work they can use a hybrid technique and Increasing the size of the data set leads in such a way as that the validity of the results will be improved. This data set can include random persons such as children, disabled, third age.

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