International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 5 Issue: 8
ISSN: 2454-4248
67 –70

Face Recognition Based on Intelligent System

Abdulkareem Merhej Radhi
Department of Information and Communication Engineering, Al-Nahrain University, Iraq
abdulkareemradhi@gmail.com

Subhi Aswad Mohamad
Department of System Engineering, Al-Nahrain University, Iraq
subhiaswad@yahoo.com

Narji A. Hassan
Department of Information and Communication Engineering
Al-Nahrain University, Iraq
sunzhra@gmail.com

Abstract- Face recognition is one of the most attractive and challenging topics in the fields of pattern recognition used in many biometric security applications. In this research, we use Two Dimensional Discrete Wavelet Transform (2D-DWT) to decompose face image for extracting features and Principle Component Analysis (PCA) for dimensional reduction of these features. For classification, we use ANFIS technique which is a combination between Fuzzy Inference System and Neural Network, Furthermore, we implemented Back Propagation Neural Network for the extracted features to compare its efficiency with ANFIS. Implementing proposed work get a best recognition rate and less computation where the recognition rate increases until it reaches maximum value (96%).

Keywords- *Face Recognition; Wavelet; Fuzzy; PCA; ANFIS*

*****

I. INTRODUCTION

Biometric is the science of establishing the identity of an individual based on the physical or behavioral attributes of the person. Face recognition is a one type of biometrics system trying to capturing the physiological characteristics for individual verification or personal identification [1]. The face recognition has a several advantages which are not involved in biometrics methods, likes (nonaggressive, friendly, conveniently) [2]. Facial features scored the highest compatibility, among the most six famous biometric systems used in Machine Readable Travel Documents (MRTD) system, such as enrollment, security system, machine requirements, renewal, surveillance system and public perception [3]. Figure (1) presents that face recognition have the highest weighted percentage in biometric system compared with others biometric traits based on MRTD [3].

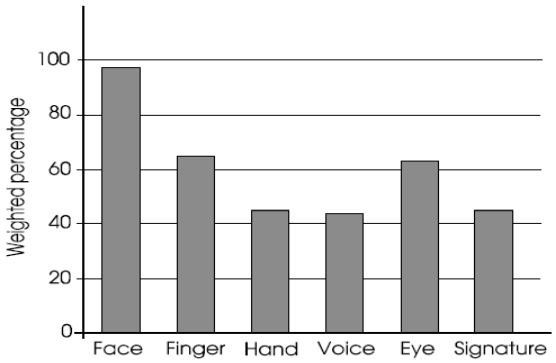


Figure (1): Comparison of various biometric Systems

The remainder of this paper is organized as follows: section 2 presents most related work to the proposed research. Sections 3, 4 and 5 depicts introduce Viola Jones, Wavelet transform and PCA decomposition. Sections 6 and 7 present's framework of the proposed system and experiments on standard face databases to evaluate the performance.

II. RELATED WORK

The most related researches to our proposed work are briefly described below:

- In [2008]: Shen. Linlin, Bai. Li, and Ji. Zhen [4], propose a novel data driven strategy for designing Gabor wavelets for face recognition. Each face image is represented through a multi-sensor scheme, which splits the 2D frequency plane into a number of channels and identifies the most significant units for extracting information.
- In [2010]: Gumus. Ergun, Kilic. Niyazi, Sertbas. Ahmet, Ucan. Osman [5], presents feature extracting techniques from Wavelet decomposition and Eigen faces method and Support Vector Machines (SVMs) are used for classification step. In [2014] Kadam. Kiran [6], Hybrid combination of principal component analysis (PCA) and discrete cosine transform (DCT) are used to reduce time and high recognition rate than PCA.
- In [2016]: Sukhija. Pratibha, Behal. Sunny Singh. Pritpal [7], propose method use Genetic Algorithm (GA) for face recognition.

 ISSN: 2454-4248
67 –70

III. VIOLA JONES APPROACH

The proposed work adapt this approach. It is a very fast and accurate approach to detect an object was devised by viola and Jones. Viola and Jones technique depend on the fact that there is some similarities in all human faces, it is used this concept as a Haar-feature to detect face in image. This is achieve by scan image by set of rectangle regions, such that all rectangle regions are of the same size which have the same form and are vertically or horizontally neighboring. If these features founded, then the algorithm passes the candidate to the next stage and so on to detect all the face [8].

IV. PRINCIPAL COMPONENT ANALYSIS (PCA)

The aim of the PCA is to reduce the dimensionality of the raw data (features) while retaining as much as possible of the variation present in the dataset i.e. it compute a linear transformation that maps data from a high dimensional space to a lower dimensional sub-space. It finds orthonormal basis for data, sorts dimensions in order of importance and discard low significance dimensions. Though dimensionality reduction implies information loss, yet enough information need to be preserved as much as possible [9].

V. DISCRETE WAVELET TRANSFORM

Discrete Wavelet Transform DWT [9] is used in analysis of signals and images. It decomposes an image into a set of basic functions called wavelets and the decomposition is defined as the resolution of an image. DWT has been proved to be a very useful tool for image compression in the recent years. It supports the multi resolution analysis of data. 2D-DWT is implemented as a set of filter banks, comprising of a cascaded scheme of high-pass and low-pass filters.

VI. PROPOSED METHOD

The general framework of the proposed method consist of two models: in the first model, we use back propagation neural network such that typical system scheme with two phases which are training and testing phases. Training phase consists of face allocation step, pre-processing step, features extraction step, and features selection step. Whereas, testing phase involves face allocation step, pre-processing step, features extraction step and classification step .The detailed structure of the proposed framework is shown in Figure (2). In both phases, face allocation step starts up with translational and rotational image for detection (or recognition). In the second model, we use ANFIS. This model is also divided into a training stage and a test stage and passes the same stages that were passed in BPNN except one stage is the dose not use face allocation step.

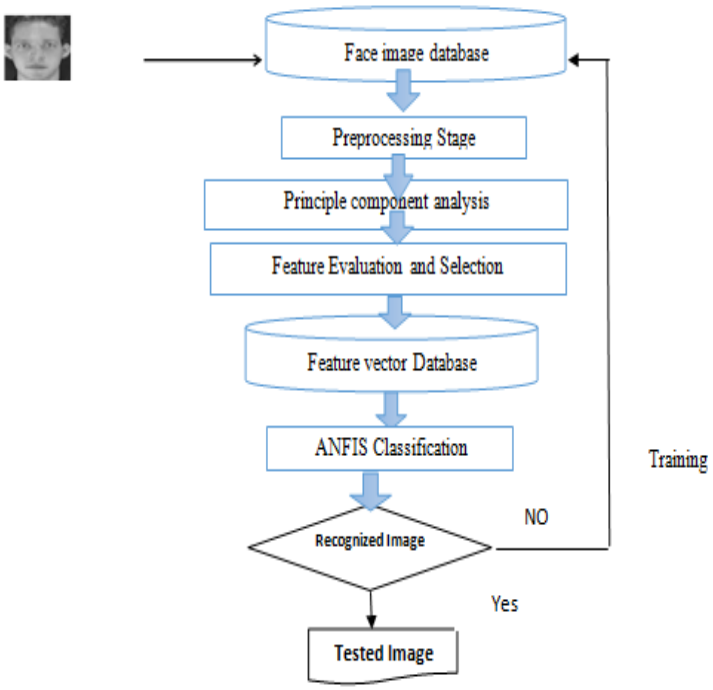


Figure (2): The Block diagram of the proposed Method with ANFIS classification

VII. PROVING THE SYSTEM PERFORMANCE

The data set is passed on the trained network to verify whether the person has been identified or not. The Recognition rate are then calculated to evaluate the facial recognition system. The recognition rate of face recognition system may be defined by "the percentage of the image count that is distinguished by the total number of images". In general, to evaluate the performance of any face recognition system and the recognition rate of the system can be calculated as in equation (1):

$$Rr = \frac{No.Pc}{Tp} \text{ x}100\% \quad \text{..... (1)}$$

Where Pc: Number of personal classify, Tp: Total number of persons, and Rr: Recognition rate.

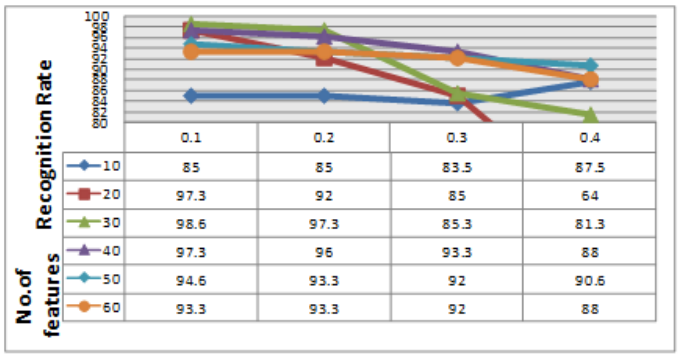
VIII. TRAINING ANFIS

In the training phase, we first determine genfis2 in order to define an optimal structure of neurons network and to obtain the number of fuzzy rules with a set of parameters. So, we need to set the number of iterations, error tolerance, initial step size, etc. Then these learnings of network parameters will be used in back propagation learning which uses the gradient descent to find a feasible set of antecedents and consequents parameters. We applied ANFIS to the classification of face recognition by varying the influence radius of the clustering between [0.0- 0.4] with 4-level and 3-level-discrete wavelet transform.

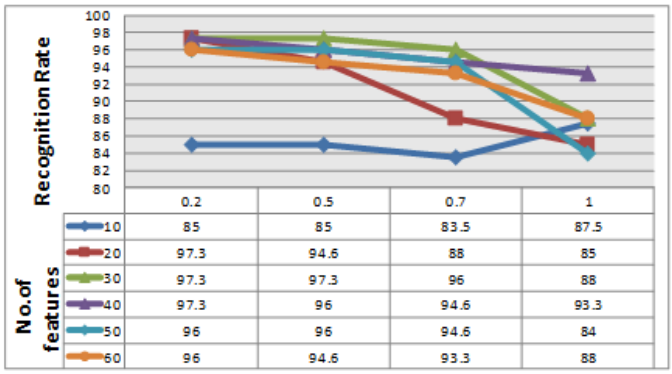
 ISSN: 2454-4248
67 –70

IX. TESTING ANFIS

The testing process is done using the testing feature factor that will be evaluated with ANFIS to observe whether the system identified the face or not. Figure (3) (a, b) shows the results of ANFIS with different level of DWT for AT&A database. Figures (3) and (4)(a,b) presents results of ANFIS with a different level of DWT for Yale and Grimace database of ANFIS.

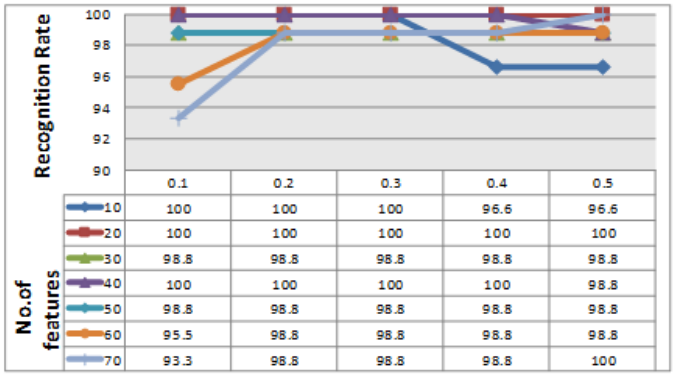


(a):3-Level DWT



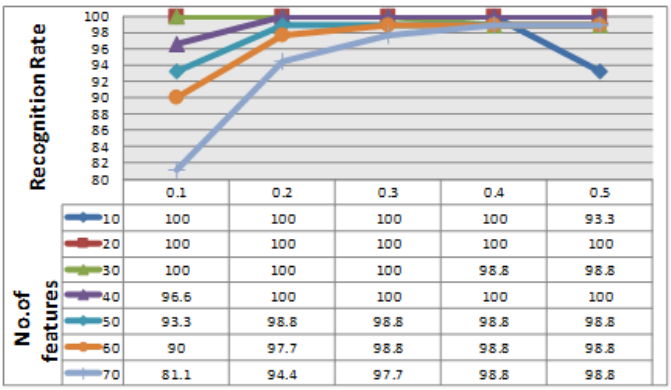
(b):4-Level DWT

Figure (3): Results of ANFIS with Yale database



.

(a):3-Level DWT



(b):4-Level DWT

Figure (4): Results of ANFIS with Grimace database

X. BACK PROPAGATION GRADIENT DECENT FUZZY NEURAL NETWORK

BPGF implemented after Next completing training and testing of back propagation neural network. Output of network gradient and epoch is used to compute the accuracy. Figures (5) depict the structure of neural network used as input to fuzzy inference system to calculate accuracy.

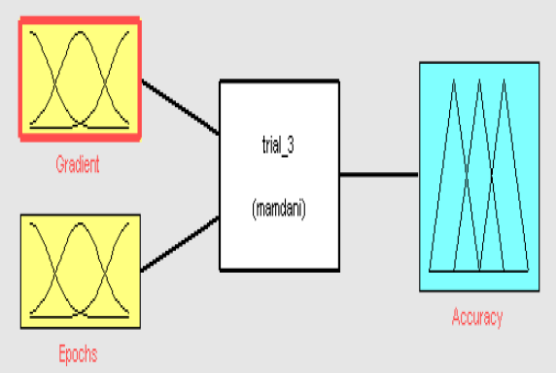


Figure (5): Designed Fuzzy Inference System

The input to the fuzzy inference system is describe by member ship function which is define between ranges 0 to 50. We can select from any member ship function which are already define or customize own member ship function. The central block of fuzzy consist of a set of proposed rules which are based on combination of two input (gradient and epoch). The final block of fuzzy inference system is output membership function which is define in range from (0-100). Figure (6) shows the output member ship function.

 ISSN: 2454-4248
67 –70

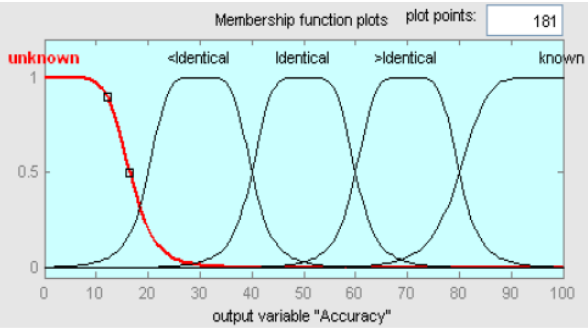


Figure (6): Output membership function

From figures and tables where BPNN and ANFIS ratings have been used to distinguish faces recognition accuracy, we prove that ANFIS's trainer has improved the accuracy of the rating. ANFIS gave high accuracy when a few features were used and the calculations were less such that the training time was less. In order to obtain a high accuracy, facial detection was used with the use of the fourth level. BPNN has several weaknesses such that: it is too slow convergence speed, easy to fall into local minimum, and easily affected by sudden peaks in the signal trend during the learning process. So, we conclude that ANFIS is a better choice to classify a person.

XI. CONCLUSIONS

In this work, when we use PCA and DWT in feature extraction will have a good recognition rate and less computation time. To test the proposed system we use more than one database and different modes to test the efficiency. In case of adaptive neuron fuzzy inference system, the recognition rate increases until it reaches maximum (96%) when the number of Eigen faces is (30).

REFERENCES

[1]. Li. Xiaodong “Face Recognition Method Based on Fuzzy 2DPCA”, Journal of Electrical and Computer Engineering,Vol. 2014, Article ID 919041, 7 pages.

[2]. Zhou. Changjun, Wang. Lan, Zhang. Qiang and WeiKey. Xiaopeng “Face recognition based on PCA image reconstruction and LDA”, Optik 124 (2013) 5599– 5603, Elsevier.

[3]. Stan Z. Li, and Anil K. Jain, “Handbook of Face Recognition”, Second Edition, Springer-Verlag, New York, 2016.

[4]. Shen. Linlin, Bai. Li, and Ji. Zhen, “Data Driven Gabor Wavelet Design for Face Recognition”, IEEE, ISBN: 978-1-4244-2316-3/08, 2008.

[5]. Gumus. Ergun, Kilic. Niyazi, Sertbas. Ahmet, Ucan. Osman N, “Evaluation of face recognition techniques using PCA, wavelets and SVM”, Expert Systems with Applications-Elsevier, Vol.37, 2010.

[6]. Kadam. Kiran D, “Face Recognition using Principal Component Analysis with DCT”, International Journal of Engineering Research and General Science Vol. 2, Issue 4, June-July. 2014.

[7]. Sukhija. Pratibha, Behal. Sunny, Singh. Pritpal, “Face Recognition System Using Genetic Algorithm", Procedia Computer Science- Elsevier, Vol.85, 2016.

[8]. Chihaoui. Mejda, Elkefi. Akram, Bellil. Wajdi, “A Survey of 2D Face Recognition Techniques", Multidisciplinary Digital Publishing Institute (MDPI), Vol.5, No.4, 2016.

[9]. Abdulrahman M., Dambatta Y., Muhammad A., and Muhammad S., " Face Recognition Using Eigen Face and Discrete Wavelet Transform " , International Conference on Advances in Engineering and Technology (ICAET'2014) March 29-30, 2014 Singapore.