Available online at www.ijsrnsc.org

IJSRNSC

Volume-4, Issue-5, Oct 2016
Research Paper

Int. J. Sci. Res. in Network Security and Communication

www.ijsrnsc.org

ISSN:2321-3256

Offline Signature Verification Based on Image Processing and Hu Moment

Abdulkarim I. Abughfa[1*], Ahmed B. Elmadani[2]

[1*] Department of Electrical and Computer Engineering, Alfateh University, Tripoli, Libya
[2]Department of Computer Science, Sebha University, Sebha, Libya
Corresponding email: elmadan@yahoo.com

Received: Sep/12/2016, Revised: Sep/21/2016, Accepted: Oct/16/2016, Published: Oct/31/2016

Abstract—In nowadays society e-business and e-commerce getting strong day to day in an open systems. Forgery is also getting rampant. Therefore a need of an automatic handwritten signature verification system (HSVS) becomes necessary to avoid unauthorized use of resources. One solution is to use a technological biometrics. Biometrics enables true identification or verification of an individual from their physical or behavioural (handwrite signature) characteristics based on their nature. This paper presents a signature authentication system based on using a digital image to authenticate signatures offline.

Keywords- HSVS, offline signature, verification, MSE, RMSE, Correlation Coefficient

I. INTRODUCTION

Signature is an age-old feature used to distinguish and identify individuals. It is a written sign used to identify an authorized check or document or concluded letters [1]. A handwritten signature is executed by hand and used for authentication purpose. Today with an increase number of transactions, especially in financial sectors, signatures are being used to authorize individuals. Legality most documents like bank cheques, visa application and academic certificates, etc..

But signatures can be forge and give non-authorized a right to use valuable resource. Attendance registers monitoring need to have authorized offline handwritten signatures [17]. Hence, several methods for automatic signature verification have been developed [2]. Signature image are acquitted by capturing signatures, either off-line mode or on-line mode. The off-line mode allows generating a handwriting static image from a scanning document and used for analysis where online is done a live using light pen movement [3].

Signatures are verified into two ways, off-line and on-line. In off-line the system acquires data by scanning a signature, and then saved it as a digital image to use later for verification process where in on-line signature acquires data directly from user through stylus, touch screen, or a digitizer that can generate dynamic values, such as coordinate values, time, or speed of signature [8].

People such hacker always try to gain unauthorized access to the resources using a forgery signatures. In automation system must be able to distinguish right signature from false [14]. In literature exists three types forgeries, Random, Skilled and Simple [12]. In random forgery signature is performed by a person got no idea and doesn't know identity. In simple forgery signature it is performed by a person who knows the shape of signature and do not practicing the signature. In skilled forgery, signature is a kind of genuine signatures [8].

Today there are several methods of signature verification systems were developed, but most use features selection and differ in decision making methodology. The way of they select features can be categorized to three ways [10]:

a. Global
b. Local
c. Geometric

TABLEI shows the common decision methods of signature verification systems.

Most of the signature verification systems based on using neural network [11,12]. Those methods use several tests before they make any decision and my cause errors and it is time consuming [13,15]. Signature verification can be performed using statistical parameters such as Hu moment [9]. Next paragraphs will explain some of the statistical parameters and how they can be used to distinguish between images.

Mean Squared Error (MSE) is a statistical parameter widely used in image processing research. It is used to measure the gray-level difference between pixels of the ideal and the distorted images without considering correlation between the neighboring pixels [5].

Distorted images with equal MSE may have significantly different visual quality. A human observer always views an image as an entirety, rather than just a collection of isolated pixels, therefore correlation between neighboring pixels plays a role in the subjective judgment of image quality. As a result, different types of signal processing procedures and noise interference can cause different perceptual effects, and the visual judgment is sometimes heavily dependent upon the degree of distortion [4,16].

TABLE I. SIGNATURE VERIFICATION SYSTEMS

No.	Title	Author	Used Method
1	Neural network-based handwritten signature verification	McCabe A. et. al. (2008)[11]	It uses NN architecture. Static (height, slant, etc.) and dynamic (velocity, pen tip pressure, etc.)
2	Offline signature verification using local radon transform and support vector machines.	Kiani V. et. al.(2011)[12]	Offline Signature Verification, Radon Transform, Support Vector Machine.
3	Offline Signature Recognition using Radon Transform	Radmehr M. et. al.(2011) [13]	Fractal Dimension, Offline Signature Recognition, Radon Transform, Support Vector Machine.
4	proposed a system in which Bank Cheques can be classified and can be authenticate using signature.	Priyadarsini P.J.(2013)[14]	Bank cheque, Area of Interest (AROI), Edge d etection , Sobel filter.
5	Offline Handwritten Signature Verification System Using a Supervised Neural Network Approach.	Nijad M and Sara N. (2014)[15]	This paper presents survey of signature forgery type, features types, methods used for features extraction and approaches used for verification in signature verification systems.
6	Off-line Signature Recognition and Verification.	Vala1 K. A., Joshi N.P. (2014)[16]	1. Deferent methods are used Neural network 2. Support Vector Machine 3. Back propagation neural network 4. Fuzzy modeling concept.
7	Offline Handwritten Signature Verification Using Neural network.	Hatkar P. V. and Salokhe B.T.(2015)[17]	Collecting geometric feature of an image using neural network technique.

Root Mean Squared Error (RMSE) is frequently used to measure the difference between values predicted by a model or an estimator and the values. It is the other quality probing metric of the image. It is obtained by taking square root over MSE [5].

Cross-correlation (C.C) is an algorithm was proposed in 1974. It uses the statistic correlation of information to match images. When the result of cross-correlation reaches the maximum, the matching image and the reference image get a best matching [6]. The similarity test is the correlation between the cover-image and stage image. Correlation is one of the best methods to evaluate the degree of closeness between two functions. This measure can be used to determine the extent to which the original image and the stego-image are close to each other. Even after embedding data. Correlations are equals to one when image is perceptually similar to the original image [7].

In next section will introduce a signature verification system that is based on statistical approach. The proposed system uses a digital image to capture a signature, enhance the image, and uses hu moment for feature extraction. The proposed system uses MSE and RMSE to narrow the search and C.C for matching proper signature.

II. THE SYSTEM

A. Preparing Required Signatures

Three hundred genuine signatures from ten different signers (given identity codes) have been collected in this study. These signers are from different age and fields. The A4 size sheet paper was given to the signers perform their signature. Therefore, three-hundred genuine signatures and two hundred forged signatures were found. The genuine signatures were shown to a new signer and asked them to repeat their genuine signature ten times. A total 1050 signature images were collected and saved to the database. The following paragraphs will explain sequence of processing and verifying signatures in the proposed system.

B. The propsed System sequence

The proposed system as it shown in Figure1, it consists of the steps pre-processing, feature extraction, feature comparing, and performance evaluation.

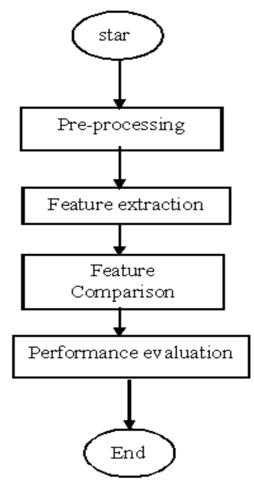


Figure1. Proposed system

C. Pre-processing

Any signature image has to flow the steps listed in the figure Figure2 in order to come out with its features clear.

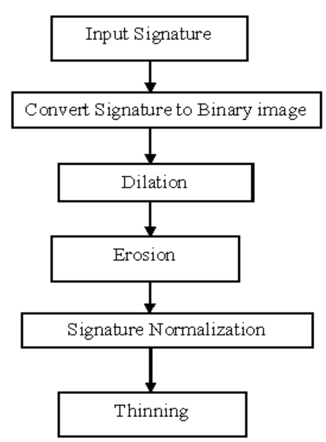


Figure2. Pre-processing

D. Features extraction

The mean goal of this process is to come out the features, which will distinguish one signature image from another. Different parameters and functions are tested, later a decision was carried to use a regular moment function $\mathbf{m_{pq}}$ of order $(p + q)$ of an image intensity function f (x, y).

1) Hu moments

It is a 2-D continuous function $f(x,y)$, the moment of order $(p+q)$ that is calculated using "(1)" as following:

$$m_{pq} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x^p y^q f(x,y)\,dxdy \quad \text{for } p,q = 1,2,3,.. \tag{1}$$

Where m_{pq} is moment sequence

These moments are not invariant to translation, rotation and scaling. The central moments of an image is found using the "(2)".

$$\mu_{pq} = \sum_x \sum_y (x-\bar{x})^p (y-\bar{y})^q f(x,y) \quad p,q = 0,1,2,\ldots \tag{2}$$

$$\text{where } \bar{x} = \frac{m_{10}}{m_{00}} \text{ and } \bar{y} = \frac{m_{01}}{m_{00}}$$

2) Central moments

The central moments of order up to 3 is found using the "(3)".

$$\mu_{00} = \sum_x \sum_y (x-\bar{x})^0 (y-\bar{y})^0 f(x,y) = \sum_x \sum_y f(x,y) = m_{00}$$

$$\mu_{10} = \sum_x \sum_y (x-\bar{x})^1 (y-\bar{y})^0 f(x,y) = m_{10} - \frac{m_{10}}{m_{00}}(m_{00}) = 0$$

$$\mu_{01} = \sum_x \sum_y (x-\bar{x})^0 (y-\bar{y})^1 f(x,y) = m_{01} - \frac{m_{01}}{m_{00}}(m_{00}) = 0$$

$$\mu_{11} = \sum_x \sum_y (x-\bar{x})^1 (y-\bar{y})^1 f(x,y) = m_{11} - \frac{m_{10}m_{01}}{m_{00}}.$$

$$= m_{11} - \bar{x}m_{01} = m_{11} - \bar{y}m_{10} \tag{3}$$

The central moments of order up to 3 are found using "(4)".

$$\mu_{20} = \sum_x \sum_y (x-\bar{x})^2 (y-\bar{y})^0 f(x,y) = m_{20} - \bar{x}m_{10}$$

$$\mu_{02} = \sum_x \sum_y (x-\bar{x})^0 (y-\bar{y})^2 f(x,y) = m_{02} - \bar{y}m_{01}.$$

$$\mu_{21} = \sum_x \sum_y (x-\bar{x})^2 (y-\bar{y})^1 f(x,y) = m_{21} - 2\bar{x}m_{11} - \bar{y}m_{20} + 2\bar{x}m_{01}$$

$$\mu_{12} = \sum_x \sum_y (x-\bar{x})^1 (y-\bar{y})^2 f(x,y) = m_{12} - 2\bar{y}m_{11} - \bar{x}m_{02} + 2\bar{y}m_{10}$$

$$\mu_{30} = \sum_x \sum_y (x-\bar{x})^3 (y-\bar{y})^0 f(x,y) = m_{30} - 3\bar{x}m_{20} + 2\bar{x}^2 m_{10}$$

$$\mu_{03} = \sum_x \sum_y (x-\bar{x})^0 (y-\bar{y})^3 f(x,y) = m_{03} - 3\bar{y}m_{02} + 2\bar{y}^2 m_{01} \tag{4}$$

3) Central moments normalizing

To normalize the central moments the proposed system uses the following equation:

A seven invariant moments can be derived from the second and third moments using "(5)" and "(6)"

$$\phi_1 = \eta_{20} + \eta_{02}$$

$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2$$

$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \eta_{03})^2$$

$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \eta_{03})^2$$

$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right]$$

$$\phi_6 = (\eta_{20} - \eta_{02})\left[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03})$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})\left[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2\right] + (3\eta_{12} - \eta_{30})(\eta_{21} + \eta_{03})\left[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2\right] \tag{5}$$

$$\eta_{pq} = \frac{\mu_{pq}}{\mu_{00}^{\gamma}} \tag{6}$$

$$\text{where } \gamma = \frac{p+q}{2} + 1 \quad \text{for } p + q = 2,3,\ldots.$$

4) Hu's seven moment invariants

Hu's seven moment invariants are invariant to image transformations including scaling, translation and rotation. However, this set of moment invariants is not invariant to contrast changes. Hu's seven moment invariants have been widely used in pattern recognition, and their performance has been evaluated under various deformation situation including blurring spatial degradations random noise skew and perspective transformations. As Hu's seven moment invariants take every image pixel into account, the computation cost will be much higher than boundary-based invariants. As stated before, image's spatial resolution decides the total amount of pixels, and to reduce the computation cost, the advantages of traditional moment over other recognition features in shape representation noted during the experiment as following:

- Less computationally demanding and easy to implement.
- Use a single value as the feature, easy for matching.
- Uniqueness.
- Invariant to shape translation, rotation and scaling.
- Less noise-sensitive.

E. Features comparison

Comparison of the extracted features is performed using the followed parameters.

1) Mean Square error (MSE)

MSE is the Euclidian distance between the original and the degraded images. The MSE was calculated using equation (7)

$$MSE = (1/MxN)\sum_{i=1}^{M}\sum_{m=1}^{N}(a_{ij} - b_{ij})^2 \quad (7)$$

Where M and N are a is and b is

In Equation (7), *aij* is the pixel value at Position (*i*, *j*) in the original image where *bij* means the pixel value at the same position in the corresponding distorted image.

The MSE for a signature image is found by:

- Take stereo image (Take two image for the same object from the different view)
- Select the image pixel I1(i, j) in the first image
- Find the matched or correspondence pixel in the second image

2) Rote Mean Squire Error (RMSE)

RMSE is frequently used to measure the difference between values predicted by a model or an estimator and the values actually observed, it is calculated using "(8)".

$$RMSE = \sqrt{\frac{1}{n}(y' - y_i)^2} \quad (8)$$

Where $Y\imath$ is the vector of n predictions and Yi is the vector of true values.

RMSE for a signature image is found by:

- Take stereo image (Take two image for the same object from the different view)
- Select the image pixel I1(i, j) in the first image
- Finding matching pixel or correspondence pixel in second image
- find the square of the value

3) Correlation (C.C)

C.C is a statistical parameter generally is used to determine the type and strength of the relationship between two variables. In the proposed system is used to determine the similarity between two signature images. It was calculated using the following procedure and "(9)".

$$C.C = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}} \quad (9)$$

where x and y are image signatures n = (x-axel, y-axel)

C.C for a signature image is found by:

- Calculate cross-correlation in the spatial or the frequency domain, depending on size of images.
- Calculate local sums by pre computing running
- Use local sums to normalize the cross
- Find location of point at which maximum normalized cross correlation is obtained.
- Locate the template at that location on reference image.

III. RESULTS AND DESCSION

A. Signature collection and pre-process

For each user a signature image is collected, the process is performed by giving him a plane A4 paper and a pen or pensile to perform his own signature. Samples of collected signatures are shown in Figure3.

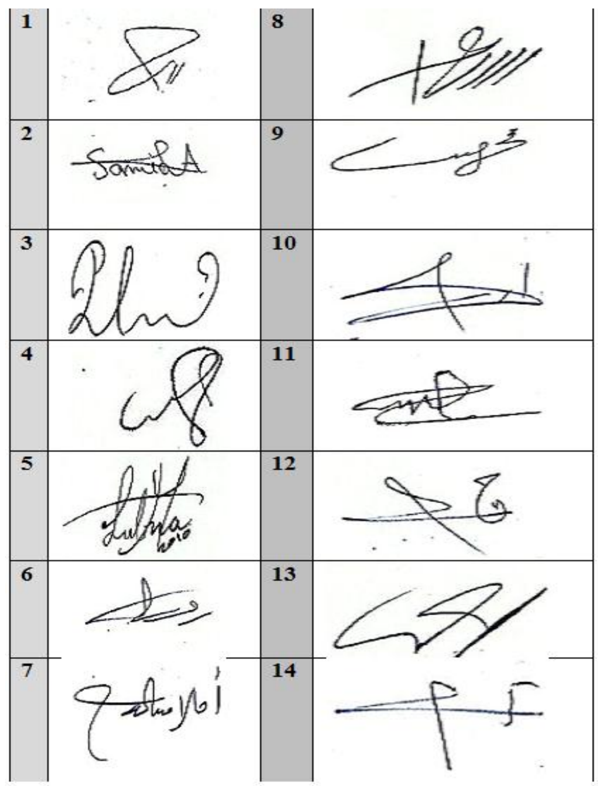


Figure3. Samples of collected signatures

The signature has then to be captured using a scanner or digital camera to convert it as a digital image, and then the captured signature is passed to the procedure mentioned in pre-processing paragraph, following sequences shown in Figure2. The process will facilitate features extraction. Figure4 shows result of pre-processing user signature.

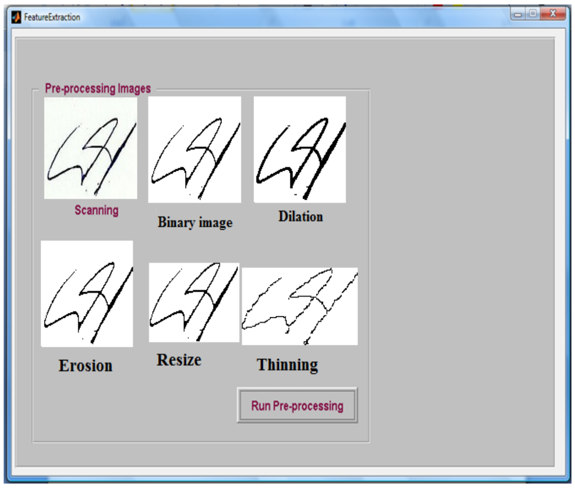


Figure4. User's signature pre-processing

B. *Extracting features from Signature image*

The user's signature image after nose removing in preprocessing procedure, features are extracted using extraction procedure using a moment method according to equations 1 – 6. M1 to M7 are values of calculated moment for the given image. TABLE II shows some of results obtained by feature extraction procedure.

TABLE II. EXTRACTED FEATURE USING HU MOMENTS

M1	M2	M3	M4	M5	M6	M7
2.053294	4.879533	7.791958	8.001711	16.079537	-10.652026	16.022338
1.928498	6.883363	7.192862	6.957629	14.454682	-10.546930	14.066471
1.998372	6.331365	6.604693	7.164963	14.051001	10.455913	15.177207
2.343614	5.638357	8.177031	8.802056	-17.292512	-12.079229	-18.480166
3.154188	10.330352	12.755445	12.620696	-25.514545	-18.443172	-25.415267

C. *Database signatures assigning*

The proposed system performs a database of signature images, it is also contains of other personal information such that name, address, identification number and etc. Search in the database based on comparing digits (M1 to M6), so it will be faster than other used methods that use images in their comparison and it will minimize time retrieval. TABLE III shows a truncated database record of the proposed system

TABLE III. TRUNCATED DATABASE RECORD IN PROPOSED SYSTEM

IDD	Name	M1	M2	M3	M4	M5	M6	M7
1	Salem Ahmed	2.053294	4.454616	7.437617	8.198574	-16.270871	-10.427532	16.097299

D. *Signatures Verification*

To verify signature image, the proposed system uses "(7)" to find MSE and "(8)" to find RMSE, the two processes narrow the searching list of compared signature images. The verification process is performed after an image features is extracted from pre-processed image as shown in Figure 5.

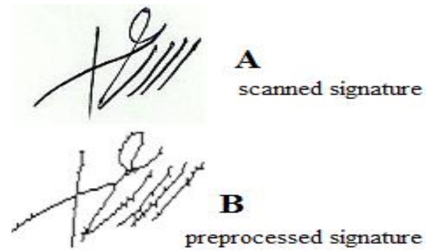
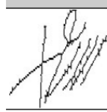


Figure5. **A** before pre-processing, **B** after pre-processing

- The unknown signature image shown in Figure5, its features are extracted. The resulted values are shown in TABLE IV.

TABLE IV. IMAGE FEATURE VALES

Signature	M1	M2	M3	M4	M5	M6	M7
	3.139949	11.924455	13.422573	12.643471	-26.145200	19.079622	-25.703144

- The signature features in TABLE IV is verified with the database values shown in TABLE V using MSE, RMSE to narrow the list then matches closer results using the C.C "(9)" to find proper signature. TABLE V shows the results of matching each sample in temporary template with its likely in the data base.

TABLE V. FEATURE COMPARISON RESULTS

ID	MSE	RMSE	CC	Decision
1	0.892780742795296	0.944870754545454	-0.698433293140824	NO
2	0.0134243400992066	0.115863454545455	0.0376906742671329	NO
3	0.207159577772746	0.455147863636364	0.394995246717677	NO
4	0.194951173336497	0.441532754545455	0.388875452123003	NO
5	0.20751441390625	0.4555375	0.391866159216721	NO
6	0.854552655745121	0.924420172727273	-0.683266195576531	NO
7	0.867694434792284	0.931501172727273	-0.699198033026308	NO
8	0	0	1	OK
9	0.207890742390139	0.455950372727273	0.366576965305389	NO
10	0.377599211426128	-0.764794496261599	0.614491018181818	NO
11	0.36208513057201	0.6017351	-0.762661961077277	NO
12	0.854552655745121	0.924420172727273	-0.683266195576531	NO
13	0.218187701001168	0.467105663636364	0.379837330492861	NO
14	0.0139333536066844	0.118039627272727	0.0369361533917403	NO

The system was tested for 1050 signatures, 300 are genuine, 90 forged, and 660 repeated. The system recognizes 959 signatures over 1050 and it doesn't recognize 91, because 90 of the rejected are false or forged. Only one signature with value of C.C equals to one was recognized and its values of MSE and RMSE are closes to zero. Tests shows that the proposed system working properly because as shown in TABLE VI, the recognition rate of total used signature (1060) scores %91.3 which is more than the expected with the consideration of the available facilities.

TABLE VI. RECOGNITION AND ERROR RATE IN PROPOSED SYSTEM

Type of signatures	Number of signatures	Recognized	Rejected	Error Rate (%)	Recognition Rate (%)
Genuine	300	300	0	0.0	100
Forged	90	1	89	0.985	0.011
Repeated	660	658	2	0.003	0.997
Total	1050	959	91	0.0867	0.913

IV. RELATED WORK

The proposed system uses a method different from a method use by [14,17] which is based on use of a neural network. The two methods use image in their comparison and such procedure will result in time required for any individual signature authentication and it require more memory space. The proposed system extracts digits as improvement of a method given by [9] from signature images. The proposed to be more accurate and avoid errors, it uses MSE, RMSE and C.C in verification comparison to avoid authentication errors. Based on the above the proposed system require less memory space, less comparison time and as result fast retrieval time.

V. CONCLUSIONS

In this work an offline signature algorithms are investigated, then it proposes a verification system that uses MSE and RMSE to minimize search list and to confirm the signature similarity, the proposed system calculates the CC parameter as indicator.

REFERENCES

[1] H. Kabir, "Offline Signature Verification using Local key point Features", International Journal of Computer Applications, Vol. 1, No.27, pp. 61-70, 2010.

[2] SM. Odeh, M. Khalil, "Off-line signature verification and recognition: Neural Network Approach", 2011 International Symposium on Innovations in Intelligent Systems and Applications, Istanbul, pp.34-38, 2011.

[3] J. Singh, M. Sharma, "A Survey on Offline Signature Recognition and Verification Schemes", IOSR Journal of Electronics and Communication Engineering, Vol. 2, Issue.3, pp.34-38, 2011

[4] N. Nourain,B. Dawoud, S. Belhaouri, J. Janier, " Fast Template Matching Method based Optimized Sum of Absolute Difference Algorithm for Face Localization", International Journal of Computer Application, Vol.18, no.8, pp.30-34, 2011.

[5] A. Nichal, S. Deshpande, "A High Capacity Data Hiding Method for JPEG2000 Compression System", International Journal of Engineering Research and Applications, Vol.2, Issue.4, pp. 751-755, 2011.

[6] SS. Kumar, K. Aruna, "Various Methods for Edge Detection in Digital Image Processing", International Journal of Computer Science and Technology, Vol.2, Issue.2, pp.188-190, 2011.

[7] CW. Lam, LM. Po, CH. Cheung, "A New Cross-Diamond Search Algorithm for Fast Block Matching Motion Estimation", IEEE International Conference on Neural Networks and Signal Processing, China, pp.1262-1265, 2014.

[8] P. Kumar, S. Singh, A. Garg, N. Prabhat, " Hand Written Signature Recognition & Verification using Neural Network", International Journal of Advanced Research in Computer Science and Software Engineering, Vol.3, Issue.3, pp.44-49, 2013.

[9] MK. Randhawa, "Off-line Signature Verification based on Hu's Moment Invariants and Zone Features using Support Vector Machine", International Journal of Latest Trends in Engineering and Technology, Vol.1, Issue.3, pp.16-23, 2012.

[10] J. Coetzer, "Off-line signature verification", Ph.D. Thesis from University of Stellenbosch, South Africa, pp.1-158, 2005.

[11] A. McCabe, J. Trevathan, W. Read, "Neural network-based handwritten signature verification", Journal of Computers, Vol.3, No.8, pp.9-22, 2008.

[12] V. Kiani, R. Pourreza, HR. Pourreza, "Offline signature verification using local radon transform and support vector machines", International Journal of Image Processing, Vol.3, No.5, pp. 184-194, 2009.

[13] M. Radmehr, SM. Anisheh, I. Yousefian, "Offline Signature Recognition using Radon Transform", International Journal of Computer Electrical Automation Control and Information Engineering, Vol.6, No.2, pp.264-268, 2012.

[14] MJP. Priyadarsini, K. Murugesan, SR. Inbathini, A. Jabeena, KS. Tej, "Bank Cheque Authentication using Signature", International Journal of Advanced Research in Computer Science and Software Engineering, Vol.3, Issue.5, pp.502-511, 2013.

[15] M. Nijad, N. Sara, "Offline Handwritten Signature Verification System Using a Supervised Neural Network Approach", 6th International Conference on Computer Science and Information Technology (CSIT), Jordan, pp.189-195, 2014.

[16] KA. Vala, NP. Joshi, "A Survey on Off-line signature Recognition and Verification Schemes", International Journal of Advanced Research in Electrical Electronics and Instrumentation Engineering, Vol.3, Issue.3, pp.7735-7740, 2014.

[17] PV. Hatkar, BT. Salokhe, "Offline Handwritten Signature Verification Using Neural Network", Journal of Information Knowledge and Research In electrical Engineering, Vol.3, Issue.2, pp.1-5, 2015.

Authors Profile

Mr. Abdulkarim I. Abughfa receive Bachelor of Science from University of Tripoli, Libya in 2006 and Master of Computer Science from Department of Electrical and Computer Engineering, School of Applied Sciences and Engineering,

Libyan Academy Libya in 2016,. He is currently a Ph.D. Department of Electrical and Computer Engineering, School of Applied Sciences and Engineering, Libyan Academy Libya.

Mr Ahmed B. Elmadani receive Bachelor of Science in the Department of Computer Science Faculty of Science Sebha University, Libya in 1988. Master of Science in electrical and computer engineering from Department of electronics and information technology Faculty of electrical and electronics Warsaw University of Technology Poland in 1995. Doctoral of philosophy Degree (Ph. D.) in Multi Media and Information Technology entitled "Secure Access to Authorized Resources Based on Fingerprint Authentication" from Department of electronics Faculty of engineering University Pertanian Malaysia (UPM), Malaysia in 2003. from University of New York, USA in year 2009. He is currently working as Associate Professor in Department of Department of Computer Science Faculty of Science Sebha University Libya since 2003. He is a member of IEEE & IEEE computer society since 2003. He has published more than 27 research papers in reputed international journals and conferences including IEEE. His main research work focuses on Cryptography Algorithms, Network Security, Biometrics Fingerprint, Authentication and e-government. He has several years of teaching experience and years in Research Experience.

