IKP based biometric authentication using artificial neural network

M. Viswanathan, Ganesh Babu Loganathan, and S. Srinivasan

View Online   Export Citation

ARTICLES YOU MAY BE INTERESTED IN

IKP Based Biometric Authentication Using Artificial Neural Network

M.Viswanathan [1 a)], Ganesh Babu Loganathan[2] ,S.Srinivasan[3]

[1] *Lecturer, Computer Science Department,, Cihan University, Duhok, KRG, Iraq.*
[2]Assistant Professor, Research Center Tishk International University, Erbil, KRG, Iraq.
[3] Asst. Professor, EEE Department Panimalar Engineering College. Chennai, India.

[a)] viswamtech19@gmail.com,

ABSTRACT: The primary objective of this paper is to verify individuals as indicated by their finger surfaces. We propose to remove Finger Texture (FT) highlights of the two finger pictures (center, ring) from a low goal contactless hand picture utilizing LBP strategy. The utilization of Inner-Knuckle-Print (IKP) in biometric recognition is the most broadly proposed validation work. The unique characteristics of the IKP give us the requirement for recognizable proof. During the IKP filtering process, the image created by the scanner might be partially unique. This paper proposes artificial neural networks for effectively coordinating procedures to IKP validation. By utilizing the Back-Propagation method, the algorithm coordinates IKP and relates them to a novel accomplished client. After grouping, the procedure restores to the best counterpart for the given finger impression variables.

Keywords— Pre-Processing, Feature extraction, LBP, Classification, ANN.

INTRODUCTION

Individual confirmation dependent available biometric characteristics has been generally utilized in the majority of advanced security applications because of its minimal effort in procuring information with its unwavering quality in checking the people and its level of acknowledgment by the client. Palm print, a unique mark of hand shape is the tests of biometric frameworks dependent close by. One of the new methodologies that are considered for research is Inner Knuckle print (IKP). It alludes to the flexion recoils in the internal skin of knuckles. It also highlights like a palm print are isolated in three classes of main line, wrinkles and edges. Like palm print features, its highlights are separated from low goal pictures. Despite the fact that edge highlights can't be separated from low goal pictures, wrinkles and lines are removed. Since central lines are comparative in some individual, utilizing both primary lines and wrinkles are valuable. Each finger has three knuckles, the second knuckles contain more lines; thus, progressively complex example is best for highlighting extraction. The three significant viewpoints in biometrics framework are; uniqueness, all-inclusiveness and permanence such that researches directed in biometric frameworks dependent on IKP are demonstrated in this new part besides having these qualities has brought great outcomes network (ANN) classification.

The remaining portion of the paper is ordered as section 2: the previous works are reviewed, section 3: pre-processing is discussed, in section 4 feature extractions are characterized and results are given in section 5 with the conclusion part in section 6.

LITERATURE SURVEY

Jain and E. Al. (2004) discussed the field of bio-metrics and outline some portion of its benefits, weaknesses, qualities, restrictions and related protection concerns. A wide assortment of frameworks requires solid individual acknowledgment method to affirm or decide the personality of an individual for providing the service. The motivation behind such method is to guarantee that the rendered services are correctly received by a requested client and nobody else. For instances secure access to building, PCs, mobiles and ATMs are utilizing such services. Without individual acknowledgment, such frameworks are defenseless against the wiles of impostor. Bio-metric acknowledgment or bio-metrics alludes to the systematic acknowledgment of people depends on their physiological or social qualities. By utilizing bio-metrics, it is conceivable to affirm or built a person's personality depends on the identity as opposed to "what she has" (such as ID card) or "what she recalls" (secret key).

Srinivasan. V and Murthy. N(1992) portrayed a method for the identification of solitary points in a finger impression picture. The solitary points particularly the center and the delta focuses are utilized enrollment purpose in unique mark matching. This technique utilizes auxiliary data that are separated from the directional histograms of the directional picture of a unique mark. The utilization of the histogram takes into consideration for a genuinely high level of clamor resilience.

Zhang. Y, Jiao.Y, Li.J, and Niu.X, (2005) the line highlight of the knuckle print with the appropriation in the finger (that is characterized as area included) to distinguish the individuals. To improve the execution of recognizable proof, various levels of arrangement is utilized to group the area highlight and lines included in various dimensions. Despite the fact that this article is the main endeavor of distinguishing proof, the exactness rate achieves 96.88% on the datasets that contain 1,432 picture tests (Maio & Maltoni, 1997) (10).

METHODOLOGY

In the proposed work, we analyzed the possibility of utilizing artificial neural networks into fingerprint recognition process. It includes three main iterations: Preprocessing, Feature extraction and Classification. Here texture features are extracted by LBP and the energy feature are extracted by GLCM. At first we extract these features and apply Artificial Neural Network. The proposed system generates good promising recognition rate in our applications with similar set of features and classifiers.
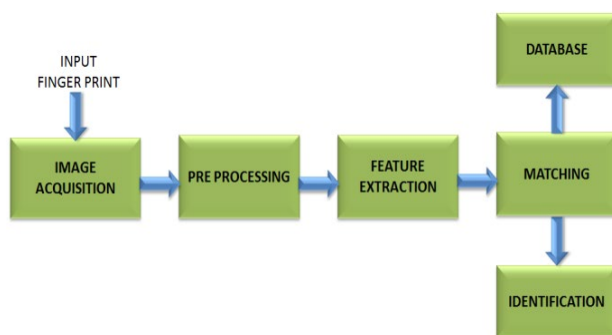

FIGURE 1: Fundamental steps of inner knuckle recognition system

A. Preprocessing

Here input image is hand image. Size of the image is chosen to be256*256. Its RGB image is used for further process of recognition.

The purpose of preprocessing is to improve image by suppressing undesired distortions or by improving some of the features of the image for further processing and analyzing (Xia, Gorman, 2002) (18). In this step, noise removal,

ordering and extracting the ROI are adopted on the images and they were prepared for extracting features. A seven steps process for pre processing was followed.

At first, middle channel with size of 3x3 was utilized for evacuating likelihood clamor in the picture. For doing binarization, great edge assumes a significant job in the last outcome. In this work, two arrangements of data focuses are separated. While the main arrangement is a focus that exists in the holes of finger and the second arrangement is a focus that exists in the tip of finger. For recognition, the first arrangement of datum point is utilized in the technique. Outskirt pixel-vector (BPV) organizes the Euclidean separation DE(i) and among them Wm and BPV are determined.

$$D_E(i) = \sqrt{(X_{wm} - X_b(i))^2 + (Y_{wm} - Y_b(i))^2} \quad (1)$$

Where (X_{wm}, Y_{wm}) are the coordinates of the wrist middle finger W_m, $(X_b(i), Y_b(i))$ are the coordinates of the ith border pixel, and $D_E(i)$ is the Euclidean distance between the ith border pixel and the wrist middle point Wm. On the off chance that the separation circulation of DE is drawn, it will be seen that three of neighborhood essential allude to the main focuses arrangement. Separation dispersion of DE is portrayed. For discovering second arrangement of focuses sufficiently, consider a neighborhood maximum that exits in separation dispersion of DE. By utilizing this focus, a square shape is made that is incorporated in the entire forefinger.

On the off chance that pictures are standardized before the extraction of highlights, the area of the highlights would be steady among various pictures in the informational collection.

B. Feature Extraction

LDP and LBP are utilized in separating the paired code from the upgraded pictures. In spite of the fact that the execution of LDP is superior to that of LBP, the calculation time for LDP is slower than the LBP by 3 times. In addition, the code length of LDP is multiple times greater than the LBP. The calculation time and format measure are the two significant variables required in structuring a biometric Sensors framework. To conquer the previous issues, the parallel code is extricated from the improved picture of the lines double codes by using a new texture descriptor called Local Line Binary Pattern (LLBP) (Jha, 2005).

$$E_i^h = \sum_{x=1}^{M} \sum_{Y=1}^{N} (H_i(x, y))^2 \quad (2)$$

One of the advantages of LLBP administrator is that it can accentuate the adjustment in picture, for example, vertices, edges and corners. Spurred by LBP, Petpon and Srisuk (Jha, 2005) (9) proposed a LLBP administrator for face acknowledgment. The administrator comprises of two parts: flat segment and vertical segment. The greatness of LLBP can be gotten by for the two parts.

The portrayal of LLBP administrator appears in Figure 6 and its mathematical expressions are provided in equations (4)–(6). LLBPh LLBPv and LLBPm are the LLBP level course of vertical heading with its sizes individually.

Utilizing equation (3) & (4), the even part of LLBP removes a paired code of [N – 1] bits in every pixel. Similar quantities of bits were separated by vertical segment of LLBP (LLBPv) by utilizing equation (3) and (5). Thus, by connecting the parallel code from LLBPh and LLBPv, the complete twofold codes of LLBP for every pixel is found to be 2(N − 1) bits. From figure 6, the paired grouping for level (vertical) segment is characterized from left (top) as 010111001111(2) (101001011101(2)). Consequently, the twofold codes for LLBP are 010111001111101001011101(2).

$$S(x)$$

$$LLBP_{hNC}(x,y) = 2^{c-n-1} + 2^{n-c-1} \qquad (3)$$

$$LLBP_{vNC}(x,y) = 2^{n-c-1} + 2^{n-c-1} \qquad (4)$$

$$LLBP_m = \sqrt{LLBP_h^2 + LLBP_v^2} \qquad (5)$$

C. Artificial Neural Network (ANN**)**

Artificial Neural Network is a gathering of connected neurons utilized for data handling as a calculation model. It is a versatile framework equipped for changing its course of action as per input and yield succession that streams in the system. Feed-forward back spread calculation is normally utilized in ANN learning procedure (Xia & Gorman, 2002).
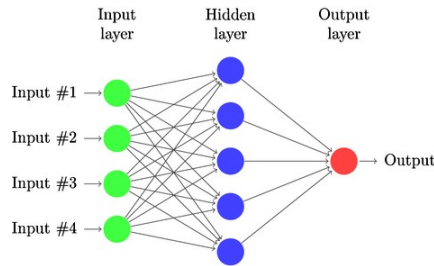

FIGURE 2: The block of ANN with input layers, hidden layers and output layer

Multiple layers network can also be obtained by ANN with more than one hidden layer.

    i.   Supervised Learning

This AI method takes derivation from the capacity of information prepared. Preparing information comprises of informational collection and yield information and applying diverse learning calculations to provide induction capacities to mapping.

  ii.   Unsupervised Learning

This AI procedure centers on finding shrouded plan of information. Here, the change of system's loads and inclinations are without impedance of outside instructor.

 iii.   Reinforcement Learning

This is like administered learning. These learning procedures keep less data about target yield compared to input provided.

 iv.   Training Technique

We are utilizing LMBP (Levenberg-Marquardt back proliferation calculation). This strategy prepared self-assertive estimated informational index and appears to be quickest method of feed forward neural systems (up to a few hundred loads). Levenberg-Marquardt calculation with no calculation of Hessian framework proposed a second request in preparing procedure. In the event of execution squares, Hessian network can be evaluated as:

$$H = J^T J$$

Such that the gradient calculation is given as

$$g = J^T e$$

Vector of system blunders is meant by e, where J indicates Jacobian framework that incorporates first derivates of system mistakes for inclinations and loads. The conventional back spread technique is utilized for estimating the Jacobian lattice; it is less troublesome compared to Hessian network estimation.

RESULTS AND DISCUSSION

Two noteworthy trials have been directed by utilizing our very own built up dataset (Hayes, 1998). Initial analysis decides the ideal shape of the sifting veil for altered Gaussian high pass channel and ideal line length N for LBP is directed. At that point, the execution of the LBP and GLCM are contrasted and LBP is recommended in the recently proposed strategies (Rhody, 2005) because of its effective performance. The quality of LBP inspection focuses on the range that has been utilized in (Rhody, 2005) are 8 and 1, separately (indicated as LBP (8, 1)). Hence ANN is used for classification.

The calculation is actualized by utilizing 2.2 GHZ Pentium 4 PC with windows 7/10 and MATLAB 13.0 as the advancement instrument. Two arrangement of picture is required for preparing the neural system and arrangement of pictures where upon testing is finished will each picture of size 188×240 pixels.
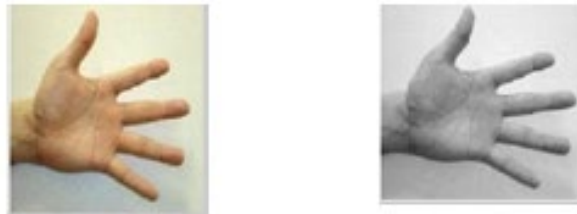

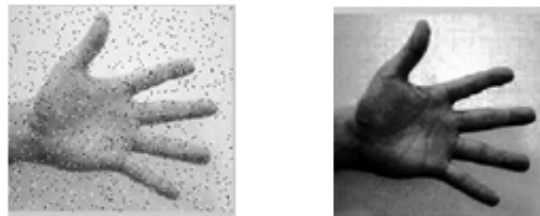**FIGURE 3**: Input image & its gray scale image

FIGURE 4: Normalized image

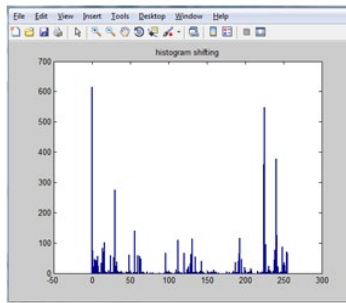**FIGURE 5**: Middle finger & feature extraction

FIGURE 6: Histogram shifting

These 100 pictures are partitioned into 50 known pictures (recently prepared one) and 50 pictures (recently untrained one) to acknowledge the testing of IKP tests. Neural Network is prepared upon some arrangement of pictures and tried concealed pictures. The outcomes were examined for computing the acknowledgment rate of the framework as appeared in Table 1. An acknowledgment rate of 100% is obtained for this framework. This acknowledgment rate esteem is superbly appropriate for INK acknowledgment frameworks. Neural system utilizes back proliferation calculation for blunder calculation and new load is estimated for every connected neuron. The system has preparation procedure, constantly in an iteration way to ascertain yield for each layer, extricating the mean square mistake and engendering it to reverse when it isn't moving toward targets. Due to the regressive mistake proliferation, blunder motions for every neuron are determined. This is utilized in refreshing the neuron weight. By chance when it is moving toward targets, at that point preparation is regarded as finished. The way toward preparing bend was moving toward its objective through correction of weights and biases.

The output of the network is ready to load pre-dispositions and initiate capacities. The initiation capacities that are utilized in the feedforward back engendering neural system are tangent sigmoid (tansig) in shrouded layer and purelin is utilized in yield layer. The capacities to go about as sum of intersection and figure out the yield for the data sources exhibited. After preparation stage is completed, the distinguishing proof procedure is executed so as to use the proposed framework. The assessment procedure was cultivated by testing the system with known and recently used finger print images. The new images to be tested were linked to the prepared neural network along the officially prepared images for computing the level of exactness and blunder. Informative supplement A and B show unique finger impression tests of preparing and testing separately.
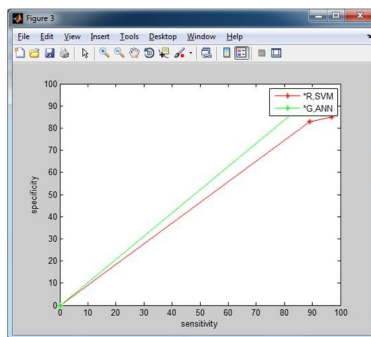

FIGURE 7: Graphical representation of SVM and ANN

CONCLUSION

Biometrics-based strategies for individual validation expect that the biometric attributes utilized for checking a person's personality. The uniqueness of internal knuckle starting with one individual then onto the next has been completely confirmed. This algorithm plans to gain by its uniqueness and improves the productivity, coordinating precision of inward knuckle as recognizable proof and validation. In our method back-spread N*N has been prepared for fingerprints classification to recognize fingerprints with successful pre-processing that can incredibly expands the

execution of the system. The acknowledgment rate of fingerprint relies upon the nature of internal knuckle and adequacy of pre-processing framework.

REFERENCES

1. Jain and E. Al, "An Introduction to Biometric Recognition", IEEE Tran. On Circuits and Systems for Video Technology, Vol.14, No.1, pp: 4-20, 2004.
2. P. Baldi and Y. Chauvin, "Neural Networks for Fingerprint Recognition", neural computation, 5, pp.485-501, 1993.
3. V. Srinivasan , and N. Murthy, "Detection of Singularity Points in Fingerprint Images", Pattern recognition, 20, pp.513-523., 1992.
4. D. Maio and D. Maltoni, ―Direct Gray Scale Minutiae Detection in Fingerprints‖, IEEE Tran on Pattern Analysis and Machine Intelligence, Vol.19, No. 1, 1997.
5. S. Al, "Fuzzy Control for Fingerprint Feature Selection", Proc. ACCV Vol. 3, pp: 767-771, 1995.
6. X. Xia, and L. O'Gorman, ‖Innovations in Fingerprint Capture Devices‖, Journal of Pattern Recognition, Pergamon Press, Vol. 36, No. 2, pp. 361-370, 2002.
7. D. Maltoni, Dmaio, A.K. Jain, S. prabhakar, "Hand book of Fingerprint Recognition", 2003.
8. A. Chatterjee, S. Mandal, G. M. Atiqur Rahaman, and A. M. Arif, ―Fingerprint Identification and Verification System by Minutiae Extraction Using Artificial Neural Network‖, ISSN 2078-5828 (PRINT), ISSN 2218-5224 (ONLINE), VOLUME 01, ISSUE 01, MANUSCRIPT CODE: 100703, 2010.
9. B. Gour, T. Bandopadhyaya, and S. Sharma, Fingerprint Feature Extraction Using Midpoint ridge Contour method and Neural Network‖, IJCSNS International Journal of Computer Science and Network Security, VOL.8, No.7, 2008.
10. Y. Zhang, Y. Jiao, J. Li, and X. Niu, ―A Fingerprint Enhancement Algorithm using a Federated Filter‖, Information Countermeasure Technique Institute, Harbin Institute of Technology, China, 2005.
11. M. Thurley, and T. Andersson,‖ Edges & Edge Detection‖, Industrial Image Processing, 2009.
12. H. Rhody,‖ Image Enhancement and Spatial Filtering II‖, Chester F. Carlson Center for Imaging Science Rochester Institute of Technology, 2005.
13. Z. Shi ,and V. Govindaraju, "Fingerprint Image Enhancement Based on Skin Profile Approximation", Center of Excellence for document analysis and recognition (CEDAR), State University of New York at Buffalo, Amherst, USA zshi@cedar.buffalo.edu, 2006.
14. A.Ida, V. Kavitha, and K. Easwarakumar, "Data Integrity in Fingerprint Images, International Journal of Soft Computing, Vol.2, No. 2, pp: 331-334, 2007.
15. M. Rizon, H. Yazid, P. Saad, A. Shakaff, A. Saad,M. Mamat, S. Yaacob, H. Desa and M. Karthigayan, "Object Detection using Geometric Invariant Moment," American Journal of Applied Sciences, Vol. 2, No. 6, pp: 1876-1878, 2006
16. A. Askarunisa, Sankaranarayanan. K. Sundaram. R and Sathick .M. Batcha, "Finger Print Authentication Using Neural Networks," MASAUM Journal of Computing, Vol. 1, No. 2, 2009.
17. G. Jha, "Artificial Neural Networks", Indian Agricultural Research Institute, PUSA, New Delhi-110 012, 2005.
18. J.P. Hayes, "Computer Architecture & Organization," Mc,Grew-Hill compon, 1998.
19. M. Mercimek, K. Gulez, and T. Mumcu, "Real object recognition using moment invariants," Sadhana Vol. 30, pp: 765–775. © Printed in India, 2005.
20. Ganesh Babu Loganathan ; Praveen M. ; Jamuna Rani D. "Intelligent classification technique for breast cancer classification using digital image processing approach" Oct 2019 Available: https://ieeexplore.ieee.org/abstract/document/8882840

21. A.Shakin Banu , Dr.P.Vasuki , Ganesh Babu Loganathan , Dr. V.Srinivasa Raman , A.Yusuf Khan, "Sparse Representation Based Despeckling of SAR Images using STDTCWT " AUG 2019 Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3431020&download=yes

22. Suganthi K, Idris Hadi Salih, Ganesh Babu Loganathan and Sundararaman K, "A Single-switch Bi-polar Triple Output Converter with Fuzzy Control" , International Journal of Advanced Science and Technology Vol. 29, No. 5, (2020), pp. 2386 – 2400.