ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT
INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

OFF-LINE SIGNATURE RECOGNITION USING MODIFIED NEURAL NETWORKS APPROACH

Navpreet Singh*, Sandeep Kaushal
*Assistant Professor (IT Department),ACET, Amritsar
Associate Professor (ECE Department), ACET, Amritsar

ABSTRACT

Biometrics, which refers to identifying an individual based on his or her physiological or behavioral characteristics, has the capability to reliably distinguish between an authorized person and an imposter. Signature verification systems can be categorized as offline (static) and online (dynamic). This paper presents neural network based recognition of offline signatures system that is trained with low-resolution scanned signature images. The signature of a person is an important biometric attribute of a human being which can be used to authenticate human identity. However human signatures can be handled as an image and recognized using computer vision and neural network techniques. With modern computers, there is need to develop fast algorithms for signature recognition. There are various approaches to signature recognition with a lot of scope of research. In this paper, off-line signature recognition & verification using neural network is proposed, where the signature is captured and presented to the user in an image format. Signatures are verified based on parameters extracted from the signature using various image processing techniques. The Off-line Signature Recognition and Verification is implemented using Matlab. This work has been tested and found suitable for its purpose. For the implementation of this proposed work we use the Matlab software.

KEYWORDS: Off-line Signature, Forgeries, Feature extraction, Neural network, FAR (False Acceptance Rate), FRR (False Rejection Rate), Signature recognition, Features, Codification, Normalization, Image Processing..

INTRODUCTION

In our society, traditional and accepted means for a person to identify and authenticate himself either to another human being or to a computer system is based on one or more of these three general principles:

- What the person knows
- What he possesses or
- What he is

The written signature is regarded as the primary means of identifying the signer of a written document based on the implicit assumption that a person's normal signature changes slowly and is very difficult to erase, alter or forge without detection. The handwritten signature is one of the ways to authorize transactions and authenticate the human identity compared with other electronic identification methods such as fingerprints scanning and retinal vascular pattern screening. It is easier for people to migrate from using the popular pen-and-paper signature to one where the handwritten signature is captured and verified electronically. The signature of a person is an important biometric attribute of a human being and is used for authorization purpose. Various approaches are possible for signature recognition with a lot of scope of research. Here, we deal with an off-line signature recognition technique. Signatures are composed of special characters and flourishes and therefore most of the time they can be unreadable. Also intrapersonal variations and interpersonal differences make it necessary to analyze them as complete images and not as letters and words put together. Signature recognition is the process of verifying the writer's identity by checking the signature against samples kept in the database. The result of this process is usually between 0 and 1 which represents a fit ratio (1 for match and 0 for mismatch). Signature recognition is used most often to describe the ability of a computer to translate human writing into text. This may take place in one of two ways either by scanning of written text (off-line method) or by writing directly on to a peripheral input device. The first of these recognition techniques, known as Optical Character Recognition (OCR) is the most successful in the main stream. Most scanning suites offer some form of OCR, allowing user to scan handwritten documents and have them translated into basic text documents. OCR is also used by some archivist as a method of converting massive quantities of handwritten historical documents into searchable, easily-accessible digital forms.

A problem of personal verification and identification is an actively growing area of research. The methods are numerous and are based on different personal characteristics; voice, lip movement, hand geometry, face, odor, gait, iris, retina and fingerprint are the most commonly used authentication methods. All these psychological and behavioral characteristics are called biometrics. The driving force of the progress in this field is above all, the growing role of the internet and electronic transfers in modern society. Therefore considerable number of applications is concentrated in the area of electronic commerce and electronic banking systems. The biometrics have a significant advantage over traditional authentication techniques (namely passwords, PIN numbers, smart cards etc) due to the fact that biometric characteristics of the individual are not easily transferable are unique of every person and cannot be lost, stolen or broken. The choice of one of the biometric solutions depends on several factors which include:

- User acceptance
- Level of security required
- Accuracy
- Cost and implementation time

The method of signature verification reviewed in this paper benefits the advantage of being highly accepted by potential customers. The use of the signature has a long history which goes back to the appearance of writing itself. Utilization of the signature as an authentication method has already become a tradition in the western civilization and is respected among the others. The signature is an accepted proof of identity of the person in a transaction taken on his or her behalf. Thus the users are more likely to approve this kind of computerized authentication method. Signature verification systems differ in both their feature selection and their decision methodologies. More than 40 different feature types have been used for signature verification. Features can be classified into two major types: local and global. Global features are features related to the signature as a whole, for instance the average signing speed, the signature bounding box and Fourier descriptors of the signatures trajectory. Local features correspond to a specific sample point along the trajectory of the signature. Examples of local features include distance and curvature change between successive points on the signature trajectory. Most commonly used online signatures acquisition devices are pressure sensitive tablets capable of measuring forces exerted at the pen-tip, in addition to the coordinate of the pen. The pressure information at each point along the signature trajectory is another example of commonly used local feature. Some of these features are compared in order to find the more robust ones for signature verification purposes. Other systems have used genetic algorithms to find the most useful features. Due to the high sampling rate of the tablet, some consecutive sample points may mark the same trajectory point especially when the pen movement is slow. Most verification systems resample the input so as to obtain a trajectory consisting of equidistant points. This is often done in order to remove redundant points to speed up the comparisons and to obtain a shape-based representation, removing the time dependencies, separately keep track of the local velocity values and use them in aligning two signatures. Signature recognition and verification involves two separate but strongly related tasks: one of them is identification of the signature owner, and the other is the decision about whether the signature is genuine or forged. Also, depending on the need, signature recognition and verification problem is put into two major classes: (i) On-line signature recognition and verification systems (SRVS) and (ii) Off-line SRVS. On-line SRVS requires some special peripheral units for measuring hand speed and pressure on the human hand when it creates the signature. On the other hand, almost all Off-line SRVS systems rely on image processing and feature extraction techniques.

Ms. VibhaPandey, Ms. SanjivaniShantaiya in 2012.[1] He proposed Signature Verification Using Morphological Features Based on Artificial Neural Network. For identification of a particular human being signatures prove to be an important biometric. The signature of a person is an important biometric attribute of a human being which can be used to authenticate human identity. Pradeep Kumar, Shekhar Singh, AshwaniGarg and NishantPrabhat in 2013. He proposed Hand Written Signature Recognition & Verification using Neural Network.[5]The signature of a person is an important biometric attribute of a human being which can be used to authenticate human identity. A number of biometric techniques have been proposed for personal identification in the past. Among the vision-based ones are voice recognition, face recognition, fingerprint recognition, iris scanning and retina scanning.[6] AshwiniPansare, Shalini Bhatia in 2012. He proposed Off-line Signature Verification Using Neural Network.[15] A number of biometric techniques have been proposed for personal identification in the past. Among the vision-based ones are face recognition, fingerprint recognition, iris scanning and retina scanning. Voice recognition or signature verification are the most widely known among the non-vision based ones.

The remainder of this paper is organized as the following. At first, in Section II we illustrate the various components of our proposed technique to offline signature recognition. Further, in Section III we present some key experimental

results and evaluate the performance of the proposed system. At the end we provide conclusion of the paper in Section IV and state some possible future work directions.

PROPOSED TECHNIQUE

This section illustrates the overall technique of our proposed Signature Recognition. In this paper we proposed "Off-Line Signature Recognition Using Modified Neural Networks Approach". The method of signature verification reviewed in this paper benefits the advantage of being highly accepted by potential customers. The use of the signature has a long history which goes back to the appearance of writing itself. Utilization of the signature as an authentication method has already become a tradition in the western civilization and is respected among the others. The signature is an accepted proof of identity of the person in a transaction taken on his or her behalf. Thus the users are more likely to approve this kind of computerized authentication method. Signature verification systems differ in both their feature selection and their decision methodologies. More than 40 different feature types have been used for signature verification. Features can be classified into two major types: local and global. Global features are features related to the signature as a whole, for instance the average signing speed, the signature bounding box and Fourier descriptors of the signatures trajectory. Local features correspond to a specific sample point along the trajectory of the signature. Examples of local features include distance and curvature change between successive points on the signature trajectory. Most commonly used online signatures acquisition devices are pressure sensitive tablets capable of measuring forces exerted at the pen-tip, in addition to the coordinate of the pen. The pressure information at each point along the signature trajectory is another example of commonly used local feature. Some of these features are compared in order to find the more robust ones for signature verification purposes. Other systems have used genetic algorithms to find the most useful features. Due to the high sampling rate of the tablet, some consecutive sample points may mark the same trajectory point especially when the pen movement is slow. Most verification systems resample the input so as to obtain a trajectory consisting of equidistant points. This is often done in order to remove redundant points to speed up the comparisons and to obtain a shape-based representation, removing the time dependencies, separately keep track of the local velocity values and use them in aligning two signatures. Signature recognition and verification involves two separate but strongly related tasks: one of them is identification of the signature owner, and the other is the decision about whether the signature is genuine or forged.

- **Features Extraction**

We approach the problem in two steps. Initially, the scanned signature image is preprocessed to be suitable for extracting features. Then, the preprocessed image is used to extract relevant geometric parameters that can distinguish forged signatures from exact ones using the ANN approach.

- **Preprocessing**

The signature is first captured and transformed into a format that can be processed by a computer. Now it's ready for preprocessing. In preprocessing stage, the RGB image of the signature is converted into grayscale and then to binary image. The purpose of this phase is to make signatures ready for feature extraction. The preprocessing stage includes two steps: Color inversion, Filtering and Binarization.

- **Color Inversion**

The true color image RGB is converted to the grayscale intensity image by eliminating the hue and saturation information while retaining the luminance.

Fig(a) A sample signature

Fig(b) A Grayscale Image

A grayscale image is a data matrix whose values represent intensities within some range where each element of the matrix corresponds to one image pixel.

- **Image Filtering and Binarization**

Any image when resample is filtered by a low pass FIR filter. This is done to avoid aliasing. This aliasing occurs because of sampling the data at a rate lower than twice the largest frequency component of the data. So a lowpass filter will remove the image high frequency components. And for this purpose the filter used. Now the grayscale image is segmented to get a binary image of objects. In a binary image, each pixel assumes one of only two discrete values: 1 or 0. A binary image is stored as a logical array.

Fig. 1.2: Binary Image interpreting the bit value of 0 as black and 1 as White Features Extraction is the key to develop an offline signature recognition system. We use a set of five global features that cannot be affected by the temporal shift.

EVALUATION AND RESULTS

To verify the effectiveness (qualities and robustness) of the proposed Off-line Signature Recognition we conduct several experiments with this procedure on several images. The main objectives of proposed work are given below:

- Image Acquisition and preprocessing: Default size images will be constructed (PNG, JPG) and noise removal using median filter. The preprocessing steps include grey scale conversion, thresholding, boundary detection and auto cropping.
- Feature point extraction: Splitting the default size images horizontally and vertically by extracting their feature points.
- Training the neural network using those feature points.
- Performance evaluation using false acceptance rate, false rejection rate.

There are some steps of our proposed technique are given below:

Phase1: Firstly we develop a particular GUI for this implementation. After that we develop a code for the loading the signature image from the database of the images.
Phase2: Develop a code for the loading the matching purpose image from the database of the images.
Phase3: Develop a code for the finding the feature extraction of the both image and by the feature extraction we done the matching processes.
Phase4: After the extraction process we can do the code for grid feature extraction for finding the feature of the images and recognition of signature using the neural network.

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

Flow Chart of proposed method:

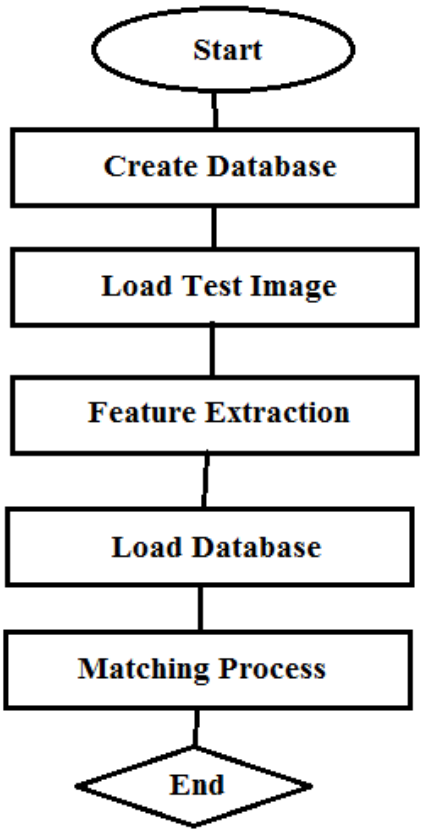

Figure: 1. Flow chart of proposed method

RESULTS

For the simulation of our propose work in Matlab we first run Main.m file and we got below figure window.

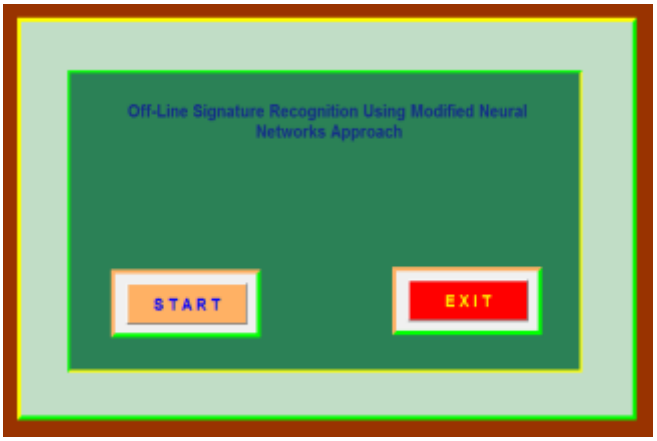

Figure: 2. Main Figure window of proposed method

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

Figure: 3. Work Figure window of proposed method

Figure: 4. Running Figure window of proposed method

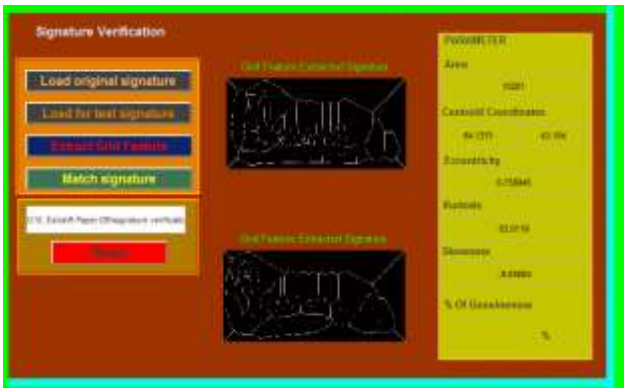

Figure: 5. Running Figure window with Grid Feature

ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

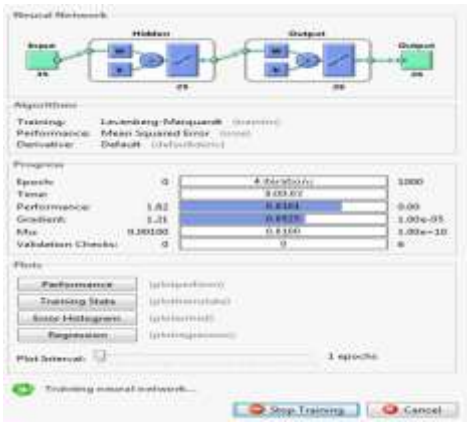

Figure: 6. Modified Neural Network Training

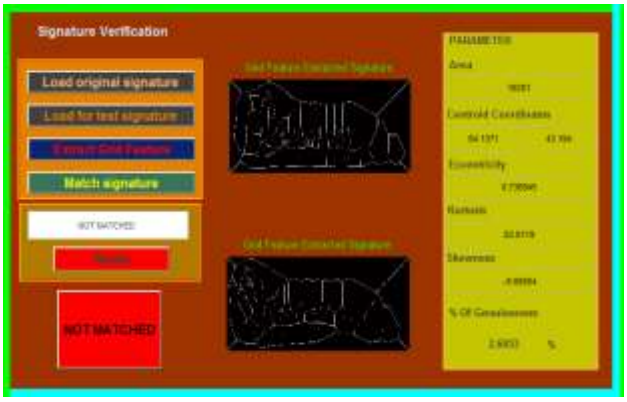

Figure: 7. Results of proposed method with Not Matched

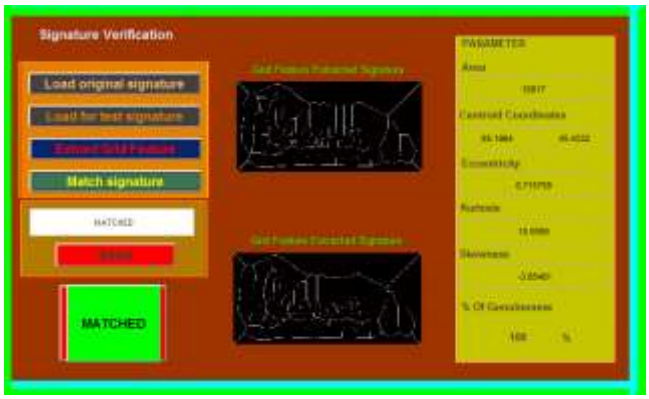

Figure: 8. Results of proposed method with Matched

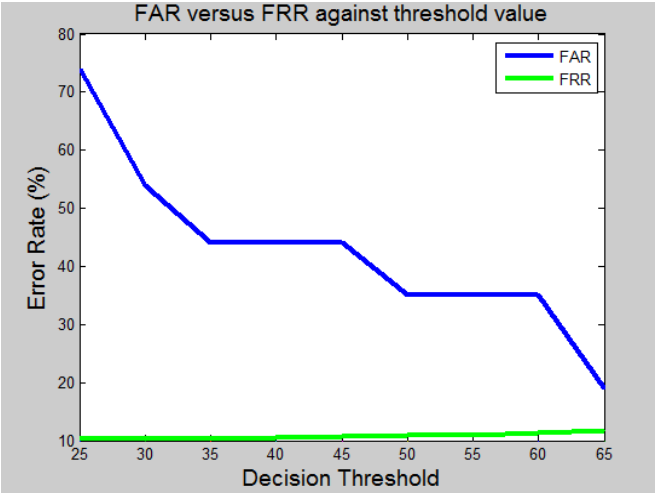

Figure: 9. Graph of FAR Vs FRR

CONCLUSION & FUTURE WORK

In this paper we present "Off-Line Signature Recognition Using Modified Neural Networks Approach". In this paper we selects grey scale image to stimulate for feature extraction. The proposed system will give better result in terms of FAR and FRR than existing techniques. The method uses features extracted from preprocessed signature images. The extracted features are used to train a neural network. The network could classify all genuine and forged signatures correctly. Recognition and verification ability of the system can be increased by using additional features in the input data set. This study aims to reduce to a minimum the cases of forgery in business transactions. This is a novel attempt in this design and has given satisfactory results as seen by its ability to attain better classification efficiency. In future work we proposed "Off-Line Signature Recognition Using Modified Neural Networks Approach using error back propagation training algorithm" because back propagation training algorithm is more accurate for verification point of view.

REFERENCES

1. G.A. Khuwaja. An adaptive combined classifier system for invariant face recognition.Digital Signal Processing 12, 21–46, DOI:10.1006/dspr.2001.0413, 2002.
2. D. Zhang, J. Campbell, D. Maltoni, and R. Bolle. Special issue on biometric systems. IEEE Trans. Systems, Man and Cybernetics - C, 35(3):273–275, 2005.
3. K. Bowyer, V. Govindaraju, and N. Ratha.Introduction to the special issue on recent advances in biometric systems. IEEE Trans. Systems, Man and Cybernetics - B, 37(5): 1091–1095, 2007.
4. G. A. Khuwaja. Fingerprint identification with LVQ. Proc of the 9th IEEE IntConf on Neural Information Processing (ICONIP'OZ), Vol. 2, Singapore, Nov. 2002.
5. J.F. Vargas, M.A. Ferrer, C.M. Travieso, and J. B. Alonso.Offline signature verification based on pseudo-cepstral coefficients.10th IEEE IntConf on Document Anal.& Recognition, 2009.
6. A.I. Al-Shoshan. Handwritten signature verification using image invariants and dynamic features. Proc of the IEEE IntConf on Computer Graphics, Imaging and Visualization (CGIV'06), 2006.
7. M. Piekarczyk. Hierarchical random graph model for off-line handwritten signatures recognition.IEEE IntConf on Complex, Intelligent, Software Intensive Systems, 2010.
8. S.M.S. Ahmad, A. Shakil, M.A. Faudzi, R.M. Anwar. Analysis of 'goat' within user population of an offline signature biometrics. 10th IEEE IntConf on Information Science, Signal Processing and their Applications (ISSPA 2010).
9. J.P. Drouhard, R. Sabourin, and M. Godbout.A neural network approach to off-line signature verification using directional PDF.Pattern Recognition, 29(3), (1996), 415--424.
10. E.J.R. Justino, F. Bertolozzi, and R. Sabourin. A comparison of SVM and HMM classifiers in the offline signature verification. Pattern Recognition Letters, vol. 26, 1377-1385, 2005.
11. K. Delac and M. Grgic. A survey of biometric recognition methods. Proc of 46th IEEE Int Symposium Electronics, Croatia, 184-193, June 2004.

12. B. Kovari, Z. Kertesz, and A. Major. Off-line signature verification based on feature matching. 11th IEEE IntConf on Intelligent Engineering Systems, Budapest, Hungary, 29 June - 1 July 2007.
13. A. Kholmatov and B. Yanikoglu. Identity authentication using improved on-line signature verification method. Pattern Recognition Letters, Volume 26, Issue 15, November 2005, pp. 2400-2408.
14. T.S. Ong, W.H. Khoh, A. Teoh. Dynamic handwritten signature verification based on statistical quantization Mechanism. IEEE IntConf on Computer Engineering and Technology, 2009.
15. J. Edson, R. Justino, F. Bortolozzi, and R. Sabourin: "An off-line signature verification using HMM for random, simple and skilled forgeries," Proc. Sixth Int. Conf. Document Analysis and Recognition, pp. 1031-1034, Sept. 2001.
16. B. Zhang, M. Fu and H. Yan: "Handwritten signature verification based on neural 'Gas' based vector quantization", IEEE Int.Joint Conf. on Neural Networks, pp. 1862-1864, May 1998. verification using compression networks and positional cuttings", Proc. 2003 IEEE Workshop on Neural Networks for Signal Processing, vol. 1, pp. 627-636, 2003.
17. A. Chalechale and A. Mertins: "Line segment distribution of sketches for persian signature recognition", IEEE Proc. TENCON, vol. 1, pp. 11–15, Oct. 2003.