

Hybrid Soft Computing Method with Neurogenetic Algorithm for Offline Handwritten Signature Detection

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Abstract— In the era of emergent technology, security is that the foremost anxiety to avoid replicas and counterfeits. There are diverse Biometric systems that enable in personal identification, amongst those verification systems, one system is Signature Verification System. Signatures are substantiated discrimination on-line and offline systems. Every human being has their own writing style and hence their signature is used in the financial domain for identity verification. So it is necessary to develop a technique which is efficient in verifying the Handwritten Signature is correct or forge. We have proposed Hybrid Soft Computing Method with NeuroGenetic Algorithm for Offline Handwritten Signature Detection. In which Feed Forward Back Propagation Neural Network is used with Genetic Algorithm for signature detection.

Key words: Signature, Off-line Signature Recognition and Verification, Global features

I. INTRODUCTION

SVRS (Signature recognition and verification system) could be a system capable of with efficiency addressing two individual however powerfully connected tasks: (1) identification of the signature owner and, (2) call whether or not the signature is real or forger. Reckoning on the particular desires of the matter at hand, SRVSS square measure typically categorized in 2 major classes: on-line SRVSSs and off-line SRVSSs. The distinction of on-line and off-line lies in however knowledge square measure obtained [1]. Within the on-line SRVSS knowledge square measure obtained victimization associate electronic pill and alternative devices. within the off-line SRVSS pictures of the signatures written on a paper square measure obtained employing a scanner or a camera. The aim of off-line signature verification is to determine, whether or not a signature originates from a given signer supported the scanned image of the signature and some pictures of the first signatures of the signer. The purpose of off-line signature verification is to decide, whether a signature instigates from a given signer based on the perused image of the signature and a few images of the original signatures of the signer.

A signature forgery means an attempt to copy someone else signature and use them against him to steal his identity there can be basically three types of forgeries [2].

A. Random Forgeries:

The signer just knows the name of the person whose signature is to be signed.

B. Simple Forgeries:

The signer knows the signature shape and has seen the signature examples prior to signing.

C. Skilled Forgeries:

The signer knows the signature shape very well and has practiced the signature prior to signing it.

In this paper we have proposed Hybrid Soft Computing Method with Neuro-Genetic Algorithm for Offline Handwritten Signature Detection. In which Feed Forward Back Propagation Neural Network is used with Genetic Algorithm for signature detection. Artificial neural network (ANN) is a machine learning approach that models human brain and consists of a number of artificial neurons. Neuron in ANNs tends to have fewer connections than biological neurons. Each neuron in ANN receives a number of inputs. An activation function is applied to these inputs which results in activation level of neuron (output value of the neuron). Knowledge about the learning task is given in the form of examples called training examples.

II. LITERATURE REVIEW

There are several implementations for signature recognition and verification.

Mujahed, nijad n sara IEEE2014 "Offline Handwritten Signature Verification System Using a Supervised Neural Network Approach" By uses Artificial neural network based on the back propagation algorithm for recognition and verification. The aim of this work is to limit the computer singularity in deciding whether the signature is forged or not.

Sisodia K., Anand S., 2009, "On-line handwritten signature verification using artificial neural network classier". The work done has provided encouraging results and has re-confirmed the ability of Artificial Neural Networks to recognize patterns and in this case their skill to generalize. An efficient Static Signature Verification (SSV) system consists of rigorous preprocessing and feature extraction followed by a classifier.

Neural networks (NNs) have been a fundamental part of computerised pattern recognition tasks for more than half a century, and continue to be used in a very broad range of problem domains. The two main reasons for their widespread usage are: 1) power (the sophisticated techniques used in NNs allow a capability of modeling quite complex functions); and 2) ease of use (as NNs learn by example it is only necessary for a user to gather a highly representative data set and then invoke training algorithms to learn the underlying structure of the data) [11].

McCabe A., Trevathan J., Read W., 2008, "Neural network-based handwritten signature verification", This paper presents a method for verifying handwritten signatures by using a NN architecture. Various static (e.g., height, slant, etc.) and dynamic (e.g., velocity, pen tip pressure, etc.) signature features are extracted and used to train the NN.

Kiani V., Pourreza R., and Pourreza H.R., 2011, "Offline signature verification using local radon transform and support vector machines". In this paper propose an effective method to perform off-line signature verification based on intelligent techniques. Structural features are extracted from the signature's contour using the Modified Direction Feature

(MDF) and its extended version: the Enhanced MDF (EMDF). Two neural network-based techniques and Support Vector Machines (SVMs) were investigated and compared for the process of signature verification. The classifiers were trained using genuine specimens and other randomly selected signatures taken from a publicly available database.

Tingmei Wang, Ge Chen, and Zhansheng Chen 2009 Analysis and Application of Iteration Skeletonization Algorithm in Recognizing Chinese Characters Image. paper studied several image skeleton extraction algorithms and compared extraction effects based on different Chinese characters by making computer programs.

Miss. Komal R. Hole, Prof. Vijay S. Gulhane, Prof. Nitin D . Shellokar April 2013 “Application of Genetic Algorithm for Image Enhancement and Segmentation” This paper introduces various approaches based on genetic algorithm to get image with good and natural contrast. The image enhancement is the most fundamental image processing tasks. And Image Segmentation is very difficult task. This paper includes the definition of image enhancement and image segmentation and also the need of Image Enhancement and the image can be enhanced using the Genetic Algorithm and the Image Segmentation using Genetic Algorithm.

Sanket rege1, rajendra memane2, mihir phatak3, parag agarwal june 2013 ‘2d geometric shape and color recognition using digital image processing’ The paper discusses an approach involving digital image processing and geometric logic for recognition of two dimensional shapes of objects such as squares, circles, rectangles and triangles as well as the color of the. The methods involved are three dimensional RGB image to two dimensional black and white image conversions, color pixel classification for object-background separation, area based filtering and use of bounding box and its properties for calculating object metrics.

Fig. 1: Existing Signature Recognition Mechanism.

A. Initialize Stage:

In this stage, the neural network is built by determining the network architecture (input units, output units).

B. Generate Training Set:

Learning algorithms depend on a training set, which is the set used to train particular neural network. In this work, the training set is created by transforming every signature into a two dimensional matrix.

C. Create Neural Network:

In this stage, the training set generated from previous step is fed into a multilayer network which contains multiple hidden layers.

D. Initialize Process:

This stage specifies the weights which are available on every connection.

E. Training Process:

The network must be trained on how to deal with the input to get the desired output. An activation function is applied to these inputs which results in activation level of neuron (output value of the neuron). Knowledge about the learning task is given in the form of examples called training examples.

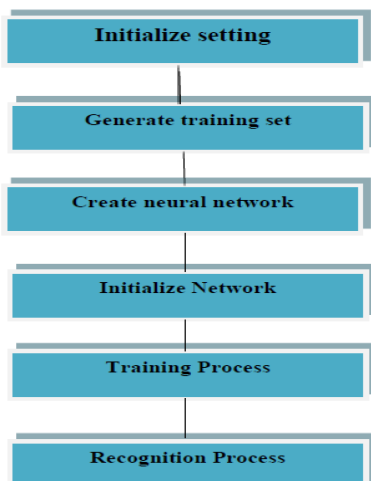
F. Recognition Process:

The signature to be recognized is fed into the system as a matrix. In order to calculate the final values in the output layer, the highest percentage value of the output layer is taken.

1) Problem Identification:

- Accuracy is less, which is measure in terms of
- FRR(False Reject Rate) , FAR (False Acceptance Rate).
- FAR-It can be described as the rate of the deceivers that the system recognized as authentic persons.
- FRR- It can be described as the rate of authorized persons who are not recognized correctly by the system.

III. OFFLINE HANDWRITTEN SIGNATURE VERIFICATION USING NN



Sr no	Approaches	Features used	FRR	FAR
1.	Offline Handwritten Signature Verification System Using a Supervised Neural Network Approach [1]	Artificial neural network based on the well-known Back-propagation algorithm	0.04	0.08

2.	Novel Feature Extraction[5]	(a) Image cell size (b)image center angle relative to the cell lower right corner (c) and pixels normalized angle relative to the lower right corner .	0.5%	1 %
3.	Graph Matching Technique[6]	Hungarian Method.		
4.	Geometric center features[7]	(a)vertical splitting, (b)horizontal splitting and (c)diagonal splitting	15%	10 %
5.	Support Vector Machine[9]	Global Features, Mask Features, Grid Feature	0.02	0.11
6.	Global feature approach[10]	(a)normalized area of the signature, (b)maximum histogram, (c) aspect ratio, (d)centroid feature, (e)number of edge points, (f) trisurface feature and six-fold feature	84.1%	17.8%
7.	Robust signature verification[2]	(a) maximum horizontal and vertical histogram, (b)horizontal and vertical centers of signature, (c) Aspect ratio and edge points of the signature.	5.4%	4.6%
8.	Critical points approach[8]	Triangle matching using the kd ratio	2.64%.	(a)Random Forgery - 0.08% Simple and Skilled forgery- 13.02%.

Table 1: Comparison based on FRR and FAR

2) Proposed Methodology:

In this paper we have proposed Hybrid Soft Computing Method with Neuro-Genetic Algorithm for Offline Handwritten Signature Detection. In which Feed Forward Back Propagation Neural Network is used with Genetic Algorithm for signature detection. Genetic Algorithm is

inspired by Darwin theory about evolution solution to a problem solved. GA is started with a set of solution called population , solution from this population are taken are used to form a new population this is motivated by a hope i.e. new population will be better than old one.

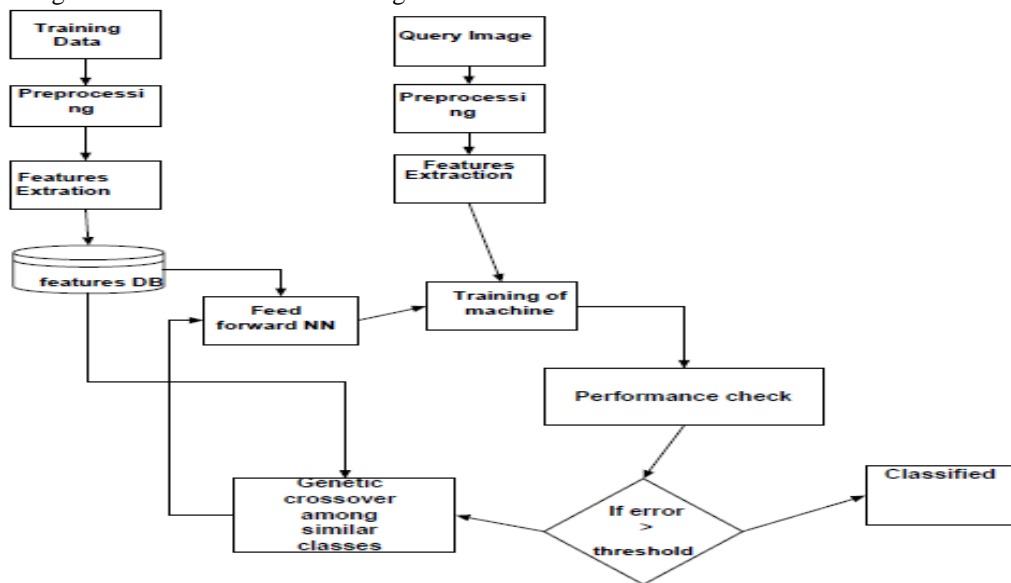


Fig. 2: Proposed Architecture

a) *Initialize Stage:*

In this stage, the neural network is built by determining the network architecture (input units, output units).

b) *Training Set:*

Learning algorithms depend on a training set, which is the set used to train particular neural network. In this work, the training set is created by transforming every signature into a two dimensional matrix.

c) *Create Neural Network:*

In this stage, the training set generated from previous step is fed into a multilayer network which contains multiple hidden layers.

d) *Genetic Algorithm:*

in this stage one point crossovers applied. One point crossover is applied on output of neural network stage.

e) *Neural Network:*

Output from Genetic algorithm stage is now treated as input in this stage.

f) *Recognition Process:*

The signature to be recognized is fed into the system as a matrix. In order to calculate the final values in the output layer, which is in the binary form.

//Algorithm Median Filter

- (1) Consider each pixel in the image
- (2) Sort the neighboring pixels (3-by-3 neighborhood) into order based upon their intensities
- (3) Replace the original value of the pixel with the median value from the list

//Algorithm for skeletonization

- (1) while(there still exist pixels to be deleted)
- (2) For foreground color point P search: {
- (3) If 8-neighborhood of the upper edge point of P
- (4) Matches templates 2,3,4,5,6,7,8, continue scanning.
- (5) If 8-neighborhood of the lower edge point of P
- (6) matches templates 1,3,4,5,6,7,8, continue scanning.
- (7) If 8-neighborhood of the left edge point of P
- (8) matches templates 1,2,4,5,6,7,8, continue scanning.
- (9) If 8-neighborhood of the right edge point of P
- (10) matches templates 1,2,3,5,6,7,8, continue scanning.
- (11) Otherwise mark point P for deleting.
- (12) End for
- (13) End while

//Algorithm for Rotation Normalization

- (1) First of all the non-zero pixels coordinates are stored in a matrix.
- (2) The covariance matrix of the resultant matrix is calculated.
- (3) The eigen vector of the covariance matrix is calculated.
- (4) Now, from this eigen vector the slope of the principal axis is found out.

//Genetic one point Algorithm.

- (1) Initialize datasets for N and M
for I = 1 to N

for J = 1 to M

//Where N is no of persons signature,M is no of individual persons signature in database

- (2) select P as a random point
- (3) Select Parent1 and Parent2 from the individual person's signature.
- (4) New child is now combination of Parent1 and Parent2
Child = Parent1(1:P) + Parent2(P+1:end)

IV. RESULT AND DISCUSSION

In this paper, the experimental results are provided for the training and performance evaluation. Training is performed using a set of 175 signatures to train the proposed system using Matlab 7.1.2. Some of the output snapshots are as follows:

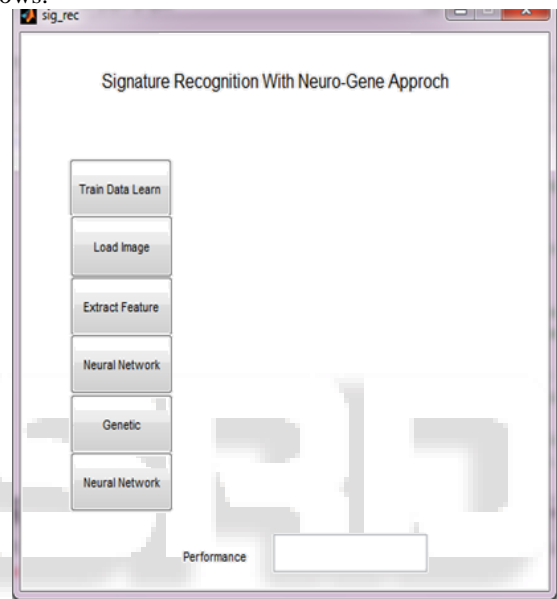


Fig. 3: GUI of Proposed System

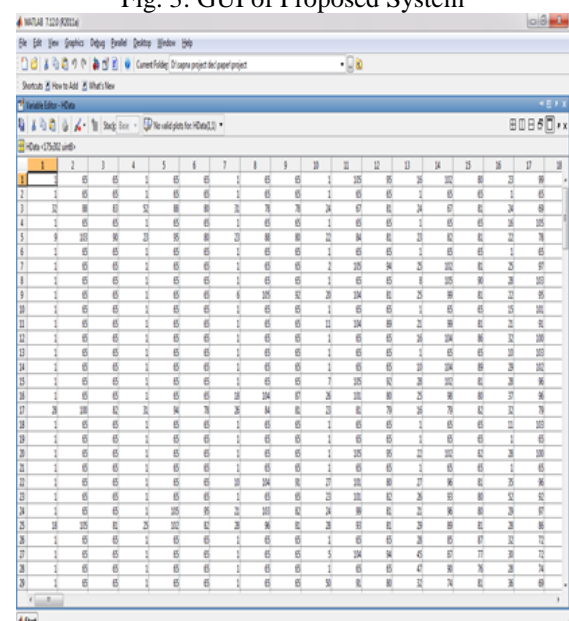


Fig. 4: Training Database

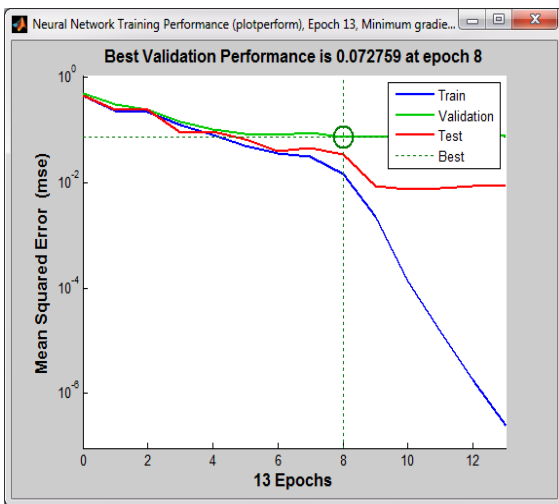


Fig. 4: NN Performance

V. CONCLUSION

Now a day's handwritten detection plays an important role in life. Signature is biometric attribute of humans that have been for authorization purposes in many documents such as forms, bank cheques, credit cards etc. In our proposed approach Feed Forward Back Propagation Neural Network is used with Genetic Algorithm for signature detection. Accuracy is increased as FAR and FAR is minimized. Performance is increased after applying Genetic algorithm. Time required for training of 175 signatures is 1minute 50 second.

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