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# Punjabi Offline Signature Verification System Using Neural Network

**Rimpi Suman, Dinesh Kumar**

***Abstract- The signature identification or verification , means where "identification" implies matching a user signature against a signature associated with the identity that the user claim. Biometrics can be classified into two types Behavioral (signature verification, keystroke dynamics, etc.) and Physiological (iris characteristics, fingerprint, etc.).Signature and Finger Print verifications are most widely used personal verifications and are one of the first few biometrics used even before computers. Signature verification is widely studied and discussed using two approaches. On-line approach and offline approach. Online signature verification represents the dynamic information related to signature which is captured at the time when signature made. The offline signature verification represents the static information of signature. Offline systems are more applicable and easy to use in comparison with on-line systems in many parts of the world however it is considered more difficult than on-line verification due to the lack of dynamic information. This paper presents about offline Signature identification method that had more attraction in recent years because of its necessity for use in daily life routines and when the signature needs to be immediately verified like bank checks, Security for Commercial Transactions, Cheque Authentication, attendance etc. In this paper we present, features types and recent methods used for features extraction in offline signature verification systems .Finally, we suggest new interesting ideas to be incorporated in the future. General Terms Signature verification, Signature matching, biometric***

***Keywords- Signature verification techniques ,Preprocessing ,feature extraction, feature detection, security.***

## I. INTRODUCTION

Biometric identification methods such as Signature Verification, fingerprint, face recognition, iris scanning, signature and DNA analysis are increasing because of their unique features. Today Human being Identifications are most necessary in our day to day life activities such as crossing international borders and entering any secure locations, Traditional bank checks, Biometric verification helps us to recognize people based on their extracted physical or behavioral features. These features must have some properties such as uniqueness, permanence, acceptability, collectability, scalability, portability and the cost to implement any biometric system. Basically, there are two common biometric feature Categories:

**1) Physical features***:* This type of Biometric include face, fingerprint, brighten, ear, palm print, retina, hand, finger geometry and DNA. Most of these features are relatively static.

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**2) Behavioral features***:* This type of biometric includes features that measure the action of the person such as speaking, motion of body and writing. These features are not static because it changes over time due to age effect and other developmental and enhancement factors. A Signature gradually appears as person name which is written by an individual in their own handwriting.

### 1.1 Signature Identification:

The signature is a biometric approach to identify a human being. It can be classified as online and offline signature Identification. The online Signature Identification deals with extraction the features of signature such as velocity, acceleration and pen pressure, as functions of time. these features are captured during acquisition of signature by using a device like tablet. The online signature verification system are more expensive as compared to offline signature verification system.
bank credits, credit cards and various legal documents and besides the many other applications. At this point, we must require higher security levels with easier user interaction or user friendly which can be achieved using biometric verification or Signature identification.
On the other hand, the offline Signature Verification system deals with the static features of signature such as area of signature image, centroids , histogram and many other features. In this paper we deal with offline signature verification using Neural Network. This research paper basically deals with the Punjabi language offline signature verification.

## II. THE OFFLINE SIGNATURE IDENTIFICATION:

**Approach:** The state of the art in offline signature Identification is follows a pattern that is similar to image processing with five steps as shown in figure1.

The input Signature are preprocessed, and then personal features are extracted and stored into the knowledge base, In the classification phase, personal features extracted from an inputted signature are compared with template signature stored in the knowledge base, to check authenticity of the test signature.


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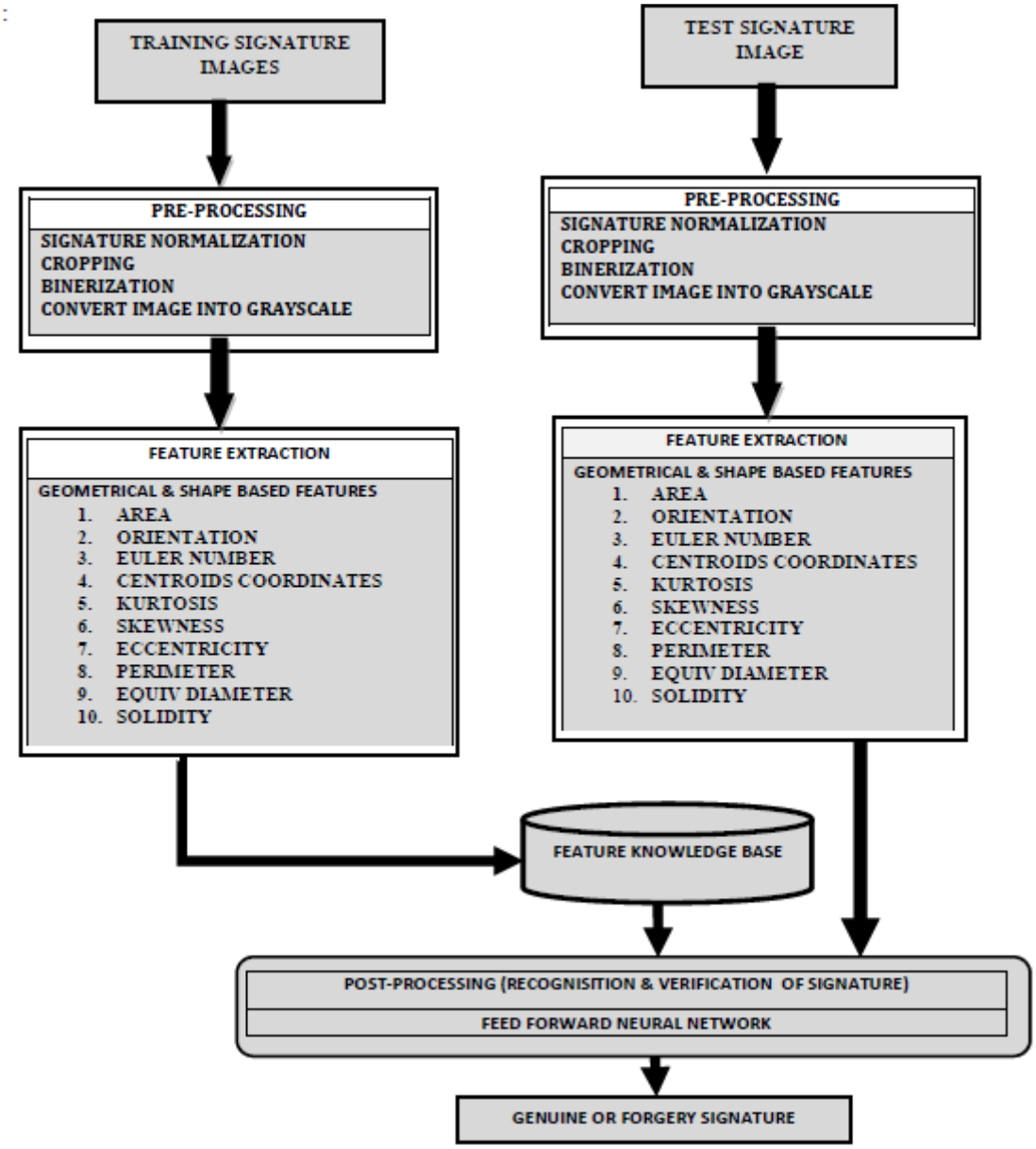


**Figure1: Offline Signature Identification Model**

**Preprocessing:**

A preprocessing phase is done to improve the signature image after scanning using a scanner device. This stage will influence the accuracy and the computational time. It consists of following steps:

a. Image Acquisition
b. Cropping Signature image
c. Convert the image into Gray Scale Image
d. Convert the image into Binary image
e. Assign Label to Binary Image

**a)Image Acquisition:** This stage indicate acquire a handwritten signature image by image sensor such as Scanner ,Digital Cameras.

**b)Cropping Signature Image**: This Step indicate Crop the particular portion of image that are occupied by signature from scanned image as shown in figure b(1).

**c) Convert the image into Gray Scale Image**: This step indicate the conversion of RGB colored signature image into gray scale image. The Gray scale image represents the intensity of an image.

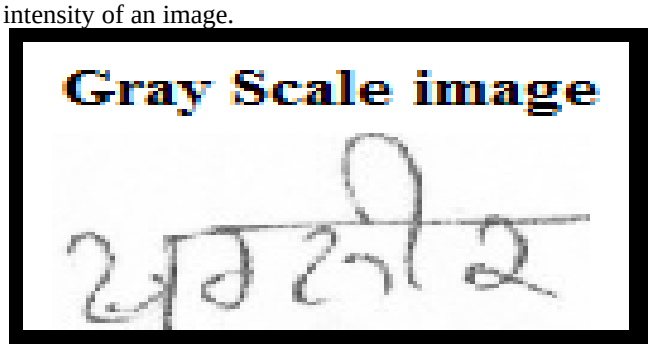


**Figure c (1) Conversion of image into Gray Sacle image**


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**d) Convert the Image into Binary image:**
This step of preprocessing is used to convert a grayscale image into binary image which is done for digitization of an image and inputted to next phase of signature identification system as shown in figure:.

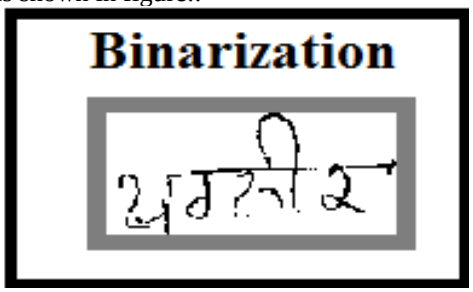


**Figure d(1) Conversion of signature image into Binary image**

**B) Feature Extraction:** It is the process of extracting the characteristics or attributes of an image. The system accuracy are mainly depends upon feature extraction phase. We use ten geometric feature such as area , euler number ,orientation, eccentricity, kurtosis, skewness, equiv diameter, centroids coordinates, Solidity and perimeter[2].
**Area**: Actual number of pixels in the region.
**Euler Number**: It indicates the Scalar that specifies the number of objects in the region minus the number of holes in those objects.
**Orientation**: The angle (in degrees ranging from -90 to 90 degrees) between the x-axis and the major axis of the ellipse that has the same second-moments as the region.
**Eccentricity**: The ratio of the distance between the foci of the ellipse and its major axis length.
**Kurtosis**: It is a measure of flatness of distribution. It gives an idea of whether the data are peaked or flat relative to a normal distribution.
**Skewness**: It is a measure of asymmetry of distribution. A distribution, or data set, is symmetric if it looks the same to the left and right of the center point.

| Extracted Features | Results |
|---|---|
| **Area** | 8580 |
| **Orientation** | 0 |
| **Euler Number** | 1 |
| **Centroids Coordinates** | 78.5 ,28 |
| **Kurtosis** | 8.83758 |
| **Skewness** | -2.68361 |
| **Eccentricity** | 0.935788 |
| **Perimeter** | 418 |
| **Equiv Diameter** | 104.52 |
| **Solidity** | 1 |

**Table. 1. Features extracted from a sample signature**

**Equiv Diameter**: Specifies the diameter of a circle with the same area as the region
**Centroids**: Horizontal and vertical centers of gravity of the signature.
**Solidity:** It specifying the proportion of the pixels in the convex hull that are also in the region.
**Perimeter**: It indicates distance around the boundary of the region. regionprops computes the perimeter by calculating the distance between each adjoining pair of pixels around the border of the region.

**C) Post Processing:** In this stage, the system should extract the features from the reference set, create a template signature and use it in the verification phase when the system reads a new input signature image. The main steps are:

**Verification:** In this stage the signature are classified by artificial neural networks to recognize whether it is Genuine or forged signature. This stage include the:

**1. Artificial Neural Network**

**1.1 ANN Training [14]**

Artificial Neural Network or ANN resembles the human brain in learning through training and data storage. [2]

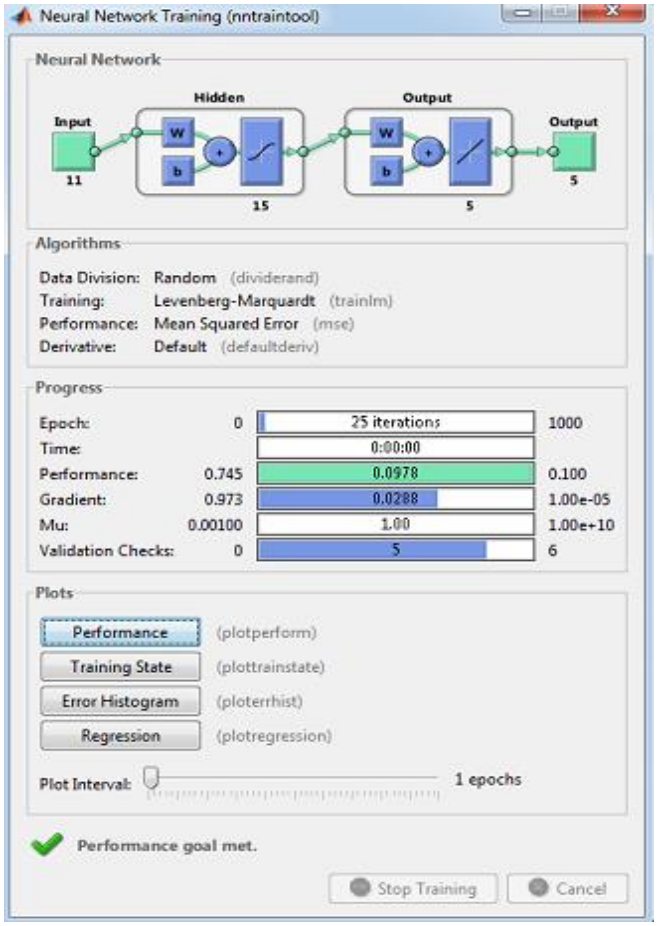


**Fig. 2. Neural Network Training**


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The ANN is created and trained through a given input /target data training pattern. During the learning process [12], the neural network output is compared with the target value and a network weight correction via a learning algorithm is performed in such a way to minimize an error function between the two values.

The **mean-squared error (MSE)** indicates error function which tries to minimize the error between the network's output and the target value. The training of network is successfully done as shown in Fig.4.

The three genuine signature and two forged signatures train the network and they were increase system accuracy by giving very good results in signature identification.

**Neural Network Detail Description For Training & Testing System**

| | |
|---|---|
| **Neural Network Type** | Feed forward Network , And Self Organization Map(SOM) |
| **Threshold** | 90% |
| **Resulting Parameters** | MSE, False Acceptance Rate False Rejection Rate |
| **Training Algorithm** | Trainlm |
| **Learning Rate(Constant)** | Default |
| **Transfer Function First Layer** | Tangent Hyperbolic |
| **Transfer Function Second Layer** | Tangent Hyperbolic |
| **Initial Weights** | Randomized |
| **Initial Biases** | Randomized |
| **Max Number Of Epochs** | 1000 |
| **Momentum Constant** | Default |
| **Error Goal** | 0.0001 |
| **Number Of Patterns For Original Signature** | 25 |
| **Number Of Patterns For Fake Signature** | 2 |
| **Number Of Tested Signatures** | 500 |
| **Number Of Tested Original Signatures(%)** | 50 |
| **Number Of Tested Fake Signatures (%)** | 50 |

**Table:2 : Neural Network Detail Description For Training & Testing System**

### 1.2. ANN Testing:

The system has been tested for its accuracy and effectiveness
on a database of about 500 signatures from 20 users which contains both their genuine and forged signatures. The database consists of signatures done with different pens with different colors. All the samples signature of database is pre-processed and the geometrical features were extracted from it.

After features extraction, testing is performed and the result is obtained and displayed, the **threshold** was taken **90%** in this research. So that if percentage obtained is less than 90% than signature is considered forged otherwise genuine signature.

**Results:**

In this research paper, The data base of about 500 signatures are tested. The accuracy of signature identification system can be expressed by two types of error [13]:

**a.False Acceptance Ratio (FAR):** The false acceptance ratio is given by the number of fake signatures accepted by the system with respect to the total number of comparisons made.

**b.False Rejection Ratio (FRR):** The false rejection ratio is the total number of genuine signatures rejected by the system with respect to the total number of comparisons made.

Both FAR and FRR depend on the threshold variance parameter taken to decide the genuineness of an image. If they choose a high threshold variance then the FRR is reduced, but at the same time the FAR also increases. If they choose a low threshold variance then the FAR is reduced, but at the same time the FRR also increases. In this research we are taking a threshold of 90%.

The network is tested and it is capable of classifying the signatures of the taken database: genuine or forged and a classification ratio of about 93% is obtained. And the minimized error percentages and indicate an additional factor for the success of the signature identification system.


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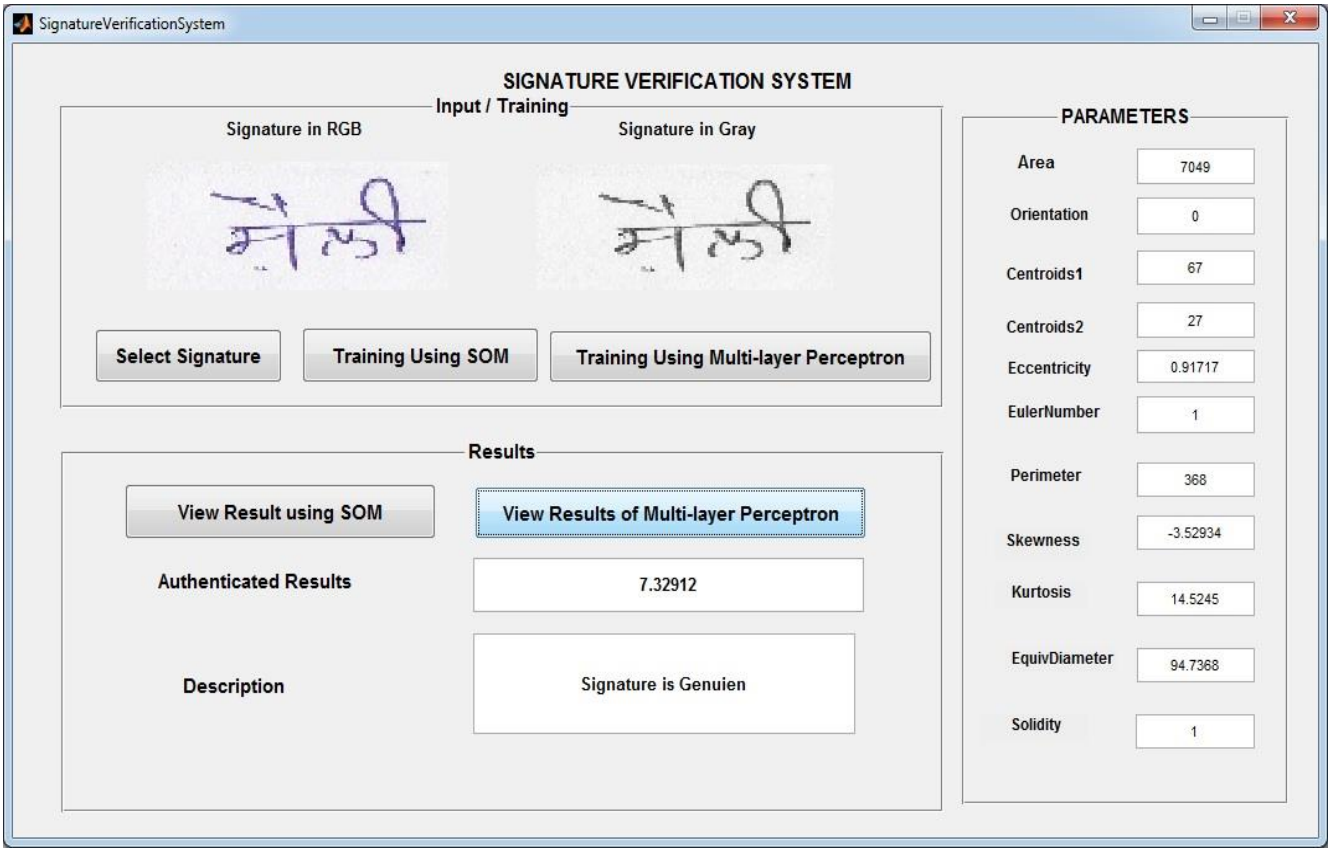


**Figure- 3 Graphical Interface When Selecting a Genuine Signature**

**Graphical User Interface:** In this research the main purpose to design a graphical user interface is to provide interaction to user. Using the following interface, the user can select signature database of interest. Then train the network with the database contents and process it. The extracted features from each signature are displayed as shown in GUI. The interface displays also a percentage level of 'Geniuses' which indicates if the signature is Actual or forged. The GUI for signature verification is as shown in figure -3.

## IV. CONCLUSION:

This paper is a research paper of Punjabi language offline signature identification. In this research, Artificial neural network technique is used for signature identification. The main advantages for using offline signature identification is system are adaptability and implementation. It includes number of benefits i.e. easily to use, low cost of implementation, and the ease of embedding the system in organization without effecting existing system. In this paper we present a state-of-the-art for the latest methods used in offline signature identification system.

## V. FUTURE WORK:

The offline signature identification techniques and algorithm can improved by improving feature extraction and matching algorithms. There is lot of future research works in signature identification because this work is done only in few Indian languages.

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