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An Efficient Signature Based Biometric System Using BPNN

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***Abstract:** There is numerous biometric traits during which you can actually have own identity like face recognition, iris inspection, fingerprint detection, and retina scanning. Handwritten signature commonly used biometric which include multiplied intrapersonal variance .Signature which is commonly used as the personal identification equipment for human that necessitate for verification technique. The fundamental purpose of handwritten signature verification is to lessen fraud in monetary transactions, boarding an aircraft and security in crossing the international borders. Signature of the person is verified to be the primary biometric attribute of a human which can be utilized to authenticate his identity. This paper offers a view on an efficient signature recognition system. The purpose of this process is to ensure that the rendered offerings are accessed simplest by way of an authentic consumer, and no longer any individual else. With the aid of utilizing this system it's possible to confirm individual's identity.*

***Keywords:** Back propagation neural network (BPNN), Feature extraction, Image Thinning.*

I. INTRODUCTION

An individual's physiological or behavioral characteristic may also be identified using the Biometric procedures. The 'Biometric' is derived from Greek phrases "bios" which signifies life and "metric" signifies measurement. A signature is one of the individualistic, distinctive, evidentiary entities. It provides an essential form of indexing in many applications. Signature based matching can be used in different applications like in Business records in both Government and Private organizations, Security based document requirements and in authentication systems.

General overview for signature matching system has following steps which are listed below.

- ✓ The query image of individual's signature is given as the input.
- ✓ The input is then pre-processed. Pre processing may involve some colour conversion, resizing, noise removal etc kind of operations.
- ✓ Next step is feature extraction. Usually feature extraction is nothing but the process of extracting a characteristic feature form the input.
- ✓ Features are particular to the whole signature. Topological features conceders only part of the signature.
- ✓ During matching the features extracted from the query input is compared with the features already stored in the knowledge based using respective classifiers. To find the most similar signature samples from the database matching is done [03].

Xianzhi Du et.al [01] presented an efficient signature matching system using graphical models. Shape based features and to build a visual vocabulary from a set of reference signatures k means clustering is used. Supervised latent Dirichlet allocation learning is done to describe the signature. This work is evaluated on DS-I Tobacco and DS-II UMD datasets with different degradations. Ms. Rajpal Kaur et.al [02] proposed a method which used two types of verification i.e. online and offline signature verification. For document authentication offline is used and for signal processing and pattern recognition online technology is used. Main aim was to

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reduce fraud in financial transactions. This work evaluated the proposed algorithm on Punjabi database of 50 persons. Gabor feature based feature extraction is done and using critical point matching and SURF features matching is done.

Ms. Vibha Pandey et.al [09] concentrated on offline signature recognition and verification approach using neural network. The captured signature is presented in the form of image format. Based on different image processing techniques signal verification is done. For the classification of the extracted features novel features are utilised. A feed forward neural network is used Taranjit Kaur [10]. Researchers in Aditya Kapil et.al [05], Saravanan K et.al [06] also proposed efficient methods for signature matching. Efficient signature matching approach is proposed in this system the feature extractions like branched points, centroid, Extrema, x coordinates and y coordinates are calculated. The extracted feature is classified using back propagation neural network (BPNN).

II. METHODOLOGY

The proposed methodology as in Figure 1 consists of two phases called testing phase and training phase. In the training phase feature from all the images are extracted and stored in the knowledge base. In the testing phase extracted feature from the query input is compared with the features stored in the knowledge base using Back propagation adoptive neural network (BPNN).

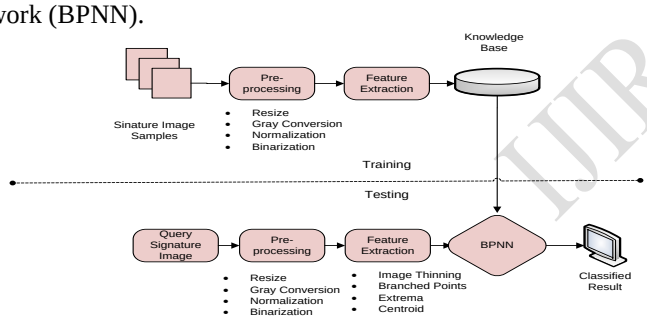

Figure 1: Block Diagram of General Biometric System

A. TESTING PHASE

In the testing phase initially the input image with signature is passed to Pre-processing block. This block involves different operation like image resizing, RGB to gray conversion, Image Normalisation and binarization. Once all these pre-processing steps are applied on the input, feature extraction is done. Total nine features are extracted from the input. In the feature extraction block initially image thinning of the binary converted signature is done. To The thinned image Extrema, Centroid and all the branched points are extracted and compared with already stored knowledge base in the training phase.

a. PRE-PROCESSING

Image pre-processing in most cases denotes a processing step re-modelling a supply image into a new image which is essentially similar to the source image, but differs in certain things like enhanced image contrast. In the proposed system different pre-processing steps like image resizing, color conversion, normalization and binary conversion are carried out. In resizing step every time the input image is resized to a fixed size and then passed for further operation. As we are dealing with shape based feature extraction, RGB information is not needed hence the color conversion of input from RGB to gray is done. Gray conversion and normalization is done using eq. (1) and eq. (2). Finally binary converted signature image is passed to Feature extraction block.

$$Gray = \frac{(Red + Green + Blue)}{3} \quad (1)$$

$$Xnew = \left[\frac{(Xold - Xmin)}{(Xmax - Xmin)}\right] * \quad (2)$$

$$Ynew = \left[\frac{(Yold - Ymin)}{(Ymax - Ymin)}\right] * M \quad (3)$$

b. FEATURE EXTRACTION

The measurements of one or more functions are called as features. Quantifiable property of an object is specified by each of these features and only significant information's are later picked from these features. Proposed methodology considers extrema, centroid and branched points kind of features after thinning the signature.To eliminate the thickness difference of signature drawn by pen by making the image one pixel thick, the image thinning step is carried out. Here the pre-processed input is reduced into a more compact representation and then passed for further feature extraction block.Calculation of Maxima and minima on the entire range of function values is defined as extrema. The point where the function reaches highest value is called as maxima and minima is nothing but the lowest value reached by the function. These points can also be referred as global and local point sometimes. A point which takes highest value on the entire range of the function is called as global maximum. Smallest value in the range of functions is called as global minimum. These extracted features are then passed to BPNN block for further comparison.

B. TRAINING PHASE

In the training phase all the signature samples are taken and feature extraction of all the images are done after pre-processing step. All these extracted features are then stored in a knowledge base. Every time when a query image is given feature of it is extracted and compared with already trained features using BPNN classifier. When the match is found the dialogue box is displayed saying input signature is an authorized one.

a. BPNN

There are many algorithms that are used to create an artificial neural network. But here in our work Back propagation approach is chosen because while preserving the network efficiency probably this method is the easiest one to implement. Back propagation artificial neural network or simply neural network (BPNN) usually consists of three

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layers: Input layer which holds the input for the network, output layer which holds the output data which is usually an identifier for input data and the layer comes between these two layers is called as hidden layer. This layer serves as a point of propagation for sending data to next layer from previous layer [07].

The typical BPNN consists of black nodes on the extreme left which is also called as initial inputs. Training a neural network consists of two phases. In the 1st phase the input data are propagated in a forward direction for computing outputs for every output node. This leads to an error for each output node. In the 2nd phase these errors are passed backward and the weights for them are fixed. Until the sum of square of output error equals an acceptable value these two phases are continued processing. Each of these neurons comprise of two units. Addition of products of weights coefficient and input signal is done by first unit. Nonlinear function is realized by second unit and is called as neuron activation function

$$y = f\ e$$

If signal e is adder output signal then output signal of nonlinear element is given in eq. (3). This signal is also the output signal of neuron. To train these neural network dataset is needed. This training step is an iterative process. During each of these iteration modifications of weights coefficients is done using new data from trained data of nodes. Teaching step focuses on both the input signals from the training set. Once all this stages are completed output signal values are determined in each network layer for each neuron [08]. General flowchart for ANN is shown in Figure 2.

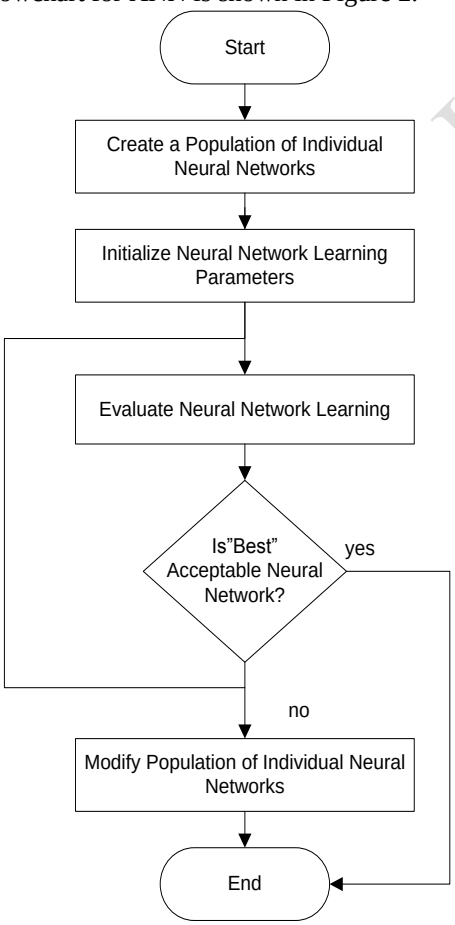
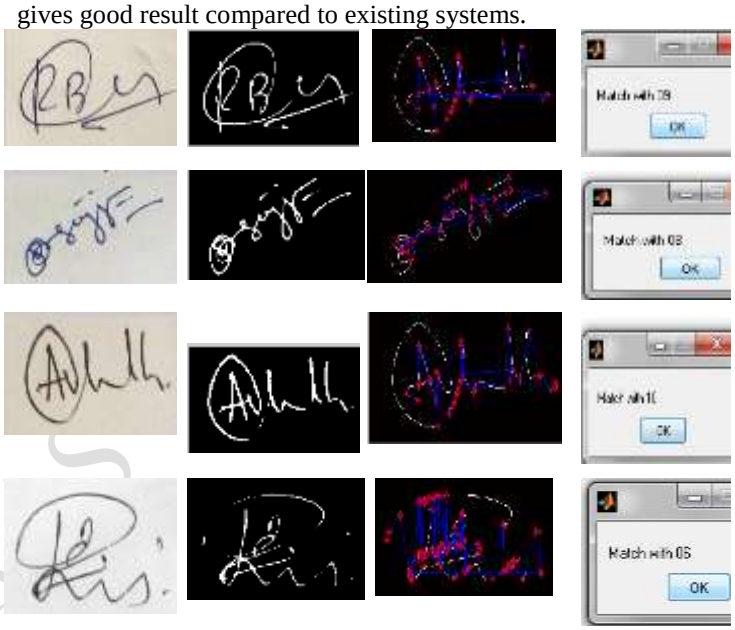


Figure 2: General Flow for BPNN

III. EXPERIMENTAL RESULT

The results obtained at each stage are depicted in this section. The Query input as in Figure 3 (a) is taken and after certain pre-processing like image gray conversion, Image smoothening, the binary image as in (b) is obtained. Certain features are extracted from the thinned image as in (c). These extracted features are then matched with already stored features using BPNN. When the match is found a dialogue box saying matched result with folder name is obtained. During training we have taken signature of 11 persons. 5 images for each type are taken. Results show that the proposed system gives good result compared to existing systems.



(a) (b) (c) (d)

Figure 3

IV. CONCLUSION

This paper presented a novel approach for signature matching using back propagation artificial neural network. Signature is matched based on extracted parameters obtained from the signatures using different image processing methods. For signature matching extraction of some novel features are necessary. These features are then used for training neural network. The proposed recognition system gives good accuracy by correctly identifying all the signatures that it was trained for. Future work may include additional features in the input dataset.

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