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A Review Paper on Signature Recognition

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Abstract: A mark or sign made by an individual on an instrument or document to signify knowledge, approval, acceptance or obligation is called as signature. Signature recognition is a behavioral biometric that identifies an individual on the basis of their handwritten text. There are two types of signature verification systems which are offline (static) and online (dynamic). When a person does a signature on a paper or on a document then it is called offline or static signature. The offline signatures images are obtained by scanner or captured by a camera. It is used in several documents and many different official purposes. Hand written signature is a common biometric used in transaction as a general authentication like bank cheques and credit cheques. Mainly biometric identification has two phase 1) recognition and 2) verification. Online signature is captured by pen based tablet and also depends on the pressure of the pen, ups and downs of the pen and time stamping. Online signature is more trustworthy and accurate but offline handwritten signature is more user friendly than online signature.

Keywords: Biometric System, Forgery, Neural network, Signature Verification, Signature Recognition.

INTRODUCTION

In earlier days, people verify their signature by comparing the signature with its sample which is already taken on one paper and at the time of verification they compare those two papers with each other. This technique is not so sufficient because it is time consuming and human may pose errors while detecting the signature so with the modern technique of signature recognition we can achieve a better result.

Signature Recognition is a behavioral biometric [1]. It can be operated in two different ways:

1. Static:

In this method, user write their signature on paper, digitize it through an optical scanner or camera and the biometric system recognizes the signature analyzing its shape. This group is also known as "Off-Line".

2. Dynamic:

In this mode, users write their signature in digitizing tablet, which acquires the signature in real time.

Another possibility is the acquisition by means of stylus-operated PDAs. Some systems also operate on smart-phones or tablets with a capacitive screen, where users can use a finger or an appropriate pen. It is also known as "On-Line". Dynamic information usually consists of the following:

- Spatial coordinate x(t)
- Spatial coordinate y (t)
- Pressure p (t)
- Inclination n (t)
- Pen up/down

There are a number of limitations in the data acquisition phase. The first is signature's length. In case of too long signatures the data analysis may be difficult for the recognition system to identify the unique data points. In addition, pre-processing and recognition process are time consuming. On the other

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hand, in case of too short signatures the data set may not be representative enough and false accept rate (FAR) coefficient may be too high [2]. The second limitation is the environment and conditions where a person performs the enrolment and verification phase. For example, two signatures taken from an individual may substantially differ from each other only because the position of that person was different [3].

The proposed steps of signature recognition are as follow:

- Pre-Processing
- Feature Extraction
- Matching
- Verification
- Output

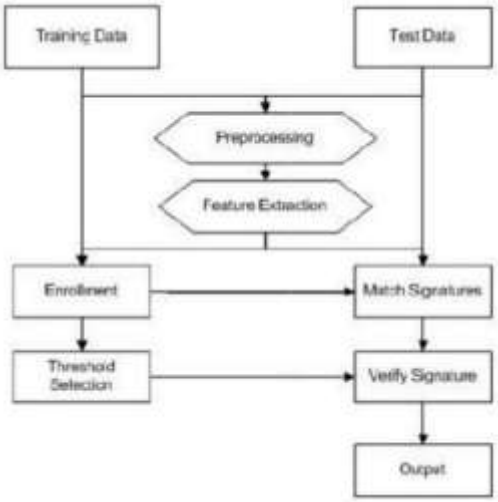

Figure 1: Process of Signature Verification

APPLICATIONS OF SIGNATURE RECOGNITION

- Business
- Forensics Casework
- Banking
- Company
- School/colleges

FLOW CHART OF SIGNATURE VERIFICATION

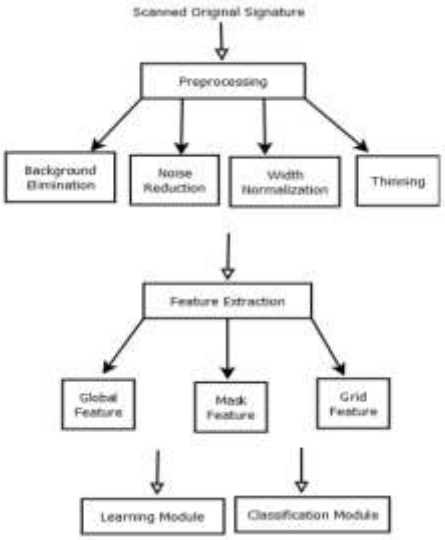

Figure 2: Flow Chart of Signature Verification

Preprocessing:

The pre-processing step is applied both in training and testing phases. Signatures are scanned in gray. The purpose in this phase is to make signatures standard and ready for feature extraction. Signatures are scanned in gray using following equations:

Gray colour= (0.299*Red) + (0.5879*Green) + (0.144*Blue)

The pre-processing stage includes following steps:

- Scaling
- Background elimination
- Noise reduction
- Width normalization
- Skeletonization
- Background Elimination

1. Background elimination:

Data area cropping must be done for extracting features. Ptile thresholding was chosen to capture

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signature from the background. After the thresholding the pixels of the signature would be "1" and the other pixels which belong to the background would be "0".

2. Noise Reduction:

Images are contaminated due to stemming from decoding errors[1] or noisy channels. An image also gets degraded because of the detrimental effects due to illumination and other objects in the environment. Median filter is extensively used for smoothing and restoring images damaged by noise. This is a nonlinear process used in reducing impulsive noise. In a median filter, a window slides over the image and for each location of the window, the median concentration of the pixels within it decide the intensity of the pixel positioned in the middle of window.

3. Scaling:

Let H be the height of the input image & W be the width of the image. We can fit the image uniform at 100*100 pixels by using the following equation as:

Xnew = (Xold * 100)/H;

Where Xnew & Xold are calculated & original X coordinate,

Ynew = (Ynew * 100)/W;

Where Ynew & Yold are calculated & original Y coordinate.

With these equations input image is transformed to uniformed 100*100 pixels image.

4. Width Normalization:

Signature dimensions may have intrapersonal and interpersonal differences. So, the image width is adjusted to a default value and the height will change without any change on height-to-width ratio. At the end of width normalization[2] width dimension is adjusted to 100.

4. Thinning:

The goal of thinning is to eliminate the thickness differences of pen by making the image one pixel thick.

Feature Extraction:

Extracted features[3] in this phase are the inputs of training phase. The features in this system are global features, mask features and grid features. Global features provide information about specific cases of the signature shape. Mask features provide information about directions of the lines of the signatures. Grid features provide overall signature appearance information.

1. Global Features:

Signature area is the number of pixels which belong to the signature. This feature provides information about the signature density. Signature height-to-width ratio is obtained by dividing signature height to signature width. Signature height and width can change. Height-to-width ratios of one person's signatures are approximately equal.

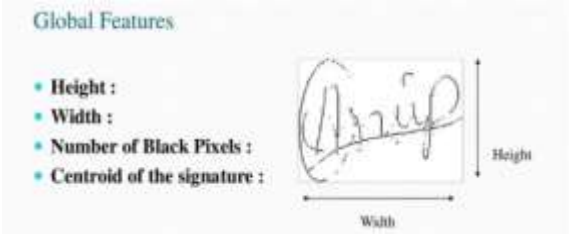

Figure. 3: Image of Global Features

2. Mask Features

Mask features provide information about directions of the lines of the signatures. The angles of the signatures have interpersonal differences. In this system 8 different 3x3 mask features are used. Each mask is taken all around the signatures and the number of 3x3 parts of the signature, which are same with the mask.

3. Grid Features

Grid features are used for finding densities of signature parts. In this system 60 grid features are

used. Signature is divided into 60 equal parts and the image area in each divided part is calculated.

Classification Methods:

1. KNN Algorithm

K -nearest neighbor algorithm is a method for classifying objects based on closest training examples in the feature space [8]. K-nearest neighbour algorithm is among the simplest of all machine learning algorithms. Training process for this algorithm only consists of storing feature vectors and labels of the training images. In the classification process, the unlabelled query point is simply assigned to the label of its k nearest neighbours. The major advantage of the KNN algorithm is that it performs well with multi-modal classes because the basis of its decision is based on small neighborhoods of similar objects. Therefore, even if the target class is multi-modal, the algorithm can still lead to good accuracy. However a major disadvantage of the KNN algorithm is that it uses all the features equally in computing similarities. This can lead to classification errors.

2. Neural Network

An artificial neuron network (ANN) is a computational model based on the structure and functions of biological neural networks [9]. Information that flows through the network affects the structure of the ANN because a neural network changes or learns in a sense - based on that input and output. ANNs are considered nonlinear statistical data modeling tools where the complex relationships between inputs and outputs are modeled or patterns are found. ANN is also known as a neural network [10].

3. FRR

The false recognition rate or FRR is the measure of the likelihood that the biometric security system will incorrectly reject an access attempt by an authorized user. A system's FRR typically is stated as the ratio of the number of false recognitions divided by the number of identification attempts.

CONCLUSION

Since last decade, researchers have proposed a large variety of methods for offline Signature Verification. While distinguishing genuine signatures and skilled forgeries remains a challenging task, error rates have dropped significantly in the last few years, mostly due to advancements in Deep Learning applied to the task. Signatures are verified based on parameters extracted from the signature using various image processing techniques. Recognition ability of the system can be increased by using additional features in the input data set. This method intends to reduce a minimum the cases of forgery in business transactions. This trend will continue for future work with researchers continuing to explore better feature representation particularly in learning representations from signature images with Deep Learning methods and ways to improve classification with limited number of samples. Methods based on ensembles of classifiers; in particular techniques for dynamic selection are also promising.

REFERENCES

[1] T. Miller, "Encoding-Decoding," in *The International Encyclopedia of Communication*, 2014.

[2] L. Benini, L. Mancini, S. Sala, E. Schau, S. Manfredi, and R. Pant, *Normalisation method and data for Environmental Footprints*. 2014.

[3] Z. M. Hira and D. F. Gillies, "A review of

feature selection and feature extraction methods applied on microarray data," *Adv. Bioinformatics*, 2015, doi: 10.1155/2015/198363.