

Online Signature Verification: A Review

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ABSTRACT

Biometrics is commonly used now days for the purpose of identification and verification of the humans and their signatures in the world. Hand written signature of an individual is a unique identification work of human which are used and accepted especially in the banking and other financial and legal transactions. But now day's handwritten signatures due to its valuable importance are at target of fraudulence. In this paper an online signature verification system concept and components are discussed for identification and verification of the signatures.

Keywords-- Signatures, verification, fraudulence, feature Extraction, training, Forgery.

1. INTRODUCTION

Technology is rapidly growing from past few decades. Due to increase and advancement in the technologies, transactions are going online as well as offline. This increase in technology has given the convenience for doing work but at the same time security of the data is the main issue. One of the useful and important methodologies in this area is the use of biometric system. It is used to confirm and verify the identity of the user.

Biometric can be of 2 types:

1. Physical
2. Behavioral

In physical biometric individual person's iris, pain, thumb impression can be used to recognize and verify the individual whereas the behavioral biometric could be signature, voice etc. If a single biometric of an individual is under study. Then, it is referred as uni-model biometrics; if more than one biometrics of an individual is used for verification is called as multi-model biometrics.

Signature is a technology to authenticate an individual. The signatures are used in cheques, legal transactions etc.

legalization of any document can be done by putting a signature on it.

Verification can be done in 2 ways:

1. Online signature verification
2. Offline signature verification

Offline Verification System: - It requires less hardware and depends upon the static features of signature image.

Online Verification system: - In this system a dynamic features are taken into consideration, which include the time when stylus is in and out of the contact with the paper, the total time taken to make signature and the post where the stylus is raised from and lowered onto the paper, number of break points, maximum minimum pressure of stylus contact, speed etc.

2. LITERATURE REVIEW

Harika et.al [1] have utilized the 2 publically available databases for the experiment. The first one is known as MCYT database, which has signatures from 75 genuine Signs. For each signer 15 forged signature and 15 genuine signatures are taken and stored in the database. The second database is known as the GPDS60. Gray signature which has signatures

collected from 881 signers. The database contains signatures in the form of checks or invoices. The blending modes that are used during experimentation include linear born, color, lighten, linear born, multiply and darken. For processing of signature only signature strokes are considered, the signature samples has white background.

Darmola et.al. [2] have presented an offline signature recognition system by using hidden markov model and discrete cosine transform (DCT). The signatures were divided vertically into the segments at center of gravity, this division was carried out with the help of pixels reference positions. The results of this experimentation showed that 99.2% correct signature recognition rate is possible.

Biswas et.al. [3] have presented a method for offline law have written signature verification with higher accuracy. They introduce processors to extract features from hand written signature images. That computed feature is used for the verifications. They used clustering technique for the verification. They proposed a new method to extract the features from hand written signature and recognition of handwritten signature. Achieved results were encouraging and suggest the adequacy of the selected features the work is actually done with the help of clustering process based on a K-nearest neighbors approach enabling to handle clusters of different size and shape. This type of image clustering techniques can also be used in the field of face recognition and thumb impression recognition.

Abbas et.al. [4] have proposed a system for managing SVM classifier conflicts. This system based on the decision combination rule that base on generalization belief function of desert Snarabdache theory. The SVM outputs are merged by this framework and use the technique of estimation.

Ferrer et al. [5] different techniques have been present on Pseudo dynamic features for automation of signature verification. Few of there have utilized gray level values of signatures stroke of pixel. The corpuses that were considered for different studies contain the signatures on while background, but with the complex background of the checks and invoices the variance has been notice in the gray level distribution of signature image. The distorted by the complexity of background was the aim of this paper and

further on the basis of that analysis proposes more robust and stable features.

Pansare et.al. [6] presents a method which consist of image processing, geometric features extraction, neural network training with extract features and verification. Verification stage includes applying the extracted features of test signature to a trained neural network which was used to classify it as a genuine of forged.

3. PROCESS OF ONLINE SIGNATURE VERIFICATION

It includes some of the procedure such as:-

- 1) Acquisition
- 2) Preprocessing
- 3) Feature extraction
- 4) Training
- 5) Comparing
- 6) Matching
- 7) Signature verification

Signature verification is not only a popular research area in the field of pattern recognition but also is an important role in other application too such as security or financial and contractual matters.

Signature of the same person can vary with time and state of mind. Signature verification system extracts certain features which can be derived from velocity acceleration of the pen together with some parameters like total time taken, pressure applied and number of pen ups the features are modeled by fitting probability density functions.

1) Acquisition of signature: - Handwritten signature is a form of identification for a person which is a skill i.e. highly personal to individuals and consist of graphical marks on the surface in relation to a particular language. For the purpose of verifying the signatures, the set of training and test of signature should be considered with few field signatures for testing the accuracy of the system.

2) Preprocessing: - Preprocessing of a signature image actually related to the removal of noises because noises may include during the scanning process of signature. For the purpose of removing the noise and enhancing the ROI, the

preprocessing is done with the help of some filters. This preprocessing have to be done for both sample and test images of signatures. Noise may cause severe distortions in the digital image and hence ambiguous feature and a correspondingly poor recognition and verification rate. Preprocessor is used to remove noise. Preprocessing is actually a step to attempt to eliminate noise from the capturing device, speed of writing etc, minimize the potential of eliminate writer dependencies.

3) ROI Detection:- In this step the area of a signature in the image has to be detected which is actually known as ROI. It has to be identified in both sample and test image of signature.

4) Feature Extraction: - Features have to be extract from both sample and test image such as signature height, signature occupancy ratio, distance ratio, signature length etc. Static features extracted from the shape of the signature such as:-

- Change of the distance between two consecutive points ($\delta x, \delta y$)
- Absolute of coordinate (Y)
- Sine & cosine of angle with the x axis ($\sin a$ & $\cos a$)
- Curvature (β)

There are some basic features which are used in signature verification experiments. This includes the angle between the strokes of two consecutive sample points in the digitized signature as well as the corresponding difference to the previously computed angle. The variation of writing speed and pressure applied on the signature is also a major factor which can be considered in the verification process

5) Training:- Training of the samples is done after extracting the features. The dataset of sample signatures are actually divided into two sets: training and testing sets.

6) Comparing:- In order to compare two signatures with respect to their shape, they must be re-sampled to eliminate the dependencies on speed. Temporal features must be extracted beforehand since all local speed information is lost during this process. Re-sampling ensures that the signature is uniformly smoothed segment of high writing

velocity will be smoothed more than segments that are written slowly.

7) Matching:- Each point after extracting the features is represented by an n array feature vector and then feature reduction is performed. After this Euclidian distance or any other technique is applied as the metric to compare two feature vectors. A set of pairing between the template and input-output string Is formed where the sum of the differences between each pair of aligned prints is minimal:

Training set: - pair wise distances between all training samples is calculate (DWT) the sample with the smallest average distance is selected as the template.

Normalization statistics:-

- Average distance from template
- Average max distance
- Average min distance

Test sample: - Compute DWT against all training Samples. The distance from template, maximum distance and minimum distance is recorded. These three distances are normalized by dividing the set's any statistics.

8) Signature verification: - It refers to the process of using a digital signature algorithm to verify a signature on the Information. After collecting all sample of lest and training samples, the verification process is carried out.

Signature verification system extracts certain features which can be divided from velocity and acceleration applied of the pen together with source parameters like total time taken, pressure applied and number of pen –ups. Signature is first segmented into 2 parts vertical and horizontal and then data is extracted from individual blocks. After this the data or information collected is compared with the test signatures.

4. FORGERY

Forgery is of artificially create a document which can change the legal reality. The goal of forger is to imitate, as closely as possible to reality the original signature. The problem occurs in signature verification system is hard to decide whether the two different signatures signed by the genuine signer is identical or not because the signature signed by the person may vary according to it's to mood, health etc.

Types of forgeries:

There are many types of forgeries some of these are

- 1) **Random forgery:** - produced without any knowledge of signature, shape or even the signer's name.
- 2) **Simple forgery:** - produced by knowing only the name of the signer's but without having any examples of signer's signature style.
- 3) **Skilled forgery:** - produced by looking at an original signature sample, attempting to imitate it as closely as possible.
- 4) **Fluent forgery:**-forger attempts to imitate the movement, while performing quick scribble& neglecting design components such as shape of letters.
- 5) **Self forgery:** - sort of forgery in which a person forges his own signature in order to deny it at a later stage.

Advantages of signature verification:-

1. User friendly
2. Well accepted socially & legally
3. Non invasive
4. Already acquired in no of apps

Disadvantages of signature verification:-

1. High intra-class variability
2. Forgeries
3. Higher error rates than other traits
4. Affective by physical & emotional states of user
5. Large temporal variation

5. CONCLUSION

Paper gives the depth review of handwritten signature verification system which includes the basic concept regarding the process including the process, types of forgeries etc. The basics concern of this paper is understand the basics of online signatures verification system, that now it works and types of forgeries it can be affected by.

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