A Detailed Survey on Offline Handwritten Signature Verification

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Abstract- *Nowadays in the era of growing technology, security is the most important thing to avoid forgeries and frauds. There are many biometric systems that helps to avoid forgeries .One of the method is Handwritten Signature Verification. Handwritten Signature Verification is used to reduce frauds in financial transaction, banks etc. There are two types of handwritten signature verification methods used. They are online handwritten signature verification and offline handwritten verification. This paper explains the importance of offline systems and gives a detailed survey on various approaches related to this paper.*

I. INTRODUCTION

A Signature is a one in which someone's name, or mark that is written on a document as a proof of identity. Signature is one of the strong authentication feature of each person. signature will be differ from person to person. In this modern world million of people's signature should be verified; and thus the visual inspection of verifying the signature is impossible and therefore an automated system should be used for verifying each person's signature. In this developed technology, many researches were on the process. And it is the difficult task for finding the original signature and the forged signature. Several techniques and several feature extractions were developed for verification. There are two types of signature verification they are online signature or dynamic signature verification; offline or static signature verification [1]. The main difference between online signature and offline signature verification is that in online signature the person is asked to sign in a tablet (tab) connected to the probe of the computer whereas in offline signature the person's sign is already loaded. The important steps involved in the handwritten signature verification are preprocessing, feature extraction, verification. The first step of offline signature verification is preprocessing. Feature extraction and selecting the features are the fundamental process. The various preprocessing steps are thinning, dilation, rotation, noise removal, cropping, binarisation, resizing, gray scale conversion etc. The various feature extraction steps are signature image area, eccentricity, kurtosis, skewness, length to width ratio, height, width. Online signature verification has features like pen pressure, velocity ,tilt etc. Then the original signature and test signature are compared using various comparison techniques like Neural Network, Hidden Markov Models, Dynamic Time Warping, Support Vector Machines, Principal Component Analysis, Pixel Based Signature Method [2].

II. FORGERIES

There are three types of forgeries they are Random forgeries, Simple forgeries, Skilled forgeries.

Random Forgeries:

In this the signer just knows the sign of the person and creates a signature of his/her own style.

Simple forgeries:

In this the signer knows the signature shape, and the forged sign looks like the original signature.

Skilled forgeries:

In this the signer watches the original signature and he tries to put the original signature.

III. PREPROCESSING

The first step is the preprocessing. The meaning for preprocessing is its improves and enchances the image. It is applied to the quality of image and pixels [3]. The various preprocessing steps are thinning, dilation, rotation, noise removal. The sub process in the preprocessing are cropping binarisation, resizing, gray scale conversion etc. And these sub process may vary accordingly depending on the approach.

IV. FEATURE EXTRACTION

The output from the preprocessing steps is given as the input to the feature extraction stage. Feature extraction means extracting the image characteristics and the accuracy depends on this feature extraction. This can be divided into Global features, Local features, Transition features. Global

features defines the height of an image, length of an image, width of an image. These are less sensitive to the noise [4]. Local features defines the specific part's property. Transition features counts the transition from white to black pixel or vice-versa. The various feature extraction steps are signature image area, eccentricity, kurtosis, skewness, length to width ratio, height, width.

V. DATA TRAINING

In this stage, the databases are collected from the individuals. The individuals are asked to put their original signature as well as the forged signature. Then the signatures were loaded. Then they were trained by various techniques. Then the performance like false acceptance ratio, false rejection ratio, true acceptance ratio, true rejection ratio, mean square error are found.

VI. DIFFERENT VERIFICATION TECHNIQUES

The different verification techniques were discussed below:

NEURAL NETWORK:

It is an information passing paradigm. It is an artificial representation of human brain. Network of neurons that process and transmit the information. In Neural network approach ,it provides 85-100 % efficiency for the test data's and also it provides more accuracy [7]. The neural network when presented with 150 genuine signatures from 30 different persons classified 125 signatures out of 150 as genuine and 25 signatures as forgeries [8].

HIDDEN MARKOV MODEL:

It is a statisticial model. It is a learning model based on principal empirical risk minimization. It is a probabilistic model with a particular set of conditional independence assumption [9]. In this the signature to be trained is vertically divided into segments using the space reference position of pixel. In this method, 99.2% results have been found [10].

DYNAMIC TIME WARPING METHOD:

It is a method which finds an match between two different features by allowing stretching and compression of the sequences. This method works by extracting the vertical portions from the image and comparing the original and test image. This method has an error rate of 2 % in comparison to 29% of the signature [11].

SUPPORT VECTOR MACHINES:

In this method, the inputs are given to the support vector machine and it draws a hyper plane and classifies the signature whether it is forged or not. SVM has tested for 336 sample signatures and the error rate is less than 7.16 % and this is found to be convincing [12].

PRINCIPAL COMPONENT ANALYSIS:

In this method, gravity and pixel density features were found and this is used to distinguish between original and forged signature. Here, the images are resized to 100*200 [13]. In this method 10 persons were asked to put signature and the results revealed this method reveals performance with accuracy of 98.5% [14].

PIXEL BASED SIGNATURE METHOD:

In this method, the database i.e) the signature image is divided into 2D array and the hexadecimal RGB value for each pixel is calculated then it is compared. If the percentage of matching is more than 90, the signature is considered as valid otherwise invalid. In this method the execution time is only 0.00003545 second only [15].

VII. COMPARISION BETWEEN VARIOUS METHODS

S .No	Methods	Features used	FAR (%)	FRR (%)
1.	Neural Network [16]	Multilayer Layer Perceptron, Radial Basis Function	14.66	20
2	Support Vector Machine [16]	Global features	11	2
3.	Dynamic Time Warping Method [11]	stretching and compression of the sequences	20	25
4	Principal Component Analysis [15]	gravity and pixel density features	2	5

VIII. CONCLUSION

This paper gives the brief survey of offline signature verification methods used by many researches. The main advantages of using offline signature verification is more number of hardwares were not used, it is less expensive and

high efficiency. In this work various methods have been discussed. From the above tabulation it is found that Dynamic Time Warping is the best method because it has the acceptance ratio of 20%.

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