SIGNATURE VERIFICATION USING DCT

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Abstract - *Signatures have been considered a typical form of authentication in our society for hundreds of years. Signature is a simple, concrete expression of the unique variations in human hand geometry. The way a person signs his or her name is known to be characteristic of that individual. A signature verification system must be able to detect forgeries, and, at the same time, reduce rejection of genuine signatures. Signatures are subject to intra-personal variations. Hence, a signature verification system is feasible only if the system is insensitive to intra-personal variability, but sensitive to interpersonal variability. Even when insensitive to intra-personal variations, the system must possess the discriminating power to foil skillful forgers.*

Key Words: (Size 10 & Bold) signature verification, interpersonal variability, intra-personal variability, Discrete Cosine Transform, Feature extraction etc (Minimum 5 to 8 key words)…

1. INTRODUCTION

Human signature is a biometric measure of person's identification. In many sectors like banks, official documents, receipts etc. handwritten signature are verified to secure and identify the concerned person. Each individual has his own signature different with others but in most of the time it is not possible to produce the replica of the signature. The signature verification problem aims to minimize the intrapersonal differences. Signature verification can be categorized into following two parts: online and offline .Online handwritten signature verification deals with automatic conversion of characters which are written on a special digitizer, tablet PC or PDA, Wherein a sensor picks up the pen -tip movements as well as pen -up/pen-down switching.

An on-line signature verification system based on local information and a one-class classifier, i.e. the Linear Programming Descriptor classifier (LPD), was presented by Nanni and Lumini [1]. The authors investigated and described how the information was extracted as time functions of various dynamic properties of the signatures, and then the discrete 1-D Wavelet Transform (WT) was performed on these features. The DCT was used to reduce the approximation coefficients vector obtained by WT to a feature vector of a given dimension. Fabregas and Faundez-Zanuy [2]: have presented a new system for on-line signature verification based on DCT feature extraction with discriminability feature selection. They performed a complete set of simulations with the largest available online signature database, MCYT, which consists of 330 people with genuine and skilled forgeries performed by five other different users.

Dimauro et.al.[3] in their study of local features stability have introduced a warping function that allows m to n points to be matched. However, such an approach may not be practical in cases of extreme values of features.

Lei and Govindaraju[4] analyzed the consistency and discriminative power of on-line features using a distance-based measure that is optimized for each feature of study. They view signature verification as a one category classification problem, and use the distances between features to distinguish them rather than the feature values themselves.

1.1 Motivation

Online handwritten signature verification system is based on the extracting the features of signature from the signature pad and consider as interpersonal features that are not statistically stable. These are used for comparison and verifications between different signatures and enhancing the interpersonal variations and classifier is used to verify signature and provide result as genuine or forgery and also to present a simple and effective approach for an online signature verification system. Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

1.2 Discrete Cosine Transform (DCT)

Online signature verification has proved to be more accurate than the offline signature verification. The DCT has the ability to compactly represent an online signature verification using a fixed number of coefficients which leads to fast matching algorithm.

A DCT coefficient is the compression of feature data, which reduces the elapsed time and storage space for training and verification processes. The time for DTW and HMM methods is very long. From these advantages of DCT, it motivated us to do online signature verification based on DCT.

2. SIGNATURE VERIFICATION SYSTEM

The proposed online handwritten signature verification system consists the following blocks as show in Fig. 1

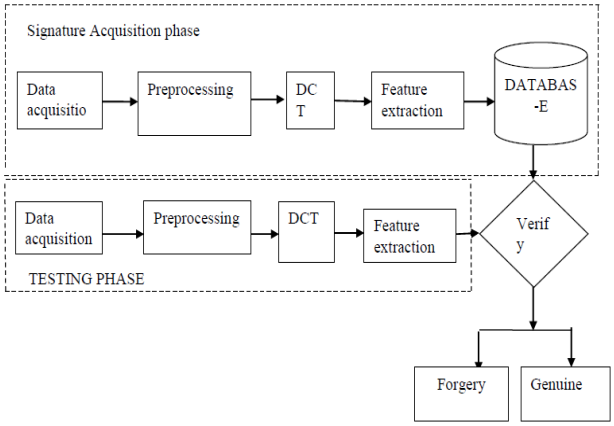

Fig -1: Block diagram of signature verification system

During signature acquisition phase signatures are acquired by using Wacom tablet the 125 signatures are taken from 25 signers at least 5 samples each user. The features are extracted from these signatures and stored in the database. Testing phase is carried out same as training phase but in testing phase we do feature extraction is only for specified sample of specified user. If, the tested signature features matches with the features of the training phase of the respective user then the tested signature will treated as genuine signature.

During the training and verification phase, test signature to be compared against the claimed user's reference set signature. In order to match two signatures, the following stages are applied:
A basis feature matrix is calculated from the reference signatures of each signer. For this, we calculate the minimum, mean, maximum and sum values for each DCT Coefficient in the reference set. The distance between the feature matrix of reference and test signatures computes. The matrix of the feature distance is also normalized to map to a value between 0 and1. Genetic algorithm is used for verification process.

3. RESULTS

The signature is acquired using tablet is as shown in Fig.2

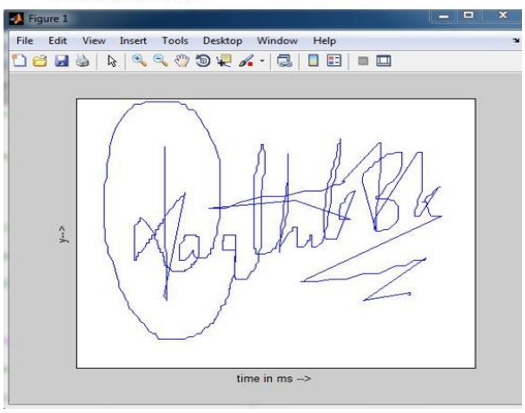

Fig -2: User signature

The user signature is varying with respect to horizontal direction i.e. X-coordinate and the DCT of X is shown in Fig. 3.

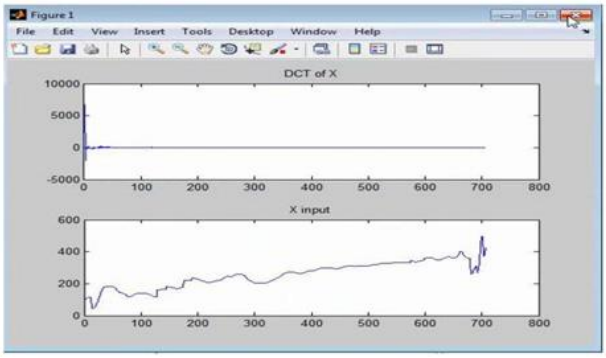

Fig -3: Plotting of theta and its DCT of signature

The user signature is varying with respect to vertical direction i.e. Y-coordinate and the DCT of Y is shown in Fig. 4.

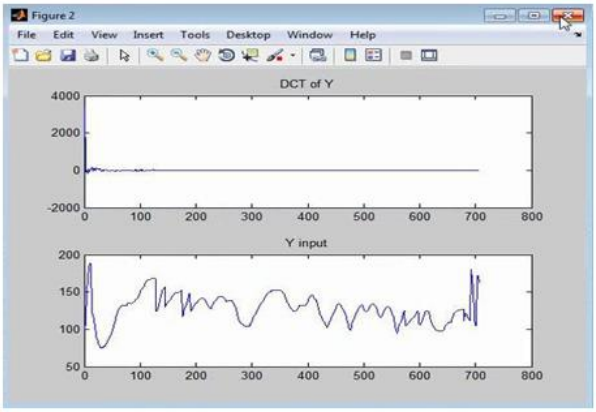

Fig -4: Plotting of theta and its DCT of signature

The value of theta represents the movement of pen with respect to X-axis and its corresponding DCT is plotted as shown in Fig.5.

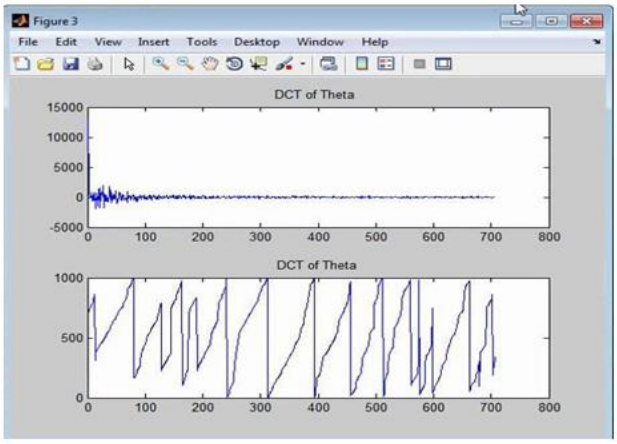

Fig -5: Plotting of theta and its DCT of signature

Genetic algorithm is used for classification of signatures, which makes the verification performance more accurate. To evaluate the experiments, False Acceptance Rate (FAR) and False Rejection Rate (FRR) are determined. FAR represents the probability that a false match occurs, while FRR represents the probability that a false rejection occurs.
Genuine and forged signatures of each user are fed to database for comparison which provides two possible results and are as follows.
When genuine signature is compared with genuine signature of users and the result obtained is "Genuine signature" as shown in Fig. 6.

Fig -6: output of genuine signature

Genuine signature is compared with forged signature of users and the result obtained is "forged signature" as shown in Fig.7.

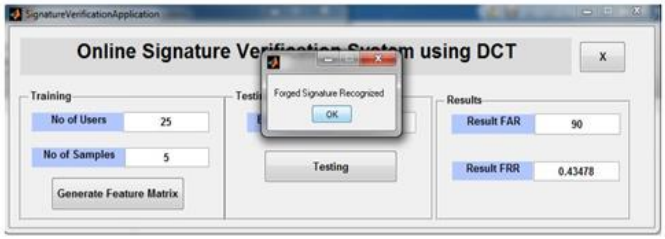

Fig -7: output of genuine signature

3. CONCULSION

Although signature verification is not one of the safest biometric solutions, the use of it in business practices is still justified. Moreover, signature verification has a very promising future. One major drawback is that humans are not consistent when signing their signatures. In this paper, a robust signature verification system has been proposed, based on DCT coefficients and the Genetic Algorithm. Our proposed method can extract basic dynamic features from signature time signals, and compress signature data, while keeping the rough form and basic information of signatures. Especially in the context of skilled forgery, where inter-personal variability in the number of features becomes negligible, an effective analysis of features based on time signals is essential for attainment of a suitable performance. Ideally we need features that are stable, i.e. do not change very much between different genuine signatures, and which are hard to forge. For attaining this purpose, capturing signals via a tablet digitizer and using the extracted dynamics information has been considered, mainly in the form of simple parameters of DCT coefficients. These features are efficient and experimental results confirm that the proposed method is promising. The summation condition in the verification process guides the system towards an accurate decision.

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