A Various Approach on Offline Signature Recognition: A Survey

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Abstract- Digital Recognition of any individual is an under kind to recognize the people. Human identification utilizing. As signatures are widely accepted bio-metric for authentication and identification of a person because every person has a distinct signature with its specific behavioural property, so it is very much necessary to prove the authenticity of signature itself. As signatures are widely accepted bio-metric for authentication and identification of a person because every person has a distinct signature with its specific behavioural property, so it is very much necessary to prove the authenticity of signature itself. A huge increase in forgery cases relative to signatures induced a need of efficient "Signature Verification System". These systems can be online or offline based on type of input taken by the system. This paper represents a brief review on various approaches used in signature verification systems.

Keywords- Signature Recognition, Off-line Signature Recognition and Verification, FAR, EER, FRR.

I. INTRODUCTION

A signature is known as a behavioural biometric. Signature is the main mechanism both for authentication and authorization in official transactions, the need for proficient auto-mated system for signature verification has increased. The writer who does the signature is known as the signatory or the signer. A person's signature is considered and treated as the legal and common means for verifying the identity of an individual. A signature is a grouping of characters or a person's name and is always written in a special way. Signatures having static and dynamic characteristics classify the verification system of signature into two kinds on-line and off-line. In off-line verification, the amount of features, which are extracted from off-line mediums, exceed those obtained from on-line verification i.e. time, pressure and velocity. In online or offline, the design of a verification system requires the five stages of data attainment, pre-processing, extraction of features, process of comparing, and conclusion. The design of an offline signature verification system is more intricate than online verification system due to the lack of timing and dynamic information. Many automatic signature verification methods. have been planned throughout the literature but still

offline signature recognition and verification system remains tough. Signature recognition is the process of authenticating the person's identity by checking his signature against samples which are kept in the database.

SR is a behavioral biometric. Biometric recognizable proof via consequently examining a man's signature and coordinating it electronically against a library of known marks biometric validation, biometric ID, personality check - the programmed distinguishing proof of living people [2] by utilizing their physiological and behavioral qualities; "pessimistic ID must be refined through biometric ID. Marks go about as a solid validation highlight of the underwriter and hence, safeguard their significant resources, for example, confirming bank checks, participation observing, property archives and other classified reports. Be that as it may, the manual check of marks by people is troublesome occupation. In this manner, a computerized Signature confirmation framework is required which will enhance the verification procedure and give secure intends to approval of authoritative records. The target of mark check framework is to separate between two classes i.e. unique and imitation [3].
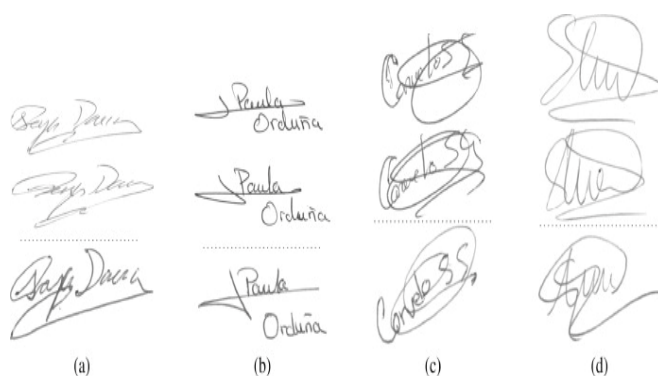

Fig1. Handwritten Templates

1.1 SIGNATURE BIOMETRICS

Handwritten signatures are generally acknowledged as a method for archive confirmation, approval and individual check. For legitimateness most archives like bank checks, travel visas and scholastic declarations need to have approved handwritten signatures. Biometrics can be arranged into two

sorts; physiological and behavioral. Physiological biometrics measure some physical elements of the subject like fingerprints, iris, hand and finger geometry which are steady after some time. Behavioral biometrics measures client activities like talking, composition and strolling which are influenced by wellbeing, age and physiological elements. A mark is a behavioral biometric described by behavioral quality that an essayist learns and obtains over a span of time and turns into his novel character. HSV frameworks are suited for fraud identification as they are shoddy and nonintrusive and give an immediate connection between the author's character and the exchange. The target of signature verification is to separate in the middle of unique and manufactured mark, which are identified with intra-individual and between individual variability. Intra-individual variety is variety among the marks of the same individual and between individual is the variety between the firsts and the imitations. We make a qualification between signature recognition and signature verification.[4]

II. TYPES OF SIGNATURE RECOGNITION

Taking into account the meanings of mark, it can prompt two distinctive methodologies of mark confirmation viz Off-Line or Static Signature Verification Technique and On-line or Dynamic Signature Verification Technique [5].

i) Off-Line or Static Signature Verification Technique:-

This methodology depends on static attributes of the mark which are invariant In this sense signature confirmation, turns into a run of the mill design acknowledgment undertaking realizing that varieties in mark example are unavoidable; the assignment of mark verification can be contracted to drawing the limit of the scope of real variety. In the disconnected from the net mark check procedures, pictures of the marks composed on a paper are gotten utilizing a scanner or a camera.

ii)On-line or Dynamic Signature Verification Technique:-
This is the second sort of mark check system. This methodology depends on element attributes of the procedure of marking. This confirmation utilizes marks that are caught by weight delicate tablets that concentrate dynamic properties of a mark notwithstanding its shape. Dynamic components incorporate the quantity of request of the strokes, the general rate of the mark and the pen weight at every point that make the mark more novel and harder to forge.

III. TERMINOLOGIES IN SIGNATURE VERIFICATION

i) False rejection rate (FRR)

It is one of the most important Specifications in any biometric system. The FRR is defined as the percentage of identification instances in which false rejection occurs. It is also known as Type- I error [6]

ii)Equal Error Rate (EER)

It is the location on a ROC or Detection Error Trade-off curve where the FAR and FRR are equal. Smaller the value of EER better is the performance of the system.

iii)False acceptance rate (FAR)

It is the measure of the likelihood that the biometric security system will incorrectly accept an access attempt by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances divided by the number of identification attempts. It is also known as Type- II error.

IV. SIGNATURE VERIFICATION BASIC CONCEPTS

The main phases of the signature verification follow the sequence.

a) Preprocessing
b) Feature Extraction
c) Data Training
d) Signature Verification

A. Preprocessing : Preprocessing is the set of subsequent oprations applied for the improvement of quality of signature image. This improvement in quality of image increases the accuracy of further steps involved in processing without using relevant information.

B. Feature Extraction : Feature means similar characteristics and extraction means accurately retrieve those features. A proper feature extraction can increases the recognitions ratio. It plays an important role in development of the robust system as all other phases are based on these features.

C. Data Training : Data Training is the stage in which the signature database is created by collecting signatures from the individuals. This collection involves both forgeries and original signatures from these signatures, feature vectors are generated which acts as template for verification.

D. Signature Verification: In the verification stage, the claimed user is asked to produce a single signature which is again represented by the set of features derived by the feature extraction module. The system then derives a signature's quantized feature vector from a given signature using the stored feature quantization step size vector and compares it against the stored user-specific quantized feature vector template. The signature is accepted if the Manhattan distance between these two quantized vectors is less than a predefined threshold, otherwise it is rejected [7].

V. NEURAL NETWORK

Neural network is situated of interconnected neurons which are utilized for estimate of widespread. Artificial neural networks are made out of interconnecting neurons that are artificial or fake. Artificial neural networks might either be utilized to pick up an understanding of biological neural networks or for solving artificial intelligence issues without essentially making a model of a genuine biological system. The genuine or natural nervous system is exceptionally in which artificial neural network algorithms attempt to abstract this quality and concentrate on what might hypothetically matter most from a data handling perspective. Good performance (e.g. as measured by good predictive ability and low generalization error) or execution copying creature or human error patterns can then be utilized as one source of proof towards supporting the theory that the reflection truly caught something essential from the perspective of data. An alternate motivating force for these abstractions is to reduce the measure of processing needed to simulate artificial neural networks.

Architecture of artificial neural network:

The fundamental architecture comprises of three types of neuron layers are input and hidden and output. In feed-forward networks the signal flow is from input data to output units entirely toward feed-forward. The data preparing can extend over multiple layers of units however no feedback connections. The recurrent networks contain some connections of feedback. In opposition to feed-forward networks the dynamical properties are crucial of the network. Now and again the activation values of the units undergo a relaxation process such that the network will develop to a stable state in which these activations don't change any longer.

Artificial Neural Networks:

Artificial neural networks are made out of interconnecting artificial neurons. Artificial neural networks might either be utilized to gain an understanding of biological neural networks or for solving artificial intelligence issues without essentially creating a model of a system of genuine biological system. The real or biological nervous system is highly complex. The artificial neural network algorithms attempt to abstract this complexity and focus on what may hypothetically matter most from an information processing point of view. Good performance or performance mimicking animal or human error patterns and it can then be used as one source of evidence towards supporting the hypothesis that the abstraction really captured something important from the point of view of information processing in the brain.

Delta Rule:

The delta rule is a gradient descent learning rule for redesigning the weights of the artificial neurons in a single-layer perceptrons. It is a uncommon instance of the more general back propagation algorithm. For a neuron j with activation function g(x), the delta rule for j's, ithe weight is given by $\Delta W_{ij}= (t_j - y_j) \, g' \, (h_j)x_i$ (1) In above equation the delta rule is generally expressed in simplified form for a perceptrons with a linear activation function as $\Delta W_{ij} = \alpha \, (t_j - y_j) \, x_i$, where α is known as the learning rate parameter.[8]

VI. LITERATURE SURVEY

Derlin Morocho, et al. [9] This work analyzes collaborative tools such as crowdsourcing and human-assisted schemes developed to improve Automatic Signature Verification systems. The performance of humans in semi-automatic recognition tasks is directly related to the information provided during the comparisons. How humans can help automatic systems goes from direct forgery detection to semiautomatic attribute labeling. In this work, we present recent advances, analyzing their performance according to the same experimental protocol. The results suggest the potential of comparative attributes as a way to improve Automatic Signature Verification systems.

Amruta B. Jagtap, et al. [10] In this paper, we proposed and implemented an innovative approach based on upper and lower envelope and Eigen values techniques. Envelope represents the shape of the signature. The feature set consists of features such as large and small Eigen values computed from upper envelope and lower envelope and its union values. Both the envelopes are fused by performing union operation and their covariance is computed. The difference and ratios of high and low points of both the envelopes are computed. Lastly average values of both the envelopes are obtained. These features set are coupled with support vector machine classifier that lead to 98.5% of accuracy.

Shubhangi L. Karanjkar, et al. [11] In this method a signature is collected from the bank cheque by cropping the area of interest. Further it is trained and stored into the trained database. Then signatures to be tested are compared with the signatures that are stored into the test database. Area, centroid, skewness, standard deviation, mean of the signature images are the parameters used to recognize the signature. By comparing the signatures from the parameters that are derived, the system can recognize the original signature.

Derlin Morocho, et.al [12] This work explores the human ability to recognize the authenticity of signatures. We use crowdsourcing to analyze the different factors affecting the performance of humans without Forensic Document Examiner experience. We present different experiments according to different scenarios in which laymen, people without Forensic Document Examiner experience, provide similarity measures related with the perceived authenticity of a given signature. The human responses are used to analyze the performance of humans according to each of the scenarios and main factors.

Igor V. Anikin, et al. [13] the suggested a method for handwritten signature recognition based on fuzzy logic. First of all, our proposed some features of handwritten signature based on curvature properties with fuzzy values. Then we proposed a method for signature recognition based on comparing these fuzzy features. We used collection of signatures MCYT_Signature_100 for testing our method. Signature recognition experiment has been conducted with 100 users, 25 original and 25 fake signatures for each user. As a result, we have got FRR value 0.03 and FAR value 0.01 which are better than the results of some other methods.

Prachi Chauhan, et al. [14] Biometrics play a crucial role in establishing an individual's identity. A signature is one of the most widely recognized way to authorize transactions and authenticate the human identity as compared to other electronic identification methods such as fingerprint and retina scans. Due to a huge demand for authentication, fast algorithms need to be assimilated for signature recognition and verification. Human signatures can be treated as an image and the techniques of neural networks can be applied to them for recognition and verification. This paper exploits a database of samples of offline signatures that are captured in an image format and thisdatabase is used to train the neural network.

Ruangroj Sa-Ardship, et al. [15] This paper proposes an alternative way to increase the recognition rate by analyzing an important characteristic of input information, namely variability of signatures. The proposed method is based on the hypothesis; reducing the variability of signatures leads to boost up the recognition rate. Therefore, the variance reduction technique is applied to normalize offline handwritten signatures by means of an adaptive dilation operator.

Vineeta Malik.et. al in 2015[16] suggested that the benefits of this systems is that the user doesn't have to remember any password or data for identification purpose and authentication purpose. The advantage of this system is that the person is in a habit of signing daily and so his signature will remain same as that stores in the database. Verification system for signature are of two forms: static that is off-line and dynamic that is on-line. Satic digitalized image of the signature is used in static verification system. When documents like forms bank cheques etc. have to be verified in a restricted time, then the manual verification of a person's signature is often not realistic. This is the reason why a number of verification systems have been developed. Dynamics of the signature which includes pressure, coordinates, and angle of the pen are considered in the dynamic signature verification system.

Mujahed Jarad.et. al in 2014 [17] suggested that these Signatures are generally used as personal verification and this is the reason why there is a need for an automatic verification system. Verification of signatures can be performed either by offline or online method based on the application. Dynamic information of a signature is captured in online system at the time the signature is made. Offline schemes work on the scanned image of a signature. In this paper they have presented a method for verification of signatures by using the back-propagation algorithm of neural network. In this system extraction of the features is done using the neural networks and it then distinguishes different pattern among all the signatures. Back-propagation algorithm is used because it provides flexibility to use layers of any number. To evaluate and test the system, a number of signatures were collected from different sources so as to train the system. The result with respect to speed, accuracy and throughput were excellent.

Othman o-khalifa.et. al. in 2013 [18] suggested that in this paper they explain the characteristics of an offline signature verification procedures and they also say that there is a need for the development of a robust and constructive signature verification system. It also highlights the evaluation among various methods and challenges to mend the verification systems. The main advantage of offline systems is to identify the correct person and offer secure services.

VII. PROPOSED METHODOLOGY

The proposed system works is implement offline signature recognition using PCA and Feed forward Neural network (FFNN) Approached. We extract signature features using histogram of orientation (Hog) and seven invariant moments.

VIII. CONCLUSION

This paper provides literature review on offline signature recognition techniques. As Recognition becomes widely used, there are some issues are there that need to be resolved. There is a large variety of different techniques with their own advantages and disadvantages. In this methodology we enhance the security levels of signature to detect the true user and safe our documents. There are several approaches for offline signature verification, Each technique has its different advantages and disadvantages, depending on feature set selected for different techniques can be used to get optimum results.

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