ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 9, September 2013

Online Signature Verification Using Energy, Angle and Directional Gradient Feature With Neural Network

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Abstract*:* Signature used as a biometric is implemented in various systems as well as every signature signed by each person is distinct at the same time. It is very important to have anonline computerized signature Verification system differentiate digital signature. Hand written signature used every day at various places (Bank, Office etc) for the authentication of a person, but a signature of a person may not be same at different time or it may be generated by some fraud way. So therobust system is required for verification of the signature. The signature verification can be done either online or offline, here we are using online signature verification network. In the proposed system the signatures is taking as a image by the signature pad and apply image processing technique before the feature extraction to make the system effective. The angle, energy and chain code features are used in this paper to differentiate the signature. Neural network is used as a classifier for this system. The studies of online signature verification are given in this paper.

Keywords: Directional Feature, Energy Density, Chain Code, Neural Network.

I. INTRODUCTION

For human identification, the usage of biometrics is important in daily routine. Signature may be used as a biometrics as every signature is distinct. The problem occur in signature verification system is hard to decide whether the two different signature signed by the genuine signer is identical or not because the signature signed by the person may vary according to its mood, health, etc. As signature has already used and accepted as an identification of the person who signed in so many systems, it is important to keenly observe the signature because it may be forgery before having any conclusion about the signee. This gives rise to a computerized signature verification system. Before modeling the computerized signature verification system, better we should know about different type of forgeries.

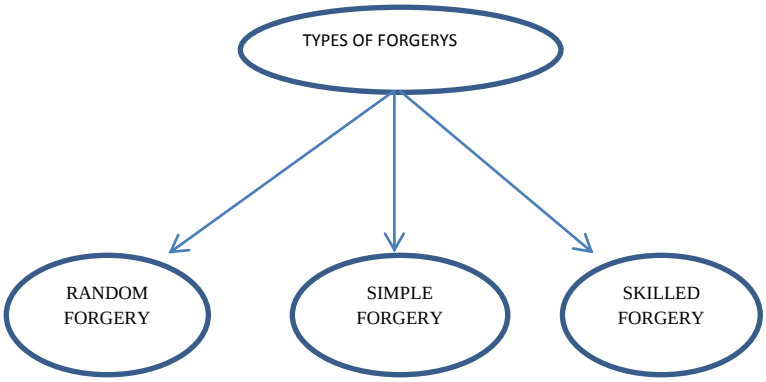

Fig. 1 :Types of forgery

ISSN: 2319-8753

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- Random forgery: It produced without any knowledge of signature shape or even the signer's name.
- Simple forgery: It is produced by knowing only the name of the signer's but without having any examples of signer's signature style.
- Skilled forgery: It is produced by looking at an original signature sample, attempting to imitate it as closely as possible.

The random & simple forgery is easily detecting but skilled forgery required efforts. So our proposed work is based on skilled forgery.

Types of signature verification system

a) On-Line or Dynamic Signature Verification system.
b) Off-Line or Static Signature Verification system.

Off-line verification system requires less hardware and depends upon the static features of signature image. Where as in the On-line system dynamic feature 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 position where the stylus is raised from and lowered onto the paper, number of break points, maximum/minimum pressure of stylus contact, speed etc.

Signature Characteristics:

The system used for analysis of signature must use the concepts of image processing. Most probable, it is possible that the signature of a signer varied for every sign but there must be some unique characteristic to identify the signature so that it can be used as biometrics. Some essential characteristics are listed below:

a) Invariant: It should be constant over a long period of time.
b) Singular: It must be unique to the individual.
c) Imitable: It must be irreproducible by other means.
d) Reducible and comparable: It should be capable of being reduced to a format that is easy to handle and digitally comparable to others.

II. BRIEF LITERATURE SERVE

We start discuss an on-line signature verification system based on dynamic time-warping (DTW). The DTW-algorithm originates from the field of speech recognition, and has been applied successfully in the signature verification area more than once. However, until now, few adaptations have been made in order to take the specific characteristics of signature verification into account. By disconnecting the DTW-stage and the feature extraction process we are able to deal efficiently with this extra amount of information [1].Fingerprint verification is one of the most reliable personal identification methods. However, manual fingerprint verification is so tedious, time-consuming, and expensive that it is incapable of meeting today's increasing performance requirements. An automatic fingerprint identification system (AFIS) is widely needed. It plays a very important role in forensic and civilian applications such as criminal identification, access control, and ATM card verification. This paper describes the design and implementation of an on-line fingerprint verification system [2]. Dynamic signature verification (DSV) uses the behavioral biometrics of a hand-written signature to confirm the identity of a computer user. Signature verification technology requires primarily a digitizing tablet and a special pen connected to the Universal Serial Bus Port (USB port) of a computer. An individual can sign on the digitizing tablet using the special pen regardless of his signature size and position. The signature is characterized as pen-strokes consisting x,ycoordinates and the data will be stored in the signature database [3]. Handwritten signature is one of the most widely used biometric traits for authentication of person as well as document. In this paper we discuss issues regarding off-line signature recognitions. We review existing techniques, their performance and method for feature extraction. We discuss a system designed using cluster based global features which is a Multi algorithmic offline signature recognition system [4]. In offline signature verification system dynamic

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International Journal of Innovative Research in Science, Engineering and Technology

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features are not available obviously, but one can use a signature as an image and apply image processing techniques to make an effective offline signature verification system. Author proposes a intelligent network used directional feature and energy density both as inputs to the same network and classifies the signature. Neural network is used as a classifier for this system [5]. In case of offline signature verification system dynamic features are not included obviously, but we can use a signature as an image and apply image processing techniques to make an effective offline signature verification system. Author wants to illustrate two techniques reviewed by him on Offline signature Verification. Those techniques are mixed of Energy with Angle and Energy with Chain Code [6]. Algorithm for verification of signatures written on a pen-input table. The algorithm is based on a neural network, called a "Siamese" neural network. Signature used as a biometric is implementation in various systems as well as every signature signed by each person is distinct at same time. So it is very important to have a computerized signature verification system [7]. This papers presents DWT based Off-line Signature Verification using Angular Features (DOSVAF). The signature is resized and Discrete Wavelet Transform (DWT) is applied to get four bands. The approximation band is considered and skeletonized. The exact signature area is cropped and resized so that the fair comparison is made among the signatures to produce better result. The angular features are extracted by dividing the signature image into number of blocks. The angular features of database and test signature are compared using distance metric. It is found that the values of FAR and FRR at optimal threshold are better compared to that of existing methods [8]. Dynamic on-line signatureverification system is a need of our present condition. The effectiveness of any on-line signature verification system depends mainly on the robustness of the dynamic features use in the system. Inability to extract highly discriminative dynamic features from signature has been contributing to higher verification error-rates. On-line signature verification experiments are conducted on seven dynamic signature features extracted from signature trajectories. Three features are found to be highly discriminative in comparison with others [9].There are many techniques have been reported for handwriting-based writer identification. The majority of techniques assume that the written text is fixed (e.g., in signature verification). In this paper we attempt to eliminate this assumption by presenting a novel algorithm for automatic text-independent writer identification. Given that the handwriting of different people is often visually distinctive, we take a global approach based on texture analysis, where each writer's handwriting is regarded as a different texture [10].Algorithms for extracting global geometric and local grid features of signature images were developed. These features were combined to build a multi-scale verification function. This multi-scale verification function was evaluated using statistical procedures. Results indicated that the multi-scale verification function yielded a lower verification error rate and higher reliability than the single-scale verification function using either global geometric or local grid feature representation [11].

III. PROPOSED METHODOLOGY

We are proposing a network with mixed feature among energy density,angle and directional feature. With this study we come to a final solution with high accuracy and less time consuming.The design of the proposed system is divided into five parts.

Data generation:

The signature database will consists of number of scanned signature images, 8-bit gray-scale. They will organize into 10 sets, and each set corresponds to one signature enrollment. There will be 50 genuine and 50 forgery signatures in a set. Each volunteer will be asked to sign his or her own signatures on a white paper 24 times. After this process had been done, we will invite some people who are good at imitating other's handwritings to generate forgery.

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Fig. 2:Data generation optical pad

Pre-Processing:

Any image-processing application suffers from noise like touching line segments, isolated pixels and smeared images. This noise may cause severe distortions in the digital image and hence ambiguous features and a correspondingly poor recognition and verification rate. Therefore, a preprocessor is used to remove noise. Preprocessing techniques eliminate much of the variability of signature data. Before processing the image for feature extracting some preprocessing algorithms are applied on the scanned image like Binarization, Denoising, Thinning algorithm because thin image required less storage memory as compared to original image also skew removal.

Feature Extraction:

The choice of a powerful set of features is crucial in signature verification systems. In our system, we use Energy, Angle and chain code features. The detail description features are as follows.

Energy Density:

In this method, two features are used for training. Aspect ratio is used as a global feature and energy density is used as local feature. Aspect ratio is the ratio of Height (maximum vertical distance) to length (maximum horizontal distance) of the signature. We have calculated it after skew removal. Energy density is defined as the total energy present in each segment.

Angle:

In this method first the Pre-processing image is resized and partitioned into four portion or cell using the equal horizontal method after that each partition(cell) are divided in to 3 row and 3 column of equal size so we have total nine sub cell of each cell. Now consider the sub cell one by one and calculate the angle of each with pixels by considering the bottom left corner after that calculate the mean value of the angles this process is repeat for all the sub cells.Once the value of angles for each sub cell is found then calculating the mean value from that to determine the value of angle for that cell or partition. This process is repeat for the reaming three partitions, so at the end we have the angle vector of size 1*4. Which is given as a input to the neural network. For example the data base used consist 100 signature samples. For one sample we have angle vector of size 1*4 so for all 100 sample we have feature vector of size 100 *4 which is used as a final data base for training the neural network and also for classification.

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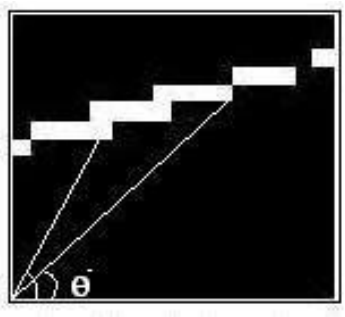

Fig 3: Find the angle and calculate the mean value

Chain codes:

Chine codes are used to represent a boundary by a connected sequence of straight-line segment of specified length and direction. Typically, this representation is based on 8-connectivity of the segment. The direction of each segment is coded by using a scheme shown in figure 4. Chain codes based on this scheme are referred to as Freeman chain code (Gonzalez and Wintz, 1987).

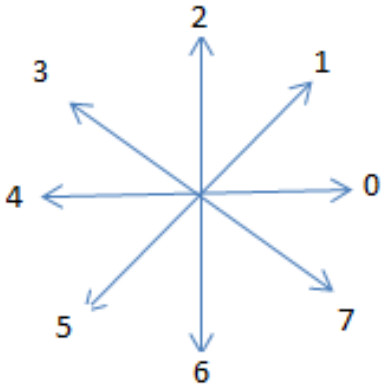

Fig 4: Direction number for 8-direction chain code

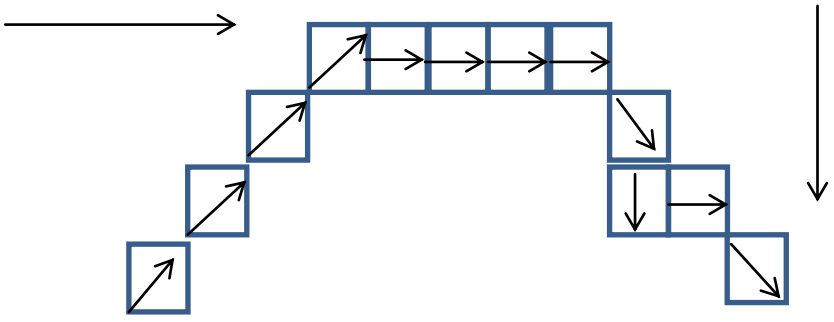

Fig 5: Direction change in a part of a signature

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IV. CONCLUSION

The paper gives in depth review of handwritten signature recognition systems and special consideration is given to the analysis of Dynamic Signature Recognition Systems (SRS). The performance metrics of typical systems are compared along withtheir feature extraction mechanisms. We have discussed an online SRS based on energy, angle and direction feature set as well as mixed global features. This is a multi-algorithmic system; such systemscombine the advantages of individual feature sets and improve theRecognition rates. The proposed method was successfully made the online signature verification with improve the efficiency and accuracy and easily can detected the skilled forgeries.

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