STM JOURNALS

Journal of Artificial Intelligence Research & Advances
ISSN: 2395-6720 (Online)
Volume 4, Issue 2
www.stmjournals.com

A Survey Paper on Offline Signature Recognition with Various Techniques

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Abstract

The signature recognition (SR) and verification technique is used to appreciate and confirm character's handwritten signature. Nowadays handwritten signature is among the most commonly permitted personal attributes for identification verification. Signature verification provides authorization in financial and business transaction. Signature verification finds its application within the area of internet banking, passport verification approach, provides authentication to candidates in public examination from their signatures, credit cards, bank cheques, etc. Due to the growing amount of handwritten signatures, it is vitally fundamental that a person offline handwritten signature to be identified uniquely. A signature is a behavioral biometric characterized by way of behavioral trait that a creator learns and acquires over a period of time and turns into his specific identification.

Keywords: *Image, signature recognition, template matching, neural networks, support vector machine*

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INTRODUCTION

Biometrics is the technology used for measuring and studying a person's specific traits. There are two kinds of biometrics: behavioral and physical. Behavioral biometrics is more frequently than no longer used for verification; at the same time, as bodily biometrics can be used for both, identification and verification. Among the many distinctive forms of biometric awareness programs corresponding to fingerprint, iris, DNA, face, voice, vein structure palm, etc., signature is the normally used bio-metric. On the basis of signature acquisition method within the pc gadget, signatures are classified as on-line and offline signatures [1].

TYPES OF SIGNATURES

There are two important forms of signatures which can be:

Online Signature

In case of on-line approach, the signer signs on the digital pad where it turns into simpler as compared to offline signature, to measure the dynamic aspects just like the speed, writing, stroke utilized, path, stress utilized are extracted which increases the accuracy rate.

Offline Signature

In offline approach, the dynamic characters of signature cannot be extracted which drops down the accuracy rate, the signature is written on paper and such kind of dynamic information is not available (Table 1). The uniqueness in the signature of the same individual and more noteworthy fluctuation have been seen because of the illness, age, time, emotional state, propensities or different irregularities are known as interpersonal varieties; additionally, the variety among original and forgeries come into the classification of entomb personal variations [2].

A signature is a handwritten depiction of anyone's name, nickname or every other picking out mark that is a proof of his or her identity. It will have some intrapersonal version, even when it comes from an identical man or woman due to geographical factors, age, emotional state, illness or due to any other motive as good as interpersonal variant approach variations between originals and forgeries. Forgeries are then additionally labeled into three special categories specifically: random, easy and skilled.

Table 1: *Comparison between Off-line and On-line Verification [3]*

Off-line Verification	On-line Verification
1. Verification depends upon analyzed image of person's signature.	1. Verification relies upon capturing and analyzing the real-time signature, because the person signing it.
2. Having various noise included	2. Zero noise included
3. Information obtained slightly	3. Faster than offline verification.
4. Fast verification process	4. Faster than offline verification.
5. Fairly high degree of accuracy.	5. Very high degree of accuracy.

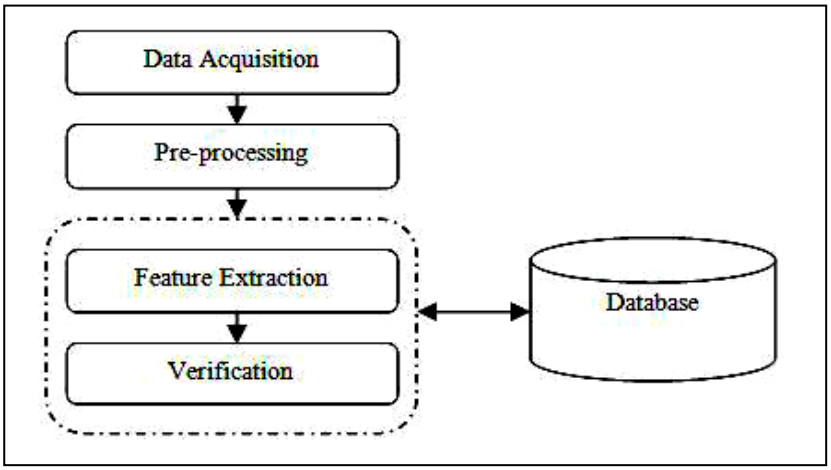

Fig. 1: *General Overview of Signature Verification.*

Forgeries

Random Forgery

The signer uses his/her own sort to forge the victim signal to make a forgery is known as random phony. It is to an extremely simple to admire by using the naked eye. These signatures should not center on any skills of the original signature.

Simple Forgery

The signer does no longer has any prior expertise to forge the victim's sign for forgery, is referred to as simple forgery.

It is additionally simple to watch by means of the human eye. These are built up on a suspicion of how the signature looks like by means of comprehension the name of the signer.

Skilled Forgery

It is the most troublesome than relaxation of all forgeries. The signer is capable and has related knowledge to duplicate the victim's sign to make falsification or in other phrases it is an imitation of the original signature. It is extremely hard to recognize via eye even via the verification process [4].

GENERAL METHODOLOGY OF SIGNATURE VERIFICATION

The first technique on how to help question operations on encrypted information with bucketization, after the facts are encrypted, the General methodology of signature verification includes the following steps (Figure 1).

Data Acquisition

This stage acquires the signature from the client through cameras, mobile phone and examined utilizing the scanners, with the goal that data is accessible in advanced configuration for further preparing.

Pre-preparing

Pre-processing is urgent stride to enhance the precision and diminish the computational needs of feature extraction and classification stage. Its principle reason for existing is to make the mark general and prepared for the trademark extraction. It fundamentally incorporates after strides.

Noise Removal

Various noise filtering techniques (Like, Mean, Median, Gaussian filters, Average filter, etc.) are applied to diminish noise experience amid a filtering process.

Change of Color Image to Gray Image
It changes over the color image of signature to a gray scale image. Grey scale pictures just contain shine data. Contrasted and parallel images contain richer information. Gray scale images contain 8 bits data.

Resizing
The image is cropped, to the bounding rectangle of the signature. So, it should be resized to a standard size.

Thinning
The purpose of the thinning is to do away with the thickness difference at each image pixel. After performing the thinning, image data of the offline signature has almost same quality of image data as online signature.

Smoothing
It is commonly used to scale down noise within an image or to supply a much less pixilated image. Nice smoothing algorithms can both eliminate various noises and maintain important points. It preserves high frequency components.

Feature Extraction
The success of signature verification step depends in most cases on the choice of the strong sets of points extracted. Feature extraction technique extracts attributes and characteristics from the given image and records it for further purpose. Feature extraction is broadly divided into three fundamental classifications:

1. Global features;
2. Local features; and
3. Geometric features.

Global Features
Here, signature is seen in general, and angles are removed from the entire pixel binding the signature image. These elements are similar to signature area, height, width, aspect ratio, edge point, horizontal and vertical center of the signature, horizontal/vertical projection peaks, number of closed loops local slant angle number of edge focuses, number of cross focuses, global slant angle, baseline shift and so forth. Global elements are suitable for random forgery but they do not give a high accuracy for skilled forgery.

Local Features
These components are separated from a part or a restricted field of the signature image. They are additional exact as in correlation with worldwide components. One of the neighborhood elements are the slant angle of a subtle element, number of dark pixels, length ratio of two consecutive parts, central line features, corner line features, position relation between the worldwide and local baseline, stroke elements, local shape descriptors, strain and slant features and critical points and many others.

Geometrical Features
These elements describe the attribute geometry and topology of a signature and maintain their global as well as local properties. It describes the geometric normal for the signature image. It can endure with distortion, variety versions, rotation variants and certain degree of translation.

Option of making use of world or local features depends on the whole on style of the signature and the types of forgeries to be detected from the system. A suitable mixture of world and local features has been improving a classifier's capability to recognize forgeries and to tolerate intrapersonal variances.

Verification
Verification is a decision making step of the cognizance approach. Performance of the verification depends upon the accuracy of the elements. Quite a lot of tactics used for the off-line signature verification techniques are established on the template matching process, statistical method, structural or syntactic process, spectrum analysis procedure and neural networks process.

Template Matching Approach
Template matching process is the procedure of matching the templates. It matches the scanned signature with the training signature (exact sig.) saved in a database. This approach is discreet but inflexible technique of pattern realization.

In a statistical technique, every last example is represented within the form of elements and thinks about as a point in a d-dimensional space. Features must be selected in such an

approach that the design vectors having a place with special categories disjoint areas and occupy compact in a d-dimensional feature space. This approach is used to perform some statistical proposal like the relation, deviation and so forth between more of them two data items to find the precise relation between them.

Structural Procedure

In structural process, each pattern is represented within the time period of symbolic data structure corresponding to graphs' bushes. To recognize any unknown pattern (cast sig.), its symbolic illustration is compared with the prototype saved in a database. This procedure is most often used in combination with different approaches. For bigger accuracy, this strategy requires large data set and big computational efforts.

Spectrum Analysis Approach

Spectrum analysis strategy is used to decompose curvature-situated signature into multi-resolution layout. This strategy can also be applied to extraordinary language like English, Chinese language. It is most more often than not used for the long signatures like some of Indian script signature.

Neural Network Approach

Neural network (NN) is a network of small processing units modeled on human nerve tissues. NN method is really utilized in signature verification. The major traits of neural networks are that they have got the capacity to learn complex nonlinear input-output relationships, use sequential training systems and adjust themselves to the info [5].

DEFINITION OF TERMS

Definitions of some terms that are used are as follows.

Pattern Matching

Pattern matching is the description or classification of measurements based on underlying model.

False Rejection (FR)

False rejection (FR) is when a genuine signature is rejected as a forged signature. Suppose that it is known beyond a shadow of a doubt that a given signature has been signed by a specific individual, which is honest to goodness. However, in the event that the framework negates this shellfish and rejects this signature as not that specific individual, such instances of rejection are termed as false rejection.

False Acceptance (FA)

False acceptance (FA) is the point at which a forged signature is acknowledged as a genuine signature. Assume that it is known beyond a shadow of a doubt that a given mark does not fit in with a man A. In any case, on contrasting and highlight vector of individual An, if the framework acknowledges the signature as having a place with the individual a, then such instances of acknowledgment are termed as false acknowledgment [6].

False Rejection Rate (FRR)

False rejection rate (FRR) is proportion of the quantity of genuine signatures rejected to the aggregate number of genuine signatures submitted.

FAR

FAR is ratio of the number of forged signatures acknowledged to the aggregate number of manufactured signatures submitted.

Average Error Rate (AER)

Average error rate (AER) is the normal of FAR and FRR.

Equal Error Rate (EER) is a point where FAR and FRR are equivalent.

APPROACHES TO SIGNATURE VRIFICATION

Template Matching

Fang *et al.* proposed two approaches for the recognition of skilled forgeries using layout coordinating. One framework is concerning the optimizing matching of the one-dimensional projection profiles of the signature patterns and the other is founded on the elastic matching of the strokes within the two-dimensional signature patterns. Given a scan signature to be confirmed, the positional editions are when put, subsequent with the information of the training set and a choice situated on a distance measure and every last binary and grey-level signature images are validated. The original verification error rate of 18.1% was as soon as finished when the local peaks of the vertical projection profiles of grey-level signature images were

used for matching and for full estimated covariance matrix integrated.

Real verification efficiency is having an effect on by way of the variation of signature stroke widths and a registered signature image selected from a set of samples in off-line signature verification using a sample matching plan.

Ueda proposed the modified sample matching process, in which unbiased of signature stroke width and collection of a registered signature image for Japanese signature verification. Experimental results demonstrated that the proposed strategies strengthen the identification.

Neural Networks

The proposed approach uses shape features from changed direction function and specific facets as floor area, length skew and centroid characteristic where signature and is isolated into two parts, and for every half of a perform of the center of gravity is calculated with regards to the horizontal axis. For classification, two approaches are:

- Comparing the resilient back propagation (RBP) neural network and
- Radial normal perform (RBF) utilizing a database of 2106 signatures containing 936 extraordinary and 1170 forgeries. These two classifiers register 91.21 and 88% real confirmation individually [6].

In the works of McCabe, several network topologies are tried and their precision is looked at. The best form of the NN based HSV framework utilizes a solitary MLP with one hidden layer to model every user's signature. It is prepared utilizing five certified signatures and one hundred zero-exertion forgeries. Utilizing this approach, a 3:3% OER is accounted for the best case.

If signature is caught and displayed to the user in an image position; at that point, signatures are confirmed cbn utilizing parameters removed from the mark in view of various image preparing procedures. It helps in recognizing the definite individual and it gives more exactness of confirming marks when contrasted with prior works. For verification of signatures some novel elements needs to be extracted. For implementation of above, this paper uses feed forward neural network (FFNN) for realization and verification of signatures of members.

Hidden Markov Model

The method of Justino *et al*. uses the graphometric features, that is, static elements like the thickness of pixels and the pseudo element components represented through axial slant. They appoint grid segmentation and divide the signature image into four zones, each with column containing cells with horizontal and vertical projections. Each and every column is changed to a characteristic vector assigned a numeric value. HMM is used for the learning and verification procedure.

In, a process is offered that makes use of only global elements. A discrete radon become which is a sinograph, is a measure for each signature binary image at variety of 0−360_, which is the performance of complete pixel in the image and the depth per given pixel calculated utilizing non-overlapping beams per perspective for X number of angles.

Because of the way of this periodicity, its shift, rotation and scale invariant; HMM is utilized to demonstrate each writer signature. The framework accomplishes an AER of 18; 4% for an arrangement of 440 specific signatures from 32 writers with 132 expert forgeries [6].

The surmising taken structure, the signature to be prepared or acclaimed is vertically separated into sections on the focal point of gravity using the separation reference positions of the pixels. Number of segmented signature pieces is the same as the number of states in the HMM for every user whatever the size of the signatures. That shows positive signatures a recognition rate of 99.2% is viable.

Fuzzy Logic Based Approaches

In this, global points of the signature, just like the skeleton of the pen trace and the structure of higher and minimize envelope are used as shape descriptors. These are obtained via sampling upper and external facets from the binary image of the signature. High pressure areas where the creator made extra stress or emphasis to be generated to a linear operate that is be used for

maximizing the correlation between the vertical and horizontal projections of the skeleton. For every of the above shape descriptors a multi-layer notion is assigned and the community is proficient with a modified back propagation set of rules, and the output of each and every person network is combined through a fuzzy imperative voter. Utilizing a scan set of 1000 signatures, the method got 90% true verification.

The creators propose the framework that extracts angle features that are displayed into a fuzzy model in light of Takagi-Sugeno model. The model is reached out to incorporate structural parameters that record for variation in writer's styles and changes in mood and the inputs are optimized to derive multiple rules. This approach obtained over 70% true verification.

In find points as control points on the boundary of the signature. These points which are locations of the boundary, show the structural characteristics of a signature. Four unique sorts of nearby components are extricated from control points on set of training signatures and these elements are fuzzified for preparing of FIS. As per that output of FIS, after that, settle on choice that test signature is forged or genuine. Effectiveness of the algorithm relies on upon varieties between preparing signatures, so if the training signatures of the specific person are not enough similar to each other, the algorithm cannot have good performance and a long way (False Acceptance cost) will develop.

Statistical Approach

It makes use of statistical information, the relation, variation, and many others, between two or extra data items can really conveniently be determined. Strictly speaking, to find out the relation between some collected data items, we most often comply with the guideline of correlation coefficients. Statistical centered on departure of two variables from independence. Efficiency and some distance (False Acceptance expense) will develop.

To confirm an entered signature with the support of a natural signature, which is received from the set of, beforehand collected signatures, follows the proposal of correlation to find out the amount of divergence in between them.

A Bayesian model is utilized for off-line signature verification including the representation of a signature for the period of its curvature is generative for specifying the knots in a difficult calculation, limited to a buffer vicinity almost a template curvature, beside impartial time warping scheme.

In this case, prior shape information in regards to the signature can be developed into the analysis. The perception model is identified with added substance white noise on the underlying curvature. This technique is implemented making use of Markov chain Monte Carlo (MCMC) algorithm and used as set of necessities circumstances of Shakespeare's signature [6].

Support Vector Machine (SVMs)

In this case, prior shape expertise in regards to the signature can also be constructed into the analysis. The remark model is concerning added substance white noise on the underlying curvature. This strategy is carried out using Markov chain Monte Carlo (MCMC) algorithm and used as set of specifications events of Shakespeare's signature.

Support Vector Computing Device

SVMs are machine learning algorithms that use an excessive dimensional function area and estimate variations between lessons of given data to sum up unseen data. The system uses global, directional and grid elements of the signature and SVM for classification and verification. The database of 1320 signatures is used from 70 writers. 40 writers are used for testing, with each signing eight signatures, as a consequence, a total of 320 signatures were obtained for training. Supposed for first testing the approach, uses eight normal signatures and eight forgeries achieve FRR 2% and some distance 11%.

In discrete radon change into used for extracting world aspects from the signatures. During enrollment number, reference signatures are utilized for each enlisted individual and get adjusted to concentrate measurements about that user's signature. We explored different avenues regarding SVM classifier and KNN

classifier. Utilizing a database of 2250 signatures (genuine signatures and gifted forgeries) from 75 writers, our present framework accomplishes an execution of approximately 80% when SVM classifier is used and a performance of approximately 70% in the case of KNN classifier.

In proposed system, signature database was utilized for training the SVM. Then the signature verification accuracy of the model has been evaluated in terms of FAR, FRR and FIR. Accordingly, SVM portrayed in this paper effectively checks the off-line signature with 90% precision.

Structural or Syntactic Process

Notion of structural and syntactic sample awareness is to furnish the patterns by the use of symbolic data structures identical to strings, trees, and graphs. To admire an unknown pattern (forged signature), it is a symbolic illustration of comparing with a range of prototypes saved in a database. Structural features use modified direction and transition distance attribute (MDF) which extracts the transition places and are founded on the relational group of low-degree elements into higher-level structures. The modified direction feature (MDF) makes use of the position of transitions from atmosphere of foreground pixels within the vertical and horizontal instructional materials of the boundary characterize an entity.

Nguyen *et al*. presents a new approach, in which structural features extraction from the signature's contour utilizing the (MDF) which extended variant EMDF, at that point two neural network-based ways and SVMs are researched and thought about for the method of signature verification. The classifiers had been advised situated on specified specimens and some other randomly chosen signatures taken publicly existing database of 3840 exact signatures from 160 volunteers and 4800 unique strong signatures. A distinguishing blunders value (DER) of 17.78% was once received with the SVM whilst retaining the false acceptance expense for random forgeries (FARR) below 0.16% [6].

LITERATURE SURVEY

Liu *et al*. presented a variable period signature for near-duplicate picture coordinating in this paper [7]. An image is spoken to via a signature, the length of which varies with appreciate to the number of patches within the photo. A brand new visible descriptor, viz., probabilistic core-symmetric local binary pattern, is proposed to represent the looks of every picture patch. Beyond each character patch, the spatial connections among the many patches are captured. So as to process the similarity between two images, we utilize the earth mover's distance which is excellent at dealing with variable-length signatures. The proposed image signature is evaluated in two distinct purposes, i.e., near duplicate record image retrieval and near-duplicate natural image detection. The promising trial results uncover the validity and effectiveness of the proposed variable-length signature.

Karthikeyan *et al*. presented that saliency detection is one of the outstanding areas of research due to the fact that it is used in many pc vision functions [8]. In this study, a visual saliency model is proposed which is bottom-up method that is used to identify salient regions of an image. The proposed procedure combines two properties to find the salient areas. First, the proposed approach uses a certain image descriptor alluded to as image signature which approximates the foreground of the image and the foreground separated image is filtered to spotlight visually salient regions. Secondly, it utilizes the property of human visible approach known as human visible acuity to increase the saliency map. This saliency technique predicts human fixations in a greater method than other existing approaches on Bruce and Tsotsos benchmark dataset.

Jayanthi *et al*. presented that procedure is compared with four other earlier approaches: I integrated region matching, fuzzy integrated region matching, color salient facets and shape features and interactive CBIR using Ripplet turn out to be and fuzzy relevance ideas mechanism which used the identical data set and evaluation strategy [9]. In keeping with the

arrived end result, the efficiency of the proposed three regions: color, straight line and outline sketch signatures centered CBIR approach used to be vastly higher than different when put next approaches.

Ettabaa *et al*. presented that remark has fostered the thought of adopting 3D illustration of spectral signature to course multi-temporal hyper spectral image [10]. The foremost cause of this illustration is to have for every object a compact model which illustrates their spectral variant over the time; it symbolizes the variation of reflectance as a performance of time and other worldly waveband. In this paper, we propose another methodology for multi-worldly hyper spectral image characterization taking into account 3D spectral signature to relief the concern of spectral variant. This method consist, predominant, to represent each pixel of labeled image by a 3D spectral signature after the applying of the strong 3D modeling strategy "Non-uniform Rational foundation Spline" (NURBS), after, to utilize local form descriptor "spherical harmonic decomposition" to extract spectral features from every 3D spectral signature and, subsequently, to class the photo by means of supervised classifier "SVMs" with Radial basis Function (RBF) kernel. To investigate this method, we used a chain of multi-temporal hyperspectral "hyperion" images.

Opdenbosch *et al*. presented that large discount within the complete computational complexity, which makes it viable for the matching of image signatures instantly on the mobile device [11]. The distinctive residences of this signature sort the basis of our proposed scalable streaming approach that preemptively hundreds image signatures of reference images within the nearby of the person onto the mobile device to mitigate the outcomes of network latency. To be able to furnish effective streaming, we compress the signatures by means of making use of utilizing exploiting the similarities of spatially neighboring reference images. In mixture, the contributions of this paper effect in an indoor localization system, which makes it possible for instantaneous digital camera-centered indoor positioning with very low specifications on the available network connection.

Wang *et al.* presented the image signature technique for content material authentication [12]. Inside the inspiration, form let change is utilized to extract image characteristic, and the information of contour let change coefficients are utilized to generate image signature Then a tampering detection and tampering localization set of rules are evolved by way of using generated image signature. Proposed approach is mighty for perceptually insignificant distortions provided by content maintaining manipulations similar to JPEG compression, including noise, filtering, and many others. It is sensitive to the adjustments brought about via malicious attacks, and it possesses the functionality to become aware of the converted image areas.

Chowdhury *et al.* presented the novel substance based image retrieval (CBIR) approach, where every image in the database is spoken to by method for a compact image signature which is figured using the no subsampled contour let get to be (NSCT) and fuzzy-C-way (FCM) method [13]. To enhance the retrieval accuracy, the proposed system accommodates least rectangular support vector machine (LS-SVM) based classifier, earth mover's distance (EMD) and relevance feedback mechanism (RFM). Extensive experiments have been utilized to assess the effectiveness of the proposed approach on simplicity image database along with a 1000 images. Experimental results and comparisons demonstrate that the proposed CBIR process performs comfortably in image retrieval domain.

Alam *et al.* present that data hiding is a powerful idea in computer security that enables the relaxed transmission of data over insecure channel by means of concealing the normal expertise into one more cover media [14]. Whilst text data hiding is relatively a phenomenon in computer safety purposes, image hiding is gaining rapid status due to its prevailing applications as an image is extra controlling to include useful information. In this study, we have carefully investigated the proposal of steganography via incorporating

image hiding within one more image with a secure structural digital signature framework. Our proposed work entails the initial image preprocessing tasks via filtering of the host picture adopted by means of embedding of the secret image and outline of the snapshot data inside the host image. Later, the stego snapshot is given as an enter to the digital signature framework by which we ensured the relaxed, legit and mistake-free transmission over wireless channel of our secret data. The promising experimental finally suggests the advantage of this framework.

USING THE TEMPLATE

Discussed in Tables 2 and 3.

Table 2: *Different Approaches Used in Offline Signature Verification [15].*

Features	Classifiers	Dataset	Accuracy
Random Transform and Fractal Dimension	SVM	SVC-2004	-
Curve let Transform, edge detection, Hough Transform	Modular Neural Network (MNN) with Mandeni Fuzzy Inference System, Artificial Neural Network	Used 270 Images, 210 Training and 60 Testing	96%
Projection and Local point density, COG, Spatial Frequency Distribution	Euclidean Distance, Least Square Error	100 Images	-
Statistical Analysis Using Chi Square Test	PSO-NN Algorithm Probability	GPDS	78%
Projection &Local point Density, COG, Spatial Frequency Distribution	Feature Vector, Correlation, Mean and Deviation	-	-
Radon Transformation Fractal Dimension With Kart method [5]	SVM Based on (SRM), SVM 3 kernels	SVC 2004	92.2% of FAR 10% of FRR
Interpolation Using NN	KNN, Learning Vector Quantization, Euclidean Distance Metric	945 Signs	94%
Energy method, Directional Feature Method, Chain Code used as a Directional Feature	Neural Network	100 signs 50 forged 50 genuine	
Global & Local features, Distance Matrices, Geometric Normalization	Euclidean Distance, Gaussian Empirical Rule, CMC curve	5400 Signs	97.17%
Static Image Processing, Novel Feature Extraction	Euclidean Distance	160 Sign s 80 genuine 80 Skilled forged	FAR is 1% FRR is 0.5%
Grid Features, Global Features	KNN Classifier, Neural Network(NN)	600 sign	FAR is 4.16 FRR is 7.51%
Binary Feature Vector, Gradient Direction Extraction, Aquinas Spatial Pyramid	Automatic Classifier & Manual Classifier	CEDAR & GPDS	92% on CEDAR, 87% on GPDS
Discrete Wavelet Transformation, Image Registration, Image Fusion	Registration by finding COG & with Euclidean Distance	90 sign	92.2%
Graph Matching (Biparti te Graph), Radon Transformation	Euclidean Distance, Cross Validation, HMM, Hungarian Method	-	-

Table 3: *Different Approaches Used in Online Signature Verification [15].*

Features and Classifiers	Dataset Users/Sig	Accuracy
BPNN, Probabilistic Model and Fusion	SVC 2004	FRR=0.3 FAR=0.5
Dynamic Time Warping	SVC 2004	FRR=5.5 FAR=4.13
Support Vector Machines Based on LCSS Kernel Function	SVC 2004	ERR 6.84
Neural Networks Classifiers and Fuzzy Inference	20/600	FRR=21.5 FAR=3.5, FRR=3.5 FAR=0.0
HMM/ANN	MCYT	ERR 0.12
PWC, HMM	MCYT	EER 6.67 EER 2.12
Bp ANN	150	
Bayes classifiers	94/1247	
HMM	2/120	FRR:6.67 FAR:0.0
	40/1440	FRR:9.94 FAR:0.5
	2/1100	FRR:11.3 FAR:2.0
String Matching	102/1232	FRR:2.8 FAR:1.6
PDF Classifiers	5/25	FAR:5

CONCLUSION

Signature is one of the accepted biometric traits for the identification. Like every other biometric functions, the signature is specific to everybody. Many of the fields that need authentication use the signature as identification. So many technologies have been emerging in this field. Handwritten signatures made by each person can have various features. These characteristics cannot be reproduced by any other person as such, even though there may be some structural similarities visible. Depending on the type of characteristics that we are considering, the signatures are of online and offline. Most of the studies show that the online systems are working more effectively than offline systems since the former use an input device to acquire some additional capabilities, normally referred to as dynamic capabilities. Signature has been a distinguishing biometric feature for a long time. They are extensively used as a means of personal verification; therefore, an automatic verification process is needed. Even at present, thousands of financial and business transactions are being approved via signatures. Signature verification finds its utility in a large number of fields opening from on-line banking, passport verification methods to even authenticating candidates in public examinations from their signatures. This paper represents a quick survey of a few off-line signature attention and verification schemes.

REFERENCES

1. Sameera Khan, Avinash Dhole. A Review on Offline Signature Recognition and Verification Techniques. *International Journal of Advanced Research in Computer and Communication Engineering*. Jun 2014; 3(6): 6879–6882p.
2. Abdul Salam Shah, Khan MNA, Asadullah Shah. An Appraisal of Off-line Signature Verification Techniques. *I J Modern Education and Computer Science (IJMECS)*. 2015; 4: 67–75p.
3. Vala KA, Joshi NP. A Survey on Off-line signature Recognition and Verification Schemes. *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*. Mar 2014; 3(3): 7735–7740p.
4. Divjyot Singh Puri, Rachit Garg. A Survey for Offline Signature Verification and Recognition Techniques Using Image Processing. *ICRTEDC*-2014. May 2014; 1(Spl. Issue 2): 35–38p.
5. Patel Bhumika A, Shashwat Kumar. A Survey on Handwritten Signature Verification Techniques. *International Journal of Advance Research in Computer Science and Management Studies*. Jan 2015; 3(1): 182–186p.
6. Surabhi Garhawal, Neeraj Shukla. A Study on Handwritten Signature Verification Approaches. *International Journal of Advanced Research in Computer Engineering & Technology*. Aug 2013; 2(8): 2497–2503p.
7. Li Liu, Yue Lu, Suen Ching Y. Variable-Length Signature for Near-Duplicate Image Matching. *IEEE Trans Image Process*. Apr 2015; 24(4): 1282–1296p.
8. Karthikeyan M, Muneeswaran K. Detecting Visual Saliency Using Image Signature. *IEEE*. 2015; 302–305p.
9. Jayanthi L, Lakshmi K. An Improved Content Based Image Retrieval using Three Region Colour, Straight-Line and Outline Signatures of the Image. *ICICES2014*. S.A. Engineering College, Chennai, Tamil Nadu, India, IEEE. 2014.
10. Karim Saheb Ettabaa, Med Ali Hamdi, Rafika ben Salem. SVM for Hyperspectral Images Classification Based on 3D Spectral Signature. *International Conference on Advanced Technologies for Signal and Image Processing, ATSIP'2014 IEEE*. Mar 17–19, 2014; 42–47p.
11. Van Opdenbosch D, Schroth G, Huitl R, *et al*. Camera-Based Indoor Positioning Using Scalable Streaming of Compressed Binary Image Signatures. IEEE. 2014; 2804–2808p.
12. Xiaofeng Wang, Lixin Zhang, Kemu Pang. A Contourlet-Domain Image Signature for Content Authentication. *Ninth International Conference on Intelligent Information Hiding and Multimedia Signal Processing IEEE*. 2013; 555–558p.
13. Manish Chowdhury, Sudeb Das, Malay Kumar Kundu. Compact Image Signature Generation: An Application in Image Retrieval. *5th International Conference on Computer Science and Information*

Technology. 2013; 1–7p.
14. Fahim Irfan Alam, Md. Mohaiminul Islam. An Investigation into Image Hiding Steganography with Digital Signature Framework. IEEE. 2013.
15. Yogesh VG, Abhijit Patil. Offline and Online Signature Verification Systems: A Survey. *International Journal of Research in Engineering and Technology*. 2014; 3 (3): 328–332p.

Cite this Article
Priyanka Chauhan, Nirupma Tiwari. A Survey Paper on Offline Signature Recognition with Various Techniques. *Journal of Artificial Intelligence Research & Advances*. 2017; 4(2): 19–29p.