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A Review Paper on Signature Recognition

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Abstract— There are two types of signature verification system are present offline (static) and online (dynamic). When a person has done a signature on a paper or on a document then it is called offline or static signature. The offline signatures images are obtained by scanner or captured by a camera. It is used in governmental documents, and many different official purposes. Hand written signature is mostly biometric used in transaction as a general authentication like bank cheques, and credit cheques. Mainly biometric identification has two types of phase 1) recognition and 2) verification. Online signature captured by pen based tablet and also depending on the pressure of the pen, ups and downs of the pen and time stamping. Online signature is more trustworthy and accurate but offline handwritten signature is more user friendly than online signature.

Keywords— Biometric System, Signature Verification, Signature Recognition, Forgery

I. INTRODUCTION

A problem of personal verification and identification is an actively growing area of research. The methods are numerous, and are based on different personal characteristics. Voice, lip movements, hand geometry, face, odor, gait, iris, retina, fingerprint are the most commonly used authentication methods. All of these and behavioral characteristics are called biometrics. The biometrics is most commonly defined as measurable psychological or behavioral characteristic of the individual that can be used in personal identification and verification. The driving force of the progress in this field is, above all, the growing role of the Internet and the requirements of society. Therefore, considerable applications are concentrated in the area of electronic commerce and electronic banking systems and security applications of vital installations. The biometrics has a significant advantage over traditional authentication techniques (namely passwords, PIN numbers, smartcards etc.) due to the fact that biometric characteristics of the individual are not easily transferable, are unique of every person, and cannot be lost, stolen or broken. The choice of one of the biometric solutions depends on several factors:

User acceptance
Level of security required
Accuracy
Cost and implementation time

Biometric and biomedical informatics are the fast developing scientific direction, studying the processes of creation, transmission, reception, storage, processing, displaying and interpretation of information in all the channels of functional and signal systems of living objects which are known to biological and medical science and practice. Modern natural sciences at present sharply need in the updating of scientific picture of the world, and the essential contribution in this process can be made by the biometric and biomedical methods. Only some more simple (statistical) forms of biometric and biomedical information have found their application when person identification, and raised interest for these methods of identification can be caused by new possibilities of information technologies.

II. TYPES OF SIGNATURE RECOGNITION

Handwritten signature verification has been extensively studied & implemented. Its many applications include banking, credit card validation, security systems etc. In general, handwritten signature verification can be categorized into two kinds – on–line verification and off–line verification. On–line verification requires a stylus and an electronic tablet connected to a computer to grab dynamic signature information. Off–line verification, on the other hand, deals with signature information which is in a static format. In On–line approach we can acquire more information about the signature which includes the dynamic properties of signature. We can extract information about the writing speed, pressure points, strokes, acceleration as well as the static characteristics of signatures. This leads to better accuracy because the dynamic characteristics are very difficult to imitate, but the system requires user co-operation and complex hardware. Digitizer tablets or pressure sensitive pads are used to scan signature dynamically. In off–line signature recognition we are having the signature template coming from an imaging device, hence we have only static characteristic of the signatures. The person need not be present at the time of verification. Hence off-line signature verification is convenient in various situations like document verification, banking transactions etc. As we have a

limited set of features for verification purpose, off-line signature recognition systems need to be designed very carefully to achieve the desired accuracy. The aim of this work is to design and develop an offline handwritten signature verification system that will differentiate between original signature and closer forge signature depending on some special features.

The present work has following objectives:

Design a system to proof genuineness or authentication of a person's signature.

Identify some special properties of a genuine signature to distinguish it from the forge one.

Analyze the skilled forgery by extracting features and comparing it with features of genuine one.

In this research work, a scanned image of signature has to be saved in JPG or JPEG (can be saved in other format) format. After that this signature will go for pre- processing stage. There after feature extraction process performs and finally checking operation performs between original signature's data (fetching from database) and this data. Offline signature verification basically uses Image Processing concepts. The system mainly used toolboxes provided by MATLAB environment

III. LITERATURE SURVEY

One of the main advantages of biometric systems lies in the fact that the user does not have to remember password or any other important data for authentication and identification purpose. Signature verification has the advantage of a very high user acceptance because people are used to sign in their daily life. Different papers provide different types of research work for signature recognition which are explained below.

In [1] the authors, Vahid, Hamid and Reza introduced a new method, Radon Transform for offline signature verification. In this proposed method Radon Transform is used as a feature extractor and they also used SVM as a classifier. And locally Radon Transfer also used for detection of line segmentation. In this method there are two major steps, one is pre-processing and another is feature extraction. They took datasets of 20 classes (Persian) and 22 classes (English), after experimenting with these classes individually the authors compared the methods. In pre-processing stage first they scanned all the signature images. Then they binaries the scanned images and after that the outer rectangular portion was selected and the margin of the signature is removed. In colour inversion process the signature image was inverted and the Radon Transform counts the pixel value. In [1] the method works locally so the segmentation applied on these signatures images. After that the feature extraction which includes 4 steps is applied; detect the line segment, validation of existence of the line segmentation, extract and summarize the feature vector and finally normalized the feature vector. At last they calculate the False Acceptance Rate and False Rejection Rate values.

S. Biswas et. al [2] introduced a procedure to extract features from Handwritten Signature Images. They have used cluster technique for verification of the offline signatures. For offline signature verification, feature was extracted which is based on vertical and horizontal segmentation. From every small blocks of signature the data have been picked up after the segmentation both vertically and horizontally. The offline hand written signature image will be processed in four stages, i) pre-processing, ii) Region of Interest Detection and Scaling, iii) Feature Extraction Stage and iv) Signature Images Clustering. In [2], for signature image verification the authors have introduced three new Feature Extraction procedures , a) Signature Height Width Ratio, b) Signature Occupancy Ratio, c) Distance Ratio calculation at boundary, d) Compute the length and ratio of Adjacency Columns, and e) Compute the number of spatial symbols within the signature Image. In [2], for each person they create separate clusters for set of sample signatures. For test a signature belong which cluster K-Nearest Neighbours' (KNN) clustering Technique is used by them**.**

In [3] the authors have proposed Persian signature, instead of using text different shapes are used and therefore different procedure must be used to authenticate such signatures. In [3], an offline method has been suggested that is based on image registration, DWT (Discrete Wavelet Transform) and Image Fusion process to identify and verify Persian signatures. DWT is the first process which is used to access the signature details, then different instances of the same person signatures are fused together to obtain the signature details and to improve the fusion process registration method was used. The Euclidean distance is used in the classification phase to compare the features.

Debnath Bhattacharyya et. al. [4], has proposed an algorithm to verify offline hand written signatures which are applying by some statistical methods. Using the statistical tool a deviation in between sample testing and the trained samples is calculated. For applying the statistical tool the value is generated, the decision is taken up on that value. Firstly collecting no_of_signs for testing purpose then generate Avg_sign which contains the set of features of testing signatures. Then the algorithm converts the testing signs in 2D array which hold the binary value i.e. 0 and 1. The average data set is procured from the binary array by using the proposed statistical method. The correlation coefficient is calculated by comparing two binary data sets obtained after analysis of Avg_Sign and Sample_Sign. The primary objective in [4], algorithm Saohsv_avgpiccalc will compare the offline signature with a standard signature in order to verify the offline signature. Application of statistical analysis on a set of signatures gives us the standard signature. The total number of signatures and corresponding signatures are analyzed by this

function to provide the decision for the acceptance of the given signatures.

In [5], the authors proposed a novel method, rotated complex wavelet filter, which captures information in twelve different directions for offline signature identification. In [05], to derive feature extraction of the signature, the authors used the dual tree complex wavelet transform (DTCWT) and rotated complex wavelet filters (RCWF). And they also used Canberra distance method in identification stage for comparing features. In [5], there is a comparison between the rotated complex wavelet filters (RCWF) and dual tree complex wavelet transforms (DTCWT). The experimental results proved that the signature identification rate of rotated complex wavelet filter method is superior over dual tree complex wavelet transform (DTCWT). The method is also compared with standard discrete wavelet transform (SDWT) which captures information in only three directions.

In [6], the authors Prashanth C. R. and K. B. Raja introduced a new method for Off-line hand written Signature Verification, which is based on Angular Features (OSVAF). In [6], the discrete wavelet transform (DWT) is applied as a noise removal. And DWT is also used to improve the spatial domain features of the hand written signatures. By pre-processing the scanned image of the signature is skeletonised and the images of the signature obtained in accurate signature area. There are two phases in which the angular features are extracted with respect to centre of the signature. The first phase comprises division of the signature into 128 blocks using the centre of signature. This is done by counting the number of black pixels there by determining the angular feature in each block to produce 128 angular features. In the second phase comprises the division of the scanned signature image into 40 blocks from each of the four corners of the scanned signature to create 40 angular features. From phase one and two 168 angular features are considered for signature verifications. To authenticate the signature, the threshold value is compared and computed with the difference between the angular features of the test signatures and training signatures.

Jesus et. al. [7] focused on pseudo-dynamic characteristics; they used features representing information of pressure distribution of a handwritten signature in a gray scale image. Pixels representing shapes or grey scale of static signature written with high pressure may appear as darker zones and the different values for pressure correspond with variation of gray levels conforming histogram. In the experiment carried by the authors [7] the database contains 24 genuine signatures and 24 forgeries of 100 individuals. In [7] authors used pseudo-cepstral coefficients calculation for signature parameterization.

IV. DETECTION OF FORGERY

Off-line verification just deals with signature images acquired by a scanner or a digital camera. In an off-line signature verification system, a signature is acquired as an image. This image represents a personal style of human handwriting. A signature verification system typically focuses on the detection of one or more category of forged signatures. Different categories of forgery are shown in figure 1 below.

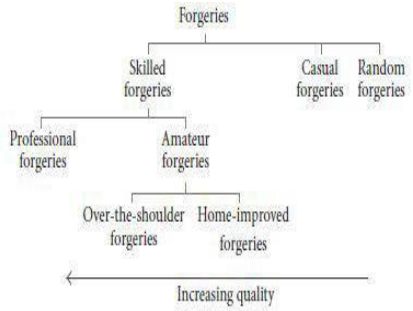

Figure 1: Types of forgeries
(Source: https://scholar.sun.ac.za/)

A *skilled* forgery is produced when the forger has unrestricted access to one or more samples of the writer's actual signature (see Figure 2 b). A *casual* forgery or a *simple* forgery (see Figure 2 c) is produced when the forger is familiar with the writer's name, but does not have access to a sample of the actual Signature stylistic differences are therefore prevalent. A *random* forgery or *zero-effort* forgery (see Figure 2 d) can be any random scribble or a signature of another writer, and may even include the forger's own signature. \

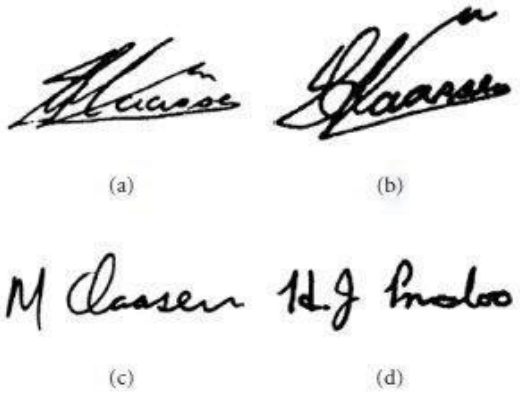

Figure 2: Example of a (a) genuine signature, (b) skilled forgery, (c) casual forgery, and (d) random forgery for the writer "M. Claasen." (Source: https://scholar.sun.ac.za/)

The genuine signatures and high quality forgeries for other writers are usually considered to be forgeries of this type. Skilled forgeries can be subdivided into *amateur* and *professional* forgeries. A *professional forgery* is produced by an individual who has professional expertise in handwriting analysis. They are able to circumvent obvious problems and exploit their knowledge to produce high quality; special forgeries (see Figure 3 b)

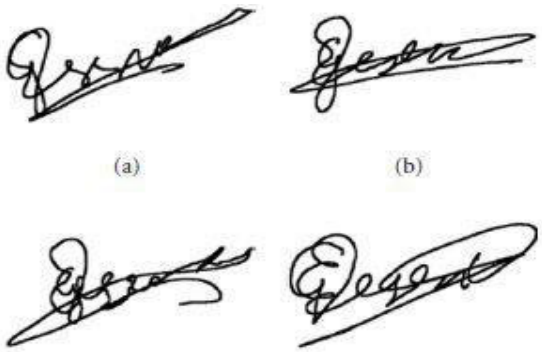

Figure 3: Example of a (a) genuine signature, (b) professional forgery, (c) home-improved forgery, and (d) over-the-shoulder forgery. (Source: https://scholar.sun.ac.za/)

V. CONCLUSION

One of the main advantages of biometric systems lies in the fact that the user does not have to remember password or any other important data for authentication and identification purpose. Signature verification has the advantage of a very high user acceptance because people are used to sign in their daily life. Signature verification systems are said to be static (off-line) or dynamic (on-line). Static verification systems use a static digitalized image of the signature. When a large number of documents, e.g. bank cheques, have to be authenticated in a limited time, the manual verification of, say the persons' signatures, is often unrealistic. This led to the development of a wide range of automatic off-line signature verification systems. On the other hand dynamic signature verification systems use the dynamics of the signature including coordinates, pressure and sometimes angle of the pen as a function of time.

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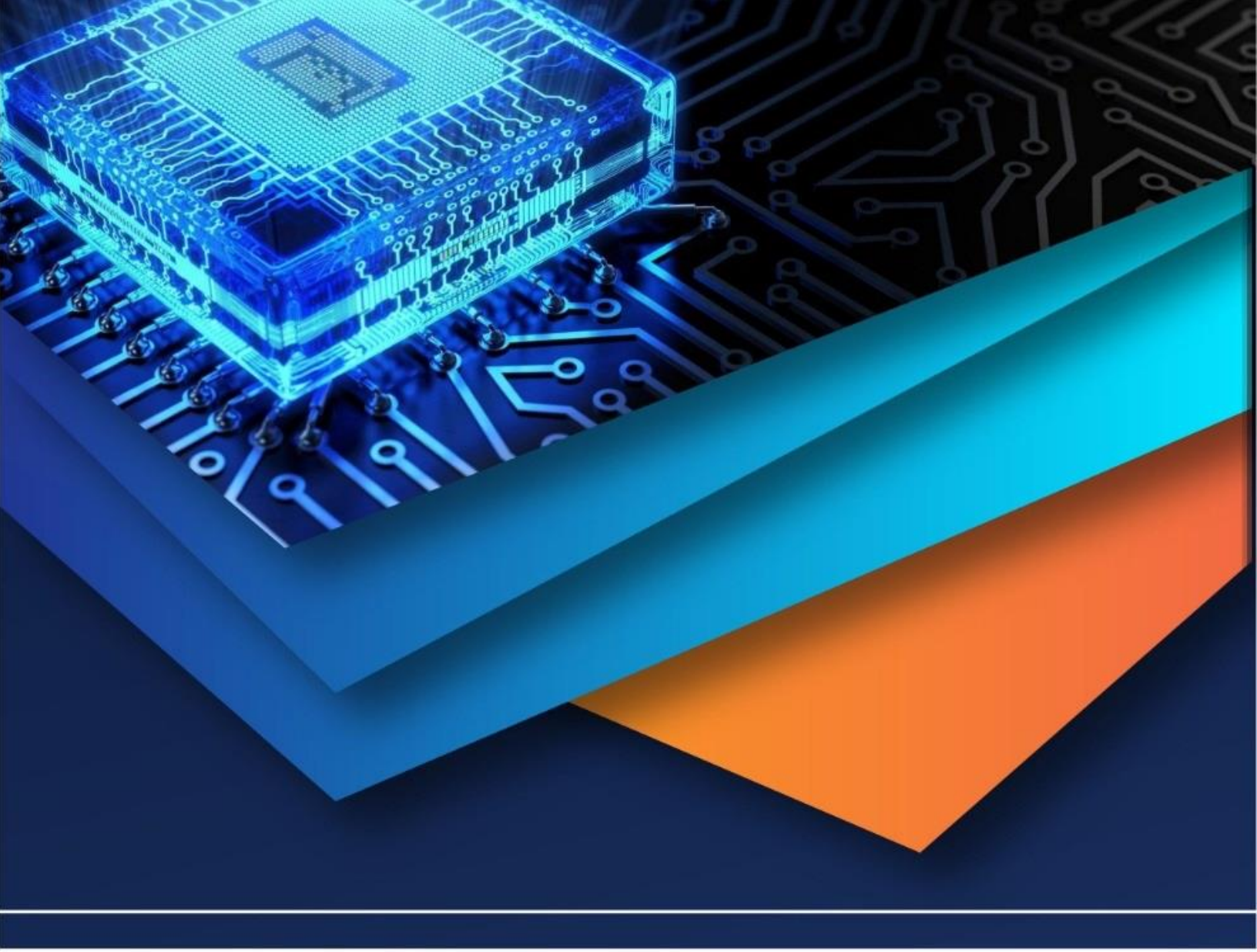

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