Review of Signature Verification Technique

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Abstract - *In today's world Signature plays a crucial role. It depicts a person name graphically or in handwritten form. It is the best form of recognition of an individual. Other attributes also plays a big role in recognition but signature is best feature among them. In order to permit a check or it is a mark as well as mark made by an individual to execute a document and signify knowledge, acceptance, or obligation. A signature is also categorized on the basis of Biometric authentication where a user's identity is established by means of physical trait or certain behavioral characteristics. . Signature facilitate us enforce security in many such cases for e.g. transactions at banks, wills, assets, government documents etc .We investigated the impact using artificial neural network (ANN) and Surf algorithm. The EER (equal error rate) is achieved as 14.64.*

Key Words: **Biometry, ANN, signature verification, FRR (False Rejection Rate), FAR (False Acceptance Rate), Forgery, image processing, SURF.**

1. INTRODUCTION

Signature depicts a person name graphically or in handwritten form. It is the best form of recognition of an individual .Other attributes also plays a big role in recognition but signature is best feature among them. In order to permit a check or it is a mark as well as mark made by an individual to execute a document and signify knowledge, acceptance, or obligation. A signature is also categorized on the basis of Biometric authentication where a user's identity is established by means of physical trait or certain behavioral characteristics. There are two different categories of verification system based on the mode of signature acquisition one is *Online* in which the signature is captured during the writing process and making the dynamic information available, and other being *Offline* for which the signature is acquired after the writing process and, therefore, only static information is available. Signature facilitate us enforce security in many such cases for eg. Transactions at banks, wills, assets, government documents etc. As Major documents such as cheques, property papers are generally subjected to malpractices. Hence prerequisite of automatic signature verification becomes unavoidable as the degree of processing and locating the individuals augmented several fold in legal and financial transaction. Thus an automated signature verification system is mandatory. The principal objective of the signature verification system is to make out the exclusive characteristics of personal styles of writing.

1.1 TYPES OF VERIFICATION TECHNIQUE

Broadly there are two types of techniques involved. These are explained below.

1. Offline Verification (static): Offline methods generally does not want any particular acquirement of hardware , just a pen or pencil and a paper, they are therefore less persistent and most user friendly as compared to online signature verification. Data collection is done by scanning individual handwritten signature. Features are extraction from signature image and used for signature verification. Since, the scanned image will be used for the signature verification only.

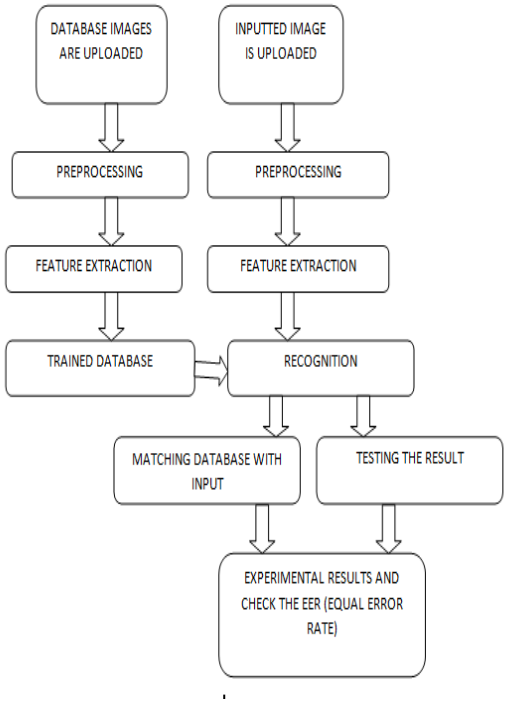
2.Online Verification: In an online system, special devices are used like digital pen, digitizer for data acquisition. It generates dynamic information such as location, pen pressure, velocity, coordinate values and speed of signature. Here the verification is performed in real-time. . It generates dynamic information such as location, pen pressure, velocity, coordinate values and speed of signature. In background, the verification is performed in real-time.

We know the fact that no two signatures are never the same, even if they were signed by the same person. However, even if signatures are accurately same, and one of them is not an original one but is a duplicate copy of the other and was obtained may be via machine copy, for e.g.by using photocopier or computer one copies a signature , or a manually produced copy. So our aim of the signature verification system is to organize between two types: the original and the fake one .The main objective of verification is to differentiate between real and imitate signatures and to avoid imitation. Broadly there are three different types of imitation.

1. *Random Forgery:* Person who doesn't grasp the shape of original signature. The person who just creates a signature with his own style by just knowing the name of a person.
2. *Unskilled Forgery:* The person who is a observant and creates a signature once or twice without any past experience.
3. *Skilled Forgery:* A Person having knowledge of original signature and have the sense of copy signature. . He copies a

signature after obtaining a good observance over it.he/she can be an expert in coping signature. Such signatures are most difficult to detect.

1.2. METHODOLOGY



1. Input Image: The first stage of the offline signature recognition system includes the input image where a image is taken as a input.GUI is created and the images which are stored un the database are obtained and using the Matlab software the preprocessed. Here input image is transformed into grayscale using software and various steps are performed for further operation

2. Pre processing : The background subtraction process is the first method of pre-processing. It is a technique which implements the difference between the current image and the image in the background used to detect the signature region. A typical methodology is to perform subtraction, after converting image is pre-processed

Ek(x,y){1 if|Fk(x,y)-Bk-1(x,y)|>T }
0 otherwise

where Ek (x,y) is the resultant difference, Fk (x,y) is the current frame and Bk-1(x,y) is the background initialized frame and T defines the threshold which restrain the shadow ehich rekon upon the value assigned.After background subtraction, median filtering is used to remove noise. Median filter perform 2d average sifting. The Median Filter block supersede the central value of an M-by-N neighborhood with its median value.

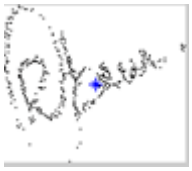


Fig.2.originalsignature fig.3. preprocessed signature

3. Feature extraction: Feature extraction techniques are an important and are used to get better the accuracy of signature . same characters of a signature are called features of that particular signature and precisely extracting these features called extraction. This process identifies and separates a person's signature from any other . This process is based on dissimilar type features such as local features, global features , texture features geometric features, face features and grid features.

4. Matching: Moving target characterization calculation is utilized separate person (i.e., passerby) from other closer view objects (viz., vehicles). Surf feature is used in this system for matching .which has not been used till date in the hand gesture recognition systems, these concentrated quirk vectors are usual to seeing single individual. Surf Feature is utilized for perceiving persons on the premise of stride. The matching of these features are done by SURF algorithm. Interest points are elected at distinctive locations in the image, such as bolbs, corners, and T-junctions. The significant property of a interest point detector is its repeatability

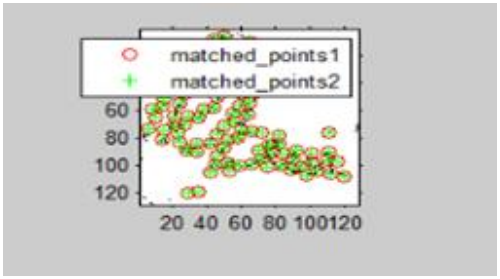


Fig.4.Matching of points.

5. Testing: In case of signatures are same result will be match successful. After that result are analyzed using NN tools. It is performed by using Neural Network (NN), which is defined as a set of interconnected neurons which used for universal approximation. Artificial neural networks are poised of interconnecting artificial neurons (imitate the properties of biological neurons). Good performance or human error pertaining to pattern can then be used as one source of evidence towards underneath the supposition that the abstraction really apprehend something noteworthy from the stance of information processing in the brain. Delta Rule algorithm as well as NNstart tool is used. The occurrence of accuracy Is not the only condition for the effective performance of this systems

2. Approaches Used

L.Basavaraj and R.D Sudhaker Samuel [1] introduced offline signature verification technique which was based on four speed stroke angle. It extracted the dynamic features of static signature image. It was based on the idea that intensity is directly comparative to the speed of the stroke. This method achieved FAR of 13.78% and FRR of 14.25%.

Shashi Kumar , R. K Chhotaray, D R K B Raja and Sabyasachi Pattanaik [2] introduced Off-line Signature Verification which was Based on Fusion of Grid and Global Features Using Neural Networks. The Fusion of global and grid features were used to generate dominant feature set and neural networks are used as classifier. FAR achieved was 4.16% whereas FRR was 7.51%.

Jesus F. Vargas and Mioguel A.Ferrer [3] proposed Offline Signature Verification which was Based on Pseudo-Cepstral Coefficients. This technique included from gray-scale images, its histogram was calculated and used as "spectrum" which further calculated the pseudo-spectral coefficients. Finally, the unique minimum-phase sequence was estimated and was used as feature vector for signature verification. Here the optimal number of pseudo-coefficients was expected for best system performance and FAR and FRR were 7.35 and 5.05 respectively

Ashwini Pansare and Shalini Bhatia [4].They extracted set of geometric features from a signature image which includes center of mass, area of signature, surface features, six fold surface features etc .FAR and FRR were reported to be 14.66% and 20% respectively.

Vu Nguyen, Michael Blumenstein Graham Leedham [5] proposed a signature verification system using SVM and features extracted are Global features based on the boundary of a signature and its projections. The first global feature was not an original version of the total energy to be produced in their signature. The another feature employed was information from the vertical and horizontal protrusion of a signature, focusing on the quantity of the distance between keystrokes in the image, and height/width of signature. The amalgamation of these features consisting of Modified Direction Feature (MDF) resulted in significant improvement in signature verification. FAR for random and targeted forgeries are 0.08% and 17.25% whereas FRR was found to be 17.25%.

Julio Martínez-R and Rogelio Alcántara-S [6] introduced On-line signature verification which was based on optimal feature representation and neural-network-driven fuzzy reasoning. Which created a positional signing model of a person consisting of shape features and dynamic features were also extracted from a set of original signatures. Afterward for each typical feature, an averaged prototype and evenness function were calculated using genetic optimization, this procedure derived from the concept of optimal feature representation in which FRR was 1.05% and FAR was 0.27%.

Patil [7] used the support vector machine which had the fast learning ability and differentiating these hyper plans in the high dimensional space feature. Main goal of this technique was to optimize the simplification bounds. The wavelets were used for the disintegration of signature image after considerate preprocessing step. The Gaussian Radial Basis Function kernel were used for classification and training. Here the Bounding rectangles were also put over the signature; the normalization was done for reshaping the signature image with the aspect ratio persistent for the unique signature. The image was carried out with bilinear interpolation method. To symbolize signature 80 features were used. For faster performance of the SVM classifier we used a Sequential Minimum Optimization method . For the training of SVM classifier, Sequential Minimal Optimization technique is used to carry out the optimization process a bit rapidly. For the linear kernel the FAR and FRR are 13% and 10% individually.

K B Raja, Shashi Kumar D R, Sabyasachi Pattanaik R. K Chhotaray [8] proposed OSV (offline signature verification) based on global features and fusion of grid using NN. They achieved FRR 7.51 and 4.16 FAR.

Mohitkumar A. Joshi, Hardik H. Adesara, Mukesh M. Goswami [9] have used low level stroke feature extraction technique which were originally proposed for recognition of a printed Gujarati text .SVM classifier along with RBF kernel was used for classifier. The EER had values ranging from 15.12 to 13.72.Thus,EER was having a range of 15 ± 2. The average EER was obtained as 15.59.

The approach carried in above results in more value of FRR and FAR. The techniques used also results in various errors and are insuffient. Neural Network Technique along with SURF results in stable value and the results were carried out for the various signature several values of FRR and FAR were noted. Here we used 15 test signatures for 10 individuals. The best results were obtained at FRR= 15.58, FAR= 14.01 at gamma function having the value of 0.11. Further increase in gamma gives reduction in FRR with the increase in FAR value and finally the FAR and FRR value cross over each other which is called as EER point. Further increase in gamma gives reduction in FRR and finally the intersection of FAR and FRR at a particular point gives us EER point. Clearly these results are better from the above work done. We can further apply new formulas or algorithm for the enhancement of accuracy in detection of signatures and reducing time for execution. The proposed algorithm can be implemented on different tools also . Comparision of various techniques along with FRR and FAR are discussed below in table 1.

Table -1: Comparison of methods used.

Sr no.	Method used	FAR(%)	FRR(%)
L.Basavaraj and R.D Sudhaker Samuel [1]	four speed stroke angle	13.78	14.25
Shashi Kumar , R. K Chhotaray, D R K B Raja and Sabyasachi Pattanaik [2]	Based on Fusion of Grid and Global Features Using neural networks	4.16	7.51
Jesus F. Vargas and Mioguel A.Ferrer [3]	Pseudo-Cepstral Coefficients along with estimation of unique minimum-phase sequence	7.35	5.05
Ashwini Pansare and Shalini Bhatia [4]	Extracted set of geometric features from a signature image which includes center of mass, area of signature, surface features, six fold surface features	14.66	20
Vu Nguyen, Michael Blumenstein Graham Leedham [5]	SVM and features extracted are Global features based on the boundary of a signature and its projections	17.25	17.25
Julio Martínez-R and Rogelio Alcántara-S [6]	optimal feature representation and neural-network-driven fuzzy reasoning	0.27	1.05
Patil [7]	support vector machine along with Gaussian Radial Basis Function kernel were used for classification and training	13%	10
K B Raja, Shashi Kumar D R, Sabyasachi Pattanaik R. K Chhotaray [8]	OSV (offline signature verification) based on global features and fusion of grid using NN.	4.16	7.51

3. Conclusion

The basic advantage of implementing neural networks is that they can extract the most discriminative and representative set of features. We have presented a learning vector quantization neural network architecture based on varying parameters and eliminating redundant hidden layer units or blind neurons that learns the correlation of patterns and recognizes handwritten signatures. The network classifier is trained on the random training samples to perform recognition task on the input signature image. . The Empirical results yield an accuracy rate of 98% for a random test set of 15 handwritten signature images of 10 persons on the network that is trained with another set of images of same subjects. In the proposed work Equal Error Rate (EER) achieved is 14.64 which is better than previous result which is by far better than the above results.

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