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# Examination and Comparison of Signatures by Computational Technique

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***Abstract:*** *Many signature verification techniques have been developed in order to distinguish between the genuine signatures and the forgeries. In this paper, an attempt is made to provide an effective method of examination and comparison of signatures by using a computational technique. For various legal problems and in relation to their admissibility in court this computational approach is given which is used as a reflection of the true state of evidence and to strengthen ones observation regarding differences among the two specimens. The computational method of measuring pixel values of signatures based on distance and angle based classification of signatures with better accuracy. The performance of this system is then calculated on the basis of False acceptance range and False rejection range, graphical representations and statistical analysis and provide the better result. Achieved results suggested the adequacy of the selected features. The experimental results is presented with the concluding mark that the presented method showed its accuracy up to 90-95%.*

***Keywords:-*** *Signature, Examination, comparison, computational approach.*

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## I. Introduction

A signature is a unique identity of a person in legal, financial, and administrative areas. It is gained behavioral biometric of a user to declare his/her unique identity on printed documents. **Bhattacharya *et al.* (2013)** it is composed of special characters and flourishes and uses to authentication one human beings from another. Signatures have assumed great importance and everybody, regardless of the social level in which he lives, must sign his name daily or many times a day. In many cases a document examiner will be asked to determine whether a suspected signature is genuine or forged.

**Legal issues in signature verification -** There is several Legal Issues in signature Examination which includes Individuality Problem that is whether the handwriting of every Individual is distinct. The Validation Problem that is whether the procedures used by examiners are repeatable and the Uncertainty Problem that is whether the inevitable uncertainty in individualization /exclusion can be quantified **Saran *et al.* (2013)** since no two signatures can be identical. No one can reproduce a signature exactly, like a printing process, and there are commonly wide variations found in the output of one person **Osborn A.S. (1929).**

Depending upon the acquisition of signatures online signature verification and offline signature verification is known. Here, the work is done on the offline signatures in which the scanned image of a signature and is used, useful in automatic verification of signatures found on bank checks and documents and in which only offline signatures are available. The proposed method starts with the scanning of images and converted it into an image file in the computer. Then, global features of signature were taken into account and with the help of MATLAB computational technique certain codes are inserted into the computer for the calculation of values. A signature database is prepared and verification of signature is performed and the result is concluded on the basis of finding. **MATLAB-** MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

## II. Methodology

Many researchers have shown few basic steps for offline signature verification. These can be classified into three basic steps i.e., Signature Acquisition, Pre-processing, Feature extraction. Here, global features of signatures are taken which are named as lowest, highest and the farthest point of a signature. **Saran *et al* (2013)**

**2.1 Computational analysis-** The developed signature verification system mainly used by calculating the parameters taken for the verification purpose followed by the image analysis provided by MATLAB environment. In order to train and test the developed signature verification system, a handwritten signatures database is created, which contains hand signatures of 50 persons, 50 genuine and 50 forged (all males) each of which is repeated 8 times, therefore total 100 samples were collected. The samples is scanned using a 300 DPI scanner for the computational analysis and converted it into an image file and stored in the computer process is known as digitization of sample and then Data Acquisition step were performed. Signature samples collected is scanned and saved as image files for the purpose of computational analysis. The samples were scanned on 300 dpi and preserved for experimental study. Global features is examined and characteristics features at pixel level were taken into account. Identification of edges of the signature is chosen so as to ensure that each and every strokes of the specimen is surrounded by the rectangular area i.e. from its top bottom, left, right. This step is basically used as cropping of image of signature within a rectangular area, and this step can be done by any photo editing app here we have used ADOBE PHOTOSHOP for cropping an image at a desirable range. Then cropped images were saved in a specific folder in the memory of computer. Dataset is created by computing the minima, maxima, and mean of three points of signature and the angle between them. The range of values is then compared between the query signatures and then a conclusion was made that whether the query signature belongs to the same person otherwise detected as forged one.

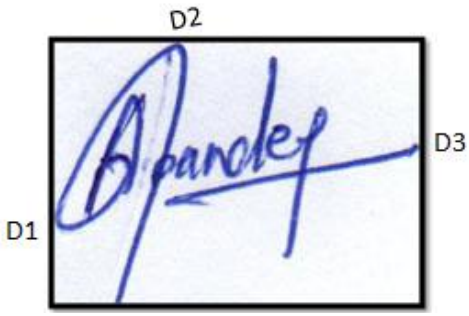


**Fig. 1** An image showing three Points D1, D2, D3

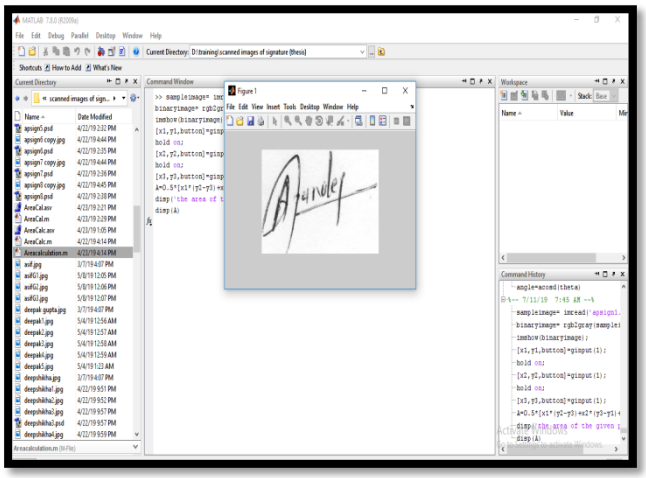

**Fig.2** Examination of questioned sample

**Statistical Approach-** Observed characteristics were then statistically evaluated using the t- test methodology. It is applied to check that whether the difference between the means of two samples different or significant and to check the alternate hypothesis and to reject null hypothesis i.e. no difference in reading values on the basis of result obtained.

**Table- 1** calculated value at point D 1

| Group | Group One | Group Two |
|---|---|---|
| Mean | 142.6800 | 193.1974 |
| SD | 57.8765 | 76.4150 |
| SEM | 8.1850 | 10.8067 |
| N | 50 | 50 |

**Table 2** Calculated values at point D 2

| Group | Group One | Group Two |
|---|---|---|
| Mean | 273.76 | 336.00 |
| SD | 103.27 | 118.65 |
| SEM | 14.61 | 16.78 |
| N | 50 | 50 |

**Table-3** Calculated value at point D3

| Group | GroupOne | GroupTwo |
|---|---|---|
| Mean | 349.44 | 424.44 |
| SD | 118.89 | 143.11 |
| SEM | 16.81 | 20.24 |
| N | 50 | 50 |

**Table-4** Calculated value of Angle

| Group | GroupOne | GroupTwo |
|---|---|---|
| Mean | 109.46 | 111.34 |
| SD | 21.88 | 21.52 |
| SEM | 3.09 | 3.04 |
| N | 50 | 50 |

## III. Validation method

For the purpose of validation of the proposed technique , 25 random genuine signature samples were collected and then the maximum and minimum distance values of three points and angle were compared with the training signature sample that were used to check the acceptance range. The values were compared with the previously noted values and the following observation was made as shown in fig. 4.6.2 below.

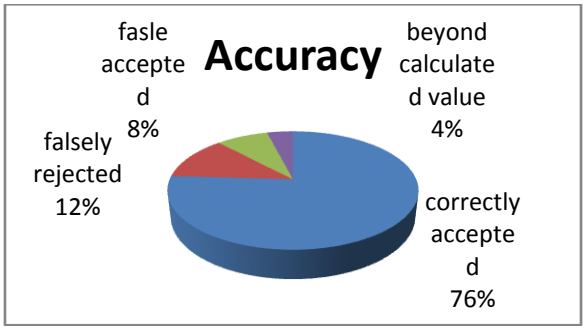


**Fig. 4** Performance rate of proposed technique

To measure the performance of this system false acceptance rate (FAR) and false rejection rate (FRR) is used. FAR is the percentage of forgeries that are incorrectly classified. FRR is the percentage of original signature that are incorrectly classified. For this purpose, 25 random genuine signature samples is collected and then the maximum and minimum distance values of three points and angle are compared with the training signature sample that are used to check the acceptance range. Out of these 19 samples were correctly accepted that shows accuracy up to 76%. 3 samples are found to falsely rejected (12%) 2 samples are false accepted (8%) and one was beyond the calculated value (4%). Experimental results proved that when only the mean values of distance are taken the accuracy was found up to 89%. However, accuracy is found to increase when the combination of three distance and angle is taken i.e. up to 90-95%.The experimental results clearly depict that this method can indeed differentiate forgery with actual ones with accuracy up to 90- 95% approximately.

## IV. Conclusion

It is concluded that two features were identified using computational technique for discriminating handwritten signatures. The identified features was evaluated using statistical test and was found that distance based features was significant in contrast to angle based feature which was insignificant, however the combination of both resulted in better accuracy.

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