



Analysis of Male and Female Handwriting

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Abstract: Handwritten Signatures are the most common biometrics used for authentication. In this paper, it has been analyzed that the handwriting of male writers is more consistent than that of female writers. The analysis has been done on the handwritten signatures of male and female writers. For database, 100 handwritten signatures have been taken from female writers and 100 handwritten signatures have been taken from male writers i.e. from 10 male writers and 10 female writers, 10 signatures have been taken from each. Database has been created by taking signatures from writers time to time by different pens. It has been observed from experiments that intra personal variations in male writer's signatures are less than that of female writer's signatures.

Keywords: Biometrics, Handwritten signatures, intra personal variations

I. INTRODUCTION

In this paper, there has been made a comparison of male and female handwritings on the basis of two criteria:

First, the signature has been verified and the FRR (False Rejection Rate)[1] has calculated, which can be defined as: **FRR (False Rejection Rate):** The percentage of original signatures that are falsely rejected by the system is called the False Rejection Rate (FRR) and is given by:

$$FRR = \frac{\text{No. of originals rejected}}{\text{No. of originals tested}} \times 100 \quad (1)$$

Verification is based on the technique [4] that verifies the human identity by extracting the pixel oriented and component oriented features from their handwritten signatures. The pixel oriented features used in this system are $m \times n$ matrix corresponding to the $m \times n$ grid over signature image[3], an array of size m , where each element of an array gives the number of black pixels in the corresponding row[3], and an array of size n , where each element of an array gives the number of black pixels in the corresponding column[3]. The component oriented features used in the proposed system are center of gravity in x direction[2], center of gravity in y direction[2], center of gravity slope[2], normalized sum of angles of all points of the signature content, contour area and aspect ratio. Verification phase of the proposed system has two steps: Global Verification and Local Verification. For global verification, pixel oriented features are used and for local verification, component oriented features are used. Features of test signature image are extracted and compared with the already trained features of the training signature image. If the signature is locally accepted as well as globally accepted then only it can be said that signature has accepted otherwise rejected. Fig.1 shows the verification[4] technique used here.

Second, the standard deviation of each feature of a signature of a male and a female writer has calculated by following formula:

$$S.D. = \sqrt{\frac{\sum_{i=0}^n (x_i - \bar{x})^2}{n}} \quad (2)$$

where x_i is the feature value of the i^{th} signature,
 $\bar{x}$ is the mean of n signature values
 n is total number of signatures(here $n=10$)

II. METHODOLOGY

For analysis, the database used consists of 100 handwritten signatures from female writers and 100 handwritten signatures from male writers i.e. from 10 male writers and 10 female writers, 10 signatures have been taken from each. I have to analyze the intrapersonal variations for each writer. This can be done in two ways by calculating:

- FRR of each writer
- Standard deviation for each feature of a signature of the writer

For FRR, pixel oriented and component oriented features [4] are extracted for each signature. 5 signatures of each writer are taken as reference signatures. Extract the required features for each signature and store the maximum and minimum values for each feature. Remaining 5 signatures are used as test images. Extract the features of test image and then verification [4] is done. In table I and II, the FRR values for male and female signatures are shown respectively. And for standard deviation, five features have been extracted for each signature. The features are:

- F1-Center of gravity in x direction [4]
- F2-Center of gravity in y direction [4]
- F3-Center of gravity slope [4]
- F4-Normalized sum of angles of all points of the signature image [4]
- F5-Aspect Ratio [4]

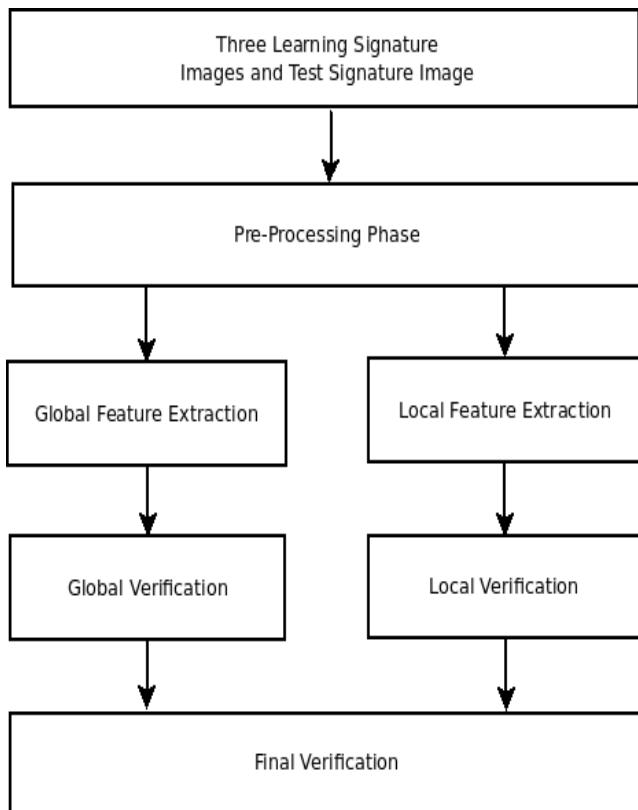


Figure 1. Block Diagram of the technique used for Verification[4]

Calculate the feature values of all signatures of each writer. Then calculate the standard deviation of each feature of all the signatures of each writer. Then compare the values for male and female writers. In the table III and IV , the values are shown for signatures of a male writer and that of a female writer .

III. RESULTS

Table I and II gives the FRR values of a male writer and that of a female writer. By comparing FRR values,I got the result that FRR of male writer is less than that of female writer i.e. there is less intra personal variations in male handwriting. Table III and IV gives the feature values of 10 signatures of a male and a female writer respectively. From Table V, it can be seen that standard deviation values of each feature of a male writer's signatures is less than that of a female writer's. Again it is due to less intra personal variations in male handwriting. Thus it can be seen from the results that there are less intrapersonal variations in male handwriting than female handwriting.

A. Verification Results of Male Signatures:

Table 1. Male Signature Verification Results

Threshold	FRR(%)
65	0
70	0.51
75	4.36
80	7.92
85	10.96
90	17.23
95	19.25
100	19.24

From Table I ,it can be seen that FRR is 7.92% for a male writer.

B. Verification Results of Female Signatures:

Table 2. Female Signature Verification Results

Threshold	FRR(%)
65	0
70	3.21
75	6.24
80	9
85	13.20
90	19.52
95	24.14
100	26.78

From Table II ,it can be seen that FRR is 9% for a female writer .

Table 3. Feature values of 10 signatures of a Male writer

Signature No.	F1	F2	F3	F4	F5
1	103	61	2.3	3.4	1.6
2	101	58	1.7	3.7	1.9
3	98	63	2.2	4.1	1.9
4	102	54	-2.9	3.6	2.1
5	98	57	-8.3	4.8	2.2
6	99	53	-7.7	5.1	2.2
7	97	67	0.5	3.6	2.1
8	105	53	-2.3	3.4	2.2
9	103	54	-1.1	3.9	1.8
10	100	58	0	3.4	1.8

Table 4. Feature values of 10 signatures of a Female writer

Signature No.	F1	F2	F3	F4	F5
1	83	65	-1.3	4.5	1.8
2	92	59	7.2	4.8	1.4
3	88	48	10.2	6.5	1.2
4	90	56	9.2	4.3	1.3
5	87	57	3.4	4.5	1.5
6	83	64	6.3	4.4	1.5
7	79	56	6.7	5.2	1.4
8	92	55	9.7	4.6	1.1
9	79	56	8.5	5.6	1.3
10	77	59	12.4	4.9	1.2

Table 5. . Standard Deviations of the Features of A Male and A Female Signature

Feature	Male Sign.	Female Sign.
F1	2.6	5.5
F2	4.6	4.7
F3	3.8	3.8
F4	0.6	0.7
F5	0.2	0.3

IV. CONCLUSION

For signatures of male writers, verification technique[4] gives FRR of 7.92% . For signatures of female writers, verification technique [4] gives FRR of 9% . From results it can be seen that male writers' signatures are more consistent than that of female writers' i.e. false rejection rate of male writers' is less than that of female writers'. Also, standard deviation of the features of signatures of a male writer is less than that of female writer. These both results are due to less intra personal variations in male handwriting. Thus, from the values of FRR and standard deviation I can conclude

that male handwriting is more consistent than female handwriting.

V. REFERENCES

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