



# **Feature Selection Based on Fuzzy Logic Algorithm for Signature Verification**

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**ABSTRACT:** Signature is the one of the technique to verify the person authority. In signature the feature selection gives more important to the verification . Various algorithm used to select the feature but compared with the offline signature verification method the online signature verification method used to identify the accurate result of the person identification. In this paper fuzzy logic algorithm used to select the proper features. Publicly available data base SVC2004 used to verify the result.

**KEYWORDS:** Fuzzy logic algorithm, Feature extraction, Feature selection, SVC 2004.

## **I. INTRODUCTION**

Biometric identification system based on person characteristics. The unchangeable person feature identify the person accurately. Signature have been used to identify the human behavioral characteristics without modification of the behavioral characteristics. Signature have unique identification in human hand geometry. The way of sign represent the individuality of the human characteristics.[1]

Two types of signature has been verified based on the acquisition devices namely off line and on line . In off line system the image of the signature obtained , analyzed and calculated. This system may give variations among the multiuser. Moving to online signature verification system , the signature captured while signing in digital tablet and PDAs. The various parameter has been selected to obtain the more accurate result. And also this signature are more difficult to forge[2]. The feature defined in two types. One is global if it is extracted from the entire signature and other one is local if it is extracted from the part of the signature.[3]

## **II. RELATED WORK**

The most online signature are collected as a real time signals and adopt the environmental changes, there are fluctuations of size, location of the angle, signature rotation, velocity, pressure for different users[4]. Many of the methods are followed to reduce the signature environmental changes[11]. Signature mainly divided into two types. Parametric approach , global approach, function based approach and local approach. In parametric approach a set of parameter is selected to design the pattern, the parameters of the reference and test signatures are used to select proper decision algorithm. In local approach some of the local variables such as size, pen pressure, velocity to be captured and identified the forgery signals.[4]. The interval valued symbolic features are selected to obtain the value based signature identification methods. The rotation of the angle to be minimized to be identified the exact features[5]. In many of the paper time functions related to the signing process are analyzed, the system provide the actual discriminative power to the system and also consistency feature are used to select the discriminative power of the signature. The legendre polynomial feature some time used to reduce the discriminative power calculation.[6]. The writer dependent feature characteristics to be selected to obtain the feature matching, such as velocity ,pen pressure, signature identification and feature level[7].

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## III. PREPROCESSING

Preprocessing is a method to remove the unwanted images in the original signature. There might be noises, distortion and fluctuations in the amount. So the signature should be preprocessed before verification. Some smoothing and normalization methods are used to remove the noise.

### a)Smoothing

Smoothing is the one of the process to remove the noises in the image. the signature curve represented  $x(n)=\{x1(n),y1(n),n=1,2,-----N\}$ . Each point in the curve fitted by smoothing algorithm with six point . the first and last point are calculated using the below expression.[4].

The first point is

$$x(n)=[a(n)*b(n)]* b(n)*b(n) \text{ -----1}$$

where

n- represents no of users.

a,b are the genuie and forgery users.Maximum no of users 40.

The middle point to be obtained

$$X(n-5)=[a(n-5)*b(n-5)*b(n-5) \text{ -----2 .}$$

### b)Normalization

The statistical method used to identify normalization of the smoothed signal. The mean and standard deviations are used to calculate the normalization value of the signal. Mean value of the signature is zero and variance goes to one. The normalized histogram equalization value using linear normalization with respect to white matter distribution is given by [8].

$$G_{ij}=f_i\sigma_i(\mu_i+\sigma_i) \text{ -----3}$$

The  $f_i$  - the fabonics series of the images.

$\sigma_i$ -variance of the image.

$\mu_i$ -standard deviation of the image.

## IV. PROPOSED METHOD

In this paper the feature has been obtained from the publically available database SVC 2004. The image to be captured by digitalized tablet. And the selected genuine signature are compared with training phase and test phase. The following diagram shows the selection process.

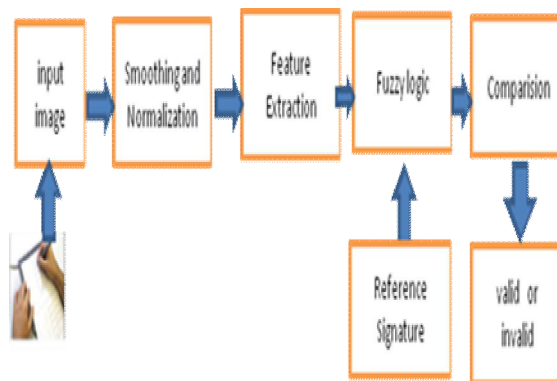


Fig 1. Feature selection process.



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Table 1: Extracted features

Extracted feature	Name of the feature
Ef1	x-direction
Ef2	y-direction
Ef3	velocity
Ef4	pressure
Ef5	displacement
Ef6	Accerelation
Ef7	Azimuth angle
Ef8	Attitude angle
Ef9	Time
Ef10	Frequency

The method used to identify the proper feature for the signature verification method.

## a)Feature extraction

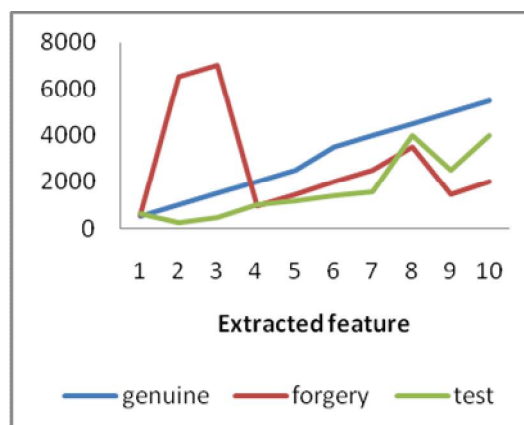
For the feature selection, the 10 original feature are extracted for our work. These are Ef1,Ef2,Ef3,Ef4,Ef5,Ef6,Ef7,Ef8,Ef9,Ef10. The table shows the selected features. Except the from the eight featur , Ef9 and Ef10 are selected as best feature by simple mathematical calculation.

## b)Fuzzy logic algorithm

The fuzzy if then rule used to calculated the imperformance of the data in fuzzy set theory and fuzzy logic application. The fuzzy theory implemented with robustness with contrast and lightening function. The fuzzy tool was introduced by lotfit in 1962. The fuzzy system support the maximum, minimum, low and high variations. Fuzzy system suitable for approximate reasoning . The fuzzy system convert inputs to outputs[10]. All genuine signatures are connected with training signature. The training signature compared with genuine reference signature. After that test signature compared with the genuine signature. The fuzzy inference system used to identify the forgery signature with compared genuine signature. The ten extracted features are compared with reference signature.

## V. RESULT

From the above mathematical calculation the Ef9 and Ef10 features are selected to give the more performance. The below table shows the comparison result of the best feature. The False acceptance rate ,false rejection rate and equal error rate are calculated to verified the result. The signature curve shows the various values of the signal.





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Table 3 Performance of the feature

DATA BASE	EXTRACTED FEATURE	FAR%	FRR%	ERR%
SVC 2004	<b>EF1</b>	3.55	4.55	2.55
	<b>EF2</b>	3.40	3.00	1.55
	<b>EF3</b>	6.50	4.50	3.50
	<b>EF4</b>	4.12	3.50	4.00
	<b>EF5</b>	4.00	2.50	2.00
	<b>EF6</b>	3.65	3.00	2.50
	<b>EF7</b>	4.32	3.52	2.80
	<b>EF8</b>	3.75	3.33	1.80
	<b>EF9</b>	2.50	5.25	3.23
	<b>EF10</b>	3.50	4.25	2.92

## VI. CONCLUSION

In this work, we represent the fuzzy logic based feature selection process for signature verification. For any environmental changes the signature is smoothed and normalized before the feature extraction. The accuracy of the signature verification conformed by selection of the proper feature and fuzzy logic algorithm. In our work, SVC 2004 database used to identify the proper selection method. The false acceptance and false rejection rate was used to select the output.

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