Biometric Based Online Signature Identification to Determine the Fraudulent Behavior

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Abstract-Signature verification is the promising technique for one's own personal identification in day to day life activities like banking transactions, credit card payments and all kind of legal documents. Nowadays wifi credit cards offered by banks are in major threat as it doesn't need any sort of verification. The customer can be verified either through online or offline depending on the input. In this paper, i built self database after collecting the details of 20 persons like their pen speed, pen angle, pen acceleration, x,y coordinates of the pen from the way of writing. Fuzzy logic is used to compute the accuracy of the recognition rate and the implementation is accomplished in Matlab. It is found that the results are remarkable and the accuracy rate is noticeable.

Keyword: Signature identification payments Nowadays

I. INTRODUCTION

Biometrics refers to authentication techniques that depend on unique physical characteristics and behavioral characteristics that can be automatically checked. Finger print recognition, Face recognition, Iris, Hand scan, voice recognition come under physical characteristics where as characteristics like gait pattern and signature verification come under behavioral characteristics.

Depending on what technology used the user information is converted into codes and is stored in the database. In verification step the sample is compared with the previously stored user information which is in coaded form.

Online signature is one of the charecteristics that is used in biometrics in which the signature software is used for automatic comparision to a signature database for examination of a signature on instrument to determine whether the hand writing is genunine or not. Dynamic signature is used for recognizing behavioural charecteristics that an individual exhibits when signing.

These devices should not be confused with electronic signature capture systems. Parameters such as pen pressure,pen angle, pen acceleration, pen speed,xy coordinates are taken into consideration through which the accuracy of the signature is determined.Section II describes the preliminaries of the start of the art in biometric online signature verification. Section III explains the real implementation of the proposed work using fuzzy logic. Section IV briefs out the results with explanations. Section V concludes the work with recommendation for future work.

II.RELATED WORKS

Taekyoung kwon et al.(2010) have developed a novel technique to combine encryption in biometric, verification of finger print and barcode generation and verification. They have used a separate key for storing the key based on biometric digital signature. They have also compared their results with conventional RSA algorithm. Their proposed work is to generate a digital signature after biometric scanning and then barcode is generated using secured key.

Nitya Raj et al.(2014) developed new methods and device to detect the bends of finger , position of hand, CCD camera orientation to acquire data for creation of difital signature. They developed an interactive hand love for the above process. Their work identities the strokes of signature based on special dynamic method that will catch even the instant dynamic characteristics.

Ms.Nikita Thawkar (2014) studied the importance and impact of online system and their respective approaches for online signature verification. They have started their work with preprocessing, extraction of appropriate features, training the data and testing the data. They made the study particularly for mobile device and have also analysed the performance of the system.

Anita Vincent et al (2015)discussed about two types of identification modes either online or offline mode which depends upon the signature acquisition method. They have implemented field programmable gate arrays (FPGAs) in online signature verification. They have captured the signature image and then it is normalized by preprocessing. Then the captured image and the templates are aligned by Dynamic Time Warping algorithm. From the aligned signature, suitable and appropriate features are extracted and given as input to Gaussian Infinite Mixture Models (GIMM), which will either deny or accept the identity of the user.

III. PROPOSED WORK

Fuzzy logic is an effective approach to compute degrees of truth rather than Boolean logic. The input space is mapped to output space in a more convenient way using fuzzy logic. It is flexible and tolerant of imprecise data it can also model non linear functions of arbitrary complexity. It is based on natural language. The accuracy of online signature is calculated by using fuzzy logic.

Revised Manuscript Received on October 15, 2019.
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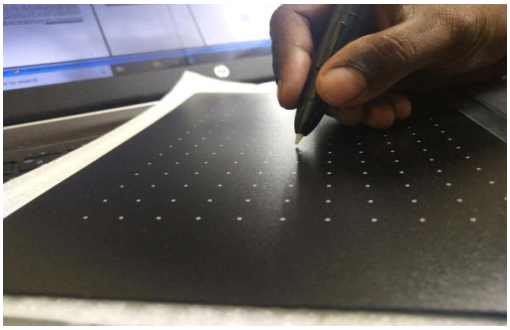

Figure 1. Signature pad used for data acquisition

As a first step, the signature data is acquired through signature pad for 20 persons. Figure 1 shows the signature pad for data acquisition.

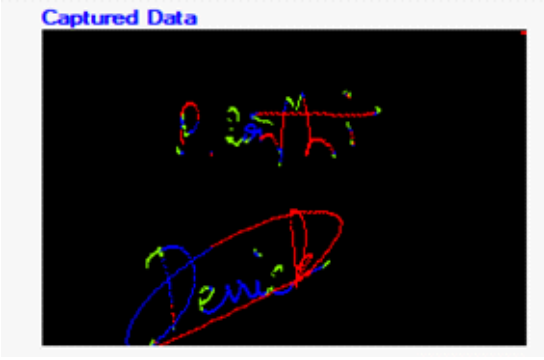

Figure 2: Digital Signature acquired through signature pad

Figure 2 shows the signature of a particular person.

Fuzzy inference systems is created and edited with fuzzy logic toolbox software. This is generated automatically by either clustering or adaptive neuro -fuzzy techniques. As matlab environment is user friendly own tools are created to customize the toolbox. It contains many membership function editor, rule editor, rule viewer, surface viewer. The shapes of the function are defined by membership functions. Rules are generated to list the rules that define the behavior of system. The rule viewer givs the exact value for the input and the graphs are plotted using the surface viewer.

INPUT

Fuzzufication

FUZZIFICATION

fis editor

FIS EDITOR

Defuzzification

Knowledge base

KNOWLEDGE BASED

Crispy output

Figure 3: Block diagram of fuzzy logic

Table 1: Range of linguistic variables in fuzzy logic

Parameter	Low	Medium	High
Pen Acceleration(mm/ sec^2)	1-3	2-5	4-8
Pen Angle(degrees)	15-40	35-55	50-90
Pen Speed(mm/sec)	5-15	10-25	20-50
XY-coordinates	0-5	3-8	6-12

IV. IMPLEMENTATION

The parameters that I consider is online signature authentication are the speed with which a person signs can be taken into consideration, which acts as one of the parameters that are used for calculating the accuracy of the signature. When the speed is about 12mm/msec we can achieve maximum efficiency. Acceleration is another parameter in which we calculate the speed with respect to time. If the acceleration is about 4 then maximum accuracy can be achieved. The signature is plotted in graph using xy coordinates. By considering the points that are plotted in the graph we calculate the accuracy of the signature. The inclinations with which the letters in signature are written are taken into consideration. When the angle is 45 degrees maximum accuracy is achieved.

V. RESULTS AND DISCUSSION

Using matlab tool R2010 I have implemented few membership function variables in online signature authentication. Here the four input parameters are acceleration, angle, speed, xy–coordinates. Acceleration and speed are interrelated. Whereas angle, xy-coordinates are independent on each other. Using these inputs the accuracy of the signature can be calculated. Initially minimum, medium and maximum values are given for each of the four parameters and the output. Rules are generated for these input and output values using AND and OR implication. Rule viewer is used to check how the linguistic variables are affected by these rules. Surface viewer shows how the linguistic variables are affected by graph.

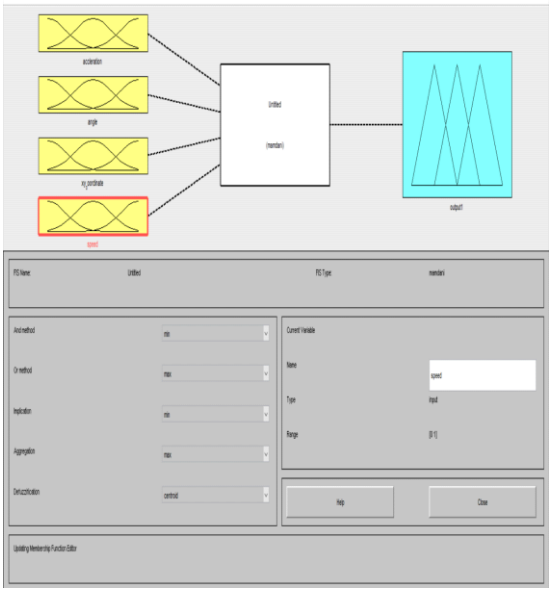

Figure 4: FIS editor for linguistic variables and the output

At first four inputs namely acceleration, speed, angle, xy-coordinates are considered with minimum, medium and maximum values. An output is also generated using mamdani with minimum, medium and maximum values using FIS editor.

Figure 5: Rules base for the linguistic variables

The figure 5 shows the rules for linguistic variables using AND implication. Here various rules are considered by taking different ranges for each linguistic variable. The below figure 6 shows how the accuracy changes with respect to the provided parameters as input values.

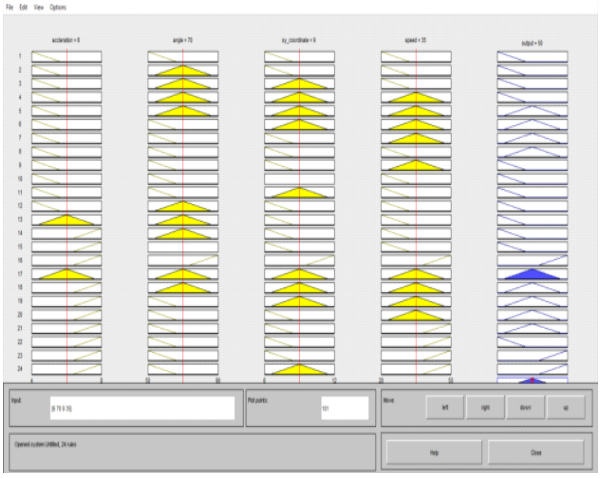

Figure 6: Rule viewers for linguistic variables

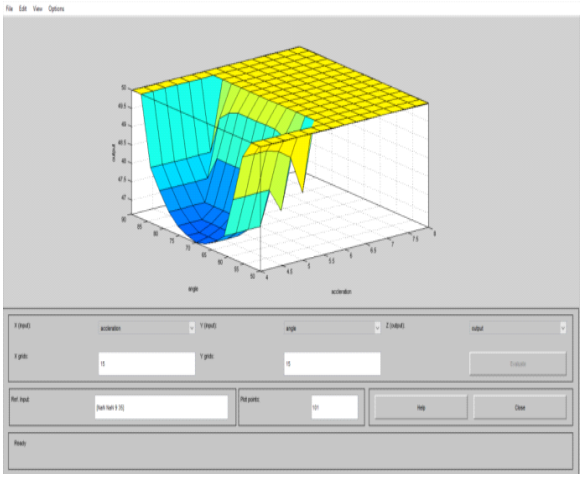

Figure 7: Surface view for linguistic variables using AND implication

Figure 7 shows how the surface view is produced for the provided linguistic variables using AND implication.

For the above input values rules are declared using OR Implication. Some of the rules are If (acceleration is low) or (angle low) or (xy coordinate is low) or (speed is low) then (output is medium),If (acceleration is medium) or (angle low) or (xy coordinate is low) or (speed is low) then (output is low),If (acceleration is low) or (angle medium) or (xy coordinate is low) or (speed is low) then (output is low), If (acceleration is medium) or (angle low) or (xy coordinate is high) or (speed is low) then (output is medium), If (acceleration is low) or (angle low) or (xy coordinate is high) or (speed is high) then (output is high).

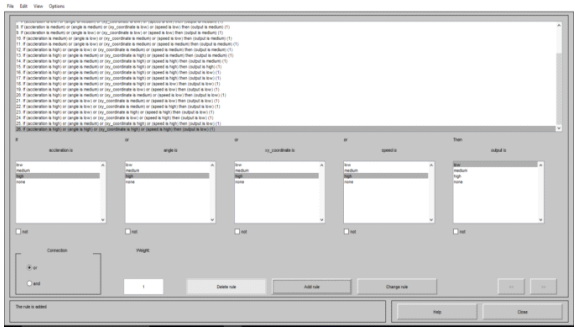

Figure 8: Rules base for the linguistic variables with OR implication and Min and Max composition

The below table depicts how the output varies with rest to rules with or condition with provided input parameters.

Table 2: Quantifying values for the input parameters

Acceleration	Angle	XY - coordinate	Speed	Accuracy
4.3	52.7	6.51	22.9	39.1
4.45	53.9	6.58	23	39.2
4.62	54.96	6.61	23	39.6
4.8	56.2	6.81	23.5	43.8
4.95	57.3	7.01	24.3	46.9
5.06	58.4	7.14	24.8	48.6
5.15	60.6	7.17	25.5	49.4
5.39	61.5	7.35	25.8	51.4
5.5	62.8	7.53	26.5	51.5
5.89	67.6	7.8	31.2	50
6	74.4	8.39	30.6	51.6
6.37	77	8.59	30.9	51.9
5.93	79.3	8.92	29.3	52.9

From the table it is clear that the accuracy is increased with the increase in the acceleration of the pen and the angle of the pen

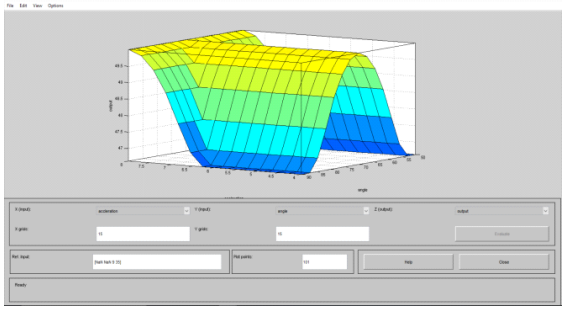

Figure 9: Surface view for linguistic variables using OR implication

The above figure 9 gives the surface view for linguistic variables for OR implications.

VI. CONCLUSION AND FUTURE WORK

This paper implements biometrics for online signature verification, the data can be secured more precisely. In this paper, different signatures for different people are acquired by signature pad and the features like acceleration, pen speed ,pen angle and the x,y coordinates are extracted and the values are given as input to fuzzy logic. The rulres are generated and the crisp output value is determined.

Also the accuracy og the verification is determined by the fuzzy logic .The results ae tested with self built database that contains 20 signatures. As a future work, this method of calculating the accuracy can be tested on offline signatures. Signatures may be written in different languages and we need to undertake a systematic study on this. To make a signature dataset real classifiers as well as novel classifiers should be explored in future work to enhance performance.

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