Online Signature Recognition System Based on Artificial Neural Network

[1]Snehal Madgude, [2]Aboli Khamgaonkar, [3]Mrunalini Godhade, [4]Prof. Shweta S. Salunkhe

[1,2,3,4]BVCOEW Department of Electronics and Telecommunication, Pune, Maharashtra, India.

[1]snehal.madgude@gmail.com, [2]aboli136@gmail.com, [3]mrunalinigodhade@gmail.com,

[4]shwetasalunkhe16@gmail.com

Abstract - In this paper include the new improved on-line signature verification system using feature of signature. This scheme is based on the technique that applies preprocessing on the signature to get a binary image and then calculate the global and texture features points from it and maintain a feature vector. All calculations are done on the basis of these feature points. The feature vector obtained from the texture features is used to compare with the feature vector of incoming testing signature. Based on the values obtained, the network will decide the appropriateness of the signature. The suggested scheme discriminates between original and forged signatures using artificial neural network (ANN) for training and verification of signatures. The input signature is taken on touch pad using android application and it is send to computer by using client server application.

Keywords- components, signature recognition, feature extraction-Neural Network, back propagation, signature verification, image processing.

I. INTRODUCTION

Signature is extensively used for authentication purpose in our daily life. It verify person's identity. The identification of user is become very important now a day's.It is used in different security purpose or to do business transaction or accessing data. As we know there are different system but the problem with those systems are that they need different PIN and Password it is difficult to remembering every time or carry such secret codes .signature detection is nothing but a behavioral biometric process which is now becoming more popular in research areas and social areas. As we know there are two different methods of signature detection. First is manual method it is basic method for person recognition. it is based on assumption. It is subjective process and it takes lot a time for detection. Another method is automatic method it is computer based. This will automatically verify the signature. This method gives more accuracy than the manual method. Now a days all systems are digitally automated.

Approach to signature detection categorize into Online signature detection and offline signature detection. Online data stored the signature while the signature is being drawn on android application. Through the client server program it is transmitted to the computer.

Preprocessing purpose in this phase is to make signatures standard and ready for feature extraction. The preprocessing stage includes four steps: Gray scale, Threshold, Filter(median), Thinning(stentiford), Cropping, Scaling Background elimination, noise reduction, width normalization and thinning.

A)Gray scale- It is related to an image in which the value of each pixel is a single sample, that is, it carries only intensity information. In this paper, Averaging algorithm is used for Gray scaling. Avg= (R+G+B)/3

B) Threshold- Data area cropping must be done for extracting features. Otsu's algorithm thresholding was chosen to capture signature from the background. After the thresholding, the pixels of the signature would be "1" and the other pixels which belong to the back-ground would be "0". It is used to automatically perform clustering-based image thresholding.

C) filter- A noise reduction filter is applied to the binary image for eliminating single black pixels on white background.

D) Thinning- Signature dimensions may have intrapersonal and interpersonal differences. So the image width is adjusted to a default value and the height will change without any

change on height-to-width ratio. In this paper, stentiford algorithm is used for thinning purpose. The goal of thinning is to eliminate the thickness differences of pen by making the image one pixel thick.

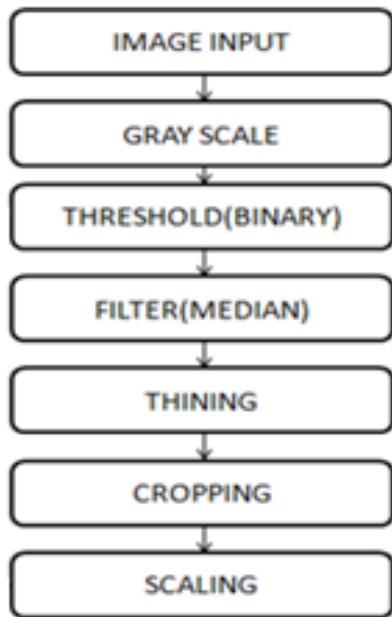*E) Cropping-* It refers to removal of the outer parts of an image to improve

Figure 1 Preprocessing steps flowchart

II. LITERATURE SURVEY

Biometrics can be broadly divided into physiological and behavioral biometrics. Behavioral biometrics is signature, voice and hand writing. Authentication of signature is done by detecting forgeries. [4]. A signature is a socially and legally accepted trait for identification of a person. There are two types of handwritten signature verification system that are online signature detection and offline signature detection. Online signature verification system gives better accuracy than the off-line signature verification system [1]. Online signature verification techniques can be achieved by using two techniques, that is first is function-based and another is featuring based[2].Data base is saved in the computer in the form of scanned images that scanned images are modify by image enhancement technique and noise reduction techniques, after that feature extraction and neural network training, and finally verifies the authenticity of the signature of the person [3]. In any verification task there are two types of error involved i.e. false rejection and false acceptance. The matching process is done using, two methods that are as follows directly or indirectly, the original time series data points of image of signature. Latter the matching process

refers to an approach where the matching process is done using descriptive features of a signature [5]. Verification performance taken from traditional datasets, by collecting it using stylus-based devices in a controlled environment or by using an android application.
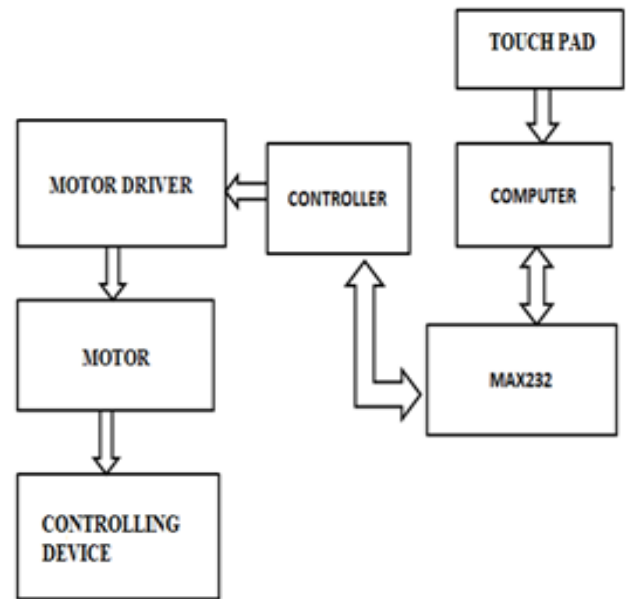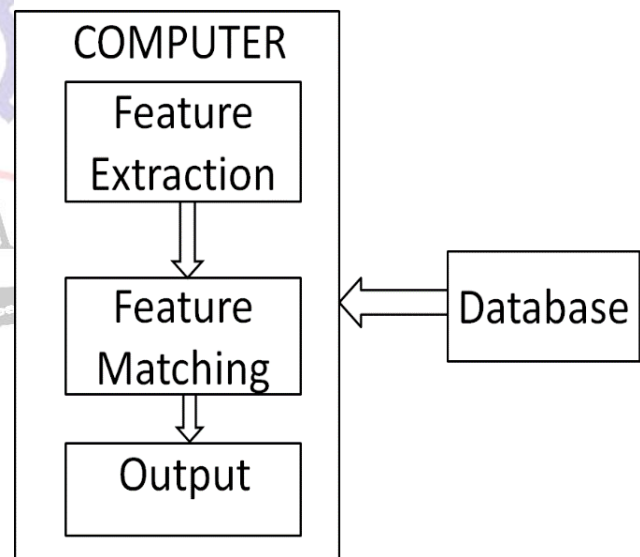

Figure 2 Block Diagram

Figure 3 Processing Steps Inside Computer

Touchpad- It is the device on which user can sign. This is android application which designed using Android language, Eclipse editor. The NETBIN software is also used for client server communication.

Computer- It is the device in which all the preprocessing, feature extraction and feature generation processes are done using MATLAB 2010 software. After all this processes if signature is verified ok or signature verification failed then

further commands are given to remaining circuit by computer.

MAX232- It is serial communication protocol. It is used to transfer the commands of computer to the microcontroller.

Microcontroller- It is controlling part of the circuit. As per the commands given from computer through MAX232 microcontroller will decide which command should give to controlling devices

For eg- If controlling device is door. Then only if signature is verified then only door will open and for unauthorized person if signature verification is failed then buzzer will notify. All this commands are given by microcontroller.

III. FEATURE EXTRACTION

Feature extraction process is an important step in developing any signature verification system since it is the key to identifying and differentiating a user's signature from another. The features extracted in this system are based on centroid point of an image. This system is design using weighted point feature algorithm. Weighted point feature algorithm gives better accuracy than previously developed systems.

Weighted point feature algorithm

1. *Read threshold image*
2. *Read width and height of image*
3. *Define depth value while extracting points*
4. *Call function-*

      A)weighted point feature for vertical division
      B)weighted point feature for horizontal division

Weighted point feature calculation

1. *Read current width and height of image*
2. *Traverse each pixel*
3. *Check if pixel value is black*
4. *Add coordinate values x and y separately*
5. *Increase total black pixel counter*
6. *End loop*
7. *Calculate mid coordinate value using average function*
8. *Display result*

In this algorithm, threshold image is taken. The height and width of the image is measured by keeping depth value is equal to 4.

Then divided image vertically then measured width using,
Calculate width = (I1', W/2, H)
Similarly measured height using,
Calculate height = (I2', H/2, W)

Again divided image horizontally then measured width using,
Calculate width = (I1', W/2, H)
Similarly measured height using,
Calculate height = (I2', H/2, W)
Continuing this process till depth which is selected is not over.
Now, measured the current width and height of the image and start to calculate weighted point using,
[X, Y]= calculate weighted point (Image, W, H, D)
Where
H= Get height ()
W= Get width ()

Initially the pixel value is equal to zero. Traverse each pixel of the image. Calculated all the black pixels of the image. Add X coordinate values and Y coordinate values separately. After that increase total black pixel value counter. Continue this process in loop. And finally measure mid coordinate value using average function,

Xmid= (Xsum/Total)
Ymid= (Ysum/Total)

Return the value of X coordinate centroid and Y coordinate centroid.
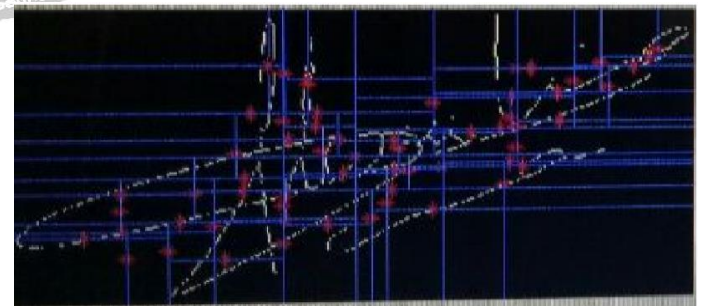

Figure 4 Threshold Image

Figure 5 Centroids Detected Image

IV. FEATURE MATCHING

Artificial Neural Network-

Neural network is generalization tools that's why the neural network is choose among number of other classification method. It is used for solving the complex problems with ease and easy to use. In this network normalization of

database is important. It introduced preprocessing of data by converting them to same decimal point value then classification error becomes less. It will be performed by supervised machine learning.

The neural network neuron, it just a processing element. Architecture of a neural network can be recognized by neuron connections. Weights and its activation function is also a method of determining architecture of neural network by using activation function. Neurons sends signal to other neurons. Neuron send signal in serial manner likewise next neuron sends signal in same way.

In this paper, Feed forward Back propagation Neural Network algorithm is used. This is supervised learning method in which first training is given to neuron and then detection is takes place.

V. RESULT ANALYSIS

Signature of 30 users taken. Then positive classification rate found is 97% and false rejection rate is 3%. And for forgery signature, data consists of 3 forgery signature of 30 users then accuracy rate of the system is 95%. The result obtained from dataset for genuine and forgery signature using all the feature extracted. Result of dataset with more sample number gives more accurate result. It is found final accurate result. It reflects the generalization capability of neural network.

This system includes the client sever communication between Android application and computer. Android application is designed using Eclipse language and it also uses Netbin software for IP configuration between client and server.

VI. CONCLUSION AND FUTURE SCOPE

In this paper features of images are extracted using weighted point feature algorithm with definite depth value. And after training current image is provided to the system which authenticate input and generate alert if signature verification failed.

This system can be used for proper bank application using cloud and IOT. This system also design for apple based platform for iphone. For better accuracy use different feature extraction technique and feature matching techniques.

REFERENCES

[1] Napa Sae-Bae, Nasir Memon, "*Online Signature Verification on Mobile Devices*" IEEE.

[2] L. G. Plamondon, R., "*Automatic signature verification and writer identification - the state of the art*," Pattern Recognition, vol. 22, no. 2, pp. 107– 131, 1989. cited By (since 1996) 342.

[3] A.NANDHINIPREETHA, N.RADHA, "*Multimodal Biometric Template Authentication of Finger Vein and Signature Using Visual Cryptography*".

[4] Suhail M. Odeh, ManalKhalil,"*Off-line signature verification and recognition: Neural Network Approach*".

[5] Babita, J Electr Electron Syst 2015, 4:3 "*Online Signature Recognition Using Neural Network*" http://dx.doi.org/10.4172/2332-0796.1000155.

[6] Marcos FZ (2007) *On-line signature recognition based on VQDTW*, Pattern Recognition 40: 981-992.

[7]J. Ortega-Garcia, J. Fierrez-Aguilar, D. Simon, J. Gonzalez, M. FaundezZanuy, V. Espinosa, A. Satue, I. Hernaez, J.-J. Igarza, C. Vivaracho, D. Escudero, and Q.-I. Moro, "*Mcyt baseline corpus: a bimodal biometric database,*" *Vision, Image and Signal Processing*, IEE Proceedings -, vol. 150, pp. 395 – 401, dec. 2003.

[8] L. Findlater, J. O. Wobbrock, and D. Wigdor, "*Typing on flat glass: examining ten-finger expert typing patterns on touch surfaces,*" in Proceedings of the 2011 annual conference on Human factors in computing systems, CHI '11, (New York, NY, USA), pp. 2453–2462, ACM, 2011.

[9] J. Galbally, M. Martinez-Diaz, and J. Fierrez, "*Aging in biometrics: An experimental analysis on on-line signature,*" PloS one, vol. 8, no. 7, p. e69897, 2013.