

# HUMAN BEHAVIOR PREDICTION THROUGH HANDWRITING USING BPN

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**Abstract-** In the present effort, the term quality is well thought-out from the utility point of view in order to investigate the cause that makes several signatures more suitable for automatic detection than others. Determining handwriting and signature throughout forensic investigating has been doing well to any degree. However there have been many instances in handwriting analysis where a forensic handwriting professional will evaluate handwriting on the basis of clear sets of characteristics and cannot make any relation among the handwriting characteristics and the personality traits because accuracy is the major question in such forensic investigating

**Index Terms-** Artificial neural network, BPN, Pen pressure, Shape.

## 1. INTRODUCTION

Human personality detection is becoming more and more important in the modern world. It helps human to shorten their jobs and solve more typical problems. Handwriting analysis or Graphology is a scientific method of identify, recognizing and distinguish personality over the move and patterns notify with the handwriting. Type of characters in the form of signatures and letters stroke can explain the personality of the author. Meanwhile the use of signatures is usually used to identify certain personality as with form of dots, streak, shapes or shell, and bottom line.[1]

This research is an expansion of previous research that only using handwriting based on five features. Our approach to model human behavior is to consider the human as a device with a large number of internal psychic states, every with its own particular control behavior and interstate transition probabilities. [2]

Biometric person recognition is a general technological tool for identity verification. It carries significant importance for national or universal security. All most each and every part of human body is unique; some of the significant ones have been used for developing automated identity authentication systems. Fingerprint, palm print, face, iris, ear etc. have been used hugely for current generation of person certification mechanics. There are still challenges in this type of research areas, and requirement for better biometric modalities, development of novel approaches and techniques are continually an ongoing process. Video inspection in public places and services has shift omnipresent, and has shift the first line of defense for protecting resources and people for different types of operating scenarios and applications – be it a civilian public space for access control to a

proficiency, or economic and proceeding oriented applications, or the high security immigration and border control analysis points. It has become an enabler of trust, integrity and security in the new abacus Economy.[6]

The destination topics of the Human Behavior Understanding (HBU) Workshop reflect some of the old and new questions in this domain:

- Social behavior subdivision & modeling, multimodal behavior patterns
- Temporal patterns
- Facial, gestural and voice-based influence recognition
- Sign-language recognition
- Human motion analysis
- Template recognition applied to novel sensors
- Pattern discovery in personal sensory networks, reality mining
- Smart environments
- Human-computer interaction
- Benchmarks studies on novel databases
- New affection selection and extraction methods
- scientific description and integration of contextual information
- Behavioral biometrics

Some of these topics have been keenly researched for a long time, like the analysis of look, voice, and bodily signals, yet these are taken up to new levels of difficulty by relaxing some of the simplifying constraints. Research focuses now on more normal settings with uncontrolled situation, real-time operation requirements and interaction dynamics. Furthermore, domain-specific semantic information is drawn into the picture as we move from generic techniques to specific applications. This re-focusing is somewhat done by introducing richer taxonomies and increasing volumes of multi-modal data.[7]

### 1.1 ARTIFICIAL NEURAL NETWORK

The title neural network was consistently known a network or circuit of neurons. The concurrent operation of the title recurrently credit to artificial neural networks, which are suppressed of artificial neurons or knob. Thus the term has two different usages: Organic neural networks are consists up of real organic neurons that are co-related or functionally related in a nervous system. An organic neural network is composed of a class or class of chemically connected or functionally affiliated neurons.

#### (i) FEED FORWARD NEURAL NETWORK

These networks have a single layer of weights in which inputs are directly connected to outputs or multilayer of weights between inputs & outputs. The data flow from input to output unit is strictly feed forward. No feedback connections are present i.e. connections from output units back to units of previous layers or input units. They are further classified into two categories.

#### (ii) SINGLE LAYER FEED FORWARD NEURAL NETWORK

A neural network in which the input layer of source nodes projects into an output layer of neurons but not conversely is known as only feed-forward or acyclic network. In single layer network, 'single layer' refers to the output layer of computation nodes as shown in Figure.1.1

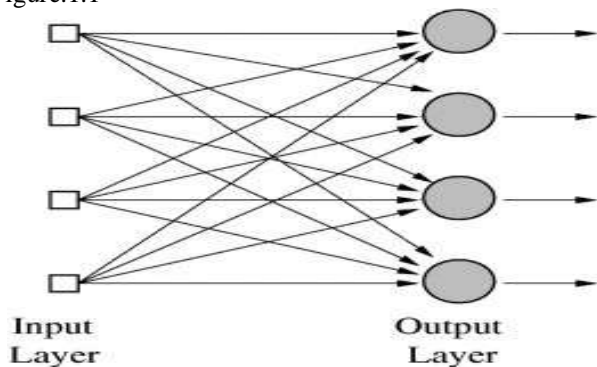


Figure-1.1: A single layered Network

#### (iii) MULTI-LAYER FEED FORWARD NEURAL NETWORK

This class of group comprises of one or more unknown layers, whose computation nodes are called hidden neurons or hidden units. The main function of hidden neurons is to interact between the external input and network output in some useful manner and to extort higher order figures. The source nodes in input layer of network supply the input signal to neurons in the succeeding layer (1<sup>st</sup> hidden layer). The output signals of 2<sup>nd</sup> layer are used as inputs to the third layer and so on. The set of production signals of the neurons in the production girdle of network constitutes the overall reaction of network to the start pattern supplied by source nodes in the input first layer.

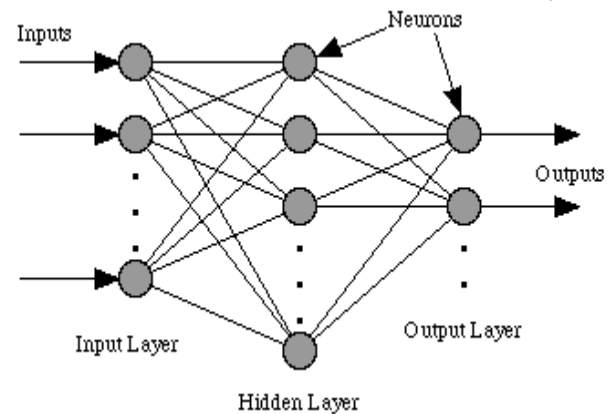


Figure-1.2: A multilayer feed forward network

#### (iv) COMPETITIVE NEURAL NETWORK

These networks are related to single level feed forward networks except that there are connections between output nodes which are usually negative.

Because of these connections there is a competition among output nodes to represent the input pattern. Sometimes, the output layer is fully connected & sometimes it is restricted to only those units that are close to each other as shown in fig: 1.3

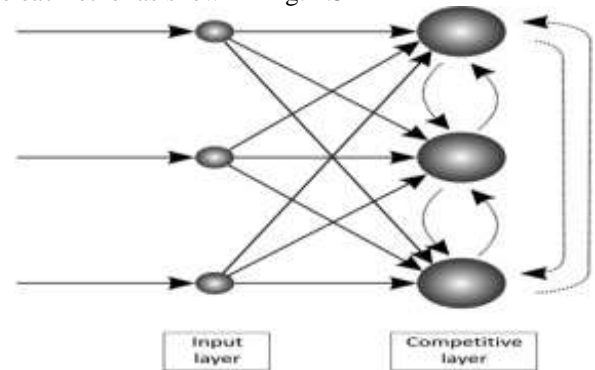


Figure-1.3: Competitive Neural Network

#### (vi) RECURRENT NEURAL NETWORK

The recurrent or feedback neural networks contain feedback connections from output units back to input units. This network focuses on dynamic properties of the system. They are also useful in the sense that they allow the network to process information. Processing in recurrent networks depends upon the state of network on the last time step as shown in fig:

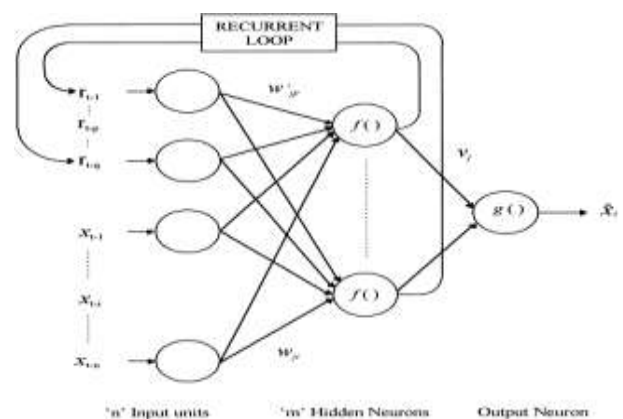


Figure-1.4: Recurrent Neural Network

## 1.2 BPN (BACK PROPAGATION NETWORK)

It is a common method of training artificial neural networks and used in conjunction with an optimization method such as gradient descent. The algorithm repeats a two phase cycle, propagation and weight update. When an input vector is presented to the network, it is propagated forward through the network, layer by layer, until it reaches the output layer. The output of the network is then compared to the desired output, using a loss function, and an error value is calculated for each of the neurons in the output layer. The error values are then propagated backwards, starting from the output, until each neuron has an associated error value which roughly represents its contribution to the original output.

Back propagation uses these error values to calculate the gradient of the loss function with respect to the weights in the network. In the second phase, this gradient is fed to the optimization method, which in turn uses it to update the weights, in an attempt to minimize the loss function. The importance of this process is that, as the network is trained, the neurons in the intermediate layers organize themselves in such a way that the different neurons learn to recognize different characteristics of the total input space. After training, when an arbitrary input pattern is present which contains noise or is incomplete, neurons in the hidden layer of the network will respond with an active output if the new input contains a pattern that resembles a feature that the individual neurons have learned to recognize during their training. Back propagation requires a known, desired output for each input value in order to calculate the loss function.

## 2. LITERATURE SURVEY

[1] Esmeralda C. Djamal projected Autography movement emulate the written element of each individual's periodicity and design. By analyzing all fundamentals of handwriting and interpreting them, using typical of graphology author could initiate a chart of the writer's character attribute, sentimental constitution and gracious design. In graph logical analysis's, an image is separated into two accession that graphics attributes and partition digit each character. In this research, author employ graphical accession based on signature and digit of character of consumption scheme using many-frame algorithms and artificial neural networks (ANN). The image crack into two space: the signature occupied on nine appearance and consumption scheme of letters digit apace. Each space had performed preprocessing to improve the recognition accuracy. ANN based classifier applies on five features of impression which outcome an exactness of 56-78%. While four appearance of the impression that disclosure using many frame algorithm result 87-100% exactness

[2] Sandeep dhang on Handwriting Analysis of Human Behaviour Based on Neural Network, Graphology or Handwriting analysis is a scientific method of identifying, evaluating and understanding of anyone personality

through the stroke and pattern revealed by handwriting. Handwriting reveals the true personality including emotional outlay, honesty, fears and defenses and etc. Handwriting stroke reflects the on paper draw of each individual's rhythm and Style. The image split into two areas: the signature based on three features and application form of letters digit area. In this research performance evaluation is done by calculating mean square error using Back Propagation Neural Network (BPNN). Human behavior is analyzed on the basis of signature by using neural network

[3] Alex Pentland, Andrew Liu focus on "Modeling and Prediction of Human Behavior". In this paper author distinct that various personal ethics can be precisely illuminate as a set of influential describe sequenced together by a Markov chain. To diagnose personal ethics from sensible data and to deduce personal ethics over a few seconds time, author then use these influential Markov layout. To ensure the virtue of this designing avenue, creator report an experiment in which, author was able to achieve 95% precision at predicting automobile drivers' subsequent actions from their starting preparatory movements.

[4] Hugo Gamboa and Ana Fredb a Escola Superior de Tecnologia de Set'ubal present "A Behavioral Biometric System Based on Human Computer Interaction". In this author distinguish a new behavioral biometric technique based on human computer communication. Author urbanized a system that captures the user communication via a lighten, and uses this observable information to verify the individuality of an individual. Using analytical pattern credit techniques, author developed a sequential classifier that processes user interaction, as reported by the user identity is considered real if a predefined accuracy level produced, and the user is classified as a pretender otherwise. Two statistical models for the features were tested, namely Parsing density opinion and a unimodal disposal. The system was checked with different numbers of users in order to assess the scalability of the proposal. Experimental results show that the normal user communication with the computer via a pointing device entails behavioral information with particular power that

[5] Diana Kalenova proposed a paper "Personal Authentication Using Signature Recognition" problem of personal authentication through the use of autograph recognition is described in this paper. There are two method of verification: online and offline signature verification. The dynamic methods covered, are based on the analysis of the shape, speed, stroke, pen pressure and timing information. While the stationary methods involve general shape recognition techniques. The paper inclined a sharp historical outline of the extant methods and presents some of the recent research in the field. In this paper problem of exclusive testimonial through the use of signature perception is considered. Twain on-line and off-line methods have been described.

## 3. PROPOSED WORK

### 3.1 Problem Formulation

The behavior of humans (and other organisms or even mechanisms) falls within a range with some behavior being

common, some unusual, some acceptable, and some outside acceptable limits. In sociology, behavior in general includes actions having no meaning, being not directed at other people, and thus all basic human actions. Behavior in this general sense should not be mistaken with social behavior, which is a more advanced social action, specifically directed at other people. The acceptability of behavior depends heavily upon social norms and is regulated by various means of control. Human behavior is studied by the specialized academic disciplines of psychiatry, psychology, social, work, sociology, economics and anthropology.

Human behavior is experienced throughout an individual's entire lifetime. It includes the way they act based on different factors such as genetics, social norms, core faith, and attitude. Behavior is impacted by certain traits each individual has. The traits vary from person to person and can produce different actions or behavior from each person. Social norms also impact behavior.

." One's attitude is essentially a reflection of the behavior he or she will portray in specific situations. Thus, human behavior is greatly influenced by the attitudes we use on a daily basis. [8]

### 3.2 Proposed Work

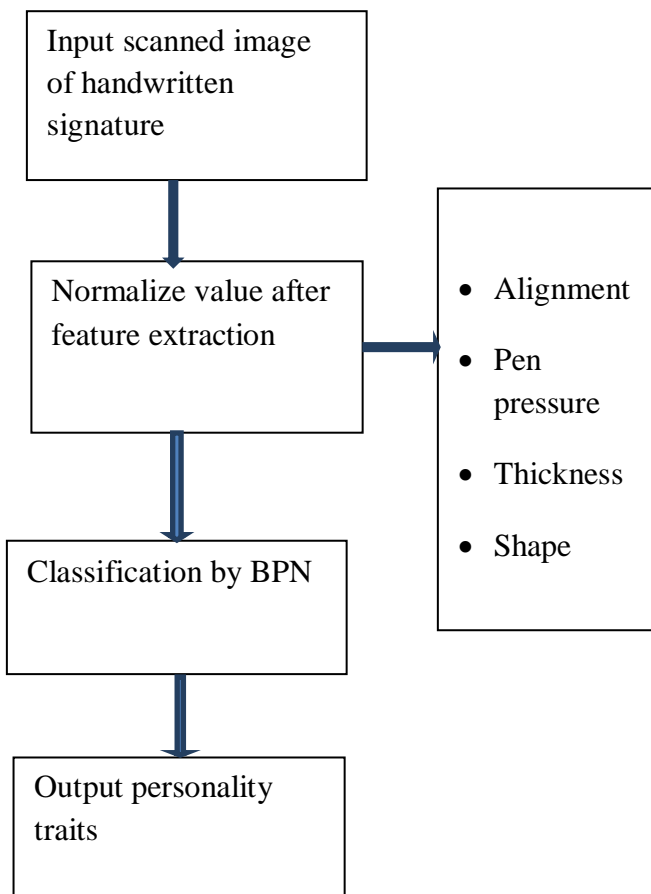


Figure 4.1: The architecture of the system

### RESULTS AND ANALYSIS

The results which are obtained by method of BPN technique After many iterations , training and testing the normal values on the basis of certain parameters such as Alignment , Thickness,

Shape and Pen pressure of different person. On the basis of this we can judge the behavior of a person.

So, firstly we will run a normalize program in which signature of person will be processed and after that its normal and eigen values are generated and on the behalf of the eigen values we take only two parameter values and run them to identify the behavior of a person. Similarly rests of the two values are processed in a similar manner. So, taking first two parameters that is Alignment and Thickness the values are:

Alignment	Thickness	Actual Value	Predicted Value	Mse
0.6234	0.1642	0.2	0.5322	0.3322
1.2318	0.3529	0.3	0.4177	0.1177
1.2641	0.5322	0.4	0.4362	0.0362
3.7760	1.2191	0.5	0.2589	0.2411
1.8497	1.2208	0.6	0.4208	0.1792

In this we see that as the predicted value of first person matches the actual value of fourth person , we can judge its behavior that it is normal. Its graphical representation can be seen as follows:

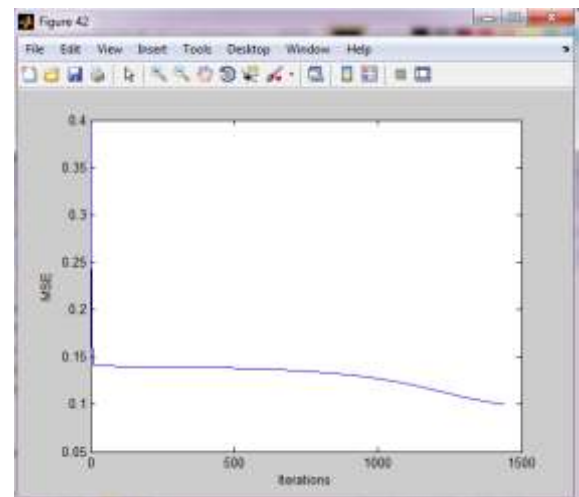


Fig. 6.1 Plot when min mse occur at no of iterations

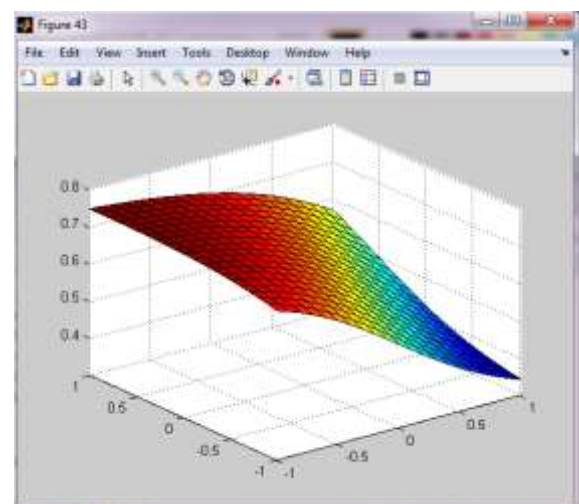
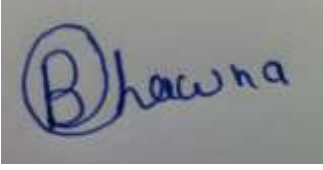
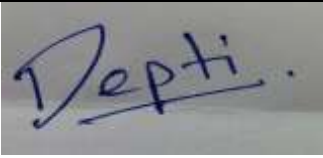
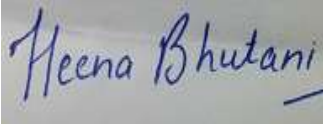
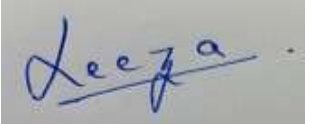
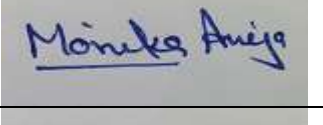
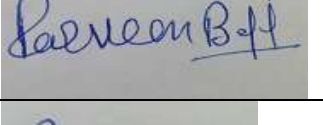
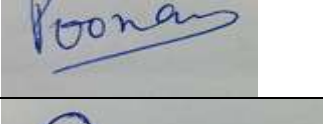
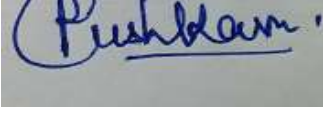
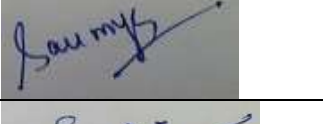
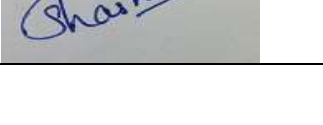


Fig. 6.2 Graphical representation of alignment and thickness parameter



TABLE 1:RESULT TABLE

S.no.	Name	Signature	Alignment	Thickness	Shape	Pen pressue	Behavior
1	Bhavna		1.3202	0.1434	0.1434	3.0904	cool
2	Depti		1.3889	0.0285	0.0285	3.5843	Emotional
3	Heena		1.2214	0.0562	0.0562	5.0897	Short-temper
4	Leeza		1.2921	0.1638	0.1638	2.6502	Normal
5	Monika		0.5447	0.1804	0.1804	4.1606	Friendly
6	Parveen		0.6234	0.1642	0.1642	5.3419	Angry
7	Poonam		1.2318	0.3529	0.3529	3.6617	Introvert
8	Pushkar		1.2641	0.5322	0.5322	3.4661	Careless
9	Saumya		3.7760	1.2191	1.2191	4.7679	Confident
10	shashi		1.8497	1.2208	1.2208	3.0571	Diplomatic

By taking other two parameters i.e; Shape and penpressure the values are;

Shape	Pen-pressure	Actual Value	Predicted Value	Mse
0.1642	5.3419	0.2	0.4882	0.2882
0.3529	3.6617	0.3	0.4585	0.1585
0.5322	3.4661	0.4	0.4800	0.0800
1.2191	4.7679	0.5	0.5721	0.0721
1.2208	3.0571	0.6	0.5477	0.0523

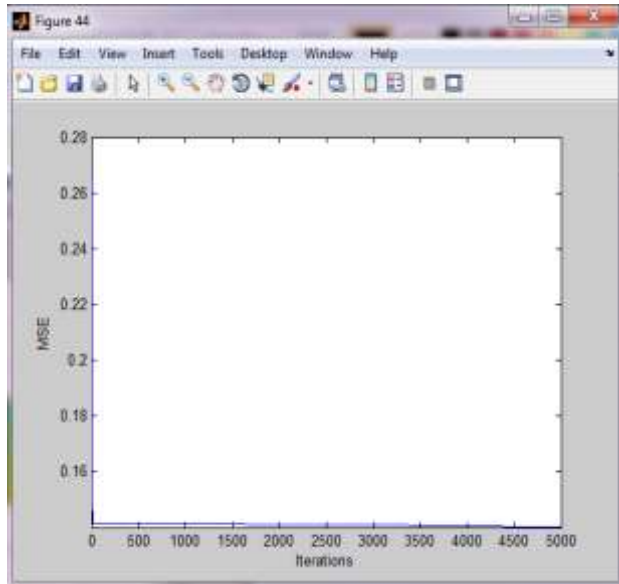


Fig 6.3 Plot when min mse occur at no of iterations

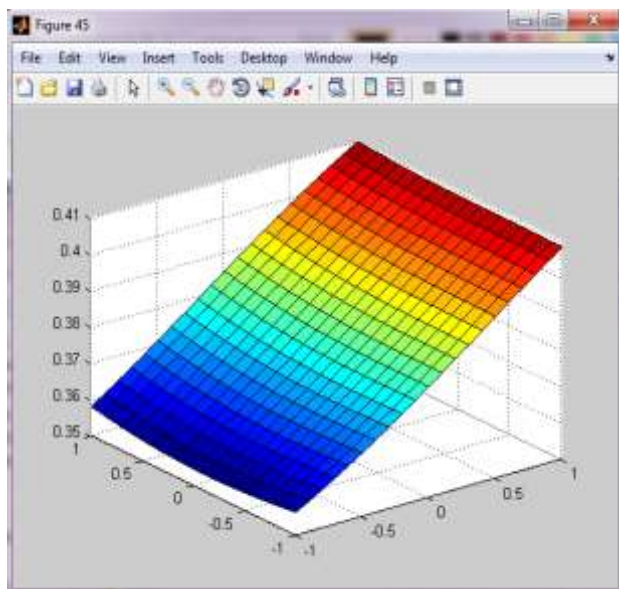


Fig. 6.4 Graphical representation of shape and pen pressure parameter

#### 4. CONCLUSION AND FUTURE SCOPE

Handwriting analysis is an emerging field for personality recognition. The various personality analysis techniques of this field can be implemented for getting correct personality trait information. Although graphology is an established science, due to human error and ambiguity in the handwriting sample, accuracy of handwriting analysis is found to be around 90% correct prediction. Automated personality identification through handwriting analysis will

prove to be a good and helpful system for personality traits identification. Such system can be built using Artificial neural networks technology where a system is pre-trained to identify characteristics of handwriting and map it to a corresponding personality trait Tests carried out on a sheet of A4 paper which is divided into two areas including the type of letter and signature area. So testing is done separately. Training is also conducted each feature. Of 26 letters, each of which has 6 types, in order to obtain 156 classes. The number of classes that were required a relatively fast method such as LVQ in training. While the analysis of the signature area provides 15 types of 9 features have vary widely so it takes relatively more rigorous methods, such back propagation. Output of the system compared to the identification type of handwriting by expert. Of the 100 test data, testing of each letter recognition system as a whole or a maximum of 32 letters in the application form only provides accuracy of 43%. However, if the terms of each letter, obtained recognition accuracy of 56%. It because, at the time of training which included training data was never recognized so that when the testing process this type will never be right in the testing process. Recognition of training data gave 77% accuracy. Recognized signature area that the test data of 100 signatures, 100% accurately detect the extreme margin, dot structure and separate signature. And 87% accurate for the detection of streaks disconnected. The four features were tested using structural identification methods graphics. Meanwhile, tests on five features using ANN obtained 63% accurate for the beginning of the curve, 58% accurate for the detection of streaks end, 75% accurate for middle streaks, 70% accurate for the detection of the bottom line and the 56% detection of the shell.

Many types of methods can be used for identification of human behavior .Techniques which can be used like Hidden Markov Method(HMM),K-means classifier etc. can be used to increase the extraction of behavior through signature and its various parameters.

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