Volume 4, Issue 9, September 2014 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Handwriting Analysis of Human Behaviour Based on Neural Network

Sandeep Dang
Electronics & Communications, SSGI
Billaspur, India

Prof. Mahesh Kumar, Mahesh
Electronics & Communications, SSGI
Billaspur, India

Abstract- Graphology or Handwriting analysis is a scientific method of identifying, evaluating and understanding of anyone personality through the strokes and pattern revealed by handwriting. Handwriting reveals the true personality including emotional outlay, honesty, fears and defenses and etc. Handwriting stroke reflects the written trace 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 behaviour is analyzed on the basis of signature by using neural network.

Index Terms – Back propagation, artificial neural network, Handwriting and signature Analysis

I. INTRODUCTION

Human personality recognition is becoming more and more important in the modern world. It helps human to simplify their jobs and solve more typical problems. Handwriting reasoning or Graphology is a scientific method of identifying, recognizing and perceive personality over the move and patterns notify with the handwriting. In Graphology, handwriting is analyzed through structural graphic elements in order to derive information about the writer personality. There are two approaches in graphology i.e. graphical analysis of the structural type of writing and analysis of the type of symbol or letter. Signature analysis includes the first one approach. This research has been to integrate the two approaches. Type of writing in the form of signatures and letters stroked can describe the personality of the author. Some types each letter is written. Meanwhile the use of signatures is usually used to identify certain personality as with appearance of dots, streaks, shapes or shell, and bottom line.

This research is a continuation of previous research that only using handwriting based on five features.To further give overview the attribute, the type of handwriting analysis executed on two areas which the author stroked on a piece of A4 cardboard. The first area is the application form which consist 32 boxes that is written in fundamental letters. Each type of handwritten letters is classified using Learning Vector Quantization (LVQ) to get three dominant of attribute trait. The second area is the type of mark analysis. From signature pattern, five features identified by ANN and four features using multi-structure algorithm. Each space had re-processing performed to improve the recognition accuracy. The combination of letter recognition and signature is intended to provide a more complete overview the personality. Each features recognized in parallel that indicates the distinct personality, in order to obtain a review of certain attributes. The success of the system is determined recognition accuracy against graphology test manually.

Our approach to modeling human behavior is to consider the human as a device with a large number of internal psychic states, each with its own particular control behavior and interstate transition probabilities. Perhaps the canonical example of this type of model would be a bank of standard linear controllers (e.g., Kalman lters plus a simple control law), each using different dynamics and measurements, sequenced together with a Markov network of probabilistic transitions. The states of the model can be hierarchically organized to describe both short-term and longer-term behaviors; for instance, in the case of driving an automobile, the longer-term behaviors might be passing, following, and turning, while shorter-term behavior would be maintaining lane position and releasing the brake. Such a model of human behavior could be used to produce improved human-machine systems. If the machine could recognize the human's behavior or, even better, if it could anticipate the human's behavior, it could adjust itself to serve the human's needs better. To accomplish this, the machine would need to be able to determine which of the human's control states was currently active and to predict transitions between control states. Handwriting analysis is also known as graphology which is a method of identifying the traits related to an individual. It helps in understanding personality traits through the strokes and patterns revealed by handwriting. It can expose marks such as emotional and deep instability, which can further lead an individual to engage in deviant behavior.

Handwriting is unique to each one individual, regardless of the word formation of an individual's handwriting; the shape of the character is will reside the same. This is applicable to all languages. Forgery of another person's handwriting can easily be identified by proper forensic examining characteristics like pen pressure and oscillation. Theoretically, it is difficult to determine personality especially when it is related to forensics.

However there have been many instances in handwriting analysis where a forensic handwriting expert will compare handwriting on the basis of clear sets of characteristics and cannot make any relation between the handwriting characteristics and the personality traits because accuracy is the major issue in such forensic examining. The main focus of this study is to examine known technology that can identify or predict personality traits, as well as those technologies that identify and authenticate handedness, authorship, and gender using handwriting samples.

1.1 Artificial Neural Network

An artificial neural network (ANN), frequently termed neural network is a mathematical model or estimation model that is animated by the framework or operative appearance of biological semantic net. An ANN made of an interdependent class of fabricated neurons, and connectionist approach to computation is used to processes information. Modern artificial neural networks are non-linear statistical data modeling tools. They are normally known classical composite association with in inputs and outputs or to asset impression in data.

Multilayer Perceptron Neural Networks (MLPNN) or Multilayer Fast-forward Neural Network (MFNN) is a fast-forward semantic net instrument. Subsisting three layers, input, output and intermediate, the MLPNN nominate different roles for every layer. Input layer maintains balanced count of neurons parallel to that of the no. of warbles in the problem. The output panel encompasses a number of neurons balanced to the elected count of amplitude, enumerated from the input and makes obtainable the pestering feedback.

1.2Various Kinds of Neural Networks

Depending upon the type of interconnection & no. of layers, there are different possible neural network architectures as defined below:

(i) Feed Forward Neural Network

(ii) Single Layer Feed Forward Neural Network

(iii) Multi-Layer Feed Forward Neural Network

(iv) Competitive Neural Network

(v) Recurrent Neural Network

(vi) Back propagation neural network

II. RELATED STUDY

[1]Esmeralda C. Djamal proposed Autography movement emulate the written element of each individual's periodicity and design. By analyzing all elements of handwriting and interpreting them, using standard of graphology author could initiate a chart of the writer's character attribute, sentimental constitution and gracious design. In this research, author use graphical accession based on signature and digit of character of utilization scheme using many-frame algorithms and artificial neural networks (ANN). The image crack into two space: the signature occupied on nine appearance and utilization scheme of letters digit apace. Each space had performed preprocessing to improve the recognition accuracy. ANN based classifiers apply on five features of impression which outcome an exactness of 56-78%.

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

[3] Javier Galbally, Julian Fierrez, Marcos Martinez-Diaz present "Quality study of Dynamic Signature Based on the Sigma-Lognormal Model". In this paper Author proposes study of the factor of dynamic handwritten impressions is fulfill placed on the Sigma-Lognormal model.

In the study, two major contentions are dispatched from a kinematic objectivity produced movements by human. The first is what makes some signatures execute better than others in self-moving signature confirmation systems, and the second issue if that information may be used as a factor measure in order to examine the expected performance of a inclined sample. Observations were carried on the MCYT

database and show the eminent latent of certain kinematic features for signature factor determination.

[4] Swarna Bajaj, Sumeet Kaur present," Typing Speed Analysis of Human for Password Protection". In this paper author defined important challenges for authentication, you mean that it is such a good imitation that it is almost the same as or good as the original in computer system. Specially used in technology like that e-banking, e-commerce, virtual offices, distributed, computing and other services over the internet. This technology is based on human behavior to type their password. Human behavior can be analyzed with their typing pattern. Keystroke dynamics are hardware independent, no extra hardware is used. Only software based technology keyboard is required for password protection. The results provide emphasis with pleasure security that growing in demand in web-based application based on internet.

[5]S. M. E. Hossain and G. Chetty present "Human Identity Verification by Using Physiological and Behavioural biometric Traits". This paper presents Biometric authentication of person is highly challenging and complex problem. A significant research effort has gone into this area and a number of research works were published, but still there is an

immense shortage of accurate and robust methods and techniques. For first stage of experimental evaluation, author used side face and gait for experiments and achieved around 100% recognition rate.

[6]Hugo Gamboaa and Ana Fredb aEscola Superior de Tecnologia de Set´ubal present "A Behavioural Biometric System Based on Human Computer Interaction". In this author distinguish a new behavioural biometric technique based on human computer interaction. Using analytical pattern recognition techniques, author developed a sequential classifier that processes user interaction, as reported by the user identity is considered genuine if a predefined accuracy level produced, and the user is classified as a pretender otherwise. Experimental results show that the normal user interaction with the computer via a pointing device entails

behavioural information with particular power that can be explored for identity authentication

[7]Albert Ali Salah1, Theo Gevers1, Nicu Sebe2, and Alessandro Vinciarelli present "Challenges of Human Behavior Understanding". Recent advances research in pattern recognition has allowed computer scientists and psychologists to jointly address automatic analysis of human behavior through computers. The establishment on Human Behavior Understanding at the International Conference on Pattern Recognition explores a number of different aspects and open questions in this field, and determines the multi-disciplinary nature of this research area. In this brief summary, we give an sketch of the Workshop and discuss the main research challenges.

[8] Roman V. Yampolskiy, Venu Govindaraju present a survey," Behavioural biometrics: a survey and classification" This study is a survey and classification of the state-of-the-art in behavioural biometrics which is based on skills like style, preference, knowledge, motor-skills or strategy used by people while concluding different everyday tasks such as driving an sports car, use telephony service. The authors check current research in the field of behaviour prediction and analyze the types of features used to describe different types of behaviour. After observing accuracy rates for verification of users using various behavioural biometric approaches, researchers address privacy issues in the future with the use of behavioural biometrics.

[9] Champa H N, K R Ananda Kumar, "Scientific Approach to Behavior Analysis through Handwriting Analysis", describe Handwriting investigation is a method to predict personality of an author and to better understand the author. Polygraph and polygraph combination analysis is a scientific method of writer identification and evaluating the behavior. To make this automated we considered six main different types of features.

[10]Othman o-khalifa, Md. Khorshed Alam focus on verification of given scanned text signature with the help of

Neural Networks. This paper addresses a brief review of different offline approaches and background of signature verification systems used by the researchers and it explains the fundamental characteristics of offline signature verification processes need to develop more robust and more constructive offline signature verification system. This paper also highlights the comparison among various approaches and challenges to develop the verification systems. The main benefit of using offline systems is indentifying the right person and provides secure services.

[11] Parmeet kaur Grewal, Deepak Prashar "Behaviour prediction through Handwriting Analysis" describe Handwriting Analysis is described as a scientific study and analysis of handwriting. It is a way of interpreting behavior from peculiarities in handwriting. The scientific name for handwriting analysis is Graphology. Handwriting is often called mind writing or brain writing. Professional handwriting examiners called graphologists predict the personality of the creator with a piece of autography. In this paper a method has been prospected to check the behavior of a person from the baseline, the letter slant, pen pressure, letter 'i' and letter 'f'. These parameters are input to the Artificial Neural Network which predicts the behavior of the writer.

[12]Janet Fisher, Anish Maredia, Anita Nixon, Nerissa Williams, and Jonathan Leet," Identifying Personality Traits, and Especially Traits Resulting in Violent Behavior through Automatic Handwriting Analysis" describe Handwriting analysis is a process that has been carried out for centuries. There are two methods of handwriting analysis: Graphology is the method of psychological analysis, while forensic document examination or handwriting identification which is the examination of documents and writing samples by a known source, or person. In this paper we have carried out research of the various state of the art technologies available in analyzing an individual's behavior based on their handwriting and the effectiveness of predicting the character and personality of that individual.

[13]David C. Funder describes an article "Persons, behaviors and situations: A schedule for personality attitude in the postwar era". The present article suggests that personality theory and research be re-organized in terms of the personality triad of persons, behaviors, and situations. A precondition for understanding the elements of this triad is better conceptualization and measurement of behavior and, especially, situations Looking further ahead, a post-inter actionist personality psychology may someday recognize that personality is a latent construct only indirectly indicated through behavior, and the ultimate understanding of that construct will be empirically tested by the ability to predict behavior in new and unique situations.

[14] Vikram Kamath, Nikhil Ramaswamy, P. Navin Karanth, Vijay Desai and S. M. Kulkarni proposed "DEVELOPMENT OF AN AUTOMATED HANDWRITING ANALYSIS SYSTEM". In this system present study a method has been proposed for the behavioral prediction of a person through automated handwriting analysis. The present work identifies the psychological traits in the writing namely size, slant and pressure, baseline, number of breaks, margins, speed of writing and spacing between the words. The handwriting is analyzed through Image Processing in MATLAB. The behavioral pattern of the person is predicted from the above traits of the handwriting.

[15]Artificial Neural Network for Human Behavior Prediction through Handwriting Analysis, May 2010 International Journal of computerApplications;Mar2010, Vol. 2, p36,this article define the Handwriting Reasoning or Graphology

method to examine the attitude of individual from the features extracted from his handwriting using Artificial Neural Networks.

III. OBJECTIVES

Need of Human Behaviour Prediction System

Human behavior cannot be predicted by observation alone. No matter how deep the statistical database, no matter how sophisticated the algorithms, accuracy derived from observation falls short because it is unable to see the inner mechanism of the mind itself. All that can be catalogued is simply the external impact of internal mental processes, and therefore observation can only chart the progress of ripples in the pond and speculate as to the nature of the pebble that produced them. Human behavior also cannot be predicted by internal self-examination. No matter how deep we focus our inner eye, no matter how extensive our thoughts, accuracy derived from self-examination falls short because it is unable to see the mechanism of its own sentience.

To predict human behavior, a true model of the mind is required – one not derived from external observation nor internal self-examination.

Objective of Dissertation

1. To identify the signatures and extract the features of signature.
2. After extract the features of signature normalize the value
3. Predict the behavior of person using signature

IV. PROPOSED WORK

It gives a method which provides training time for a neural network. Prediction of human behaviour using Artificial Neural networks. Predicting is a process of conceiving something as it might happen in future, based fundamentally, on knowledge gathered from past experiences and from present scenario. Trained system architecture is shown in fig: 3.2

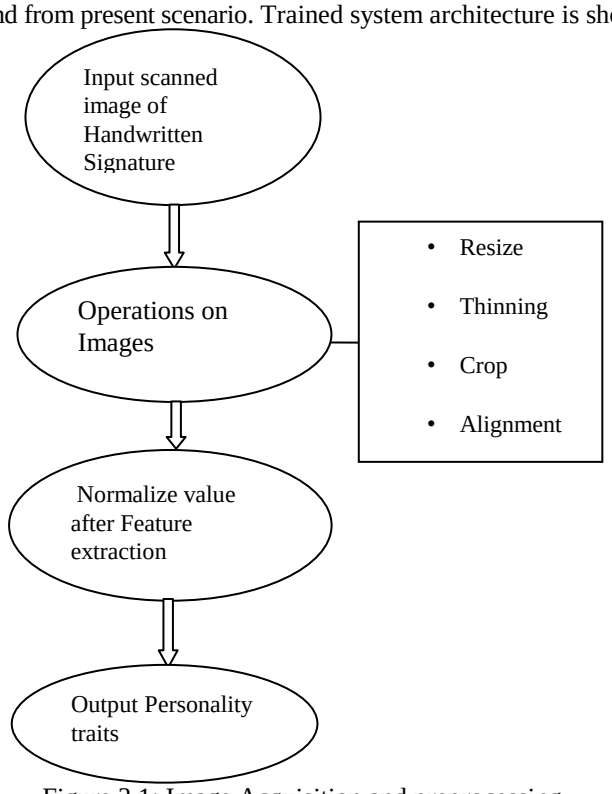


Figure 3.1: Image Acquisition and preprocessing

V. RESULTS

Training Set

The data set for 10 signatures with different parameters is shown in different table 5 below.

TRAINING DATA:-

Sr.No	Signature image	F1	F2	F3	F4	o/p=(1-ms error)	Behaviour
1.		6.4037	59.0653	59.0653	544.7980	0.669131 0.715516 0.756345 0.791291 0.820626	GOOD NORMAL AGGRESSIVE POOR EMOTIONAL

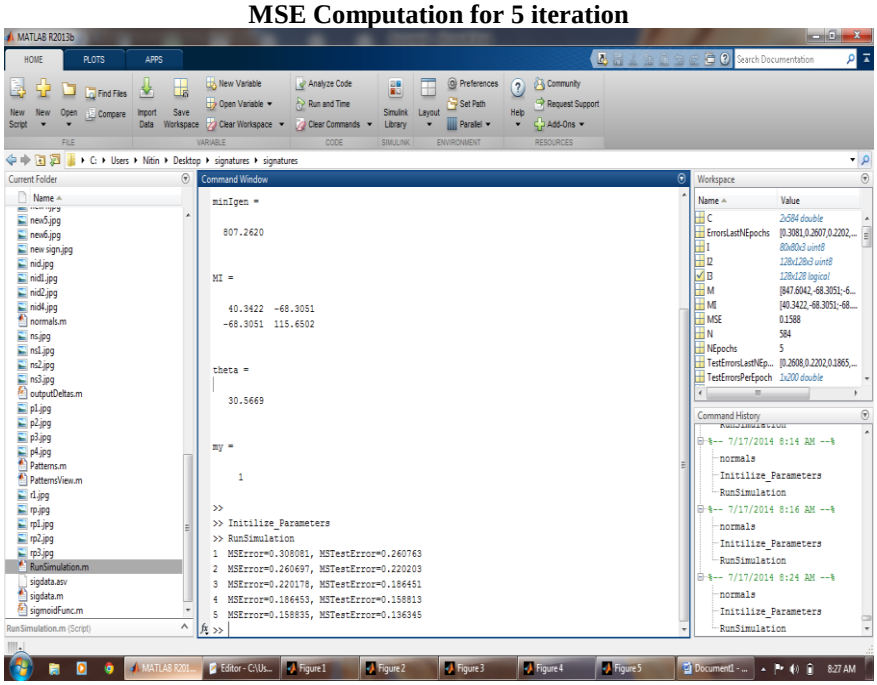
Sample taken for prediction:-

Sr. No	Predicted output=(1-ms test error)
1.	0.716041
2.	0.756664
3.	0.791434
4.	0.820627
5.	0.844867

After the comparison of training data and predicted output we find the matching value 0.83549 and 0.813547 which define the poor behaviour.

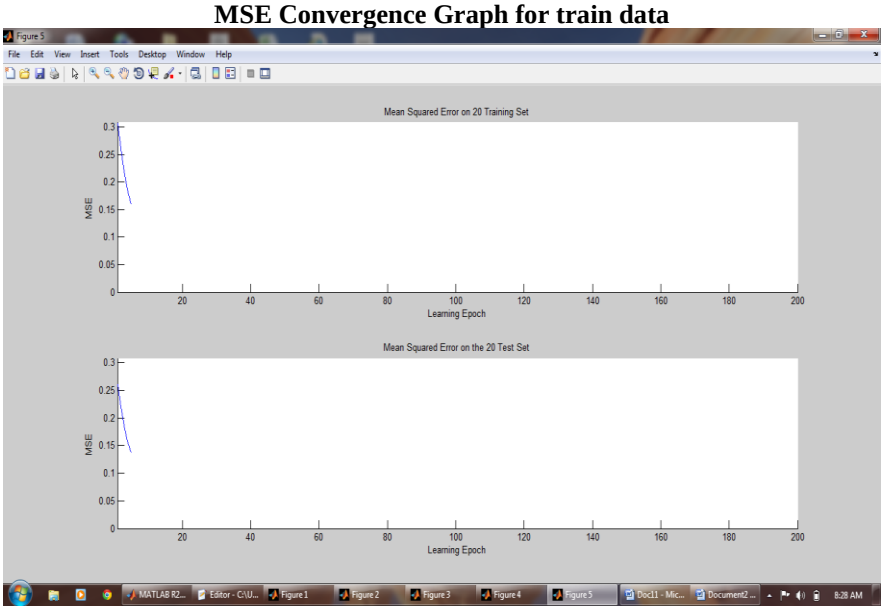
Sr.No	MS ERROR	MS TEST ERROR
1	0.308081	0.260763
2	0.260697	0.220203
3	0.220178	0.186451
4	0.186453	0.158813
5	0.158835	0.136345

MSE Computation for 5 iteration



Mean Square Error is the diff. between actual and predicted Output.

MSE Convergence Graph for train data



REFERENCES

[1] Esmeralda C Djamal, Sheldy Nur Ramdlan, Jeri Saputra, *"Recognition of Handwriting Based on Signature and Digit of Character Using Multiple of Artificial Neural Networks in Personality Identification"* ,Information Systems International Conference (ISICO), 2-4 December 2013

[2] Javier Galbally, Julian Fierrez, Marcos Martinez-Diaz, R´ejean Plamondon E´cole Polytechnique de Montre´al," *Quality Analysis of Dynamic Signature Based on the Sigma-Lognormal Model"*, 2011 International Conference on Document Analysis and Recognition

[3] Swarna Bajaj, Sumeet Kaur, "*Typing Speed Analysis of Human for Password Protection (Based On Keystrokes Dynamics)"*, International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-3, Issue-2, July 2013

[4] S. M. E. Hossain and G. Chetty," *Human Identity Verification by Using Physiological and Behavioural Biometric Traits"*, International Journal of Bioscience, Biochemistry and Bioinformatics, Vol. 1, No. 3, September 2011

[5] Hugo Gamboaa and Ana Fredb," *A Behavioral Biometric System Based on Human Computer Interaction"*

[6] Albert Ali Salah1, Theo Gevers1, Nicu Sebe2, and Alessandro Vinciarelli3*," Challenges of Human Behavior Understanding"*

[7] Champa H N, Dr. K R AnandaKumar "*Artificial Neural Network for Human Behavior Prediction through Handwriting Analysis*", International Journal of Computer Applications (0975 – 8887) Volume 2 – No.2, May 2010

[8] Roman V. Yampolskiy, Venu Govindaraju present a survey, "*Behavioral biometrics: a survey and classification"*

[9] Alex Pentland, Andrew Liu," *Modeling and Prediction of Human Behavior"* Massachusetts Institute of Technology, Cambridge, MA 02139, U.S.A.

[10] Parmeet Kaur Grewal, Deepak Prashar, "*Behavior Prediction Through Handwriting Analysis"* IJCST Vol. 3, Iss ue 2, April - June 2012.

[11] H.E.S.Said, T.N.Tan and K.D.Baker, ―"*Writer Identification Based on Handwriting*", IEE Third European workshop on Handwriting Analysis and Recognition, vol.33, no.1, 2000, pp 133-148.

[12] Champa H.N, KR Ananda Kumar, " Automated *human behavior prediction through handwriting analysis*", First International Conference on Integrated Intelligent Computing, IEEE Computer Society, 2010, pp. 160-165.

[13] Champa H N, K R AnandaKumar," *Handwriting Analysis for writer's Personality Prediction*", International Conference on Biometric Technologies and Applications- the Indian perspective, 2008, pp. 182-191

[14] Huber RA, Headrick AM (1999). *Handwriting Identification: Facts and Fundamentals*. Boca Raton: CRC Press. ISBN: 084931285X

[15] Hand writing Personality file. http://handwritingpro.com (1998)

[16] G. Hargreaves and P. Wilson, " How *to Read Handwriting The A-Z of your Personality"*, Singapore, 1953.

[17] P.D. Sunar, "*Read the full review Graphology Personality Through Writing His handwriting*", Yogyakarta : Diva Press, 2010.

[18] V. M. Jr and Z. Riha, "*Biometric authentication systems*," Tech. Rep. FIMU-RS-2000-08,FIMU.Reportseries, http://www.fi.muni.cz/informatics/reports/files/older/FIMU-RS-2000-08.pdf, 2000.

[19] S. Prasad, V.K. Singh, A. and Sapre, " Handwriting *Analysis based on Segmentation Method for Prediction of Human Personality using Support Vector Machine*", International Journal of Computer Applications (0975 – 8887) Volume 8– No.12, October 2010.

[20] P.K.Grewal and D Prashar, "*Behavior Prediction Through Handwriting Analysis*", IJCST Vol. 3, Issue 2, 2012

