



## Human Behaviour Modelling & Analysis Using Artificial Neural Network

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**Abstract**— This is a survey and classification based on behavioural biometrics which is based on skills, style, preference, knowledge or strategy used by people while accomplishing different everyday tasks such as driving an automobile, talking on the phone, handwriting analysis, face analysis, visual action recognition, keystroke dynamics, using a computer. In this research, using combination of graphical approach based on signature and digit of character of application form using multi-structure algorithms and artificial neural networks (ANN). We examine current research in the field and analyse the types of features used to describe different types of behaviour by using signature in handwriting analysis. The following feature used in this paper are: orientation, letter spacing, thickness, streaks. Various techniques used for comparing accuracy rates for verification of users using different approaches such as Markov model, Sigma Lognormal model

**Keywords**— Artificial Neural Networks, Markov Model, Sigma Lognormal Model, Behavioural Biometrics

### I. INTRODUCTION

**Biometric** is the most secure and convenient authentication tool. Biometrics measure is individual's physical or behavioral characteristics to recognize or authenticate their identity. Some popular physical biometrics include fingerprints; geometry of hand or palm; and retina, iris, or facial characteristics. Behavioral character consist of signature, voice, keystroke pattern, and gait. for this class of biometrics, technologies for signature and voice are most developed[4].

#### Biometric technology

Two types of biometric systems exist that enable the link between a person and his/her identity.

- ✓ **Identity verification** (or authentication) occurs when a user claims who he is and the system accepts (or declines) his claim.
- ✓ **Identity identification** (sometimes called search) occurs when the system establishes a subject identity (or fails to do it) without any prior claim[6].

This system can be based on any physiological or behavioural characteristics as long as the following properties are fulfilled2:

- (i) Universality — Every person should have the characteristics.
- (ii) Uniqueness — No two persons should be the same in terms of the biometric characteristics.
- (iii) Permanence — The characteristics should be invariant with time.
- (iv) Collectability — The characteristics must be measurable quantitatively and easy to acquire.
- (v) Performance — The biometric technique accuracy level[6].

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

- Social behavior analysis & behavior modeling, multimodal behavior patterns
- Temporal patterns
- Facial, gestural and voice-based affect recognition
- Sign-language recognition
- Human motion analysis
- Novel sensors applied by pattern recognition
- In sensor networks, reality mining pattern discovery
- Smart environments
- Human-computer interaction
- In Novel databases Benchmarking studies
- Selection and extraction methods for new feature
- Behavioral biometrics[7]

**HANDWRITING ANALYSIS** An approach to modeling human behavior is to consider the human as a device with a large number of internal mental states. The research builds on the observation that although human behaviors such as speech, handwriting, hand gestures and even American Sign Language.

Personal identification or identity authentication using biometrics applies pattern recognition techniques to measure physiological or behavioral characteristics.

There are two types of biometric systems that help to understand the link between a person and his/her identity.

- Identity verification (or authentication) occurs when a user claims who he is and the system accepts (or declines) his claim.
- Identity identification (sometimes called search) occurs when the system establishes a subject identity (or fails to do it) without any prior claim.

Human personality recognition is becoming more and more important in the modern world. Identifying, evaluating and understanding personality is done by a scientific method known as Handwriting analysis or Graphology, through the strokes and patterns revealed by handwriting. Type of writing in the form of signatures and letters stroked can describe the personality of the author. The use of signatures is usually used to identify certain personality as with appearance of dots, streaks, shapes or shell, and bottom line[1]. Accuracy of handwriting analysis depends on how skilled the analyst is. Human intervention in handwriting analysis although has been effective, it is costly and prone to fatigue. Development in image processing and pattern recognition lead to analyzing of handwriting based on graphology can be done automatically. Handwriting is included in the image, so that recognition can be performed through the stages of conversion of images into numerical vector, image processing for quality improvement, followed by pattern recognition and feature extraction.

Due to the fact that biometrics, as an automatic means of human. Several research handwriting analysis automatically with the aid of a computer without the human intervention to predict personality traits have been conducted. Among all some of them, using baseline, the pen pressure and the height of the T-bar on the stem of the letter 't' are considered for predicting the personality of the writer. recognition, constitutes a relatively novel field of research [1], most efforts undertaken by the different parties involved in the development of this technology (industry, researchers, evaluators, etc.) have been mainly (but not exclusively) directed to the improvement of its performance (i.e. finding ways to obtain lower error rates). Different studies have proved that performance of biometric systems is heavily affected by the quality of the input signals, and that even the best systems worldwide struggle in the presence of noisy samples. The term quality is considered from the *utility* point of view in order to investigate the cause that makes some signatures more suitable for automatic recognition than others[1].

**KEYSTROKES DYNAMICS** Mouse dynamic is also used for security purpose but tracking of keyboard activity is much more practical now a days. Keystroke dynamics is a behavioral biometric based on the assumption that different people type in a unique manner. Neurophysiologic factors make written signatures unique per person. Some of these factors are also expected to make typing characteristics unique per person.

Keystroke dynamics is also known with other names such as keyboard dynamics, keystroke analysis, typing biometrics and typing rhythms.

Keystroke dynamics are advantageous as compare to another biometric methods that another biometric may evenly change due to slight accident and other environment factors but keystroke have based on behavior of typing keys[4].

#### A. KEYSTROKE DYNAMICS FEATURES

There are several different features which can be detected when the user presses keys on a Keyboard.

**Possible features include:**

- Pressing time (the time in which the key is held down)
- Releasing time (the time in which the key is released).
- Latency (the time between two consecutive keys 2).
- Pressure used when hitting keys while typing (requires a special keyboard).
- Finger placement (the place where the finger is placed on the key or even the angle of the finger when pressing the key). In this case a required thing is camera.
- Finger choice (which finger is used on the key of the keyboard): In this case a camera is required.

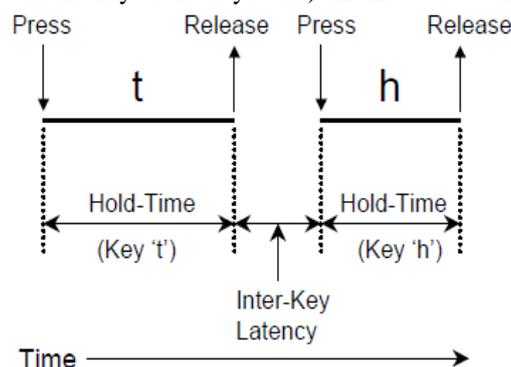


Fig.: Relationship between key hold-time and inter latency-time

**VISUAL ACTION RECOGNITION** In the analysis of human behavior vision is currently the most heavily used sensory modality. Visual human action recognition concerns the detection and noticing of people, and more generally, the understanding of human behaviors from image sequences involving humans. Predictions of humans and human behavior inherently involves estimation of body pose, locations and movements of body parts, interaction with objects. While estimating the pose means determining the location and the orientation for an object, humans manifest more complex pose aspects. In a tracking algorithm pose estimation can be a post processing step, or it can be an active part of the tracking process[7].

**FACE ANALYSIS** constitute a large portion of nonverbal behavioral cues, and facial expressions are among the most extensively studied signals in this category. These result from movements of the facial muscles as the face changes in response to a person's internal emotional states, intentions, or social communications. Psychological studies suggest that facial expressions, as the main mode for nonverbal communication, play a vital role in human face-to-face communication.

Facial expressions recognized by computer has many important applications in intelligent human-computer interaction, computer animation, surveillance and security, medical diagnosis, law enforcement, and awareness systems[7].

### **Biometric Technologies Comparison**

Particular human characteristic choice to be used as a biometric trait depends on the following criteria:

- 1) How well the biometric separates individually from another is known as uniqueness.
- 2) Permanence measures that how well a biometric resists aging.
- 3) acquisition for measurement is ease of collectibility.
- 4) Performance accuracy, speed, and robustness of technology used.
- 5) Acceptability degree is approval of a technology[5].

## **II. LITERATURE SURVEY**

The various approaches used for human behaviour modelling and analysis described below:

### **A. Personality recognition based on digit of handwriting and signature analysis**

Author Esmeralda C Djamal 4 December 2013, explained Handwriting stroke which reflect the written trace of each individual's behavior and style. By examining all elements of handwriting and interpreting them separately, we could generate a sketch of the writer's character, emotional disposition and social style using standard of graphology. According to image, the analysis of graphology is divided into two approaches that graphics features and segmentation digit each character. In this research, using combination of graphical approach based on signature and digits of character of application form using multi-structure algorithms and artificial neural networks (ANN). The image split into two areas: the signature based on nine features and application form of letters digit area. Each area had preprocessing performed to improve the recognition accuracy. In an image, Signature area is classified using ANN based on five features which result an accuracy of 56-78%. While four feature of the signature that detection using multi structure algorithm result 87-100% accuracy. In meantime, pattern recognition of application form digit area using Learning Vector Quantization gave 43% accuracy. It used 100 sets of data testing after training with 10-25 data. The system has been implemented with the software so that it can be used for classification of personality from handwriting scanned automatically[1].

### **B. Dynamic Markov models to recognize human behaviours**

The author Alex Pentland discussed Many human behaviors can be accurately described as a set of dynamic models (e.g., Kalman filters) sequenced together by a Markov chain. To recognize human behaviors from sensory data and to predict human behaviors over a few seconds time, author then use these dynamic Markov models. For testing of the power of this modeling approach, author report an experiment in which he were able to achieve 95% accuracy at predicting automobile drivers' actions from their initial preparatory movements[2].

### **C. Analysis of the quality of on-line handwritten signatures**

Author Javier Galbally 2011, Based on the Sigma-Lognormal model, an analysis of the quality of on-line handwritten signatures is carried out. In the study of kinematic perspective of humanly-produced movements two main issues are addressed. On the one hand, what makes some signatures perform better than others in automatic signature verification systems, and on the other side if that information may be used as a quality measure in order to predict the expected performance of a given sample. On the MCYT database experiments were carried out and show the high potential of certain kinematic features for signature quality assessment[3].

### **D. Calculation of pressing time, dwell time and total time of password in keystroke dynamics**

Author Swarna Bajaj, Sumeet Kaur, July 2013 discussed about an important problem describe as authentic, mean that it is such a good imitation that it is almost the same as or good as the original in computer system. Specially those used in e-banking, e-commerce, virtual offices, e-learning, distributed, computing and other services over the internet. Using keystroke dynamics technology we can secure our password. This technology is based on human behavior to type their password. Authors analyze the human behavior with their typing pattern. Keystroke dynamics are independent of

hardware, no extra hardware is used. Only software based technology keyboard is required for password protection. The results provide emphasis along with pleasure security that growing in demand in web-based application based on internet[4].

**E. Identification of Personality using multimodal Physiological biometrics and behavioural biometrics.**

The author S. M. E. Hossain and G. Chetty in 3, September 2011 discussed that a person Biometric authentication is highly challenging and complex problem noticed . A effective 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. Author had taken survey several important research works published in this area and we found our new technology to identify a person using multimodal physiological and behavioural biometrics. For first stage of experimental evaluation,author used side face and gait for our experiments and achieved around 100% recognition rate[6]

**F. Using Computer Automatic analysis of human behavior**

The author Albert Ali Salah1 made recent advances in pattern recognition has allowed computer scientists and psychologists to jointly address automatic analysis of human behavior via computers. At the International Conference on Pattern Recognition, the Workshop on Human Behavior Understanding explores a number of different aspects and open questions in this field, and the multi-disciplinary nature was demonstrated by this research area.

**III. TABLE**

<b>METHOD</b>	<b>AUTHOR &amp; YEAR</b>	<b>APPROACHES USED</b>	<b>ACCURACY RATE</b>
<b>Personality recognition based on digit of handwriting and signature</b>	Esmeralda C Djama1, 4 December 2013	Artificial Neural Networks (ANN) & Multi Structural Algorithm	56-78% (ANN) 87-100%(Multi Structure Algo)
<b>Dynamic Markov models</b>	Alex Pentland, 1999	Markov Chain	95% accuracy
<b>On-line Handwritten Signatures</b>	Javier Galbally 2011	MCYT database	
<b>Calculation of pressing time, dwell time and total time of password</b>	Swarna Bajaj, Sumeet Kaur, July 2013	Keystroke Dynamics	
<b>Multimodal Physiological biometrics</b>	S. M. E. Hossain and G. Chetty , 3, September 2011	Parzen density estimation and a unimodal distribution	100% Accuracy
<b>Computer Automatic analysis</b>	Albert Ali Salah1	Automatic Classification	

**IV. CONCLUSIONS**

Biometrics refers to metrics related to human characteristics. Biometrics authentication used in computer science as a form of identification of individual person. Biometric are classified into two categories physiological versus behavioral characteristics. Behavioral characteristics represent the pattern of behavior of a person, which includes typing, signature, gait, and voice, face expression.

This survey, I have presented some of the popular behavioural biometrics but any human behaviour can be used as a basis for personal profiling . Some behavioural biometrics which are quickly gaining ground such as Handwriting Analysis (4 December 2013), behavior prediction using Keystroke Dynamics (1999), Visual Action Recognition (July 2013), Face Analysis (3, September 2011)

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