

Personality Detection using Handwriting Analysis: Review

Hemlata, Manoj Sachan, Shailendra Kumar Singh

Abstract— Handwriting is one of the unique characteristic to represent what is in our minds, to communicate with others. Handwriting shows the true personality including behaviour, emotional outlay, self-esteem, anger, imagination, honesty, fears, defences and many other personality traits. It is commonly known as Graphology. Graphology is the scientific method for recognizing, assessing and to understand writer's personality through the shapes and word patterns in the handwriting. Personality can be identified through various handwriting features such as zone, baseline, slant, size, spacing, margin, pressure etc. Handwriting analysis has wide application in the various fields such psychology, medical diagnosis, recruitment of staff, career counseling, writer identification, forensics studies etc. This paper provides an outline of handwriting analysis, features of handwriting, its related personality traits, overview of the handwriting analysis system (HAS) and a literature survey of the existing papers on handwriting analysis.

Keywords—handwriting, handwriting analysis, personality, handwriting features, graphology

I. Introduction

Handwriting analysis [1]-[3] is a scientific method for recognizing, assessing and to understand writer's personality through the shapes and word patterns in the handwriting. Handwriting shows the true personality of the writer including behaviour, emotional outlay, self-esteem, anger, imagination, fears, honesty and many other personality traits. It is commonly known as Graphology.

Professional handwriting examiners who identify the personality through the handwriting samples are called graphologist. We can interpret the inner psychology and behaviour through the tone of voice (speech), facial expression, gestures, posture, and manner of dressing. Often, the external style mirrors the inward one. Handwriting is also one of the expressive ways that tells about your nature, psychology and behaviour of the writer.

Handwriting[1],[2] is unique to each individual. And it will be same and unique for a writer whether he/she has written with his/her foot, hand or mouth. Handwriting is written by the brain, not by the feet or hand. So, the handwriting is also called as brain writing. Each personality trait has neurological brain pattern in the human brain. Each neurological brain pattern design delivers one of a kind neuromuscular movement which is the same for each individual who has that specific personality trait. Each stroke or movement in handwriting reveals a particular personality trait. Graphology is the science which identifies these strokes in handwriting and describing the corresponding personality trait. Writer identification is used for various purposes for example, for security, monetary activity, forensic & utilizes as access control, analysis of handwriting documents can be used to judge the culprits in the criminal justice organizations.

Handwriting analysis or graphology has wide scopes in the fields such as recruitment, psychology, medical diagnosis, forensic, human computer interaction. Handwriting represents the personality and behaviour of the humans so it can be used in recruitment and staff selection. The handwriting discloses many things about the writer such as a psychological problem, morality, hidden talents, health related problems, past experience etc.[5]. Handwriting analysis can be used to obtain an insight in to the psyche of the person. Handwriting serves as one of the diagnostic tool. The handwriting reveals the psychological and physiological conditions of the patient; hence it is used as a valuation tool in medical and psychological diagnosis.

Earlier handwriting analysis was done manually by spending a lot of time to predict the nature of the person. In manual analysis, accuracy of the analysis depends on the skills of the graphologist. The graphologist is also prone to fatigue when several samples are to be analyzed. For getting a well-experienced graphologist high cost is incurred. At the other hand automated handwriting analysis is very fast, accurate, very low-cost and convenient method in the prediction of human personality.

This paper mainly focuses on the handwriting analysis process to detect the personality of a person based on their handwritten documents. Section II describe the related works in field of handwriting analysis, section III explains the

Hemlata
Department of Computer Science and Engineering
Sant Longowal Institute of Engineering and Technology, Sangrur
Punjab, India

Manoj Sachan
Department of Computer Science and Engineering
Sant Longowal Institute of Engineering and Technology, Sangrur
Punjab, India

Shailendra Kumar Singh
Department of Computer Science and Engineering
Sant Longowal Institute of Engineering and Technology, Sangrur
Punjab, India

Corresponding Author:
Manoj Sachan

handwriting features and personality, section IV explains the process of HAS and section V gives conclusion and future scope.

II. Related Work

Rahiman A.M et al. [1] proposed an offline, handwriting analysis tool called "HABIT" which stands for Handwriting Analysis Based Individualistic Traits Prediction which is used to detect the personality characteristics of writer from the given scanned image of a writer's handwriting sample. Champa H N et al. [3] proposed a rule base system whose input parameters are the pen pressure, baseline, height of the t-bar, and shape of the loop of letter 'y'. This system predicts the personality traits from these features. The baseline was found using polygonalization method, the position of 't' bar and slant of writing were found by template matching, the pen pressure using grey level threshold value, the loop of 'y' is analyzed by Generalized Hough Transform (GHT) technique.

Mukherji S et al. [8] proposed various algorithms to extract features like baseline, slant, size, margin etc from handwritten document image for personality detection. Dhadwal A. et al. [9] proposed a neural network system to know the psyche of the person through handwriting sample of the writer. This paper used image processing to detect the pressurized sections, edge detection, line segmentation and character segmentation to calculate the slant angles, height and pressure using thresholding.

Joshi P et al. [10] proposed a machine learning tool with KNN classifier with incremental learning to improve the efficiency of the handwriting analysis. The features baseline, letter slant, height of 't' bar, margin are used for personality analysis. The baseline was calculated using polygonalization method, margin was calculated using vertical scanning method, the height of the t-bar on the stem of alphabet 't' and word slant were calculated using template matching.

Mutalib S et al. [11] proposed a system to determine the level of emotion control of the writer using the fuzzy inference. The emotion of the writer was analyzed by the baseline of the writing and Mamdani inference was used. This system was mainly developed to help the counselor in order to detect the emotional control of their counselees.

Grewal P. K et al. [12] proposed a system with Artificial Neural Network to predict the behaviour by using the features like slant, baseline, pen pressure, letter 'f', letter 'i'. The baseline and slant were analysed using the polygonization method, the pen pressure was analysed using grey-level threshold value, and letter 'i' and letter 'f' were analysed using template matching.

Cha S.H et al. [13] proposed an artificial neural network to detect the forged handwriting by proposing a hypothesis that the authentic handwriting samples has the smooth ink traces while forged handwriting has wrinkly traces. The feature which was used includes the wrinkleless, centroid ratio, stroke width, slant, ascender and decender, the projected histograms and the gradient histogram.

Coll R. et al. [14] proposed a tool for measuring the active personality and leadership of the writer. To find the characteristic trait the writer they used the layout configuration, shape, letter size, slant and skew angle of lines, etc. and used a neural network to classify the person qualities. This paper proposed some new feature like roundness factor and frequencial analysis of word's core region which are different from one person to another.

Kamath V et al. [15] proposed an automated system to analyze the behaviour of the person using the features which includes slant, pressure, size, baseline, margins, number of breaks, spacing between the words and speed of writing.

III. Handwriting Features and Personality

There are various features of handwriting which are used to detect the personality characteristics of the person. These handwriting features the zone, baseline, pressure, size, spacing, slant, margin etc. are explained below.

A. Zones

The handwriting is partitioned into three parts called upper part, middle part, and lower part as shown in Fig.1. The Personality can be identified by analysing these three zones. The sections of the three zones are used to define the balance between the three major areas of ego development of the writer: the intellectual and spiritual sphere of the individual, everyday activities and the unconscious intuitive drives [16].

- Upper Zone represents: Future, upper body, conscious spiritual, intellectual and cultural aspirations, mental perceptions, concepts, fantasy.
- Middle Zone represents: Present, middle body, realistic, practical and social expression of the ego, emotional expression.
- Lower Zone represents: Past, Lower body, memory, unconscious drives, sensual perception, basic drives, unconscious drives and biological needs.

B. Baseline

The baseline can be ascending, descending, straight, as shown in Fig.2. Baseline is used to find the emotional outlay and nature of the writer. Ascending baseline represents the person is Optimistic, Hopefulness & cheerfulness, Stay Busy and Active, Excitability, choleric behaviour. Descending baseline shows that the person is pessimistic, mental tiredness of a temporary nature and has digestive trouble. Straight baseline shows that the person has stable outward behaviour, straightness, realism, and disciplined.

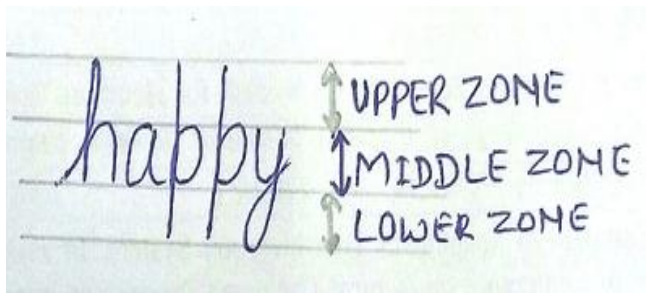


Figure 1. Different zones of characters

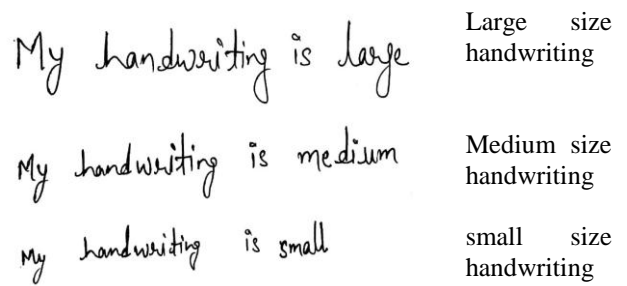


Figure 4. Different size of handwriting

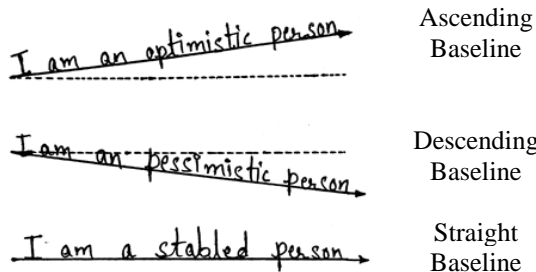


Figure 2. Different types of baseline

C. Slant

The slant of the writing is defined by the direction of letter slope and is measured by the angle formed between the letter (down stroke) and the baseline. The slant tells about the emotions, degree of sentimental control, emotional control and of the writer. There are three types of slant as shown in Fig.3.

D. Size

Size of the handwriting is measured by the vertical height of the letters. The size can be large, medium or small as shown in Fig. 4. Size tells us that how much importance the writer places upon himself and upon his own actions. It indicates how the writer will amaze himself upon his environment. For example, the writer with large size handwriting approaches life with extroversion and overindulgence and the small writer with seclusion and shyness.

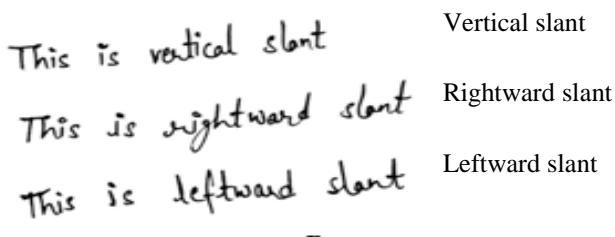


Figure 3. Different types of slant

E. Pressure

The amount of the force applied at the time of writing is considered as pressure of pen. It can be heavy, light or medium as shown in Fig. 5. From the pen pressure we can analyze the mental energy of the writer. The heavy pressure depicts the writer is energetic, active, anxious, vigorous, energetic in everything, angry, alert and punctuate. The medium pressure shows that the writer's feeling is not very intense. The light pressure depicts the calmness, passivity, lack of energy and illness [2].

F. Word Spacing

The space between the ending of first word and starting of the second word is known as word spacing. It represents the distance that the writer would like to maintain between himself and other people as shown in Fig.6. Spacing tells the closeness of writer with the other people and his intelligence. Wide spacing shows discrimination, independence, good taste, exclusiveness, snobbery, pride, has clear thought, ability to organize his work. Narrow spacing shows Inability to be alone, poor taste, friendliness, obtrusiveness.

G. Margin

Margin is the amount of space that the writer leaves in the left side of page or right side of the page or the top or at the bottom of the page [14]. When writer start writing on the blank sheet of paper, then they assume some margin space on that paper sheet and after that start writing. The margin of various types i.e. top, bottom, left and right margin. Margin can define the past and future, adjustments, intelligence, fastness and truthfulness [2].

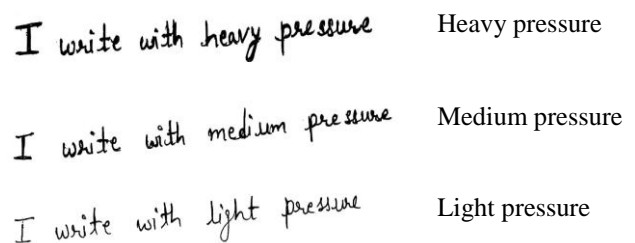


Figure 5. Different types of pressure during writing

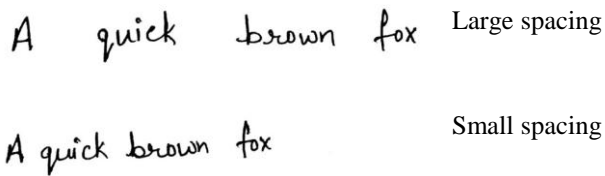


Figure 6. Word spacing between words

IV. Handwriting Analysis System

To analyse the personality from handwritten scanned sample we need to follow some steps as shown in Fig.7.

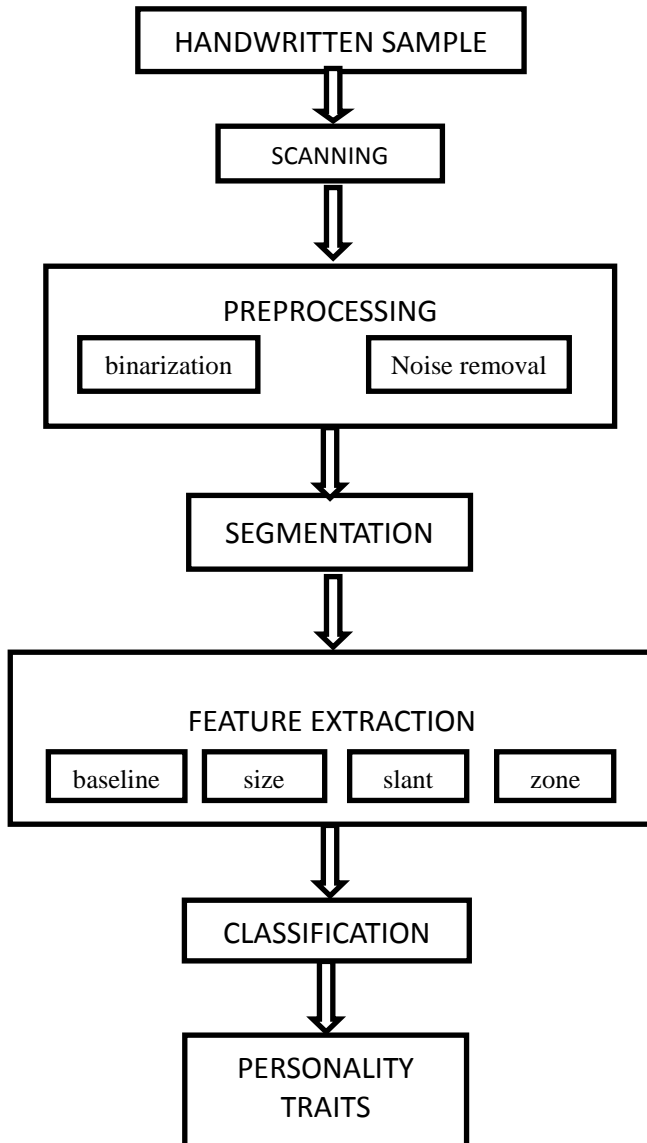


Figure 7. Personality detection system

A. Scanning

The handwriting samples are taken on a white A4 size paper. This handwriting sample provided as input to system. The handwriting sample paper is scanned using a scanner and

stored as image file (JPEG or PNG etc.) format or it can be taken using a camera.

B. Preprocessing

Pre-processing is done to enhance the image data as input and also some image features quality is improved for further processing. Image preprocessing includes noise removal, binarization, and normalization. Binarization converts the gray scale image into binary image. Noise removal techniques are applied to remove the unwanted data and to improve quality of image. Normalisation is used to remove some of the variations of handwriting styles and to simplify the shapes of symbols.

C. Segmentation

Segmentation is the process for segmenting the handwritten page into three different types of segments, i.e. line, word and character segment. Line segmentation is used to segment the handwritten image into text lines, lines further used for word segmentation which are used in feature extraction process, and character segmentation is used to segment the words into characters.

D. Feature Extraction

Feature extraction is a process of dimensionality reduction or extraction of an important data from a high dimensional input data. The output data is used for analyzing the personality of writer. The features can be the size, baseline, slant, margin, zones etc.

E. Classification

Classification is used to recognize the personality traits of the writers. The various features extracted in the feature extraction step act as input to the classifier. According to the feature values the personality of writer is identified. Using classification methods, classifiers or using rule base system the classification can be done.

v. Conclusion and Future Scope

HAS identifies the personality of a person. A scanned image of handwriting sample is given as input and a set of personality traits are produced as output. The paper studied has implemented HAS using various handwriting features such as baseline, size, slant, spacing, margin, pressure etc. and a more number of features like zone, f, i, speed of handwriting can be included to make the analysis more accurate. A Language independent human personality analysis tool can be created, which can recognize personality from different handwritings written in different languages. A fully automated HAS can be formulated that require no human interaction. A system can be created that recognize the changes in the past and present personality of a person through the change in the handwriting. Personality detection using HAS will be a helpful and efficient system for personality traits classification.

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About Author (s):



Hemlata has obtained BTech degree from Atal Bihari Vajpayee Govt Institute of Engineering and Technology, Pragtinagar, Shimla HP. She is pursuing M.tech in computer science and engineering from Sant Longowal Institute of Engineering and Technology, Sangrur, Punjab, India



Dr. Manoj Sachan is currently Associate Professor at Sant Longowal Institute of Engineering and Technology (SLIET), India. He did his B.Tech in Computer Science from Punjabi University, Patiala, India. He did M.E in Computer Science from Thapar Institute of Engineering & Technology, Patiala and Ph.D from Punjab Technical University, Jalandhar, India. His research interests include handwriting recognition, natural language processing and data mining.



Shailendra Kumar Singh has obtained BTech degree from UPTU, Lucknow, India and M.tech in computer science and engineering from BIT, Mesra, India. He is pursuing Ph.D from Sant Longowal Institute of Engineering and Technology, Sangrur, Punjab, India