



# Personality Identification through Handwriting Analysis: A Review

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**Abstract:** Whenever we listen to or meet a new person we try to predict personality attributes of the person. Our behavior towards the person is hugely influenced by the predictions we make. Personality is made up of the characteristic patterns of thoughts, feelings and behaviors that make a person unique. Your personality affects your success in the role. Recognizing about yourself and reflecting on your personality can help you to understand how you might shape your future. Various approaches like personality prediction through speech, facial expression, video, and text are proposed in literature to recognize personality. Personality predictions can be made out of one's handwriting as well. The objective of this paper is to discuss methodology used to identify personality through handwriting analysis and present current state-of-art related to it.

**Keywords:** Personality identification, Handwriting Analysis, Personality Traits, Writing Features.

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## I. INTRODUCTION

Graphology is the study of handwriting. It is a scientific method of evaluating, and also understanding a person's personality by identifying the strokes and patterns revealed by his handwriting. Handwriting is recognized as being unique to each individual. Irrespective of the fact whether the person has written with his hand, foot or mouth his handwriting will be the same and unique. The handwriting is done by the brain and not by the hand or by the feet. Hence handwriting is also known as 'brain writing'. Some scientists in the neuromuscular field of research state that some small neuromuscular movements are associated to the person's personality. Each trait of personality is shown by a neurological brain pattern. A unique neuromuscular movement is produced by each neurological brain pattern which is similar for every person who has that personality trait [5]. These tiny movements occur unconsciously while writing. Each stroke or written movement reveals a specific personality trait. Graphology is the discipline of identifying these strokes as they appear in handwriting and describe the corresponding personality trait.

The science of graphology is not new to the world. Interest in handwriting started 400 years back. Camillo Baldi is rightly called as the father of graphology as it is he who carried out systematic observations on the manner of handwriting and in the year 1622, he wrote the first graphological essay. In the year 1897, it was Abb Jean-Hippolyte Michon who coined the term 'graphology' by merging two Greek words 'graphein' (to write), and 'logos' (science) [1]. Handwriting can reveal a number of elements of the person's behavior, character or personality. This also gives us some glimpse about the person's intellect, his emotional responsiveness and energy, his defenses and fears, his motivation, integrity and imaginative power and his aptitude. It can even reveal his sex drive and his issues related to trust. Over 100 individual traits can be revealed and with an unlimited number of combinations. If a automated system for handwriting analysis is developed, then it will help in the detection of diseases like Parkinson's and cancer and also in personality recognition [12]. Hence, in the western countries graphology is a widely accepted method of personality recognition. Also it must be known that based on the person's age and current mental state his handwriting constantly keeps changing. And the absence of some particular characteristic in the handwriting does not mean the absence of that trait in that person.

## II. HANDWRITING AND PERSONALITY

There are many features of handwriting like the baseline, slant, pressure, letter, size, letter spacing, word spacing, margin etc. that can be used to reveal the personality of a person [1]. Various writing features used to predict personality traits are explained below.


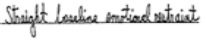







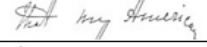

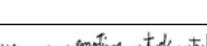

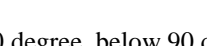
### A. Baseline:

Baseline is pre-printed or imaginary line on which letters reside. If the paper is with no pre-printed line, then writer assumes their own baseline according to his/her writing style. Even on the pre-printed page writer is not adhere to the line during the writing. Hence, writing can be straight, ascending, true ascending, descending, concave, suicidal or erratic. These baselines help to find out the emotional control and the reliability of the writer. Various types of baselines are explained below:

- *Stable baseline* indicates that the writer should have stable outward behavior, disciplined, realism and straightness.

- *Ascending baseline* indicates that writer should be optimistic and the descending baseline indicates pessimistic nature.
- About *Suicidal writing*, the graphologist came to know that the baseline of the suicidal note is straight at starting and suddenly it is downward at the last. i.e. last letters crashed with another. These suicidal writing or suicidal notes are usually not very long.
- *Concave baseline* defines the enthusiasm of the writer at the starting of work, at middle writer is not sure about completion, therefore writing goes down at the middle and at the end somehow they reach to their goal. Hence, the starting and the ending points are at the same baseline.
- *Erratic baseline* shows the moodiness of the writer because the writing contains number of ups, downs and sometimes straightness. It shows they may laugh and cry easily and having unstable nature. The summary of baseline is given in Table I.

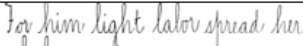
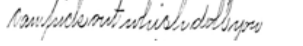
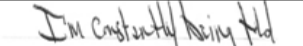
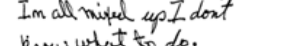
Table I. Baselines and related personality traits

Sr. No.	Type	Personality Traits	Writing Sample
1	 Straight Baseline	Stable outward behavior, disciplined, realism and straightness.	
2	 True Ascending Baseline	Healthy mental energy, Stay busy and Active. Hopefulness & Cheerfulness. Excitability, euphoria, and choleric behavior.	
3	 False Ascending Baseline	Quitter, Enthusiastic about his/her goal.	
4	 Descending Baseline	Sinking feeling, Purely physical weakness or physical or mental tiredness of a temporary nature. Depression & Melancholy. Pessimistic, Digestive trouble.	
5	 Suicidal Baseline	Suicidal feeling	
6	 Concave Baseline	Enthusiastic at start of the work, depressive at the middle and reach to goal at the end.	
7	 Erratic Baseline	Unstable, Moody, can easily cry and laugh.	

## B. Slant:

When writer writes assuming imaginary line, each letter in the sentence can be at 90 degree, below 90 degree or above 90 degree. If each letter in the sentence is at 90 degree then writing is considered as vertical slant. If it is below, then considered as rightward slant and if above 90 degree, then considered as leftward slant. Sometimes, writing may contain combination of above three slants and it is known as unstable slant or variant slant. The slant of the writing convey about emotions of the writer. Handwriting with vertical slant defines the writer as having positive qualities of independence, cool judgment and controlled emotions. The rightward slant depicts initiative character, social achievements, intense bonding of emotion. The leftward writing depicts selfish, introversion and inexpressive emotion character of the writer and the variant slant shows the unstable nature. This will be understood by referring Table II.


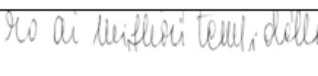
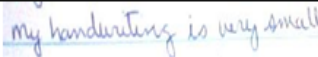
Table II. Slant and related personality traits

Sr. No.	Type	Personality Traits	Sample
1	Vertical Slant	Real feelings, Positive qualities of independence, Living in the present, Cool judgment, Discrimination and Controlled emotions. Apathy, coldness, laziness.	
2	Rightward slant	Demonstrative, Affectionate, Passionate, Speaks of future, Compliance, Vision, and Expressiveness.	
3	Leftward Slant	Avoid emotional involvement in a situation. Materialistic, Oriented towards the past, Negative, past, fear, resistance, doubt and repression.	
4	Variant Slant	Unstable nature, <u>can not</u> take decision correctly.	

### C. Size:

The size of letters can be large, medium or small. These three types of size define the concentration of writer. The large handwriting tells less concentration and extrovert. Actors, politicians and salespersons have large handwriting. The medium handwriting tells ability of writer to concentrate on things and maintaining them. The writer having small handwriting is introvert, have more ability to concentrate. Scientists, authors, composers have small writing. Various types of letter size and related personality traits are shown in Table III.

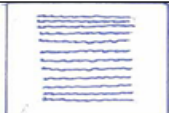
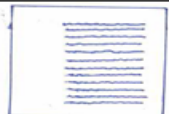
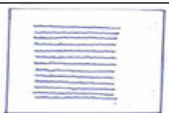
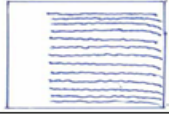
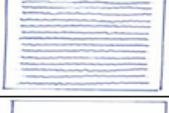
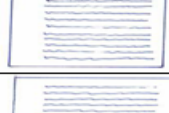
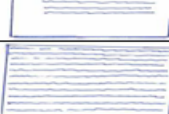

Table III. Size and related personality traits

Sr. No.	type	Personality Traits	sample
1	Large size	Extroverts, Cannot concentrate on small details, Demand space in life, Lavish, ceremonial, prodigal, and luxurious, big planners and see things in a big way, Boisterous and loud.	
2	Medium size	Social and have an average ability to concentrate on things, Has a need to conform in all areas.	
3	Small Size	Introversion, Sense of economy, Deep concentration	

### D. Margin:

The layout of the page can be considered as margin. When writer writes on the blank page, they assume margin and writes. The written page when we see, there is blank space on left, right, top and on bottom. These are margins. Margin can define the past and future, intelligence, adjustments, truthfulness and fastness. If there is constant left margin, then writer should have the good manners and constant behavior. If it is irregular, then writer is careless about their dressing and behavior. Constant right margin shows good judgment and the ability to take decision. Top margin tells about convention. Less space on bottom side shows laziness and indecision of writer. Various margins with related personality traits are given in Table IV.

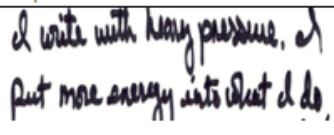

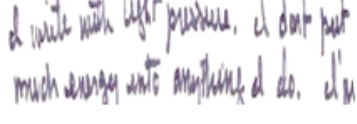
Table IV. Margins and related personality traits

Sr. No.	Type	Personality Traits	Sample
1	Even Margin all around	Naturally appearance-conscious, Interest in beauty, design, symmetry, order, and balance.	
2	Overly wide left margin	Imaginary barrier between himself/herself and the past, Feels the past.	
3	Overly wide right margin	Future goals, Imaginary barrier as to how far one can get in life.	
4	Crushed right margin	Dangerous impulsiveness, not conscious, do not plan ahead, do not think.	
5	Narrow margin on left and right	Can't prepare himself to leave room for others.	
6	Wide upper margin	Formal, Respectful. (official letters)	
7	Wide lower margin	Afraid of future and not going ahead.	
8	No margin at all	Fill every waking moment of your life with some activity or other, Have a compulsion to be busy leaving no time for relaxation, Will do everything to get a thing done.	

### E. Pressure:

The amount of the force exerted at the time of writing is considered as pressure of pen. Pen pressure may be heavy, light or medium. The pen pressure shows the mental energy of the writer. The medium pressure depicts the feeling not so intense. The heavy pressure shows self-assertive, dynamic, heavy in everything, angry, energetic, active, anxious, alert and punctuate. The light pressure shows passivity, calmness, lack of intensity and illness.

Table V. Pressure and related personality traits

Sr. No.	Type	Personality traits	Sample
1	Heavy Pressure	Highly successful in their career, Extremely ambitious, Emotional experiences last long, Good power of determination, High energy/vitality to execute plan.	
2	Medium Pressure	Average in terms of success, Capable of handling stressful situations well, Consistent with regard to their plans.	
3	Light Pressure	An indicator of poor health, Low self-esteem, Lack of determination, Can endure traumatic experiences without being much affected.	

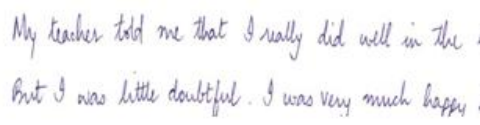
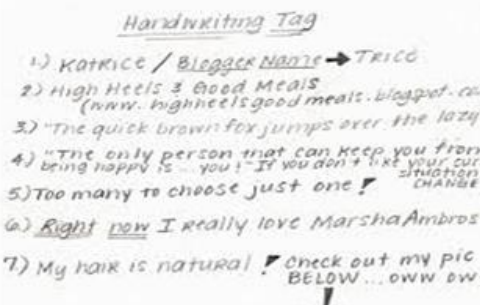
### F. Speed:

The speed shows how quickly or slowly the writer writes. It shows thinking ability of writer. Fast writing shows that writer dislike to wait for anything, having large imaginary power and slow writing shows response to a greater degree, less imaginary power and thinks slowly.

If writer's speed is fast, then he gives more space between two words and dot of letter 'i' and bar of letter 't' is not there mostly or the dot of the 'i' is more away from the letter and bar of the 't' is not completely crossed, it is crossed more from t-stem to right. Generally, these are the writers with light pen pressure and right slant.

If writer's speed is slow, then he exerts heavy pressure, dot of 'i' and bar of 't' is from left to the letter or more accurate. Slow speed handwriting usually have left slant and missing end strokes. When writer copies from the provided material, then speed of the writing automatically goes slow. Different types of speed with related personality traits are given in Table VI.

Table VI. Speed and related personality traits

Sr. No.	Type	Personality Traits	Sample
1	Fast Speed	Intelligent and spontaneous, honest, Fast in thinking and acting, Often impatient, Dislike to waiting for anything.	
2	Slow speed	Becomes guarded and makes calculated responses, afraid.	

### G. Spacing:

In graphology spacing implies the distance maintained between the lines, words and letters by the writer. Spacing can reveal various personality constructs like the writer's closeness with people, and also his intelligence. Spacing can be identified into two main groups as wide or narrow as shown in table below:



Table VII. Spacing and related personality traits

Sr. no	Type	Personality Traits	Writing Sample
1	Wide Spacing	discrimination, good taste, independence, exclusiveness, isolation, loneliness, snobbery, and pride.	Out, out, brief candle!
2	Narrow Spacing	warmth, sympathy, gregariousness, obtrusiveness, poor taste, and inability to be alone	Hello! This is Ramana Rajgopal from Pune, India.

#### H. Zones:

Zones are categorized in three parts: upper zone, middle zone and lower zone. Personality is identified by analyzing these three zones.

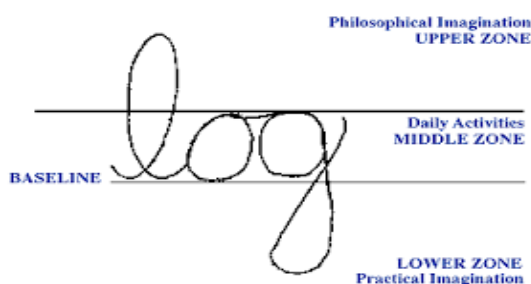


Figure 1: Zones

Here 'l' is in upper zone, 'o' in middle and loop of 'g' is in lower zone.

The upper zone consists mainly of letters with upper loops like: 'd', 'h', 'k', etc. The upper zone identifies with the personality trait of Super ego of the writer. Such a person is overly egoistic and has a futuristic approach to life.

The middle zone has the letters like 'ó', 'á', 's', 'c', etc. A prominent writing in this zone indicates a person with moderate ego and can also tell whether the person is happy or not. This also indicates a person who lives in his present.

The lower zone letters include letters having their loops in the lower zone such as 'y', 'g', 'j', etc. A prominent lower zone in the writing indicates that the person enjoys a luxurious and materialistic lifestyle. Such a person is usually troubled by incidents of his past.

Table VIII. Zones and related personality traits

Sr. No	Zone	Freudian Model	Time Model	Body Model	Sample	Meaning
1.	Upper zone	Superego	The Future	Upper body	The D. B. B. B.	It is the domain of the mind. All that we think, create, imagine, and hope are in the head. Therefore thinking, fantasy, imagination, ideas, illusions, philosophy, and religion are there.
2.	Middle zone	Ego	The Present	Middle body	I am a leader	The middle zone represents our daily life. It will indicate whether we are happy or not. It can also reveal whether we are egoists or feel small and insecure. It can also tell if we are childish.
3.	Lower zone	Id	The Past	Lower body	So far wonderful	It is the realm of libido. It contains instincts, urges, longings, and desires. It can show our attitude towards home life, body, basic drives for sustenance, money, health, and sex.

#### I. Print writing and cursive writing:

There are print, cursive and mixed writing. Print writing shows practicality, profession, consideration, overcompensation, standing out, dishonesty and hiding personality.

Cursive writing shows sequential thinking and good behaviour, while Print-cursive writing shows that person likes to save his/her time. The mix writing styles represents that the person is of antisocial tendency. Different writing styles with related personality traits are shown below:

Table IX. Print, cursive writing and related personality traits

Sr. No	Type	Sample	Personality
1.	Print	I WAS REALLY IMPRESSED BY THE ARRANGEMENT.	Practicality, consideration, profession, standing out, overcompensation, hiding personality, and dishonesty.
2.	Cursive	<i>Cursive or Connected Writing</i>	Sequential thinking and acting.
3.	Print-Cursive	<i>management</i>	Saving time and being fast.
4.	Mixing Styles	WHAT IS MIXING OF styles	No predictable pattern of life, antisocial tendency.

#### J. Connecting Strokes

In Cursive writing, connecting strokes links one letter to other. They consist of four main groups of connecting strokes: garlands, arcades, angles, and threads.

When letters are connected by the underhand strokes, then we can say that the writing is of garland stroke. This garland stroke can be found in the palmer method of writing. The arcades have an exactly opposite feature of that garland. It connects the letters by an overhead strokes.

When letters are connected with sharp strokes like upward and downward, then we can say that writing have angle strokes. Thread linking strokes are a kind of scribble, a flow of line that can mean practically nothing. These all types of strokes are summarizes in the given Table X.

Table X. Connecting strokes and related personality traits

Sr. No	Types of strokes	Sample	Personality
1.	Garlands	<i>garlands</i>	Friendliness with variation, show off, burdened, deceptive goodness.
2.	Arcades	<i>when when her had</i>	Cover up, aberrant thinking.
3.	Angles	<i>angles are sharp</i>	Aggressiveness, stubborn, uptightness.
4.	Threading	<i>tending, tendency, tendency</i>	Unhappiness, fatigue, sneakiness, diplomacy, inconsiderate.



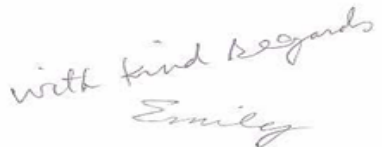



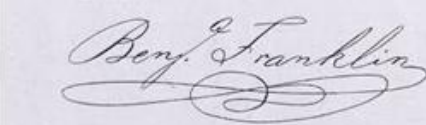
#### K. Signature:

Signature represents one's public character, self-possession, insensitivity, inflections, diversity, and imagination. Signature is the calculation and material of your public character. It gives idea of how one behaves in public, how one pictures around people, and in short, one's social facade. It can also comprise themes of what one consider his personality in public.

It is said that while lettering a sentence, we leave on the pages our information and belief. But whenever we sign, we represent our name, our self, and our public character on the page.

By matching one's signature with the rest of writing, we can notify whether one is the same in community as well as in personal life. Different types of signature with related personality traits are given in Table XI.

Table XI Signature and related personality traits

Sr no	Type of signature	Personality	Sample
1.	Ascending signature	Most mental energy in regard to his/her public self-image. Feels good about his/her public character.	
2.	Descending signature	Depression, disappointment, disillusionment, or negative feelings associated with the public self-image	
3.	Descending signature with uphill writing	Mental energy with his/her uphill writing, depressed about his/her public self-image.	
4.	Underscored signature	Healthy self-confidence, reaffirmation. The more one underscores, the more the person is lacking in public self-worth.	
5.	Over scored signature	Defensiveness, insecurity with the public self-image. Egotistical type of signature.	
6.	A period after signature	Such kind of person says in a shrill voice that after me there is no more. The end.	
7.	Creative signature	Creative, dramatically express him/herself.	

### III. PERSONALITY IDENTIFICATION THROUGH HANDWRITING ANALYSIS SYSTEM OVERVIEW

The block diagram of Personality Identification System is shown in Fig. 2. It comprises steps like scanning, preprocessing, feature extraction and classification. These steps are explained below.

#### (a) Scanning:

The input to the system is handwriting sample. The sample is taken on a plain white A4 size paper. It is then scanned using a scanner in JPEG or BMP format or a photo of the sample is taken using a camera. This is called as offline approach for handwriting recognition. Another approach would be an online approach where the user can directly write onto the scratch pad or any other similar text accepting instruments [10]. This image is given as input to the preprocessing step.

#### (b) Preprocessing:

In the preprocessing step image segmentation is done. This process includes normalization, binarization, noise removal and slant removal. The image is then segmented. Segmentation process partitions a digital image into multiple segments. This is done in order to get only the relevant information i.e. text and remove out all unwanted information. The segmented image acts as input to the feature extraction step.

**(c) Feature Extraction:**

The writer's characteristics are defined by handwriting features. This feature extraction process extracts the important and relevant information about the writer. The feature extraction process finds out various writing features like baseline, slant, size of the letters, pen pressure, spacing between the words, spacing between letters, zone, speed, margin etc. Using these extracted features we can classify the writer's character in a particular class. Feature extraction includes three types of methods:

**1) Statistical Method:**

It takes care of the style of the character letters. It includes calculation of the upper zone, middle zone, lower zone, shape of character, uppermost and lowermost point of character, horizontal and vertical projections and the calculations of distances between the words. The Zernike and Pseudo-Zernike statistical methods can be used for feature extraction [11].

**2) Structural Method:**

This method calculates the loops of the character, cross points, strokes and directions of the words.

**3) Global Transformation:**

It is used to calculate the contour of the character image.

**(d) Classification:**

To identify different personality traits, the writing features extracted from the feature extraction phase are classified using any classification method. Most of the works have used the classifier built using ANN where the neural network is pre-trained to identify personality traits from characteristic strokes of the handwriting sample.

Bin Zhang and Sargur N. Srihari state that the GSC algorithm can be effectively used to characterize the image by concavity, gradient and structural features [9].

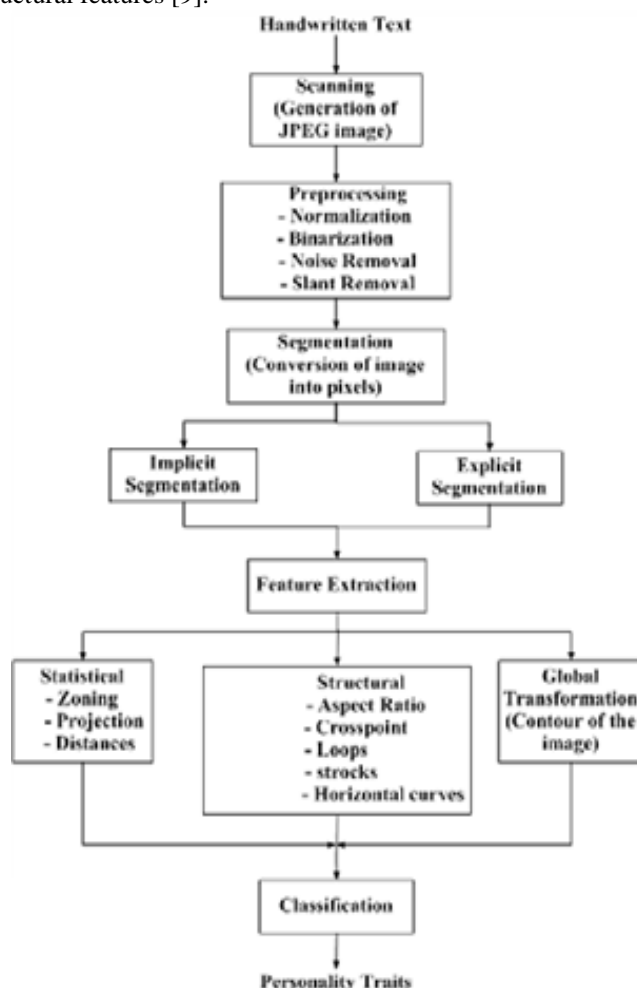


Figure 2. Personality Identification through Handwriting Analysis System Block Diagram

#### IV. CONCLUSION

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 [2]. It can find its applications especially in the fields of personnel recruitment, in fields of marketing, medicine and counseling and also biometrics, forensics studies [8].



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