

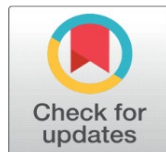
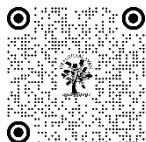
TO STUDY THE IMPLICATIONS OF VARIOUS PARAMETERS OF HANDWRITING OF AN INDIVIDUAL TO FIND HIS BEHAVIOUR AND SENTIMENT

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ABSTRACT

Analyzing a person's writing can provide important insights on their sentiment and behaviour by looking at a variety of linguistic and psychological factors. While lexical choices like pronouns and emotional or cognitive words reveal the writer's focus and social orientation, sentiment polarity—whether positive, negative, or neutral—highlights the emotional tone. Punctuation, sentence structure, and complexity provide more information on cognitive processes and emotional intensity. The use of metaphors and images, as well as temporal attention, reveal the inner condition and concerns of the individual. Additional factors that influence behavioural patterns like assertiveness, anxiousness, or self-focus include tone, repetition, and psycholinguistic traits. Through the integration of these criteria, text analysis provides a window into an individual's psychological composition and is an effective tool for recognizing emotional states, cognitive tendencies, and possible behaviours.

Keywords: Graphology, Features, Personality Traits, Handwriting, Feature Extraction

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1. INTRODUCTION

People have a wide range of attitudes and behaviours. Gathering knowledge about a person's nature is quite challenging. In certain situations, handwriting analysis can be used to express a person's personality. Handwriting analysis is also called as Graphology.

People's textual expressions can provide important details about their underlying feelings, mental processes, and behavioural patterns. A writer's mental state can be seen through linguistic analysis, which reveals both the writer's immediate emotional tone and more profound psychological patterns. One can determine the writer's emotional state and cognitive orientation by looking at a number of factors, including sentiment polarity, word choice, tone, sentence structure, and temporal focus. Sentence complexity or the use of pronouns, for instance, can reveal the writer's degree

of introspection, societal perspective, or analytical thinking, while the use of emotive phrases can convey feelings of joy, stress, or rage. These textual components are crucial for comprehending behaviour because they convey the nuances of attitude, mood, and possible behaviours.

Written text analysis has emerged as a vital technique in behavioural and sentiment analysis, providing a sophisticated method of comprehending personal psychology in a world where digital communication is becoming more and more prevalent. This introduction lays the groundwork for investigating how different textual factors can convey sentiment and behaviour.

2. TYPES OF WRITING

The term "handwriting" refers to any kind of handwriting that is not assisted by a computer. There are two types of writing.

Print Writing:

In print, the letters don't seem to fit together at all. Manuscript, print script, block letters, and other similar terms all describe it. On official documents, these types of writing are commonly used. It's straightforward and easy to read, making it suitable for many formal documents and communication. - It's commonly taught to children when they first learn to write.

Figure 1

1) Hand printed words

Straße u. Hausnummer	
WILHELM-RUNGE-STRASSE	11
PLZ	Ort/-Ortsteil
89081	ULM
Nachname	
JÄGER	
Vorname	
STEFAN	
	weibl. männl.
	☐ ☒

2) Cursive writing

When writing in a handwritten style, each letter of a word is joined together. Longhand is another name for it. Several letters utilize the cursive approach because it is believed to boost writing speed and because pen lifting is infrequent. It encourages better language and recall skills and boosts our capacity for creative thinking.

Figure 2

Types of cursive script



3. LITERATURE REVIEW

The researcher has explored the fuzzy technique to extract the features in handwriting and then recognize the emotion of person. It uses slope or baseline of the handwriting for defining the level of emotion control= whether it is very low, low, medium, high or very high using Mamdani inference. The author has concluded that Handwriting analysis

have been valid in many fields such as self-awareness, counselling, employee selection, and criminology. (Sofianita Mutalib et.al. 2008)

The researcher has presented a simple method to extract, analyze, correlate and classify writings from a psychological method. This method mainly depends on the features which are observed on the writings. The author has concluded that the method presented provides HR professionals with a useful and fast tool which are more reliable than personal interviews, that allows to improve selection filters as well as saves time and efforts in recruitment processes (Ricard Coll et. al., 2019).

The researcher has proposed an automated method by using SVM machine learning algorithm to guess the personal behaviour of an individual from their handwriting analysis in digital form. Segmentation was used to compute the features from digital handwriting and was trained to SVM which outputs the behaviour of the writer. The author has concluded that it was a real-time handwriting analysis system which was writer-independent. (Shitala Prasad et. l., 2010)

The researcher has focused on convolution neural network for recognizing emotional state, using handwritten text analysis and psychological assessment. It is necessary to identify negative emotions like depression, anxiety and stress of an individual who might be in the need for counselling of psychological treatment. The author has concluded that, based on handwritten text, negative emotions such as depression, anxiety and stress could be predicted. (S.V. Kedar et. al., 2019)

The researcher has proposed a method to predict the personality of a person by discovering his handwriting. In this method, the system compares the input image which is created after applying the convolutional network on training dataset with the CNN model. The key feature of this proposed method was by using CNN, extract all the possible Behaviours of human from handwriting. The author suggested that the proposed method can be used to improve the accuracy as well as the behaviours of a person faster by graphologist. (Rutuja Gaikwad et. al., 2020)

The proposed system's primary objective is to employ machine learning to develop a system that can anticipate a writer's personality. Through the examination of every person's handwriting pattern, author put forth a technique to forecast some aspects of an individual's personality. Every SVM classier receives training for every personality attribute. The author has decided that it accurately determines your personality based on your handwriting. With the SVM classifier, he is able to reach 90% accuracy. (Patil Abhijit et. al., 2020)

This research has suggested a machine learning technique to predict an individual's personality attributes. To extract behavioural data from handwritten records, a Convolutional Neural Networks based technique is proposed. The suggested method can be utilized in a variety of contexts, such as helping graphologists improve handwriting accuracy, selecting candidates who are psychologically qualified for a given position. (Prajakta Mahale et. al., 2021)

The goals of the research were to use graphology as an analytical tool to determine English language learners' intrinsic motivation, personality traits, and preferred methods of instruction. This study employed a qualitative methodology. The author's conclusion is based on the data analysis results, which indicate that there was 82.6% data accuracy among the interview and analysis results. (Septiana Rifda Saskia et. al., 2022)

4. METHODOLOGY

- 1) **Image acquisition:** The first step is to take pictures of papers or handwritten characters. These obtained photos are used as input information for additional processing. Image Capture: Digital input devices, scanners, and photographs are some of the ways that handwritten documents can be captured on camera.
- 2) **Preprocessing:** Preprocessing techniques are used to improve the quality and eliminate distortions after the photos are acquired. Typical preprocessing duties include: Noise reduction, which is the elimination of undesired noise or artifacts, Thresholding is the process of converting grayscale photos to binary format, and contrast enhancement is the process of modifying image contrast.
- 3) **Segmentation:** The obtained image is broken up into smaller parts in this stage, like individual characters or text lines. Each handwritten character is divided into smaller representations for additional examination.
- 4) **Feature Extraction:** The handwritten lines are straightened using contour-based analysis. Its main goal is to record details about the form and organization of the contours (boundaries) of objects or characters in an image. With this method, contours are found, regions of interest are extracted, and then these sections are straightened utilizing features including baseline, slant, letter size, pressure, and spacing.

- 5) **Training and Testing:** Create the model by dividing the dataset into 70% training and 30% testing. Use the training dataset to train the model, then use the testing dataset to test it.
- 6) **Result:** A person's trait will be shown in the end product.

4.1. PARAMETERS

There are a number of important factors to take into account while examining someone's writing in order to deduce their mood and behaviour. Each sheds light on various facets of the individual's emotional condition, thought processes, character attributes, or possible actions.

The primary parameters and their implications are listed below:

- 1) **Slant:** Whether the writing leans to the left, right, or remains upright.
- 2) **Size of Letters:** Large letters versus small, compressed letters.
- 3) **Pressure:** The amount of pressure exerted on the writing surface.
- 4) **Spacing:** The distance between letters, words, and lines.
- 5) **Baseline:** The imaginary line along which the letters are aligned

1) Slant

A person's handwriting style might indicate their emotional expressiveness and world view.

Table -1

Letter Slants and Personality Traits

Letter Slant	Personality Traits
Rightward Slant extroverted	gregarious, open, emotionally expressive and
Leftward Slant	more reserved, reflective and emotionally stable
Upright Slant	sensible, pragmatic, self-control and emotional equilibrium.

- **Rightward Slant:**

Implication: People with a rightward slant are frequently gregarious, open, and emotionally expressive. They are more inclined to be extroverted and to show their feelings openly.

Behaviour: A person with this slant might be outspoken, self-assured, and love social interaction.

Sentiment: Despite their potential for enthusiasm and responsiveness, they may exhibit impulsive behaviour when under stress.

- **Leftward Slant:**

Implication: A person with a leftward slant is more reserved, reflective, and emotionally stable. These folks frequently like keeping their emotions to themselves.

Behaviour: Tends to be cautious and introverted. They may seem reclusive or like to be alone.

Sentiment: They might repress their feelings and avoid conflict, which could make them come across as aloof or uneasy in social settings.

- **Upright Slant:**

Implication: Handwriting that is upright conveys self-control and emotional equilibrium. These people may be sensible, pragmatic, and have a tendency to control their emotions.

Behaviour: Demonstrates impartiality and independence. These individuals could come across as impartial and refrain from making rash decisions.

Sentiment: A balanced and steady thinking is reflected in a neutral emotional disposition, where one may not be readily influenced by intense emotions.

2) Size of Letters

The writer's self-perception and relationship to the outside world are typically reflected in the size of their handwriting.

Figure 2

Handwriting Size and Proportion

Letter Size	Personality Traits
Large Letters outgoing, self-importance	extrovertism, self-assurance, confident,
Small Letters	Introversion, orderly, focused, concentrated, Shy
Medium Letters	balanced outlook, Emotional stability and adaptability

- **Large Letters:**

Implication: Extrovertism, self-assurance, and a desire to stand out or have an influence are all linked to large handwriting.

Behaviour: People that write big letters are typically confident, gregarious, and outgoing. They could like being the focal point of a gathering and look for attention.

Sentiment: Excitement or a feeling of self-importance. In severe situations, it may indicate a lack of subtlety or even a need for approval.

- **Small Letters:**

Implication: Small handwriting frequently conveys focus, attention to detail, and introversion.

Behaviour: Shows a considerate, orderly, and focused person who enjoys isolation and is more likely to be contemplative and concentrated.

Sentiment: A feeling of modesty or shyness. These people are more inclined to be critical of themselves and are reluctant to seek attention.

- **Medium Letters:**

Implication: A balanced person who can adjust to different social situations is suggested by medium-sized handwriting.

Behaviour: Shows a balanced outlook on life, neither overly demanding nor overly reclusive.

Sentiment: Emotional stability and adaptability are demonstrated by balanced and pragmatic feelings.

3) Pressure

Stress, energy levels, and emotional intensity can all be revealed by the pressure used when writing.

Table 3

Amount of Pressure and Personality Trait

Amount of Pressure	Personality Trait
Heavy Pressure	strong feelings, vigor, or elevated stress and anxiety

Light Pressure	calm, tranquil or more passive, peaceful
Variable Pressure	erratic energy levels, mood swings

- **Heavy Pressure**

Implication: Strong feelings, vigor, or elevated stress and anxiety are all suggested by heavy pressure.

Behaviour: These people frequently have strong wills, passions, and determination. When under strain, they could also become irritable or hostile.

Sentiment: Reflects the depth of their emotions, since they may feel and show intense emotions like rage or excitement. Additionally, persistently high pressure may be a sign of tension, worry, or annoyance.

- **Light Pressure:**

Implication: A calm, tranquil, or more passive emotional state is reflected in light pressure.

Behaviour: Light pressure is indicative of a more passive, serene, or peaceful emotional state.

Sentiment: Shows a calm, easy-going demeanour. It can also imply someone who is less vivacious or emotionally aloof, and in certain situations, they might feel worn out or insecure.

- **Variable Pressure:**

Implication: Alternating between heavy and light pressure indicates emotional instability or erratic energy levels.

Behaviour: This could indicate a person who is readily influenced by their feelings, which could result in mood swings or erratic behaviour.

Sentiment: Variable emotions, suggesting that the individual may be prone to abrupt mood swings or sentimental changes.

4) Spacing:

Spacing between letters, words, and lines provides insight into how an individual manages personal boundaries and relates to others.

Table 4

Spacing and Personality Trait

Spacing	Personality Trait
Wide Spacing	privately protective, cautious, and restrained
Narrow Spacing	prefers intimacy and social contacts, loving
Irregular Spacing	erratic emotions, abnormal thinking or emotional confusion

- **Wide Spacing Between Words:**

Implication: A person who prefers to keep emotional distance from others and values independence and personal space is suggested by the wide spacing between words.

Behaviour: Likely to be privately protective, cautious. They might prefer more intimate social relationships or prefer to be alone.

Sentiment: Shows a more introverted personality, restrained with a propensity to keep oneself or other people emotionally or physically apart.

- **Narrow Spacing Between Words:**

Implication: A person who prefers intimacy and social contacts and frequently looks for emotional or physical connections with others is indicated by narrow spacing.

Behaviour: These people might be more outgoing, loving, and at ease in social situations.

Sentiment: Dependency and emotional intimacy, indicating a desire for closeness or cooperation.

- **Even Line Spacing:**

Implication: A structured, rational, and emotionally stable person is reflected in lines and words that are spaced consistently apart.

Behaviour: Suggests a person with a balanced outlook on life who planned and thinks clearly.

Sentiment: Shows a calm and collected person by demonstrating emotional clarity and mental order.

- **Irregular Spacing:**

Implication: Uneven spacing is a sign of emotional instability or abnormal thinking.

Behaviour: These people may have trouble making plans or may have erratic emotions that make it difficult for them to maintain organization.

Sentiment: Possible signs of abnormal thinking or emotional confusion include stress or emotional instability.

5) Baseline:

The imaginary line that the text is printed along is called the baseline. A person's emotional stability and perspective might be shown via deviations from the baseline.

Figure 3

Baseline and Personality Traits

Baselines		Personality Traits
	Rising upwards	Optimism, faith in future, feeling of being loved, excitement, joy
	Slanting downwards	Pessimism, fatigue, discouragement, depression, illness
	Straight	Reliability, even temper, control of emotions, reason rules, unwavering resolution

- **Rising Upwards:**

Implication: A baseline that slopes upward conveys motivation, optimism, and good vibes.

Behaviour: These people frequently have a positive attitude on life, faith in future, feeling of being loved

Sentiment: Shows optimism, excitement and joy.

- **Slanting Downwards:**

Implication: A baseline that slopes downhill suggests emotional suffering, exhaustion, or pessimism.

Behaviour: Represents a person who might be feeling fatigue, , perhaps experiencing discouragement.

Sentiment: Implies unpleasant feelings like depression, illness.

- **Straight:**

Implication: A straight baseline shows stability, reliability and even temper.

Behaviour: shows that the person is reason rules, trustworthy, disciplined.

Sentiment: Anchored, controlled emotional state and unwavering resolution.

Benefit from Graphology in Your Daily Life:

The study of handwriting and how it relates to personality is known as graphology. It is a private, non-intrusive method of learning more about your personality and the characteristics of those around you.

You can use graphology in your daily life in the following ways:

- Improve your self-awareness. You can have a better understanding of your own personality, strengths, and shortcomings by using graphology. You can utilize this knowledge to advance your job, relationships, and general well-being. You can use this information to choose a career that plays to your strengths and to create time management techniques, for instance, if you discover that you are a very organized and detail-oriented person.
- Build stronger relationships. You can have a deeper understanding of the personalities of the people in your life by using graphology. You can utilize this information to strengthen your relationships, resolve conflicts, and communicate more effectively. For instance, you can try to be more receptive to new experiences and to value your partner's distinct viewpoint if you discover that they are more impulsive and imaginative than you are.
- Enhance your leadership skills. You can determine other people's leadership styles with the aid of graphology. With this knowledge, you may modify your own leadership approach to more effectively inspire and include your team members. For instance, you might give a team member extra time to consider their ideas before asking them to present them in front of the group if you find out that they are more introverted.
- Improve your hiring process. One tool for evaluating the abilities and character attributes of possible hires is graphology. Making better recruiting decisions and building a more cohesive and effective team are both possible with this information. For instance, you could want to seek applicants with clear, readable, and amiable handwriting if you are looking for a customer service position.

Here are a few concrete instances of how graphology might be applied in everyday situations.

- When you are on a date, pay attention to your date's handwriting. Does their handwriting reveal any personality traits to you? You can use this information to decide whether you want to see your date again and to obtain a better understanding of them.
- When you are interviewing a job candidate, ask them to write a short cover letter on the spot. This will allow you to better understand their personality and examine their handwriting.
- If you are having trouble with a co-worker, try to analyze their handwriting. This can assist you in better understanding their communication style and creating plans for more productive collaboration.
- If you are a parent, you can use graphology to better understand the personalities of your children. You can assist their development and have more successful conversations with them if you have this knowledge.

5. APPLICATIONS

These days, graphology is utilized in business organizations, educational institutions, homes, child development, and marriage compatibility. The following are some applications.

1) Improve the Weakness: One can identify their strengths and limitations. He can overcome his shortcomings by using the right graphotherapy treatments. He can also increase his self-esteem and willpower.

2) Understand others: We occasionally find ourselves in situations when we are unable to comprehend the reasons behind the actions of others. In these circumstances, you can study their handwriting to determine the cause.

3) Compatibility Analysis: Preventing any form of calamity in life is beneficial. If two individuals are already involved, you can analyze their handwriting, identify any errors, apply the proper graphotherapy procedures, and resolve their issues.

4) Candidate Analysis before Recruitment: Finding the hidden skills is made easier with the help of graphology. It can be applied to candidate analysis prior to hiring. By analyzing the candidate's handwriting, it is possible to determine whether or not they are a suitable fit for the post for which they applied.

5) Child development: The new age parent may become confused by abrupt changes in eating habits, insecure behaviour, or competing opinions when it comes to kid development. Graphology can be used to detect emotional characteristics including insecurity, loneliness, and inability to focus.

6) Bank Fraud Detection/Criminology: Graphology is also very helpful in fraud detection and criminology. When a check is dropped off at a bank, the depositor's signature and the withdrawer's handwriting are first examined and compared. Therefore, it is safe to say that graphology plays a significant role in preventing fraud.

6. CONCLUSION

Handwriting analysis has a broader, frequently unimaginable scope because it can disclose not just personality features but also important information about a person's mental state at the moment of writing. It is regarded as the best instrument for examining or figuring out a person's personality and character traits. Additionally, this tool's range of applications is growing in popularity over time. There are several techniques or systems for personality analysis that can be used to obtain very accurate information on a person's personality traits. Automated personality detection via handwriting analysis will be a useful and enjoyable method for identifying personality features.

CONFLICT OF INTERESTS

None.

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None.

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