A Review of Gender Identification Based on Handwriting Characteristics.

Komaljeet Kaur

Chandigarh University, Gharuan, Punjab.

Abstract

In the field of forensic science, gender identification using handwriting has emerged as a significant area of research within biometrics and pattern recognition. This review explores the various methodologies and feature extraction techniques employed to determine an individual's gender based on handwriting characteristics. It covers both traditional approaches involving statistical and structural analysis, as well as modern machine learning and deep learning techniques. The paper highlights commonly used datasets, key features such as slant, curvature, stroke width, and letter formation, and evaluates the accuracy and limitations of different classification algorithms. Additionally, the study discusses challenges related to variability in handwriting styles, cultural influences, and data quality. By synthesizing current findings, this review aims to provide insights into the effectiveness, trends, and future directions in handwriting-based gender classification.

Keywords

Keywords: Handwriting, Gender, Natural variation, Macro features, Question document, judgment of handwriting, stereotypes, Investigation, Authentication, Forensic Science, Statistical approach.

Introduction

In human life, documents serve a crucial function. A document is a piece of paper with a symbol or text on it that has meaning for one or more people. It might be stone, a wall, a wooden piece, a glass, a metal sheet a skin, a piece of cloth, a parchment or a paper. We write and sign a variety of documents every day, such as a personal letter, a receipt, a check, or an order that touch the lives of many people. 1 A person's signature and handwriting are both distinctive to them. Document examiners will be able to detect fabrication or modifications as a result of this. Document examiners who have been trained in handwriting and signature analysis will be able to spot a faked signature.2

The discipline of forensic science known as questioned documents studies handwriting analysis. Expert questioned documents examiners, or QDEs, review these records. Handwriting is one of the most crucial pieces of evidence used to verify the authenticity of a document by analyzing the handwriting of both the suspect and the victim. Over time, a person's handwriting

evolves changes in his or her life time.3 Questionable handwriting and hand lettering can be marked or incised on walls or other objects of any size, using paint instead of ink, markers, brushes, and other materials. Regardless of the breadth of scope of questioned document investigation, most examiners find that handwriting or handwritten signature analysis accounts for 70% or more of their labour. 3 The determination of the sex of handwriting has a continuous link with handwriting, according to research.4

Dresbold in her book Sex, Lies, and Handwriting, clarifies how a solitary sentence of an individual's handwriting or penmanship can give data one's experience, brain research, and conduct. In this book, she investigates the handwriting or penmanship of various people like shrewd lawmakers, indicted hoodlums, infamous executioners, suspected cheats, and common individuals and she give us data about probably the most hazardous attributes in handwriting or penmanship, including weapon-molded letters, "shark\'s teeth," "club strokes," and "criminal's hooks." Dresbold likewise clarifies how crooks are followed through manually written signs and what mates, companions, or representatives may be stowing away in their content. 5

The writer's physical state has an impact on his or her handwriting. A person's writing can be affected by age, disease, medication, narcotics, alcohol, or stroke. Nervousness and stress, the writer's position (such as sitting, standing, or a cramped area), and the writing surface (writing quality can be altered by different surfaces, such as a rough surface) are some other elements that might affect handwriting which can cause tremors in the writing) and the layout of the writing (such as the use of margins, the alignment of signatures to text, and the proximity of writings) are all important concerns.6

The process of handwriting analysis includes three main steps for examining the similarities and differences between the questioned and known samples of a suspected person’s handwriting:

1. Analysis - The primary step is to research the known and unknown writing sample for unique characteristics like letters and word spacing, letter and slant, size and proportionality of letters, unusual formations of letters, flourishes, etc.
2. Comparison – The second step is to differentiate the weather like spelling, grammar, punctuation, and phrases also in the known sample and therefore the unknown samples of handwriting.
3. Evaluation - The third step is to see out the similarities within the known and unknown samples. All uniformity must be considered. After the right evaluation of the documents, the examiner must make a judgment in each case.7

Handwriting may be a unique identity of each individual which may neither be copied nor be recreated. This uniqueness of handwriting in every individual is that the product of variation which one makes either consciously or unconsciously but this uniqueness is that the foremost requirement of handwriting analysis. 3

Examination of handwriting and graphology has always been of great utility in forensic science not only as a source of physical evidence in criminal investigation but also for evolving new techniques and idea associated with the aim of private identification if it becomes possible to predict the gender of the author or forger alongside his age therefore the innocent might be protected and hence it's going to speed up the investigation process.

Examination of handwriting for gender identifying feature for gender discrimination could also be evolved as an excellent area for research studies in future. With the expansion of latest ideas and technologies the methods of examination has been evolved from manual to computerized automatic methods of examination has been evolved from manual to computerized automatic methods involving use of varied software which can easily identify the gender identifying features within the handwriting and predict the gender within a moment or seconds. This may not only reduce the human labor, cost and risk of error but also increase the probabilities of positive and best outcome in every large population size. 1

Review of Literature

Different types of labor are done so far within the sector of questioned documents for signature and handwriting analysis. We had skilled various research papers, the work done till today and thus the methods utilized in each work are shown under literature review.

1. The aim of this study is to figure out the gender of a personal by handwriting.

The study was carried out in the Chhattisgarh district of Bilaspur. and the Guru Ghasidas Vishwavidyalaya in Bilaspur is where the sample was collected. According to the study's findings, the two techniques that could help explain the usefulness of these tests for analysing handwriting for gender-identifying characteristics are feature extraction and the z-test. A handwriting sample can also be analysed for gender identification purposes because it is commonly stated that male and female handwriting varies greatly.
This study analyzed 130 handwriting samples from 65 male and 65 female volunteers aged 18-30 years. Results showed that macro and micro features were examined using feature extraction and z¬ tests. Out of 27 features tested, seven were found to be gender-identifying, aiding in identifying the author's gender. The study excluded literate, young, and healthy individuals.

2. Judging gender from samples of adult handwriting: accuracy and use of cues.

The research conducted two experiments involving participants judging adult handwriting for the gender of the writer. The participants' accuracy was significantly better than chance and improved with practice. They also found that participants cued for gender of writer were influenced by gender stereotypes, leading to errors. The study found that varsity students and teachers were able to accurately judge the gender of a touch of handwriting, even when minimal information was available. Both male and female judges were equally accurate in their judgments. The study also found that there are objective gender differences in handwriting, with a 60% accuracy rate under controlled conditions and improved with practice.

3. Examination of handwriting for gender identifying features.

The study aimed to examine gender identifying features in handwriting samples of male and female participants. Over 130 samples were examined, with promising results proving the handwriting features to be gender-identifying. The study used feature extraction and a z-test to examine the handwriting for gender identifying features. The results showed that there are significant differences between handwriting of male and female participants, and a handwriting sample can be examined for gender identification purposes. The study collected 130 samples, 65 from males and 65 from females, aged 18-30 years. The samples were examined for 27 features, divided into macro and micro features. The results were confirmed using magnifying lenses, enlargers, scales, and protectors. This could be a breakthrough in graphology and forensic science, allowing for the prediction of the gender of a writing and facilitating investigation.

4. Sex differences in judging the sex of handwriting.

It is also possible that the study that is about to be published is a byproduct of a larger investigation into sex differences. As the conclusion of the study, a group of 115 high school students were asked to write down from dictation the documented six line jingle, “Thirty days hath September,” etc. After the preparation of a key list, names and each one other data by which sex might be judged were cut from the sheets and thus the papers thoroughly shuffled. Judgments of the sex of the writers were made individually by 10 men and 10 women, most of whom were graduate students within the Institute of child Welfare of the University of Minnesota. Each judge was given a sheet of paper bearing in serial order the numbers just like the handwriting specimens.

5. Handwriting and gender: a statistical study.

A study aimed to determine the gender of writers by analyzing characteristic elements in their handwriting. The study involved 100 males and 100 females aged 18-25, who were asked to write a passage without knowing their gender. The authors examined the handwriting samples using a statistical approach, focusing on characteristics of masculine and feminine handwriting. The results were more significant than those obtained by Briggs, as more parameters were analyzed. Female handwriting had rounded open counters in vowels, gentle hooks and curves, consistency in size, slant, inter word space, and angle of crossbars. In contrast, masculine handwriting had cramped and tiny counters in vowels, inconsistency in size, slant, inter word space, angle of crossbars, letter starts with flourishes, straight stems, and sharp corners and ends. The study provides convincing evidence of significant differences between male and female handwriting.

6. Sex differences in handwriting: a discuss spear.

Margaret Spear suggests either that there are differences between the handwriting of boys and girls or that teachers are operating with popular cultural stereotypes. This paper presents evidence to means that there are indeed substantial differences between the handwriting of boys and girls which this difference is clearly recognized by seven to eight year olds.

7. Identifying sex from handwriting.

During this research, the facility to infer the sex of the author from cursive handwriting was examined under a spread of conditions. In 5 experiments male and female college students were able to perform this task at the 75% accuracy level even with small amounts of cloth, sometimes just one letter or one geometric pattern. On the other hand, age of the author was just barely discernible from handwriting. It had been suggested that sex or gender is present in handwriting in much the same way because it's present in movement of the whole body. Present intentions were first, to verb the Binet finding then to determine whether there are reliable differences between male and female judges in identification of the sex of the author.
This experiments show that writers' sex is often inferred from their handwriting with about 75% accuracy. Kozlowski and Cutting (1977) reported that patterns of body movement are often identified as male or female with about 60 to 70% accuracy, even when all which can be seen could also be a couple of lights attached to parts of the body. Combining this result with those findings suggests that people communicate their sex by the way they move, both in walking and in handwriting. From this view, handwriting is often thought of as a record of movement. The processes which operate during socialization and development apparently cause strong tendencies for such practiced movements to convey information about sex.

References

1. Sushma Upadhyay, Jyoti Singh, S.K. Shukla, Determination of Sex Through Handwriting Characteristics IJCRR Section: General Science Sci. Journal Impact Factor 4.016 ICV: 71.54 - Int J Cur Res Rev, Vol 9, Issue 13, July 2017.
2. Sharma B.R., Forensic Science in Criminal Investigation & Trials, Universal Law Publishing Co, Pvt. Ltd, 2013, vol. 4, p. 562.
3. Saferstein Richard Criminalities –Introduction to Forensic Science tenth edition fearson Education.
4. Kopoenhaver M. Katherine., forensic Document Examination, Humana Press. 2007.
5. Goodenough, F. L., Sex differences in judging the sex of handwriting, Journal of Social Psychology. 1945, vol. 22, Pp; 61–68.
6. Hamid, S., Loewenthal, K. M., Inferring gender from handwriting in Urdu and English, Journal of Social Psychology. 1996, vol.136, Pp; 778–782.
7. Hartley, J., Sex differences in handwriting: A comment on Spear, British Educational Research Journal. 1991, vol. 17, Pp; 141– 145.
8. Upadhyay S, Singh J. Estimation of Age through Handwriting Characteristics in Female Writers. Indian Journal of Science and Technology. 2017,vol.10(13).

9. Vivien Burr, Judging gender from samples of adult handwriting: accuracy and use of cues. The Journal of Social, Psychology. 2002. 142(6). 691-700
10. Cohen, M. R. (1997). Individual and sex differences in speed of handwriting among high school students. Perceptual and Motor Skills, 84, 1428-1430.
11. Hartley, J. (1991). Sex differences in handwriting: A comment on Spear. British Educational Research Journal, 17, 14 1 - 145.
12. Ziviani, J. (1984). Use of modem cursive handwriting and handwriting speed in 7-14 olds. Perceptual and Motor Skills, 58, 535-539. Received November 24, 1999 Accepted June 14, 2001
13. Manju Sahu, Anjali Yadav and Isukapatla Arjun Rao, Examination of handwriting for gender identifying features. International Journal of Current Research Vol. 9, Issue, 01, pp.45923-45928, January, 2017. ISSN: 0975-833X.
14. Desai Bhavana, Kalyan J. L. 2013. Forensic Examination of Handwriting and Signatures, International Journal of Innovative Research and Development, 2 (5), 514-527.
15. Huber A. Roy, Headrick M. A. 1999. Handwriting Identification: Facts and Fundamentals, CRC Press, Boca Raton New York.
16. Florence L. Goodenough, Sex Differences in Judging the Sex of Handwriting, The Journal of Social Psychology, 22:1, 61-68, USA Published online: 01 Jul 2010..
17. Suneet KUMAR, Vaibhav SARAN, Bikram Ashok VAID, Ashok Kumar GUPTA. Handwriting and Gender: A Statistical Study, Problems of Forensic Sciences, 2013, 95: 620-626. ISSN - 1230-7483.
18. James Hartley, Department of Psychology, University of Keele, British Educational Research Journal, Vol. 17, No. 2, 1991
19. William N. Hayes Albion College, Perceptual and Motor Skills, 1996,83,791-800. O Perceptual and Motor Skills 1996.