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Assessing Forgery Skills Across Professions: Analyzing Handwriting Imitation Success

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Abstract: This study examines the ability to forge handwriting across 12 different occupations. For this study, I collected handwriting samples from 12 different professions, gathering 10 samples from each, resulting in 120 samples. Each participant was asked to provide an original handwriting sample followed by a forged version of the same content. To facilitate this, I supplied a piece of paper with specific handwriting. First, they copied the content in their handwriting, and then they forged the given handwriting. The samples were analyzed using 12 different handwriting characteristics. The samples were analyzed based on 12 different handwriting characteristics using the Chi-Square test. The analysis revealed that Artists, Police Officers, Army Officers, Bankers, Professors, IT professionals, Nurses were able to successfully forge handwriting, while doctors were unable to replicate their handwriting.

Keywords: Occupations, Forged handwriting, original handwriting, Chi-Square test, Analysis.

I. INTRODUCTION

Handwriting is the neuro-muscular coordination between the hand and brain. Handwriting is the personal and unique style of writing with a writing instrument, such as a pen or pencil in the hand. Handwriting includes both block and cursive styles and is separate from generic and formal handwriting script/style, calligraphy, or typeface. Because each person's handwriting is unique and different, it can be used to verify a document's writer. [1]

The general characteristics of handwriting are classified into two: Class characteristics and Individual characteristics. Class characteristics are the universal traits that are shared by a category of people. When it comes to handwriting analysis, class characteristics are the traits that people with comparable backgrounds, age, level of education, or cultural influences, have in common when writing. Some class characteristics are line quality, pen pressure, alignment, line spacing, word spacing, letter formation, speed, and stroke. The distinctive qualities and characteristics that distinguish one person's handwriting from another are known as individual characteristics. These characteristics are specific to the writer and they help to differentiate and identify individuals. Individual characteristics play a crucial role in handwriting analysis, aiding in the accurate assessment of behaviour, authenticity, and personality. [3]

Handwriting is influenced by both external and internal. External factors affecting handwriting include writing surface (which means smooth or rough), writing instruments (includes pen type, grip, and ink flow), lighting; brightness and direction of light, temperature, environment, and position. Internal factors such as motor skills, psychological state, age, health conditions, and educational background, also

play a significant role in shaping one's writing style. These factors collectively contribute to variations in handwriting, making it a valuable tool for analysis in forensic science and personal identification.

Forensic document examiners use a variety of tools for analysing the handwritings. It includes Video Spectral Comparators (VSC-4), ESDA, UV Light, MiScope, Stereo Microscope. VSC-4 consist of various light sources and an adjustable recording device that automatically adapts to different angles and is used to detect inks and dyes present in a document. ESDA is a device used to decipher indentations in writing that are present on a paper underneath the original sheet, caused by the pressure of the writing instrument. This instrument is non-destructive and highly sensitive in their operation, capable of deciphering content even from indentations that have been present for years. UV light and deciphers faded writing by illuminating the UV region. MiScope is a portable microscope with various light sources and is used to decipher the obliterated writing. It includes a camera to capture the results. A stereo microscope produces an enlarged view of the exhibit document, which and characteristics of the writer.

A forgery is a false document that has legal significance and is used to deceive someone. Committing forgery is a crime, and serious consequences can result, including jail time, if you knowingly engage with false printed or written materials. This holds true even if you did not create the document yourself. If you possess a document that you know is inaccurate or untrue and use it to mislead someone else, you could be charged in a criminal case. [3]

When comparing forged handwriting to original handwriting, the most significant variations include inconsistent letter size; it can be small and bigger size, irregular slant, altered letter formations, inconsistent spacing between letters and words, changes in pen pressure; it can be high and low pressure, unusual connecting strokes.

In a previous study examination of original handwriting and disguised handwriting from 10 different occupations (Doctor, Teacher, IT professional, Forensic Expert, Custom personnel Banker, Media personnel, Lawyer, Charter Accountant) was done by comparing seven different handwriting characteristics. In the present study, I am going to examine original and forged handwriting samples from 12 different occupations (IT, Lawyer, Doctor, Banker, Artist, Professor, Clerk, Accountant, Army Officer, Nurse, Engineer, Police Officer) by comparing 12 different handwriting characteristics.

In a previous study, forensic examination of disguised handwriting with different occupations, they only analyzed 7 handwriting characteristics covering 10 different occupations. In this study, the samples were analyzed using 12 handwriting characteristics across 12 different occupations.

This analysis can also link specific writing characteristics to different occupational analyses and is particularly useful in identifying suspects and linking them to crimes involving altered or forged documents.

II. LITERATURE REVIEW

1. John J Harris (1953) studied **"Disguised Handwriting."** In this study he studied about disguised handwriting, finding it prevalent in fraudulent activities. Through a classroom experiment with 100 student samples, he discovered that most individual fail to effectively conceal their handwriting, despite attempts to alter slant, letter formation and spacing. Inconsistencies often betray the writer. He concluded that successful disguise is rare, with many resorting to obvious, grotesque writing styles. The study emphasizes the importance of understanding natural handwriting characteristics for forensic examiners. Harris's research highlights the psychological and practical difficulties of handwriting disguise, laying groundwork for future forensic studies. [4]

2. Mohamed, Hazir's (2010) studied **"Statistical Examination of Common Characteristics for Disguised Handwriting amongst Malaysians."** In this study they analysed 110 samples, they found variations in letter size, slant, and speed in disguised writing, while alignment remained relatively consistent. Using Pearson Chi-Squared tests, they established links between demographic factors, including race and handwriting traits. The study concludes that disguised

writing is distinguishable from normal writing, despite attempts to alter it. Demographic influences on handwriting were notable. This research offers a statistical basis for forensic handwriting analysis, highlighting the challenges of effective disguise. [13]

3. Carolyne, Bryan (2010) studied **"Forensic Document Examiners Skill in Distinguishing between Natural and Disguised Handwriting Behaviours."** In this study they studied FDE's ability to distinguishing between natural and disguised handwriting. FDE's showed significantly higher accuracy (95.66%) compared to laypeople (87.84%). FDEs also had a higher inconclusive rate, demonstrating a cautious approach. Their misleading response rate was lower, indicating greater reliability. The study highlights the expertise of FDEs and the importance of their training in forensic document analysis. This research supports the validity of FDE skills in legal context. [6]

4. Bhavya, Himanshi et.al, (2019) studied **"Individuality of Numerals in Disguised Handwriting."** In this study they analysed 100 samples from individuals aged 18-30. They found that the numeral '3' was most frequently disguised (43%), while '0' was least altered (5%). On average, 30% of numerals were disguised, revealing the difficulty of complete concealment. The research employed visual analysis and statistical methods to identify disguised and non -disguised numerals. The study concluded that subconscious muscle memory often leads to the reversion of natural handwriting, making complete disguise impossible. This highlights the importance of numeral analysis in forensic document examination for identifying forgeries and anonymous documents. [5]

5. Reeta R Gupta (2019) studied **"Forensic analysis of Characteristic Features of Disguised Handwriting in fixing Authorship."** In this study it highlighted the challenges in analysing deliberately altered writing, noting that while individuals attempt to conceal their identity, inherent handwriting features often remain. Through comparative analysis of disguised and standard handwritings, the research emphasized the importance of thorough examination to uncover subtle, identifiable characteristics. The study concluded that even with disguise, skilled forensic analysis can reveal authorship by identifying consistent, individualistic writing traits. [9]

6. Sharma, Yadava Vajjey et.al (2020) studied **"The Analysis of Master Disguised Writing with the Aid of Specific Individual Writing Characteristics."** This study reveals that even sophisticated attempts to alter writing retain identifiable individual traits. Focusing on initial and connecting strokes, along with letter formations, the authors compared disguised and regular samples. Their methodology utilized t-tests to statistically validate observed differences, providing these features significance in author identification. The research concludes that these elements can penetrate even master disguises, offering a robust framework for forensic handwriting analysis. This paper is valuable for forensic experts, providing a scientific basis for identifying writers despite deliberate alterations. [11]

7. Achsah Merrin, Ashwini Rao (2021) studied **"An Insight into Disguised Handwriting: A Review Study."** In this study they categorize handwriting into class and individual characteristics, revealing that while criminals attempt to mask their writing, inherent traits often remain. The review synthesizes various studies, highlighting methodologies like statistical analysis and advanced instrument use, such as VSCs. It concludes that complete disguise is rare, with alterations typically affecting slant, size, and spacing. The study emphasizes the need for improved technology and further research into demographic variations in disguised handwriting, providing valuable insights into the psychological and technical aspects of authorship determination. [7]

8. Hashmi, Upadhyay's (2021) studied **"Forensic Identification of Forged Urdu handwriting in different regions of India."** In this study they examined forged Urdu signatures by individuals unfamiliar with the script, specifically from Delhi, Kashmir, Sikkim. They found that forgers exhibit mixed writing directions, high pen pressure, and oversized letters, deviating from standard Urdu practices. Forger prioritized pictorial representation over structural accuracy. The study analysed 100 forged samples using forensic tools, revealing distinct characteristics compared to

authentic signatures. It concluded that language familiarity and regional influences are crucial in Urdu forgery detection. [3]

9. Upadhayay, Kumar (2022) studied **"The Forensic Examination of Disguised Handwriting Characteristics and Its Relation with Different Occupation."** In this study they examined the relationship between the occupation and disguised abilities. In their study they analysed disguised handwriting samples from 10 professions, finding that speed was the most commonly altered characteristics. IT professionals where best at distinguishing slant while media professionals exceled at altering speed. Forensic experts demonstrated the higher proficiency in disguising individual characteristics like I dotting and t crossing. The research involved comparing original and disguised samples, using statistical analyses to evaluate findings. The study concluded that occupation influences disguised capabilities, with forensic experts being the most adept. This research provides insights for forensic document examiners and highlights the need for further exploration in this area. [2]

10. Jitender Singh, Bhoopesh Kumar (2023) studied **"Comparison of Handwriting of Accustomed and Unaccustomed Hand of Individuals and Ascertaining Their Identifiable Parameters."** In this study they found significant differences in quality (alignment, slant, tremors) but consistent individual traits (spacing, connecting strokes, signature placement). Using 200 samples from 50 individuals, the study revealed that while disguised handwriting shows deterioration, core characteristics persist due to ingrained neuromuscular processes. This highlights the potential for forensic document examiners to identify authorship even in altered handwriting, emphasizing the complexity of handwriting as a unique individual marker. [12]

III. AIM AND OBJECTIVES

AIM:

To examine the forged handwriting in relation to different occupations.

OBJECTIVE:

- To examine the forged handwriting in relation with different occupation.
- To identify which occupation is best in forged handwriting.
- To identify the most forged handwriting characteristics in each occupation.

IV. MATERIALS AND METHODOLOGY

MATERIALS:

- A4 Size Paper
- Writing Sample
- Pen
- Magnifying Glass
- Ruler
- Microsoft Excel
- Pencil

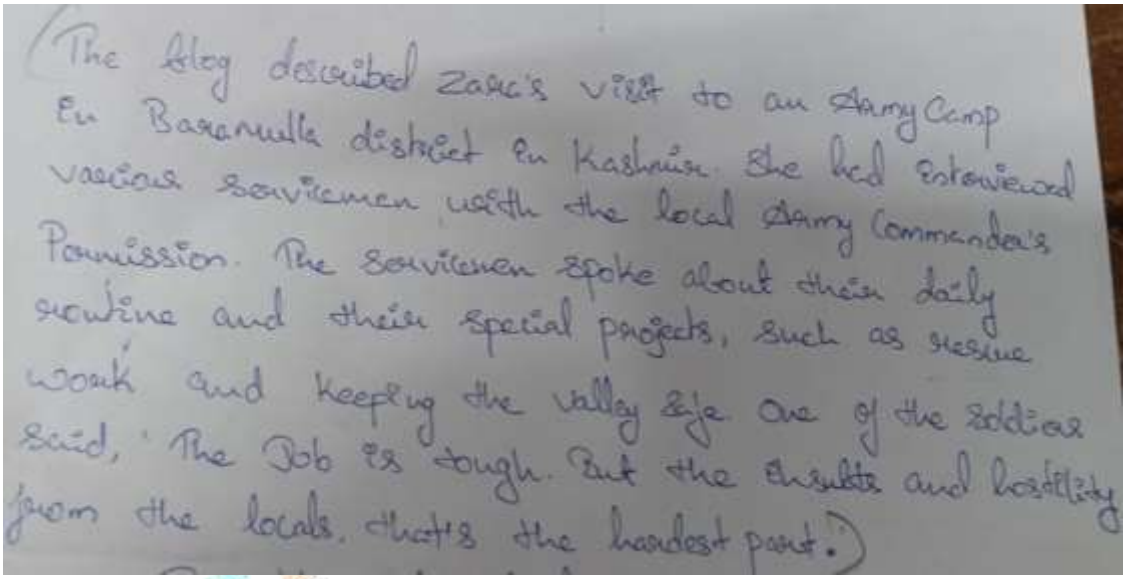
Fig No: 1 Ruler

Fig No: 2 Magnifying Glass.

METHODOLOGY:

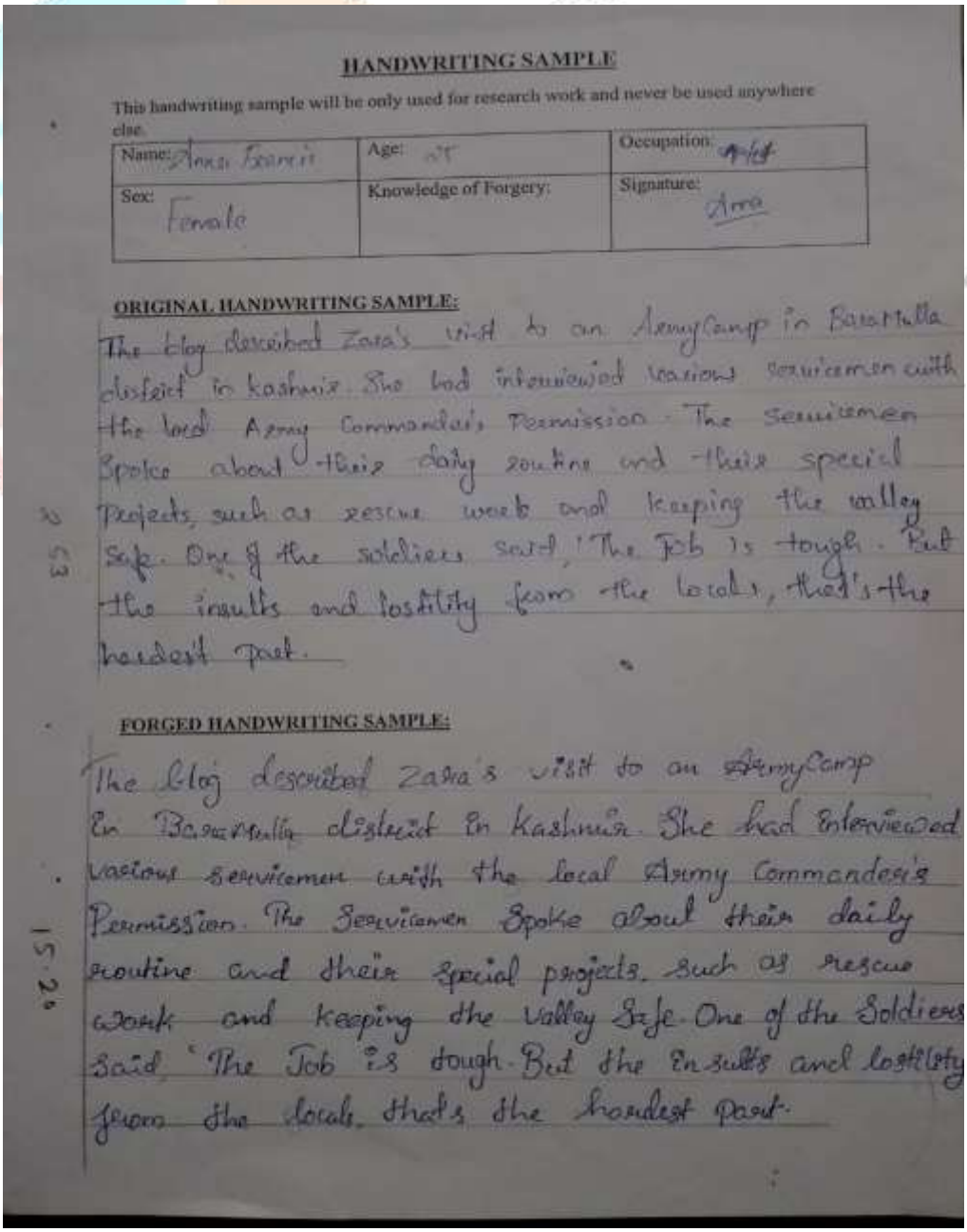
In this present study, I collected samples from individuals in 12 different occupations (Advocates, Police Officers, Artists, Assistant Professors, Doctors, IT Professionals, Clerks, Accountants, Nurses, Army Officers, Engineers, Bankers.) Ten samples were collected from each profession. Each individual was required to provide a first sample of their original handwriting, followed by a forged handwriting of the same content. For this, I provided a paper with specific handwriting. First, they copied the content in their own handwriting, and then they forged the given handwriting. A total of 120 were collected from each occupation. The samples were analyzed using 12 different characteristics: Line Quality, Pen Pressure, Alignment, Arrangement, Rhythm, Word Spacing, Line Spacing, Diacritic Marks, Starting Stroke, Terminal stroke, Speed, and Pictorial Effect.

The graph based on a percentage of similarities of forged handwriting was drawn using Microsoft Excel.



The blog described Zara's visit to an Army Camp in Baramulla district in Kashmir. She had interviewed various servicemen with the local Army Commander's Permission. The servicemen spoke about their daily routine and their special projects, such as rescue work and keeping the valley safe. One of the soldiers said, 'The Job is tough. But the insults and hostility from the locals, that's the hardest part.')

Fig No: 3 Content.



HANDWRITING SAMPLE

This handwriting sample will be only used for research work and never be used anywhere else.

Name: Anza Fatima	Age: 21	Occupation: Student
Sex: Female	Knowledge of Forgery:	Signature: Anza

ORIGINAL HANDWRITING SAMPLE:

The blog described Zara's visit to an Army Camp in Baramulla district in Kashmir. She had interviewed various servicemen with the local Army Commander's Permission. The servicemen spoke about their daily routine and their special projects such as rescue work and keeping the valley safe. One of the soldiers said, 'The Job is tough. But the insults and hostility from the locals, that's the hardest part.

FORGED HANDWRITING SAMPLE:

The blog described Zara's visit to an Army Camp in Baramulla district in Kashmir. She had interviewed various servicemen with the local Army Commander's Permission. The servicemen spoke about their daily routine and their special projects. such as rescue work and keeping the valley safe. One of the Soldiers said, 'The Job is dough. But the insults and hostility from the locals. that's the hardest part.

Fig No: 4 Collected Handwriting Sample.

V. DATA ANALYSIS AND DISCUSSION

ADVOCATES

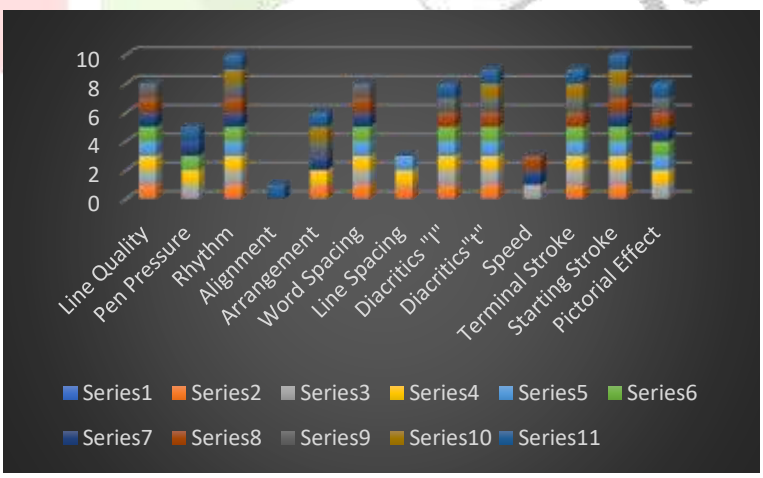
In the below graph forged handwriting of advocates was analyzed. A total of 10 advocates were given the sample. This graph shows that all 10 advocates were able to forge a starting stroke and rhythm. 9 of them were able to forge terminal stroke and diacritics of 'T'. 8 advocates were able to forge Line Quality, Pictorial Effect, Diacritics of 'I', and Word Spacing. 6 of them were able to forge arrangement and 5 of them were able to forge Pen Pressure. 3 were able to forge speed and Line spacing. 1 was able to forge alignment.

The most forged handwriting characteristics among them were Starting Stroke and rhythm i.e.; all 10 were able to forge and the least forged handwriting characteristic was alignment i.e.; only 1 was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	1	1	1	1	1	0	1	1	0
2	1	1	1	0	0	1	0	1	1	1	1	1	1
3	1	1	1	0	1	1	1	1	1	0	1	1	1
4	1	0	1	0	0	1	1	1	1	0	1	1	1
5	1	1	1	0	0	1	0	1	1	0	1	1	1
6	1	1	1	0	1	1	0	0	0	1	0	1	1
7	1	0	1	0	0	1	0	1	1	1	1	1	1
8	1	0	1	0	1	1	0	1	1	0	1	1	1
9	0	0	1	0	1	0	0	0	1	0	1	1	0
10	0	1	1	1	1	0	0	1	1	0	1	1	1

Table No.1 Data analysis of Advocates.

H0= Advocate forged successfully
H1= Advocate failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 0.999
P Value>0.05 = 0.99
In the given value, p Value is 0.99. So, the null hypothesis is accepted.



Graph No. 1 Graph of Advocates forged handwriting analysis.

POLICE OFFICERS

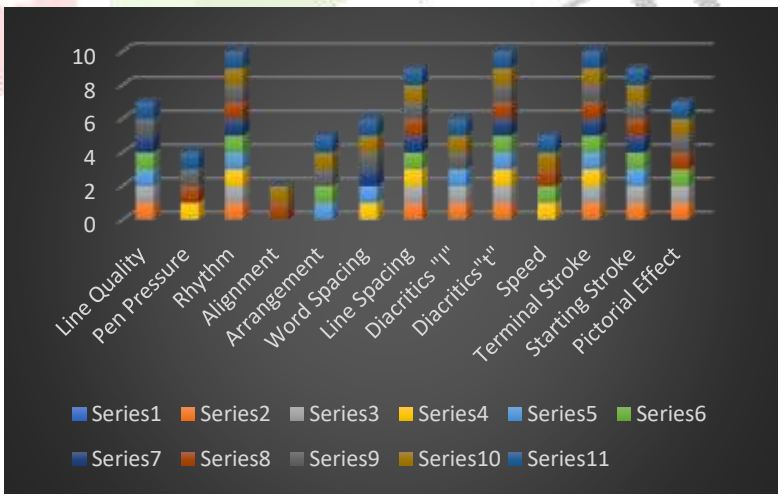
In the below graph forged handwriting of police officers was analyzed. A total of 10 Police Officers were given the sample. This graph shows that all 10 Police Officers were able to forge the rhythm, Diacritics 'T', and Terminal stroke. 9 of them were able to forge line spacing and starting stroke. 7 of them were able to forge line quality and pictorial effect. 6 of them were able to forge word spacing and diacritics 'I'. 5 of them were able to forge the speed and arrangement. 4 of them were able to forge pen pressure and 2 of them were able to forge alignment.

The most forged handwriting characteristics among them were rhythm, Diacritics 'T', and Terminal stroke i.e.; all 10 were able to forge and the least forged handwriting characteristics were alignment i.e.; two of them were able to forge alignment.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	0	0	1	1	1	0	1	1	1
2	1	0	1	0	0	0	1	1	1	0	1	1	1
3	0	1	1	0	0	1	1	0	1	1	1	0	0
4	1	0	1	0	1	1	0	1	1	0	1	1	0
5	1	0	1	0	1	0	1	0	1	1	1	1	1
6	1	0	1	0	0	1	1	0	1	0	1	1	0
7	0	1	1	1	0	0	1	0	1	1	1	1	1
8	1	1	1	0	1	1	1	1	1	0	1	1	1
9	0	0	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	0	1	1	1	1	1	1	1	1	1

Table No. 2 Data analysis of Police Officers.

H0= Police Officer forged successfully
H1= Police Officer failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted.



Graph No. 2 Graph of Police Officers Forged Handwriting analysis.

BANKERS

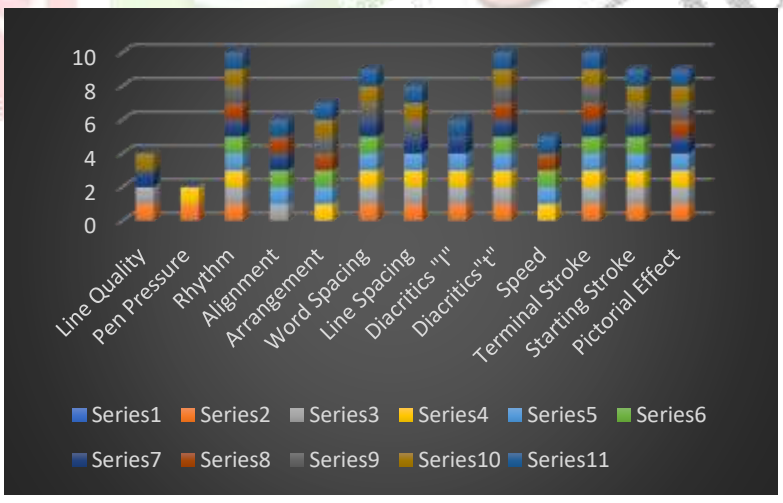
In the below graph forged handwriting of Bankers was analysed. A total of 10 Bankers were given the sample. This graph shows that 10 were able to forge Rhythm, Diacritics 'T', and Terminal stroke. 9 were able to forge word spacing, starting stroke and pictorial effect. 8 were able to forge line spacing. 7 were able to forge the arrangement. 6 were able to forge the alignment and diacritics 'I'. 5 were able to forge the speed. 4 were able to forge line quality and 2 were able to forge pen pressure.

The most forged handwriting characteristics among them were rhythm and diacritics 'T' i.e.; all 10 were able to forge and the least forged handwriting characteristic was Pen pressure i.e.; two were able to forge pen pressure.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	1	1	0	0	1	1	1	1	0	1	1	1
2	1	0	1	1	0	1	1	1	1	0	1	1	1
3	0	1	1	0	1	1	1	1	1	1	1	1	1
4	0	0	1	1	1	1	1	1	1	1	1	1	1
5	0	0	1	1	1	1	0	0	1	1	1	1	0
6	1	0	1	1	0	1	1	1	1	0	1	1	1
7	0	0	1	1	1	0	0	0	1	1	1	0	1
8	0	0	1	0	1	1	1	0	1	0	1	1	1
9	1	0	1	0	1	1	1	0	1	0	1	1	1
10	0	0	1	1	1	1	1	1	1	1	1	1	1

Table No. 3 Data analysis of Bankers.

H0= Bankers forged successfully
H1= Bankers failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted.



Graph No. 3 Graph of Bankers Forged Handwriting analysis.

PROFESSORS

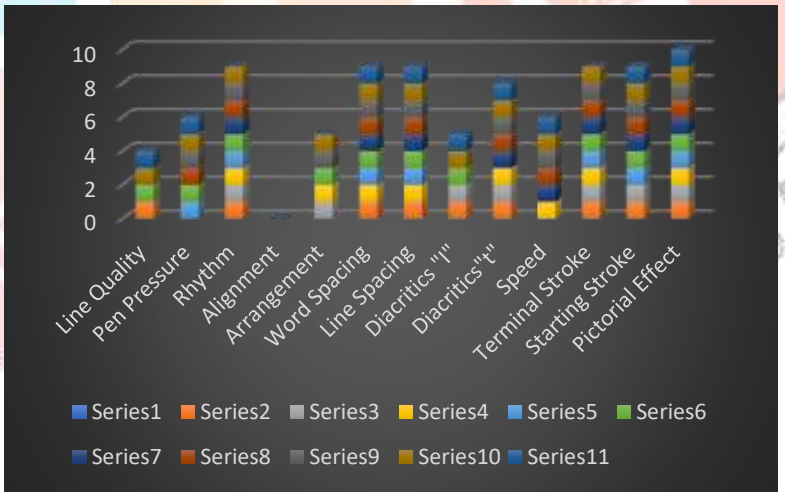
In the below graph forged handwriting of Professors was analysed. A total of 10 Professors were given the sample. This graph shows that all the 10 were able to forge the pictorial effect. 9 of them were able to forge the rhythm, word spacing, line spacing, terminal stroke and starting stroke. 8 were able to forge diacritics of 'T'. 6 of them were able to forge speed and pen pressure. 5 of them were able to forge the arrangement and diacritics of 'I'. 4 were able to forge line quality and no one was able to forge the alignment

The most forged handwriting characteristics among them were pictorial effect i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; no one was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	0	1	1	1	1	0	1	1	1
2	0	0	1	0	1	0	0	1	1	0	1	1	1
3	0	0	1	0	1	1	1	0	1	1	1	0	1
4	0	1	1	0	0	1	1	0	0	0	1	1	1
5	1	1	1	0	1	1	1	1	0	0	1	1	1
6	0	0	1	0	0	1	1	0	1	1	1	1	1
7	0	1	1	0	0	1	1	0	1	1	1	1	1
8	0	1	1	0	1	1	1	0	1	1	1	1	1
9	1	1	1	0	1	1	1	1	1	1	1	1	1
10	1	1	0	0	0	1	1	1	1	1	0	1	1

Table No. 4 Data analysis of Professors.

H0= Professors forged successfully
H1= Professors failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted.



Graph No. 4 Graph of Professors Forged Handwriting analysis.

IT PROFESSIONALS

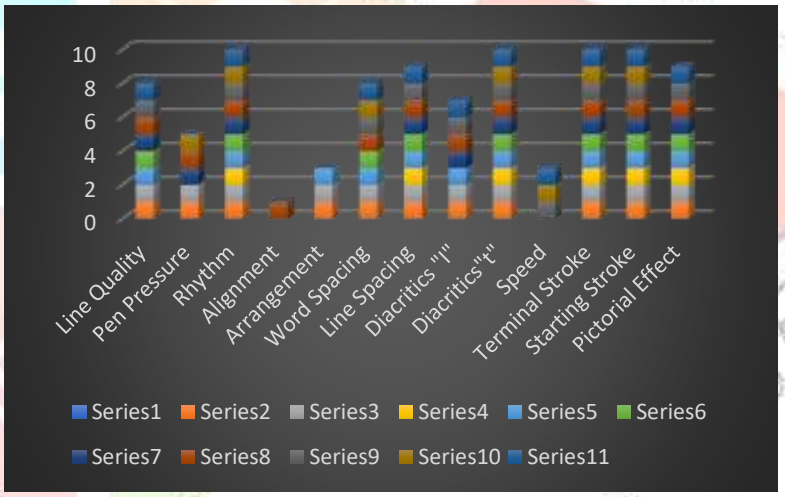
In the below graph forged handwriting of IT Professionals was analysed. A total of 10 IT Professionals were given the sample. This graph shows that 10 of them were able to forge Rhythm, diacritics ‘T’, Terminal stroke and starting stroke. 9 of them were able to forge line spacing and pictorial effect. 8 of them were able to forge line quality and word spacing. 7 of them were able to forge Diacritics ‘I’. 5 of them were able to forge pen pressure. 3 of them were able to forge the arrangement and speed. 1 of them were able to forge alignment.

The most forged handwriting characteristics among them were Rhythm, Diacritics ‘T’, Terminal Stroke and Starting Stroke i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; one of them was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	1	1	0	1	1	1	1	1	0	1	1	1
2	1	1	1	0	1	1	1	1	1	0	1	1	1
3	0	0	1	0	0	0	1	0	1	0	1	1	1
4	1	0	1	0	1	1	1	1	1	0	1	1	1
5	1	0	1	0	0	1	1	0	1	0	1	1	1
6	1	1	1	0	0	0	1	1	1	0	1	1	1
7	1	1	1	1	0	1	1	1	1	0	1	1	1
8	1	0	1	0	0	1	1	1	1	1	1	1	1
9	0	1	1	0	0	1	0	0	1	1	1	1	0
10	1	0	1	0	0	1	1	1	1	1	1	1	1

Table No. 5 Data analysis of IT Professionals.

H0= IT Professionals forged successfully
H1= IT Professionals failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted.



Graph No. 5 Graph of IT Professionals Forged Handwriting analysis.

ACCOUNTANT

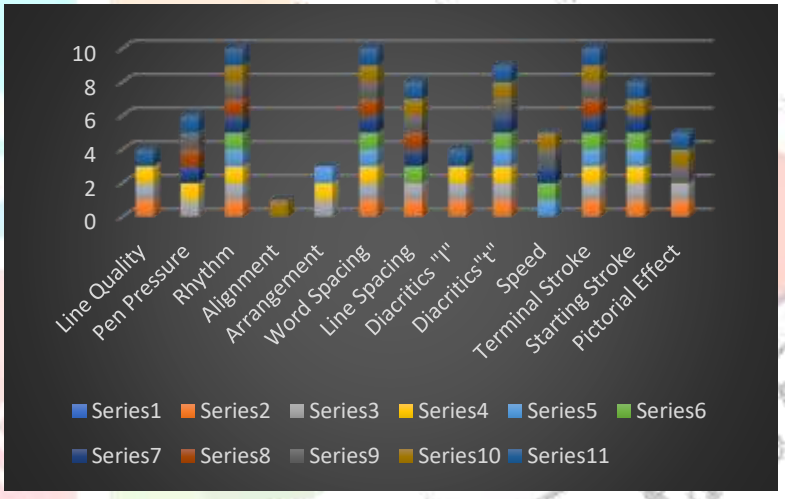
In the below graph forged handwriting of the accountant was analysed. A total of 10 Accountants were given the sample. This graph shows that 10 of them were able to forge Rhythm, word spacing, and Terminal Stroke. 9 of them were able to forge diacritics of 'T'. 8 of them were able to forge line spacing and starting stroke. 6 of them were able to forge pen pressure. 5 of them were able to forge pictorial effects and speed. 4 of them were able to forge line quality and diacritics of 'I'. 3 of them were able to forge arrangement and 1 was able to forge alignment.

The most forged handwriting characteristics among them were Rhythm, word spacing, and Terminal Stroke i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; one of them was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	0	1	1	1	1	0	1	1	1
2	1	1	1	0	1	1	1	1	1	0	1	1	1
3	1	1	1	0	1	1	0	1	1	0	1	1	0
4	0	0	1	0	1	1	0	0	1	1	1	1	0
5	0	0	1	0	0	1	1	0	1	1	1	1	0
6	0	1	1	0	0	1	1	0	1	1	1	1	0
7	0	1	1	0	0	1	1	0	0	0	1	0	0
8	0	1	1	0	0	1	1	0	1	1	1	0	1
9	0	0	1	1	0	1	1	0	1	1	1	1	1
10	1	1	1	0	0	1	1	1	1	0	1	1	1

Table No. 6 Data analysis of Accountant.

H0= Accountant forged successfully
H1= Accountant failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 0.999999993
P Value>0.05 = 0.99
In the given value, p Value is 0.99. So, the null hypothesis is accepted.



Graph No. 6 Graph of Accountant Forged Handwriting analysis.

CLERK

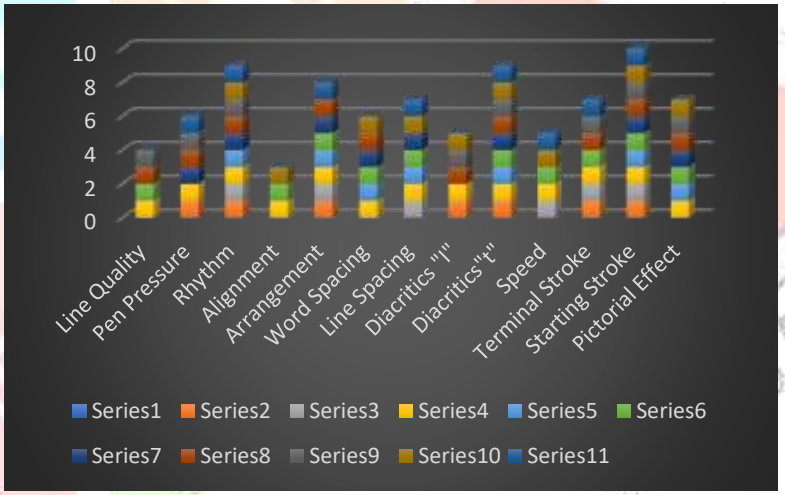
In the below graph forged handwriting of Clerks was analysed. A total of 10 Clerks were given the sample. This graph shows that 10 of them were able to forge starting stroke. 9 of them were able to forge rhythm and diacritics 'T'. 8 of them were able to forge the arrangement. 7 of them were able to forge terminal stroke, pictorial effect and line spacing. 6 of them were able to forge pen pressure and word spacing. 5 of them were able to forge speed and diacritics of 'I'. 4 of them were able to forge line quality. 3 of them were able to forge alignment.

The most forged handwriting characteristics among them were Starting Stroke i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; only 3 of them was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	0	1	1	0	1	0	0	1	1	0	1	1	0
2	0	0	1	0	1	0	1	0	0	1	1	1	0
3	1	1	1	1	1	1	1	1	1	1	1	1	1
4	0	0	1	0	1	1	1	0	1	0	0	1	1
5	1	0	0	1	1	1	1	0	1	1	1	1	1
6	0	1	1	0	1	1	1	0	1	0	0	1	1
7	1	1	1	0	1	1	0	1	1	0	1	1	1
8	1	1	1	0	0	0	0	1	1	0	1	1	1
9	0	0	1	1	0	1	1	1	1	1	0	1	1
10	0	1	1	0	1	0	1	0	1	1	1	1	0

Table No. 7 Data analysis of Clerk

H0= Clerk forged successfully
H1= Clerk failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 0.999999999
P Value>0.05 = 0.99
In the given value, p Value is 0.99. So, the null hypothesis is accepted



Graph No. 7 Graph of Clerk Forged Handwriting analysis.

NURSE

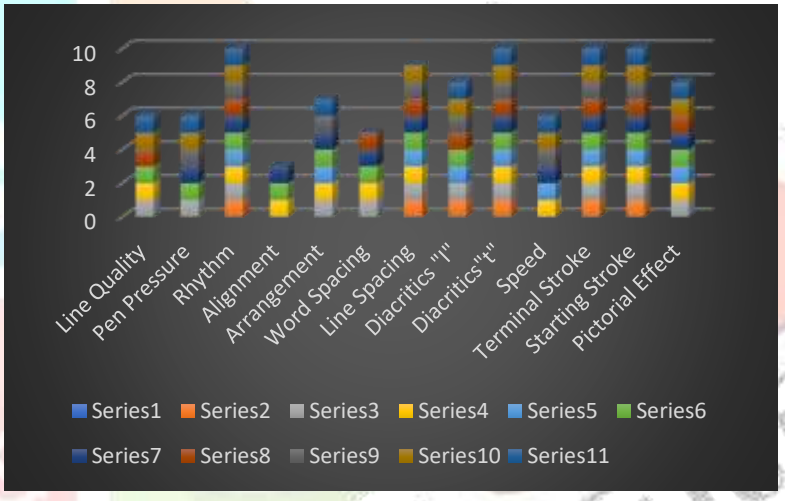
In the below graph forged handwriting of Nurses was analyzed. A total of 10 Nurses were given the sample. This graph shows that 10 of them were able to forge rhythm, diacritics ‘T’, terminal stroke, and starting stroke. 9 of them were able to forge line spacing. 8 of them were able to forge diacritics ‘I’ and pictorial effect. 7 of them were able to forge arrangements. 6 of them were able to forge line quality, pen pressure, and speed. 5 of them were able to forge word spacing. 3 of them were able to forge alignment.

The most forged handwriting characteristics among them were rhythm, diacritics ‘T’, terminal stroke and Starting Stroke i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; only 3 of them was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	0	0	1	0	0	0	1	1	1	0	1	1	0
2	1	1	1	0	1	1	1	1	1	0	1	1	1
3	1	0	1	1	1	1	1	0	1	1	1	1	1
4	0	0	1	0	1	0	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	0	1	1	1
6	0	1	1	1	1	1	1	0	1	1	1	1	1
7	1	0	1	0	0	1	1	1	1	0	1	1	1
8	0	1	1	0	1	0	1	1	1	1	1	1	0
9	1	1	1	0	0	0	1	1	1	1	1	1	1
10	1	1	1	0	1	0	0	1	1	1	1	1	1

Table No. 8 Data analysis of Nurse

H0= Nurse forged successfully
H1= Nurse failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted



Graph No. 8 Graph of Nurse Forged Handwriting analysis.

ARTIST

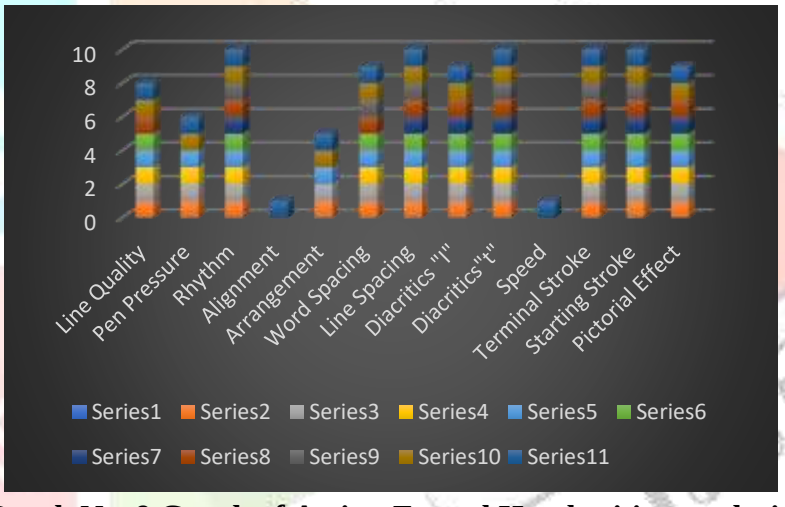
In the below graph forged handwriting of doctors was analyzed. A total of 10 Doctors were given the sample. This graph shows that 10 of them were able to forge rhythm, line spacing, diacritics ‘T’, terminal stroke, and starting stroke. 9 of them were able to forge word spacing, diacritics ‘I’, and pictorial effect. 8 of them were able to forge line quality. 6 of them were able to forge pen pressure. 5 of them were able to forge arrangements. 1 of them was able to forge alignment and speed.

The most forged handwriting characteristics among them were rhythm, line spacing, diacritics ‘T’, terminal stroke and starting stroke i.e.; all 10 were able to forge and the least forged handwriting characteristic was alignment and speed i.e.; only one of them was able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	1	1	0	1	1	1	1	1	0	1	1	1
2	1	1	1	0	1	1	1	1	1	0	1	1	1
3	1	1	1	0	0	1	1	1	1	0	1	1	1
4	1	1	1	0	1	1	1	1	1	0	1	1	1
5	1	0	1	0	0	1	1	1	1	0	1	1	1
6	0	0	1	0	0	0	1	1	1	0	1	1	1
7	1	0	1	0	0	1	1	1	1	0	1	1	1
8	0	0	1	0	0	1	1	0	1	0	1	1	0
9	1	1	1	0	1	1	1	1	1	0	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1

Table No. 9 Data analysis of Artists.

H0= Artist forged successfully
H1= Artist failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted



Graph No. 9 Graph of Artists Forged Handwriting analysis.

DOCTORS

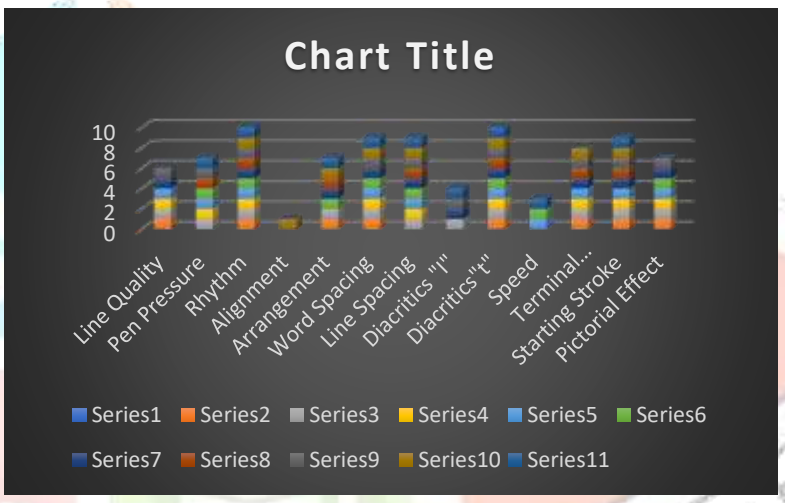
In the below graph forged handwriting of doctors was analyzed. A total of 10 Doctors were given the sample. This graph shows that 10 of them were able to forge rhythm and diacritics ‘T’. 9 of them were able to forge word spacing, line spacing, and starting stroke. 8 of them were able to forge terminal stroke. 7 of them were able to forge pen pressure, arrangement, and pictorial effect. 6 of them were able to forge line quality. 4 of them were able to forge diacritics ‘I’. 3 of them were able to forge speed and 1 of them was able to forge alignment.

The most forged handwriting characteristics among them were rhythm, and diacritics ‘T’ i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; only 1 of them were able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	1	1	0	0	1	0	1	1	1
2	1	1	1	0	1	1	1	1	1	0	1	1	1
3	1	1	1	0	0	1	1	0	1	0	1	1	1
4	1	1	1	0	0	1	1	0	1	1	1	1	1
5	0	1	1	0	1	1	1	0	1	1	0	0	1
6	1	0	1	0	1	1	1	1	1	0	1	1	1
7	0	1	1	0	1	0	1	0	1	0	1	1	0
8	1	1	1	0	0	1	1	1	1	0	1	1	1
9	0	0	1	1	1	1	1	0	1	0	1	1	0
10	0	1	1	0	1	1	1	1	1	1	0	1	0

Table No. 10 Data analysis of doctors.

H0= Doctors forged successfully
H1= Doctors failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 0.619780204
P Value>0.05 = 0.61
In the given value, p Value is 0.61. So, the null hypothesis is accepted.



Graph No. 10 Graph of Doctors Forged Handwriting analysis.

ENGINEERS

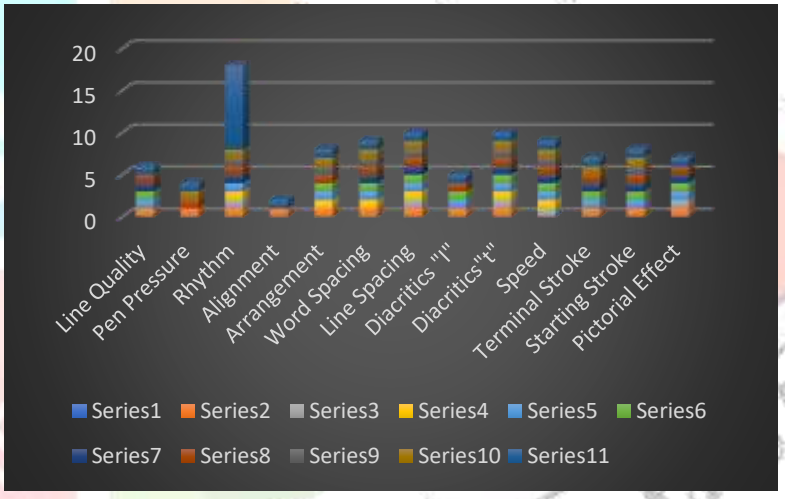
In the below graph forged handwriting of Engineers was analyzed. A total of 10 Engineers were given the sample. This graph shows that 10 of them were able to forge line spacing and diacritics ‘T’. 9 were able to forge word spacing and speed. 8 were able to forge rhythm, arrangement, and starting stroke. 7 were able to forge terminal stroke and pictorial effects. 6 were able to forge line quality. 5 of them were able to forge diacritic ‘I’. 4 of them were able to forge pen pressure, and two of them were able to forge alignment.

The most forged handwriting characteristics among them were line spacing, and diacritics ‘T’ i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment i.e.; only two of them were able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	1	1	1	1	1	1	1	1	0	1	1	1
2	0	0	1	0	0	0	1	0	1	1	0	0	1
3	0	0	1	0	1	1	1	0	1	1	0	0	0
4	1	0	1	0	1	1	1	1	1	1	1	1	1
5	1	0	0	0	1	1	1	1	1	1	1	1	1
6	1	0	1	0	0	1	1	0	1	1	1	1	1
7	1	1	1	0	1	1	1	1	1	1	1	1	1
8	0	0	1	0	1	1	1	0	1	1	0	1	0
9	0	1	1	0	1	1	1	0	1	1	1	1	0
10	1	1	10	1	1	1	1	1	1	1	1	1	1

Table No 11. Data analysis of Engineers.

H0= Engineers forged successfully
H1= Engineers failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 0.999999947
P Value>0.05 = 0.99
In the given value, p Value is 0.99. So, the null hypothesis is accepted.



Graph No. 11 Graph of Engineers Forged Handwriting analysis.

ARMY OFFICERS

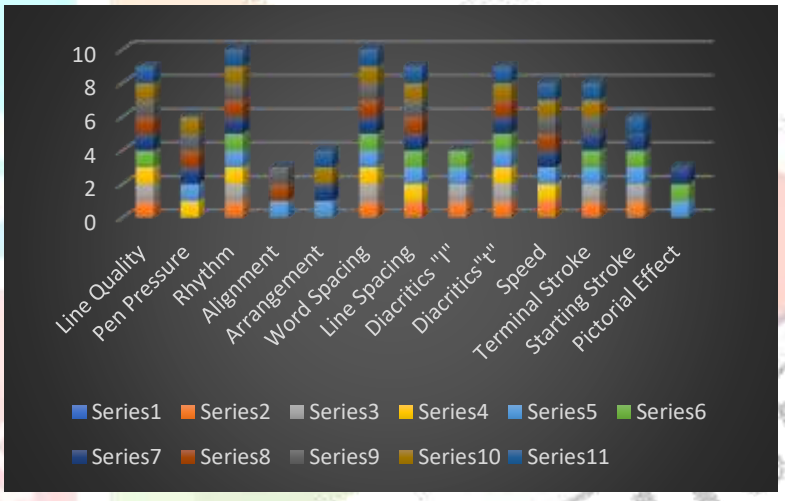
In the below graph forged handwriting of Army Officers was analyzed. A total of 10 Army Officers were given the sample. This graph shows that 10 of them were able to forge rhythm, and word spacing. 9 of them were able to forge line quality, line spacing and diacritics of 'T'. 8 of them were able to forge speed and terminal stroke. 6 of them were able to forge pen pressure and starting stroke. 4 of them were able to forge arrangement and diacritics of 'I'. 3 of them were able to forge alignment and pictorial effect.

The most forged handwriting characteristics among them were rhythm, and word spacing i.e.; all 10 were able to forge and the least forged handwriting characteristic was Alignment and pictorial effect i.e.; only three of them were able to forge this characteristic.

Sample No:	Line Quality	Pen Pressure	Rhythm	Alignment	Arrangement	Word Spacing	Line Spacing	Diacritics "I"	Diacritics"t"	Speed	Terminal Stroke	Starting Stroke	Pictorial Effect
1	1	0	1	0	0	1	1	1	1	1	1	1	0
2	1	0	1	0	0	1	0	1	1	0	1	1	0
3	1	1	1	0	0	1	1	0	1	1	0	0	0
4	0	1	1	1	1	1	1	1	1	1	1	1	1
5	1	0	1	0	0	1	1	1	1	0	1	1	1
6	1	1	1	0	1	1	1	0	1	1	1	1	1
7	1	1	1	1	0	1	1	0	1	1	0	0	0
8	1	1	1	1	0	1	1	0	0	1	1	0	0
9	1	1	1	0	1	1	1	0	1	1	1	0	0
10	1	0	1	0	1	1	1	0	1	1	1	1	0

Table No. 12 Data analysis of Army Officers.

H0= Army Officers forged successfully
H1= Army Officers failed to forge
P Value<0.05: Reject null hypothesis
P Value>0.05: Accept the null hypothesis
Chi Sq. (p Value) = 1
P Value>0.05 = 1
In the given value, p Value is 1. So, the null hypothesis is accepted.



Graph No. 12 Graph of Army Officers Forges Handwriting analysis.

VI. RESULT

This study involved the forensic examination of forged handwriting in relation with various occupations. For this purpose, the samples were analyzed manually and evaluated using the Chi-Square test. A total of 120 samples were collected from 12 different occupations.

By analyzing the samples, I found that artists can execute forged handwriting perfectly while doctors were unable to forge their handwriting. For the calculations, I considered p Value < 0.05 to reject the null hypothesis and p Value > 0.05 to accept the null hypothesis. The Chi-Squared test was utilized to evaluate the proficiency of forged handwriting among various professions. For Advocates, the p value is 0.99; Police officers: 1; Bankers: 1; Professors: 1; IT: 1; Accountants: 0.999; Clerk: 0.999; Nurses: 1; Artists: 1; Doctors: 0.619; Engineers: 0.99 and Army Officers: 1.

Advocates were able to forge the starting stroke and Rhythm. Police Officers could forge the rhythm, Terminal stroke, and diacritic of 'I'. Bankers managed to forge the diacritic of 'T', Terminal Stroke, and Rhythm. Professors could forge the Pictorial Effect. IT professionals were able to forge the rhythm, Diacritics T, Starting, and Terminal Stroke. Accountants could forge the rhythm, word spacing, and terminal stroke. Clerks managed to forge the starting stroke. Nurses were able to forge the rhythm, diacritics T, Terminal, and Starting stroke. Artists could forge the rhythm, line spacing, Diacritics T, Terminal and starting stroke, and Pictorial effect. Doctors managed to forge the rhythm and Diacritics of T. Engineers

were able to forge the diacritics T and Line spacing. Army Officers were able to forge the rhythm and word spacing.

From the analysis, Artists can execute forged handwriting perfectly. Police Officers, Army Officers, Bankers, Professors, IT professionals, Nurses can also do forged handwriting while doctors failed to forge the given handwriting. Every occupation was able forge the Rhythm and they all failed to forge the alignment.

VII. CONCLUSION

The above study has been done to know whether there is any relation between profession and their ability to forge. This study shows the impact of profession and knowledge of forgery will affect the capability of forging their handwriting. For this purpose, 12 different occupations were considered and their forged handwriting was analyzed on the basis of 12 different characteristics. The samples were analyzed manually and were recorded on an Excel sheet as '0' and '1'. So, in this '0' is considered as forged, and '1' is considered as not forged.

For the purpose of identifying which profession is more successful in forging their handwriting among all 12 professions, I tested the whole data in the Chi-Square test and found that Artists were able to forge their handwriting. Police Officers, Army Officers, Bankers, Professors, IT professionals, Nurses were also able to forge their handwriting. However, the Doctors were not able to forge their handwriting. So, this shows that the most forged occupation is Artist, Police Officers, Army Officers, Bankers, Professors, IT professionals, Nurses and the least able to forge their handwriting is doctors.

VIII. FUTURE AND RECOMMENDATIONS

The future of forensic handwriting examination of forged handwriting, particularly concerning different professions, is likely to involve the use of advanced technologies and methods tailored to specific occupational contexts. In fields such as law, finance, and art, where verifying handwriting authenticity is crucial, forensic experts may utilize AI-driven analysis to improve the accuracy of detecting forgeries, analyzing writing patterns, and identifying anomalies typical of certain professions.

Moreover, developing specialised training programs of forensic examiners that focus on the unique handwriting characteristics associated with various occupations could enhance their ability to interpret and evaluate handwriting evidence effectively. As my understanding of the psychological and environmental factors influencing handwriting evolves, forensic examination may also begin to incorporate behavioural analysis to evaluate the likelihood of forgery based on stressors and motivations related to specific occupations.

In future research, it would be beneficial to gather larger number of samples. This expanded dataset would enable a more precise analysis of which professions exhibit higher success rates in forgery. By increasing the sample size, researchers can enhance the statistical validity of their findings, allowing for more reliable conclusions about the correlation between occupation and the effectiveness of handwriting forgery techniques.

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