

Case ref. Number: 0121-08/2022
Case assigned by: Not-disclosed
Mode of receipt: Online request / website form
To, Not-disclosed
Address: Not-disclosed

1 Description of the Documents:

The content of this report is made by **Aithenticate.art** based on the documents described below.

1. RGB Photo *Q1.png* of resolution 1044x822 showing the questioned signature, from now on referred as **Q1**, for which Mr/Ms. commissions Aithenticate.art services for. The signature is handwritten using ink with a pen, over white paper. Refer to Figure 1.
2. RGB png scans of the documents labeled “*Admitted Signatures*”, including 33 signatures deemed as authentic by the customer. All the 33 signatures are made on the same paper tone, grade and relative location to its edges than Q1. Also, a similar pen and similar ink color is used for these. Refer to Figure 2.
3. Additional faked signatures requested to the close family members of the author of **Q1**. These *skilled forgeries* are also made with the same requirements as the “*Admitted Signatures*”: Same paper color and grade, and using a similar pen. All photos have been taken with the same camera. Refer to Figure 2.



Figure 1: Figure 1: Signature labeled **Q1**, commissioned to authenticate.

Authentic ("Admitted Signatures")

Non-Authentic ("Skilled Forgeries")

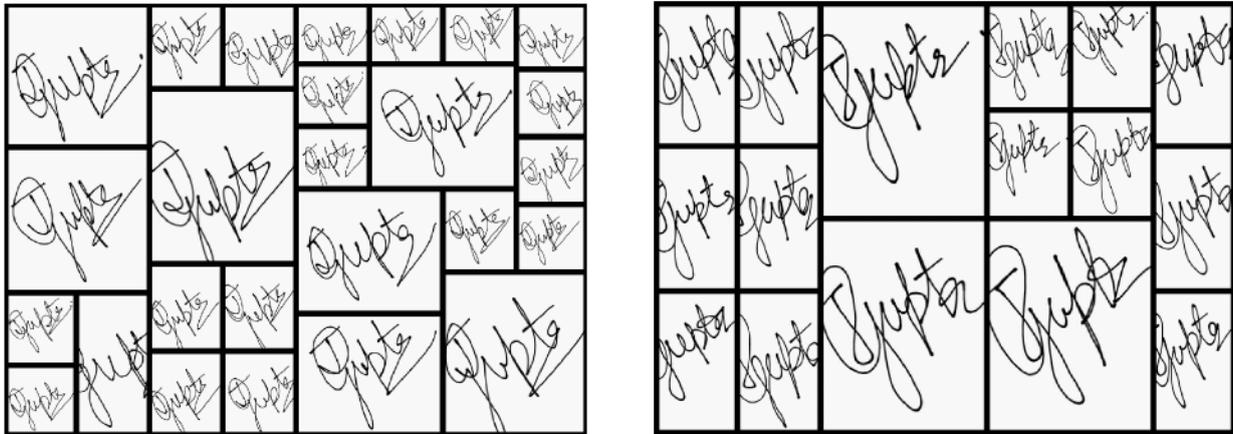


Figure 2: On the left, Some samples of authentic signatures taken from *Admitted Signatures*", included in the training of the Neural Networks. On the right, fakes "*Skilled Forgeries*" made to test the trained AI.

2 Assignment

1. To prove that the area of inscription of the signature Q1 is **free of alterations**, by using digital inspection techniques.
2. To validate the resolution and pixel ranges on the **areas of inscription** of the signature Q1, *Admitted Signatures* and *Skilled Forgeries* as **identical** by our Artificial Intelligence (AI) and other digital comparison techniques.
3. To find out whether the AI model determine that the Questioned Signature **Q1** and the *Admitted Signatures* have been handwritten by the same person.
4. To perform a **graphological description** of the signatures, and verify the consistency of their authentication cues in rythm, form and size.



We use images of the **whole scanned A4 standard paper** in our AI authentication. The size of the signature itself is an authentication cue, and our AI model recognizes the size relative to the paper. Additionally, we compare the signature dimensions as an individual graphological cue.

2.1 Declaration of Standards

For this work, we are working subject of two international standards:

1. Scientific Working Group for Forensic Document Examination (SWGDOC)'s **Standard for Examination of Handwritten Items** for examinations and comparisons involving handwritten items and related procedures using side by side comparison methods.
2. **ANSI/ASB Standard 35: Standard for the Examination of Documents for Alterations** to ensure that there is no alteration of the document by physical, chemical, electronic, or mechanical means, or a combination thereof.

3 A.I. Authentication results

We run our unique AI based mathematical models applied to the digitized images of the signatures.

- Our AI model classifies correctly 92% of the signatures.



The verdict of the Artificial Intelligence model:
The signature Q1 is a FORGERY with a probability of 92%.

The heatmap is shown in Figure 3:

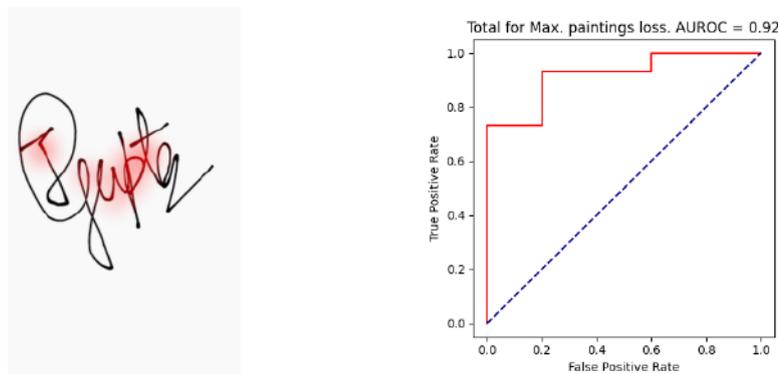


Figure 3: On the left, the heatmap for **Q1**, showing in red the regions used by the AI classify it as a forgery. On the right, the ROC proving the forgery classification accuracy of 92%



Heatmap on the signature: According to the AI model, the strokes in **Q1** that differ the most respect to the authentic samples are located on the rightmost region of the signature. This is highlighting a transition in writing speed that we describe in Section 4.

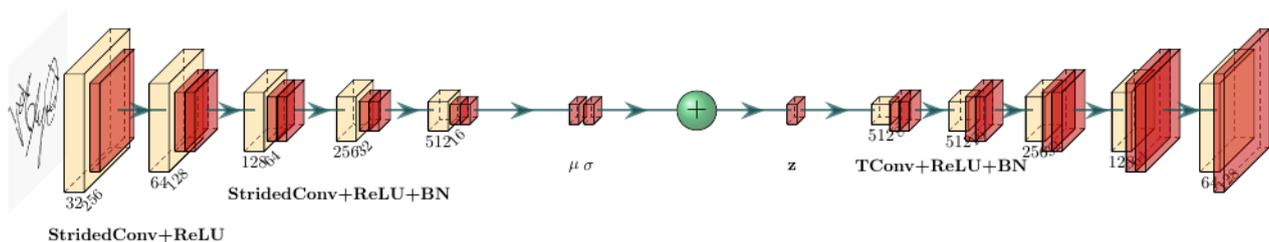
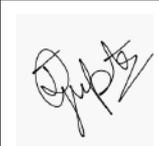
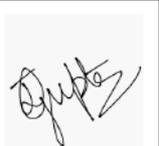


Figure 4: A diagram of the architecture for our AI model for Signature Authentication.

4 Signature description and graphological cues

In this section we describe the comparison of **Q1** with a subsample of the authentic signatures, labeled as A1-A5. These samples are selected by a graphologist as a representation for the graphological cues of the authentic *Admitted Signatures*:

Q1	A1	A2	A3	A4	A5
					

- An inter-se comparison of the *Admitted Signatures* A1 to A5 shows consistent formation with some natural variations.
- Identical bonafide format of Q1 and Admitted Signatures A1 to A5
- Comparison with the Q1 shows an average penmanship with poor rhythm, which is also a remarkable feature on A2 and A3.
- Identical poor line quality, letter designs and relative size. These three cues are usually preserved when all the signatures are made by the same person or when we are holding a high quality forgery.
- Relatively identical spacing for the first three characters in A1-A5. However, for Q1 the spacing gets irregular after half of the signature.
- Similar right slant (with respect to the paper) for all the *Admitted Signatures* signatures. This right slant gets 3° lower in the case of Q1. However, small or medium variation in right slant, unrelated to another graphology cue, will never be a feasible authentication cue.

4.1 Individual/personal graphological traits

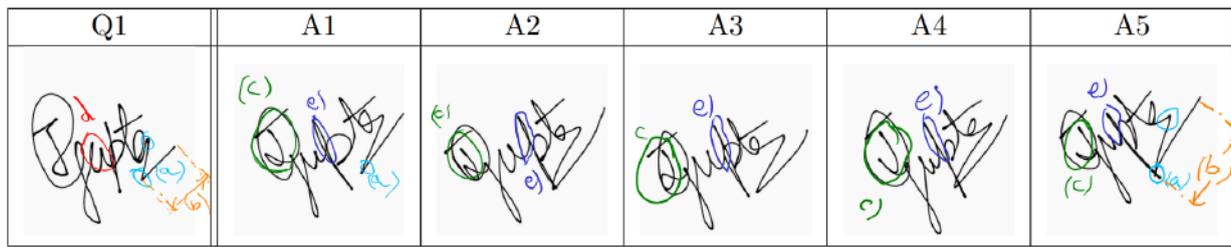
In signature Q1 we observe the following characteristics traits of a **fast writer**: Usage of both **garland** and **thread** connective forms, right slant altogether with ascending baseline.



The writing **speed** is a remarkably characteristic trait, although difficult to assess accurately, and subject to change from one sample from another. However, the **variations in speed** are always observed around the same character in signatures made by the same person. Additionally, the locations of the **peaks of speed** of writing are kept constant across authentic signatures.

The most remarkable **individual/personal features** of the *Admitted Signatures*, from a graphological point of view, are:

- A **transition to a more angular writing** towards the tail thread end. This cue is noticeably more prominent on the Q1 than on the *Admitted Signatures*.
- The cue (a) ties another cue which may be the most noticeable difference between Q1 and the *Admitted Signatures* for a non-professional observer: A **smaller size of the tail thread end** relative to the whole length of the signature.



According to the literature and our experience, the tail end size relative to the length of the signature is actually the *proportionality cue* of a signature which statistically shows a larger variance. Therefore, although in the case of Q1, this cue may seem the most prominent for the untrained eye, it is not actually decisive for a signature authentication by any means. By the opinion of our experts, the transition to angular writing is more telling than the reduced size of this end thread in Q1.

- (c) The slant of Q1 is very similar to the *Admitted Signatures*. The regularity is however not so well kept in the Q1. The **opening non-fluent hooked shank connection** is not present on Q1, which shows a fluent formation of the feature.
- (d) Very fluent formation of the **garland form in the u**, with a good **fluid rhythm**. However this garland in Q1 shows more open on the first candle, and this is one of the most a relevant authenticity cues in this graph.
- (e) The letter **p** features an **arcade** type of connectivity, similarly to the authentic samples.

5 Conclusion

We firstly used our unique Artificial Intelligence based mathematical models applied to the digitized images of the signatures. The verdict of the Artificial Intelligence model was a forgery, with a high classification probability of 92%, and highlighting an area of transition in writing speed, which ties to the graphological description of the signature. We have found a handful of traits which differ from the questioned signature Q1 to samples of the *Admitted Signatures*.



In Aithenticate.art we have experience working with skilled forgeries. Brush-made signatures may have a larger number of telling authentication cues due to the texture and colors of both the signatures and the area of inscription. However, pen-made signatures, once isolated from the area of inscription have more than enough traits for a thoroughful graphological description, like in the case presented in this report.

6 Disclaimer / Legal note

The present report by Aithenticate.art is the result of the digital analysis and description of the images of the signatures submitted by the customer, using mathematical models. This analysis has been done with Diligence and Good Faith, but Aithenticate.art does not provide any warranty with the correctness of the sentences in this report with respect to the authenticity, or guarantees any error-free operation of Image Analysis Software, including the Artificial Intelligence (AI) model used. To the extent permitted by law, all warranty and liability of Aithenticate.art is hereby excluded, including, but not limited to, liability for financial damage in connection with the use of the present report document and the confidence in it, any decisions taken, purchases, sales, insurance, security, display or other dispositions relying upon the present report, damage or loss profits due to incorrect statements in the report. For further information, please refer to our [Terms and Conditions](#).