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Case ref. Number: 0206-12/2022
Case assigned by: Roi S.
Mode of receipt: Online request / website form
To, Mr. [HIDDEN]
Address: Not-disclosed

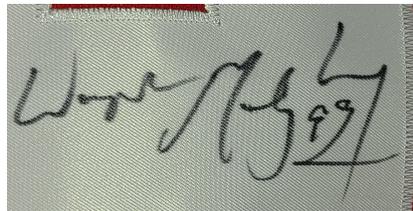
1 Description of the Documents:

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

1. RGB Photo *jersey.jpg* of resolution 3024×4022, provided by the customer and showing a dedicated autographed jersey. The signature is handwritten under the number 99, using a marker. Refer to Figure 1 for the reproduction and Section 3 for a description.
2. RGB png images of shirts, items and cards with verified authentic autographs from Wayne Gretzky, dated at the same time period. The signatures are labeled “*Admitted Signatures*”, and include 15 verified authentic autographs.
3. RGB png images of *skilled forgeries*. The *skilled forgeries* used for validation are made by Aithenticate.art subject the same requirements as the *Admitted Signatures*. The selected 15 signatures are made with similar marker and extracted using the same technique as with **Q1**.



(a) Autographed shirt.



(b) Close up photo.



(c) Questioned signature **Q1**.

Figure 1: Images of the autograph and area of inscription, used for the authentication.

1.1 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, and compare the feature vector curves.
4. To perform a **graphological description** of the signatures, and verify the consistency of their authentication cues in form and size.

1.2 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 the Examination of Handwritten Items](#) for examinations and comparisons involving handwriting 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.

2 A.I. Authentication

We run our AI based mathematical model trained on digitized images of the verified authentic *Admitted Signatures* and *Skilled Forgeries*.

In this section we describe the comparison of **Q1** with the *Admitted Signatures*, labeled as S1-S15, which we selected for including all the variations we observed in our research on the authentic signatures from Wayne Gretzky. Of these, Q1, S1, S3, S4, S7, S8, S9, S13 and S15 are made on textile surfaces (jerseys).

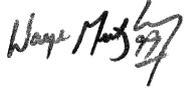
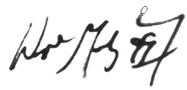
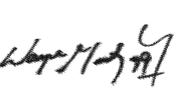
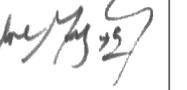
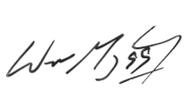
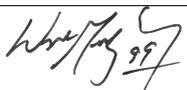
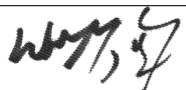
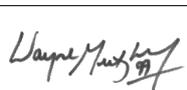
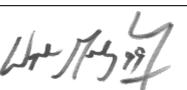
Q1	S1	S2	S3	S4	S5
					
S6	S7	S8	S9	S10	S11
					
S12	S13	S14	S15		
					

Figure 2: Q1 side by side with verified authentic signatures by Wayne Gretzky.

The diagram of the neural networks is shown on Figure 4. In Figure 3 we can see the resulting heatmap and the classification ROC curve. We have also included the features vector curves in the same figure.



Our AI model correctly classified all the signatures in the experiment run, and classified **Q1** as authentic, with a probability over 96%. Therefore, **The A.I. model classifies Q1 as AUTHENTIC with an accuracy of 96%.**

(a) **Heatmap on the signature:** According to the AI model, the strokes in **Q1** that the AI used to prove the authenticity are located all along the signature. The regions which are resourced

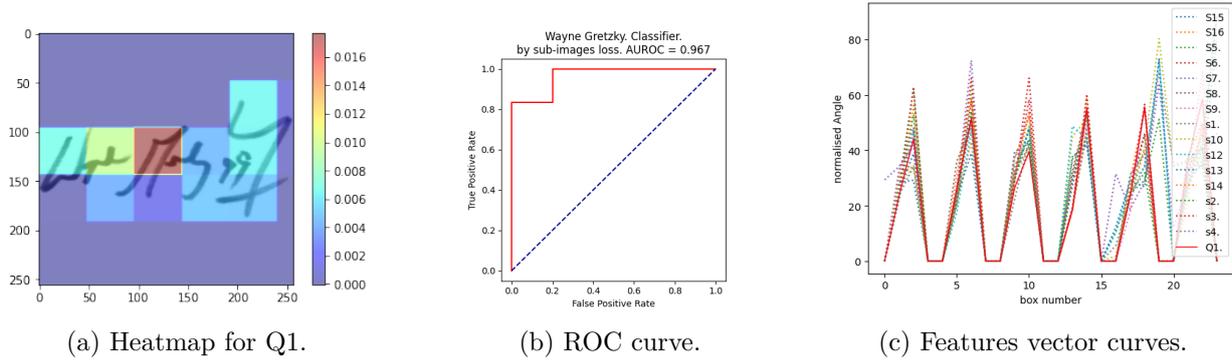


Figure 3: a) The heatmap for **Q1**, highlighting the regions that were used by the AI to classify the signature as authentic. b) The AUC score obtained with our test samples is 0.97, which is very high. c) The features vector curves for **Q1** altogether with the *Admitted Signatures*

the most by the AI for the verdict are the ones highlighted in red and yellow. We observed that the features on these regions are preserved across **Q1** and authentic signatures of Wayne Gretzky. We describe these fetures in detail in Section 3.



(c) **Features Vector curves of the signatures:** These curves characterize the signatures attending to the response to filters on corresponding regions. We observe that this curve for **Q1** is very similar to the one obtained with the 15 verified authentic autographs (S1-S15). This finding agrees with the AI classification of "authentic".

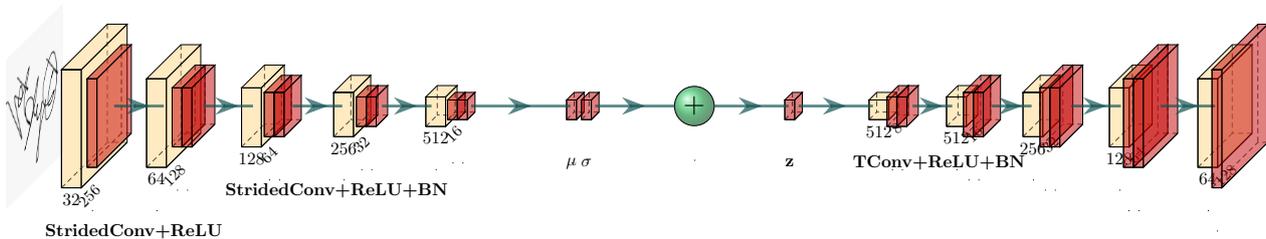


Figure 4: A diagram of the architecture for our AI model for Signature Authentication.

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3 Signature description

The signature is hand-written on the white textile surface of the jersey. We conducted a digital examination and chromatic analysis of the signature Q1 and its surrounding area on the jersey and determined that it is a handwritten signature and not a print. Our chromatic analysis further showed that the marker used had a dark green hue. This color is also seen on verified authentic autographs from the same time period (refer to Figure 5). This suggests that the author was using the same model of marker. It is common for celebrities to have a preference for a specific marker brand and color.

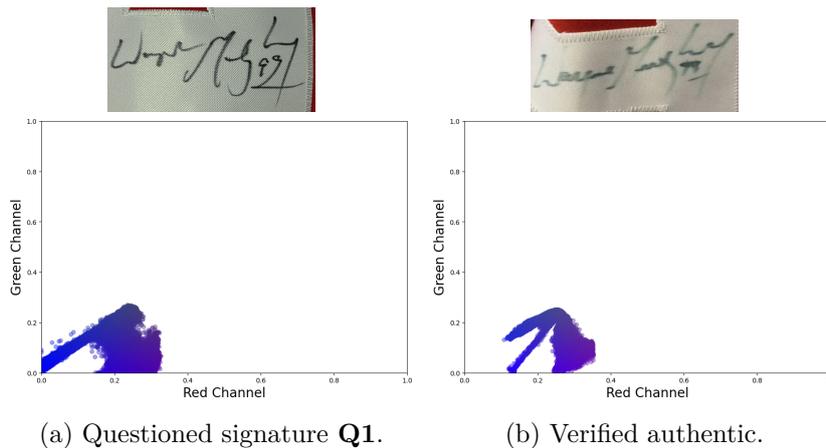


Figure 5: Comparison of chromaticity of signature and area of inscription.

By comparison of Q1 with the *Admitted signatures*, labeled S1-S15 (refer to Figure 2), we found the following common graphological cues between the signatures:

1. An inter-se comparison of the *Admitted Signatures* shows a varying general writing pose, with natural variations and a consistent rhythm. In other words, the angle, slant, pressure, speed, and other factors of the individual's writing style may vary across signatures.
2. The basic handwriting description must mention a consistent mid tier penmanship. It is evident that the author is used to sign often, and many features are repeated across samples.
3. Identical bonafide format of **Q1** and *Admitted Signatures*. We considered factors, such as the overall shape and size of the signature, the pressure applied, and the speed of the signature.
4. The direction of the strokes in Q1 are the same as the corresponding ones in *Admitted Signatures*.



The direction of the stroke in a signature can be a unique characteristic and could potentially be used as part of an authentication process. However, it is not a foolproof method as individuals may not consistently write with the same stroke direction, and the direction can be easily altered.

5. Preference of arcades over garlands are observed on **Q1** and *Admitted Signatures*.
6. Consistent angularity and waviness along the signature. This is coupled with smooth and fast writing pace.

7. The presented autographs are made at noticeably different speeds. Though, **Q1** shows identical line qualities, letter designs, poses and relative sizes, compared to many authentic samples. These four cues are usually preserved when all the signatures are made by the same person.
8. In **Q1** we observe the following characteristics traits of a rather **fast writer**: Ascending baseline. Right slant. Usage of **thread** connective forms.



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.

9. Absence of underlines or decorative loops on all the signatures.
10. Relatively similar spacing for the all the characters for the **Q1** and *Admitted Signatures*.
11. Usage of Gretzky's number, 99, at the end of the signatures.

4 Conclusion

We firstly used our unique Artificial Intelligence based mathematical models applied to the digitized images of the autograph **Q1** and the signatures we compiled. The verdict of the Artificial Intelligence model was that **the signature is an authentic autograph** from Wayne Gretzky, resulting in a high classification accuracy of 96%. Secondly, the feature vector curves shows that the response of **Q1** to our filters is very similar than with the verified *Admitted Signatures*. Our graphological characterization of the signature in Section 3 includes a thoughtful description. We have found a handful of traits which are in common with other verified signatures from Wayne Gretzky from the same time period.

5 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](#).

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