

Case ref. Number: 0194-12/2022
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 *jj.jpg* of resolution 1868×1170, provided by the customer and showing the Nike University of Michigan Football with the questioned signature. The signature is handwritten on the ball using ink with a pen, altogether with a "Go Blue!" inscription. Refer to Figure ?? for the reproduction and Section 3 for a description.
2. RGB png scans of documents and items with verified authentic autographs from JJ McCarthy, labeled "*Admitted Signatures*". These include 24 verified authentic signatures from JJ McCarthy, extracted from autographs and documents he signed during his sports career. The selected 24 signatures are made with similar pen and extracted from the documents and items using the same technique as with **Q1**. The *skilled forgeries* are also made with the same requirements as the "Admitted Signatures".
3. Public product information released by the Official Merchandise Retailer for Michigan Athletics, **M Den**.



(a) Autographed Football.



(b) Rectified image of the signature.



(c) **Q1** (Extracted signature)

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



The images we used in our AI authentication include the **whole autographed item or scanned standard specification documents**, in order to make the comparative up to scale. 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.

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 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.

2 A.I. Authentication results

We run our AI based mathematical model trained on digitized images of the verified authentic *Admitted Signatures* and *Skilled Forgeries*. The diagram of the neural networks are shown on Figure 3.

- Our AI model correctly classified 96% of the signatures in the experiment run, and classified as authentic the autograph on the football.



The verdict of the Artificial Intelligence model:
The AI classifies Q1 as AUTHENTIC with a probability of 96%.

The heatmap is shown in Figure 3:

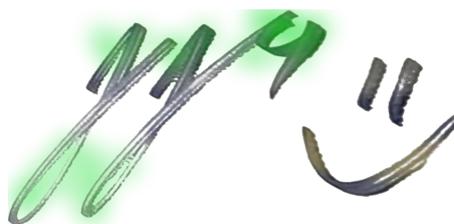


Figure 2: On the left, the heatmap for **Q1**, showing in green the regions used by the AI classify it as **authentic**.



Heatmap on the signature: According to the AI model, the strokes in **Q1** that the AI used to prove the authenticity are located on both J's and on the M initial of the surname. We observed that these regions are preserved across other authentic signatures of JJ McCarthy, which we describe in detail in Section 4.

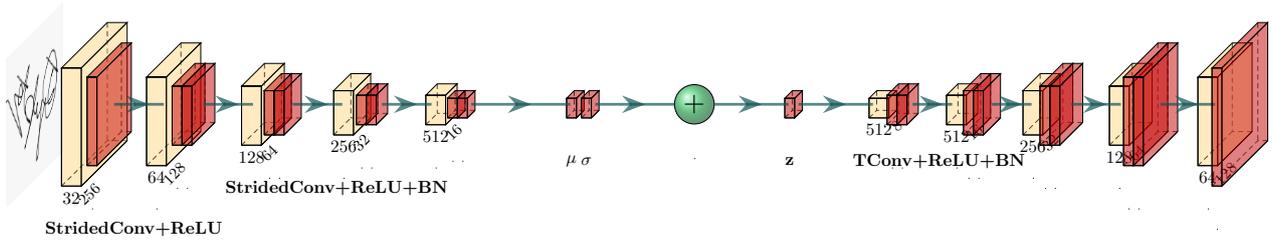


Figure 3: A diagram of the architecture for our AI model for Signature Authentication.

3 Chromaticity study of the item

The autograph is handwritten on a Football, manufactured during the year 2022. The present Autographed Football presents a brand new condition. The Michigan Athletics "M" logo, the autograph and area of inscription are free from alterations. We used a digital technique to compare the RGB color touse for corresponding printed areas to the Football made on the same year 2022 to advertise the product. The item shows very few colors: dark blue over yellow for the logo, and dark blue for the signature and handwritten inscriptions. We plot the color decomposition to find traces of the yellow for the blue channel, with a light tone for the green channel. This feature holds identical for both pictures. Also, the content of both chromaticity plots in Figure 4 show a very similar distribution, proving that the colors are the same of the authentic JJ McCarthy Autographed Footballs.

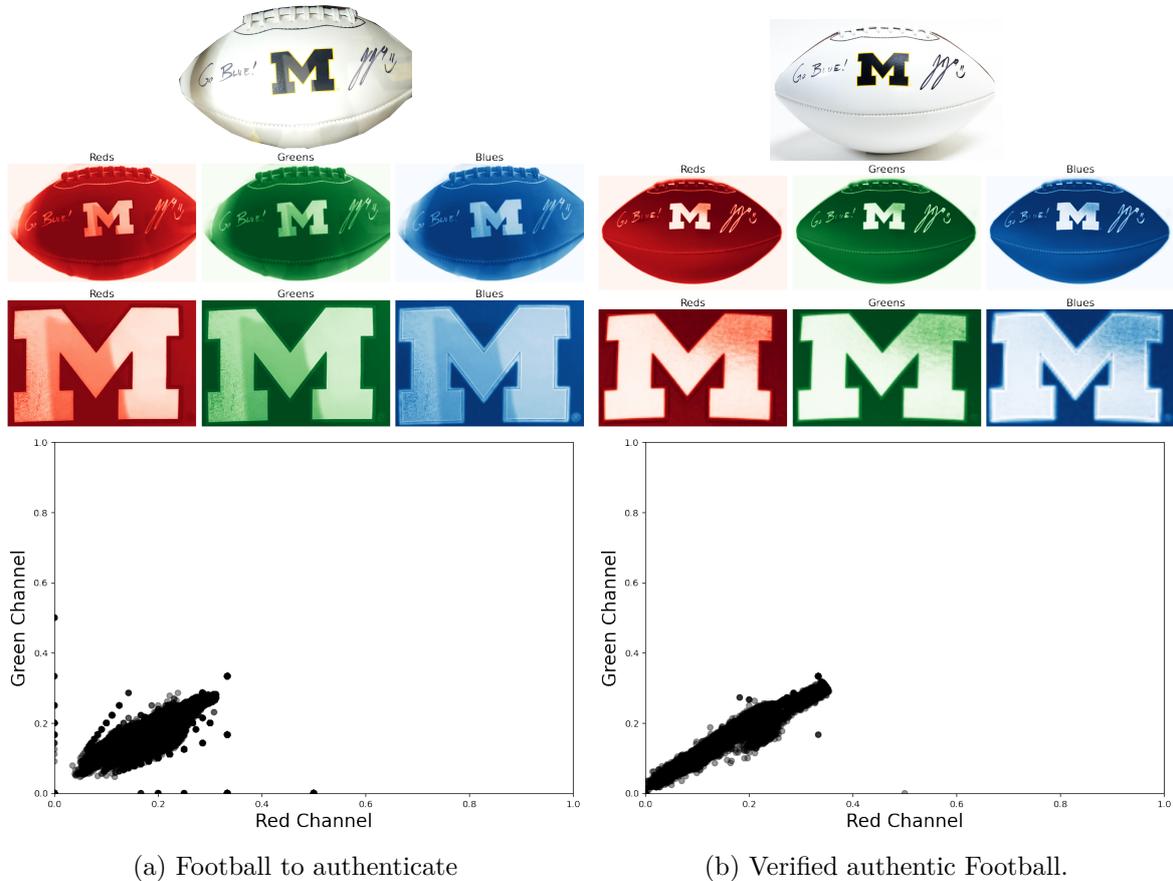
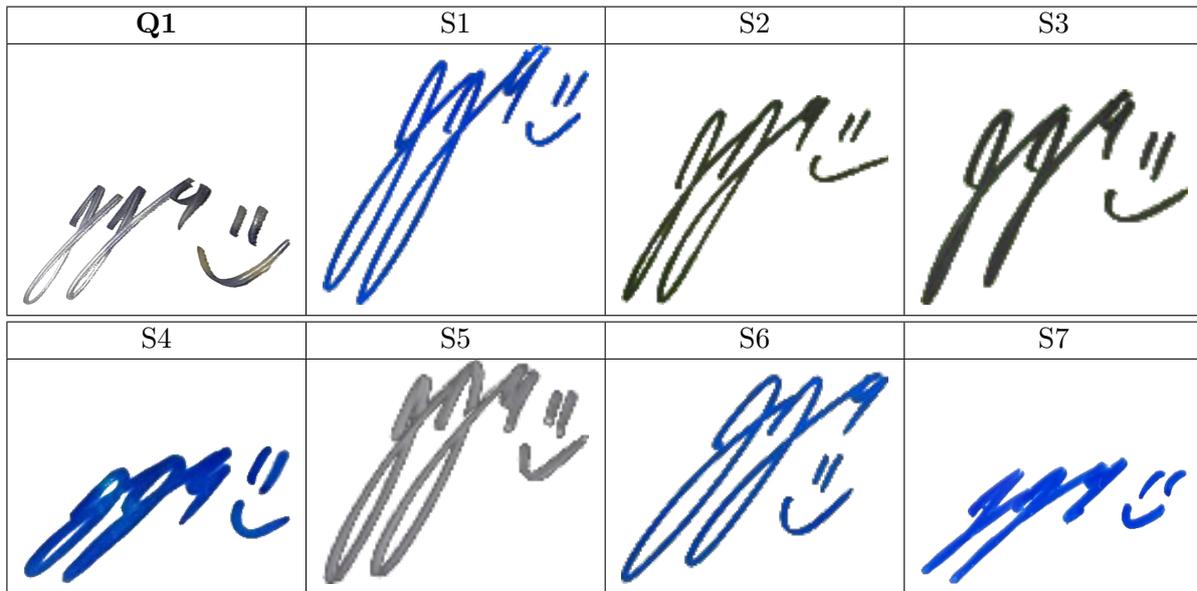


Figure 4: RGB color decomposition and chromaticity plots for the images of both Footballs.

4 Individual/personal graphological cues

In this section we describe the comparison of **Q1** with a subsample of the *Admitted Signatures*, labeled as S1-S7, which we selected for including all the variations we observed in our research on the authentic signatures from JJ McCarthy. In this regard, it is remarkable that our metrics for the graphological cues of the signature of JJ McCarthy are preserved very well across samples. This personal characteristic itself allows the graphologist to focus on more specific writing traits for the authentication of the autographs:



- (a) An inter-se comparison of the *Admitted Signatures* S1-S7 shows a very consistent general writing pose, pace and rhythm, with natural variations. These natural variations are found to be due to the constraints of the dimensions of the area of inscription.
- (b) The basic handwriting description must mention a consistent mid tier penmanship. It is evident that the author is used to sign often, and most features are repeated across samples.
- (c) Tendency to keep the angularity and waviness along the signature. This is coupled with smooth and rather fast writing pace.
- (d) Identical bonafide format of **Q1** and *Admitted Signatures* S1-S7.
- (e) A comparison of *Admitted Signatures* with the **Q1** unveils that the preference for the arcade connections over the garland is preserved for the J's and the initial of surname.
- (f) Non fluid separation of the J's is the same for **Q1** and the *Admitted Signatures*.
- (g) The presented autographs are made at noticeably different speeds. Though, **Q1** shows identical line qualities, letter designs, poses and relative sizes, compared to S1-S7. These four cues are usually preserved when all the signatures are made by the same person.
- (h) Relatively identical spacing for the all the characters for the **Q1** and *Admitted Signatures*.
- (i) Changing right slant for **Q1** and *Admitted Signatures* signatures, due to area of inscription constraint, however all the features keep proportional. The right slant of **Q1** is very similar to the ones of S1, S2, S3 and S5. Small or medium variations in right slant across samples, unrelated to another graphology cue, is not a feasible authentication cue.

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



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 **Q1** and the *Admitted Signatures*, from a graphological point of view, are:

5 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 JJ McCarthy, with a high classification probability of 96%, which ties to the graphological description of the signature. Our characterization of the signature, and area of writing on the Football in Section 3 includes a thoughtful description. We have found a handful of traits which are in common with other verified signatures from JJ McCarthy from the same time period.

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](#).