Case ref. Number: 0195-12/2022
Case assigned by: Roi S.
Mode of receipt: Online request / website form
To, Mr. [HIDDEN]
Address: Not-disclosed

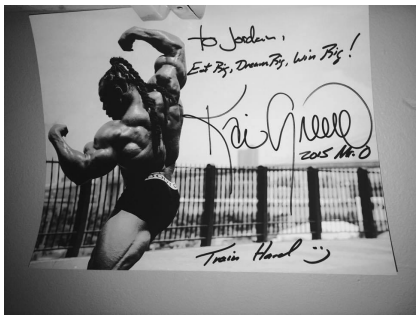
1 Description of the Documents:

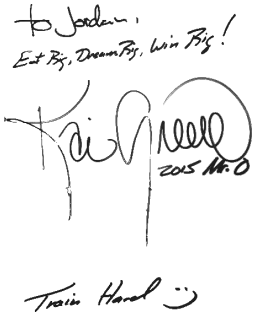
The content of this report is made by **Aithenticate.art** based on the documents described below.

1. RGB Photo *KaiGreene.jpg* of resolution 960×720, provided by the customer and showing an autographed photo of Kai Greene. The signature is handwritten on the ball using ink with a pen, altogether with the following dedication inscriptions: "to Jordan, Eat Big, Dream Big, Win Big!", "2015 Mr. O" and "Train Hard" . Refer to Figure 1 for the reproduction and Section 3 for a description.

2. RGB png scans of documents and items with verified authentic autographs from Kai Greene, labeled "*Admitted Signatures*". These include 15 verified authentic signatures from Kai Greene, extracted from autographed photos and documents he signed during his sports career. The selected 15 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 Retailers for Kai Greene,kaigreene.com and trainwithkai.com.


(a) Autographed photo.


(b) Complete inscription.


(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.

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 document. 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 95% of the signatures in the experiment run, and classified as authentic the autograph on the photograph. The verdict of the Artificial Intelligence model:
The AI classifies Q1 as AUTHENTIC with a probability of 95%.

The heatmap is shown in Figure 2:

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 the opening K and on the cursive connected lower-cases. We observed that these regions are preserved across other authentic signatures of Kai Greene, which we describe in detail in Section 3.

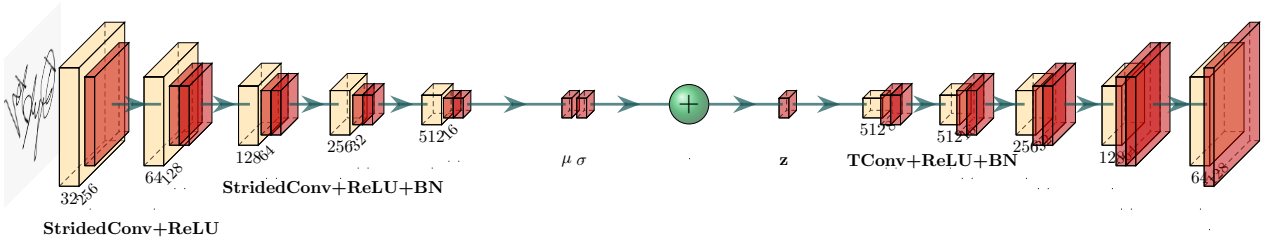
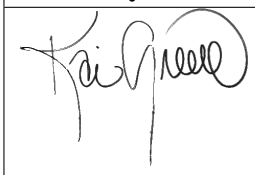


Figure 3: A diagram of the architecture for our AI model for Signature Authentication.

3 Signature description

In this section we describe the comparison of **Q1** with a subsample of the *Admitted Signatures*, labeled as S1-S4, which we selected for including all the variations we observed in our research on the authentic signatures from Kai Greene:

Q1	S1	S2	S3	S4
				

1. An inter-se comparison of the Admitted Signatures S1-S4 shows a varying general writing pose, with natural variations and a consistent rythm.
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. Arcade type connections. The general preference of arcades over garlands is observed on both Q1 and *Admitted Signatures*.
4. Cursive handwriting, which enables different right slants across samples.

> Cursive handwriting is a style of writing in which the letters are connected to each other in a flowing, continuous line. This style is often used for writing in cursive because it is faster and easier to write than print letters, which are separate and disconnected. Cursive handwriting is often considered more aesthetically pleasing than print letters, and it is often used in calligraphy and other artistic writing. Cursive handwriting is also used in many school systems as a way to teach children how to write, as it helps to improve their fine motor skills and promote legibility.

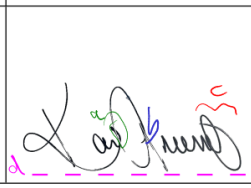
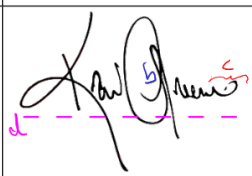
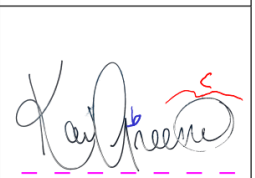
5. Tendency to keep the angularity and waviness along the signature. This is coupled with smooth and rather fast writing pace.
6. Identical bonafide format of **Q1** and *Admitted Signatures* S1-S4.
7. Very fluid connections , same for Q1 and the *Admitted Signatures*.

8. The presented autographs are made at noticeably different speeds. Though, **Q1** shows identical line qualities, letter designs, poses and relative sizes, compared to S1-S4. These four cues are usually preserved when all the signatures are made by the same person.

9. Relatively identical spacing for the all the characters for the **Q1** and *Admitted Signatures*.

3.1 Individual/personal graphological cues

Here, our graphologist analyzes personal cues of the signatures, their location and how they propagate across different samples:

Q1	S1	S2	S3	S4
				

(a) Usage of a thread between name and surname, which ends pointing to the i tittle.

(b) A fluid opening hook shape initial of the surname.

> In a signature, a fluid **opening hook shape initial** of the surname may indicate that the person has a confident and expressive writing style. The hook shape may be indicative of a person's desire to add a personal touch to their signature, and it could also suggest that they are artistic and creative. The fluidity of the initial may indicate that the person has a smooth and graceful writing style, and the fact that it is the initial of the surname could suggest that the person is proud of their family name.

(c) The round shape at the end of Kai Greene signature is commonly known as a "loop" or a "double loop." Some people may refer to it as a "circle" or a "curl," but these terms are not as commonly used to describe this feature of a signature.

> The **loop** is created when a person makes a continuous line that loops back on itself, forming a closed shape. This can add a decorative touch to a signature, and it is often seen in cursive handwriting. Some people may include a loop in their signature for artistic reasons, while others may use it to add a personal touch to their signature.

(d) Very stable horizontal baseline on all the signatures. The right slant changes across signatures, however it is always well maintained along each signature. Variations in right slant across samples, unrelated to another graphology cue, is not a feasible authentication cue.

(e) In **Q1** we observe the following characteristics traits of a rather **fast writer**: Usage of both **arcade** and **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.

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 Kai Greene, with a high classification probability of 95%, which ties to the graphological description of the signature. Our 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 Kai Greene from the same time period.

5 Disclaimer / Legal note