BETWEEN MICHELANGELO AND THE HOLY SHROUD: ARTIFICIAL INTELLIGENCE AND ITS MIRACLES

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1. Introduction

The search for a link between the greatest sacred artist in history and the greatest of sacred relics has all the potential to be seen as a need yet to be realized in the science of biography. Nevertheless, this topic is despised in academic circles - and beyond - for various reasons. How so? The lack of materiality is probably the main reason. But would a natural association between Michelangelo Buonarroti (1475-1564) and the Holy Shroud really be out of place?

Just as with Leonardo, perhaps the total lack of documentary evidence associating Michelangelo with the Shroud is due to something justifiable (the reason for which is hidden from us) or simply mere chance – but "absence of evidence" should not be confused with "evidence of absence". Incidentally, there is also no documented personal evidence that Michelangelo was homosexual or that Leonardo painted the *Mona Lisa*.

One must consider that, not only for these two artists, but (virtually) for any other Renaissance artist, no relationship with the Shroud of Turin was ever evident - as if the subject of the "Shroud" was something to be naturally kept a secret. Could it have been simply because they were unaware of it, or because they had never come across the Shroud? Hard to believe, since the fame of this relic in Europe (and particularly in Italy) was widespread; moreover, the close relationship between ecclesiastical and political authorities and many of these great artists was a constant, a natural consequence of the importance of their activities. Suffice it to say that 96% of Michelangelo's works were commissioned by popes and cardinals [1].

An obvious explanation for such silence might be the fact that, if a connection between the artist and the Shroud had been revealed, it would have been suspected that the relic was, in fact, a fake. Obviously, society would not have tolerated such frauds, and even if there were "official" copies of the Shroud on display, these would already be recognized as replicas[1].

As an intellectual attentive to religious symbolism and scientific questions of human anatomy, it would have been extremely unlikely that the Shroud would have gone unnoticed by Michelangelo - he, who frequented the most cultured circles between Rome and Florence, eager to understand God's creation and how evolution had sculpted the shapes and volumes of the "human machine". Learning from the very nakedness of the Son of God was for him a journey to the divine, the transcendental.

With these notions in mind, I decided to undertake research making use of all the

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material we have available, to bring more of it to light, and to try to answer the question: if there was indeed a relationship between Michelangelo's art and the Shroud, where would the evidence that would confirm it be? Evidence that is often embedded within the art of the one who is called "The Divine".

An analysis of his ideas, codified in the artistic production that immortalized him [2], and in his writings [3], could offer us clues capable of revealing a new perception of the inner sacredness of the genius. Below, I will outline some arguments in support of a probable link between the greatest sacred artist in history and the greatest of sacred relics as represented by the overlapping sections shown in Figure 1.I would also like to point out that this study was approved by Barrie Schwortz, the world's foremost authority on Shroud research and dissemination, editor and founder of the Shroud of Turin Website (www.shroud.com) and the official photographer for the Shroud of Turin Research Project (STURP) between 1978 and 1981 [4].

2. The Shroud at the center of the Pietà

It cannot go unnoticed that the presence of the Shroud - more or less explicit - ended up being a constant in Michelangelo's work, given the level of attention the artist devoted to the theme of the dying Christ.

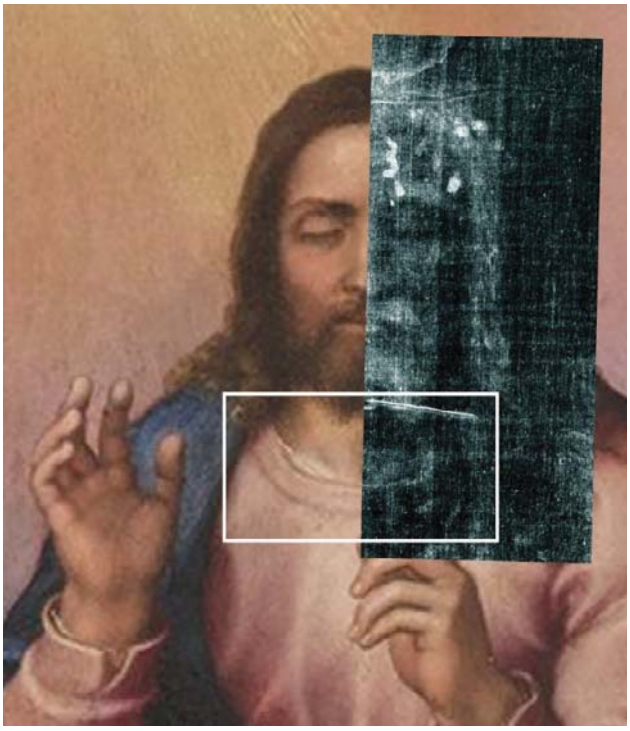

Figure 1. The face of Christ (detail) in a painting by Marcello Venusti based on a drawing by Michelangelo and the face of the Shroud. The perfect correspondence of the facial features and the line of the neckline is striking. (Source: Átila Soares / Massimo Gaudio / Wikimedia Commons)

In the iconic *Vatican Pietà* (Figure 2), the Sacred Shroud is present at the very center of the composition, in the wide drapery covering the legs of Mary, who holds her dead Son on her lap.

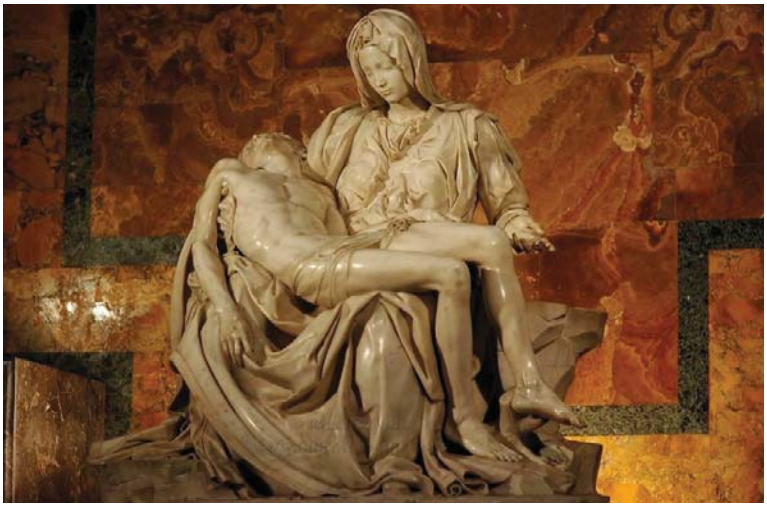

Figure 2. Michelangelo Buonarroti's "Pietà", St. Peter's Basilica in the Vatican (1497-1499). (Source: Wikimedia Commons)

The Shroud is also depicted in paintings on the theme of the "Deposition of Christ" based on preparatory drawings by Michelangelo. Figures 3 and 4 give a clear example; the two paintings belonging to Marcello Venusti and Jacopino del Conte are based on Michelangelo's drawings.

Figure 3. "The "Deposition" with the Shroud: a "gloomy" version in a painting by Marcello Venusti (left), and another similar one Figure 4 by Jacopino del Conte (right) based on drawings by Michelangelo. (Source: Accademia di San Luca, Rome / Palazzo Barberini, Rome)

Figure 5. "Illuminated" version of the "Deposition" (Michelangelo, 1500-1501, National Gallery) and the nudity of Christ: a constant in Michelangelo's depictions. (Source: National Gallery / Wikimedia Commons)

Figure 6. There is a high level of correspondence between the faces of Jesus in the "Bandini Pietà" (left) and in his last, unfinished work (right), the "Rondanini Pietà", and the face of the Holy Shroud: would Michelangelo have known about or had closer contact with the greatest treasure of Christendom? (Source: Private Archives - Átila Soares da Costa Filho / Mdig.com / Renata Testa)

Figure 5 is in contraposition with the classical representation of Christ, because Michelangelo painted him nude. On the theme of the Pietà (Michelangelo made four of them), it is possible to find another element that directly evokes the Shroud, except for the "Palestrina Pietà", where it is not very evident. Thus, besides the fabric representing the Shroud in the *Vatican Pietà*, two of the other three variants show the face of Christ, very similar to that of the relic.

The *Bandini Pietà* (Figure 6), commissioned by Francesco Bandini in 1547, features Michelangelo's self-portrait as Nicodemus supporting the lifeless body of Christ. The sculptor and architect, Tiberio Calcagni (1532-1565) was commissioned to restore the (usual) signs of fury that Michelangelo had left on the marble in this massive work [5]. The work conveys a spiritual and dramatic atmosphere to us, given the advanced age of its author, and today it is preserved in the Museo dell'Opera del Duomo, Florence, Italy.

The *Palestrina Pietà*, made of marble and belonging to the Barberini family, probably dates back to 1556. It depicts the exact moment the body of Jesus is lowered from the Cross and supported by his Mother and her followers - something revolutionary in the art of sculpture up to that time. As mentioned, it is the only version that has no obvious connection with the Holy Face (Turin). It was once located inside the church of Santa Rosalia in Palestrina, but now belongs to the collection of the Galleria dell' Accademia in Florence.

And finally, the *Rondanini Pietà*, also in marble, begun in 1552 and left unfinished due to Michelangelo's death in 1564. It is interesting to note that, in addition to approaching a Gothic style - choosing to represent pain rather than beauty - in this version, it is the Son who seems to support the Mother, when seen from another point of view[2]. His last *Pietà*, extraordinarily moving, is preserved today in the Castello Sforzesco Museum in Milan.

3. A "sacred technology" - the "Luminari" method

It is possible that the mere fact that the Son of God was completely naked in the Shroud called Michelangelo's attention. The union of Christ's pure divinity with his human, male bodily dimension would have been a perfect event in terms of synthesizing the greatest values and spiritual interests of his mind and soul: a miracle that had materialized before him. Indeed, virtually every time the artist decided to depict the adult Christ, he presented him naked or half-naked, whether in drawings, paintings, or sculptures.

The most famous image is the Christ-Apollo figure at the center of the *Last Judgment* (1535-1541), in the Sistine Chapel. It was later covered (along with the other nude figures) with a strip of cloth by the brush of Daniele da Volterra, his greatest disciple [6].

Also noteworthy is the Crucifix of Santo Spirito, which he sculpted in 1492, at the age of 17, for the convent of the same name in Florence.

Incidentally, Buonarroti's fondness for the body of the Messiah was so great that there is a curious fact regarding the preparatory sketch of the *Pietà* for Vittoria Colonna. The drawing (now in the Isabella Stewart Gardner Museum in Boston) was executed in 1538 by the master as a gift for his Platonic muse and great intellectual companion, the poetess Vittoria Colonna, marchioness of Pescara. However, there is great debate whether the related painting has come down to us [7]. In 2010, the media broke the news of a strong candidate for the privately owned "lost original" in Buffalo, New York. In 2023, I had the opportunity to perform an analysis on some good reproductions of

the painting using an artificial intelligence program developed, in part, by me, while an interesting aspect was revealed concerning the body (described later in the text). This particular methodology - named "Luminari" [8] - includes a series of tests performed using Machine Learning engineering, following rigorous academic standards. In essence, it is a system with convolutional neural network architecture, specifically suited to performing predictive tasks in the field of artwork. The engineering includes multiple layers, from correction codes to "Max Pooling". The processed images are then converted into a one-dimensional vector with "softmax" activation.

4. The challenge of small datasets for artworks

One of the great difficulties of Artificial Intelligence (AI) systems that specialize in artwork attribution lies in the fact that, in many cases, they deal with possible artists whose output is very sparse. The reason is obvious: the premise of Machine Learning is that the more examples there are to build a database - or a library - the better. It is on this data that a digital signature will be built for each artist. How then to deal with certain painters (or draftsmen) who have done little, who have been sparsely prolific, and whose output is not compatible with the minimum satisfactory number of 100 works[3] to be analyzed? How will this "algorithmic signature" be formed? To give an idea, Leonardo da Vinci (1452-1519), the author of the two most famous works in history, the *Mona Lisa* and the *Last Supper*, has 15 universally accepted and authenticated works. And, like Leonardo, there are other geniuses at the other end of the spectrum - Michelangelo, with 48 (including 40 in the Sistine Chapel alone), Jan Vermeer (1632-1675) with 34, and Hyeronimus Bosch (1450-1516) with 25, to name a few[4].

One of the faculties of the Luminari method is that it predicts such a situation and is able to readily create the possibility of providing a solution. The formula, a private and exclusive technique, is protected for intellectual property reasons. However, it can be said it was generated by AI itself, from multiple works subcategorized as being of potential authorship by a particular artist, based on intelligent piecemeal analysis (computerized) combined with a critical method at the preparatory stage.

5. The importance of interdisciplinarity: art criticism - expertise - AI

To make this argument clearer, I will give a very current example: Ivan Gaskell, a teacher of Cultural History and Museum Studies at the Bard Graduate Centre, is a well-known expert on the Golden Age of Dutch Painting (Baroque) and, in particular, Vermeer. When dealing with the cataloguing of the artist, one of Gaskell's concerns already starts with the implications and inevitable clashes that would have been generated in the fields of History, Art, Semiotics, Philosophy, and even the Exact Sciences. Vermeer is the case of a painter with a very limited output, as explained above, and Gaskell's main concern in dealing with Vermeer's "authenticity" [9] is to address the relationship between visual material and art from the perspective of three fundamental institutions of Western culture: dealers, auction houses, and collectors; museum and public gallery management (based on bureaucracy); and art historians, academics, publishers, and critics. Note, for example, that the work of art, when in the hands of a dealer, acquires a different meaning, as it includes aspects of attribution from the perspective of *connoisseurship*. In a context of such complexity, it is necessary to analyze what distinguishes the category labeled "art" (itself subdivided into scholarly, decorative and

design) from its counterpart, defined by the term "other".

In this sense, *connoisseurship* is fiercely opposed by historians. "Radical theorists" define it as a limited and inherently right-wing activity that simply supports the art market and encourages the evasion of important issues by focusing on discrete and insignificant minutiae. Even photography - the boom that is taking artistic and philosophical events by storm at the end of the century - will be able to provide a personal reading of the material it produces[5] [10]. Thus, we use three theoretical aspects: authorship, canonicity, and interpretation. Trying to avoid any kind of preconceived notions, we take the example of Rembrandt (1606-1669) [11] and his study to suggest that, in terms of "authorship", *connoisseurship* can be seen as an ally in Art History studies. In fact, it provides information that contributes to the understanding of a particular author, their production and their era. It is advisable to see these phenomena in an anti-historical way, because each era perceives things according to the knowledge and manners of that time and social environment. Thus, one can better appreciate the information the image conveys, even if one feels a little uncertain. The willingness to understand the visual material is therefore entirely subjective and subject to changes in the involved judgments of value. In this regard, we have two "not uncommon" turning points in Art History: the "rebirth" of Botticelli's (1445-1510) name by the Pre-Raphaelites of the Bèlle Époque, and the "death" of Guido Reni`s (1575-1642) name[6].

That is why we must ask how far the legitimacy, competence and scientificity of criticism in general goes when it establishes levels of value - the most discrepant ones - to evaluate and classify an artist or a work of art, using an opinion that serves only at that precise moment. The way out is to avoid labels and the phrase "postmodern". Moreover, Gaskell extols the value of the works of iconoclasm, calling for interdisciplinarity on the issue of "nuances" that might go unnoticed by a historian steeped in traditional academicism: "While I sincerely hope that historians will increasingly turn their attention to visual material, I regret that few to date have shown awareness of the issues necessarily involved or the particular skills needed to cope with such material" [12]. According to the author, it is not even up to Image History to have the last word on visual material. It is on occasions like this that one is reminded of what Demosthenes said about the relativity - and fallibility - that happens in the human conception of things: "Nothing is easier than self-deceit. For what each man wishes he also believes to be true".

It is precisely because of the importance of this interdisciplinarity that it is necessary to cross-check tools in the service of Art History and its attributions: AI for *connoisseurship* and *connoisseurship* for AI. So much so that different AI models often produce different results when analyzing the same artwork[7] [13].

In the face of so many complex issues of a subjective nature, the Luminari method seeks to create a harmony between the necessary eye of the *connoisseur* and the convolutional coolness of algorithms. The method advocates the need for significant intervention by expertise and art criticism during test preparation, as it believes that a purely mathematical treatment - while also of the utmost importance - is not in itself definitive in the search for a result. In the end, the work of AI will present its final verdict in the attribution.

6. Technical report on model performance

To better exemplify this in a prototype test with trained systems, we will use a "confusion matrix" as a reference model, as can be seen in Figure 7. This matrix is a table used by some intelligent systems to evaluate the performance of a binary, but also

multiclass classification model.

For our example, the sum of the values in the horizontal (row) is equal to the number of test images that were taken for the artist in the respective row. For example: in the Modigliani row, we have: 6 + 2 + 1 + 1 = 10 test images of the artist Modigliani.

On the other hand, vertically (column), we have the distribution of model ratings (predictions) for each of the artists examined.

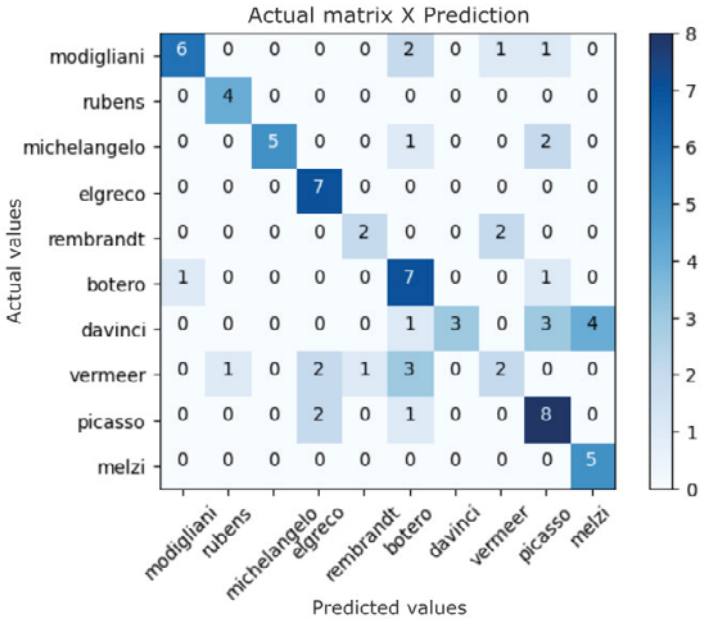

Figure 7. Generic example of a simplified "confusion matrix". (Source: Átila Soares da Costa Filho)

For example, in the Picasso column we have:

- 1 image recorded as Modigliani, but classified as Picasso (error);
- 2 images recorded as Michelangelo, but classified as Picasso (error);
- 1 image recorded as Botero, but classified as Picasso (error);
- 3 images recorded as Da Vinci, but classified as Picasso (error);
- 8 images recorded as Picasso and classified as Picasso (correct).

In other words, our main goal is to obtain as many values on the diagonal of the matrix (correct) as possible. Anything that does not fit on the diagonal is an error in the model. Thus, having correctly interpreted the "confusion matrix", we can conclude that:

- For Modigliani: the model correctly predicted Modigliani 6 times but erred by predicting him as Botero 2 times and as Picasso and Vermeer 1 time.
- For Rubens: the model correctly predicted Rubens for all 4 tested images.
- For Michelangelo: The model correctly predicted Michelangelo 5 times but erred by predicting him as Botero 1 time and as Picasso 2 times.
- For El Greco: the model correctly predicted El Greco 7 times.

- For Rembrandt: the model correctly predicted Rembrandt 2 times but erred by predicting him as Vermeer 2 times.
- For Botero: the model correctly predicted Botero 7 times but wrongly predicted him as Modigliani 1 time and as Picasso 1 time.
- For Leonardo da Vinci: the model correctly predicted Leonardo da Vinci 3 times, but erred by predicting him as Botero 1 time, as Picasso 3 times, and as Melzi 4 times.
- For Vermeer: the model correctly predicted Vermeer 2 times, but erred by predicting him as Rubens 1 time, El Greco 2 times, Rembrandt 1 time and Botero 3 times.
- For Picasso: the model correctly predicted Picasso 8 times but erred by predicting him as El Greco 2 times and as Botero 1 time.
- For Melzi: the model correctly predicted Melzi for all 5 tested images.

We will now examine the results of the model according to the criteria of "false positives" (FP) and "false negatives" (FN) - in this case, since it is a "multiclass" system, the calculations to be performed are different from those of binary classification problems.

- False positives (FP): cases where the model predicted one class, when in fact it was another.
- False negatives (FN): cases in which the model failed to predict a class that was actually present.

Usually, multiclass classification models are evaluated by the metrics of accuracy, precision, recall and score. In our case, the following metrics were used:

1. Accuracy: measures the overall correctness of the model and is calculated as the proportion of correctly predicted instances to the total number of instances. Thus:

   Accuracy = correct classifications / all classifications.

   The accuracy of our model, looking at the "confusion matrix", is the sum of the diagonal values (6 + 4 + 5 + 7 + 2 + 3 + 2 + 8 + 5 = 49) divided by the total number of test images (77). The result is 49/77 = 0.64 or 64% accuracy of the classification model. This accuracy considers the classes collectively, providing an overview of the model's performance over all series.

2. Precision: measures the ratio of correctly predicted positive observations to total positive predictions. It measures how many of the predicted positive images actually turn out to be positive. Precision can be calculated separately for each performer, providing insights into the quality of predictions on an individual basis. Thus:

   Precision artist X = correct classifications of artist X / (correct classifications of artist X + false positives of artist X).

   In this case, the precision of the artist Modigliani, observing the "confusion matrix", is the sum of the values correctly classified as Modigliani (6) divided by the values correctly classified as Modigliani (6), plus the difference between the

sum of the values in the Modigliani (7) column and the correct images of Modigliani (6). The result is 6 / (6 + (7 - 6)) = 6 / (6 + 1) = 6 / 7 = 0.86 or 86% accuracy to classify the artist's images as Modigliani.

3. Recall: measures the proportion of positive observations predicted correctly for all real positives. It measures how many real positive instances were captured by the model. Recall can be calculated separately for each artist, providing insights into the quality of predictions for individual artists. Thus:

   Artist recall X = correct classifications of artist X / (correct classifications of artist X + false negatives of artist X).

   In this case, the recall of the artist Picasso, observing the "confusion matrix", is the sum of the values correctly classified as Picasso (8) divided by the values correctly classified as Picasso (8), plus the difference between the sum of the values in the Picasso row (11) and the correct images of Picasso (8). The result is 8 / (8 + (11 - 8)) = 8 / (8 + 3) = 8 / 11 = 0.73 or 73% recall for classification of the artist's images as Picasso.

In the specific case of this study, a total of 1022 images were used, attributed to 10 well-known artists in art history, including Vermeer, Da Vinci, Picasso, Rembrandt, Botero, Melzi, Modigliani, Rubens, Michelangelo and El Greco. The distribution of images considered for each artist is shown in the figure below: about 100 images for each. It should be noted that the choice (exclusive methodology), not to limit ourselves to perfect homology (the same number of works for each painter) is due to the very existence of greater or lesser stylistic variations between the individual productions of the painters analyzed. Throughout the centuries of art, just as there have been artists who have allowed themselves marked variation in the plastic direction of their creations, there have also been those who little dared to stray from their comfort zone. In some cases, they have not even lived long enough to do so.

This variety of works allows a more comprehensive and detailed analysis for the development of the model for identifying the authorship of paintings.

Out of the total number of images, 868 were used in the training of the machine learning models, while 154 were reserved for evaluating its performance, the total number of images and their subdivision between authors is showed in Figure 8.

This is equivalent to about 15% of the images allocated for testing. Note that, due to the fact that this technology is private in nature, certain graphical information regarding the validation phase had to be preserved. The following is a brief explanation of the machine learning models evaluated here.

- **Random Forest (RF):** RF is an ensemble learning method based on so-called "decision trees". It constructs a multiplicity of "decision trees" during training and then produces the mode classes of "individual trees" to determine an outcome.
- **Support Vector Machine (SVM):** the SVM is a supervised learning model used to analyze image classification. It works by finding the hyperplane that best separates classes in feature space.
- **Convolutional Neural Networks (CNNs) - ResNet:** this is a type of CNN that addresses the problem of missing gradients during training by introducing jump or residual connections. These connections allow the network to learn residual

mappings instead of learning the desired mappings directly. It should be noted that the ResNet model was pre-trained on ImageNet, a huge dataset that itself contains millions of images in thousands of categories.

- **Convolutional Neural Networks (CNNs) - ConvNet:** this CNN is a deep learning model designed specifically to process structured grids of data, such as images. It consists of several layers of convolution and pooling operations, followed by other fully connected layers.

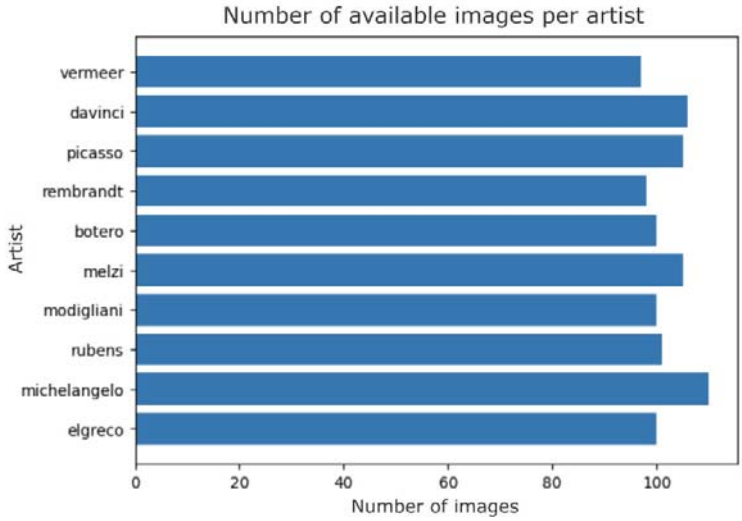

Figure 8. Balance between the number of works selected and the respective artists (Source: Átila Soares da Costa Filho).

SVM and Random Forest models can handle high-dimensional data, which makes them suitable for identifying patterns in paintings that can indicate authorship. ResNet and ConvNet models, on the other hand, are fully capable of training deep neural networks. They excel at learning intricate features and patterns on images, making them suitable for this type of task, where subtle details can be very important. In other words, each of the models presented brings unique strengths to the image classification task.

For this project, we were able to experiment with different configurations of the algorithms, such as the number of levels and the depth of the trees, with the goal of optimizing the performance of the models.

To determine which was best, we considered metrics such as accuracy and recall, as well as analyzing the confusion matrix, which shows where the model is right and where it errs. Importantly, factors such as the time required to train these models, the desired level of interpretability, and available computing resources were not part of the decision to choose models.

The model evaluation process involved 154 test images, ensuring a balanced data set. Figure 9 shows the best results obtained in terms of accuracy, recall, and precision for each of the models. It shows that the best result came from CNN - ResNet50 (RN50), with an accuracy of 75% - indicating that the model is correct in 75% of its global prediction - and an accuracy of 79% - indicating that when it makes a positive prediction, it is correct 79% of the time. Figure 10 shows the confusion matrix of the RN50 model,

which provides a more detailed view of its performance by showing how many images of each artist were correctly or incorrectly classified. Each row represents the true authors of the paintings, while each column represents the authors predicted by the model.

```
Model:    CNN
Accuracy:     0.564935064935065
Precision:     0.5795424272697001
Recall:     0.564935064935065
F1 Score:     0.5583856364992984
Confusion matrix without normalization


Model:    RF
Accuracy:     0.4025974025974026
Precision:     0.422372495830288
Recall:     0.4025974025974026
F1 Score:     0.4004126317991759
Confusion matrix without normalization


Model:    SVM
Acuraccy:     0.4155844155844156
Precision:     0.42699238939840445
Recall:     0.4155844155844156
F1 Score:     0.4024289086769133
Confusion matrix without normalization


Model:    RN50
Accuracy:     0.7532467532467533
Precision:     0.7895572140702011
Recall:     0.7532467532467533
F1 Score:     0.7586213612262089
Confusion matrix without normalization
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Figure 9. Final results for each of the models. (Source: Átila Soares da Costa Filho)

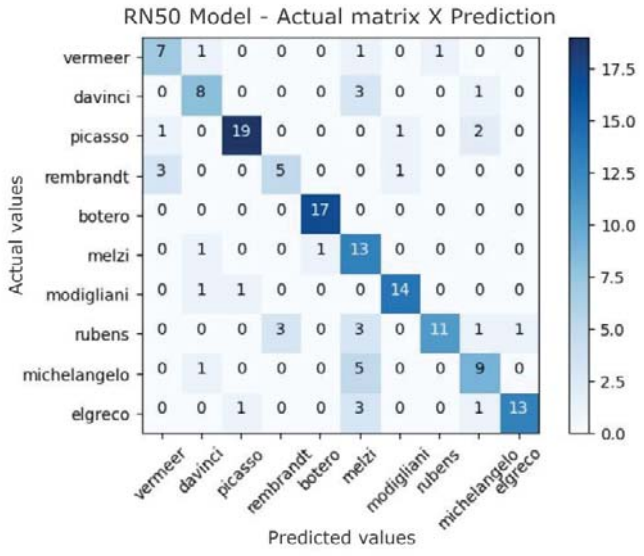

Figure 10. The current "confusion matrix" for measurements in complex architectures. (Source: Átila Soares da Costa Filho)

In the first row of the confusion matrix, out of 10 Vermeer paintings (added

horizontally) used to evaluate the model, 7 were correctly classified as belonging to Vermeer himself. However, one painting was incorrectly attributed to Da Vinci, another to Melzi, and a third to Rubens.

In the second row of the confusion matrix, out of 12 Da Vinci paintings, 8 were correctly classified by the model as belonging to Da Vinci himself. However, three paintings were incorrectly attributed to Melzi and one to Michelangelo.

In the third row of the confusion matrix, out of 23 Picasso paintings, 19 were correctly classified by the model as belonging to Picasso himself. However, one painting was incorrectly attributed to Vermeer, one to Modigliani, and two to Michelangelo.

In the fourth row of the confusion matrix, out of 9 Rembrandt paintings, 5 were correctly classified by the model as belonging to Rembrandt himself. However, three were incorrectly attributed to Vermeer and one to Modigliani.

In the fifth row of the confusion matrix, all 17 paintings made by the artist Botero were correctly attributed to Botero himself.

In the sixth row of the confusion matrix, out of 15 Melzi paintings, 13 were correctly classified by the model as belonging to Melzi himself. However, one painting was incorrectly attributed to Botero and another to Da Vinci.

In the seventh row of the confusion matrix, out of 16 Modigliani paintings, 14 were correctly classified by the model as belonging to Modigliani himself. However, only two paintings were incorrectly attributed: one to Da Vinci and the other to Picasso.

In the eighth row of the confusion matrix, out of 19 Rubens paintings, 11 were correctly classified by the model as belonging to Rubens himself. However, three paintings were incorrectly attributed to Rembrandt, another three to Melzi, one to Michelangelo, and another to El Greco.

In the ninth row of the confusion matrix, out of 15 Michelangelo paintings, 9 were correctly classified by the model as belonging to Michelangelo himself. However, five paintings were incorrectly attributed to Melzi and one to Da Vinci.

In the last line of the confusion matrix, out of 18 El Grego paintings, 13 were correctly classified by the model as belonging to El Greco himself. However, three paintings were incorrectly attributed to Melzi, another to Picasso, and yet another to Michelangelo.

The superior performance of the ResNet model pre-trained with the ImageNet dataset can be attributed to several reasons.

- **Deep architecture:** ResNet is a neural network architecture with a depth of up to 152 layers. Its depth allows it to learn complex representations about the characteristics of paintings.
- **Pre-training on ImageNet:** the ResNet model, as mentioned above, has been pre-trained on a huge dataset (ImageNet) containing millions of images across thousands of categories [14]. This pre-training allows the model to capture general high-level features of paintings - such as shapes, textures, and parts of objects - that are transferable to specific classification tasks with a smaller data set.
- **Transfer learning**: using the pre-trained ResNet model as a base, we can apply transfer learning to adapt it to the specific task of classifying images of paintings. During training, the model can adapt the learned representations to focus on the patterns relevant to identifying the authorship of paintings, taking advantage of ImageNet's prior knowledge.
- **Improved generalization:** by pre-training on a diverse dataset such as ImageNet, the ResNet model tends to generalize better for new datasets. It develops a broader and more robust understanding of common visual features

in a variety of images, allowing it to better handle different artistic styles and variations in paintings.

- **Balanced overfitting:** pre-trained models such as ResNet are less prone to overfitting, especially when the training dataset is relatively small. This happens because pre-trained representations provide more stable initialization and implicit regularization, preventing the model from overfitting the training data. It improves its ability to generalize new examples.

Taking our New York painting again, at first the system established a standard value as a starting point to test ~~of~~ any works by or attributed to Michelangelo or his followers/imitators.

In other words, this number (standard value) refers to the "debugging" of mathematical probabilities according to typical criteria of the School of Michelangelo: it is a common value - across the entire artistic-historical spectrum - that makes a Michelangelo a true Michelangelo (including the mentor himself).

Next, the neural technology presented the values corresponding to the algorithmic identification of the unique peculiarities of the technique and style of each of the artists circumscribed to the selection.

At a further level, it also statistically displayed the least likely candidates (i.e. authors) in descending order - a purely speculative possibility (due to graphical matching points) - and based solely on pure arithmetical logic.

Figure 11. New York's "Pietà" based on Michelangelo's design for Vittoria Colonna. Right: (detail) "anatomical" Christ that led to favorable indices of authenticity via A.I. (Source: Fred R. Conrad/The New York Times).

Thus, by adding up the percentages in the two "debugging" stages, I have curiously verified that in such a painting, based on a drawing of the *Pietà* for Vittoria Colonna (Figure 11), the half-naked body of Christ would be by Michelangelo's hand with a 77% match percentage - since 75% is the minimum established for any authenticity test [15]. And the probable co-author would be Marco Pino (Marco di Giovan Battista), a disciple of Michelangelo, also known as "Marco da Siena" (1521-1583), with a significant 98% match rate on the rest of the work. Apparently, the multifaceted artist would have personally taken care of the "icing on the cake", which is the body of Christ.

7. The orant Christ

Striking is the uncanny similarity between the face of Christ in Michelangelo's drawing, "Christ at Prayer in the Garden of Olives" (which is now in a poor state of preservation in the Uffizi Gallery in Florence), and the later pictorial versions by his followers, such as Marcello Venusti, who, moreover, was a close friend of Michelangelo's. The painting *"Oration in the Garden",* showed in Figure 12, is a clear example of the inspiration that Marcello Venusti got from Michelangelo.

Figure 12. Marcello Venusti's "Oration in the Garden" (1570) (Palazzo Barberini, Rome). Frontal face and closed eyes of Christ in the left of the composition; in the centre Jesus scolds his lax disciples. (Source: Massimo Gaudio)

Enthusiastic about contortionist, dynamic and vibrant imagery, it was quite unusual for Michelangelo to choose to depict a static face in a solemn full-frontal view. I also call attention to how rare it was in Renaissance art to present Christ praying with his eyes closed - as in the Shroud - in the New Testament episode of the agony in Gethsemane. A design, then, consciously inspired by the Shroud face seems to make sense and would explain such a choice. Figures 13 and 14, as in Figure 1, show a clear correspondence (visible also at first glance) between them and the Holy Shroud, as evidenced by the overlapping with a portion of the shroud.

8. The *Last Judgment* as the face of the Holy Shroud

In 2012, a retired FBI special agent, Philip Dayvault, published a startling theory: the entire composition of the *Last Judgment* (Figures 15 and 16) in the Sistine Chapel is actually a representation of the face of the "Man of the Shroud" [16]. Although the idea of the fresco as a face had already been put forward by writer Sue Binkley Tatem,

it was Dayvault who gave an "identity" to the enigmatic face by drawing graphic analogies between some of the marks imprinted in the fabric and details in the *Judgment* - something highly unlikely to be produced by mere coincidence alone. For anyone with a modicum of reason, all the geometry and the body of evidence gathered by Dayvault seems worthy of certain attention.

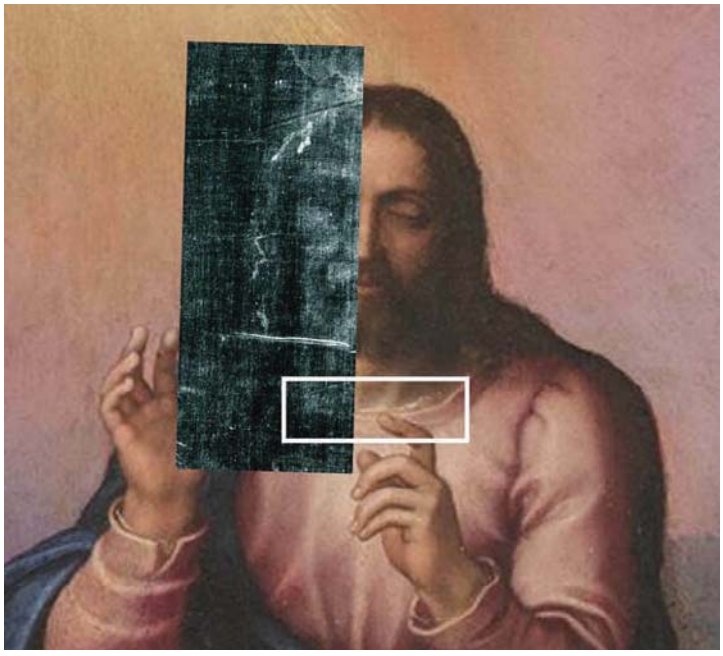

Figure 13. The left half (in relation to Figure 1): Interesting to note how the tip of Christ's left index finger "touches" exactly the cleavage line, as if to say, "look here"- in other words, this is "the limit". (Source: Massimo Gaudio)

Figure 14. The very high correspondence is also confirmed in other versions by Venusti (Source: Albertina).

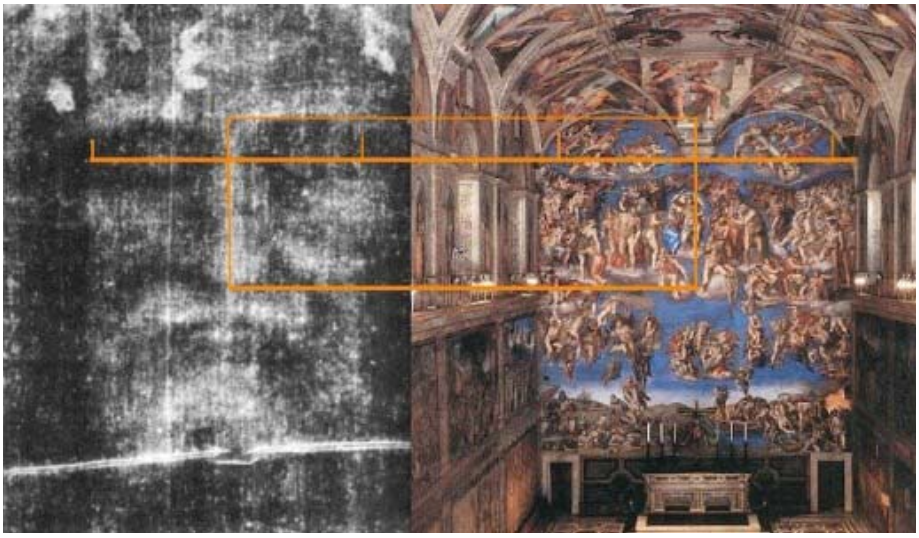

Figure 15. The "Last Judgment" is a face: geometries and other elements unite two large icons of the Resurrection as a "Metamorphosis" (Source: Wikimedia Commons / Jos Verhulst).

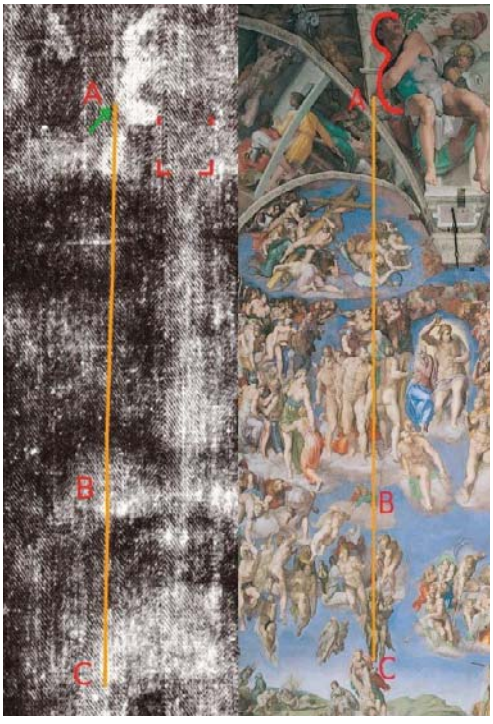

Figure 16. The "Last Judgment" is a face: landmarks in Michelangelo's colossal work anchor the signs of the Passion (Source: Wikimedia Commons / Jos Verhulst).

9. The remarkable "Michelangelesque"

Interestingly, one of Michelangelo's most important followers was the Croatian, Giulio Clovio (1498-1578), whose name will be irreversibly associated with the Shroud for eternity. Indeed, he is responsible for a 1540 painting (Figure 17), preserved in the Galleria Sabauda in Turin) that is the most famous iconographic image of the Shroud, second only to the famous photograph taken by Secondo Pia in 1898, which revealed the image in negative with a wealth of detail worthy of a miracle.

As if that were not enough, probably towards the end of his life, Clovio was also responsible for the creation of a "new Shroud" or a "second generation" Shroud relic, that is: using pictorial techniques, he was able to reproduce the image of the Shroud on another cloth, previously "magnetized" (touched) onto the original relic, so as to obtain two relics - and no longer just one [17]. The whole process, or "ritualization", involving the production of copies, acquired an alchemical dimension - in fact, the real power and ultimate goal of the alchemist was "renewal" - in other words, a "resurrection". Clovio's "second relic" is considered one of the most perfect replicas of the Shroud[8] (today there are 135) [18].

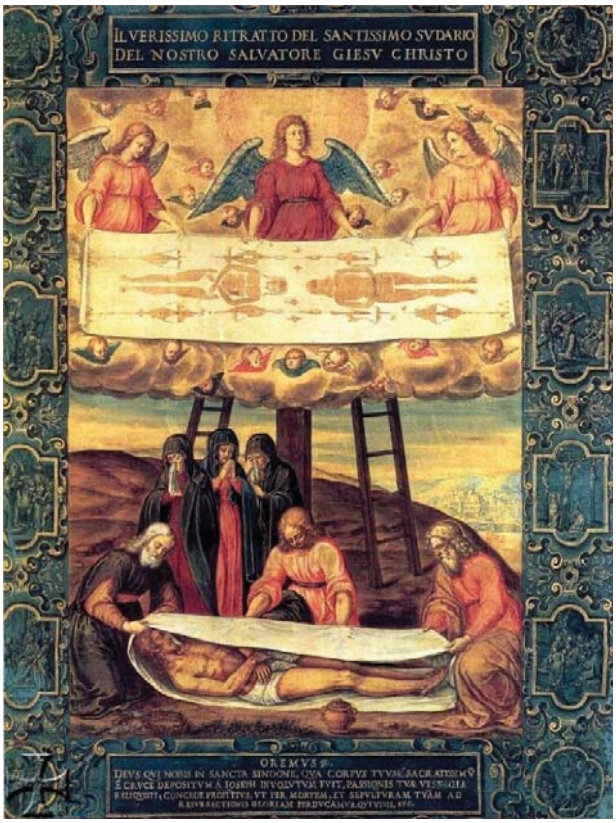

Figure 17. The Holy Shroud, depicted by Giulio Clovio (Galleria Sabauda, Turin). The painting by a follower of Michelangelo has become an icon in the history of shroud devotion (Source: Wikimedia Commons).

10. Concealed elements

The rivalry between the genius of Michelangelo and that of Leonardo is well known by now, but because of this, the criticisms and disagreements between the two have given mankind masterpieces. In order to better understand one of the most revealing elements underlying my argument, I would like to elaborate on an issue concerning Leonardo's work.

We know that one of his most iconic projects, the *Last Supper*, holds a seemingly endless sea of religious and esoteric interpretations. And following this lead, I recently discovered what the true meaning of this mysterious painting might be. Objectively speaking, I was able to identify in the *Last Supper* that the group of Apostles with Jesus form the outline of Christ's dead body, identical to that of the Shroud. In other words, the Supper is, in fact, the Shroud itself. The visual effect is most obvious through the blurring of the whole, with Jesus and the Apostles united, where we can see the figure of a human body lying on the table - exactly like the image of the man imprinted on the Shroud.

The elements on which this new view of the *Last Supper* is based are not lacking: the face of the Shroud had already been identified in this painting, on the left wall, above and between the heads of St. Bartholomew and St. James the Less - perhaps to indicate on which side of the table the head of the "coded" body was located. Another factor is the hypothesis, supported by decades of study, that the tablecloth covering the table on the painting is, in fact, the Holy Shroud.

This is the thesis defended by archaeologist and art critic Yasmin von Hohenstaufen, as well as physician and writer Gabriele Montera. The latter has even presented a precise dimensional correspondence between the cloth of the Shroud and the tablecloth of the Da Vinci masterpiece [19].

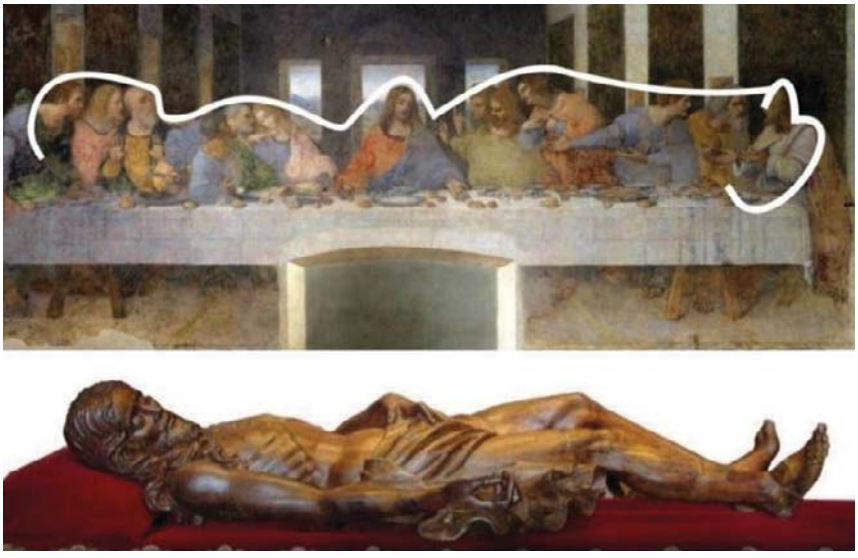

Figure 18. a) Leonardo's "Last Supper" (top) and b) the "Dead Christ" (bottom) from the Museum of Sacred Art in Belém, Pará: a significant correspondence that may suggest Leonardo's greatest secret behind the most esoteric of his works (Source: WikiCommons - Átila Soares / Antônio Sales).

Later, finding it strange that the tablecloth did not have any of the Passion marks, I deduced that these should be somewhere else in the composition. And then I realized that the body could simply be depicted lying on the tablecloth/Shroud. If my assumption is correct, nothing could be more consistent than for the ghostly body of the Messiah to be part of it and discreetly and poetically presented in this way. The image speaks for itself: the conformation of the characters in the Upper Room has a very high level of correspondence with what the body imprinted on the Shroud must have been.

Figure 19. Michelangelo and the technique of concealing elements within a rich set of forms. The Sistine Chapel becomes an "Atlas of Anatomy". (Source: Frontal Magazine - 2015)

While we consider that the artistic-forensic reconstructions of the body imprinted on the relic vary slightly from each other (especially in the feet), the overall appearance indicates an immense resemblance to Leonardo's iconic painting - which strongly suggests that not only was the artist aware of the Shroud, but he had a great interest in it (Figures 18a and 18b).

Bearing in mind that both Leonardo and Michelangelo - precisely because of their competitive spirit - sought to learn about their opponent's designs and works, we can think that the latter, having come across this Shroud theme, used the former's inspiration to conceal elements in his works, in the Sistine Chapel, for example.

Thus, with the same formula, Michelangelo could have distributed, here and there, multiple volumes to insinuate various organs of the human anatomy (Figure 19). An amazing discovery to this effect was made in 1990, at different stages, by four physicians - two American and two Brazilian: neurologist Frank Lynn Meshberger, nephrologist Garabed Eknoyan, cancer surgeon Gilson Barreto and chemist Marcelo Ganzarolli de Oliveira, respectively [20].

If we interconnect all these factors, we come to the logical conclusion that Michelangelo may also have learned about the Shroud through Leonardo's box of surprises.

11. Conclusion

If it is something intentional on the part of Leonardo and Michelangelo, the practice of concealing elements and references in their creations is something already highly regarded in academia, a way of "arousing ingenuity", as Leonardo himself states in the *Treatise on Painting* [21]:

“Non isprezzare questo mio parere, nel quale ti si ricorda che non ti sia grave il fermarti alcuna volta a vedere nelle macchie de' muri, o nella cenere del fuoco, o nuvoli, o fanghi, od altri simili luoghi, ne' quali, se ben saranno da te considerati, tu troverai invenzioni mirabilissime, che destano l'ingegno del pittore a nuove invenzioni sì di componimenti di battaglie, d'animali e d'uomini, come di vari componimenti di paesi e di cose mostruose, come di diavoli e simili cose, perché saranno causa di farti onore; perché nelle cose confuse l'ingegno si desta a nuove invenzioni.”

“Don’t underestimate this idea of mine, in which you are reminded that it is not grievous for you to stop sometimes to see in the stains of the walls, or in the ashes of the fire, or clouds or mud, or other such places, in which, if they are well considered by you thou wilt find most admirable inventions, which arouse the painter's ingenuity to new inventions as much of compositions of battles, of animals and men, as of various compositions of countries and monstrous things, as of devils and such like things, for they will be cause to do thee honor; for in confused things the mind is aroused to new inventions”[9].

Michelangelo, too, could have made use of this as an exercise in perception or reasoning. A potential ploy to make a work richer and more interesting[10]. In the case of the Shroud, it would be a discourse of overcoming death, of alchemy, of resurrection, of the challenging metamorphosis in which passion becomes joy and the end is transformed into rebirth.

The evidence illustrated and analyzed here - with the help of a newly developed Artificial Intelligence model - reveals a new landscape based on the high probability, demonstrated here, that Michelangelo Buonarroti was not only aware of the existence of the Shroud, but was interested in including it in his work. These are traces of authorship and further symbolic indications that gain significance and emerge as silent witnesses to art, which have become a tool for meditation on the mysteries of the invisible wheel of life.

Notes

[1] The replicas bore a seal, which was a sign of legitimacy, as these seals were issued by the church itself.

[2] However, Michelangelo projects the body of Christ from the very body of the Mother, as if the latter is desperately trying to revive him at the moment of his death. A perfect symbiosis between Mother and Son, united - the same flesh. Although it is considered unfinished, the resemblance of Jesus' face to that of the Shroud is evident.

[3] This was possible due to the use of a pre-trained model, which was adjusted specifically for our task through a process known as “fine tuning". This pre-trained model had already been trained with thousands of images from different contexts, which probably influenced the relatively small number of images needed for that specific task.

[4] But there are other painters, such as Pablo Picasso (1881-1973), with 50,000 works, Katsushika Hokusai (1760-1849), with about 30,000, Pieter Paul Rubens (1577-1640), with 10,000, or Pierre-Auguste Renoir (1841-1919), with exactly 4,124 paintings executed.

[5] In fact, behind the lens is a manipulator who enables the picture to be taken. This manipulator - the photographer - captures his version of what he sees in front of him through the lens. He then chooses exactly how to make the scene appear to posterity, exploiting all the mechanical resources of the camera as a painter would when handling the brush and colors at his disposal.

[6] Reni was the leading exponent of the Carraccesque school in Bologna and the

first painter in Rome at the end of the Renaissance.

[7] One recent example was in 2023, when a painting attributed to Raphael Sanzio, the Tondo of the Madonna of Brécy, was authenticated by the University of Bradford in the United Kingdom, which showed a 95% match with the original Sistine Madonna, now housed in the Gemäldegalerie Alte Meister in Dresden. In contrast, Art Recognition, an authentication service using AI, based in Zurich, presents a robust 85% probability in the opposite direction.

[8] Preserved today in the Convent of Santo Domingo in Santiago del Estero, Argentina.

[9] Free translation by the author.

[10] Moreover, at a time when the dissection of human bodies was a very risky business and whose authorization, for scientific purposes, Michelangelo had managed to negotiate with the Church.

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Biographical Notes

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Cf. https://professoratilasoares.weebly.com/

Summary

This study examines the implications of a discrete presence of the Shroud of Turin in the work of Michelangelo Buonarroti (1475-1564). With the use of a new artificial intelligence model, it was possible to construct evidence that points to a probable link between the greatest sacred artist in history and the greatest of sacred relics. One such piece of evidence reveals a striking similarity (and combination of details) between the face of Christ in a painting made to a design by Michelangelo and the face of the Shroud. The painting examined is by one of his illustrious disciples, Marcello Venusti, while the original drawing is the "Christ at Prayer in the Garden of Olives", preserved in the Uffizi in Florence. The very high correspondence is also confirmed by other versions by Venusti.

Riassunto

Questo studio esamina le implicazioni di una discreta presenza della Sindone di Torino nell'opera di Michelangelo Buonarroti (1475-1564) e, con l'utilizzo di un nuovo

modello di intelligenza artificiale, è stato possibile costruire evidenze che indicano un probabile legame tra il più grande artista sacro della storia e la più grande delle reliquie sacre. Una di queste evidenze rivela una sorprendente somiglianza (e combinazione di dettagli) tra il volto di Cristo in un dipinto realizzato su disegno di Michelangelo e il volto della Sindone. Il dipinto preso in esame è di un suo illustre discepolo, Marcello Venusti; mentre il disegno originale è il "Cristo in preghiera nell'Orto degli Ulivi", conservato agli Uffizi di Firenze. L'altissima corrispondenza è confermata anche da altre versioni del Venusti.