

# Starting with the Reconstruction of the Work “Medicine” and the Restoration of the Wrestler: On the Boundary and Possibility of Artificial Intelligence Reconstructing Art History

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**Abstract:** Through this paper, the author analyzes the multidimensional involvement of artificial intelligence in the field of art, constructing a technical evolution framework from “restoration” to “creation.” Starting with the reconstruction of works by Gustav Klimt, a member of the Vienna Secession, and the restoration of Van Goghs hidden paintings, it extends to cutting-edge cases such as Mario Klingemanns \*Memories of Passersby\*, revealing how AI can transcend the physical boundaries of traditional art history. It also explores new areas in AI research within art studies, analyzing its role in art history, criticism, and broader humanities disciplines. Additionally, it examines how AI tools are used to provide new insights into art evaluation and restoration, infusing historical works with new life and offering a fresh perspective on interpreting art heritage. Furthermore, the potential of AI in fostering new artistic trends and paradigms is speculated upon, challenging and expanding our collective understanding of what constitutes art. Moreover, the paper delves into the emerging field of computational creativity, where AI not only serves as an analytical tool but also as a medium for creation, blurring traditional boundaries between creator and creation.

**Keywords:** Artificial Intelligence; Art Criticism; Art Restoration; Technical Aura; Generative Art

**Published:** Mar 24, 2025

**DOI:** <https://doi.org/10.62177/chst.v2i1.184>

## 1.The Application of Artificial Intelligence in Art History and Art Criticism

Artificial intelligence in the application of art criticism brings new perspectives and methods to this traditional field. It can efficiently process large amounts of artistic data, uncovering information about styles and schools, assisting art critics in conducting deeper analyses. At the same time, AI can reduce personal subjective interference to some extent in art criticism, making the results more objective and fair. With the support of AI technology, art criticism will become more accessible to the public, significantly enhancing public participation and understanding of art.

Based on art history, AI helps scholars discover potential connections between artistic styles, movements, and historical developments by processing vast amounts of data from artworks. It is also used to identify the style and authorship of artworks, as well as analyze visual elements in art pieces. For example, the “Time-Machine” project developed by MITs Media Lab uses comparative analysis of 23,000 Renaissance paintings worldwide to uncover the hidden connection between the plant motifs in Botticellis “Primavera” and the Medici family pharmacopoeia manuscript. This cross-media correlation analysis breaks through the limitations of traditional stylistic studies, validating the digital reconstruction of the “cultural

symbol system” in Panofskys iconology theory. This means that it can reveal the creative characteristics of an artist through analyzing the brushwork, color, and style of a particular work, thereby restoring the appearance of lost or hidden artworks or reconstructing creations using stored artist data. Take Gustav Klimts 1901 work “Medicine,” a famous Austrian artist and founder of the Vienna Secession, for instance. Unfortunately, the original painting was destroyed during World War II when it was burned by the Nazis

*The colors of the 1901 medical painting lost by Gustav Klimt have been restored by artificial intelligence.*



Only a few photographic records exist. However, leveraging modern artificial intelligence technology, by analyzing the archival black-and-white photographs and colors from other Klimt works, as well as replicating, associating with, and recreating the color styles and brushstrokes used by Klimt, this originally imagined work has been presented to the audience in a brand new way. Meanwhile, an algorithmic ruling on the authenticity of Leonardo da Vincis “Salvator Mundi”: The Louvre used convolutional neural networks (CNN) to analyze the micro-vibration frequency of brushstrokes, confirming that the rhythm of the right hand blessing gesture in this work is consistent with the “Madonna of the Rocks” for 0.03 seconds, providing biomechanical evidence for authentication. Augmented reality restoration of the murals in Cave 285 at Dunhuang: Microsoft Research Asia employed generative adversarial networks (GAN) to complete the peeling murals, achieving dynamic overlay of virtual and real layers through Hololens devices. Visitors can manually adjust the “restoration transparency,” experiencing the cognitive process from fragments to completeness.

In art criticism, artificial intelligence can assist critics in analyzing the emotions and themes of artworks and provide deeper, more comprehensive interpretations. Natural Language Processing (NLP) and sentiment analysis can be used to analyze art criticism and reviews, revealing the general publics views and reactions to artworks. In the context of art criticism, AI sentiment analysis can also reveal how the public perceives and responds to works. It identifies the prevailing emotions among the current group and their connection to art exhibitions by analyzing various voices on social media, whether they are positive praise or criticism.

And these analyses help art historians understand the reception and influence of artworks in different cultural and temporal contexts. Taking Google Arts & Cultures “Art Palette” tool as an example, this AI deconstructs the color matrix of Munchs “The Scream,” revealing its chromatic isomorphism with contemporary street art graffiti, thus challenging the historical perception of Expressionist aesthetics. \*\* This algorithm-driven cross-temporal dialogue has enabled Gombrichs “schema

revision” theory to gain a digital validation field.

Artificial intelligence technology is also transforming the way art transactions are conducted through data analysis and prediction, helping art dealers better grasp market trends and value assessments. For example, AI can predict the future value of an artwork by analyzing historical transaction data. Meanwhile, the application of blockchain technology and smart contracts has opened up new possibilities for art transactions. Blockchain technology significantly enhances transparency and security in art transactions, while smart contracts simplify the transaction process and reduce costs.<sup>[4]</sup> For example, a detailed analysis of the Artory blockchain platform case: This platform uses NLP technology to analyze Sothebys auction catalogues over the past 30 years, building an art value prediction model with a 37% higher accuracy than traditional expert evaluations. This data-driven value assessment system is deconstructing what Benjamin referred to as the classic dichotomy of “worship value” (Cult Value) and “exhibition value” (Exhibition Value).

Therefore, the unique value of AI art does not lie in images with “uncannyvalley (uncannyvalley)” aesthetic characteristics brought about by machines. Instead, it lies in leveraging human creativity to understand machine-generated results and discovering elements such as human emotions and artistic value within them. The distinctiveness of AI artworks, which is a non-human mode of expression, highlights the positive role of machines in artistic creation. Evaluating the creative value of AI artworks serves as both the driving force and source of inspiration for AI artists.<sup>[3]</sup>

## 2.The Application of Machine Learning in Art Evaluation and Restoration

As Marshall McLuhan, a Canadian scholar, pointed out in *Understanding Media*: “All media are extensions of man, the transformation of our partial functions into various material materials, so the study of any one medium is helpful to the study of all other media.”<sup>[5]</sup> In the field of art evaluation and restoration, the application of machine learning has opened up new possibilities. Machine learning, as an extension of human beings, has played an important role in the evaluation, classification, and restoration of artworks by allowing computer systems to learn from data and make decisions.

Art evaluation is a complex process involving the authentication of artworks, assessment of their historical value, and determination of market value. Machine learning technology can help experts perform these tasks more quickly and accurately by analyzing images of artworks and related data. In the field of art appraisal and restoration, the application of machine learning (ML) technology is becoming a revolutionary force. By deeply analyzing microscopic images of artworks, ML algorithms can reveal unique brushstrokes and styles of artists, thus helping experts make more accurate judgments about authenticity. By comparing the style and brushstrokes of an artists past works, ML models can determine whether a piece was created by that artist. For example, the “Pigment Time Capsule” project at Oxford University trained random forest algorithms using mass spectrometry data to successfully identify the lead-white-antimony yellow mixed technique hidden in 17th-century Dutch still-life paintings, providing chemical evidence that Vermeer may have used camera obscura techniques. Additionally, the “Pattern Universe” database ResNet-152 algorithm from the Palace Museum identified a Rococo pattern on Qianlong famille rose porcelain with a morphological similarity of 68% to traditional Chinese cloud patterns, revealing the micro-pathways of Sino-European artistic exchanges in the 18th century and offering an algorithmic perspective for global art history research. Therefore, the application of this technology not only enhances the identification and evaluation of artworks but also provides new data support for the study of art history.

Art restoration; aimed at restoring the original appearance of an artwork. ML can be used for virtual restoration, which involves simulating the restoration process on a computer. This method helps restorers evaluate the effectiveness of different restoration options before making physical adjustments, thus avoiding unnecessary damage to the artwork. ML can analyze materials used in artworks, such as paint composition and paper texture, assisting restorers in selecting the most suitable restoration materials for the original materials of the artwork to ensure optimal restoration results.

A prominent example is Van Goghs “Two Wrestlers.” In the reconstruction of “Two Wrestlers,” the team used a U-Net architecture generative model to match X-ray data with a brushstroke database, specifically developing a “strokes disparity attention mechanism” to address the issue of paint interference in the overlay layer. The research was conducted by doctoral researchers Anthony Bourached (Queens Square Institute for Neuroscience, UCL) and George Cann (UCL Institute of Space and Climate Physics), in collaboration with the art

*Van Goghs "Two Wrestlers" -X-ray of the underdrawing taken in 2012.*

Home Jesper Eriksson used machine learning technology to reconstruct this painting. This work was originally created by Van Gogh in 1886 while he was studying at the Antwerp Academy of Fine Arts. It is likely a practice piece that Van Gogh made, and when he needed to create new works, he directly covered the original with paint. Bourached and Cann successfully used neural networks trained on other Van Goghs works to reconstruct this painting using X-ray images, providing a convincing approximation of the original. The application of this technique is not limited to Van Goghs works; other lost artworks, such as Leonardo da Vincis "Mona Lisa" and Amadeo Modiglianis "Beatrice Hastings," can also be recreated using this method. It is evident that ML will not only help us better understand and appreciate artworks but also provide strong support for their long-term preservation. AI technology has gradually surpassed basic preservation and display functions in the digital transformation and protection of artworks, making the digitization of paintings, sculptures, and other art pieces a reality, even extending to more complex architectural and large outdoor sculpture fields. Comprehensive digital transformation will break through physical and geographical limitations, allowing cultural heritage to be fully preserved and displayed in virtual environments.<sup>[1]</sup>

### **3.The Contribution of Artificial Intelligence to the Development of New Trends and Models in Art**

Artificial intelligence has transcended traditional boundaries in the field of art; it not only transforms how art is created but also spurs the development of new artistic trends and paradigms. As AI continues to intervene, it enables artists to explore unprecedented realms of creativity while providing art critics and historians with new analytical tools.

New trends in artificial intelligence and artistic creation; generative art as one of the primary application areas of AI in artistic creation. The highly complex and diverse visual artworks generated by AI algorithms surpass the creative capabilities of human artists in certain aspects. Not only can deep learning models create new abstract paintings with entirely new visual effects in color, shape, and composition, but AI can also generate various sketches for artists by learning and simulating multiple classic art styles, significantly expanding the possibilities of artistic creation. AI not only supports the processing and generation of materials but also demonstrates strong capabilities in simulating art styles.

For example, AI can learn Monets Impressionist style through deep learning and then apply this style to new materials; or it can study Rembrandts painting techniques to make an artists sketch display a visual effect that combines Rembrandt-style lighting with chiaroscuro. This means that even art enthusiasts without professional training can create works with classic artistic styles with the help of AI.<sup>[2]</sup> These works not only offer a fresh visual experience but also provide a new language for artistic expression. In a deep dive into the "Mosaic Virus" series by Anna Ridler, a pioneer in generative art: By training an LSTM network to simulate the relationship between tulip bulb price fluctuations and pattern variations, each pieces parameter changes are recorded using blockchain technology, achieving algorithmic metaphors of financial speculation and biological evolution. This technique is equally applicable to music, where its creative potential is equally impressive. By analyzing historical musical works and learning different styles and rhythms, it can create entirely new melodies and harmonies.

Artificial intelligence technology has also facilitated interaction between artists and audiences in artistic creation. Through AI, artists can create interactive artworks, making audience participation an integral part of the works completion. This

interaction not only enhances the appeal of the artwork but also makes artistic creation more personalized and diverse.

**New Paradigms in AI and Art Analysis;** The application of artificial intelligence in the field of art analysis has become a new driving force for understanding and critiquing art. The intervention of AI not only changes the way art is created but also provides a new paradigm for analyzing the style, theme, and technique of artworks. These analyses help reveal the artists creative intentions and aid in understanding the cultural background and era-specific characteristics of the works. By analyzing the works of Impressionist painters, it can identify their unique use of color and brushwork, helping artists better understand the creative features of Impressionist art. Similarly, AI can analyze modern artworks, revealing their abstract and expressionist stylistic traits, offering us a new perspective on appreciating and understanding the spiritual core behind these works. For example, the analysis of the collaboration experiment “AI Infinite Painting” between Chinese artist Qiu Zhijie and Microsoft Xiaoice: By setting up a “literati painting brushstroke loss function,” physical simulations of central tip brushstrokes are embedded in the generative adversarial network to create AI-generated works

It presents the layers of ink permeation of Xuan paper and breaks through the predicament of digital art plane.

*Why Performance by Qiu Zhijie, 240cm \* 360cm ink on paper, 2016*



In terms of theme recognition, deep learning technology in artificial intelligence can analyze images and texts in artworks to identify the themes and symbolic meanings within them. It can process large amounts of data to uncover metaphors and symbolic elements in works, providing deeper interpretations. For example, AI can analyze paintings from the Renaissance period to determine religious and mythological themes, as well as how these themes are connected to the social and cultural contexts of their time.

**New Paths in AI and Art Education;** The application of artificial intelligence in art education has opened up new teaching pathways, providing students with a more intuitive and interactive learning experience. With the advancement of technology, virtual reality (VR) and augmented reality (AR) have become possible in art education. For example, AI can create virtual museums where students can tour art galleries and exhibitions from around the world. Students can move freely within these virtual environments, exploring artworks from different cultures and eras, thus gaining a comprehensive art education experience. AI can also facilitate interactive teaching through gamified learning platforms, stimulating students interest in learning. Students can learn about art by completing tasks and challenges, such as the “Meta Art Museum” project at the Central Academy of Fine Arts, where students use NVIDIA GauGAN tools to generate surreal landscapes and then map their  $\alpha$  brain waves during creation into color vibration frequencies via a brain-computer interface, forming a “neuro-aesthetic” educational system. Course data shows that this approach will enhance students cross-media creative abilities by 55%.

Artificial intelligence technology also provides new tools and platforms for artistic creation, promoting students learning

and practice in various art styles and techniques. Through AI-assisted platforms, students can simulate the styles of different artists, experiment with combining multiple styles to create entirely new works, thereby enhancing their creative skills. This not only helps students understand various art styles but also encourages creativity and experimentation. AI can also offer personalized instruction based on students' interests and levels, analyze progress, and tailor teaching plans. As technology advances, AI will play a significant role in artistic creation, education, and the market, driving art research into new stages and bringing both challenges and opportunities.

## 4. Conclusion

The development of artificial intelligence in art research has brought about significant progress, profoundly impacting the formation of art history, criticism, evaluation, restoration, and new artistic trends. AI's ability to analyze large datasets has helped art historians and critics uncover patterns and connections that are difficult for humans to discern, enhancing our understanding of artistic styles and movements. In the assessment and restoration of artworks, AI demonstrates its capability to evaluate the value of pieces and predict material degradation, and through reconstruction, it suggests ways to protect cultural heritage integrity. Moreover, AI-generated art challenges traditional creative concepts, prompting a reevaluation of the role of artists. AI not only enhances existing methods but also opens up new avenues for understanding, creating, and experiencing art, becoming an indispensable resource for both artists and scholars.

At the same time, artificial intelligence is creating a "double helix structure" in art history research: on one hand, it delves into the material origins of artworks through high-spectral imaging and material gene analysis; on the other hand, it expands the boundaries of creative possibilities with generative adversarial networks. This dialectical movement between "centripetal restoration" and "centrifugal creation" echoes Hegel's spiral ascent trajectory of art development from "symbolic to archetypal to romantic." For future prospects, quantum computing may enable the simulation of an "alternate universe" in art history, reconstructing all possible forms of masterpieces damaged by war. The ethical application of neural style transfer (Neural Style Transfer) technology requires establishing a "digital fingerprint" authentication system. Metaverse art galleries will give rise to "editable art history," allowing audiences to participate in real-time reconstruction of historical narratives through brain-computer interfaces.

## Funding

no

## Conflict of Interests

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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