

AI study shows Raphael painting was not entirely the master's work

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Madonna of the Rose, Raphael (Raffaello Sanzio). Credit: Museo Nacional del Prado

A famous Raphael painting features a face that was NOT created by the Renaissance master, according to new artificial intelligence analysis.

Experts from the Universities of Nottingham, Bradford and Stanford have used intelligence-based deep feature analysis on the Madonna della Rosa (Madonna of the Rose), and they have discovered that while most of the painting is indeed by Raphael, the face of Joseph is most likely not by the same hand.

The della Rosa, which hangs in the Museo del Prado, Madrid, Spain, has intrigued art experts, with some—including Raphael scholar Professor Jurg Meyer zur Capellen—suggesting that Raphael's pupil Giulio Romano may have contributed. One theory is that the rose and the lower portion may have been painted by someone else. However, new analysis reveals the lower part of the painting is "most likely" by Raphael.

Professor Hassan Ugail, Director of the Centre for Visual Computing and Intelligent Systems at the University of Bradford, devised the algorithm that recognizes authentic works by Raphael, with 98% accuracy.

Professor Ugail explains, "When you present an image to the [computer](#), it will give a binary classification of whether it's an authentic Raphael or not, with 98% accuracy. Now we can say with great confidence whether a painting is an authentic Raphael or not.

"When we tested the della Rosa as a whole, the results were not conclusive. So, then we tested the individual parts and while the rest of the picture was confirmed as Raphael, Joseph's face came up as most likely not Raphael."

"This analysis of art works by the artist Raphael presents an objective and quantifiable approach, using machine learning, to the classification of painted imagery. It promises to be a useful, additional tool in future investigations of this nature, alongside well-established methods such as spectroscopy. It is adaptable in that works by other artists may be

examined using the same technique, and this is the goal of future research," said Dr. Christopher Brooke, Honorary Research Fellow at the University of Nottingham.

A paper on the work, titled "Deep Transfer Learning for Visual Analysis and Attribution of Paintings by Raphael," co-authored by Professor Ugail, Professor Brooke, Professor Howell Edwards (Emeritus Professor of Molecular Spectroscopy, University of Bradford), and Stanford University Adjunct Professor David G. Stork, has been [published](#) in the *Heritage Science* journal.

Explaining more about the history of the Madonna della Rosa, Howell Edwards, Emeritus Professor of Molecular Spectroscopy at the University of Bradford, says, "Painted on canvas around 1517/18, the Madonna della Rosa was regarded by early connoisseurs as a Raphael autograph, i.e., he painted 100% of it. From the mid-1800s, the art historian Johann David Passavant and others questioned its composition and preferred to attribute its execution partially to Raphael and partially to his workshop.

"The attribution to Raphael's workshop was gradually accepted later and attributed particularly to his pupil Giulio Romano and possibly also to Gianfrancesco Penni. In Spain the original attribution has never been questioned.

"Some connoisseurs regard the quality of the composition and painting for the Madonna, Child and St. John as far exceeding that of St. Joseph, whom they feel has been added at the workshop as somewhat of an afterthought.

"The AI program analysis of our work has demonstrated conclusively that whereas the three figures of the Madonna, Christ Child and St. John the Baptist are unequivocally painted by Raphael, that of St. Joseph is

not and has been painted by someone else—possibly by Romano, as believed by zur Capellen and others."

The research team has [previously used](#) artificial intelligence-assisted computer-based facial recognition on a mystery painting known as the de Brécy Tondo, which bears a resemblance to Raphael's Sistine Madonna. The computer determined it was a work by Raphael, building on previous pigment analysis by Professor Howell Edwards, also at the University of Bradford, which placed it firmly in the Renaissance era.

"Using deep feature analysis, we used pictures of authenticated Raphael paintings to train the computer to recognize his style to a very detailed degree, from the brushstrokes, the color palette, the shading and every aspect of the work. The computer sees far more deeply than the human eye, to [microscopic level](#)," said Professor Hassan Ugail, Director of the Centre for Visual Computing and Intelligent Systems at the University of Bradford

Professor Ugail continues, "This is not a case of AI taking people's jobs. The process of authenticating a work of art involves looking at many aspects, from its provenance, pigments, condition of the work and so on. However, this sort of software can be used as one tool to assist in the process."

Stanford University Adjunct Professor David G. Stork, a pioneer in the application of computer vision to problems in the history and interpretation of fine art paintings and drawings, also contributed to the recent research. He agrees with Professor Ugail that this type of analysis is one tool in the process of authenticating a piece of art, to be used in conjunction with traditional methods.

Dr. Stork, author of *Pixels & paintings: Foundations of computer-assisted connoisseurship*, said, "Computer methods are slowly but surely

proving they can aid traditional humanistic studies of art, but they must always be employed with a deep understanding of art [historical context](#), and their results understood and interpreted in the broader context of art knowledge relevant to the problem at hand.

"Art attribution and authentication are some of the most vexing and challenging tasks faced by art scholars who must study provenance (the documentary record of ownership, sales, and exhibitions of a work), material studies (chemistry of pigments, canvas, paper, varnish), the condition of the work (is it degraded over time or retouched), iconography (are the people and objects depicted appropriate), and finally connoisseurship (close visual study of brush strokes, color, composition, and more).

"Most computer studies in art—including the current study—have focused on enhancing connoisseurship. The current study's results should not be taken as sufficient for an authentication decision, but a step toward improving overall authentication protocols. Some of the most successful computer studies of art have exploited large databases of art images to learn an artist's style and other properties.

"As such, databases grow, computer algorithms are refined, and most importantly, as humanistic art scholars criticize and refine computer methods, computer methods will improve and become widely used throughout art history and criticism."

More information: Hassan Ugail et al, Deep transfer learning for visual analysis and attribution of paintings by Raphael, *Heritage Science* (2023). [DOI: 10.1186/s40494-023-01094-0](https://doi.org/10.1186/s40494-023-01094-0)

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