CAN ARTIFICIAL INTELLIGENCE CREATE GREAT ART?

Autonomous programs have started to produce paintings that match human talent. So should artists hang up their paintbrushes for good?

WORDS: DINSA SACHAN

At this year's Sonar+D, a glittering arts-tech event in Barcelona, enthusiasts lined up to get a glimpse of the Spanish artist Albert Barqué-Duran's creative process as he fervently painted a mural. It was a typical sight at the arts event, but the painting was no ordinary artwork.

Next to the mural, a computer screen showed a nude, voluptuous woman, her face slightly blurred out. The painting had been conjured up by an artificial intelligence-powered program. Barqué-Duran was essentially transferring the program's 'imagination' onto a wall.

So, artificial intelligence (AI) has entered the world of art, but people are curious to know: can AI create artistic masterpieces? Can an AI be the next Vincent van Gogh or Rembrandt?

The field of AI art seems to have emerged out of nowhere, but it has actually been years in the 2

"The program even reflected on its output, by providing commentary on the portrait"

2 making. "Artworks created with help from machine learning and artificial intelligence fall under the broader category of new media art, a genre that has been active for several decades," says Ali Momeni, associate professor of art at Carnegie Mellon University, Pennsylvania. The first AI artist was AARON, which was created by British-born artist Harold Cohen. It produced paintings in many styles, from the 1970s until Cohen's death in 2016.

But the last few years have seen an explosion of projects. Momeni says that free software resources such as Google's TensorFlow and hardware advances of the gaming industry have played a key role in propelling the field of AI art. TensorFlow is a free software library that developers can use to create artificial intelligence programs. Graphic processing units (present on graphic cards) are crucial for many computer games. But thanks to their fast processing speeds they also come in handy for making digital art.

Add to that winning mix, the ready availability of datasets. "Software tools rely on an enormous body of pre-analysed data – such as ImageNet for images – based on which new things could be classified or generated, and these datasets were simply not available a decade ago," Momeni explains.

THE RISE OF AI ARTISTS

The program that created the nude at Sonar+D was trained by German artist Mario Klingemann. At the heart of Klingemann's work are artificial intelligence algorithms called Generative Adversarial Networks, or GANs. A GAN is basically a type of neural network, and a neural network is an algorithm that mimics how the brain works. Klingemann uses a combination of several different neural networks to achieve intricately detailed paintings. First, he has to prepare a training set that consists of thousands of example images showing humans in a variety of poses off the internet. Next, he uses a neural network that is able to extract stick figures from these images. Then a second neural network – the GAN – is trained using this dataset. The GAN is run through sets of stick figures and the original photo from which they

BELOW: This chair image, named *Uneasy*, is one of The Painting Fool's earlier pieces

were derived. After processing thousands of such pairs it learns how stick figures can be translated to humans in various poses. The GAN makes a lot of mistakes because it is difficult for it to master the human form. "But for me that is exactly the interesting aspect of working with these neural networks since it leaves a lot of space for uncertainty and surprise," says Klingemann.

For artists like Klingemann, AI is about experimenting with art and learning about machine creativity. "Right now, we mostly see visual examples where the networks learn to transform one image into another, but the same principle could be applied to audio, text or any other kind of data." Klingemann says that businesses will start to use AI art when it becomes cheap to produce. For example, retailers could use AI to generate original designs for wall art in shops or restaurants, then mass produce them on canvas.

And then there is The Painting Fool: a highly complex program from Prof Simon Colton, a computer scientist at Goldsmiths College, London. Colton likes to consider The Painting Fool an 'aspiring' AI artist. Different AI techniques, including machine learning and natural language processing, have been used to give The Painting Fool the ability to create original art. Machine learning technology uses algorithms – basic sets of rules to solve problems – that can learn to get better on their own. In the world of art, that generally means creating machines that don't need to be programmed in a detailed manner every time you want them to produce an artwork. Natural language processing, on the other hand, is a type of AI technique that allows computers to understand human language and apply them to their tasks – something that normal computers are unable to do.

The Painting Fool's art has been exhibited in museums and galleries across the world. At an exhibition in Paris in 2013, the program enthralled the audience by creating their portraits. To stimulate the program's mood, the researchers provided it with a newspaper. "If it read 10 articles of a very happy nature – somebody won a football cup, somebody gave birth to triplets – then it would be in a good mood," says Colton. Based on its mood, the program chose adjectives. For example: happy. If it was happy, it 2
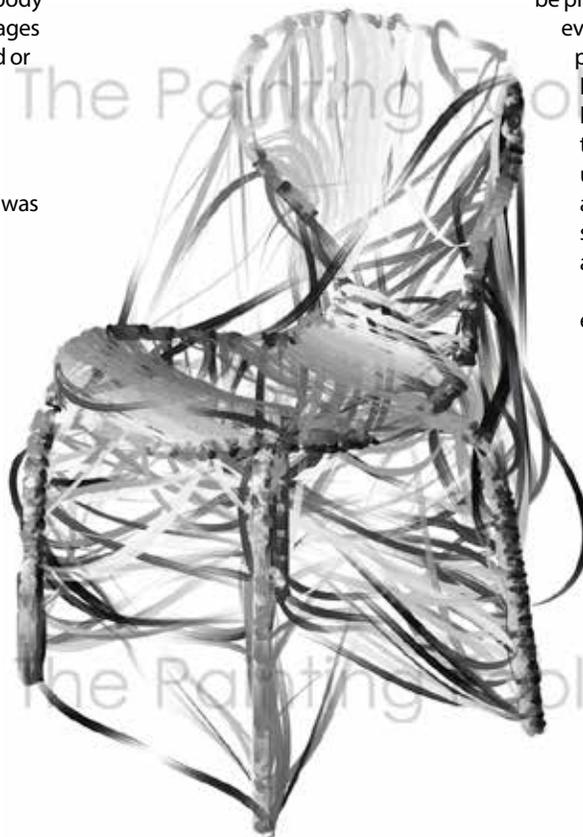
British artist Harold Cohen created a painting machine controlled by his AI program AARON

My Artificial Muse is programmed with stick figures, which it uses to create nudes. At this year's Sonar+D exhibition, artist Albert Barqué-Duran recreated one of My Artificial Muse's designs as a mural (pictured)

2 requested the subject to smile. If it was sad, it asked the subjects to simply go away. The program even reflected on its output, by explaining why it was happy or unhappy with the finished result.

Some of The Painting Fool's ability has been borrowed from Digital Artist Communicating Intent (DARCI), the brainchild of Prof Dan Ventura at Brigham Young University in Utah. DARCI has been trained to perceive pictures just as humans do. "It looks at these pictures and tries to make sense of these shapes and forms and makes something of its own," says Ventura. Ventura's team ran the program through thousands of images that humans had tagged with adjectives. This means that DARCI can look at a picture and ascertain whether the picture is happy, sad or scary.

IS AI THE FUTURE OF ART?

The Painting Fool and DARCI seem to demonstrate a level of independence, and that's why their creators call them artists. But it does beg the question: do we really need them? Colton argues that a product like The Painting Fool helps the arts. It has made more than a thousand portraits, and some of its subjects later hired professional artists to do their portraits. "It helps people realise the value of creativity in their lives," says Colton. "It democratises the arts by making available to non-rich people the kind of things rich people take for granted."

While AI might be threatening jobs in transport and information technology, it's only natural for artists to be concerned about this wave of art-generating programs. "We're not talking about making art that will rival what humans do. It's mostly about machine learning right now," says Marian Mazzone, professor of modern and contemporary art at the College of Charleston, South Carolina. Mazzone was part of a team that recently developed a special type of GAN that can crank out painting-like images in novel styles. Mazzone says that this GAN is comparable to human creativity. "The system is exposed to a number of other artists' works, and then develops its own works based on that knowledge," she says. "Decisions are made, elements are chosen, new combinations are tried. Human artists also learn from other artists and develop their own style over time."

Right now, a computer is unlikely to create a masterpiece like Pablo Picasso's *Guernica* or Leonardo da Vinci's *Mona Lisa*. Klingemann says the current quality of AI art is comparable to the blurry and unrealistic images of photography's early days. "But in 5 to 10 years, AI will definitely mimic what humans consider great art," he 2

RIGHT: The Next Rembrandt project involved scanning paintings by Rembrandt, to create a completely original piece of Rembrandt-like art using AI techniques and 3D printing

"We're not talking about making art that will rival what humans do"

PHOTO: GETTY X2

A HISTORY OF AI ART

1970s
AARON

This computer, invented by professor and artist Harold Cohen, created paintings autonomously, starting in the early 1970s until Cohen's death last year.


2006
The Painting Fool

The brainchild of British computer scientist Simon Colton, this complex tool is capable of setting its mood and generating paintings based on how it feels. It can also reflect on the quality of its work and learn from its mistakes.


2010
DARCI

Developed by Dan Ventura, a computer scientist at Brigham Young University in Utah, DARCI can make sense of things like colour and texture in pictures and use them as inspiration for its own original painting-like images.
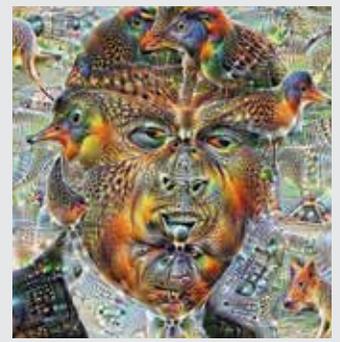

2015
Deep Dream Generator

Google's free program can take simple, everyday pictures and transform them into quirky, psychedelic ones. The tool inspired an entire generation of artists to experiment with AI art.
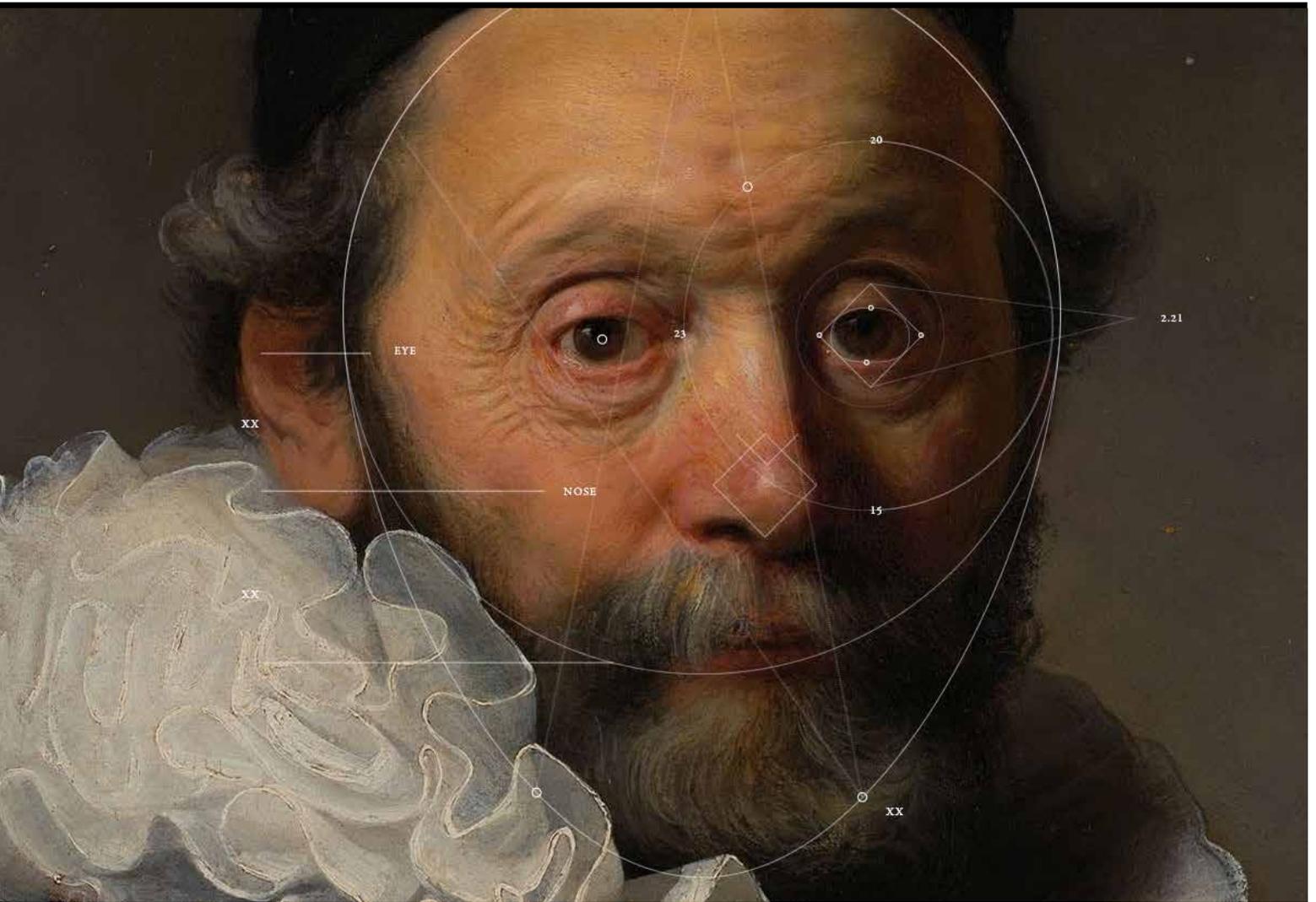
2016
The Next Rembrandt

Researchers at advertising agency J Walter Thompson Amsterdam taught a computer to paint like Rembrandt using advanced AI techniques. The computer produced an original piece of art in Rembrandt's style.
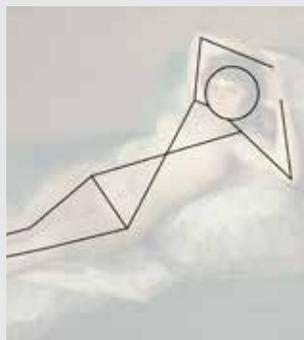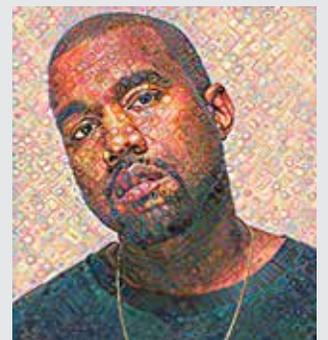

2017
My Artificial Muse

German artist Mario Klingemann used an AI program to convert stick figures into paintings with human forms. Spanish artist Albert Barqué-Duran transferred the painting onto a mural.

2017
Creative Adversarial Networks

Researchers from Rutgers University reported an AI trained in different styles of art. It can create paintings in its own novel styles by deviating from conventional styles.

2017
Artificial Intelligence:
The End Of Art As We Know It

Artist Matty Mo joined forces with hackers to design an AI to create portraits of people who could lose their jobs to AI.

WHAT IS MACHINE LEARNING?

Machine learning is a branch of artificial intelligence that borrows heavily from other fields such as statistics, mathematics, physics and theoretical computer science. Machine-learning algorithms enable computers to perform tasks without human intervention. With this technique, machines can be taught to make their own programs. Every time you ask your virtual assistant Alexa or Siri to perform a specific task, that's machine learning in action.

More complex uses of machine learning include image classification. For example, Adobe has developed a feature called Smart Tags for its program Experience Manager. It can add tags to images automatically. For example, to an image of the Washington Memorial, it would slap tags such as 'architecture', 'memorial', and 'Washington Memorial'. If someone searched for architecture images on their system, the Washington Memorial photo would show up. AI art tools developed by Mario Klingemann, Dan Ventura and Simon Colton all make use of machine learning.

2 predicts. Yet even with improving technology, it might not be possible to get a truly creative AI. "That would mean that it is able to develop its own personality, taste and motivations autonomously," explains Klingemann. "Compelling storytelling – or even story understanding – is still an unsolved problem in AI and in my opinion it is one of the most important components from which you can then create everything else."

Humans use their life experiences to influence their art – something programs can't do. "If you think about Vincent van Gogh, his whole life story, his mental illness, struggle, all of it added up to making his work more of a masterpiece than what it would have been without all of that backstory," says Colton. "If a program painted those pictures, they would probably be immaterial."

So if there ever is a truly creative AI, would the art world accept its creations? "I'm not holding my breath," says Momeni. "In fact, I wouldn't be surprised if the art market had the absolute opposite response and retreated further into conservatism." ⊕

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BELOW: Deep Dream can interpret a painting style and transfer it onto an uploaded image