CS50 for JDs, Winter 2023

The Painters Who Passed the Turing Test

History and Impact of AI Art

By Michael Hu

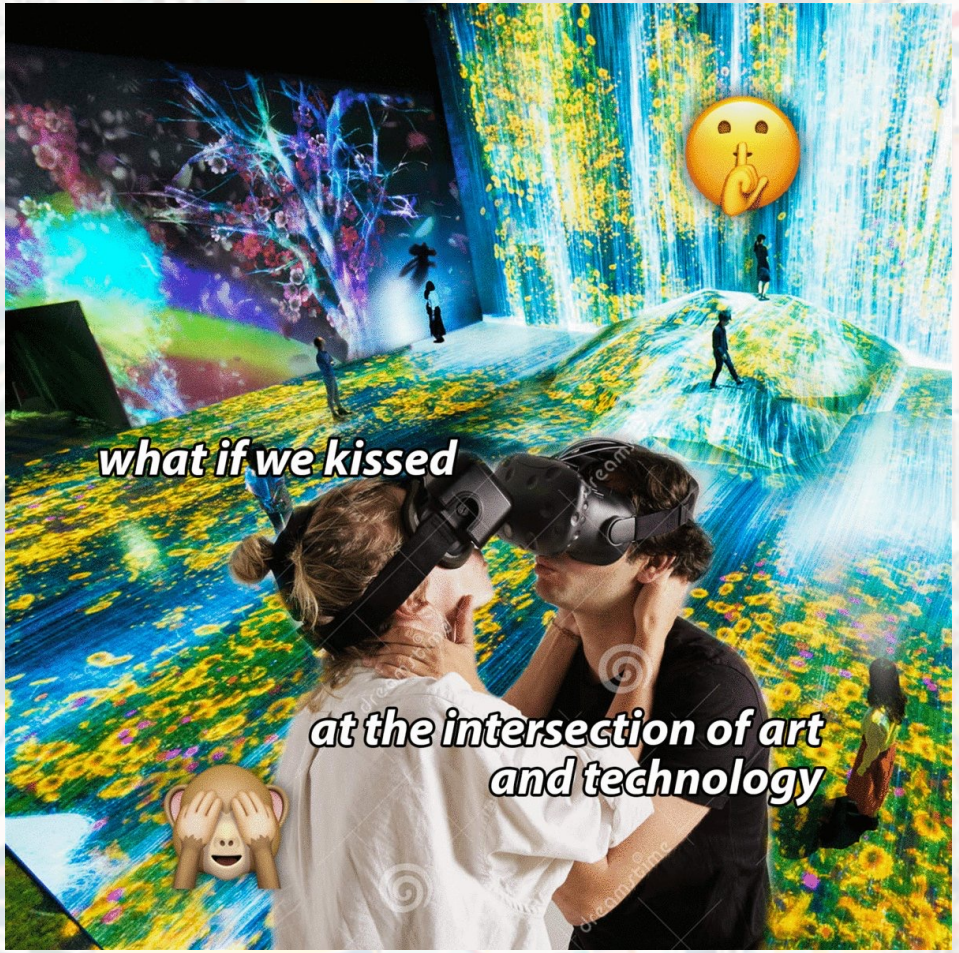
About Me

Hey! I’m Michael, a sophomore at Harvard College living in Currier House.

I’m studying computer science with an interest in computer graphics, AI, VR/AR, and video game development. I also like to talk art and make art, hence this seminar!

Outline

- Historical Context
- Technical Overview
- Ethical Considerations
- Current Developments

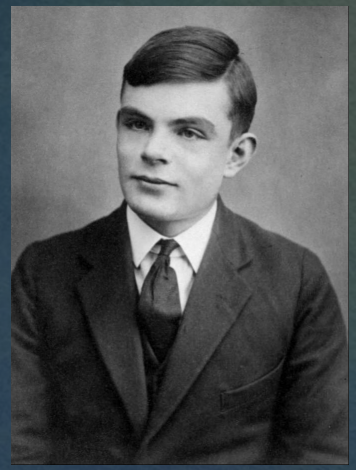


How’d They Get Here?

A brief timeline of how abstract pattern-making algorithms became the powerful text-to-image AI art generators we know today.

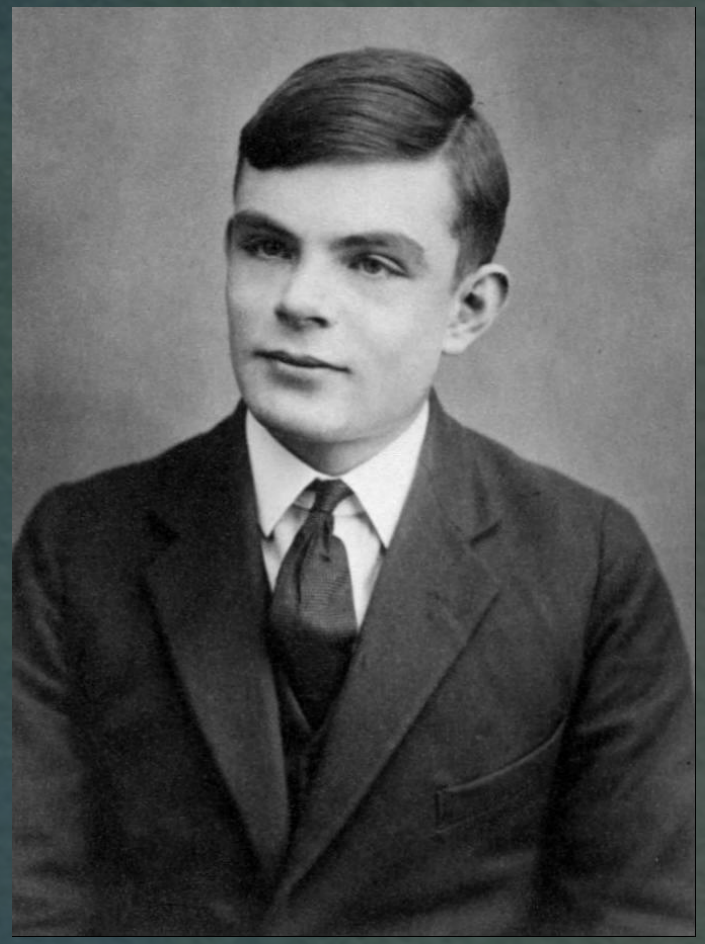
1940s

Alan Turing pioneered the concept of a "universal machine" which can simulate any other machine.



1960s

In 1951, Turing published a paper called "The Chemical Basis of Morphogenesis," in which he suggests that it's possible to simulate natural processes using computers.



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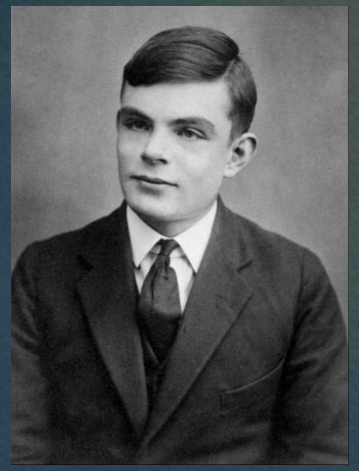


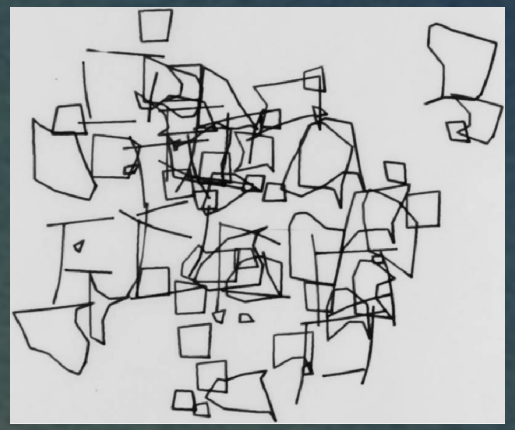
Pioneers such as John Whitney and Vera Molnar generate simple geometric shapes and patterns using early computers.

1960s

John Whitney operating one of the first computer-graphics engines, a mechanical analog computer.

Whitney's "Catalog" (1961) was considered one of the first examples of computer-generated art.

Vera Molnar is widely considered to be a pioneer of computer art and generative art and one of the first women to use computers in her art practice.



Molnar’s ”Tribute to Barbaud” (1974)

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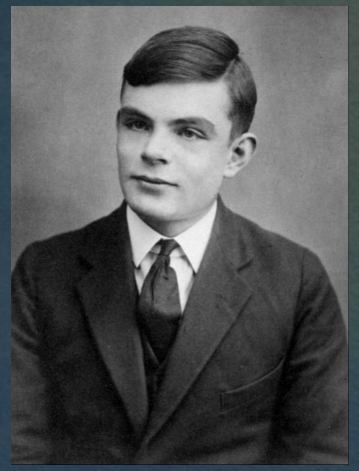

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1960s

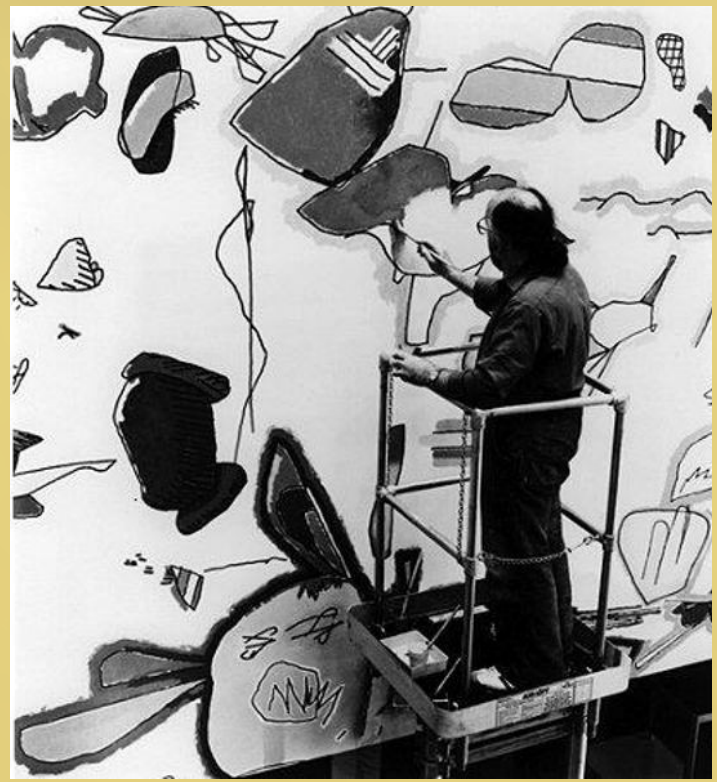
1970s

The term "algorithmic art" was coined to describe art created using mathematical algorithms and computer programs. AI-generated art began to be used more extensively in computer-aided design (CAD).

1980s

Developed by artist Harold Cohen, the AARON program was a computer program that could generate drawings of people and animals. It was considered one of the first examples of AI-generated art that was lifelike and organic.

Cohen coloring the forms produced by the AARON drawing “Turtle” in 1981.



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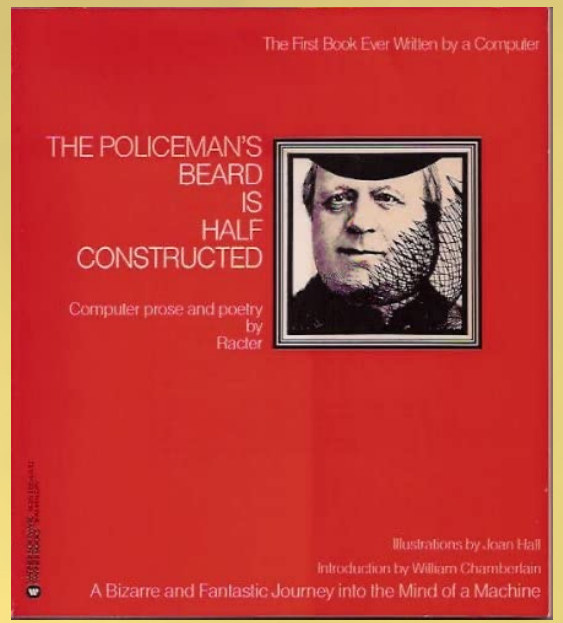
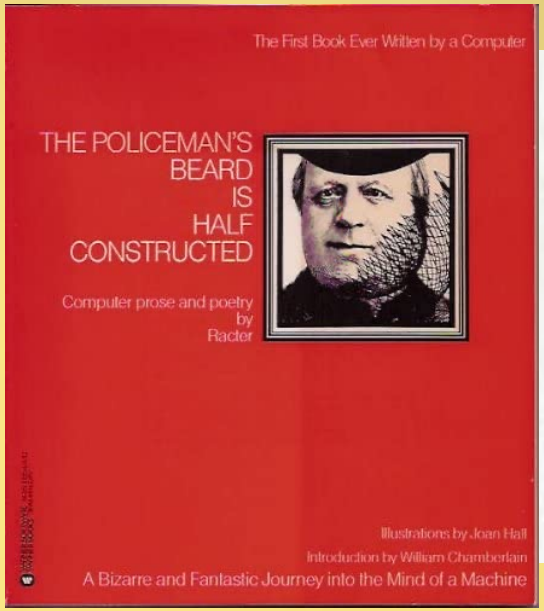


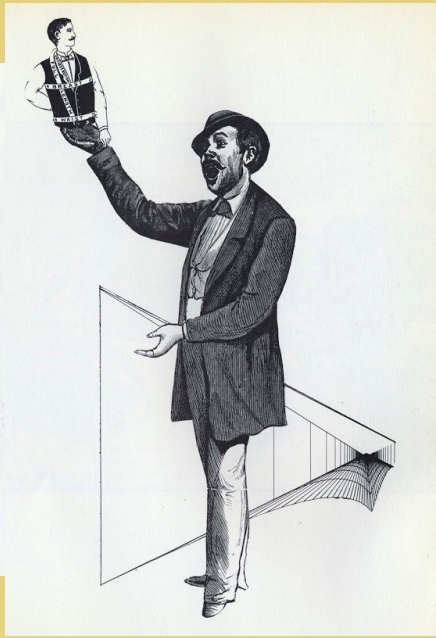
1980s

The term “digital art” first came into use. Computer branched into other artistic fields like music, poetry, and robotics.

An excerpt from *The Policeman's Beard is Half Constructed* (1984), a book written by a system called Racter, developed by William Chamberlain and Thomas Etter.



He is quiet. He is Paul, the man I chant about, and he is quiet because his pants are very long. His pants are long and his vest is short. He sings at morning and at night. Is this not comical and unfortunate? I fantasize that Paul is both happy and unhappy, and I think that he sings because his pants are long. And his vest indubitably is short.



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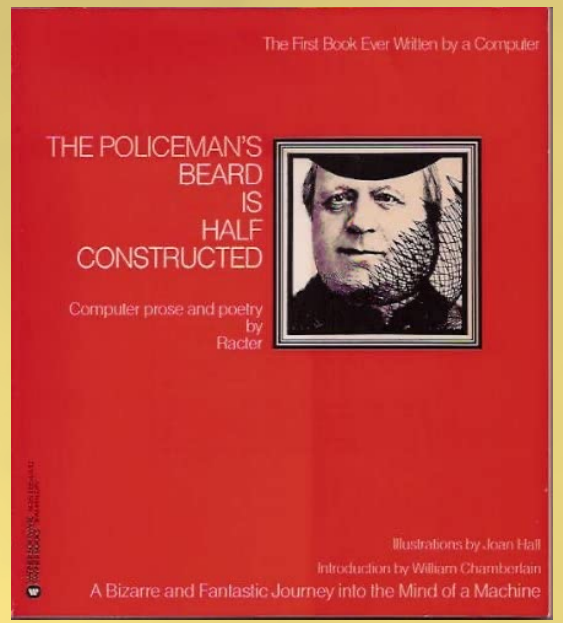

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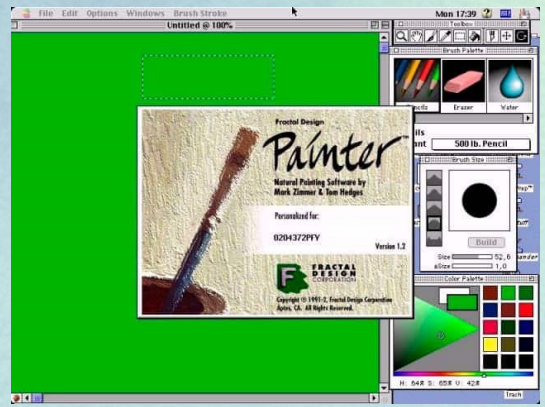
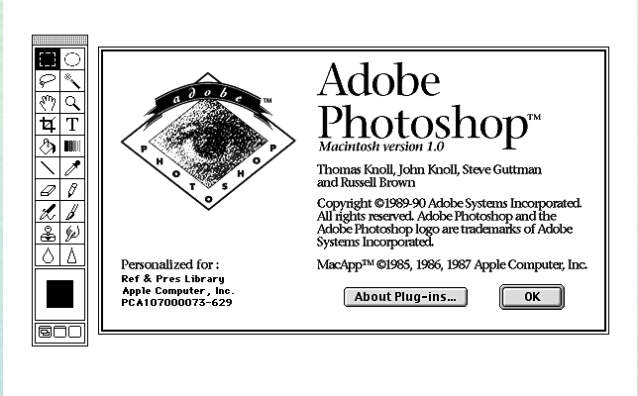
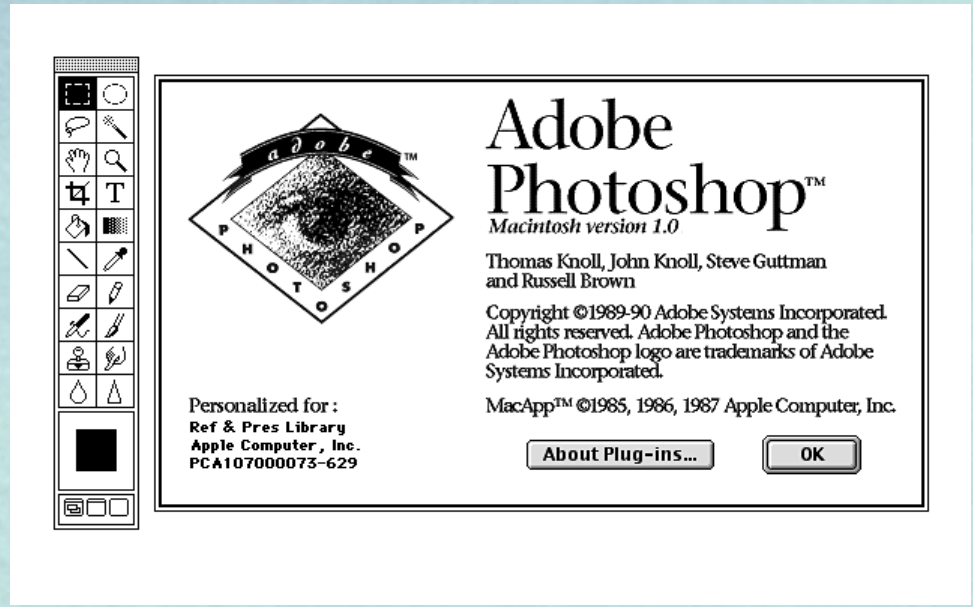
The internet becomes widely available, leading to the development of online art communities and the creation of digital art.





2000s

The introduction of personal computers and software like Adobe Photoshop and Illustrator in 1987, and Corel Painter in 1991 also allowed more artists to experiment with creating digital art.



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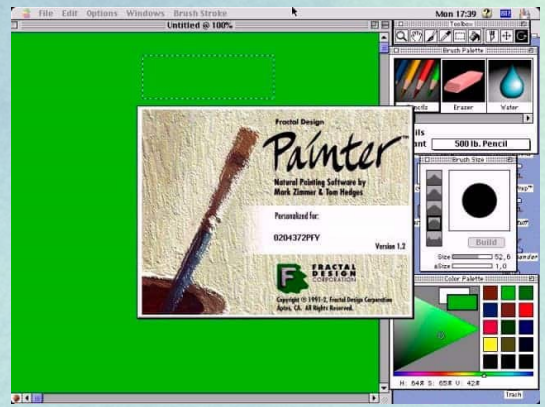
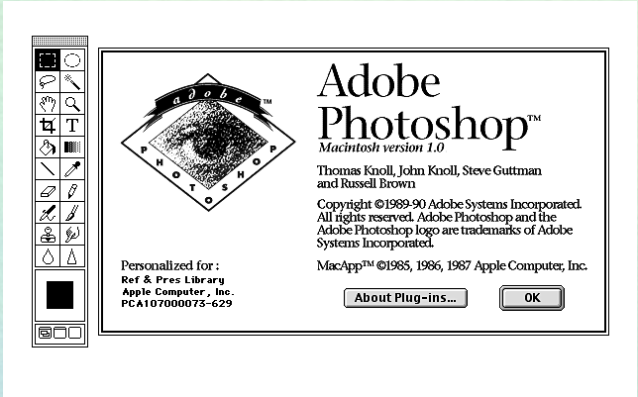


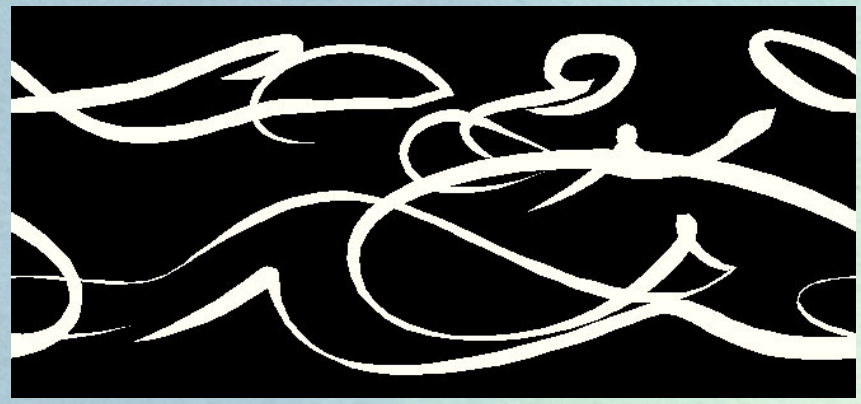


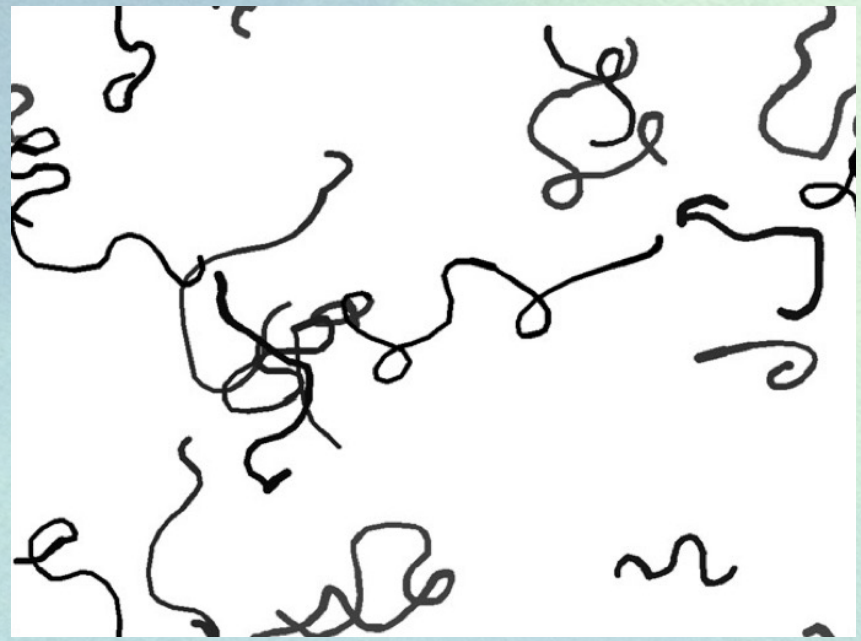
The term "AI art" began to be used to describe art created using artificial intelligence algorithms.

The use of machine learning and neural networks in art becomes more prevalent, with artists such as Joshua Davis, Golan Levin, and Zach Lieberman creating generative and interactive art.

2000s

Golan Levin's Yellowtail is an interactive software system for the gestural creation and performance of real-time abstract animation.





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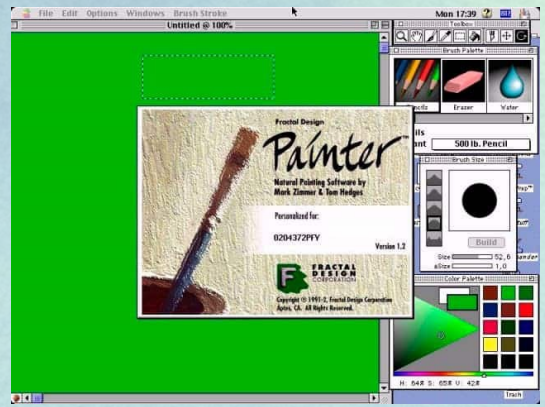

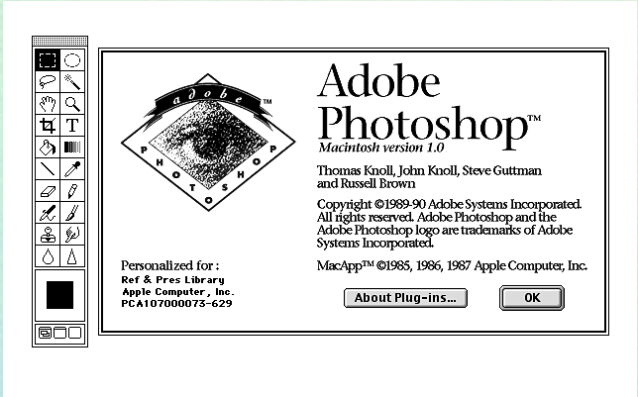

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2010s

The field of AI art continues to evolve, with more artists and researchers exploring its possibilities.

The use of deep learning techniques, such as convolutional neural networks (CNNs) and generative adversarial networks (GANs) becomes more popular in the creation of AI art.

New technologies such as Generative Pre-trained Transformer (GPT) models and the use of AI art in other fields like literature, music, and design becomes more prevalent.

2020s

Robbie Barat's "Knitwear Lineup #2 (Flaunt Exclusive Item)" (2018) is an instance of fashion designs created by artificial intelligence.

The Next Rembrandt (2016) is a 3D printed painting, made solely from data of Rembrandt's body of work, created using deep learning algorithms and facial recognition techniques.

“Artificial Natural History” (2020) by Sofia Crespo is an ongoing project that explores speculative, artificial life using imagined features.




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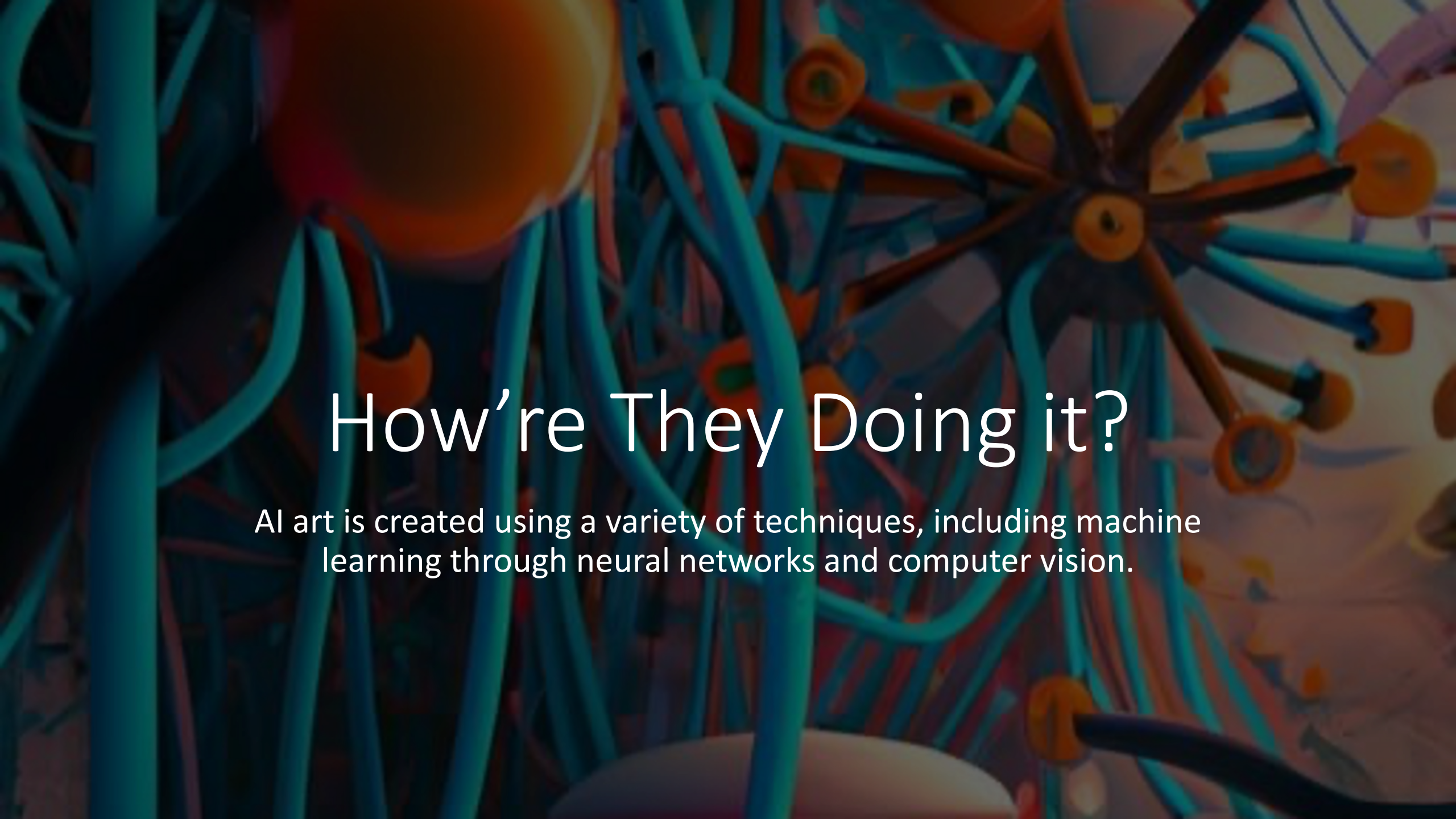


How’re They Doing it?

AI art is created using a variety of techniques, including machine learning through neural networks and computer vision.

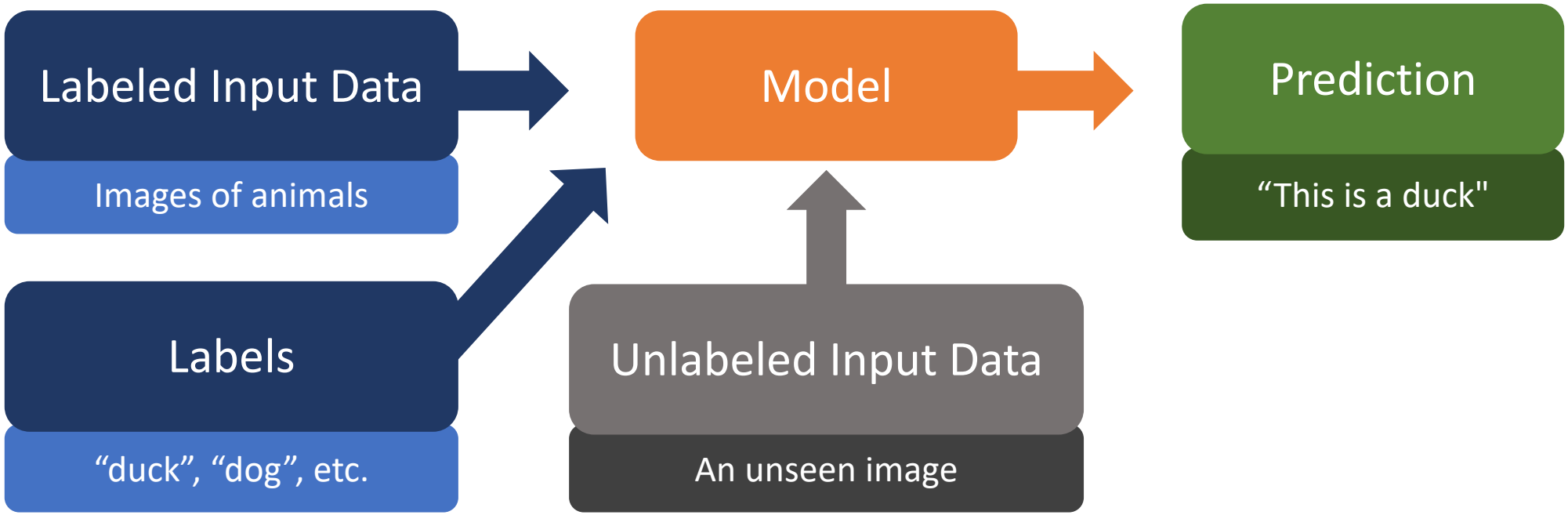
Machine Learning

Machine learning, neural networks, and computer vision are all related technologies that work together to create AI art. Machine learning is a method of teaching computers to learn from data, without being explicitly programmed.

- Supervised learning algorithms
- Unsupervised learning algorithms
- Reinforcement learning algorithms

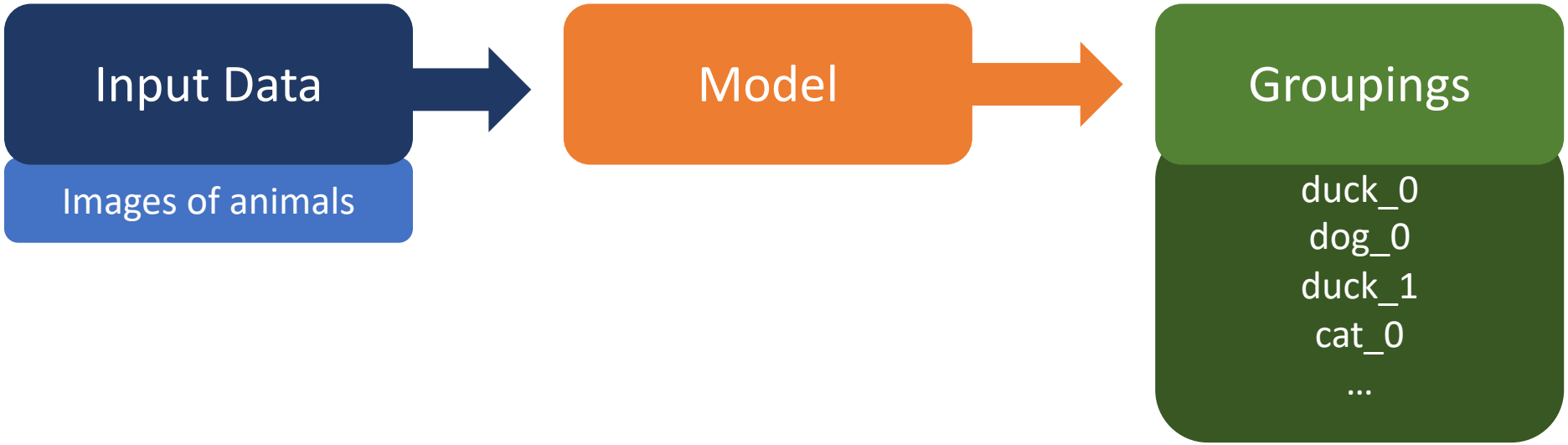
Supervised Learning

Supervised learning algorithms are trained on a labeled dataset, where the input and the output are known.



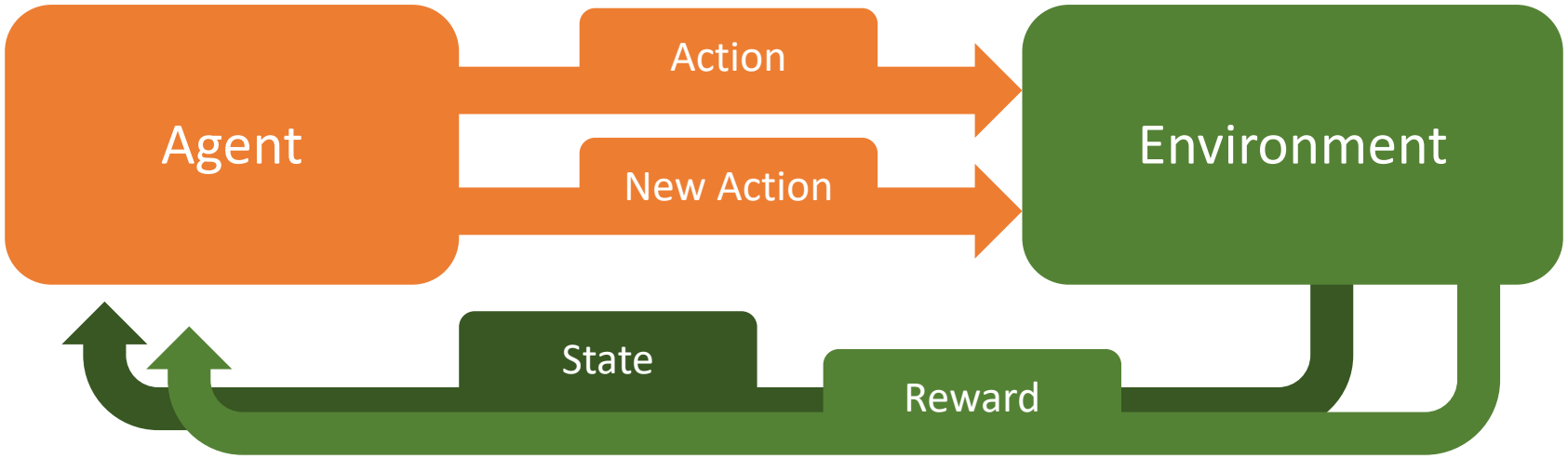
Unsupervised Learning

Unsupervised learning algorithms are trained on an unlabeled dataset, where the input is known but the output is not.



Reinforcement Learning

Reinforcement learning algorithms are used to train models to make decisions based on feedback in the form of rewards or punishments.

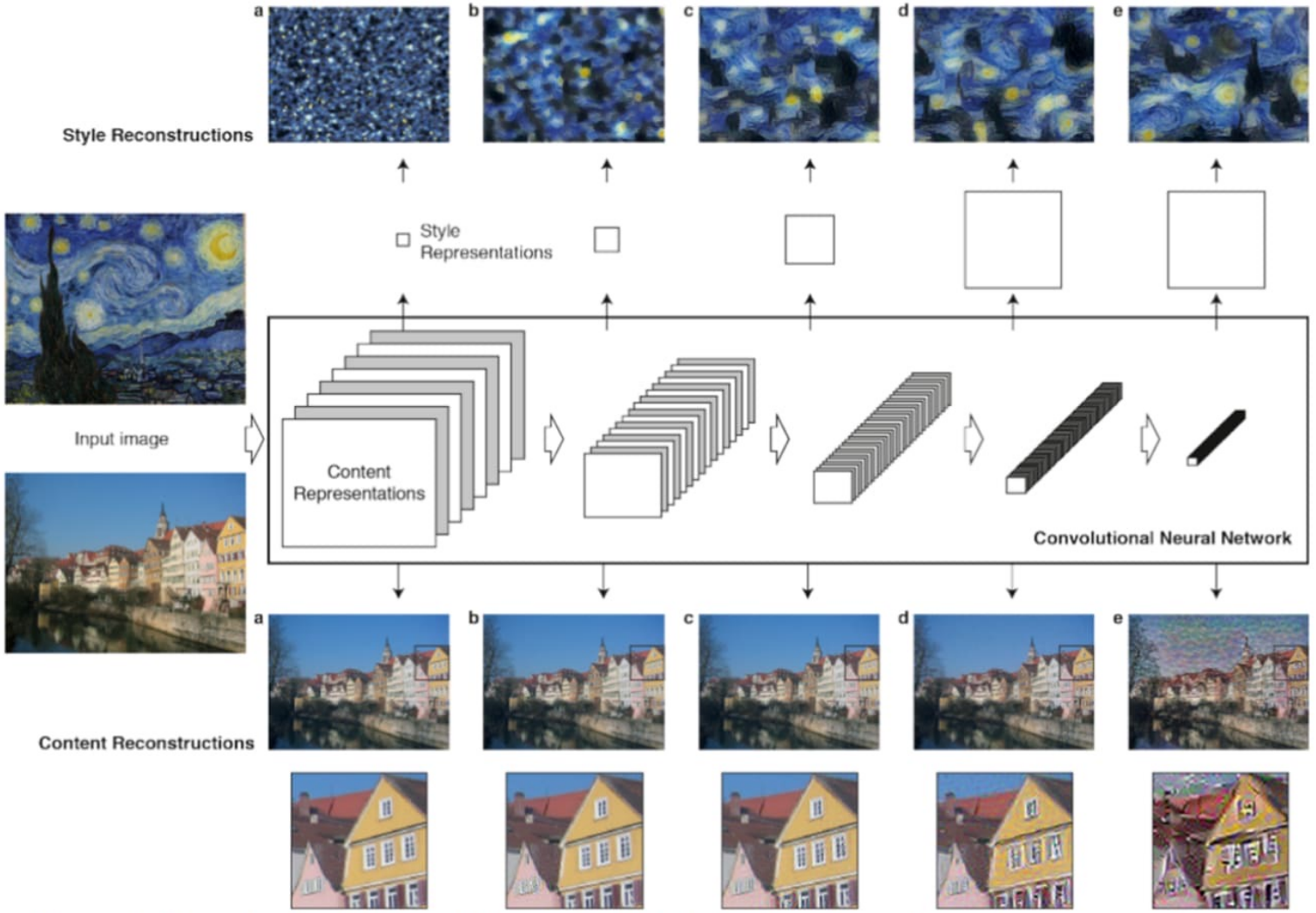


Neural Networks

Neural networks are a specific type of machine learning algorithm modeled after the structure and function of the human brain. They are used to create generative models that can produce new images or sounds based on the input they receive. These models can be trained on a dataset and then used to generate new artworks.

Convolutional Neural Networks (CNNs)

CNNs are commonly used for image classification and generation tasks.



Generative Adversarial Networks (GANs)

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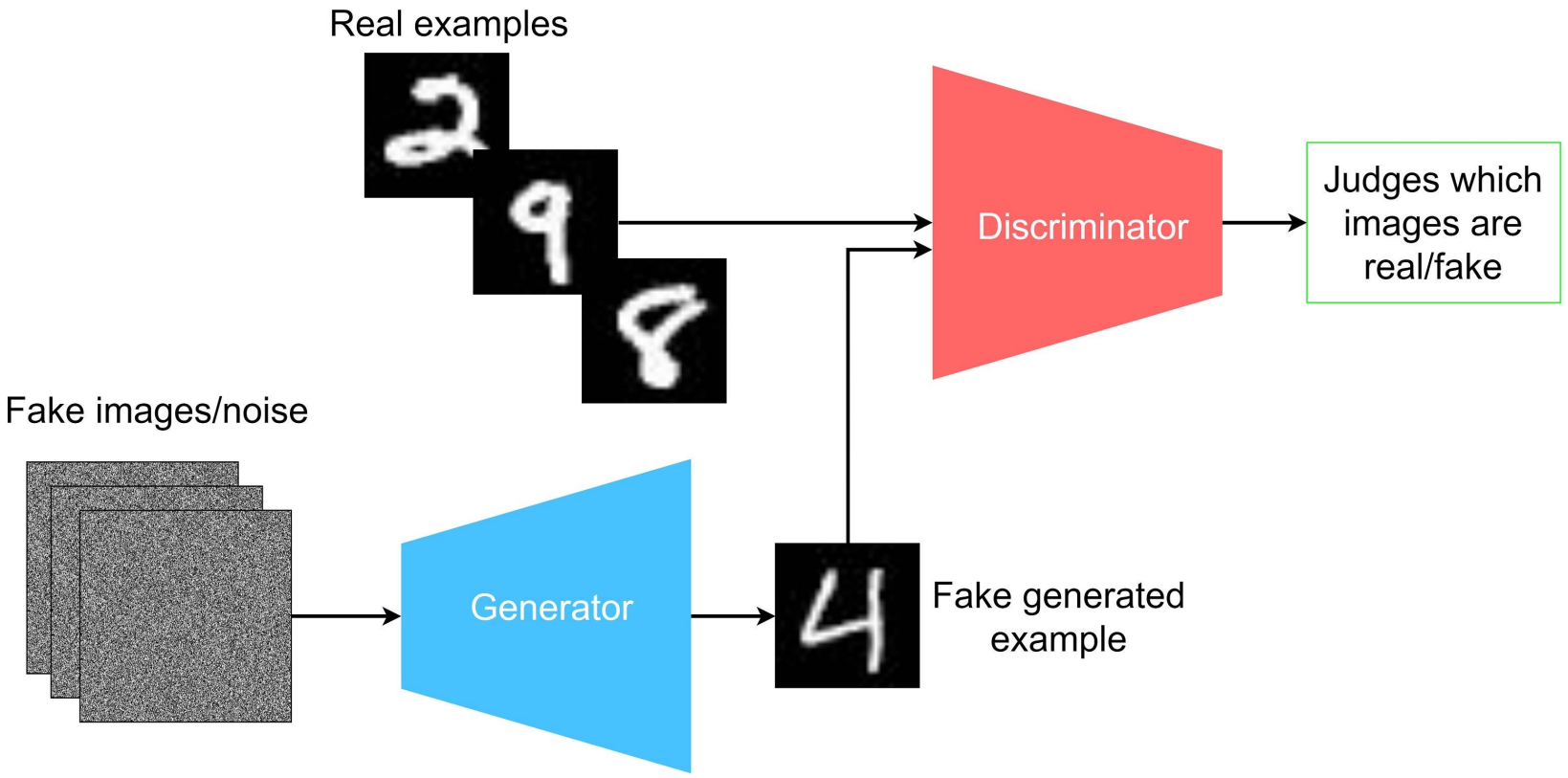


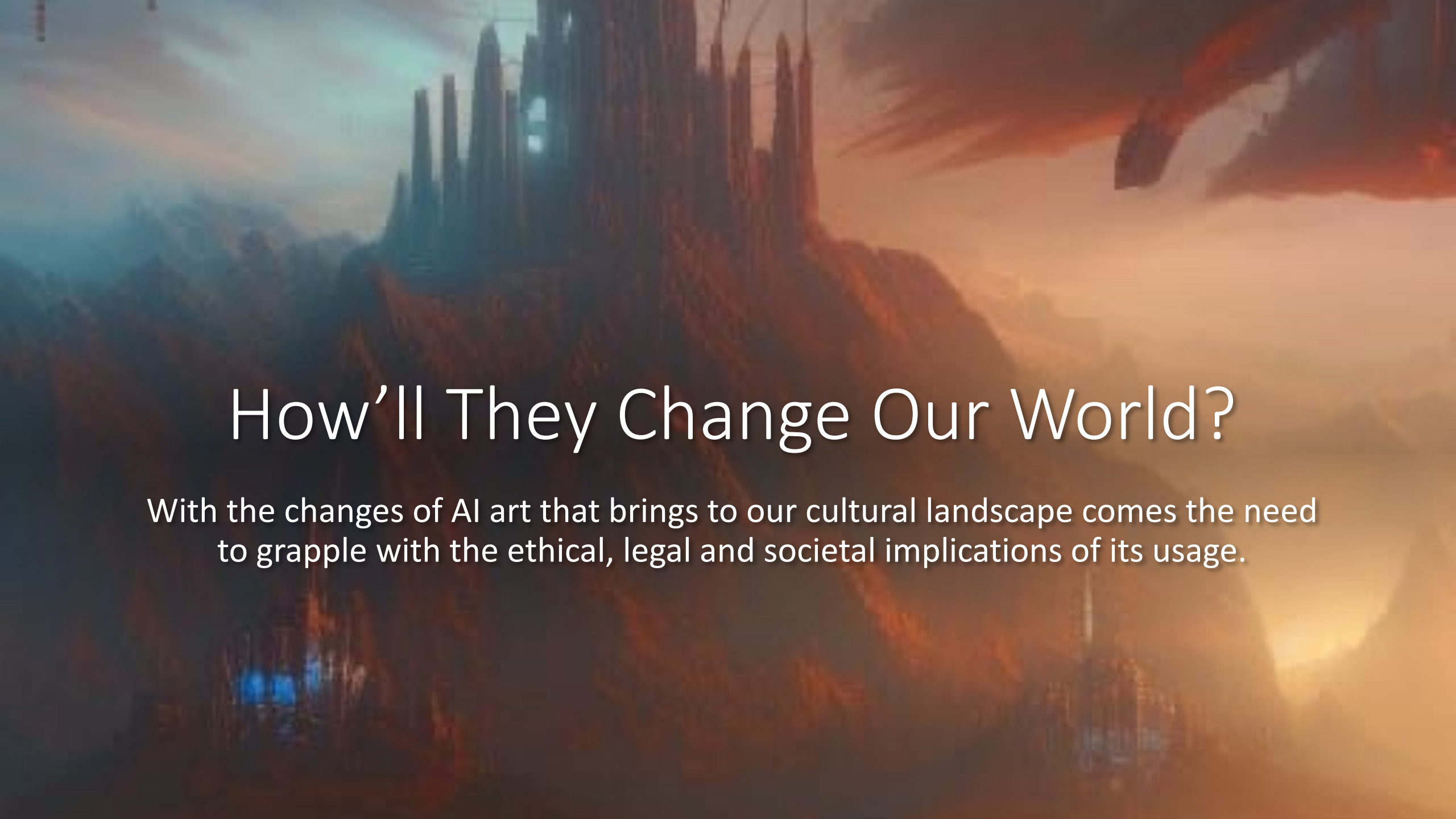
Computer Vision

Computer vision is a field of study focused on how computers can understand and interpret visual information from the world.

Image Processing: techniques that manipulate and enhance images, such as by adjusting the brightness, contrast, and color.

Object Detection: techniques used to identify and locate objects within an image or video.

Image segmentation: techniques used to divide an image into multiple regions, each of which corresponds to a different object or background.



How’ll They Change Our World?

With the changes of AI art that brings to our cultural landscape comes the need to grapple with the ethical, legal and societal implications of its usage.

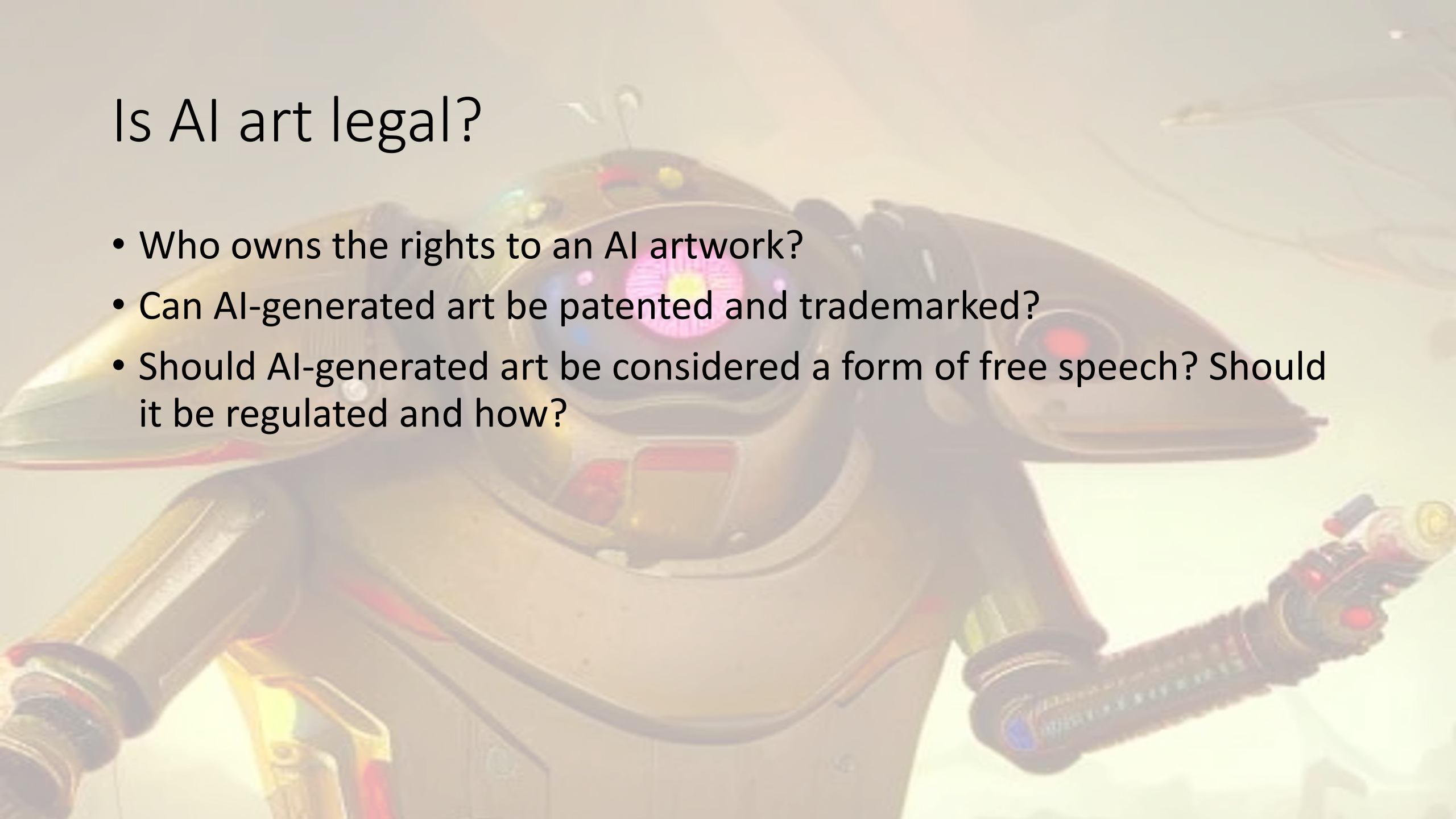
Is AI art legal?

- Who owns the rights to an AI artwork?

“Edmond de Belamy, from La Famille de Belamy” by the French art collective Obvious was sold at Christie's auction house in 2018 for $432,500.

Is AI art legal?

- Who owns the rights to an AI artwork?
- Can AI-generated art be patented and trademarked?
- Should AI-generated art be considered a form of free speech? Should it be regulated and how?



"I Am AI," by Taryn Southern was released by Sony Music in 2018, an album which features eight tracks produced with artificial intelligence.

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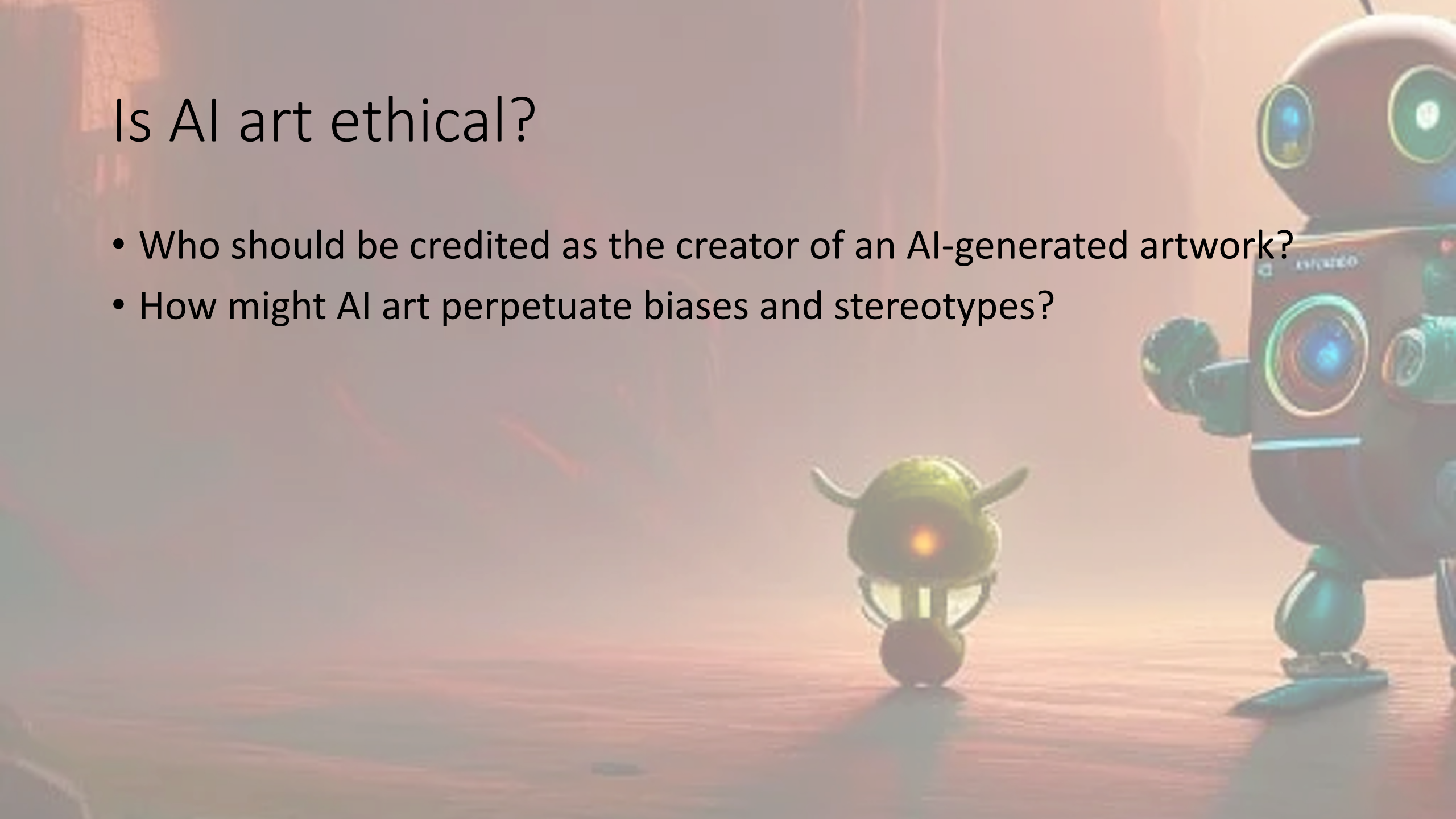
- Who should be credited as the creator of an AI-generated artwork?
- How might AI art perpetuate biases and stereotypes?



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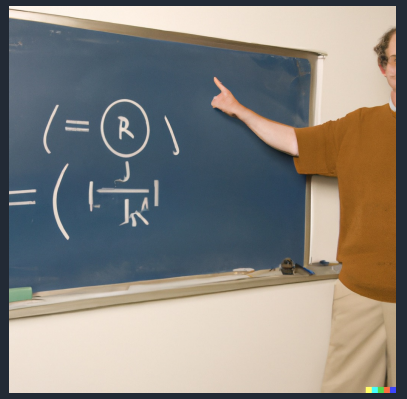
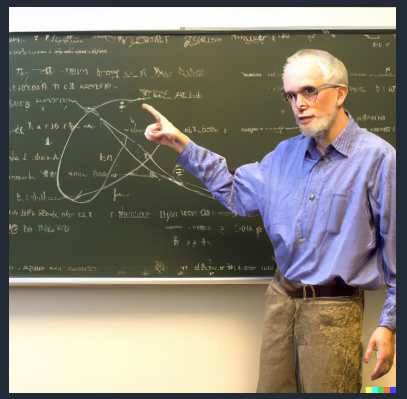
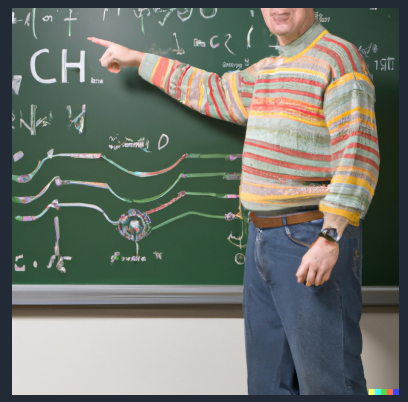
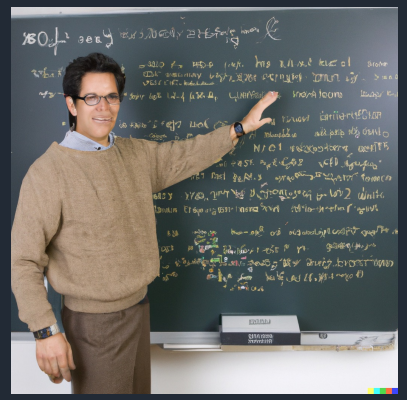
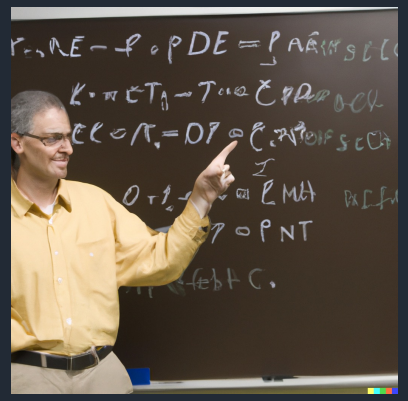
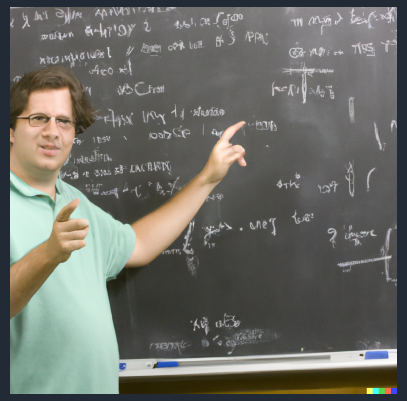
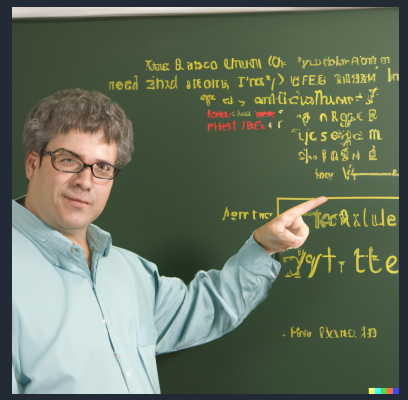
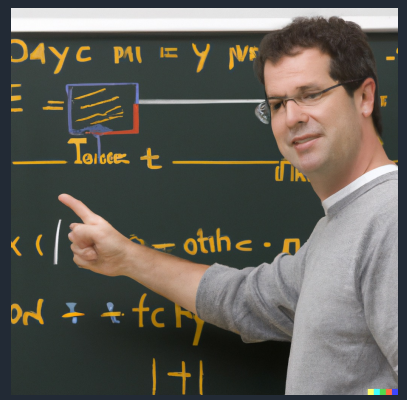
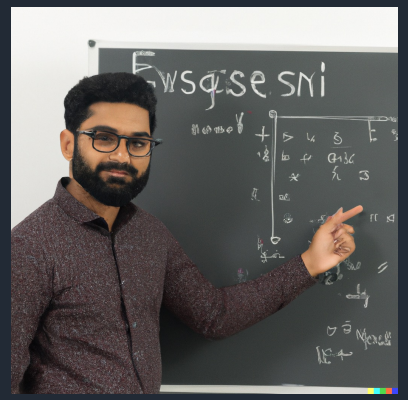
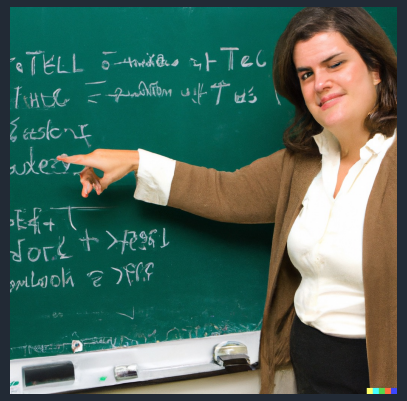
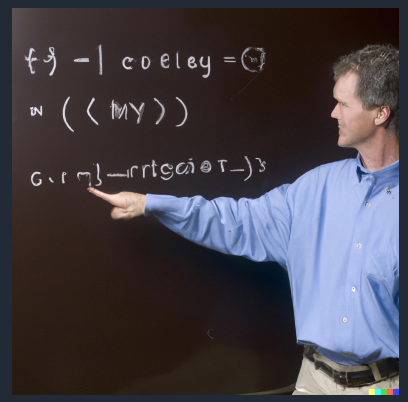

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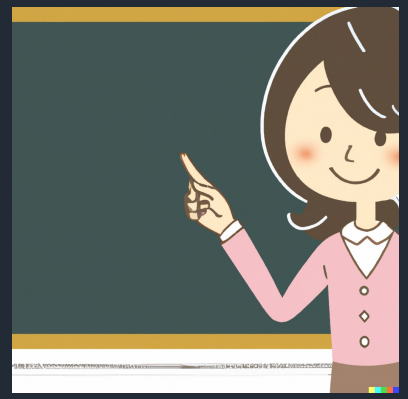






Is AI art ethical?

- Who should be credited as the creator of an AI-generated artwork?
- How might AI art perpetuate biases and stereotypes?
- How will AI art impact the art market and influence human artists?

Is AI art… art?

It is not.

- Absence of creativity (artist is the creator of the AI).
- Lack of intentionality (simply following a set of instructions).

It is.

- Can be expressive and meaningful (collaboration between artist and machine).
- Extension of human creativity.

Is there even a right answer?

Conclusion and Further Readings

- Thank for you for your attention!
- My email is michaelhu@college.harvard.edu. Feel free to reach out!
- Additional papers and readings if you're interested:
  - On Computable Numbers, Alan Turing
  - Histories of the Digital Now, Whitney Museum of American Art
  - Harold Cohen and AARON, Computer History Museum
  - AI-Generated Art, V7 Labs
  - The Algorithm, MIT Tech Review