

Creative AI and Visual Arts

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What Is Creativity?

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Can AI be Creative?

What is Creativity?

- Creativity is a new great mystery! What we call creative? Where do ideas come from? How can we cultivate them?
- In the ancient days, only the divines were considered creative. Gradually, the term was used to describe extraordinary individuals, like a genius. In the modern era, the idea of being creative was democratized to every individual.

What creativity means for machines?

Can computers think like us? Could they have flashes of inspiration?

Some believe computers are already creative, and some dismiss machine creativity and attribute it to human and data used to develop it.

Will computers develop their own ways of thinking and begin to operate and function autonomously, not as replica people but as an altogether different and independent form of intelligence?

Reference: "The Artist in the Machine" by Arthur I. Miller

How We Make Creative Art: Story of Es Devlin

Es Devlin is a very talented stage designer. She explains her creative process to form an idea:

- **Research:** Looking at elements, and images of nature, human anatomy, ...
- **Imitation:** Copying patterns enough to feeling comfortable with it
- **Finding Connections:** exploring the connection between two different concepts
- **Quick Prototyping:** using basic approaches making quick prototypes
- **Iterative Improvements:** Iteratively improve the idea



Es Devlin, *Rendering of Forest of Us*, 2021



How to Test Machine Creativity?

- We have the Turing test to evaluate machine intelligence.
- Can we evaluate creativity similarly?

Tech / Innovation

AI paintings of Chinese landscapes pass as human-made 55 per cent of the time, research by Princeton student shows

(a) Human



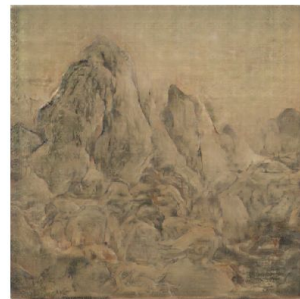
(b) Baselines



(c) Ours
(RaLSGAN+Pix2Pix)



(d) Ours
(StyleGAN2+Pix2Pix)



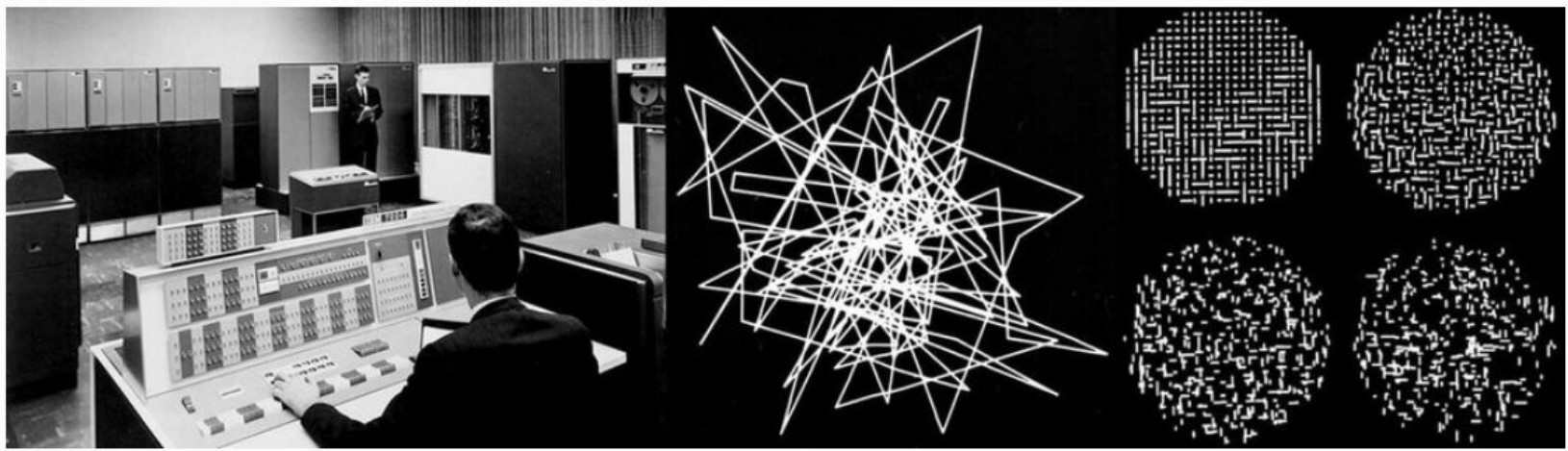
Early Works: Computational Creativity

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Creative Algorithms

What is Generative Art?

Generative Art is a process of algorithmically generating new ideas, forms, shapes, colors or patterns. First, you create rules that provide boundaries for the creation process. Then a computer follows those rules to produce new works on your behalf



IBM 7094 with IBM 7151 Console (1962) / Creative use of Computer Graphics by A. Michael Noll at Bell Labs (1962).

Early Computational Creativity in Software

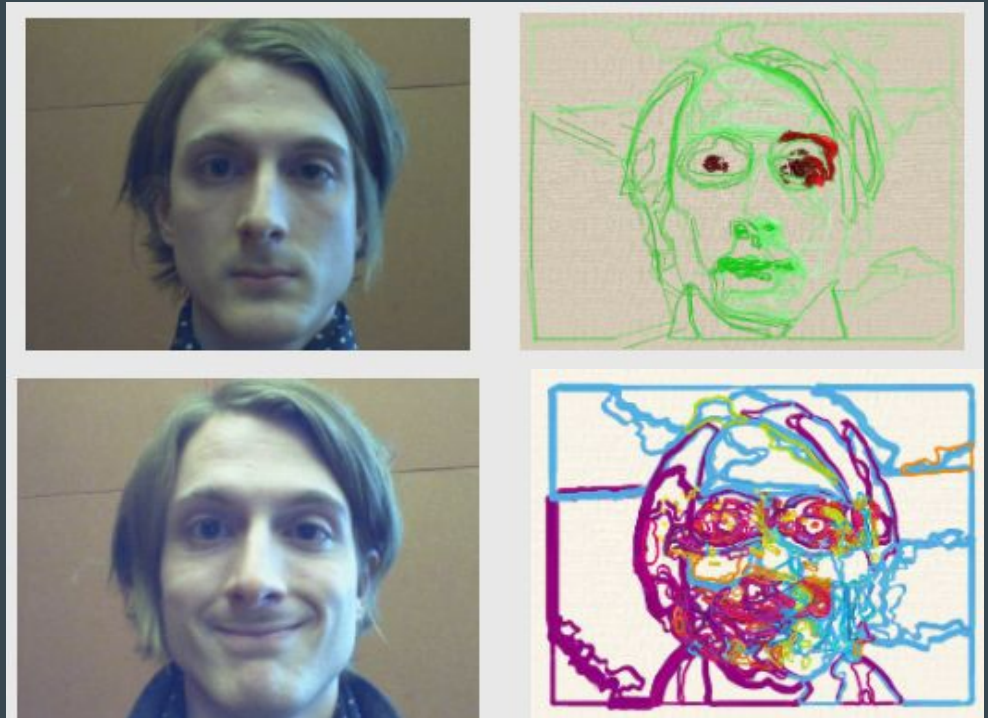
AARON (developed by Harold Cohen since 1973): *The further exploits of AARON, Painter*



Early Computational Creativity in Software

The painting fool developed by Dr Simon Colton (2001):

<http://www.thepaintingfool.com/>



Notable Artists in Creative AI Today

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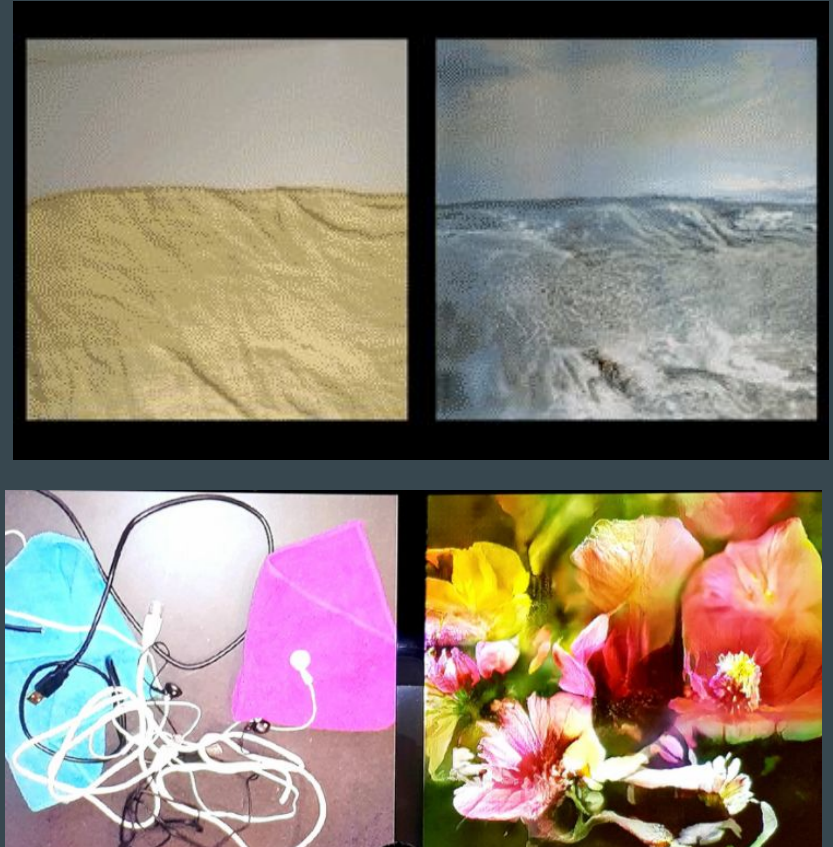
What AI Generated Art Looks like?

AI Art Notable Artists: Memo Akten

The work is an interactive installation in which a number of neural networks analyse a live camera feed pointing at a table covered in everyday objects.

These networks contain knowledge of the entire dataset, hundreds of thousands of images. Having been trained on these datasets, when the networks look at the world, they can only see through the filter of what they have seen before.

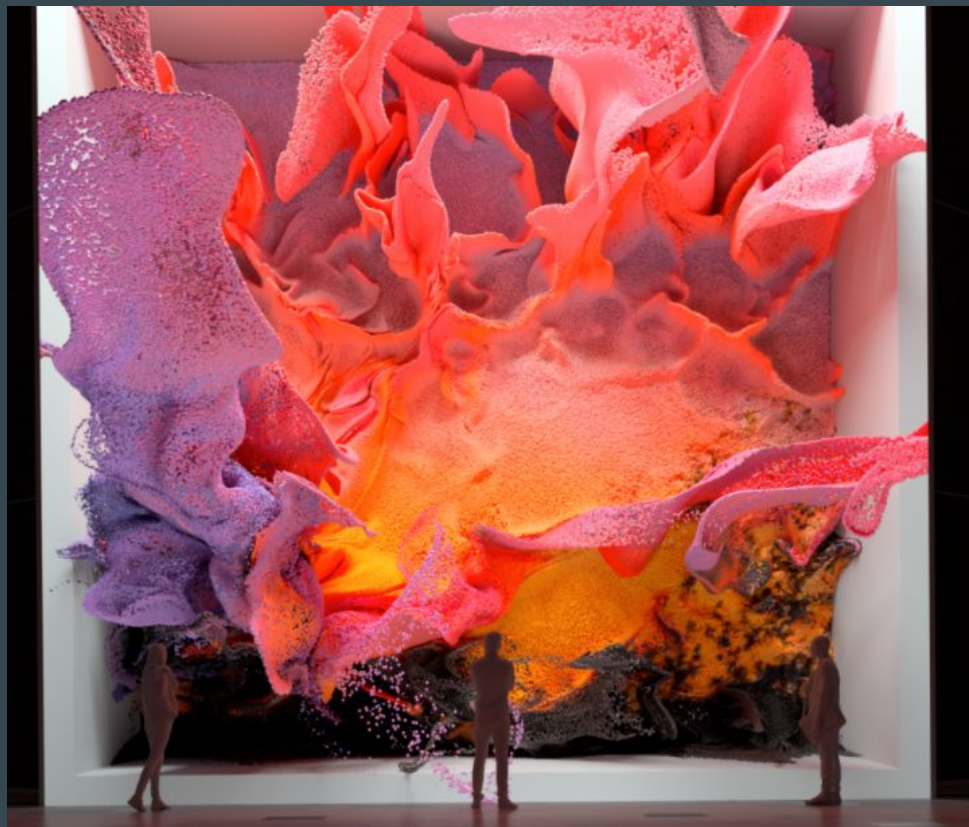
Learning to see



AI Art Notable Artists: Refik Anadol

Quantum Memories:

- A StyleGan is trained on 200 million photos of landscapes
- Using Google AI Quantum's and algorithms to explore the possibility of a parallel world.
- Quantum noise generated data that speculate parallel modalities are fed into StyleGan as input



AI Art Notable Artists: Mario Klingemann

Memories of Passersby I: It's a never-ending stream of portraits, disquieting visions of male and female faces created by a machine.

The flow of images presented does not follow a predefined choreography but is the result of the AI interpreting its own output; the complex nature of this feedback loop means that no image will ever be repeated.

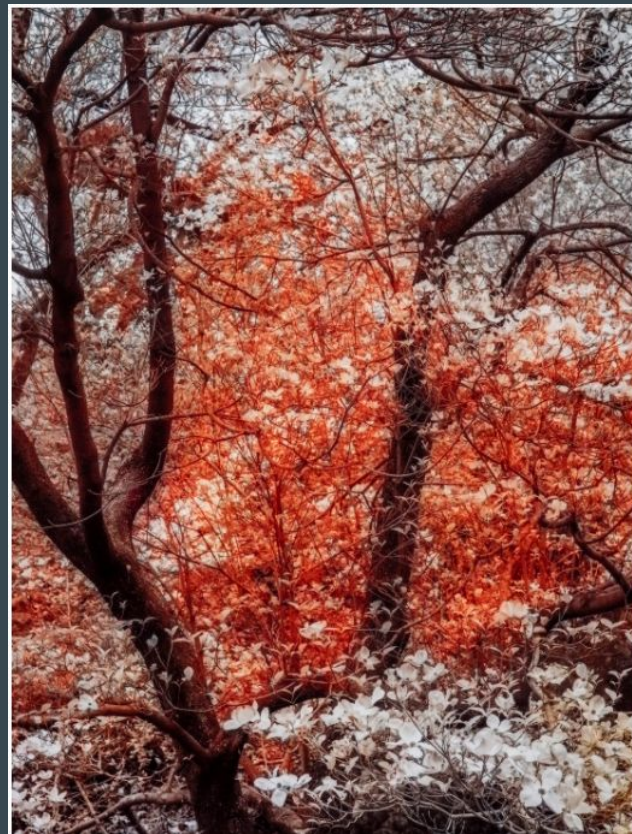


AI Art Notable Artists: Trevor Paglen

These photographs of the spring bloom have been analyzed by an AI system to look for the “deep saliency” in the images.

In other words, an AI system is “looking” at the photographs and trying to determine what the different parts of the image are (i.e. different shapes, objects, textures, and tones).

The colors in the images represent the different self-similar regions that the AI detects.



Trevor Paglen, Bloom (#79655d), 2020

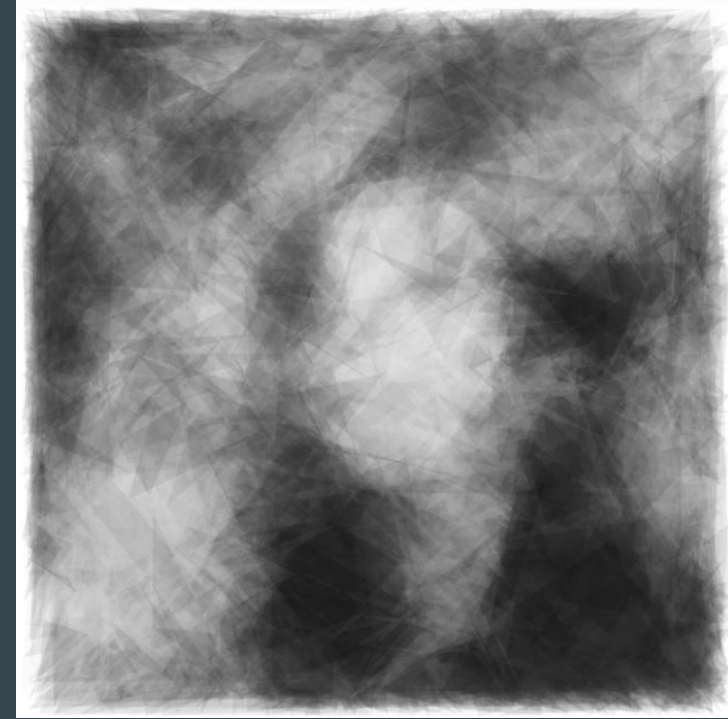
AI Art Notable Artists: Trevor Paglen

The portraits are made by creating facial recognition models of the people.

A second program generates polygons.

These two programs go back and forth until an image 'evolves' that the facial recognition model identifies as a representation of that particular person.

It takes several days for each of these images to generate.



Trevor Paglen, Kate, 2020

AI Art Notable Artists: Anna Ridler

Let Me Dream Again is a series of experiments that use GANs to try to recreate lost films from the fragments of early Hollywood and Western cinema that still exist.

These experiments include an endlessly evolving, algorithmically generated film.

Alongside this is the research that sits behind the film, documented as an interactive cutting room floor and covering the dataset used to create the artwork.



Let me dream again, Online experience for Google Arts & Culture, 2020

AI Art Notable Artists: Helena Sarin

For “Leaves of Manifold” more than 1000 leaves are photographed as the part of the dataset.

She uses a modified version of CycleGAN and PGAN, and makes heavy use of GAN chaning.



Leaves of Manifold: Seasonal GanTemplations

AI Art Notable Artists: Tom White

Tom White's artwork investigates the Algorithmic Gaze: how machines see, know, and articulate the world.

He has created a drawing system that allows neural networks to produce abstract ink prints that reveal their visual concepts.

Neural networks have been trained to recognize thousands of individual items from everyday life. Using the drawing system, the neural networks directly express in simple ink drawings their own versions of these categories – creating abstract shapes that convey their understanding of the world.



Rabbit, banana, and killer whale as seen by NN

AI Art Notable Artists: Bas Uterwijk

Bas Uterwijk uses GAN (generative adversarial network) to generate hyper-realistic portraits of famous historical figures.

The model is trained with thousands of photographs, and is able to generate photographs that look — at least superficially — genuine to the human eye from paintings and sculptures.



Art Generated By Algorithm/Robots

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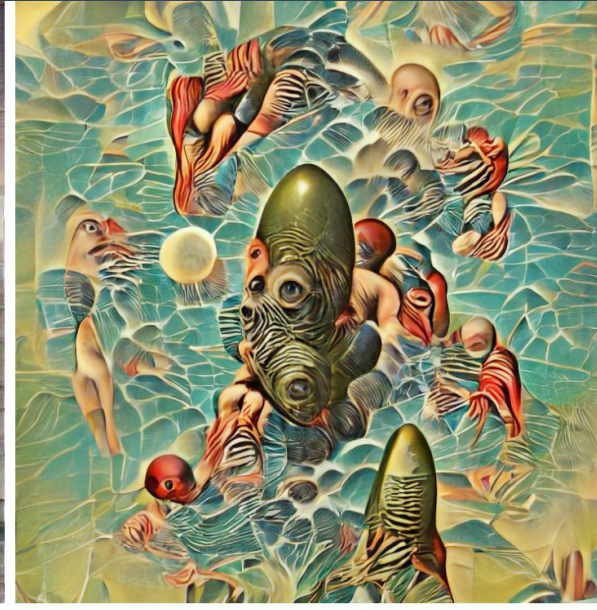
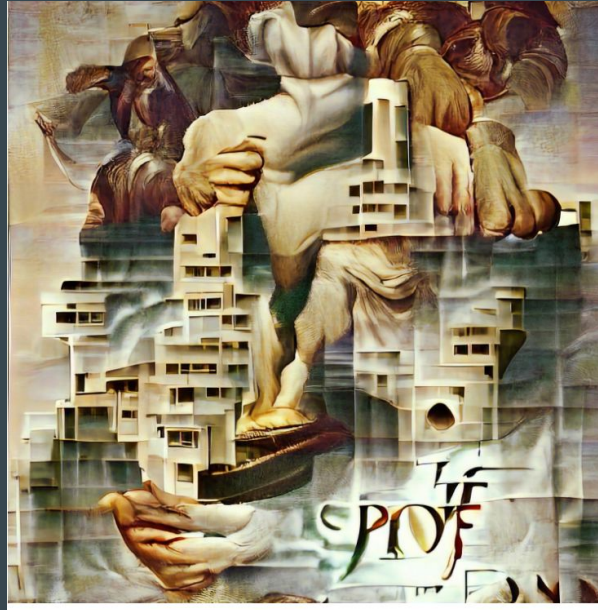
What AI Generated Art Looks like?

Botto A decentralized Autonomous Artist

Botto creates 50 art pieces a week and presents them to the community.

The community votes on these art fragments.

Collectively, votes are used as feedback for Botto's generative algorithm - dictating what direction Botto should take its next series of art pieces.



Ai Da Humanoid Robot-Artists

Ai Da (named after Ada Lovelace)

Ai-Da is the world's first ultra-realistic artist. She draws using cameras in her eyes, her AI algorithms, and her robotic arm. Created in February 2019.



Sophia the walking, talking AI-powered humanoid robot

Sophia is a humanoid robot built by Hanson Robotics that debuted in 2016.

This piece, titled Sophia Instantiation, is a 12-second video file showing a portrait by living, breathing Italian artist [Andrea Bonaceto](#) evolving into a digital painting by Sophia.



Creative AI Changing Art Market

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How Art Market Is Adaptive to Digital Art?

AI in Arts Now: Is it taken seriously in art community?

Christie's recently sold its first piece of auctioned AI art—a blurred face titled “Portrait of Edmond Belamy”—for \$432,500.

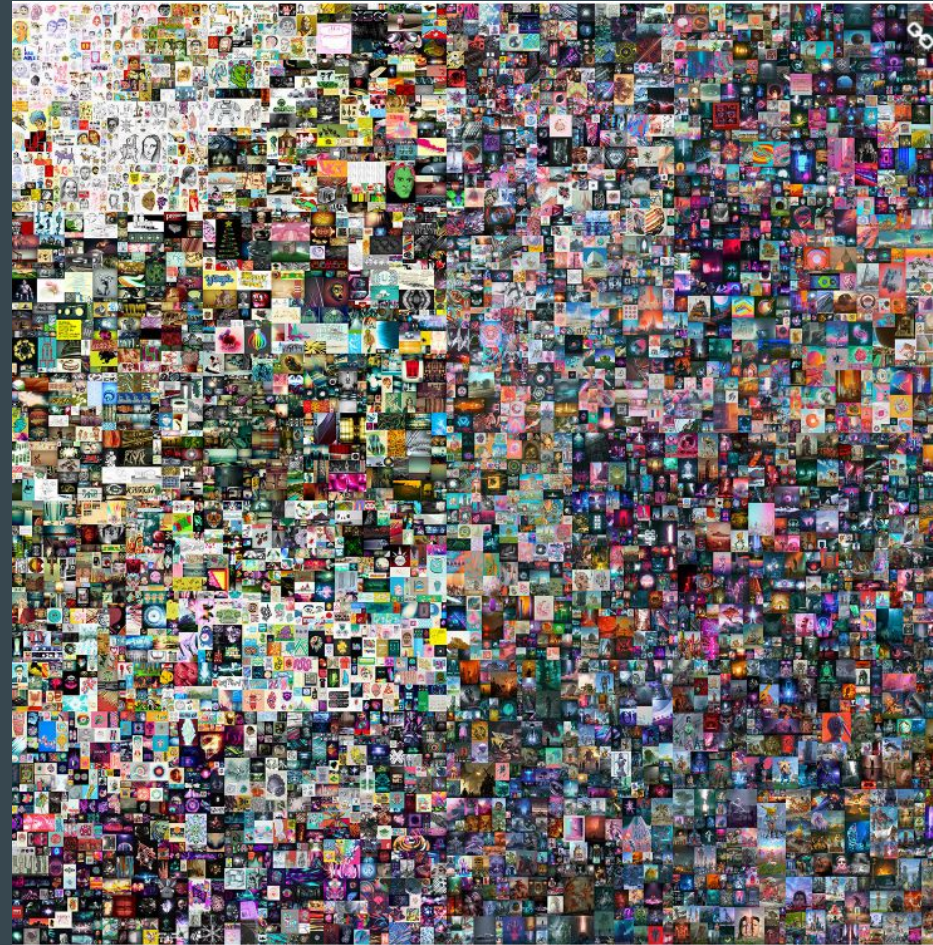


NFTs and Crypto Art

- NFT (non-fungible token) is a digital token tied to assets. NFTs are best understood as computer files combined with proof of ownership and authenticity, like a deed.
- Traditional works of art such as paintings are valuable because they are one of a kind. But digital files can be easily and endlessly duplicated. With NFTs, artwork can be "tokenised" to create a digital certificate of ownership that can be bought and sold.
- As with crypto-currency, a record of who owns what is stored on a shared ledger known as the blockchain. The records cannot be forged because the ledger is maintained by thousands of computers around the world.

How Classic Art Auctions are Reacting to Digital Art?

- Christie's hosted its first [Art + Tech Summit in 2018](#), to explore the potential applications of blockchain within the art market.
- The [second edition](#), in June 2019, focused on artificial intelligence.
- Christie's sold the first NFT for a digital work of art ever offered at a major auction house ([Beeple's Everydays, March 2021](#)), with the acceptance of cryptocurrency as a means of payment. Sold for \$69,346,250



Creative AI and NFTs

Blockchain and AI are two big, buzzy topics, and they have intersected in unexpected ways, especially during this year's crypto art boom.

Artists whose work uses GANs, have turned to crypto platforms not only to sell their work, but also to explore ways of critically and creatively engaging the blockchain.



[See Info](#)



[See Info](#)

Models Mostly Used for Creative AI

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Research and State-of-Art

Neural Style Transfer

Neural style transfer uses deep learning to compose one image in the style of another image



DeepDream

The original image influences what kind of objects form in the processed image.

DeepDream is an experiment that visualizes the patterns learned by a neural network. Similar to when a child watches clouds and tries to interpret random shapes



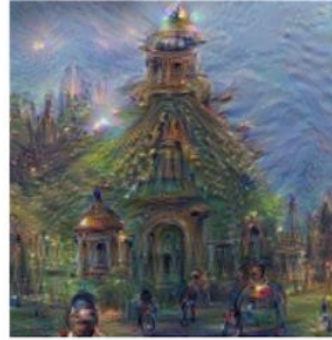
Horizon



Towers & Pagodas



Trees



Buildings



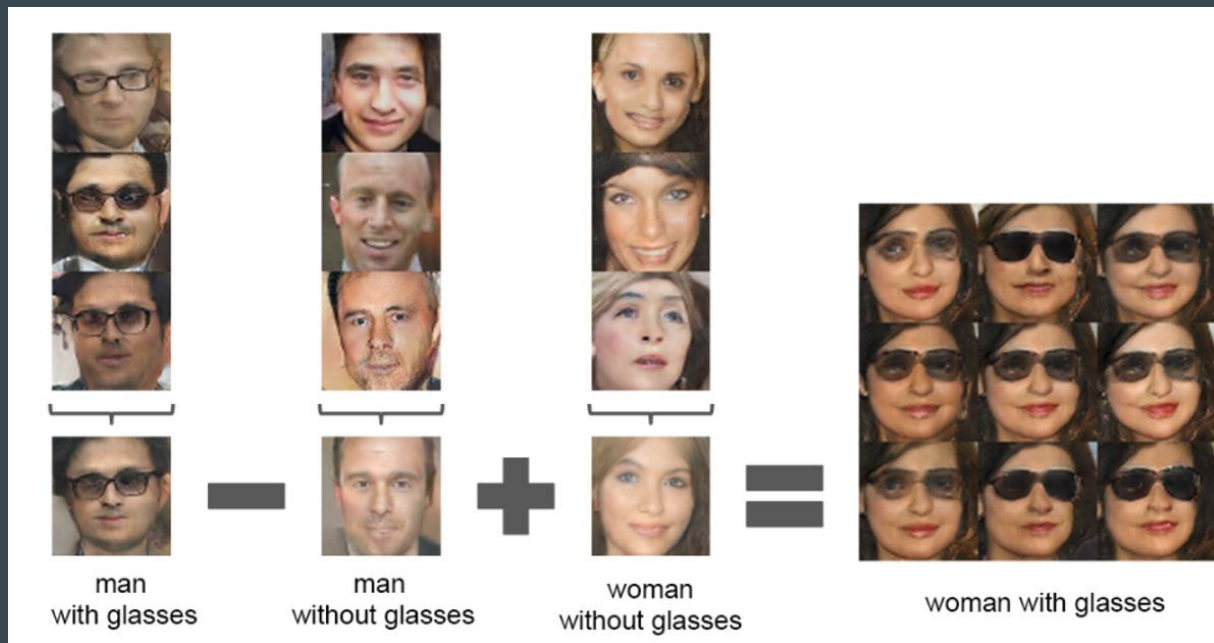
Leaves



Birds & Insects

DCGAN

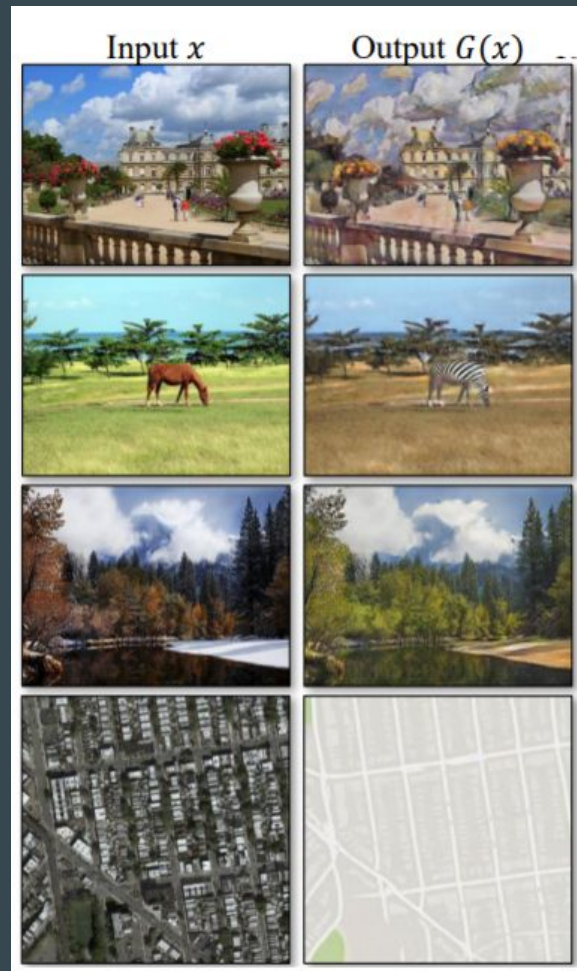
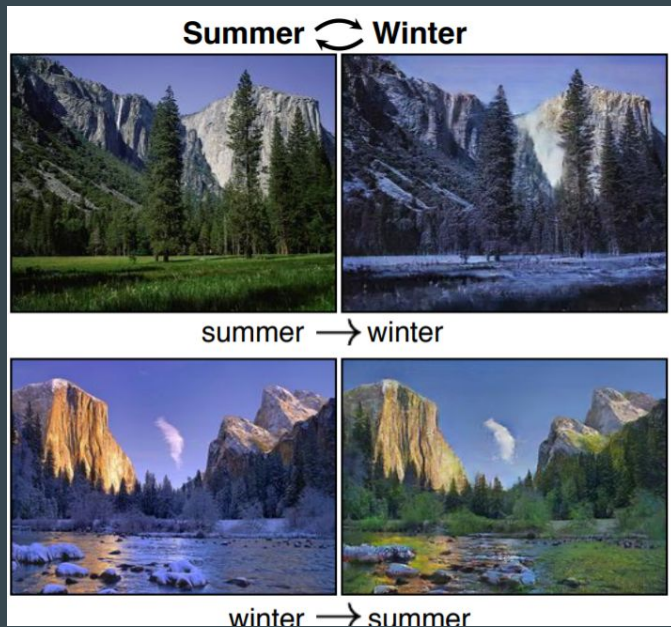
DCGAN, or Deep Convolutional GAN is a generative adversarial network architecture.



CycleGAN

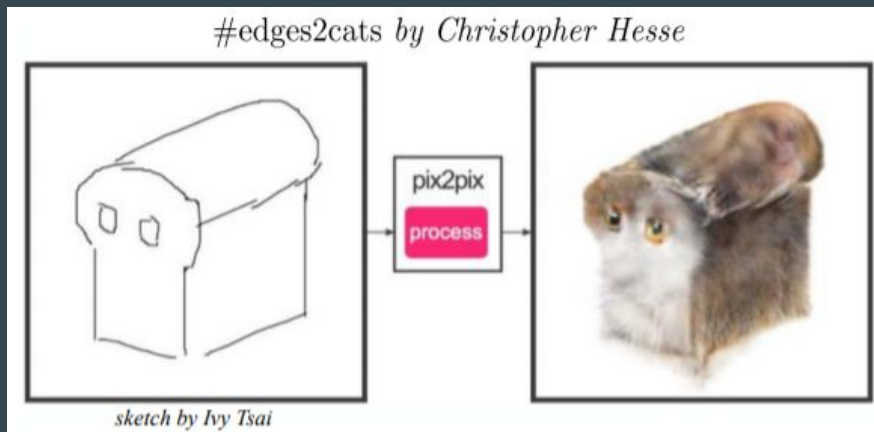
The CycleGAN is a technique that involves the unsupervised training of image-to-image translation models without paired examples.

The Network learns mapping between input and output images using unpaired dataset, and can translate one image into the other.



Pix2Pix

Pix2pix uses a conditional generative adversarial network (cGAN) to learn a function to map from an input image to an output image.



Background removal



by Kaihu Chen

Palette generation



by Jack Qiao

Sketch → Portrait



by Mario Klingemann

Sketch → Pokemon



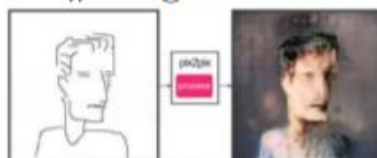
by Bertrand Gondouin

“Do as I do”



by Brannon Dorsey

#fotogenerator



sketch by Yann LeCun

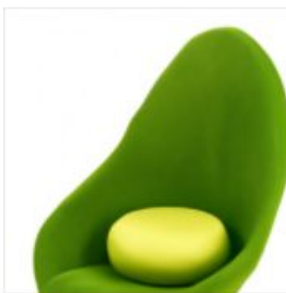
DALL·E

DALL·E creates images from text captions for a wide range of concepts expressible in natural language. It is based on GPT-3 and is trained to generate images

TEXT PROMPT

an armchair in the shape of an avocado. . . .

AI-GENERATED
IMAGES



Other Open Source Models

VQGan-Clip: <https://github.com/EleutherAI/vqgan-clip>

Taming Transformers: <https://github.com/CompVis/taming-transformers>

Real ESRGan: <https://github.com/xinntao/Real-ESRGAN>

GAN Zoo: <https://github.com/hindupuravinash/the-gan-zoo>

Creative AI Tools



Accessible AI for Artists

Accessible AI for Artists: Google Magenta Project

This project explores the role of Machine Learning in the creative process. They provide an open source library and datasets to produce creative music, text and images using AI models based on:

- Generative Models
- Auto-Encoders
- Variational Auto-Encoders
- Generative Adversarial Networks

<https://magenta.tensorflow.org/>

Accessible AI for Artists: ML5.JS

ML5.JS tries to make machine learning approachable for a broad audience of artists, creative coders, and students.

The library provides access to machine learning algorithms and models in the browser, building on top of TensorFlow.js

It includes implementations of models such as:

- Pix2Pix
- DCGAN
- ...

Accessible AI for Artists: Processing

- Processing – A flexible software sketchbook and language for learning how to code within the context of the visual arts.
- Includes p5js (Processing for JavaScript) and Processing.py (Processing for Python).
- Processing does not use AI, but is a great tool for generative visual art.

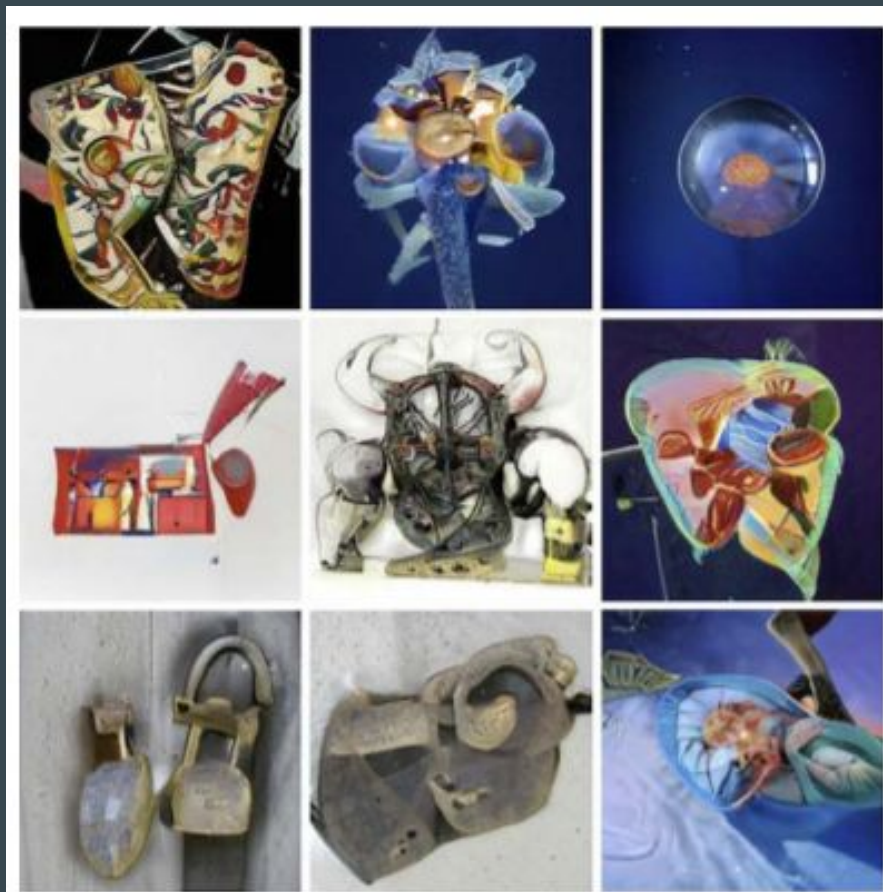
Accessible AI for Artists: Doodle to Realistic images

GauGan: Developed by NVIDIA, it can turn rough doodles into photorealistic masterpieces



Accessible AI for Artists: ArtBreeder

Artbreeder, is a machine learning-based art website. Using the models StyleGAN and BigGAN, it allows users to generate and modify images of faces, landscapes, and paintings, among other categories.



BigGAN images from the Artbreeder website.

More Tools

- Deep Dream Generator: <https://deepdreamgenerator.com/>
- Deep Art: <https://deepart.io/>
- Visionist: <https://apps.apple.com/us/app/visionist/id1071126584>
- Go Art: <https://goart.fotor.com/>
- Deep Angle: <http://deepangel.media.mit.edu/>
- Google Deep Dream: <https://github.com/google/deepdream>
- Fractal Art Generators: <https://aiartists.org/fractal-art-generators>
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Ethics in Creative AI



How to Use AI in Arts Responsibly?

AI in Art: What are the Ethical Concerns?

- Intellectual Property: Model, Data, and the Artist
- Environmental Effects of BlockChain and NFTs
- Bias and Discrimination
- Democratization and accessibility
- Misuse and Fraud
-

AI Art Manifesto

AI Art Manifesto was created the Futurological Congress in the frame of Transart Festival 2020 in Bolzano, Italy.

It includes guidelines to create art with AI. Some main focuses of this manifesto are:

- Fighting systematic bias and limitations caused by AI and datasets
- Exposing mis-usage of AI
- Ethics and responsibility
- Democratization of AI
- Openness and human-centered intelligence
- ...

Research on Ethics

- [Ethical considerations in creative applications of computer vision](#)
- [Towards Standardization of Data Licenses: The Montreal Data License](#)
- [The ethics of AI ethics: An evaluation of guidelines](#)
- [The State of AI Ethics Report](#)
- [AI ethics](#)

Creative AI Communities and Events

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Where Everything is Happening?

Events and Communities for AI Artists

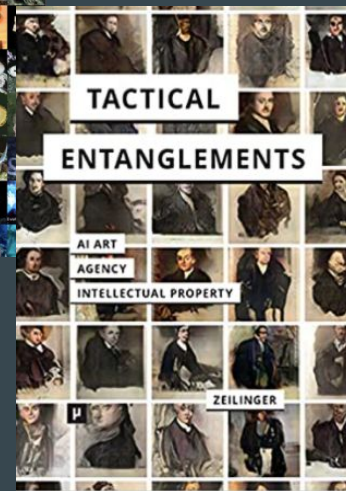
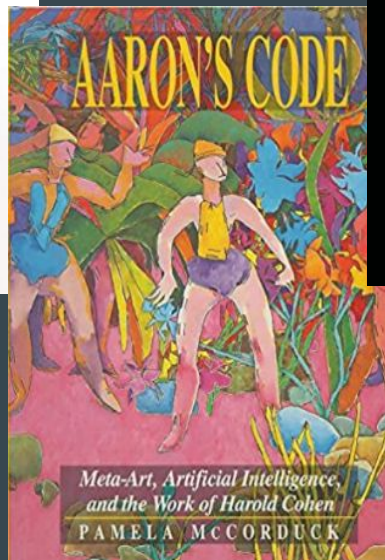
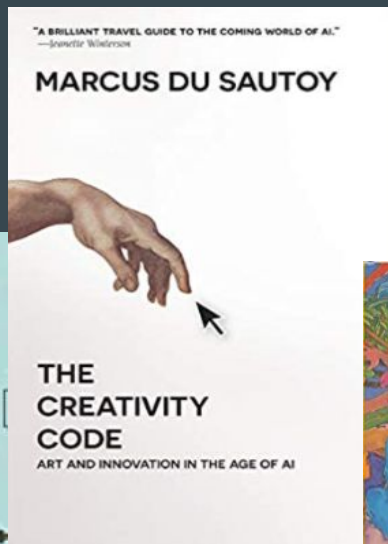
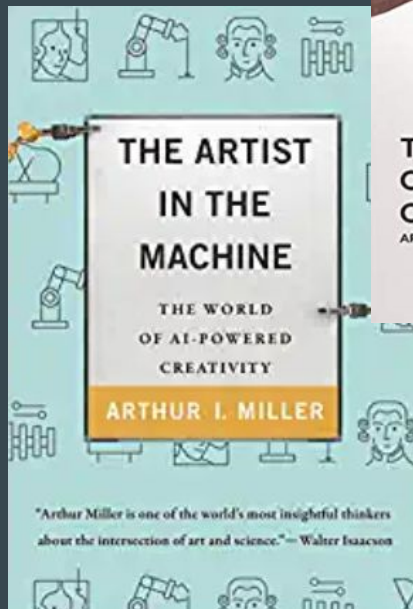
[NVIDIA AI Art Gallery](#)

[AIArtists.org](#)

[CVPR Computer Vision Art gallery](#)

[Serpentine Galleries: Arts Technologies](#)

Interesting Books



Explore

Test GPT-2 that generates text based on a given sample: <https://app.inferkit.com/demo>

AI Song Contest: <https://www.aisongcontest.com/>

Sony Flow Machines: <https://www.flow-machines.com/>

Deepmind AlphaGo:

<https://deepmind.com/research/case-studies/alphago-the-story-so-far>