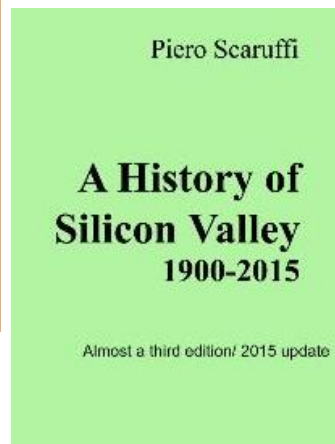
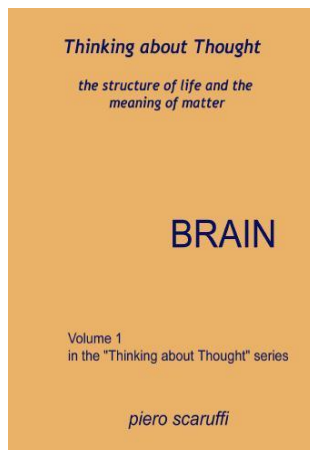
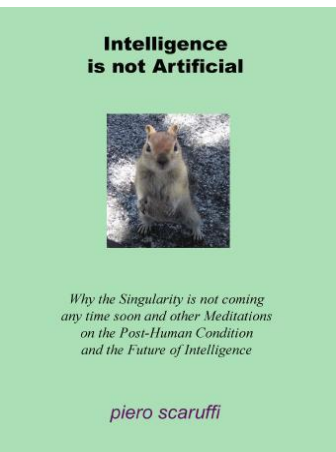


When A.I. makes art, is it still Art?

University of San Francisco
July 2016

Piero Scaruffi

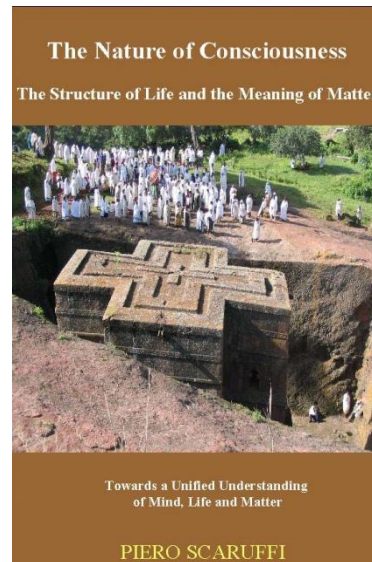
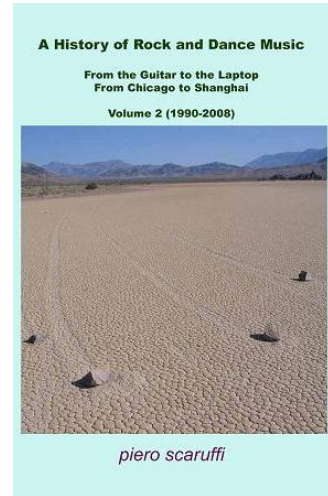
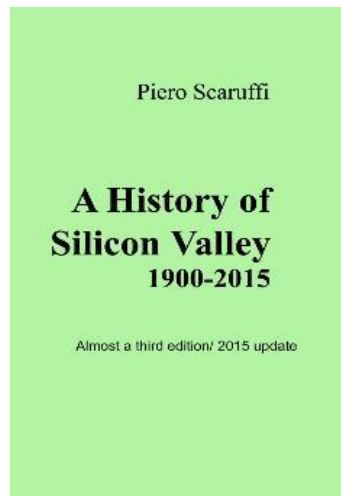
- piero scaruffi
p@scaruffi.com
scaruffi@stanford.edu



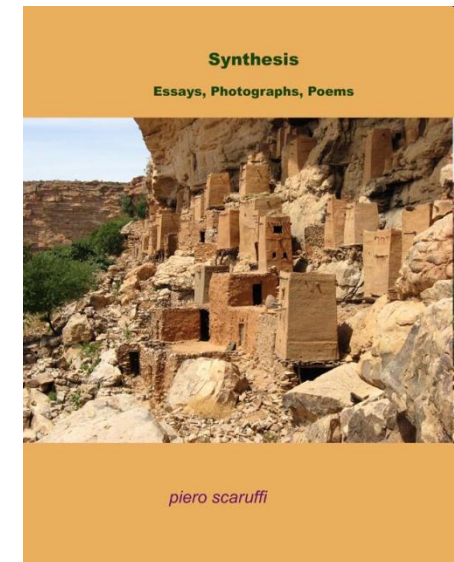
Olivetti AI Center, 1987

Piero Scaruffi

- Cultural Historian
- Cognitive Scientist
- Blogger
- Poet
- www.scaruffi.com



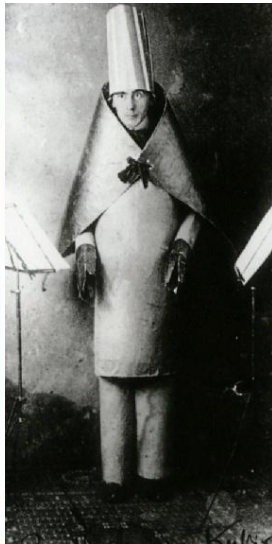
www.scaruffi.com



This is Part 10

- See <http://www.scaruffi.com/singular> for the index of this Powerpoint presentation and links to the other parts
 1. Classic A.I. - The Age of Expert Systems
 2. The A.I. Winter and the Return of Connectionism
 3. Theory: Knowledge-based Systems and Neural Networks
 4. Robots
 5. Bionics
 6. Singularity
 7. Critique
 8. The Future
 9. Applications
 10. Machine Art
 11. The Age of Deep Learning
 12. Natural Language Processing

A Simplified History of the Visual Arts from 1916 to 2016



This is an Artwork

- Paul Strand



"Abstraction, Twin Lakes,
Connecticut" (1916)

This is an Artwork

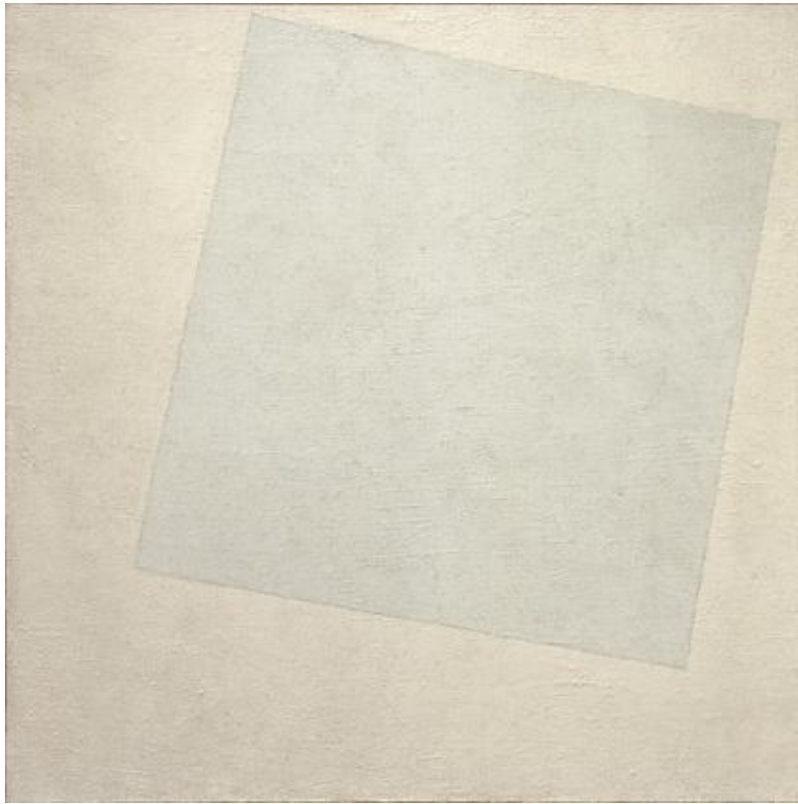
- Marcel Duchamp



“Fountain”
(1917)

This is an Artwork

- Kazimir Malevich



“White on White” (1918)

This is an Artwork

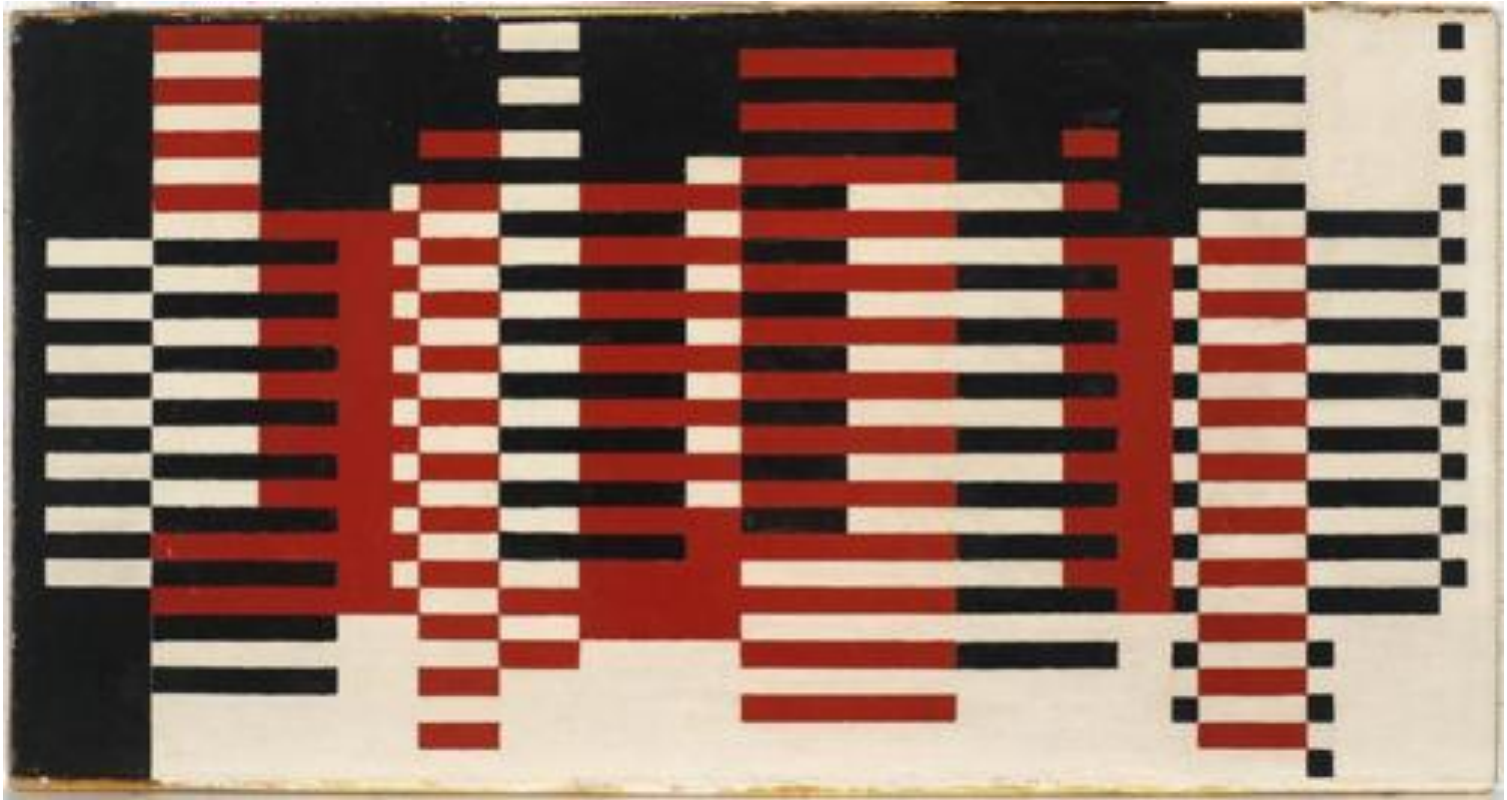
- Man Ray



“The Enigma of Isidore Ducasse” (1920),
a sewing machine wrapped in an army
blanket

This is an Artwork

- Josef Albers



“The City” (1928)

This is an Artwork

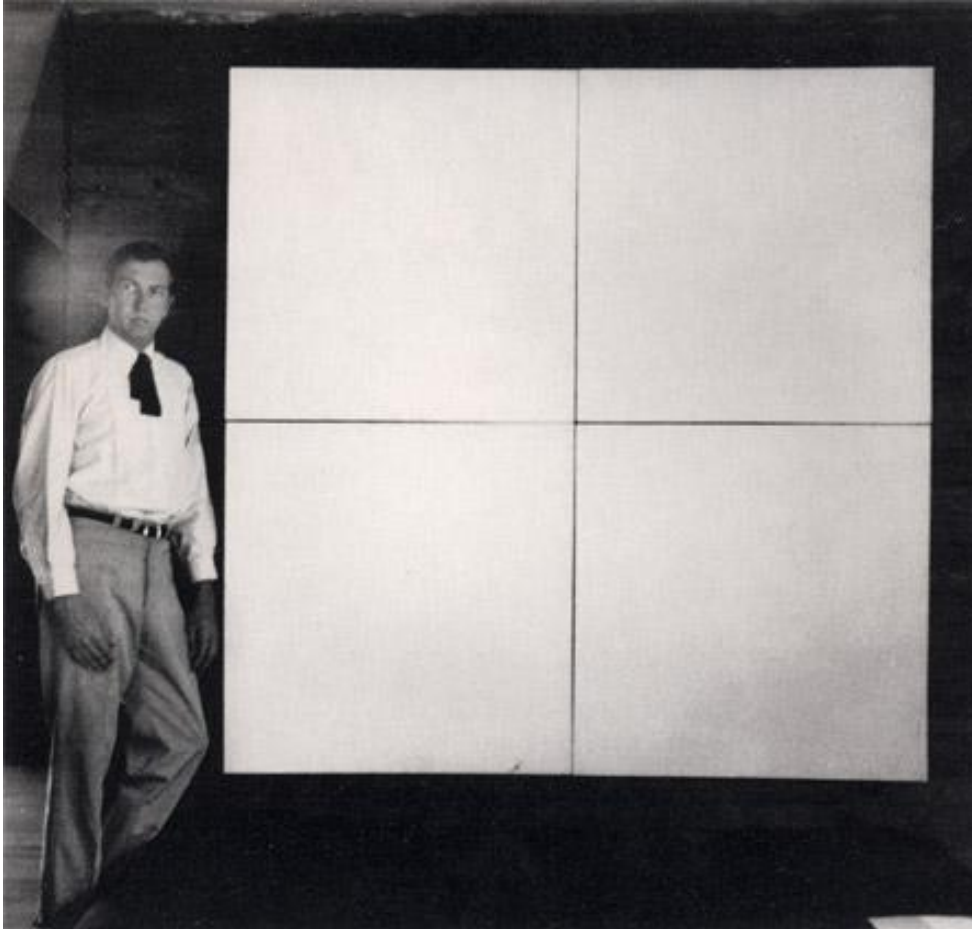
- Paul Klee



“Ad Parnassum” (1932)

This is an Artwork

- Robert Rauschenberg



(1951)

This is an Artwork

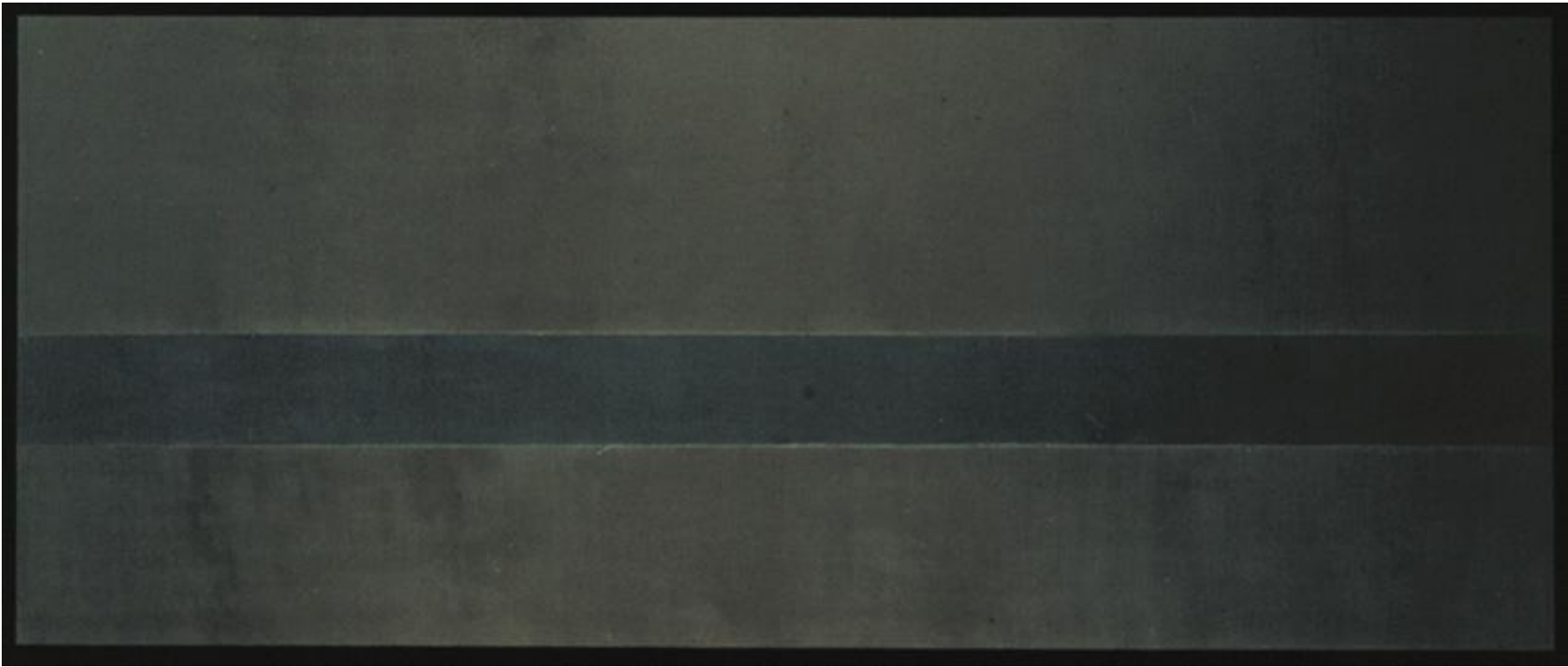
- Franz Kline



“High Street” (1956)

This is an Artwork

- Barnett Newman



Abraham, 1949

This is an Artwork

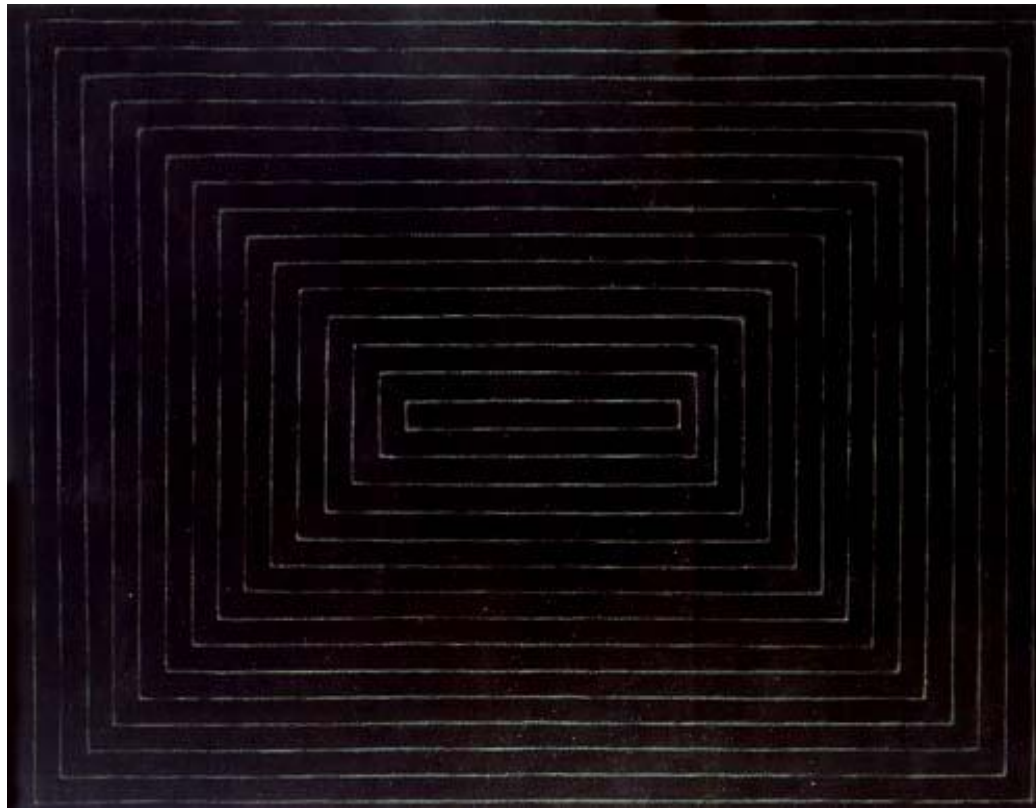
- Jackson Pollock



“Blue Poles” (1952)

This is an Artwork

- Frank Stella



(1959)

This is an Artwork

- Yves Klein (1928, France)



“Anthropometries of the Blue Period” (1960)

This is an Artwork

- Andy Warhol



“25 Marilyns” (1962)

This is an Artwork

- Shigeko Kubota



"Vagina Painting" (1965)

This is an Artwork

- Bruce Nauman



“Self Portrait as a Fountain” (1966)

This is an Artwork

- Henry Moore



"Oval with Points" (1970)

This is an Artwork

- Christo



The Reichstag (1971)

This is an Artwork

- Lynda Benglis



(Artforum advertisement1, 974)

This is an Artwork

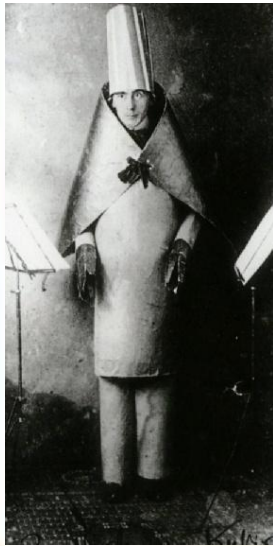
- Marina Abramovic



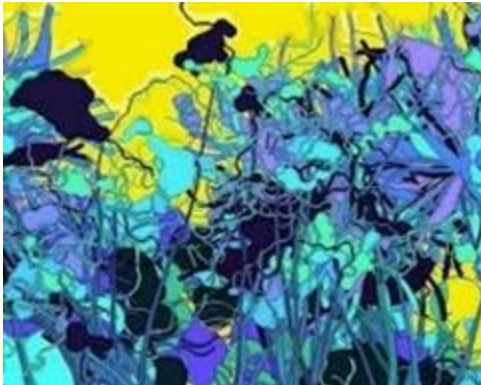
“Imponderabilia” (1977)

Human Art

Did you enjoy it?



A Short History of Machine Art



Machine Art

- Harold Cohen's painting machine AARON (1973)
- David Cope's automatic music composition (1981)
- William Chamberlain and Thomas Etter's poetry "The Policeman's Beard Is Half Constructed" (1983, subtitled "the first book ever written by a computer")
- Peter Todd's "A Connectionist Approach to Algorithmic Composition" (1989)
- Ken Goldberg's painting machine "Power and Water" (1992)

Machine Art

AARON



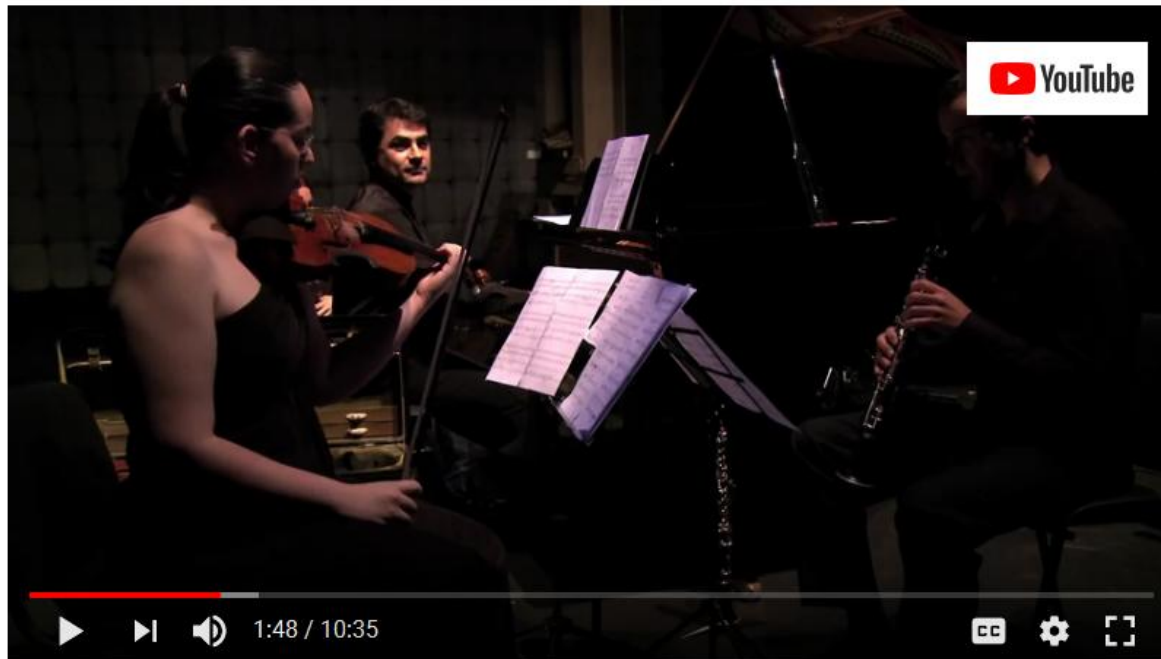
Machine Art

- Matthew Stein's online robotic artist PumaPaint (1998)
- Jurg Lehni's graffiti-spraying machine Hektor (2002)
- David Cope's music composer Emily Howell (2003, that release the albums "From Darkness Light" and "Breathless")
- Pindar Van Arman's painting robots (2006)
- Luke Kelly and Doug Marx's Vangobot to reproduce artistic styles (2008)



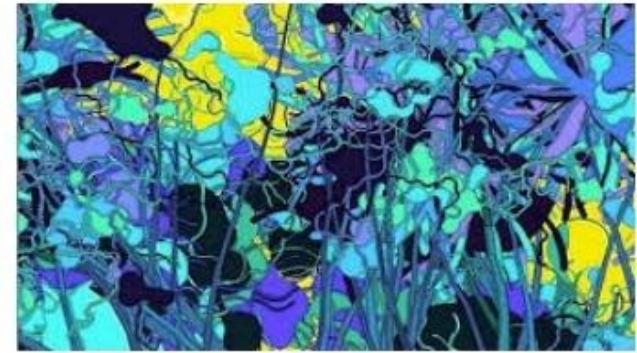
Machine Art

- Harvey Moon's drawing machines (2010)
- Patrick Tresset 's portrait-maker robot Paul (2011)
- The album "Iamus" (2012), that contains four computer-composed compositions for full orchestra performed by the London Symphony Orchestra



Machine Art

- Ken Stanley's polyphonic arranger MaestroGenesis (2012)
- Oliver Deussen's painting robot e-David (2013)
- Simon Colton's program The Painting Fool (2013)



Machine Art

- Supko & Bill Seaman's program that composes the album "S_traits" (2014, voted by the critics of the New York Times as one of the best recordings of the year)

The New York Times

Classical Critics Pick the Top Music Recordings of 2014

SIBELIUS, THOMAS ADÈS: VIOLIN CONCERTOS Augustin Hadelich, violinist; Royal Liverpool Philharmonic Orchestra, Hannu Lintu, conductor (Avie). The impressive young violinist Augustin Hadelich partners with the Royal Liverpool Philharmonic Orchestra and the conductor Hannu Lintu for an exciting performance of Thomas Adès's kaleidoscopic, emotional Violin Concerto "Concentric Paths" (2005) and a passionate rendition of the Sibelius Violin Concerto. **VIVIEN SCHWEITZER**

'S_TRAITS' Bill Seaman, media artist; John Supko, composer (Cotton Goods). This hypnotic disc is derived from more than 110 hours of audio sourced from field recordings, digital noise, documentaries and piano music. A software program developed by the composer John Supko juxtaposed samples from the audio database into multitrack compositions; he and the media artist Bill Seaman then finessed the computer's handiwork into these often eerily beautiful tracks. **VIVIEN SCHWEITZER**

TRIO MEDIAEVAL: 'AQUILONIS' (ECM New Series). So varied are the sources — from 12th-century Italian devotional songs to contemporary

Deep Learning Art

- Andrew Zisserman (2014): visualizing what a neural network is learning while it is being trained

Deep Inside Convolutional Networks: Visualising Image Classification Models and Saliency Maps

Karen Simonyan

Andrea Vedaldi

Andrew Zisserman

Visual Geometry Group, University of Oxford
{karen, vedaldi, az}@robots.ox.ac.uk

Abstract

This paper addresses the visualisation of image classification models, learnt using deep Convolutional Networks (ConvNets). We consider two visualisation techniques, based on computing the gradient of the class score with respect to the input image. The first one generates an image, which maximises the class score [5], thus visualising the notion of the class, captured by a ConvNet. The second technique computes a class saliency map, specific to a given image and class. We show that such maps can be employed for weakly supervised object segmentation using classification ConvNets. Finally, we establish the connection between the gradient-based ConvNet visualisation methods and deconvolutional networks [13].

Deep Learning Art

Understanding Deep Image Representations by Inverting Them

Aravindh Mahendran
University of Oxford

Andrea Vedaldi
University of Oxford



Deep Learning Art

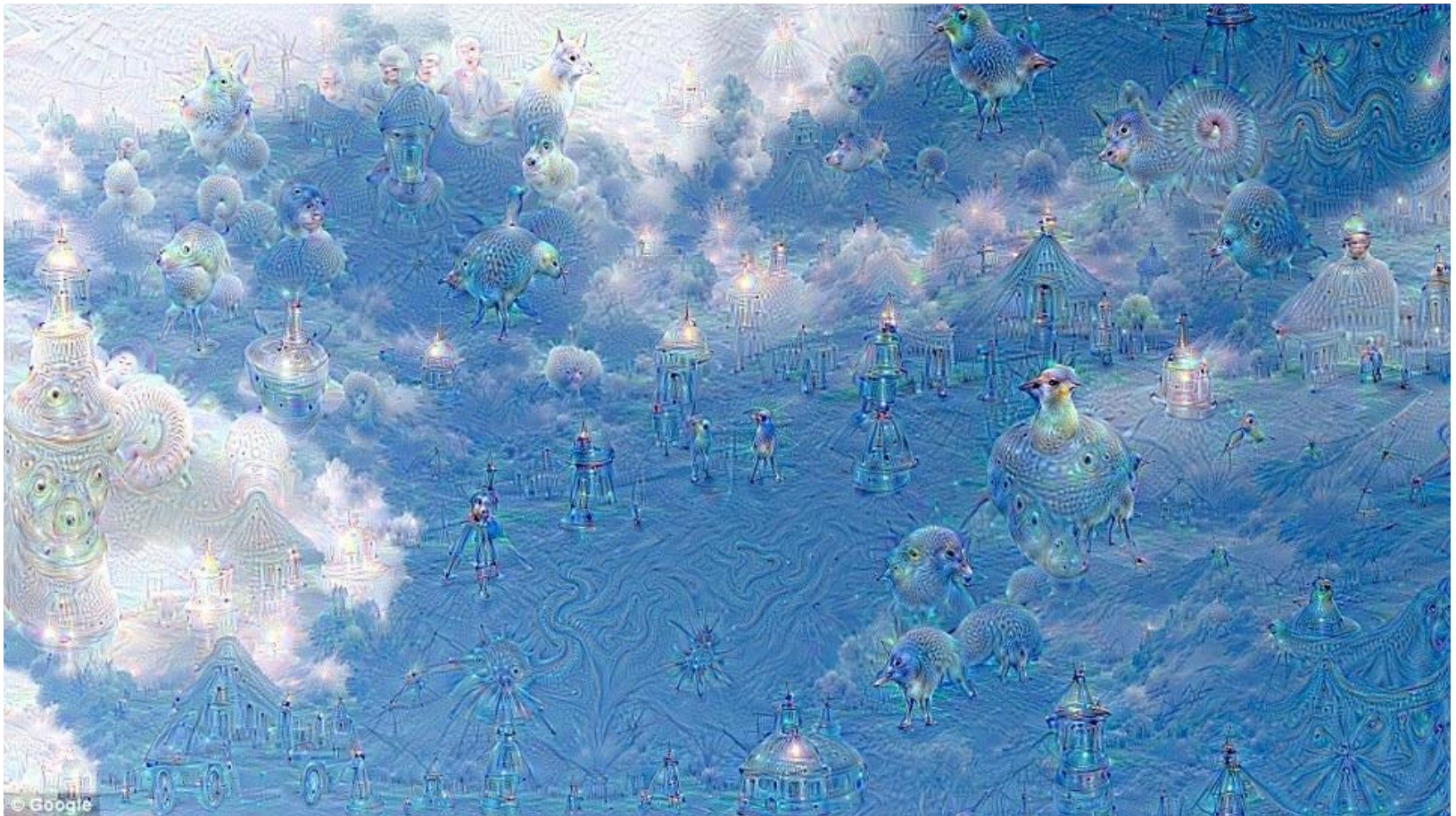
Andrea Vedaldi

Visualising deep networks



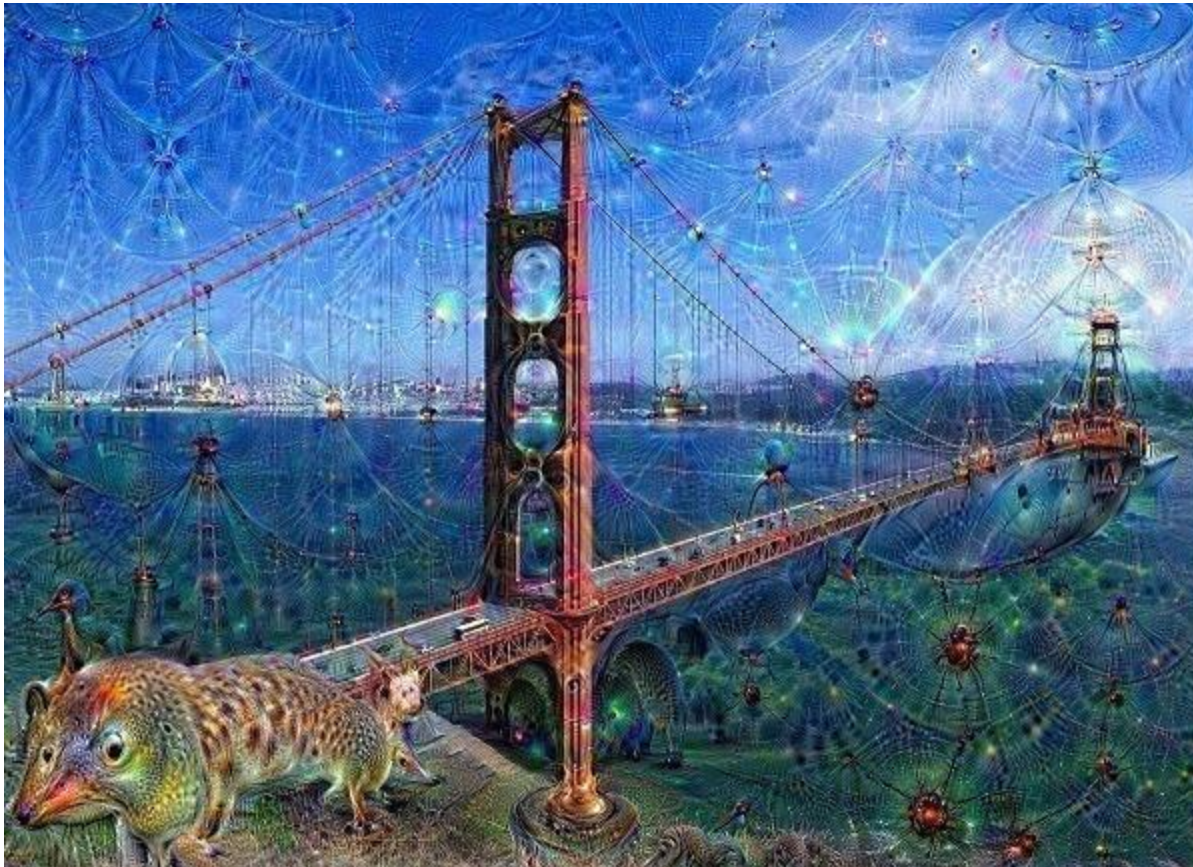
Is this an Artwork?

- Alexander Mordvintsev's "Inceptionism" (2015)



Is this an Artwork?

- Alexander Mordvintsev's "Inceptionism" (2015)



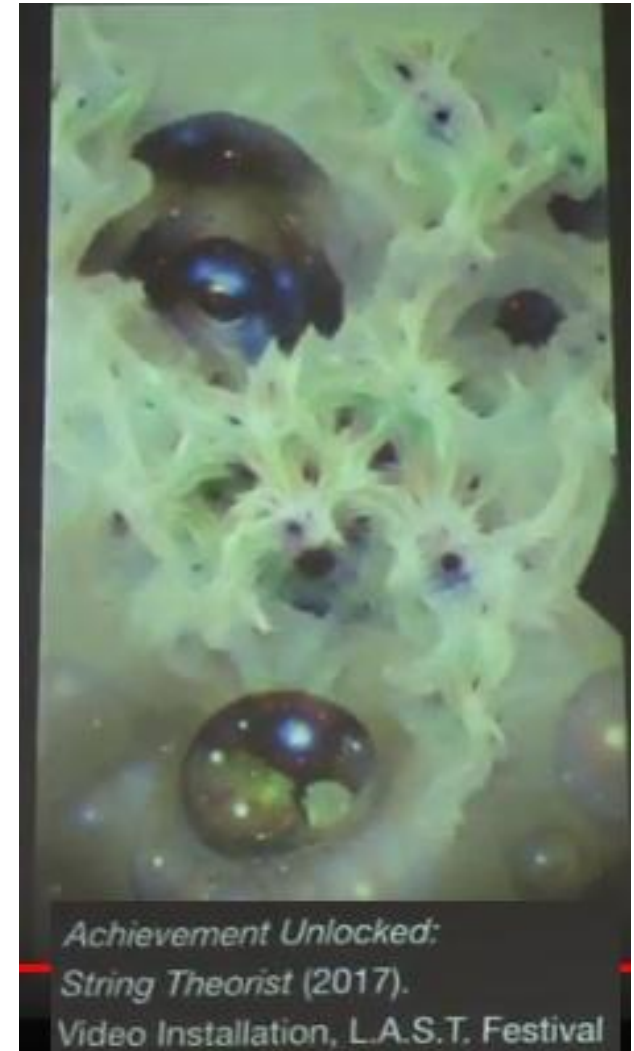
Is this an Artwork?

- Audun M. Øygard (2015)



Is this an Artwork?

- Gary Boodhoo (2016)

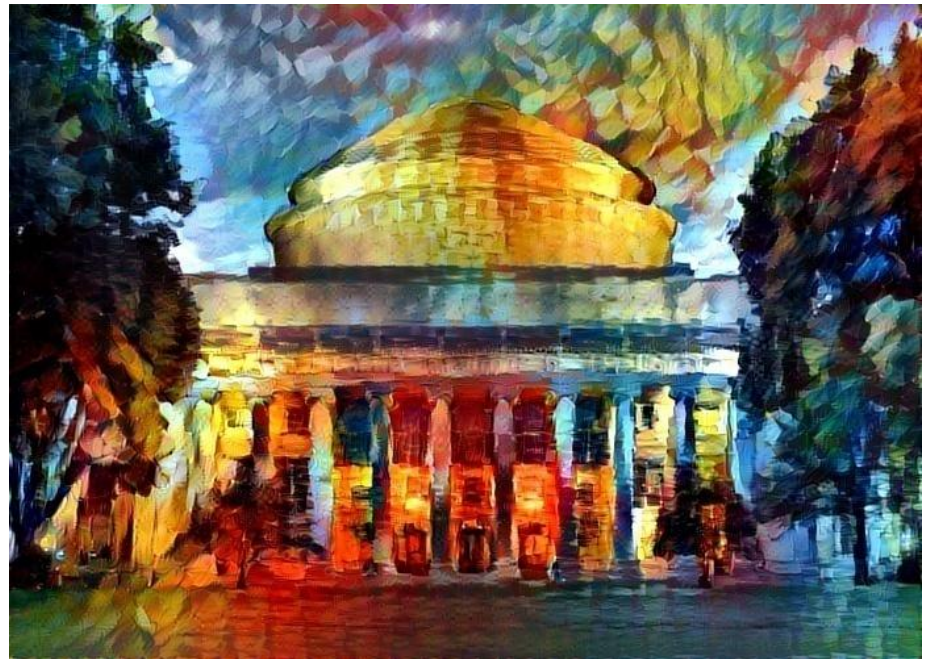


Is this an Artwork?

Leon Gatys and Alexander Ecker's "A Neural Algorithm of Artistic Style" (2015)



Leonid Afremov

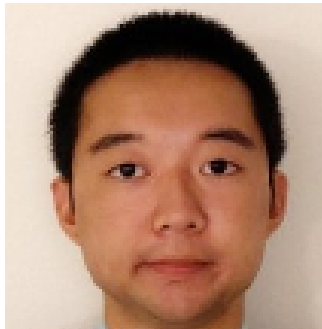


Neural Network

Is this Art?

Visually-Aware Fashion Recommendation and Design with Generative Image Models

Wang-Cheng Kang
UC San Diego



Chen Fang
Adobe Research

Zhaowen Wang
Adobe Research

Julian McAuley
UC San Diego



CNN + GAN = Learn a person's favorite style of fashion and generate personalized clothing



(a) Generated Images



Is this an Artwork?

- William Anderson used old-fashioned Markov chains (2017)



Using Machine Learning to Make Art

Markov chains are probably best known for powering autocomplete on search engines. Here's what happened when I applied them to art.



William Anderson
May 10

Is this an Artwork?

- Joris Dik : a new 3D-printed “Rembrandt” portrait (2016)



Is this an Artwork?

- Donya Quick (2015): automated music composition



Donya Quick performs a piece composed using the Kulitta software.

Is this an Artwork?

USC's A.I. (2016)

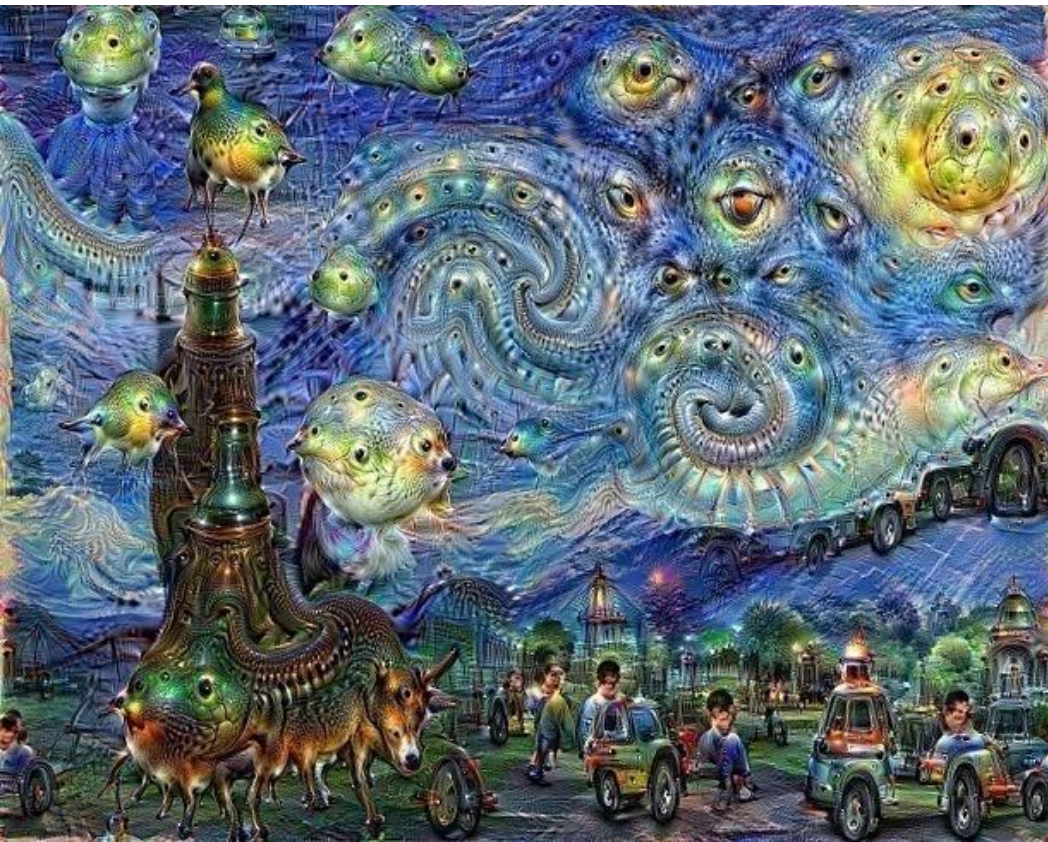
*“And from the other side of my apartment/
An empty room behind the inner wall/
A thousand pictures on the kitchen floor/
Talked about a hundred years or more”*

Is this an Artwork?

artnet[®]news

Google's 'Inceptionism' Art Sells Big at San Francisco Auction

You've never seen 'Starry Night' like this before.



Is this an Artwork?

WaveNet (2016)

Ross Goodwin (2016)

Google's WaveNet uses neural nets to generate eerily convincing speech and music

Posted Sep 9, 2016 by *Devin Coldewey*



ars TECHNICA

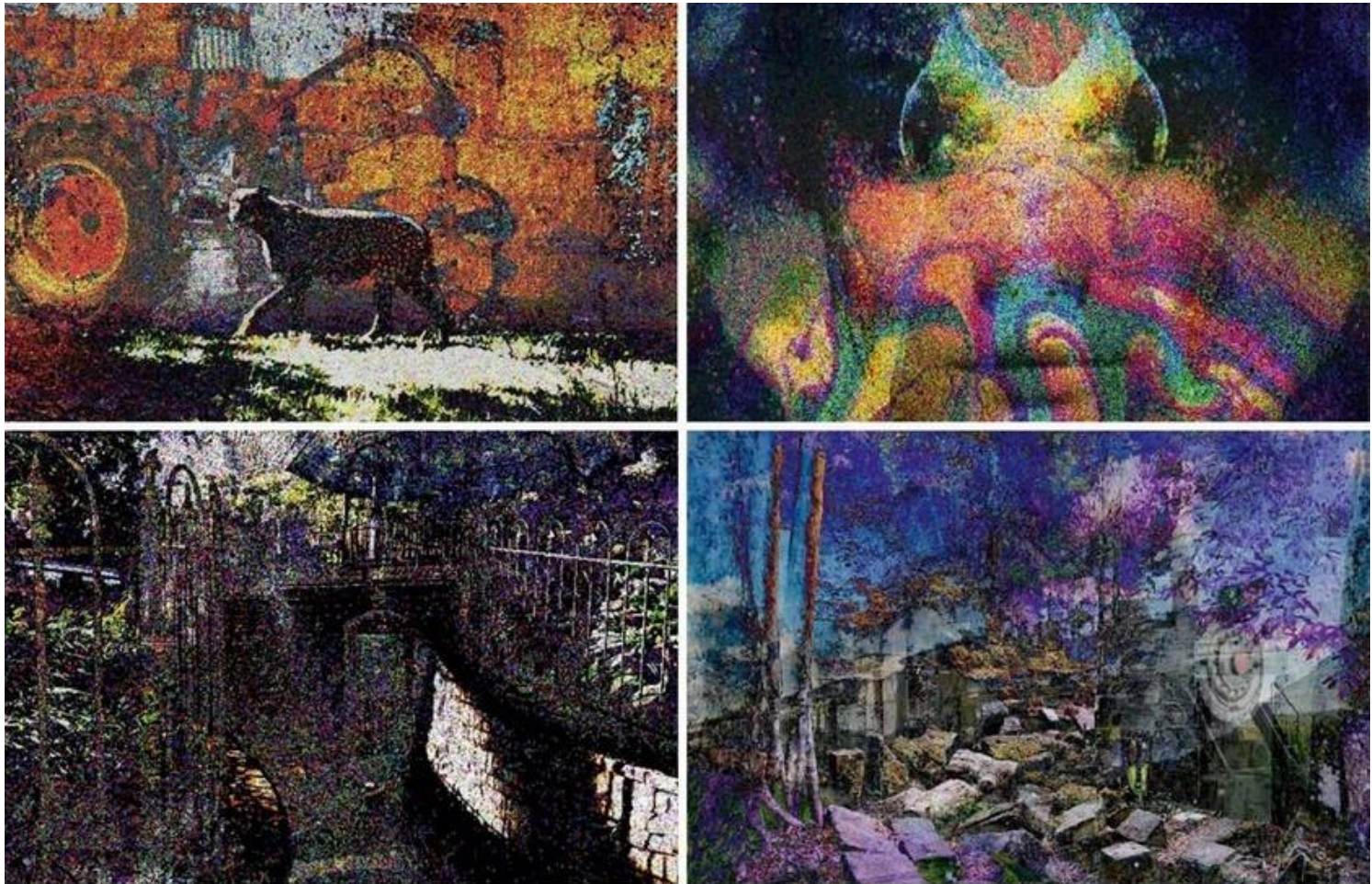
6/9/2016,

**Movie written by algorithm
turns out to be
hilarious and intense**



Is this an Artwork?

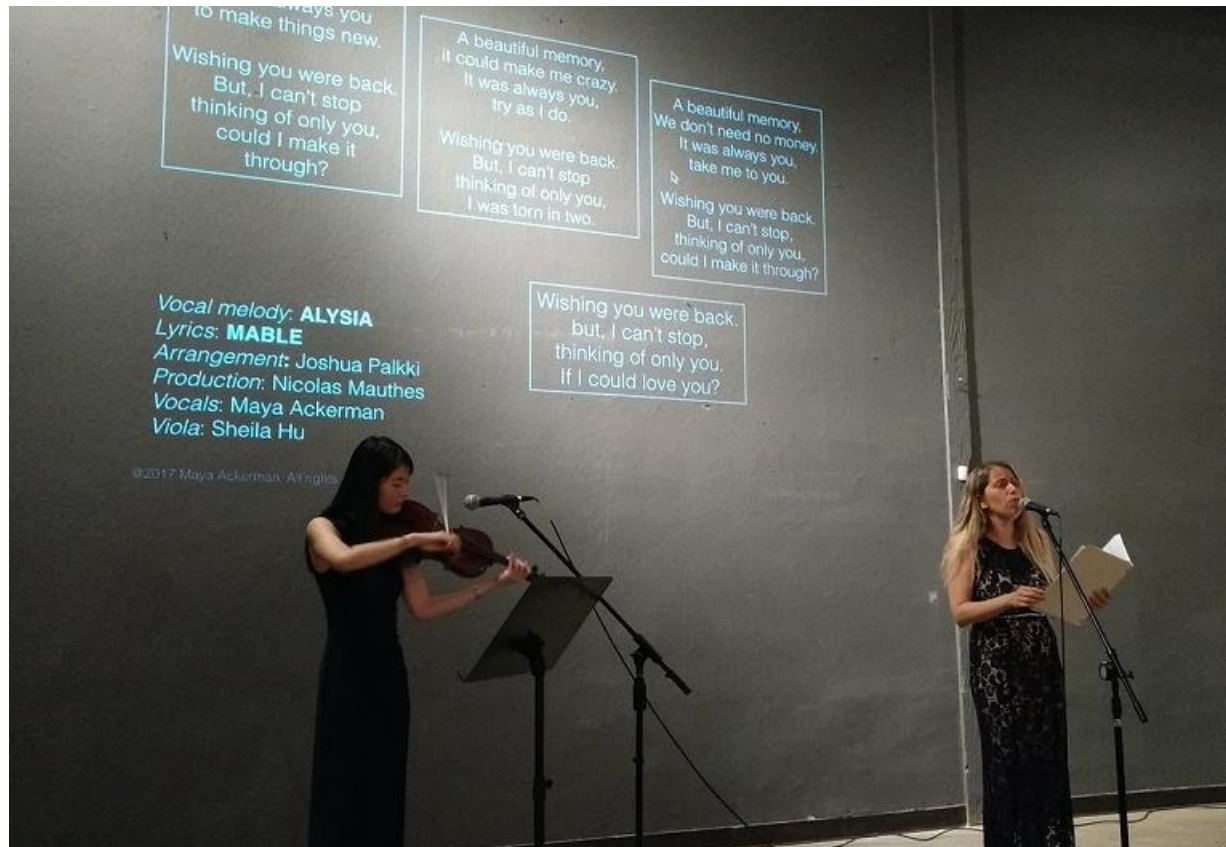
Stephen Thaler's DABUS (2017)



DABUS's output gets progressively more surreal as cognitive flow is reduced

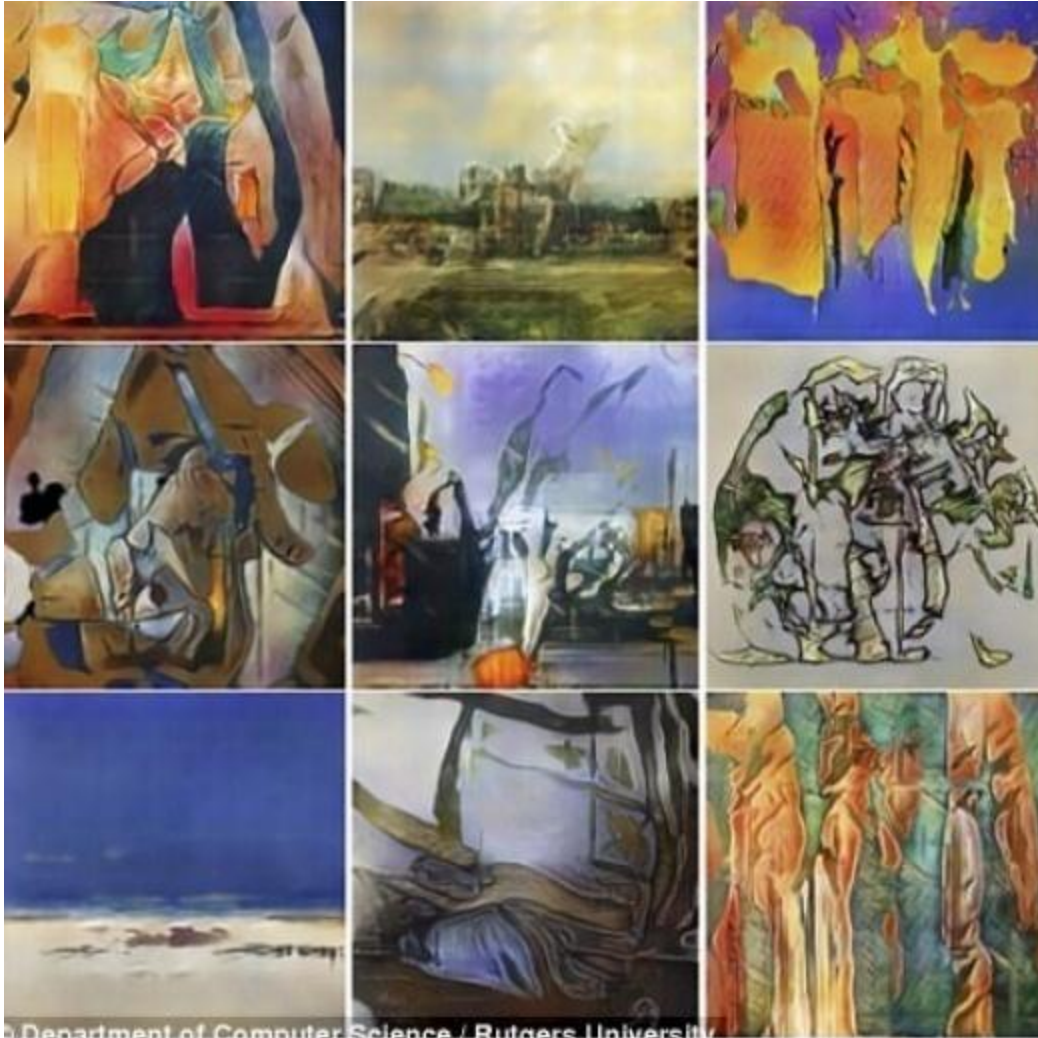
Is this an Artwork?

Maya Ackerman performing music and lyrics composed by algorithms Alysia and Mable (San Jose L.A.S.E.R., 2017)



AI Art

- AI generates new style of art: Ahmed Elgammal (Rutgers)



CAN: Creative Adversarial Networks
Generating “Art” by Learning About Styles and
Deviating from Style Norms*

Ahmed Elgammal^{1†} Bingchen Liu¹ Mohamed Elhoseiny² Marian Mazzone³
The Art & AI Laboratory - Rutgers University

¹ Department of Computer Science, Rutgers University, NJ, USA

² Facebook AI Research, CA, USA

³ Department of Art History, College of Charleston, SC, USA

June 23, 2017

AI Art

- Mario Klingemann (Google artist in residence 2016)



"Memories of Passersby I" (2018)



AI Art

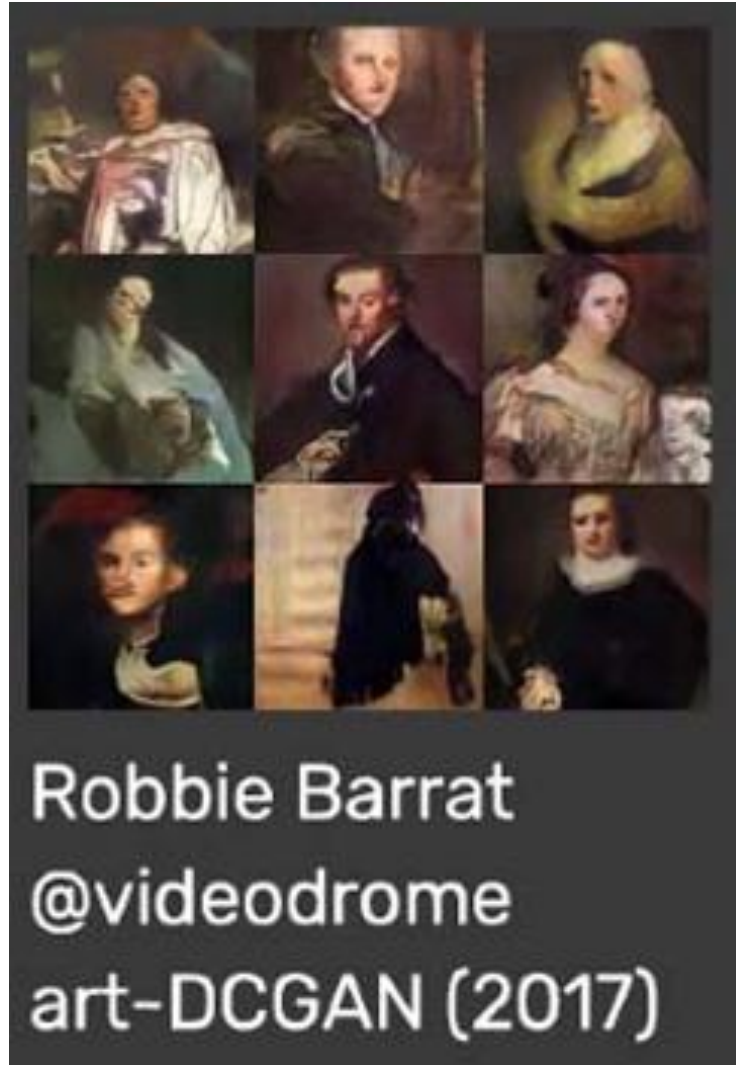
- GAN artists: Obvious



Obvious
@obv_ious
Edmond de Belamy (2018)

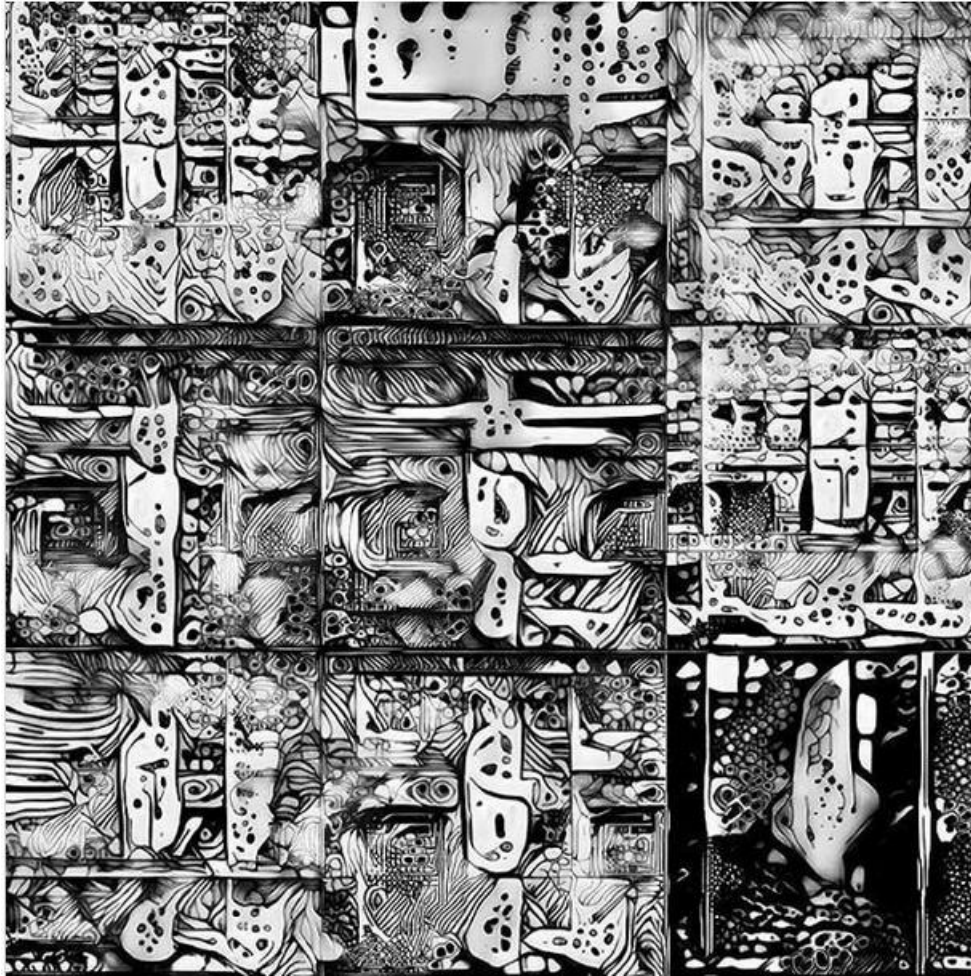
AI Art

- GAN artists: Robbie Barrat



AI Art

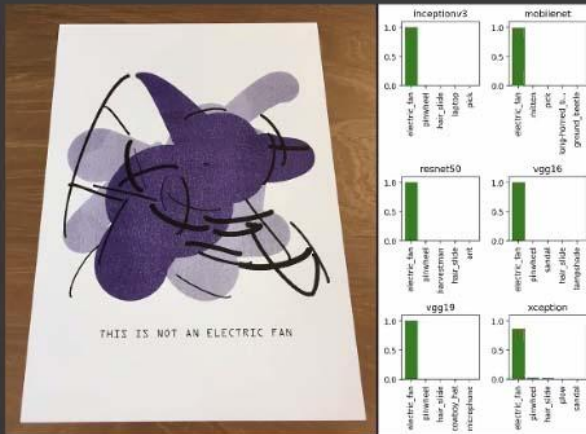
- GAN artists: Helena Sarin



AI Art

- GAN artists: Tom White

Treachery of ImageNet (2017)

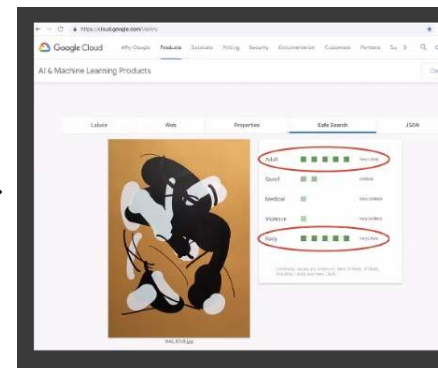


How do modern AI algorithms perceive common objects?

- Machines have their own way of seeing
- We can create art for and by machines
- Through art we can appreciate the ways that machines perceive the world

Perception Engines (2018)

10 riso prints



Fails Google Safe Search: extremely "Adult" and "Racy"

Amazon considers this "Explicit Nudity"

Yahoo considers this "NSFW"

AI Art

- GAN artists: Tom White

Killer Whale



Killer Whale	98%
Marine Mammal	83%
Illustration	79%
Cetacea	77%
Whale	76%
Art	63%
Dolphin	57%
Tail	53%

Penguin



Penguin	99%
Flightless Bird	98%
Bird	95%
Stencil	73%
Art	63%
Illustration	60%
Beak	54%
Fictional Character	53%
Adorable Penguin	52%
Emperor Penguin	51%

AI Art

- Robot artist: Ai-Da



Aidan Meller

Introducing Ai-da,
the world's first
ultra-realistic
humanoid AI robot
artist



Ai-Da with Her Paintings. Photo by Victor Franko

"AI Robot Artist"

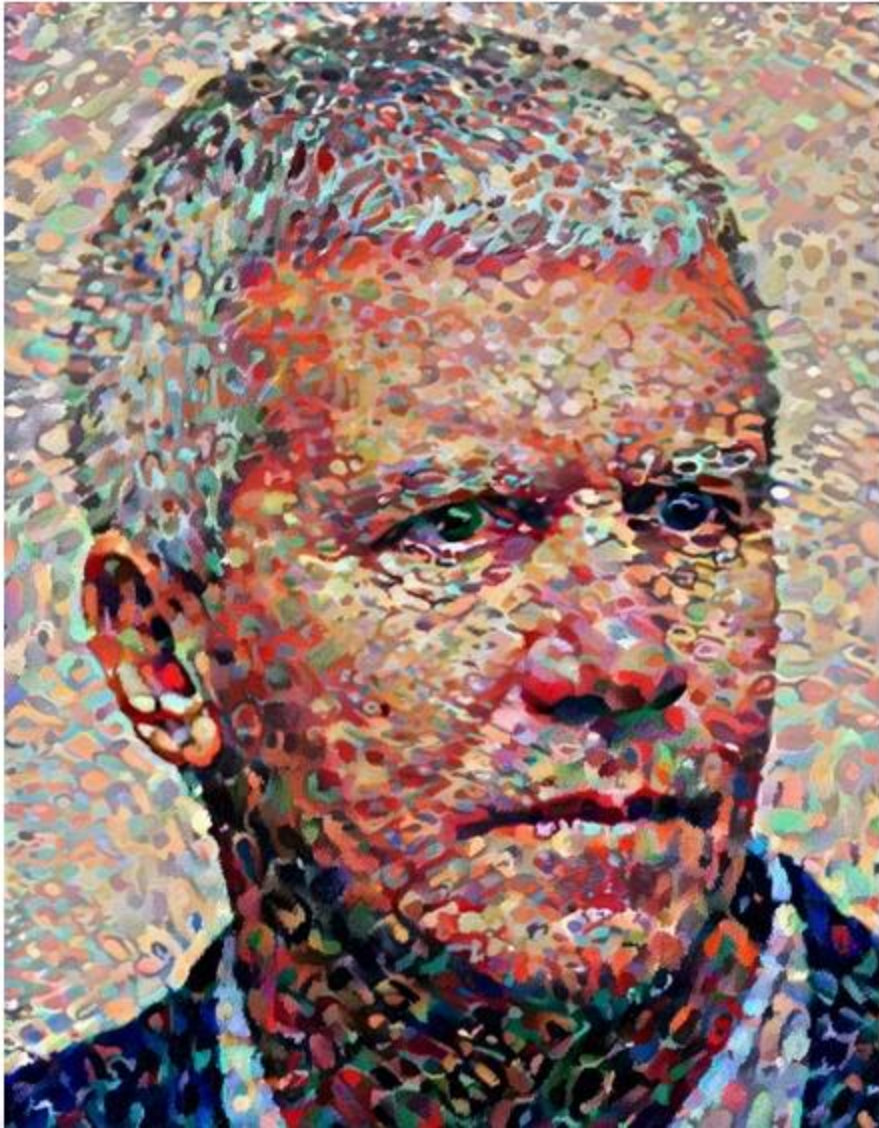


Ai-Da

Engineered Arts

<https://ai-darobot.com/>

AI Art



artificial intelligence
THE END OF ART AS WE KNOW IT

the most famous artist

The McLoughlin Gallery

11a - 6p
Tuesday June 27
49 Geary St #200

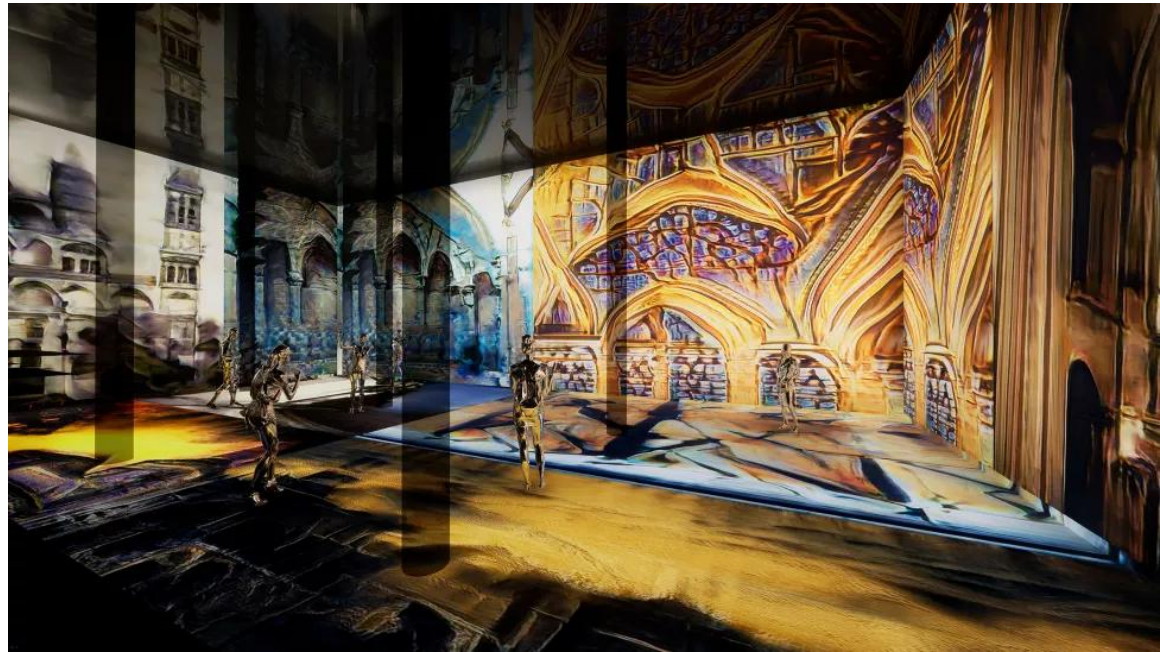
AI Art

- Refik Anadol: interactive installations



“Melting Memories” (2018)

“Machine Hallucination” (2019)



AI Art

- The AI-Art Boom (2019)



Is This an Artwork?

- Blaise Aguera y Arcas, principal scientist at Google (2016):

"We're on the edge of a new frontier in art and creativity — and it's not human"



Is This an Artwork?

Artificial Intelligence

A New AI Can Write Music as Well as a Human Composer

Aiva

Genesis

SOUNDCLOUD

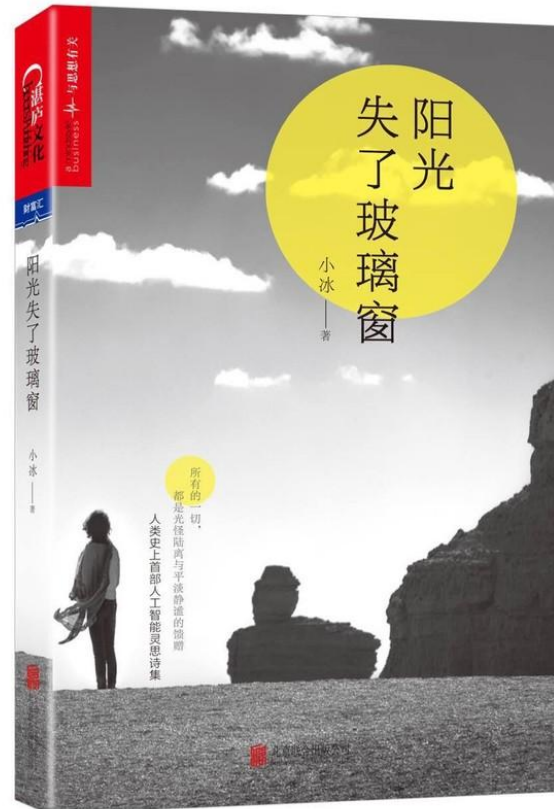
24 TRACKS



Futurism.com, 2017

Is This an Artwork?

- A poetry book written by Microsoft's chatbot Xiaoice published in May 2017



Is This an Artwork?

- Paris-based art collective Obvious: “Portrait of Edmond Belamy” (2018), made by a neural network trained with a dataset of 15,000 portraits painted between the 14th and 20th centuries, sells at a New York auction for \$432,500



Portrait of Edmond de Belamy.

Is This an Artwork?

- AICAN (Ahmed Elgammal, Rutgers, 2017): CAN (Creative Adversarial Networks)

AICAN
SCOPE Miami Beach 2018



AICAN
End Between Heaven and Earth, 2017
AICAN
\$25,000
Clemente Gallery



AICAN
The Last Rites, 2018
AICAN
\$8,500
Clemente Gallery



AICAN
Chop Rising, 2018
AICAN
\$8,500
Clemente Gallery



AICAN
Divided Jerusalem, 2018



AICAN
The Last Rites, 2018



AICAN
Psychiatric Illness, 2018



Ahmed Elgammal



Is This an Artwork?

- AICAN (solo exhibition, New York, 2019)



HG
CONTEMPORARY

AICAN + AHMED ELGAMMAL

HG CONTEMPORARY NEW YORK

2/12/2019



Is This an Artwork?

- OpenAI Jukebox (2020)



Jukebox

We're introducing Jukebox, a neural net that generates music, including rudimentary singing, as raw audio in a variety of genres and artist styles. We're releasing the model weights and code, along with a tool to explore the generated samples.

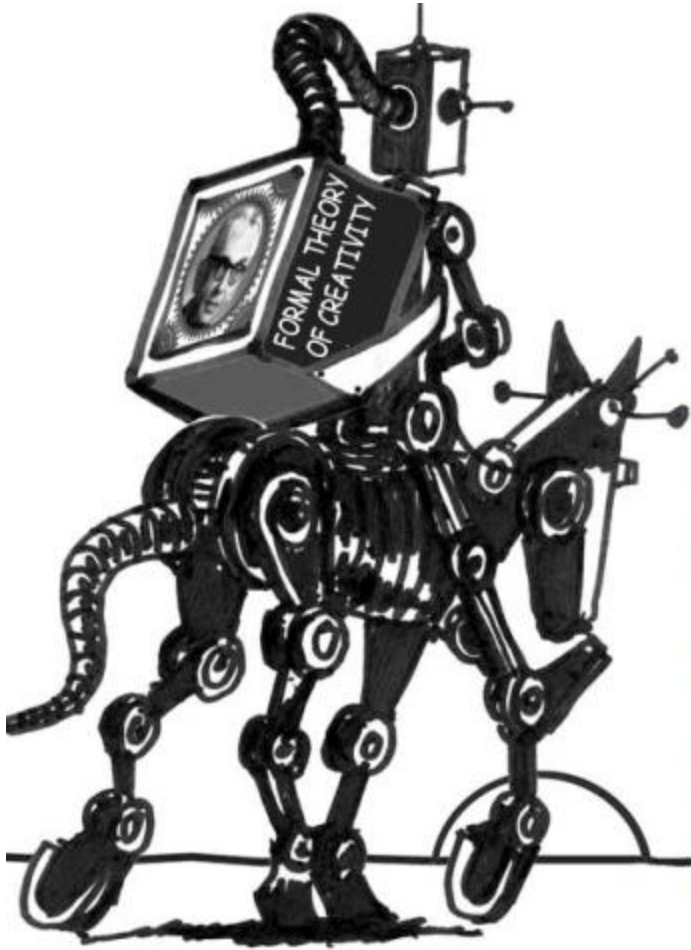
 [READ PAPER](#)

 [VIEW CODE](#)



APRIL 30, 2020
12 MINUTE READ, 10 DAY LISTEN

Juergen Schmidhuber



FORMAL THEORY OF FUN
& NOVELTY & SURPRISE &
ATTENTION & CREATIVITY &
CURIOSITY & ART & SCIENCE &
HUMOR

schmidhuber

<http://www.idsia.ch/~juergen/creativity.html>

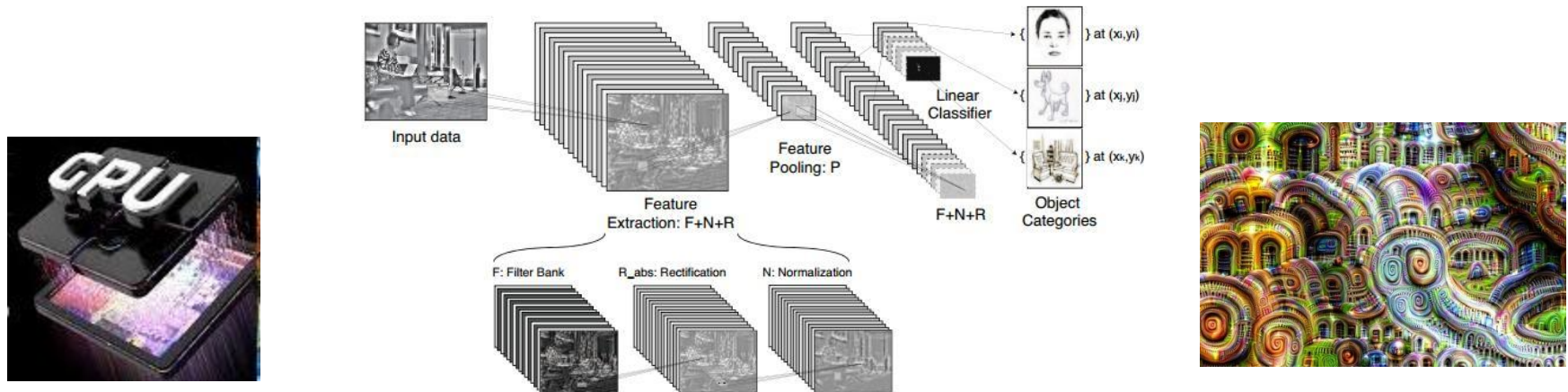
Discussion

- Authorship: Who is the creator of Art?
- Institutionalization: Who decides what is Art?
- Interpretation: What is the meaning/ purpose/ function/ value of Art?

Authorship

- Who should take credit?

Convolutional Network



Architecture of a typical convolutional network for object recognition

From a paper by Yann LeCun



*Che fai tu, luna, in ciel? dimmi, che fai,
Silenziosa luna?
Sorgi la sera, e vai,
Contemplando i deserti; indi ti posi.
Ancor non sei tu paga
Di riandare i sempiterni calli?*₇₀

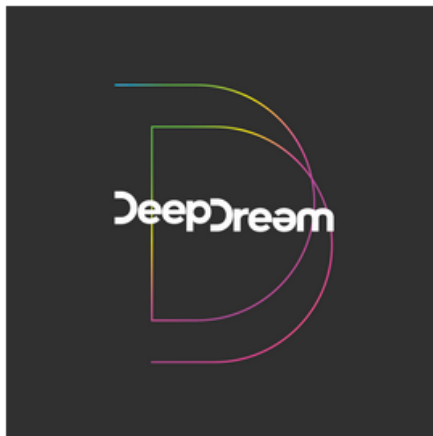
Leopardi, “Canto notturno di un pastore errante dell'Asia”

Authorship

- Natural beauty vs constructed beauty? Is any beauty not natural?

Authorship

- What did the art collectors buy at the DeepDreams auction? The output of a neural network is a digital file, which can be copied in a split second. The only way to guarantee that no other copies will be made is to physically destroy the neural network.



Gray Area Foundation for the Arts and Research at Google invite you to join us for a benefit auction and art exhibition of: **DeepDream: The art of neural networks** a special gallery show of artworks made using artificial neural networks. The entire limited edition collection of works will be auctioned during this special evening.

Institutionalization

- Who decides what is Art?
- Everything is potentially Art

Institutionalization

- What does it take to be called Art?



Institutionalization

- What does it take to be called Art?



Institutionalization

- What does it take to be called Art?



Institutionalization

- Even harder to decide what is Art in “the age of mechanical reproduction”
- Art is what the Pope, the princes, the art critic, the art gallery, the art museum decide that it is Art
- Art is **NOT** in the eye of the beholder

Institutionalization

- Art is communication, but art is more **the noise** than **the signal** (**style/ content**)
- Art is useless

Interpretation

- What is the meaning/function/value of Art?
- Why care?
- Isn't Science enough?
- If an artist creates and never shows it to anyone, is it art?
- Art is a dialog between the artist and society

Interpretation

- What goes into a museum?
 - Michelangelo's David was commissioned by the Church for a cathedral
 - It was instead placed in a public square (1504)
 - Today the statue is at the Galleria dell'Accademia
 - It has been displayed in the cathedral only once for one day (12 November 2010) and it was a replica
 - A replica stands in the public square

Interpretation

- What goes into a museum?
 - The David?
 - The marble?
 - Michelangelo?
 - ?

Interpretation

- Art is a process
- To understand why something is reputed beautiful by someone you have to understand a whole system, its history, its values, its processes
- Aesthetic experience cannot be reduced to a simple "Like"

Interpretation

- Who appreciates human art? Humans.
- Who appreciates machine art? Humans.



David Hickey



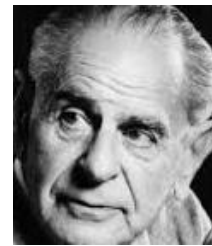
Rosalind Krauss



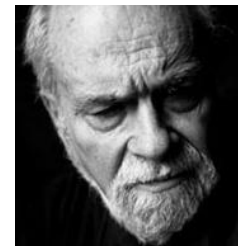
Lucy Lippard



Brian Sewell



Frank Popper



Arthur Danto



Philippe Daverio

Interpretation

- Can a machine critique its own work of art?
Or the work of art of another machine? Or
the work of art of a human artist?

Appendix

- For the record...
- Beauty in Science: solving a complex problem in a simple way

Appendix

- The way that a neural network can be “hijacked” to do art may help understand the brain of the artist.

What is Creativity?

- Joy-Paul Guilford: "Creativity" (1950)
- Frank Barron: "Creativity and Psychological Health" (1963)
- Arthur Koestler: "The Act of Creation" (1964)
- Howard Gardner: "Frames of Mind" (1983)
- Margaret Boden: "The Creative Mind" (1990)
- Douglas Hofstadter: "Fluid Concepts and Creative Analogies" (1995)

Next...

- See <http://www.scaruffi.com/singular> for the index of this Powerpoint presentation and links to the other parts

Intelligence is not Artificial

Expanded Edition

Past, Present and Future
of Artificial Intelligence



*Why the Singularity is not coming
any time soon.*

*Life in the coming age of
incredibly stupid machines.*