

*Insegnare STEAM
con la didattica digitale
la realtà aumentata*

Grzegorz Karwasz

Lezione 7, Parte III: Intelligenza artificiale (AI)

Computational support for all



From calculators to software tools and thinking machines.

- Prehistory: Ramon Llull (13th C), Gottfried F. Leibniz (17th C), Alan Turing, John von Neumann, Marvin Minsky, Allen Newell, Herbert Simon ...
- Computational physics – Cormack, Hounsfield, Nobel 1979 CT Tomography.
- Computer chemistry – J. Pople, Nobel in chemistry 1998
- Bioinformatics – Karplus, Levitt, Warshel, Nobel in Chemistry 2013.
- Materials engineering – numerous software tools.
- In psychology, sociology, law, medicine, brain research – many tools.
- Artificial Intelligence – in all areas, numerous easy-to-use tools.

Computational science: how to use IT tools to solve difficult problems?

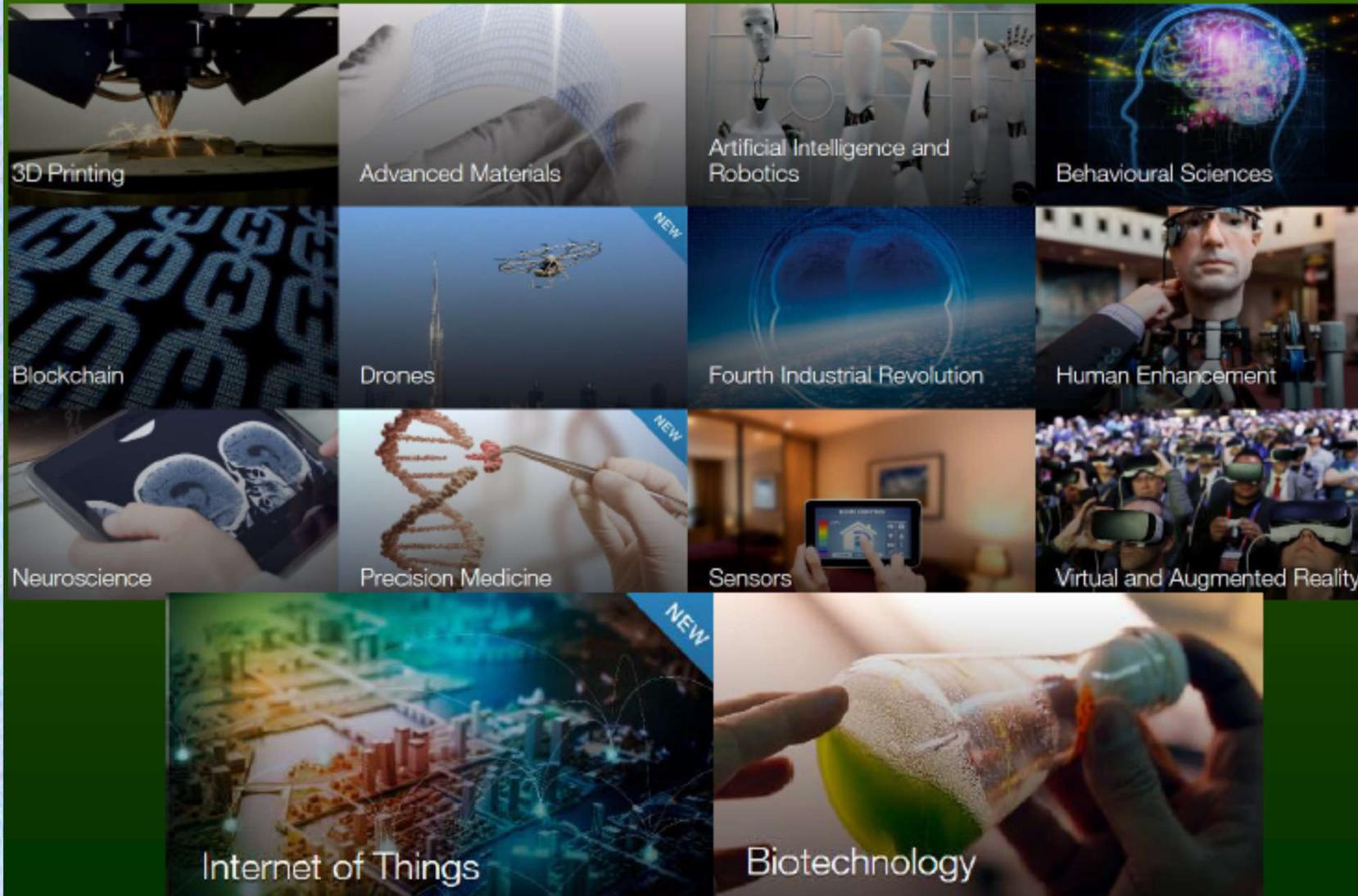
Teach informatics + specialization, or vice versa? Major / minor US system?

1994, Albuquerque, USA Department of Energy conference on how to use supercomputers – computational sciences that we still do not have.

Credits: Wodzislaw Duch

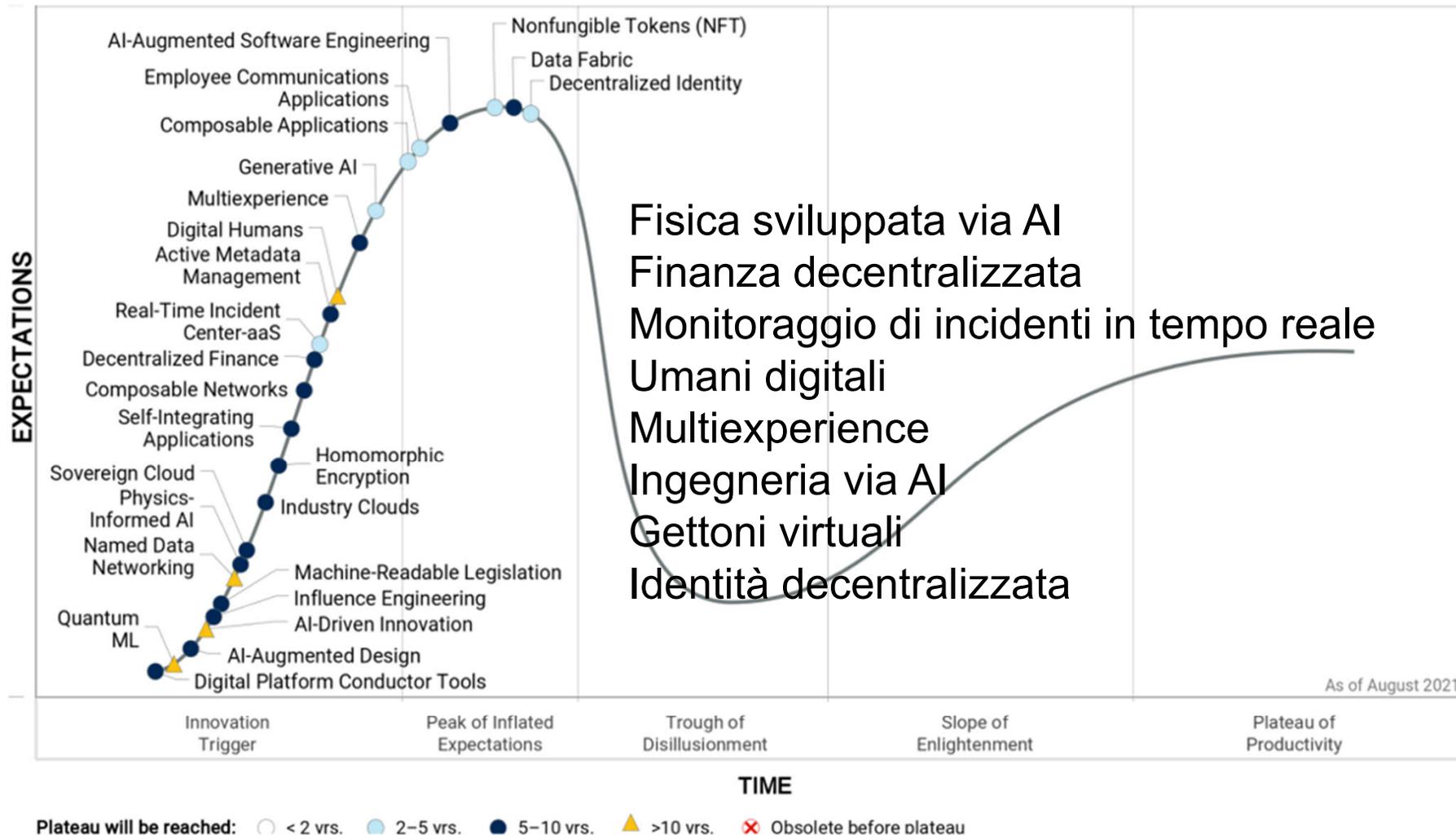
La quarta rivoluzione industriale

WEF: 4th Industrial Revolution driven by AI/neuro



<https://toplink.weforum.org/knowledge/explore/4th-industrial-revolution>

Le tecnologie del futuro (il ciclo di Gartner)



Source: Gartner (August 2021)

747576

<https://www.gartner.com/en/newsroom/press-releases/2021-08-23-gartner-identifies-key-emerging-technologies-spurring-innovation-through-trust-growth-and-change>

Cerebras CS-2

Neuromorphic future

Wall with 1024 TrueNorth chips, equivalent of 1 Billion neurons, 256 B synapses.
1/6 of chimp brain. Cerebras CS-2 chip has 2600 B transistors, almost 1M cores!

Integration:

Nano +

Neuro +

Info +

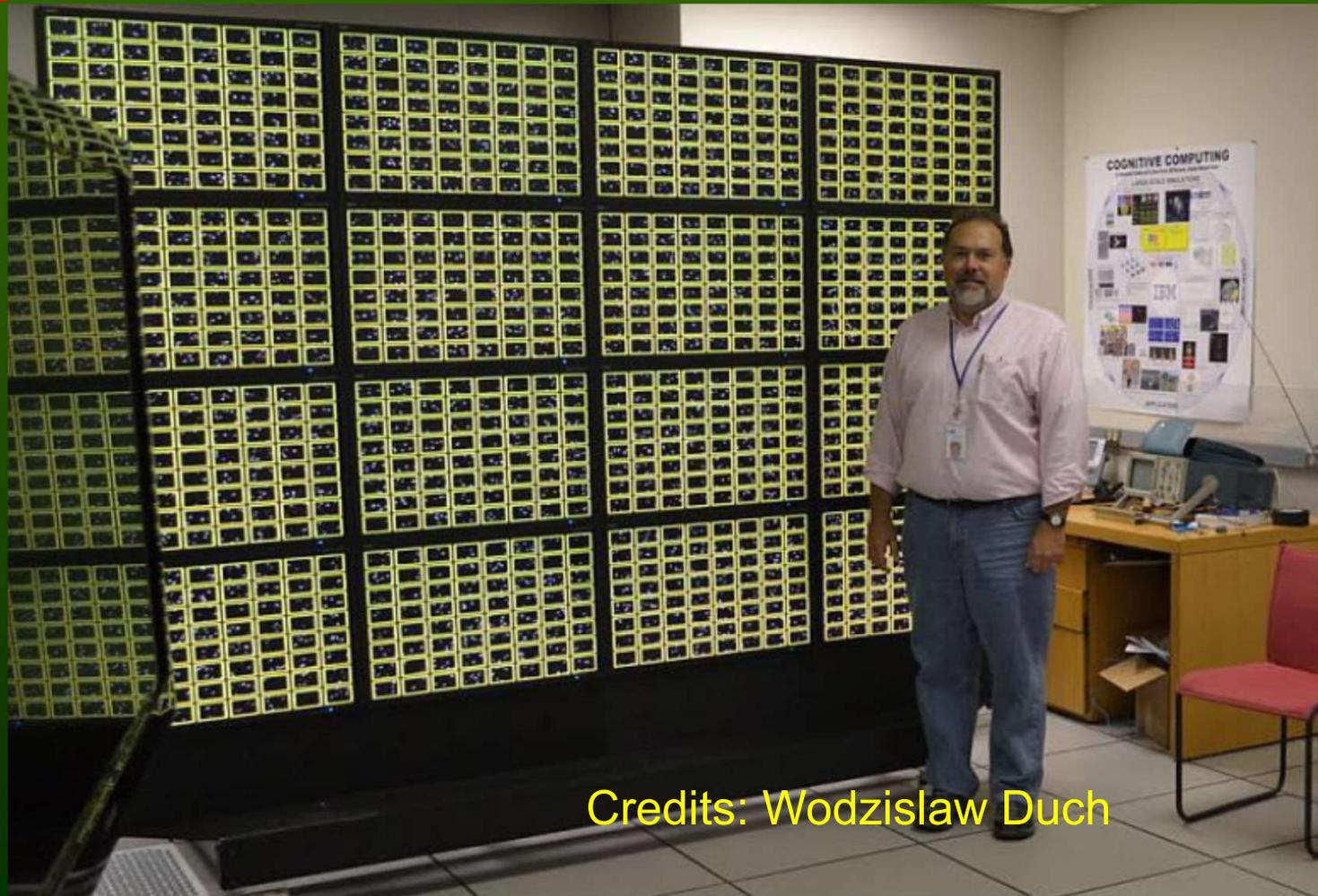
Kogni

Neural AI
accelerators

AD 2021

200 x CS-2,

models $> 10^{14}$
parameters.



Credits: Wodzislaw Duch

Cerebras CS-2

The screenshot shows the top navigation bar of the Cerebras website with the logo on the left and links for Product, Industries, Resources, Developers, Company, and Join Us. A prominent orange 'Get Demo' button is on the right, along with social media icons for Twitter, YouTube, and LinkedIn.

GlaxoSmithKline
"The Cerebras CS-2 is a critical component that allows GSK to train language models using biological datasets at a scale and size previously unattainable. These foundational models form the basis of many of our AI systems and play a vital role in the discovery of transformational medicines."
Kim Branson
SVP Global Head of AI and ML
GlaxoSmithKline

AstraZeneca
"Training which historically took over 2 weeks to run on a large cluster of GPUs was accomplished in just over 2 days — 52hrs to be exact — on a single CS-1. This could allow us to iterate more frequently and get much more accurate answers, orders of magnitude faster."
Nick Brown
Head of AI & Data Science
Astrazeneca

TotalEnergies
"TotalEnergies' roadmap is crystal clear: more energy, less emissions. To achieve this, we need to combine our strengths with those who enable us to go faster, higher, and stronger... We count on the CS-2 system to boost our multi-energy research and give our research 'athletes' that extra competitive advantage."
Vincent Saubestre
CEO & President
TotalEnergies Research & Technology USA

<https://www.cerebras.net/>

The screenshot shows three testimonials from different organizations, each with a quote, a name, and a title. The background of each testimonial is a dark image related to the organization's work.

Argonne National Laboratory
"Cerebras allowed us to reduce the experiment turnaround time on our cancer prediction models by 300x, ultimately enabling us to explore questions that could have taken years, in s."
English

National Energy Technology Laboratory
"We used the original CS-1 system, which features the WSE, to successfully perform a key computational fluid dynamics workload more than 200 times faster and at a fraction of the power consumption than the same workload on the Lab's"

Pittsburgh Supercomputing Center
"With the Cerebras Technology, we see a machine that is specifically designed for AI and for the potential optimizations in deep learning."
Dr. Paola Buitrago
Director of AI

Sfida con gli umani

Superhuman AI



Reasoning: 1997–Deep Blue wins in chess; 2016 –AlphaGo wins in Go; 2017 Alpha GoZero beats it.

Perception: recognition of faces, images, personality traits, sexual preferences, political ...

Strategy and Controls: 2017–OpenAI wins in Poker and Dota 2; 2019-Starcraft II ... what's left?

Scientific experiments: 2015-AI uncovers genetic and signaling pathways of flatworm regeneration. 2020-AlphaFold 2 almost solves protein folding.

Robotics: 2020 Boston Dynamics' backflip and parcour, autonomous vehicles on the roads.

Creativity and imagination: AIVA and other AI music composers, DeepArt, Dall-E2 and other GANs.

Language: 2011–IBM Watson wins in Jeopardy; 2018–Watson Debater beats professionals 2020: BERT answers questions from SQuAD database.

Cyborgization: BCI, brain optimization, coming?

Capire la lingua parlata (2018)

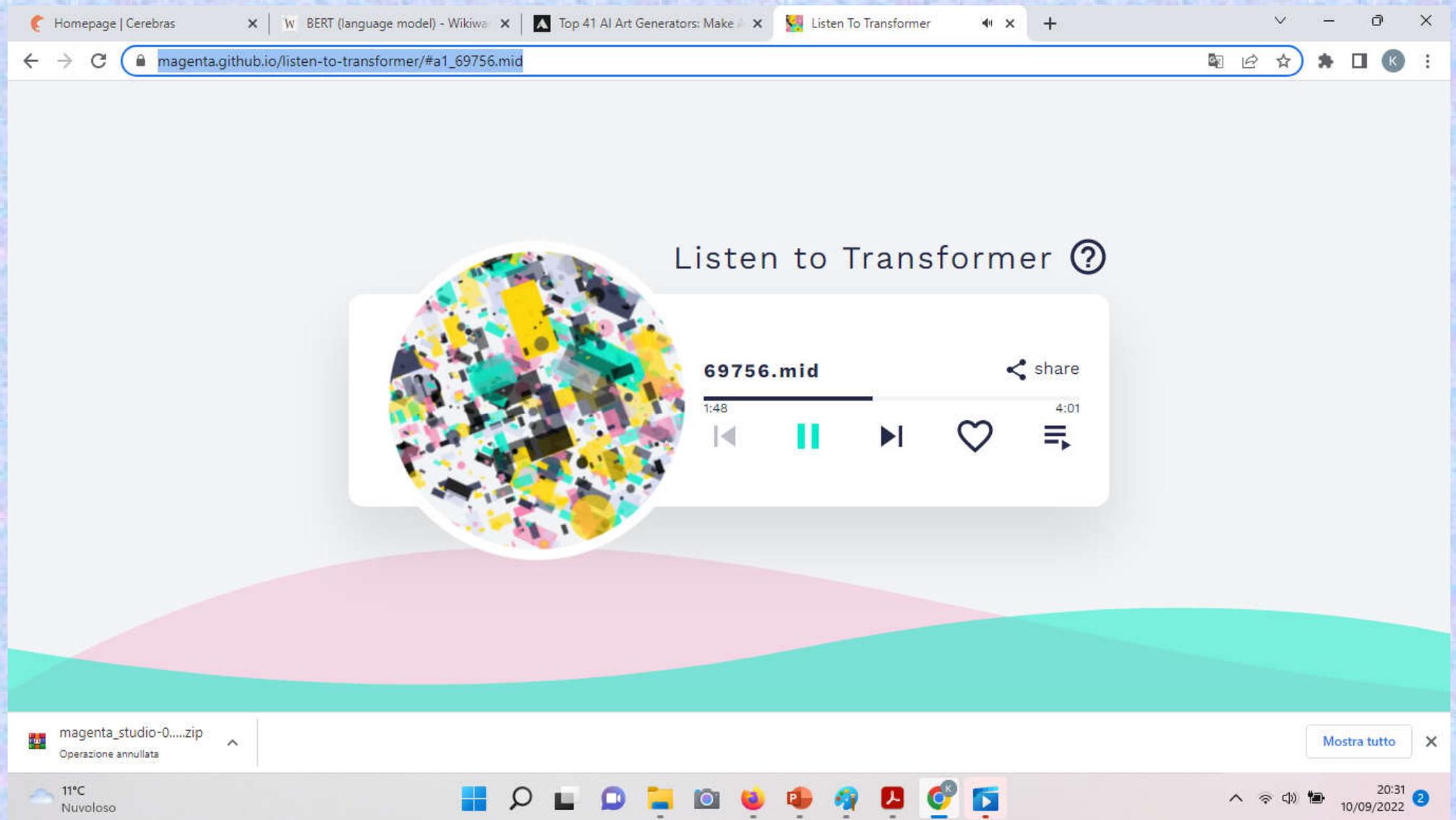
BERT



Language models may encode knowledge about relation of words in complex network structures. In 2018 Google group created BERT, language model pre-trained on a large text corpus to gain a general-purpose “language understanding”. That model is then fine-tuned for specific NLP tasks such as question answering or semantic information retrieval.

- **Bidirectional Encoder Representations from Transformers (BERT)**.
Transformer-based machine learning technique for (NLP) pre-training.
- English-language BERT: two networks, smaller 110M parameters, larger model with 340M parameters in 24-layers; trained on the BooksCorpus with 800M words, and Wikipedia with 2,500M words.
- 12/2019 BERT worked in 70 languages, in 2020 many smaller pre-trained models with the whole word masking open software models were published in GitHub repository.
- The network learns to predict masked words (images, signals):
Input: the man went to the [MASK1] . he bought a [MASK2] of milk.
Labels: [MASK1] = store; [MASK2] = gallon
- Super-human Q/A on Stanford Question Answering Dataset (SQuAD)

Musica creata dalla IA



The screenshot shows a web browser window with the address bar containing the URL magenta.github.io/listen-to-transformer/#a1_69756.mid. The page title is "Listen to Transformer" with a help icon. The main content area features a circular image of a colorful, abstract pattern. Below the image is a music player interface for the file "69756.mid". The player shows a progress bar from 1:48 to 4:01, with a play button in the center. To the right of the play button are icons for a heart and a list. A "share" button is also visible. The browser's taskbar at the bottom shows the Windows logo, search, and several application icons. The system tray on the right indicates a temperature of 11°C, weather as "Nuvoloso", and the time as 20:31 on 10/09/2022.

https://magenta.github.io/listen-to-transformer/#a1_69756.mid

Insegna tu la musica alla IA

Top Augment... Pensa con la f... Curiscope Mu... Augmented R... Expeditions &... La Battaglia di... The Imitation... Exploring Ho... MUSIA

← → ↻ https://musiaplugin.com

MUSIA PRODUCT ▾ PRICING BLOG SUPPORT SIGN IN TRY FOR FREE

Genre & Instrument Base Auto Chord Auto Melody

Melody Knob Transposition DAW Compatible

MUSIA Chord Vol. Melody Vol. Tempo 108 Chord Instr. Piano 3 Melody Instr. Glockenspiel Genre Easy Listening 2x ? @

C D E F G A B C D E F G A B C D E F G A B C D E F G A B C

Key ON Chord Progression Auto Melody 4 Bars 8 Bars Dictate AI

C E7(9-13) Am C F2 F#dim Dm7 B7(9-13) Em7-9 A7(9-13) Dm7 Fm7 C Am9 Dm7 B

Auto Chord Auto Melody Basic Only

Melody Option Pentatonic Heptatonic Melody Scale Note Density Note Split Syncopation Rhythmic Complexity

#01 #02 #03

Chat with us here
Replies within an hour

9°C Soleggiato 09:22 13/10/2022

<https://musiaplugin.com>

Strumenti per creare la musica e arte

Homepage | Cerebras x | W BERT (language model) - Wikiwa x | Top 41 AI Art Generators: Make / x +

aiartists.org/ai-generated-art-tools

Staff Picks to Generate AI Art:

- [Runway ML](#) – An easy, code-free tool that makes it simple to experiment with machine learning models in creative ways. Our overall staff pick.
- [Nature of Code](#) – This interactive book teaches you how to code generative art; the last chapter is an exceptional introduction to AI art, with real code examples.
- [GANBreeder](#) – Breed two images to create novel new ones using GANBreeder. (Note that

AI Generated Music/Sound:

- [Magenta Studio](#) – A collection of music plugins built on Magenta's open source tools and models.
- [AI Duet](#) – Play with a piano that responds to you.
- [NSynth Sound Maker](#) – Create your own hybrid sounds and instruments.
- [MuseNet](#) – Generate 4-minute musical compositions with 10 instruments, and combine styles from country to Mozart with MuseNet (also available on GitHub).
- [Pitch Detection](#) – Use a pre-trained pitch detection model to estimate the pitch of

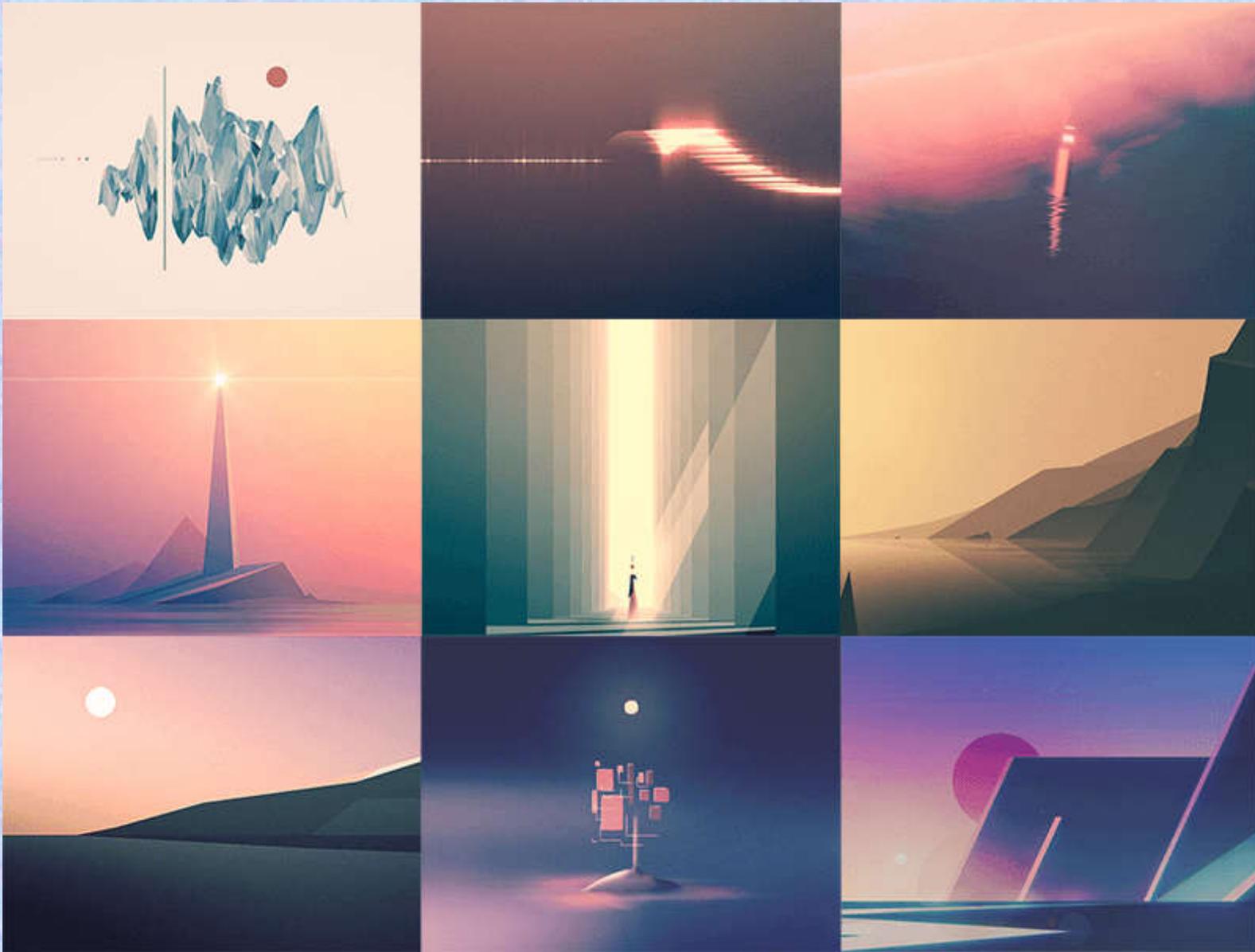
magenta_studio-0.....zip
Operazione annullata

11°C
Nuvoloso

Mostra tutto x

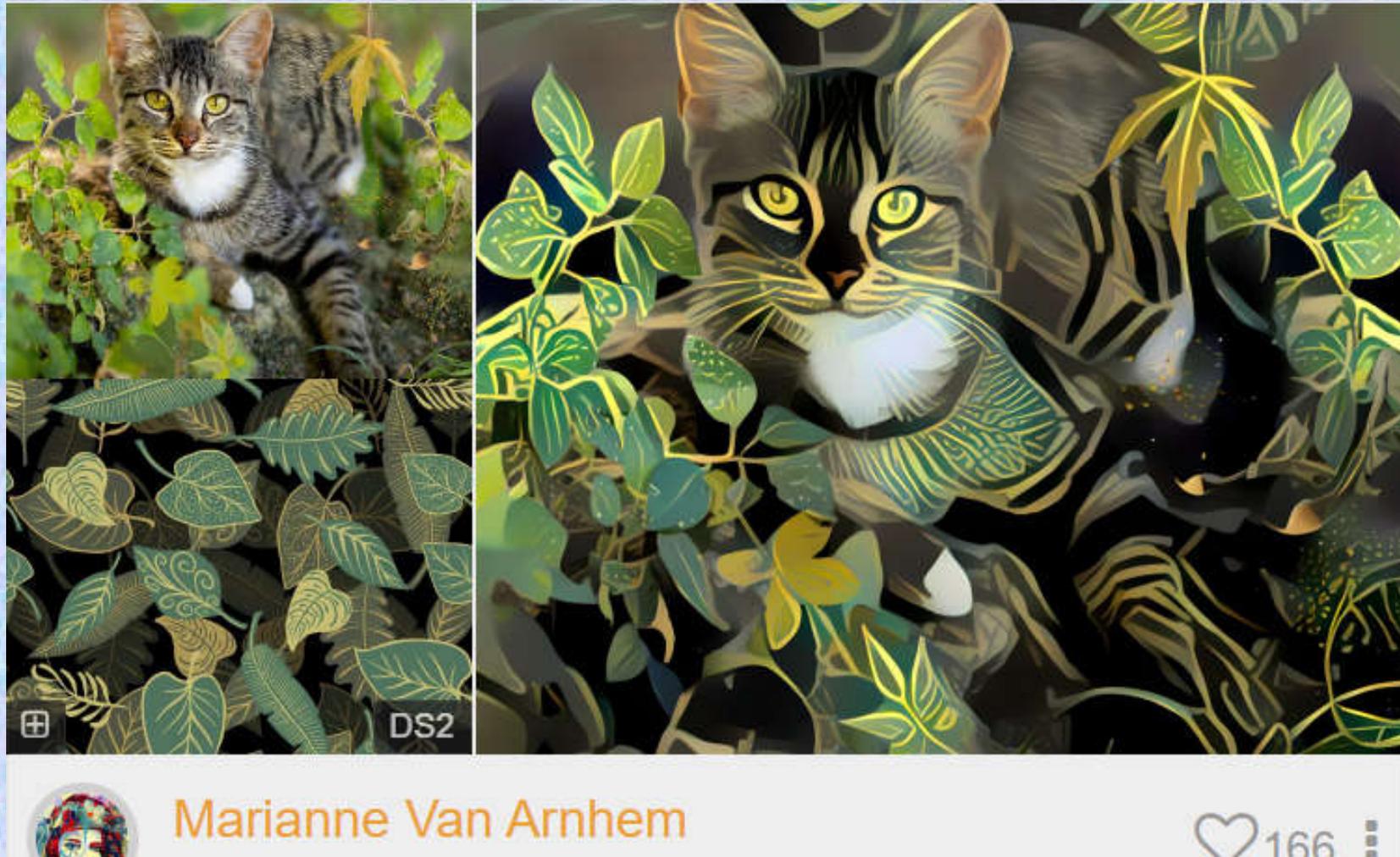
20:54
10/09/2022

Arte creata dalla IA



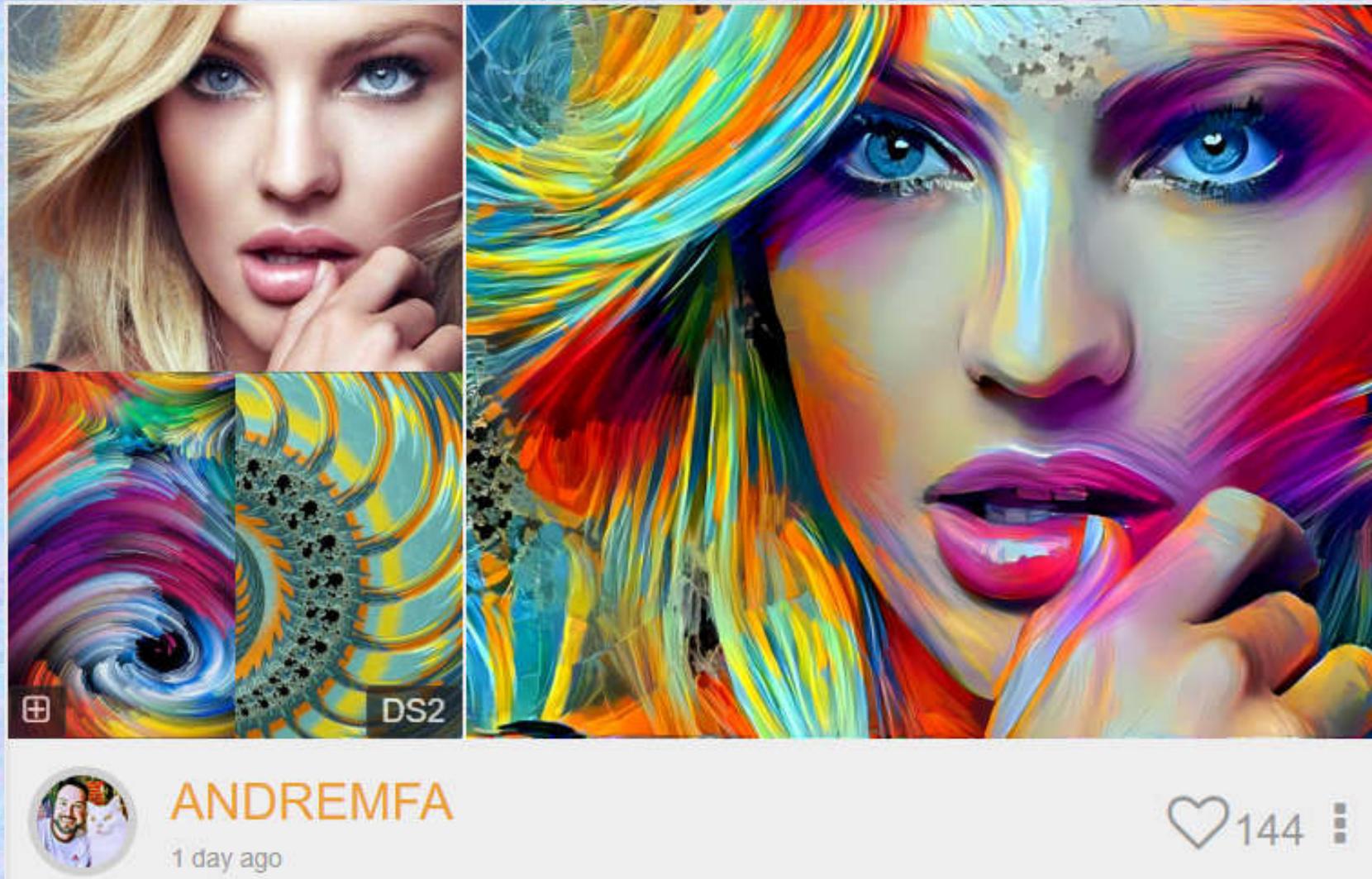
<https://aiartists.org/ai-generated-art-tools>

Google Deep Dream Generator



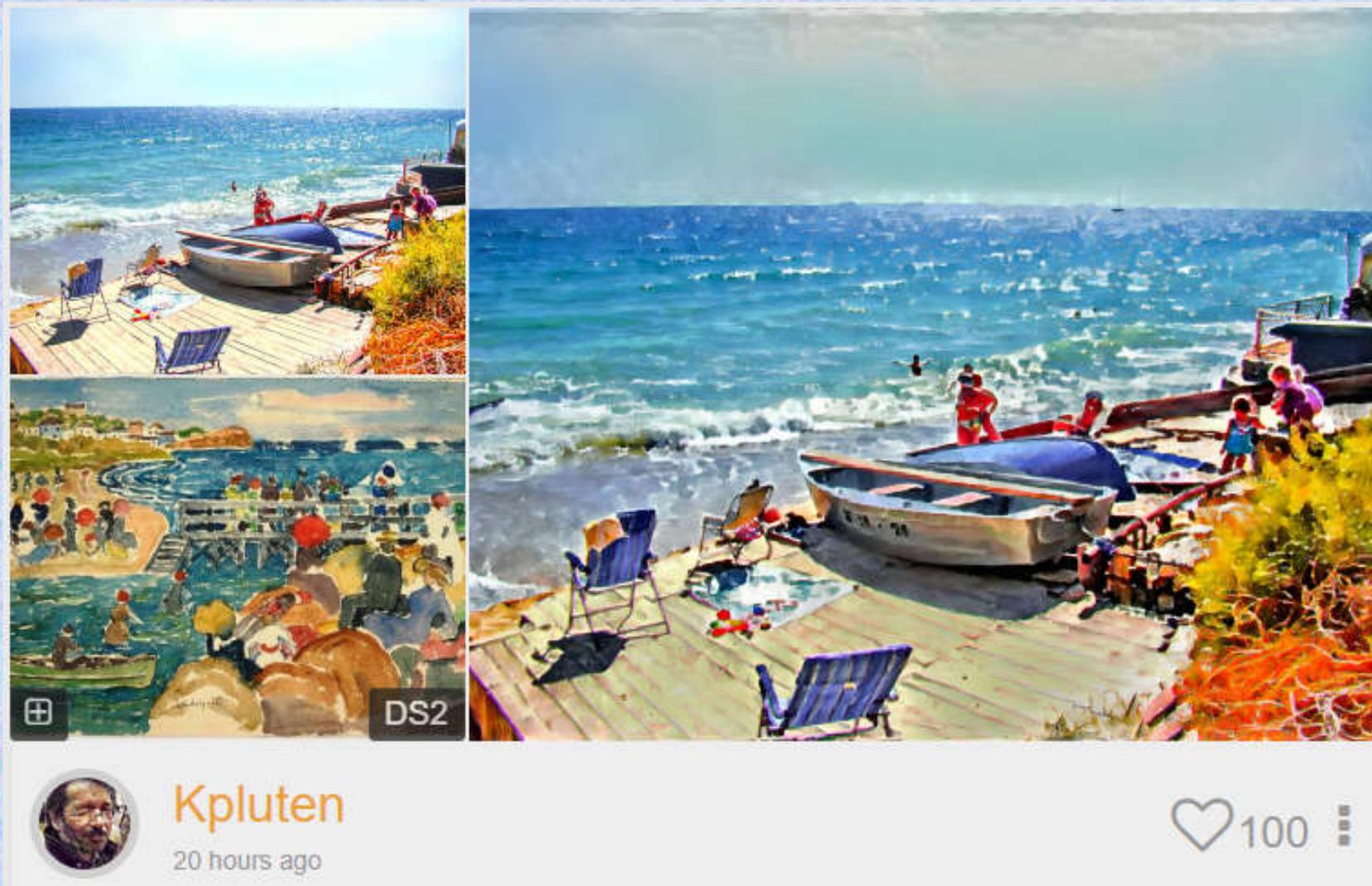
<https://deepdreamgenerator.com/>

Google Deep Dream Generator



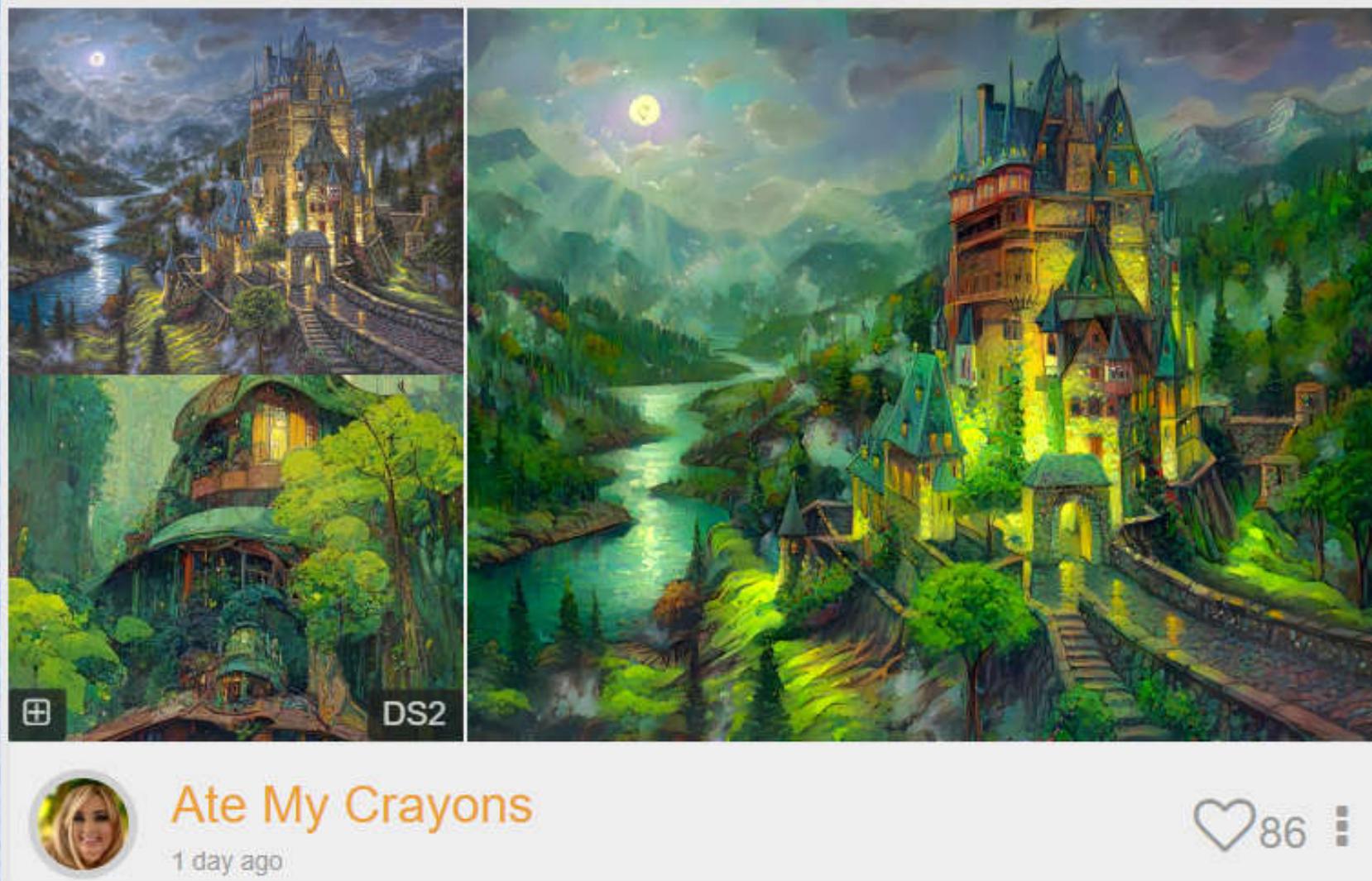
<https://deepdreamgenerator.com/>

Google Deep Dream Generator



<https://deepdreamgenerator.com/>

Google Deep Dream Generator



<https://deepdreamgenerator.com/>

Google Deep Dream Generator



kite

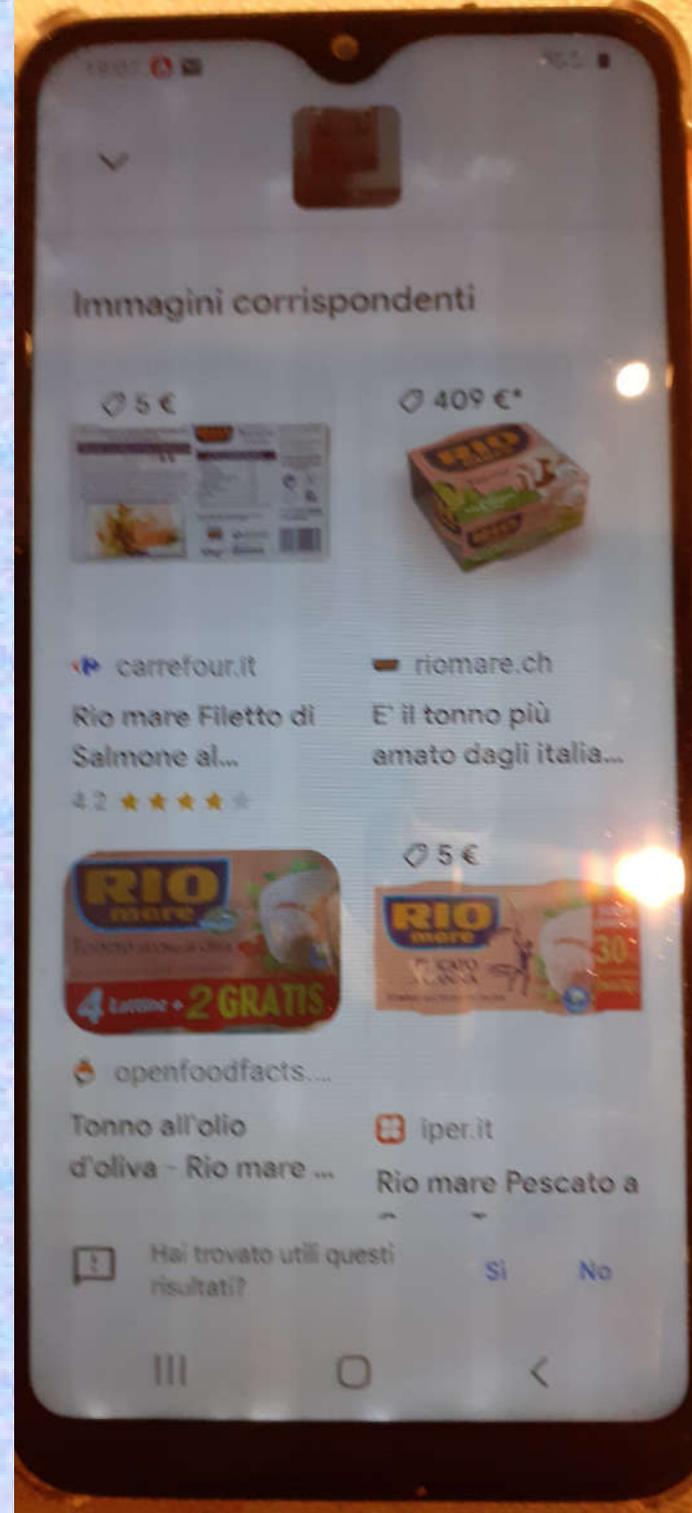
23 hours ago

Augmented reality



<https://deepdreamgenerator.com/>

Google Lens



Google Lens



Compressorhead



- **Mega-Wattson** - Lead singer; voiced by [John Wright](#). It was built in 2017. ^[18]
- **Fingers** - Lead guitarist; It is equipped with two hands, with a total of 78 fingers. It was built in 2009. ^[20]
- **Hellgå Tarr** - Rhythm guitarist and backup singer; It was built in 2017. ^[19]
- **Bones** - Bassist; It has two hands, each with four individual fingers, and is mounted on a platform equipped with caterpillar tracks that allows it to move around onstage. It was built in 2012. ^[20]
- **Stickboy** - Drummer; It has four arms to which the sticks are secured, and two legs that play the [kick drum](#). Its head has several metal protrusions that resemble a [Mohawk hairstyle](#). It was built in 2007. ^[20]
- **Junior** - An "assistant" to the drummer that operates the [hi-hat symbol](#). It was built in 2007. ^[20]

Compressorhead: ma il programmer è sempre dietro le quinte



Compressorhead Robot Band Performance in Berlin Spandau
<https://www.youtube.com/watch?v=j4UZh2FjEQw>

Adesso anche con un «cantante» da 384 kg

Top Augmented Re... JE McDonalds: Happy X The brain dictionary X One of Japan's Biggi X Level UP: Mario and X compressorhead - G X Compressorhead - PLAYING

https://www.youtube.com/watch?v=tdfwOf1OjpU

Bookmarks X

Search bookmarks

Bookmarks Toolbar

Bookmarks Menu

Other Bookmarks

YouTube PL Szukaj

Wszystkie Podobne Ostatnio przesłane

I SEE WHAT'S COMI 4:21

What is Coming After the rerelease of Avatar
Drinking in Pandora
943 wyświetlenia • 13 godzin temu
Nowy

Maurizio Pollini - Piano Recital (2002.6.25 Paris, Cité de la...
Jun Kumazawa
42 tys. wyświetleń • 2 lata temu

In Christ Alone | Dalam Yesus | Mike Sammy
Michael Sammy
29 wyświetleń • 21 godzin temu
Nowy

Likely Math Olympiad | Nice Exponential Equation...
Olustat Math Class
52 wyświetlenia • 22 godziny temu

#Futurium
Compressorhead

Concerti dal vivo

<https://www.youtube.com/watch?v=tdfwOf1OjpU>

(ma il «cantante» non è granché)

/s.

emu

08:47
4/09/2022

5

Fortunatamente, altri sono «umani»



0:42 un batterista con solo due mani

0:44 elementi di grafica per illustrare la musica

«Studio di ballo»



Una complessa tecnologia con elementi di AR

Una pop-star del tutto virtuale

The screenshot shows a web browser window with multiple tabs. The active tab is titled "One of Japan's Biggest Pop Star". The address bar shows the URL: <https://www.youtube.com/watch?v=vPBRj0bE55w&t=76s>. The YouTube interface includes a search bar with the text "Szukaj", a navigation menu on the left, and a video player. The video player shows a virtual pop star performance with the text "but she started out" and "Odtwórz (k)". Below the video player, the video title is "One of Japan's Biggest Pop Stars Isn't Human" by Bloomberg Markets and Finance. The video has 3,2 tys. likes and 141 815 wyświetleń. The right sidebar shows a list of recommended videos, including "【Hatsune Miku】 World is Mine / ryo (supercell) 【初音...", "James Bond and The Queen London 2012 Performance", "THE AGE OF A.I. S1 ODC. 1", "How Far is Too Far? | The Age of A.I.", "Sviatoslav Richter plays Beethoven Piano Sonata no. 3...", and "TOP 10 SYNTH RIFFS". The bottom of the screenshot shows the Windows taskbar with the date 14/09/2022 and time 08:28.

Bloomberg: <https://www.youtube.com/watch?v=vPBRj0bE55w&t=76s>

Hatsune Miku

ality Course X | JE McDonalds: Happy Meal How to... | The brain dictionary - YouTube | One of Japan's Biggest Pop Stars | Level UP: Mario and Tiny Mario

https://www.youtube.com/watch?v=vPBRj0bE55w&t=76s

YouTube PL Szukaj

©SEGA / CFM

Odtwórz (k)

0:36 / 3:45

One of Japan's Biggest Pop Stars Isn't Human

Bloomberg Markets and Finance ✓
1,35 mln subskrybentów

WESPRZYJ SUBSKRYBUJ

3,2 tys. Nie podoba mi się Udostępnij Zapisz ...

141 815 wyświetleń 29 paź 2017 Oct.29 – Hatsune Miku is not your ordinary anime character.

Wszytkie Ostatnio przesłane

【Hatsune Miku】 World is Mine / ryo (supercell) 【初音...
HatsuneMiku 🎵
13 mln wyświetleń • 9 lat temu

ADGO
337 tys. wyświetleń • 7 lat temu

TOP 10 SYNTH RIFFS
Top 10 Synthesizer Riffs Of All Time
Doctor Mix ✓

08:30
14/09/2022

100 mila brani, scritti da tanti compositori del tutto il mondo, concerti in «vivo»
Milioni di fan, fa da introduzione ai concerti di Lady Gaga

Virtual (holographic) Pop-star

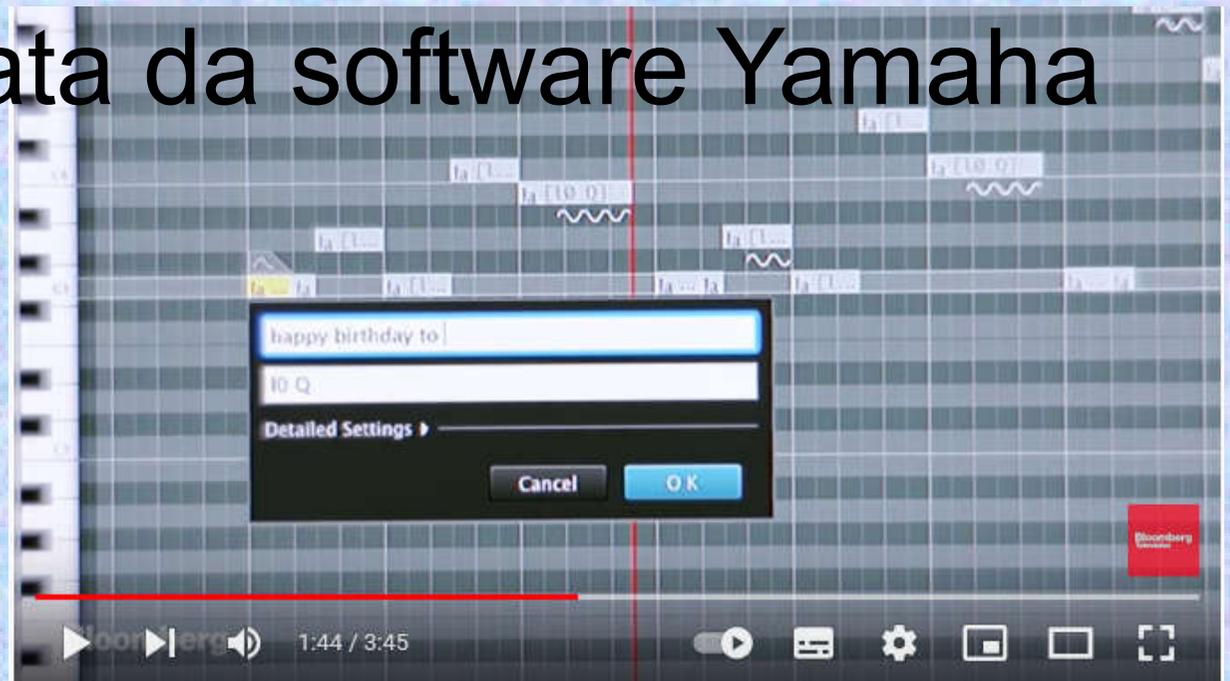


Ologramma è una immagine fatta con fasci laser
Tuttavia, non si riesce ancora proiettare «dal vivo»: le immagini vengono preparate prima e proiettate (usando potenti computer)



Musica orchestrata da software Yamaha

Un modo nuovo per scrivere la «partitura»



A radical change is coming...

Our politicians still have not noticed that something had changed.



Credits: prof. Wodzislaw Duch

Critiche

Critiche all'IA in generale sono state mosse da diverse parti, già nel corso degli anni Sessanta e persistono ancora oggi [1996]. Essi utilizzano vari argomenti come prova confutante la possibilità di costruire delle vere macchine «intelligenti».

In ordine del tempo, la prima (di genere dualista-mentalista) è stata quella di John Lucas, che faceva esplicito riferimento ai teoremi d'incompletezza di Gödel. Se ogni computer reale, in quanto sistema formale, s'identifica con una macchina di Turing, allora esiste una formula che non può essere dimostrata esso e che, in quanto tale non può essere da esso generata. In ogni caso, questa formula sarà ugualmente vera e solo la mente dell'uomo, capace *d'intuizione*, potrà riconoscere tale verità.

Angelo G. Sabattini, Francesco Iannello, *Le nuove frontiere delle mente*, Tascabili Economici Newton, Newton, Roma 1996, p.54

Conclusioni

Oramai, dobbiamo abituarci (insistere) che le funzioni/operazioni più semplici, come:

- operazioni matematiche (addizioni, moltiplicazioni, integrali)
- procedure specializzate (gioco di scacchi, go-go)
- procedure codificabili (traslazioni)
- accesso alle memorie

vengano lasciate ai macchinari (di Pascal, Turing, IBM, Google)

CONSTRUCTIVISTIC PATHS IN TEACHING PHYSICS: FROM INTERACTIVE EXPERIMENTS TO STEP-BY-STEP TEXTBOOKS

April 2015 · *Problems of Education in the 21st Century* 215(64):6-23

DOI: [10.33225/pec/15.64.06](https://doi.org/10.33225/pec/15.64.06)

Project: Cognitive didactics



Grzegorz P. Karwasz ·



Krzysztof Służewski ·



Anna Kamińska

Conclusioni (2)

Siamo ancora lontani dall'era dell'Intelligenza artificiale

Per il momento, le applicazioni rimangono ancora limitate, e sembrano basate più sulla *memoria* e confronto che sulla vera intelligenza, i.e. capacità di risolvere problemi nuovi usando il ragionamento come il mezzo.

In altre parole: per il momento ne artificiale ne intelligenza