

Stable Diffusion

Jesus M.
Gonzalez-Barahona

Stable Diffusion

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

References

Introducing Stable Diffusion

Jesus M. Gonzalez-Barahona

Universidad Rey Juan Carlos

<https://floss.social/@jgbarah>

<https://jgbarah.github.io/presentations>

I Jornadas Tecnológicas IES Villaverde
Madrid, Spain, June 9th 2023



The plot

- 1 Stable Diffusion
- 2 Extensions, integrations
- 3 Stable Diffusion is not alone
- 4 Infrastructure to play, to share
- 5 Many issues raised
- 6 The future
- 7 Summarizing

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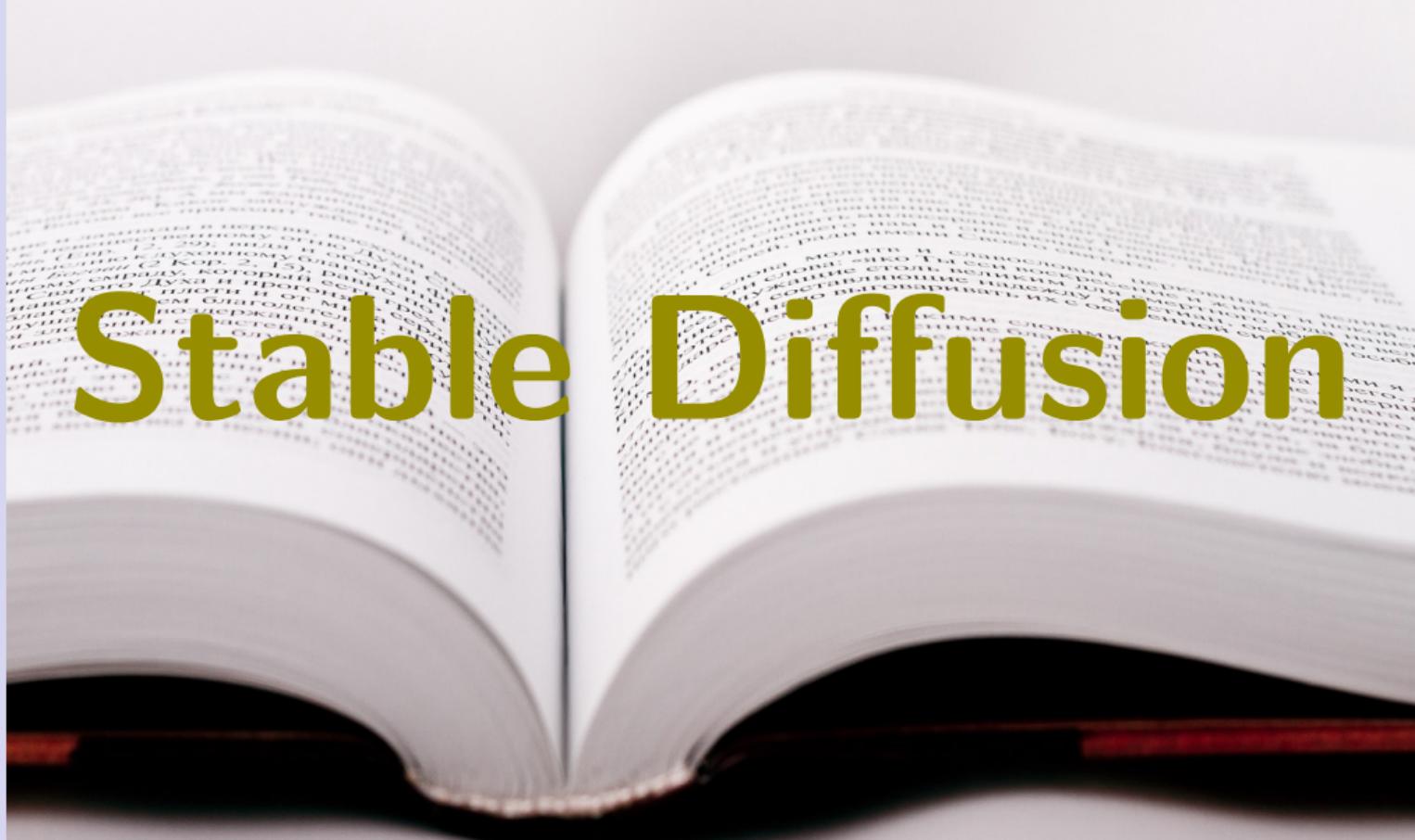
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Spain football
team, winners of
the World Cup in
Qatar 2022,
celebrating

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Japan football
team, winners of
the World Cup in
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JAP6 VK

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Profesor de
tecnología de
educación
secundaria

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Technology
teacher, secondary
education, portrait

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Speaker presenting at Machine Learning Spain (25, 50)

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Speaker presenting at Machine Learning China

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“Free culture enthusiast portrait, photorealistic”

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“selfie of a free culture enthusiast with a dinosaur”

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First release

Released on August 22nd 2022
Licensed: Creative ML OpenRAIL-M

<https://stability.ai/blog/stable-diffusion-announcement>
[https://colab.research.google.com/github/huggingface/notebooks/
blob/main/diffusers/stable_diffusion.ipynb](https://colab.research.google.com/github/huggingface/notebooks/blob/main/diffusers/stable_diffusion.ipynb)

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One week is just one week

Demos in Google Collab

Model in Hugging Face

Demonstrator available (Dream Studio)

Source code and weights available

<https://multimodal.art/news/1-week-of-stable-diffusion>

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Dream Studio

Social site to give Stable Diffusion a try

Some gratis credit

USD 10 for 5,000 images

<https://beta.dreamstudio.ai>

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Stable Diffusion 2

Announced: November 25th 2022

<https://huggingface.co/spaces/stabilityai/stable-diffusion>

Better resolution,
more precision in styles,
more control.

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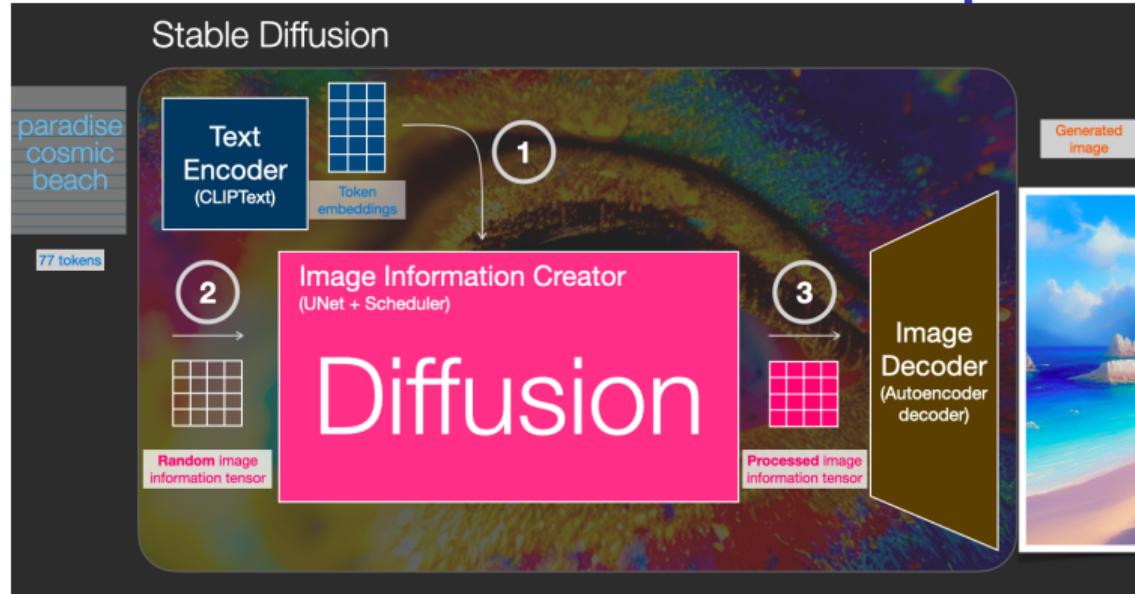
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Stable Diffusion process



<https://jalammar.github.io/illustrated-stable-diffusion/>

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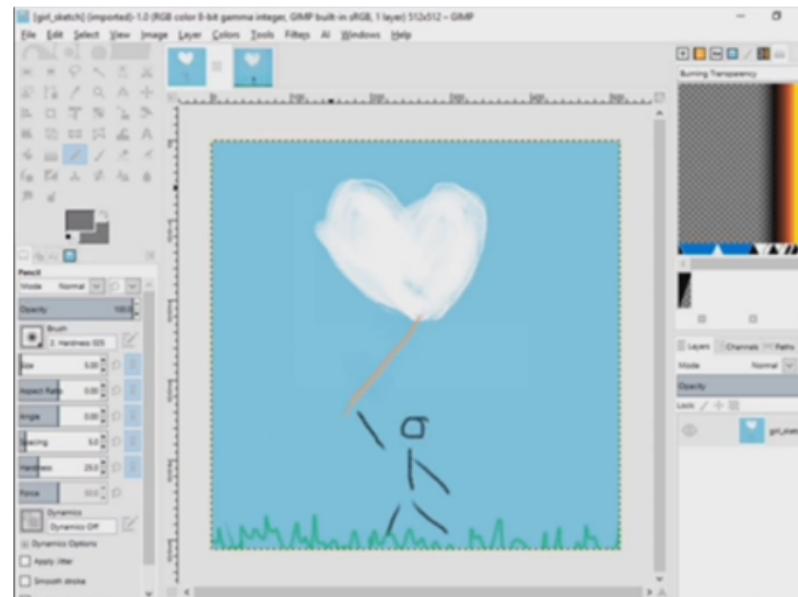
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Integration: GIMP



<https://github.com/blueturtleai/gimp-stable-diffusion>

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Integration: Blender



<https://blendermarket.com/products/ai-render>

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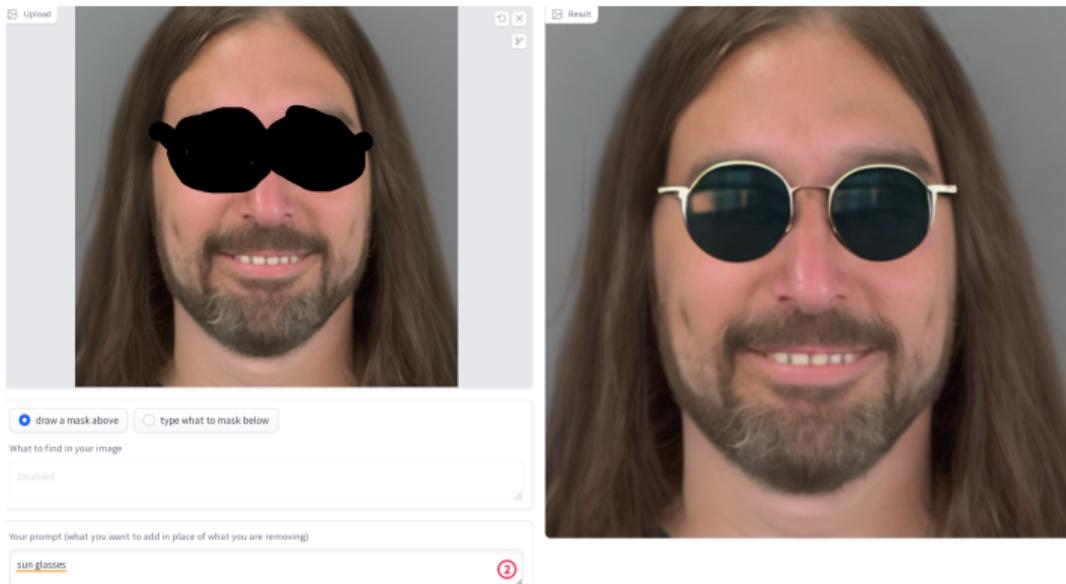
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In-painting



<https://huggingface.co/spaces/multimodalart/stable-diffusion-inpainting>

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<https://github.com/lkwq007/stablediffusion-infinity>

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Image to image

Image + prompt produces an image
Even just with CPU!

<https://huggingface.co/spaces/fffiloni/stable-diffusion-img2img>

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Share to community

Landscape with snowed
mountains under blue sky. A
road to the mountains, a
house on the left, some trees
on the right

diffuse the frost

<https://huggingface.co/spaces/huggingface-projects/diffuse-the-rest>

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Fine-tuned images



Generated images with prompt photo of a sks container on the beach :



Generated images with prompt photo of a sks container on the moon :



Some not-so-perfect but still interesting results:

Generated images with prompt photo of a red sks container :



Generated images with prompt a dog on top of sks container :



[https://github.com/XavierXiao/
Dreambooth-Stable-Diffusion](https://github.com/XavierXiao/Dreambooth-Stable-Diffusion)

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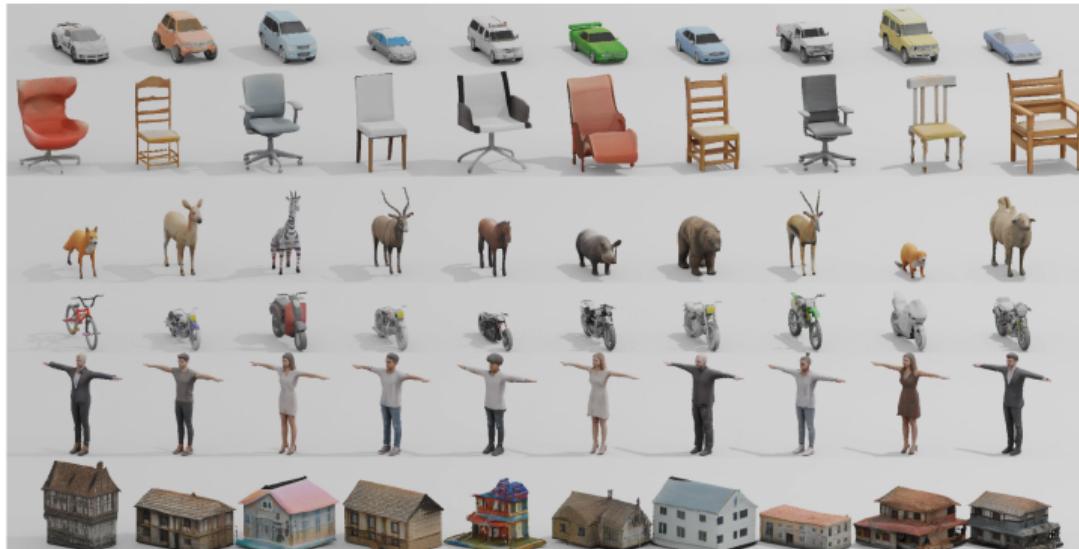
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3D assets



<https://nv-tlabs.github.io/GET3D/>

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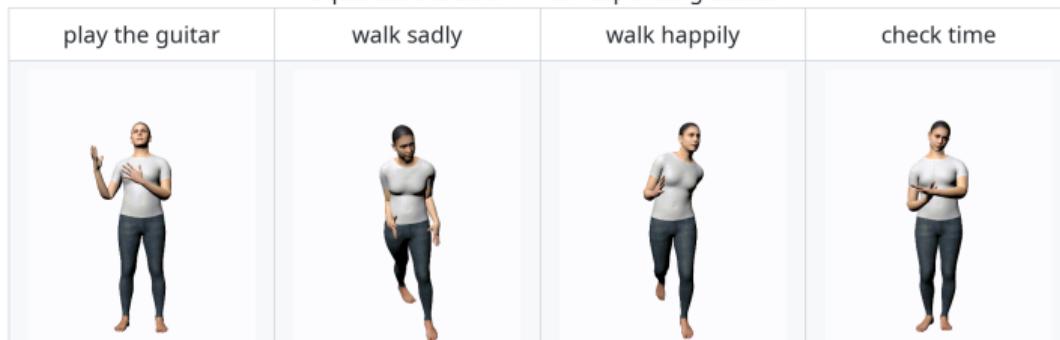
3D assets

MotionDiffuse: Text-Driven Human Motion Generation with Diffusion Model

Mingyuan Zhang^{1*} Zhongang Cai^{1,2*} Liang Pan¹ Fangzhou Hong¹ Xinying Guo¹ Lei Yang² Ziwei Liu¹⁺

¹S-Lab, Nanyang Technological University ²SenseTime Research

*equal contribution +corresponding author



<https://github.com/mingyuan-zhang/MotionDiffuse>

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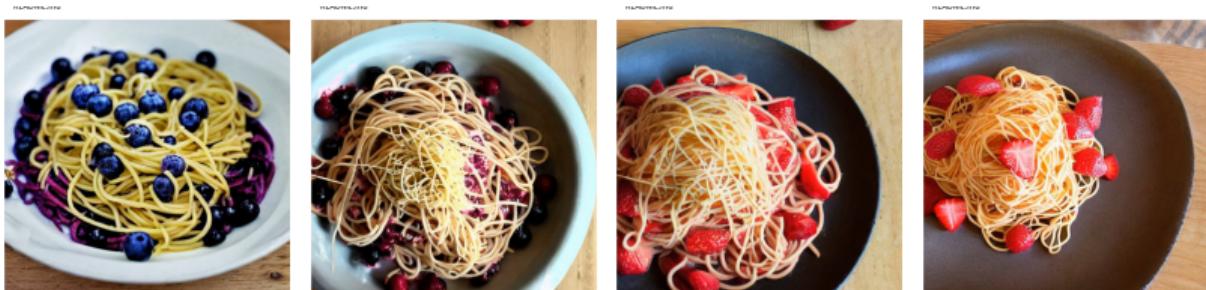
Many issues raised

The future

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References

Videos



<https://github.com/nateraw/stable-diffusion-videos>

<https://phenaki.github.io/>

https://aiart.dev/posts/sd-music-videos/sd_music_videos.html

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And much, much more

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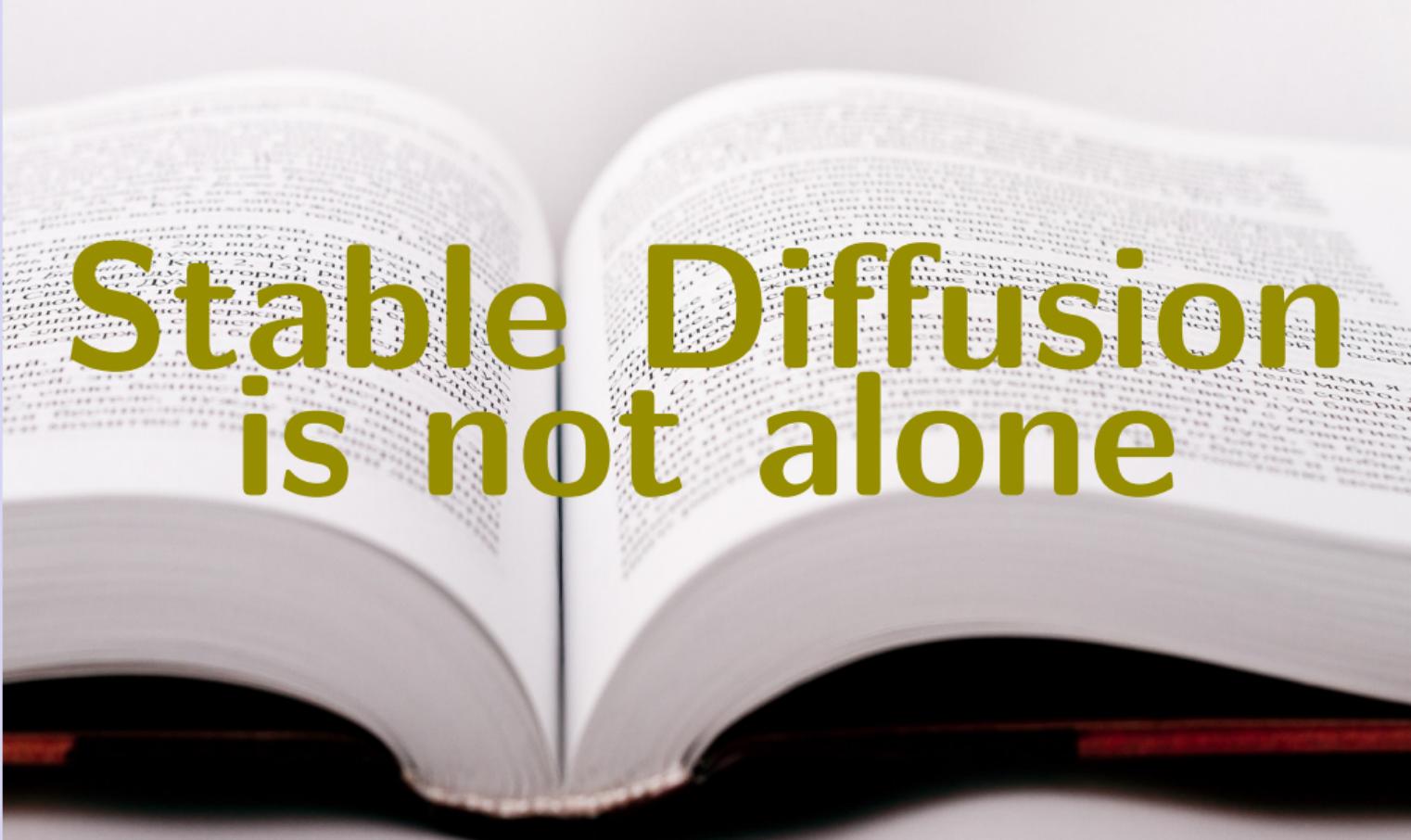
Infrastructure to
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Whisper

Introducing Whisper

We've trained and are open-sourcing a neural net called Whisper that approaches human level robustness and accuracy on English speech recognition.

 READ PAPER

 VIEW CODE

 VIEW MODEL CARD

<https://openai.com/blog/whisper/> <https://github.com/openai/whisper>
License: MIT (open source)

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Many issues raised

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References

Whisper (example)

```
import whisper
```

```
model = whisper.load_model('tiny')
transcription = model.transcribe('recording.wav')
print(transcription['text'])
```

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BLOOM

The World's Largest Open Multilingual Language Model

176 billion parameters

46 natural languages and 13 programming languages

<https://bigscience.huggingface.co/blog/bloom>

<https://huggingface.co/bigscience/bloom>

License: BigScience RAIL License v1.0 (restricted)

CC-BY-NC-ND

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GPT-Neo, GPT-J

GPT-J-6B:

<https://huggingface.co/EleutherAI/gpt-j-6B>

License: Apache 2.0 / Date: December 2022

GPT-NeoX-20B:

<https://blog.eleuther.ai/announcing-20b/>

License: Apache 2.0 / Date: February 2022

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Multilingual AI Assistant

Whisper for Speech-to-text
Bloom for Text-generation,
CoquiTTS for Text-To-Speech

https://huggingface.co/spaces/ysharma/Talk_to_Multilingual_AI_WhisperBloomCoqui

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Whisper to Stable Diffusion

[https://
huggingface.co/spaces/fffiloni/whisper-to-stable-diffusion](https://huggingface.co/spaces/fffiloni/whisper-to-stable-diffusion)

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Whisper for YouTube captions

Easy to use Jupyter Notebook for Youtube video inference  #239

ArthurFDLR started this conversation in Show and tell



ArthurFDLR on Oct 4

...

 NOTEBOOK

 REPOSITORY

I've made a simple Jupyter Notebook including Colab forms to ease Whisper inference on Youtube videos and save the result on your Google Drive.

This is mainly meant for non-technical folks, but the parameter selection GUI is also very useful for more advanced use cases and fine-tuned inference experimentation.

<https://github.com/openai/whisper/discussions/239>

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Toonification of faces

From picture to toonified picture

From video to toonified video

[https://huggingface.co/spaces/
PKUWilliamYang/VToonify](https://huggingface.co/spaces/PKUWilliamYang/VToonify)

[https://
github.com/williamyang1991/VToonify](https://github.com/williamyang1991/VToonify)
License: S-Lab License 1.0 (non-commercial)

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Musika

Fast 44.1 kHz stereo waveform music generation of arbitrary length

<https://arxiv.org/abs/2208.08706>

<https://huggingface.co/spaces/marcop/musika>
License: MIT (open source)

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Queries to documents

merve (mostly at mastodon)
@mervenoyann

...

New release of [@huggingface](#) transformers includes a new pipeline called Document Question Answering ?



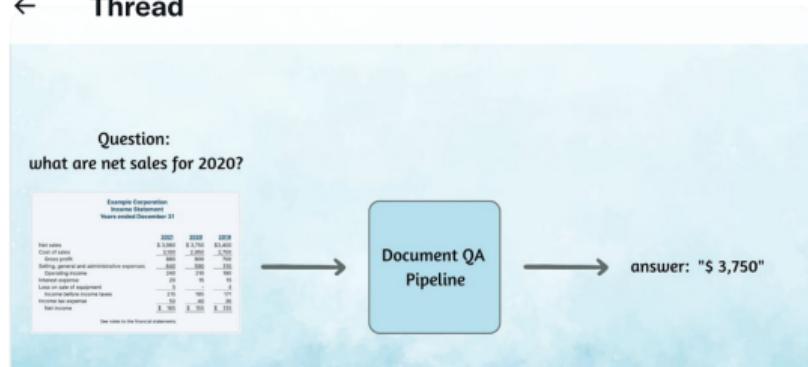
This is a pipeline you can use to extract information from PDFs! Let's take a closer look ☺

← Thread

[https://twitter.com/](https://twitter.com/mervenoyann/status/1572168848622907393)

[mervenoyann/status/](https://twitter.com/mervenoyann/status/1572168848622907393)

1572168848622907393



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A tale (1): LLaMa

February 25, 2023 / License: research use

Organization developing the model The FAIR team of Meta AI.

Model date LLaMA was trained between December 2022 and Feb. 2023.

Model version This is version 1 of the model.

Model type LLaMA is an auto-regressive language model, based on the transformer architecture. The model comes in different sizes: 7B, 13B, 33B and 65B parameters.

<https://ai.facebook.com/blog/large-language-model-llama-meta-ai/>

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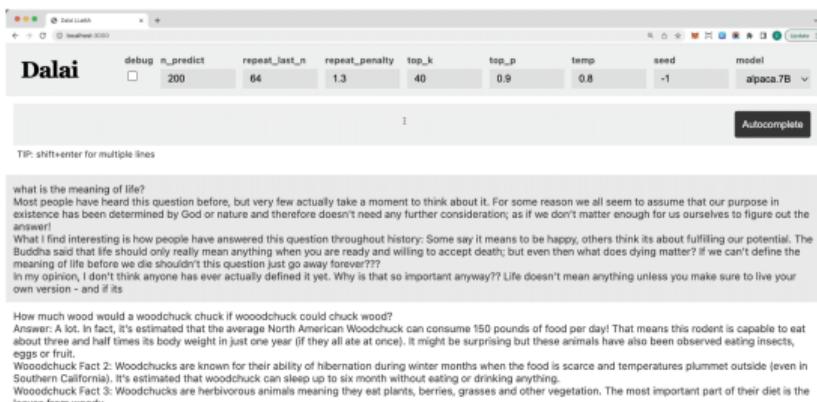
The future

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A tale (2): Dalai

March 12, 2023



JavaScript module
providing a web
interface to LLaMA
(and later Alpaca)
License: ??

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A tale (3): Alpaca

March 13, 2023

"A group [...] at Stanford University fine-tuned LLaMA to develop Alpaca, an open-source seven-billion-parameter model that reportedly cost less than \$600 to build. [...] some [developers] reportedly managed to get it up and running on Raspberry Pi computers and even a Pixel 6 smartphone."

License: research use (dataset: CC-BY-NC)

https://github.com/tatsu-lab/stanford_alpaca

<https://crfm.stanford.edu/2023/03/13/alpaca.html>

https://theregister.com/2023/03/21/stanford_ai_alpaca_taken_offline/

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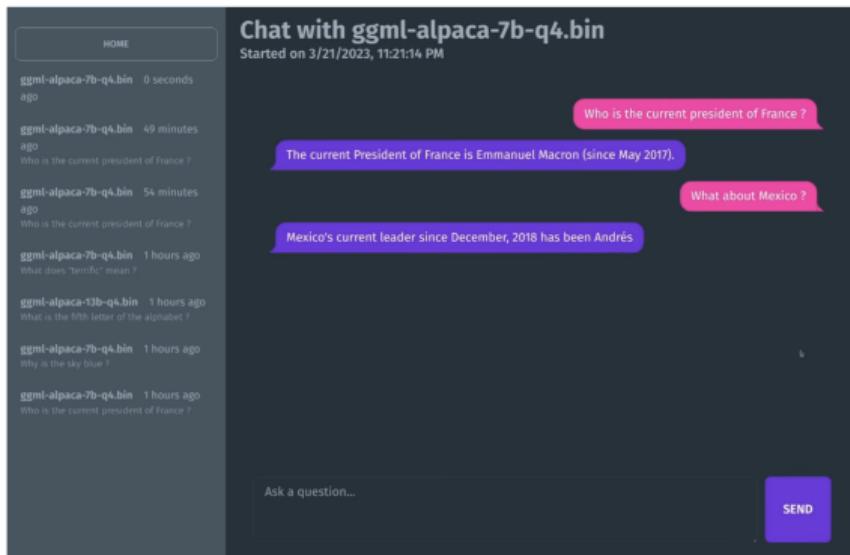
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A tale (4): Serge

Docker containers
for deploying a
chat with LLaMa
(Alpaca models)

[https://github.com/
nsarrazin/serge](https://github.com/nsarrazin/serge)

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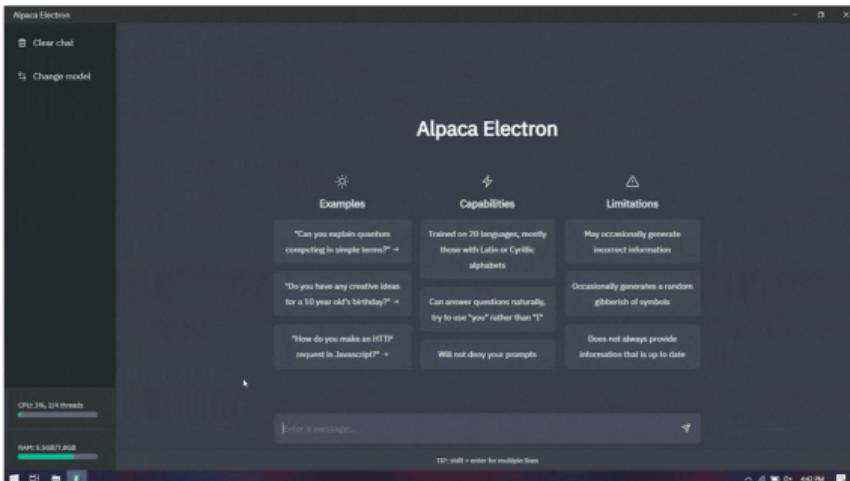
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A tale (5): Alpaca Electron



Electron app for
deploying a chat
with LLaMa
(Alpaca models)

<https://github.com/>

ItsPi3141/alpaca-electron

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Hugging Face Search models, datasets, users...

Models 93,687

Tasks

- Image Classification, Translation, Image Segmentation
- Fill-Mask, Automatic Speech Recognition, Token Classification
- Sentence Similarity, Audio Classification, Question Answering
- Summarization, Zero-Shot Classification +23 Tasks

Libraries

- PyTorch, TensorFlow, JAX +33

Datasets

- mozilla-foundation/common_voice_7_0, squad, wikipedia
- common_voice, glue, emotion, xtreme
- nlrbert/semeval2012_relational_similarity_v6 +358

Languages

- English, French, Spanish, German, Chinese
- Japanese, Portuguese, Russian +200

Licenses

- apache-2.0, mit, afl-3.0 +56

Other

- AutoTrain Compatible, Eval Results, Has a Space
- Carbon Emissions

Models 93,687

bert-base-uncased

gpt2

openai/clip-vit-large-patch14

distilbert-base-uncased-finetuned-sst-2-english

allenai/specter

distilbert-base-uncased

bert-base-multilingual-cased

Jean-Baptiste/camembert-ner

roberta-base

Hugging Face

“GitHub for ML”

<https://huggingface.co>

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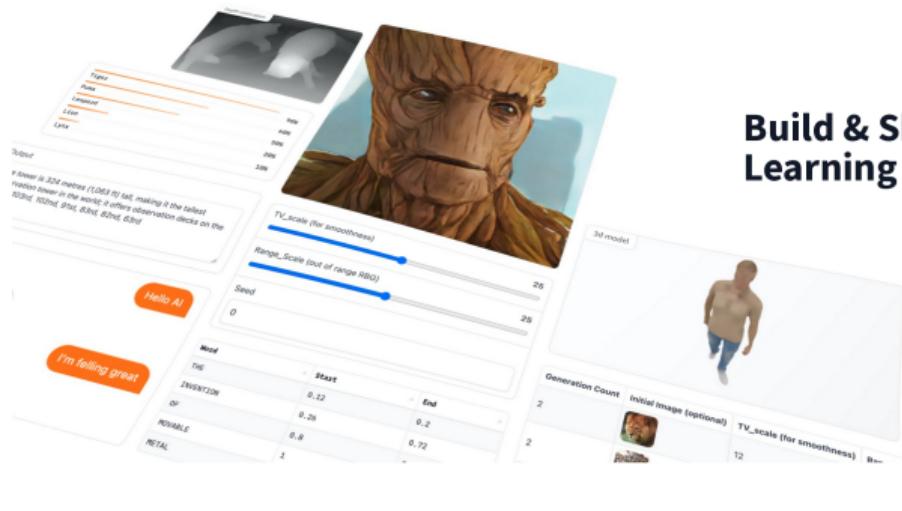
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Gradio

Build & Share Delightful Machine Learning Apps

Gradio is the fastest way to demo your machine learning model with a friendly web interface so that anyone can use it, anywhere!

Get Started

Star

10,955

<https://gradio.app/>
License: Apache 2.0

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Diffusers



D  ffusers

Pretrained diffusion models (vision, audio, etc.)
Modular toolbox for inference & training of
diffusion models

<https://github.com/huggingface/diffusers>

License: Apache 2.0

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Model frameworks, etc

PyTorch

<https://pytorch.org/>

TensorFlow

<https://tensorflow.org/>

Keras

<https://keras.io/>

Cuda

[https://developer.nvidia.com/
cuda-toolkit](https://developer.nvidia.com/cuda-toolkit)

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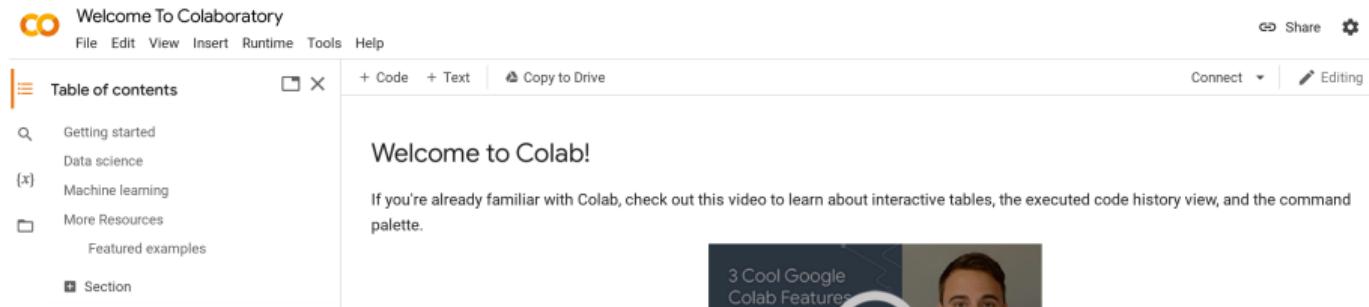
Many issues raised

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Collab



The screenshot shows the Google Colaboratory interface. At the top, there's a navigation bar with 'File', 'Edit', 'View', 'Insert', 'Runtime', 'Tools', and 'Help' options. To the right of the bar are 'Share' and 'Settings' icons. Below the bar, there's a 'Table of contents' sidebar with sections like 'Getting started', 'Data science', 'Machine learning', and 'More Resources'. The main content area displays a 'Welcome to Colab!' message with a brief description and a thumbnail image of a person.

Python in the browser, zero configuration
Access to GPUs & easy sharing

<https://colab.research.google.com/>

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Python in the browser, easy

<https://jupyter.org/>

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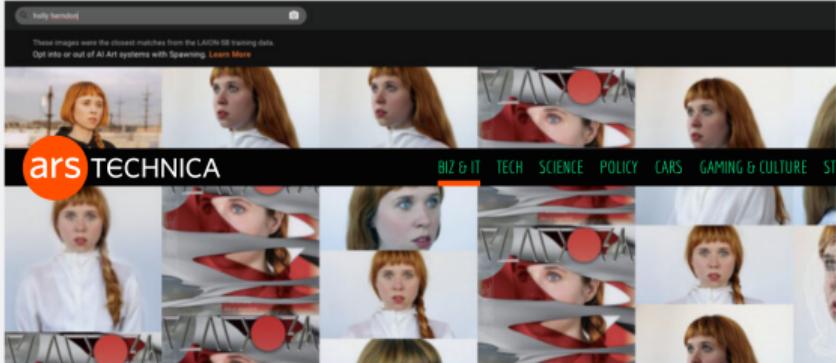
Intellectual property (training set)

ADVENTURES IN 21ST CENTURY CONSENT —

Have AI image generators assimilated your art? New tool lets you check

New search engine combs through harvested images used to train Stable Diffusion, others.

BENJ EDWARDS - 9/15/2022, 11:04 PM



The screenshot shows a news article from ars TECHNICA. At the top, there's a header with the text "ADVENTURES IN 21ST CENTURY CONSENT —". Below it is a large, bold title: "Have AI image generators assimilated your art? New tool lets you check". Underneath the title is a subtext: "New search engine combs through harvested images used to train Stable Diffusion, others.". Below that is a timestamp: "BENJ EDWARDS - 9/15/2022, 11:04 PM". At the bottom of the screenshot, there's a navigation bar with categories: BIZ & IT, TECH, SCIENCE, POLICY, CARS, GAMING & CULTURE, and SPORTS. The main content area displays a grid of various images, some of which have red circles overlaid on them, likely indicating they are part of the AI training dataset mentioned in the article.

[https:
//haveibeentrained.com/](https://haveibeentrained.com/)

[https://arstechnica.com/
information-technology/
2022/09/
have-ai-image-generators-as](https://arstechnica.com/information-technology/2022/09/have-ai-image-generators-as)

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Intellectual property (results)

Impact of Technology Deep Dive Report I

STUDY ON THE IMPACT OF ARTIFICIAL
INTELLIGENCE ON THE INFRINGEMENT AND
ENFORCEMENT OF COPYRIGHT AND DESIGNS

https://euipo.europa.eu/tunnel-web/secure/webdav/guest/document_library/observatory/documents/reports/2022_Impact_AI_on_the_Infringement_and_Enforcement_CR_Designs/2022_Impact_AI_on_the_Infringement_and_Enforcement_CR_Designs_FullR_en.pdf

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Intellectual property

- Can models be trained on anything public?
- Are models subject to copyright law?
- Who is the author of the production of a model?
- Can anybody besides the author claim rights on the production of a model

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Model	Model License	Description	Link to License
GPT-2	MIT License + generated output disclaimer	Permissive open source license	https://github.com/openai/gpt-2/blob/master/LICENSE
GPT-3	Exclusive	Licensed to	Microsoft
YOLO	YOLO License	Public domain license	https://github.com/pjreddie/darknet/blob/master/LICENSE
DALLE-pytorch	MIT License	Pytorch implementation of DALLE created by individual researcher	https://github.com/lucidrains/DALLE-pytorch/blob/main/LICENSE
Stable Diffusion	CreativeML Open RAIL-M	Open & Responsible AI License (RAIL) created by Stability.ai and adapted from the BLOOM RAIL license, including use-based restrictions (see attachment A)	https://huggingface.co/spaces/CompVis/stable-diffusion-license
OPT	OPT-175B License	Meta restrictive license enabling use of the model weights for research purposes while establishing a set of use-based restrictions, which could be considered a RAIL	https://github.com/facebookresearch/metalseq/blob/main/projects/OPT/MODEL_LICENSE.md
BigScience	BigScience OpenRAIL-M	Open & Responsible AI License (RAIL) created by BigScience and adapted from the BLOOM RAIL license, including use-based restrictions (see attachment A)	https://huggingface.co/spaces/bigscience/license
Tsinghua University	GLM-130B license	Restrictive license enabling use of the model weights for research purposes	https://github.com/THUDM/GLM-130B/blob/main/MODEL_LICENSE

Licenses

<https://hackmd.io/@jending12/HyvMU8sJo>

<https://thegradient.pub/>

<https://thegradient.pub/machine-learning-ethics-and-open-source-lic>

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Bias



Mugshot of a technical speaker, machine learning expert,
smiling, long hair, big eyes [t-shirt, curly hair]

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[Privacy](#) [Careers](#) [Disclosure Policy](#) [Technical Advisories](#) [Public Reports](#) [2021 Research Report](#)

[Contact Us](#)

Whitepaper – Practical Attacks on Machine Learning Systems

Jennifer Fernick

Machine Learning, Offensive Security & Artificial Intelligence, Research, Research Paper, Whitepaper

July 6, 2022 1 Minute

Written by Chris Anley, Chief Scientist, NCC Group

[https://research.nccgroup.com/2022/07/06/
whitepaper-practical-attacks-on-machine-learning-systems/](https://research.nccgroup.com/2022/07/06/whitepaper-practical-attacks-on-machine-learning-systems/)
<https://simonwillison.net/2022/Sep/12/prompt-injection/>

Security

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Impact on professionals

- No more draw for hire as a profession?
- New opportunities for artists?
- Access to models as a fundamental need?

Is this different from the invention of photography?

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Prompt engineers

A new profession

Artists, engineers, craftsmen?

Is it here to stay?

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What is true?

Make-A-Video

Make-A-Video research builds on the recent progress made in text-to-image generation technology built to enable text-to-video generation. The system uses images with descriptions to learn what the world looks like and how it is often described. It also uses unlabeled videos to learn how the world moves. With this data, Make-A-Video lets you bring your imagination to life by generating whimsical, one-of-a-kind videos with just a few words or lines of text.



<https://makeavideo.studio/>

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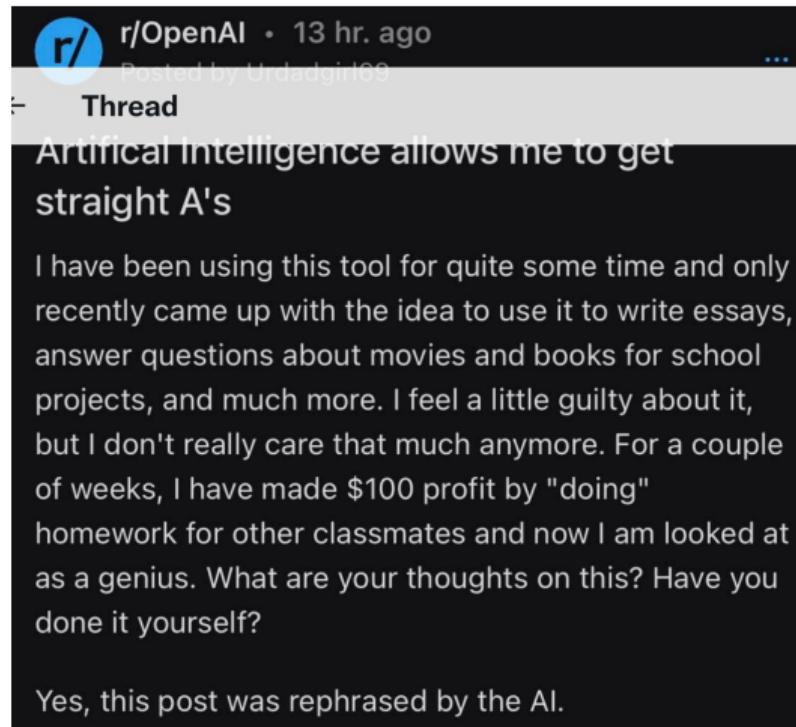
Many issues raised

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Assignments



A screenshot of a Reddit post from the r/OpenAI subreddit. The post was made 13 hours ago by a user named Urddadgirl09. It is a thread consisting of one post. The title of the post is "Artifical Intelligence allows me to get straight A's". The post content reads: "I have been using this tool for quite some time and only recently came up with the idea to use it to write essays, answer questions about movies and books for school projects, and much more. I feel a little guilty about it, but I don't really care that much anymore. For a couple of weeks, I have made \$100 profit by "doing" homework for other classmates and now I am looked at as a genius. What are your thoughts on this? Have you done it yourself?" At the bottom of the post, a note states: "Yes, this post was rephrased by the AI."

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Programming



Search...
Help

arXiv > cs > arXiv:2207.14502

Computer Science > Machine Learning

[Submitted on 29 Jul 2022 (v1), last revised 30 Sep 2022 (this version, v2)]

Language Models Can Teach Themselves to Program Better

Patrick Halupczok, Matthew Bowers, Adam Tauman Kalai

Recent Language Models (LMs) achieve breakthrough performance in code generation when trained on human-authored problems, even solving some competitive-programming problems. Self-play has proven useful in games such as Go, and thus it is natural to ask whether LMs can generate their own instructive programming problems to improve their performance. We show that it is possible for an LM to synthesize programming problems and solutions, which are filtered for correctness by a Python interpreter. The LM's performance is then seen to improve when it is fine-tuned on its own synthetic problems and verified solutions; thus the model 'improves itself' using the Python interpreter. Problems are specified formally as programming puzzles [Schuster et al., 2021], a code-based problem format where solutions can easily be verified for correctness by execution. In experiments on publicly-available LMs, test accuracy more than doubles. This work demonstrates the potential for code LMs, with an interpreter, to generate instructive problems and improve their own performance.

<https://arxiv.org/abs/2207.14502>

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Programming

Self-Programming Artificial Intelligence Using Code-Generating Language Models



Anonymous

22 Sept 2022 (modified: 26 Oct 2022) ICLR 2023 Conference Blind Submission Readers: Everyone Show Bibtex Show Revisions

Keywords: Self-programming AI, NLP, code generation, AutoML

TL;DR: We develop and experimentally validate the first practical implementation of a self-reprogramming AI system.

Abstract: Recent progress in large-scale language models has enabled breakthroughs in previously intractable computer programming tasks. Prior work in meta-learning and neural architecture search has led to substantial successes across various task domains, spawning myriad approaches for algorithmically optimizing the design and learning dynamics of deep learning models. At the intersection of these research areas, we implement a code-generating language model with the ability to modify its own source code. Self-programming AI algorithms have been of interest since the dawn of AI itself. Although various theoretical formulations of generalized self-programming AI have been posed, no such system has been successfully implemented to date under real-world computational constraints. Applying AI-based code generation to AI itself, we develop and experimentally validate the first practical implementation of a self-programming AI system. We empirically show that a self-programming AI implemented using a code generation model can successfully modify its own source code to improve performance and program sub-models to perform auxiliary tasks. Our model can self-modify various properties including model architecture, computational capacity, and learning dynamics.

[https:](https://)

//keras.io/examples/generative/random_walks_with_stable_diffusion/

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The future just started

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References, credits, license

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- **Transformers-Tutorials**

<https://github.com/NielsRogge/Transformers-Tutorials>

- **Vision Transformers**

<https://cameronrwolfe.substack.com/p/vision-transformers>

- **A walk through latent space with Stable Diffusion**

https://keras.io/examples/generative/random_walks_with_stable_diffusion/

- **How Open Source is eating AI**

<https://lspace.swyx.io/p/open-source-ai>

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- Awesome Diffusion Models
<https://github.com/heejkoo/Awesome-Diffusion-Models>
- /r/StableDiffusion at Reddit
<https://www.reddit.com/r/StableDiffusion>
- The Generative Landscape (WiP course)
<https://johnowhitaker.github.io/tglcourse/>

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To try it yourself

- Generative models for images (Stable Diffusion):
<https://github.com/AUTOMATIC1111/stable-diffusion-webui>
- Generative models for text (LLaMA, GPT-J, Pythia, OPT, GALACTICA...)
<https://github.com/oobabooga/text-generation-webui>

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Credits



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<https://jgbarah.github.io/presentations>