

Generative AI

Jesus M.  
Gonzalez-Barahona

Examples: images

Examples: text,  
code...

What's in a  
generative model

Extensions,  
integrations

Stable Diffusion is  
not alone

Infrastructure to  
play, to share

Many issues raised

The future

# Generative AI

Jesus M. Gonzalez-Barahona

Universidad Rey Juan Carlos

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

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

IES Villaverde

Madrid, Spain, Oct 18th 2023



# Plan

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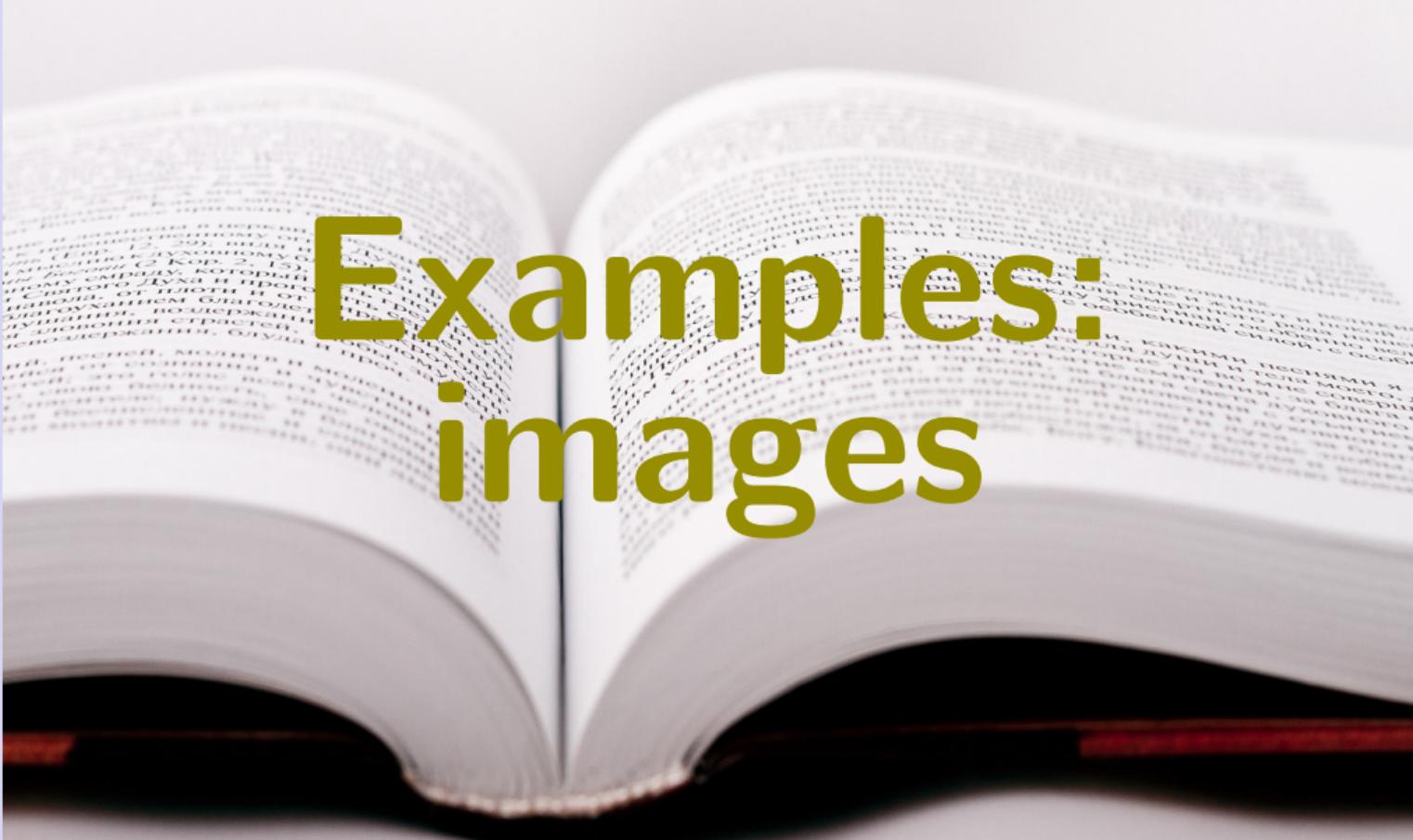
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Dinosaurio, vestido  
con un traje, con  
sombrero flamenco,  
ofreciendo una  
margarita

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Spain football  
team, winners of  
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Qatar 2022,  
celebrating

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Profesor de  
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educación  
secundaria

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Technology  
teacher, secondary  
education, portrait

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<https://stablediffusionweb.com>

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selfie of a teacher  
with a dinousar, in  
Manhattan  
cinematic-default

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“selfie of a free culture enthusiast with a dinosaur”

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# Test it yourself

<https://beta.dreamstudio.ai/>

<https://www.bing.com/images/create>

<https://app.prodia.com/>

<https://stablediffusion.fr/xl>

<https://stablediffusionweb.com>

Or install Stable Diffusion XL it in your own  
infrastructure

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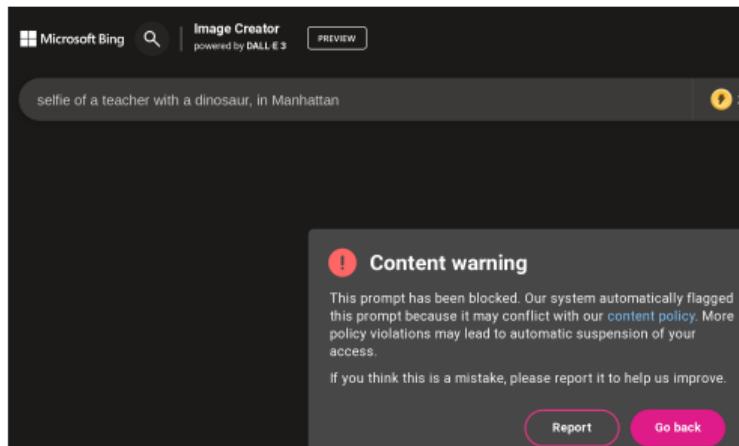
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# But beware!



“selfie of a teacher with a dinosaur, in Manhattan”

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# Chats

<https://chat.openai.com>

<https://claude.ai>

<https://www.jasper.ai/chat>

<https://bard.google.com>

<https://huggingface.co/chat/>

<https://huggingface.co/chat/>

<https://open-assistant.io/chat>

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# Code

Usually as plugins for IDEs

Exammples: Cody

<https://about.sourcegraph.com/cody>

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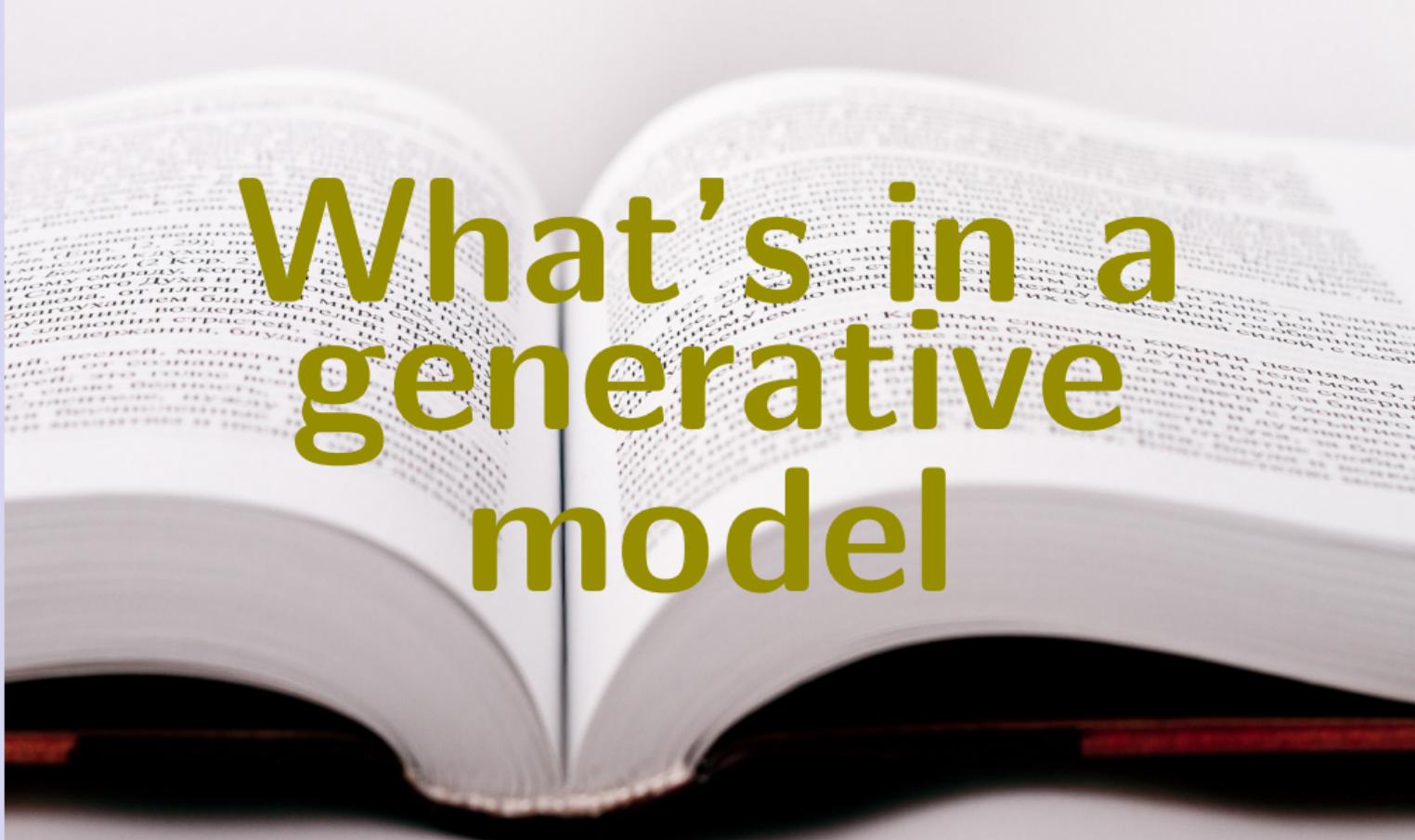
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# What's in a generative model



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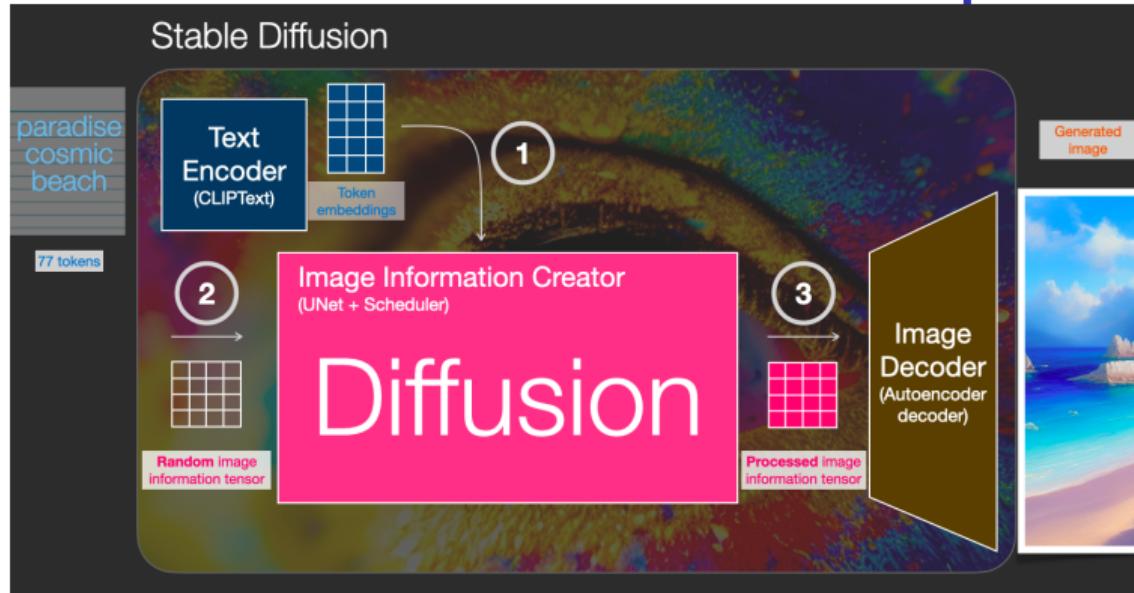
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# Stable Diffusion process



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

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# Extensions, integrations



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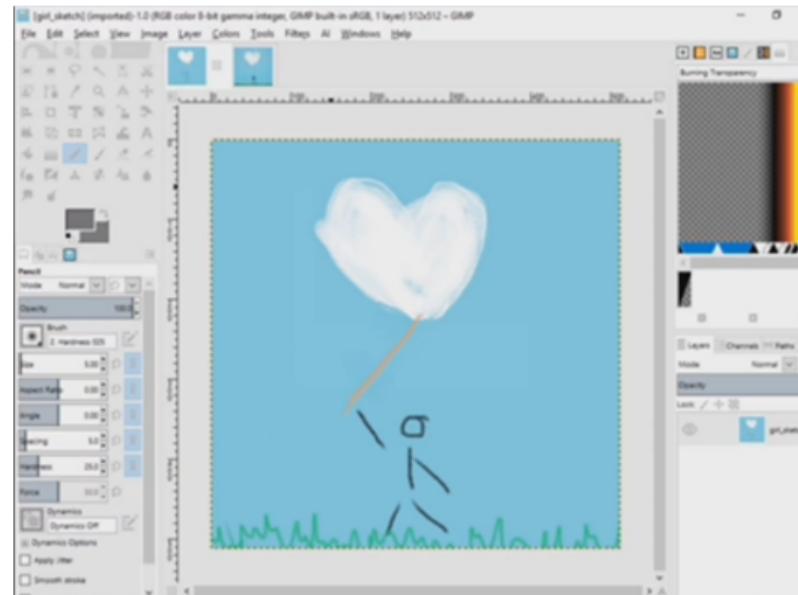
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# Integration: GIMP



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

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# Integration: Blender



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

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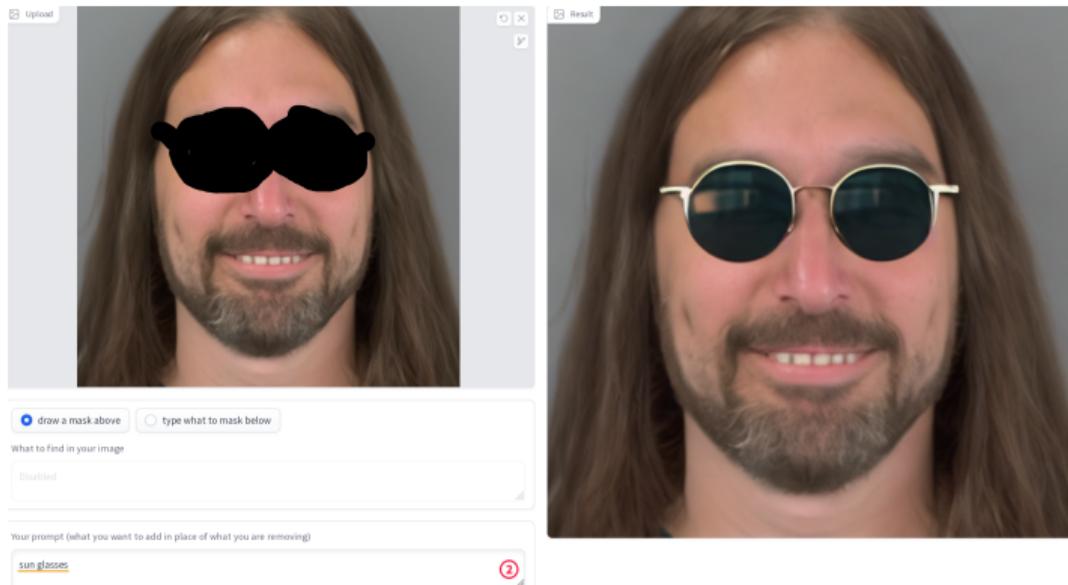
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# In-painting



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

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# Out-painting



<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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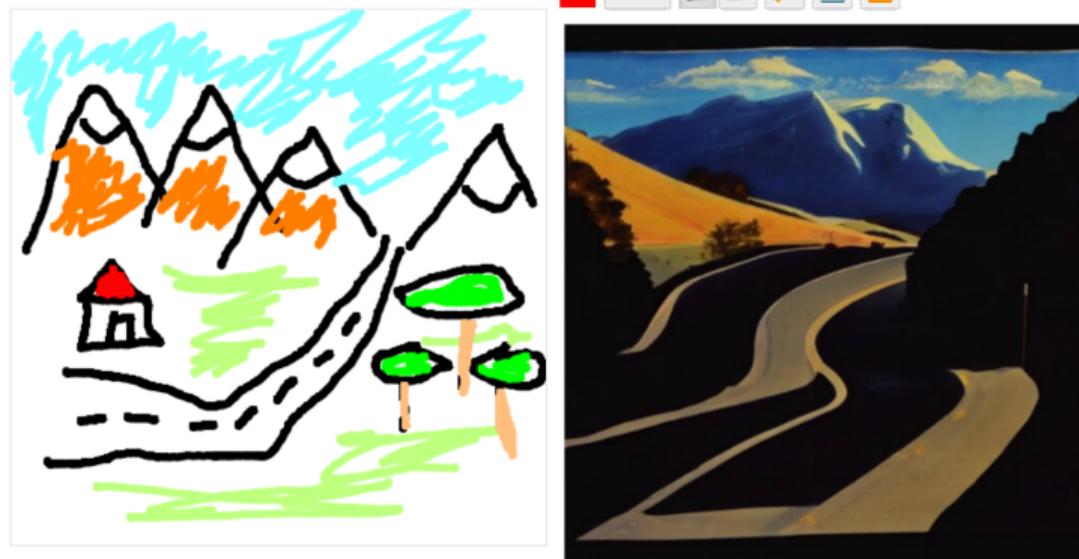
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Share to community

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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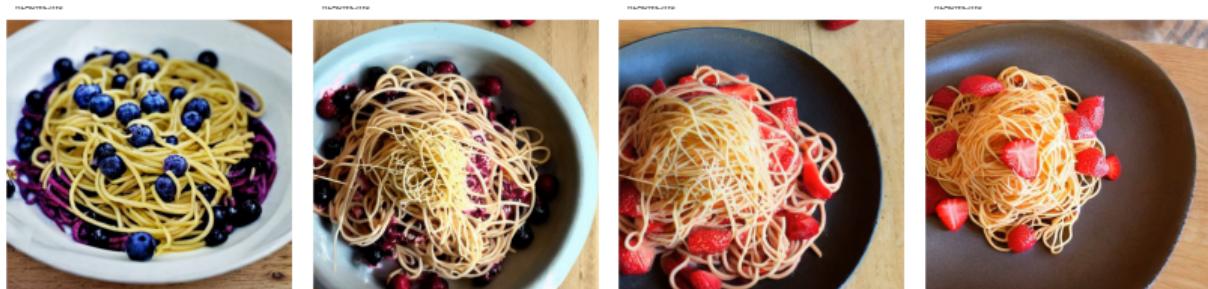
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# Videos



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

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

[https://aiart.dev/posts/sd-music-videos/sd\\_music\\_videos.html](https://aiart.dev/posts/sd-music-videos/sd_music_videos.html)

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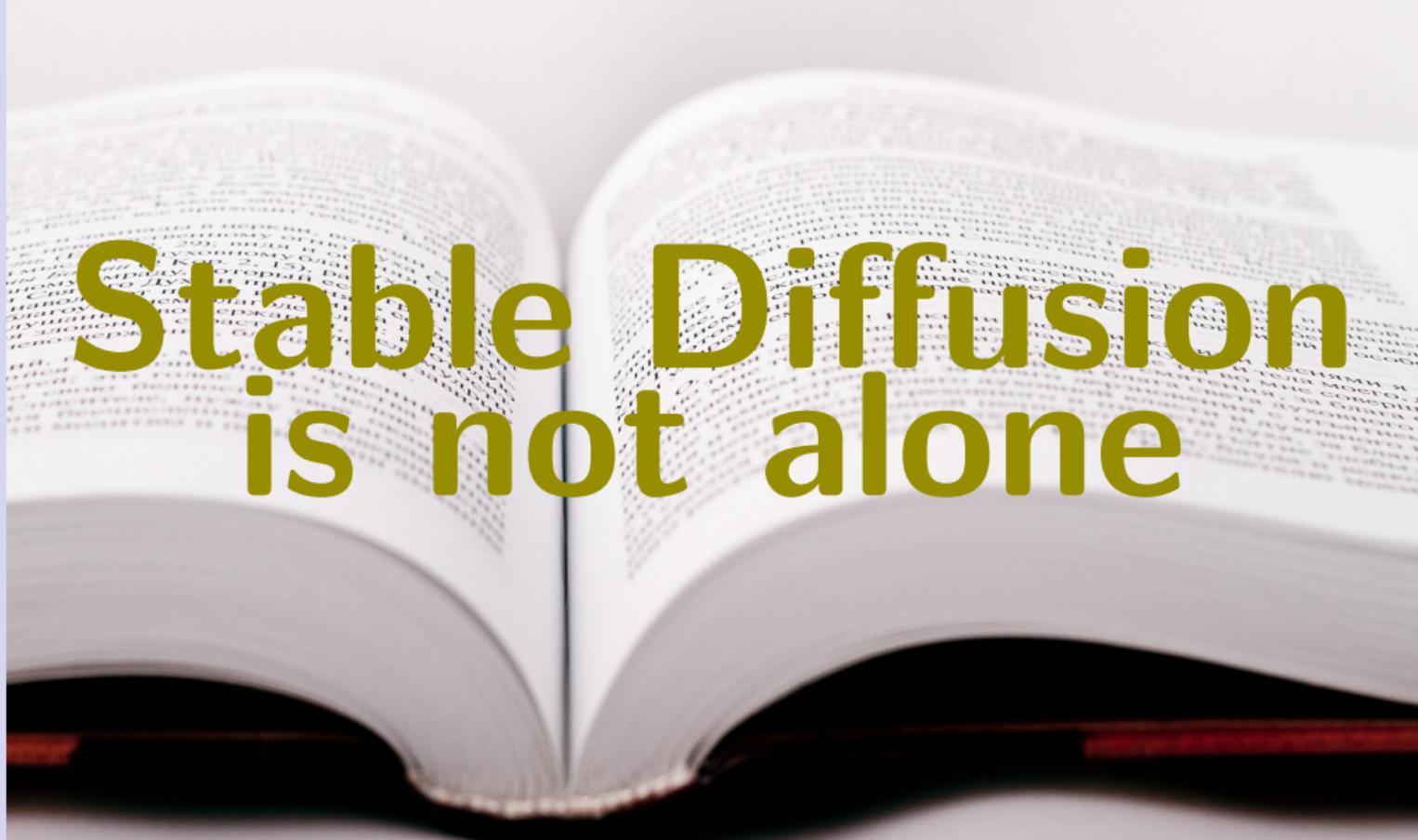
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# Whisper

## 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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# 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)

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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](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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# 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 ?



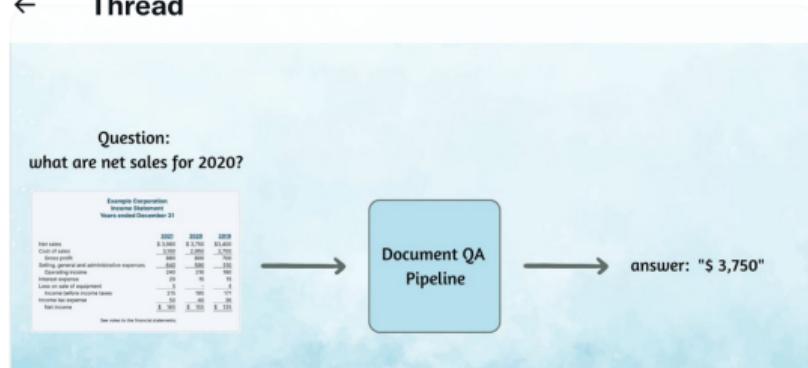
This is a pipeline you can use to extract information from PDFs! Let's take a closer look ☺

← 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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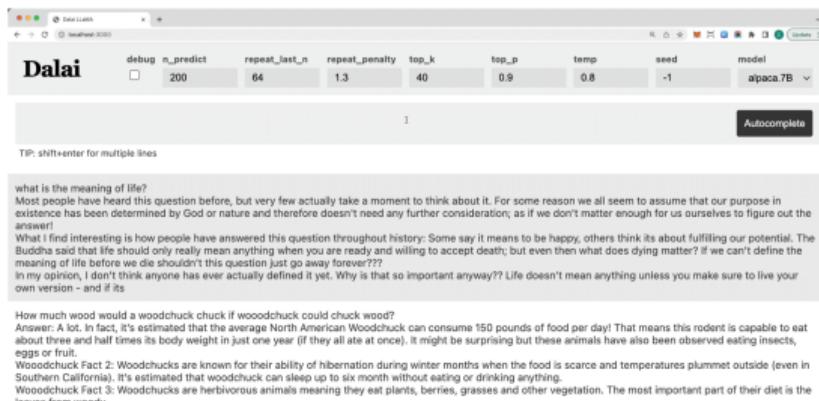
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# A tale (2): Dalai

## 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://github.com/tatsu-lab/stanford_alpaca)

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

[https:////theresister.com/2023/03/21/stanford\\_ai\\_alpaca\\_taken\\_offline/](https:////theresister.com/2023/03/21/stanford_ai_alpaca_taken_offline/)

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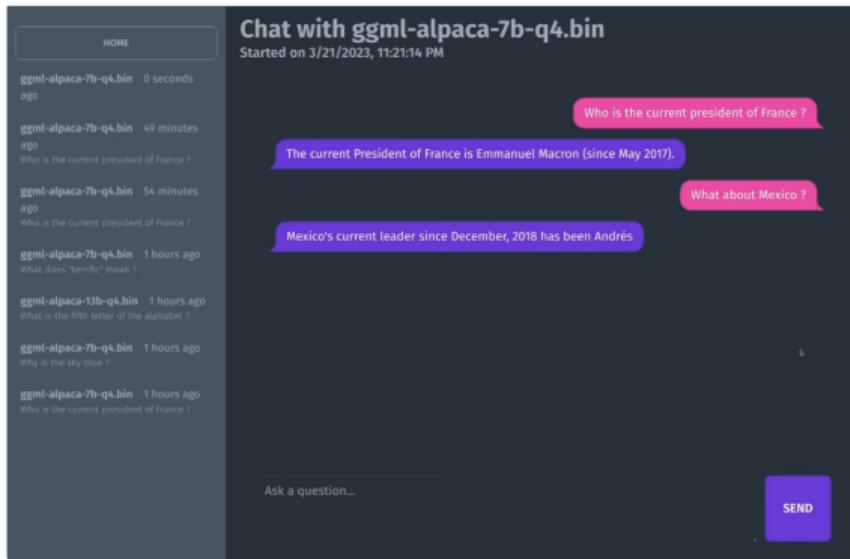
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# A tale (4): Serge



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

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

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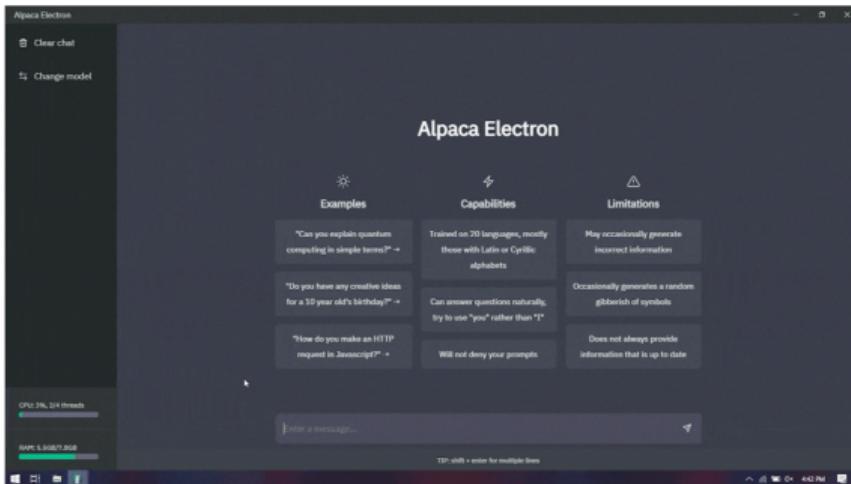
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# A tale (5): Alpaca Electron



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

<https://github.com/>

ItsPi3141/alpaca-electron

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# A tale (6): OobaBooga

The screenshot shows a web-based text generation interface. At the top, there are tabs for 'Text generation' (which is selected), 'Chat settings', 'Parameters', 'Model', 'Training', and 'Session'. Below the tabs, a conversation log is displayed:

- User (red circle): Tell me a little joke, involving bananas, dinosaurs and clouds
- Assistant (blue circle): Okay, here's one! A banana walks into a cloud. The cloud says "I'm sorry, I don't speak banana" And the banana leaves in disgust.
- User (red circle): Come on, something more funny!
- Assistant (blue circle): Alright, how about this? An old man goes for a walk at night. He hears noises coming from under his shed, so he opens up the door and sees a monkey eating a bunch of bananas. The monkey looks at him and asks "Old man, why are you laughing?" The old man explains that he finds humor in everything because that is what keeps him sane. The monkey then laughs too...and continues to eat all of the bananas while they laugh together.

At the bottom of the interface, there is an input field labeled 'Input' with a placeholder 'Type your message here...', and several buttons: 'Stop' (disabled), 'Generate' (highlighted in orange), 'Continue', 'Impersonate', 'Regenerate', and 'Remove last'.

OobaBooga  
provides an easy  
web interface to  
many models.

<https://github.com/>

ItsPi3141/alpaca-electron

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Examples: images

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Extensions,  
integrations

Stable Diffusion is  
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Infrastructure to  
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Many issues raised

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# Infrastructure to play, to share



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**Hugging Face** Search models, datasets, users...

**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, ari-3.0 + 56

**Other**

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

**Models** 93,687 Filter by name

- bert-base-uncased** Updated 14 days ago - 22.5M - 352
- gpt2** Updated 7 days ago - 12.3M - 323
- openai/clip-vit-large-patch14** Updated Oct 14 - 8.91M - 90
- distilbert-base-uncased-finetuned-sst-2-english** Updated 14 days ago - 8.61M - 114
- allenai/specter** Updated Jun 29 - 7.62M - 33
- distilbert-base-uncased** Updated 14 days ago - 7.56M - 104
- bert-base-multilingual-cased** Updated 14 days ago - 7.41M - 69
- Jean-Baptiste/camembert-ner** Updated Oct 13 - 6.81M - 43
- roberta-base** Updated Sep 29 - 6.76M - 85

# Hugging Face

“GitHub for ML”

<https://huggingface.co>

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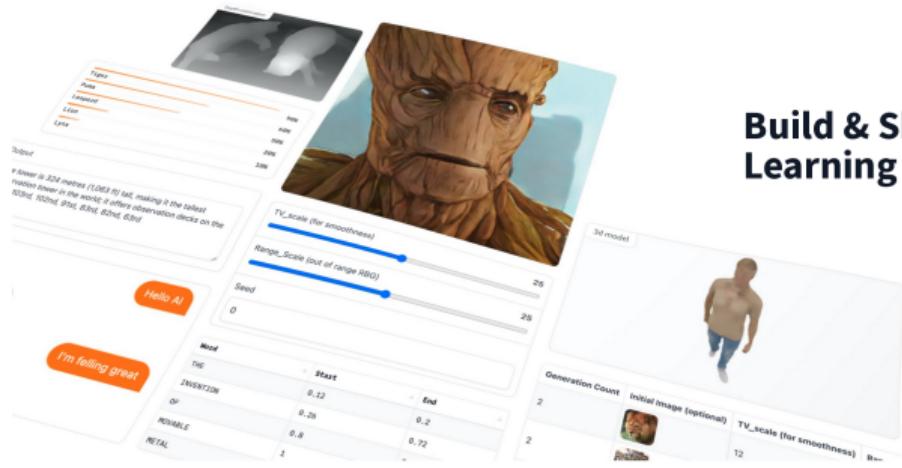
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# Gradio



## 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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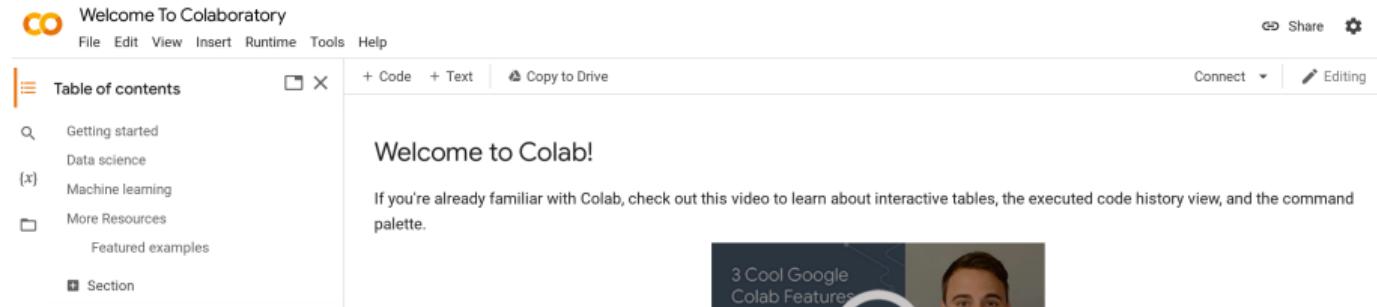
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# Collab



The screenshot shows the Google Colaboratory interface. At the top, there's a navigation bar with the 'Welcome To Colaboratory' logo, file menu (File, Edit, View, Insert, Runtime, Tools, Help), and a 'Share' button. Below the nav bar is a toolbar with '+ Code', '+ Text', and 'Copy to Drive' buttons. On the left, a sidebar titled 'Table of contents' lists sections: 'Getting started', 'Data science', 'Machine learning', 'More Resources' (with 'Featured examples' and 'Section' options), and a search bar. The main content area displays the 'Welcome to Colab!' message, which includes a video thumbnail for '3 Cool Google Colab Features' and some descriptive text about interactive tables and command palettes.

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

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

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# Jupyter



## Python in the browser, easy

<https://jupyter.org/>

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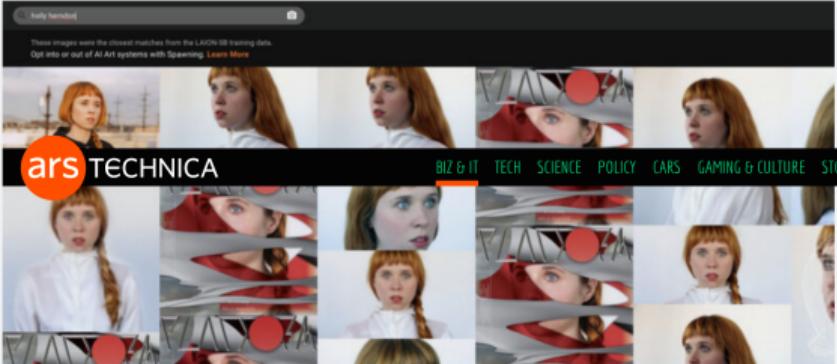
# Intellectual property (training set)

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

A screenshot of a news article from ars TECHNICA. The article title is "Have AI image generators assimilated your art? New tool lets you check". Below the title, it says "New search engine combs through harvested images used to train Stable Diffusion, others.". The author is BENJ EDWARDS and the date is 9/15/2022, 11:04 PM. The article includes a grid of AI-generated images of a woman with red hair, some of which have red circles overlaid on them. The ars TECHNICA logo is visible in the bottom left corner of the grid.

[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](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

## Generative AI

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# Licenses

Model	Model License	Description	Link to License
GPT-2	MIT License + generated output disclaimer	Permissive open source license	<a href="https://github.com/openai/gpt-2/blob/master/LICENSE">https://github.com/openai/gpt-2/blob/master/LICENSE</a>
GPT-3	Exclusive	Licensed to	Microsoft
YOLO	YOLO License	Public domain license	<a href="https://github.com/pjreddie/darknet/blob/master/LICENSE">https://github.com/pjreddie/darknet/blob/master/LICENSE</a>
DALLE-pytorch	MIT License	Pytorch implementation of DALLE created by individual researcher	<a href="https://github.com/lucidrains/DALLE-pytorch/blob/main/LICENSE">https://github.com/lucidrains/DALLE-pytorch/blob/main/LICENSE</a>
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)	<a href="https://huggingface.co/spaces/CompVis/stable-diffusion-license">https://huggingface.co/spaces/CompVis/stable-diffusion-license</a>
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	<a href="https://github.com/facebookresearch/metaseq/blob/main/projects/OPT/MODEL_LICENSE.md">https://github.com/facebookresearch/metaseq/blob/main/projects/OPT/MODEL_LICENSE.md</a>
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)	<a href="https://huggingface.co/spaces/bigscience/license">https://huggingface.co/spaces/bigscience/license</a>
Tsinghua University	GLM-130B license	Restrictive license enabling use of the model weights for research purposes	<a href="https://github.com/THUDM/GLM-130B/blob/main/MODEL_LICENSE">https://github.com/THUDM/GLM-130B/blob/main/MODEL_LICENSE</a>

<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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# Security



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

[Contact Us](#)

## Whitepaper – Practical Attacks on Machine Learning Systems

By 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/>

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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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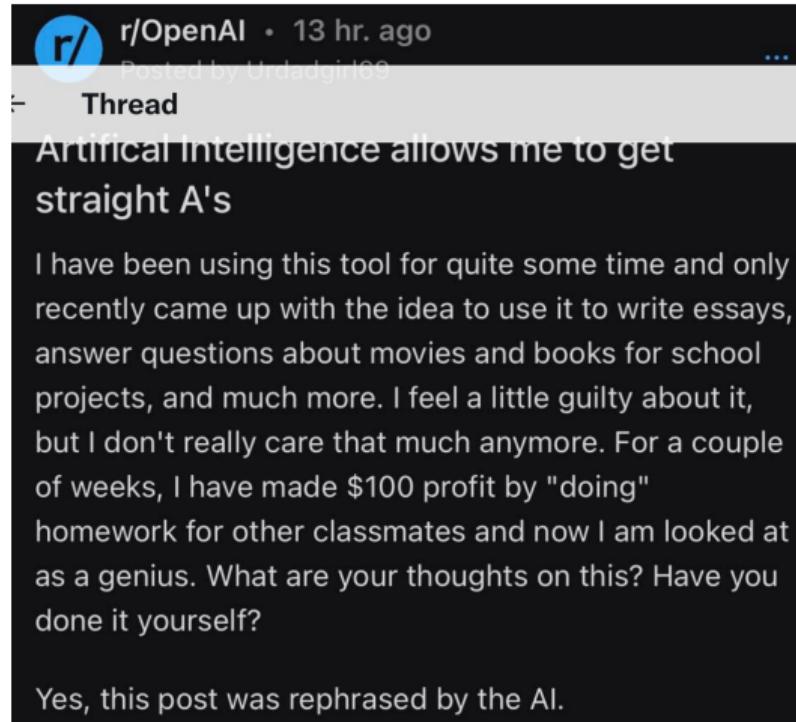
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# Assignments



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 content of the post is a long text describing how the user has been using AI to write essays, answer school questions, and do homework, making \$100 profit. The text ends with a question: "What are your thoughts on this? Have you done it yourself?" Below the post, a note states "Yes, this post was rephrased by the AI."

r/OpenAI • 13 hr. ago

Posted by Urddadgirl09

Thread

Artifical Intelligence allows me to get straight A's

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?

Yes, this post was rephrased by the AI.

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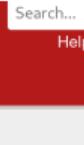
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# Programming

A screenshot of an arXiv search results page. The header features the arXiv logo and navigation links for 'Search...', 'Help', and 'Computer Science > Machine Learning'. Below the header, the title 'Language Models Can Teach Themselves to Program Better' is displayed in bold black text. The authors' names, 'Patrick Halupczok, Matthew Bowers, Adam Tauman Kalai', are listed in blue. A summary of the research is provided in black text.

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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# Summarizing



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# The future just started

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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/](https://keras.io/examples/generative/random_walks_with_stable_diffusion/)

- **How Open Source is eating AI**

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

## Generative AI

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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



Book, by NikolayFrolochkin, Pixabay.  
License: Creative Commons CC0

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This document (including source) is available from  
<https://jgbarah.github.io/presentations>