

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>

Machine Learning Spain  
Madrid, Spain, December 1st 2022

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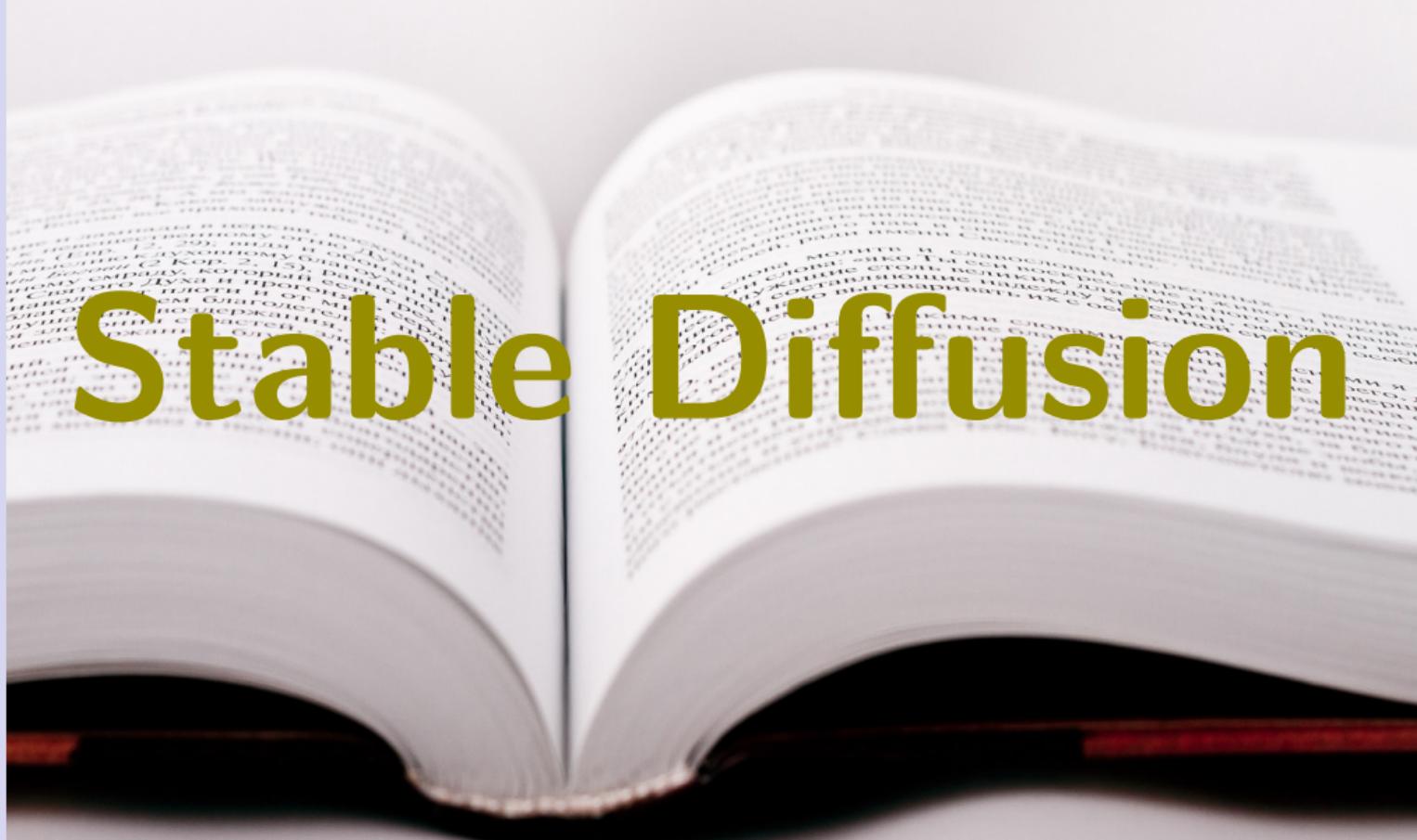
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Spain football  
team, winners of  
the World Cup in  
Qatar 2022,  
celebrating

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Speaker presenting at Machine Learning Spain (25, 50)

# Stable Diffusion

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Speaker presenting at Machine Learning China

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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 last week

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

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# Stable Diffusion process



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

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# Extensions, integrations



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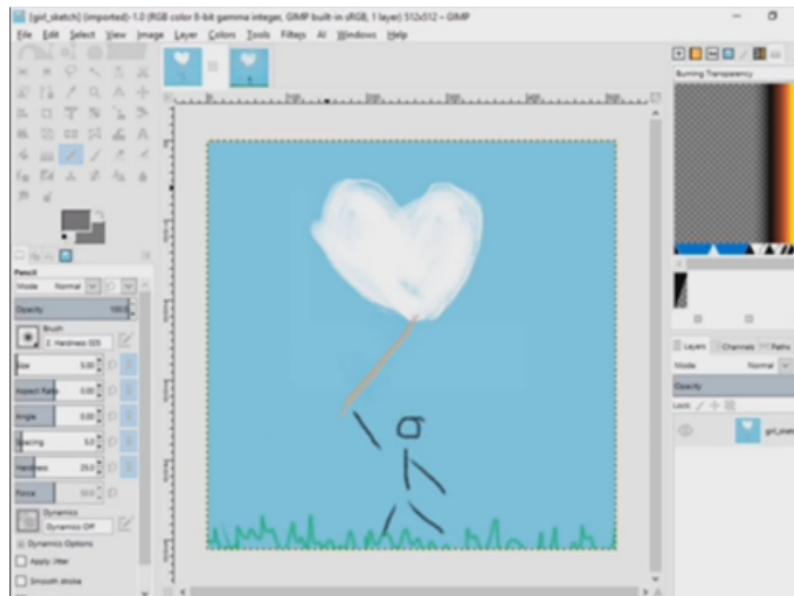
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# Integration: GIMP



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

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# Integration: Blender



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

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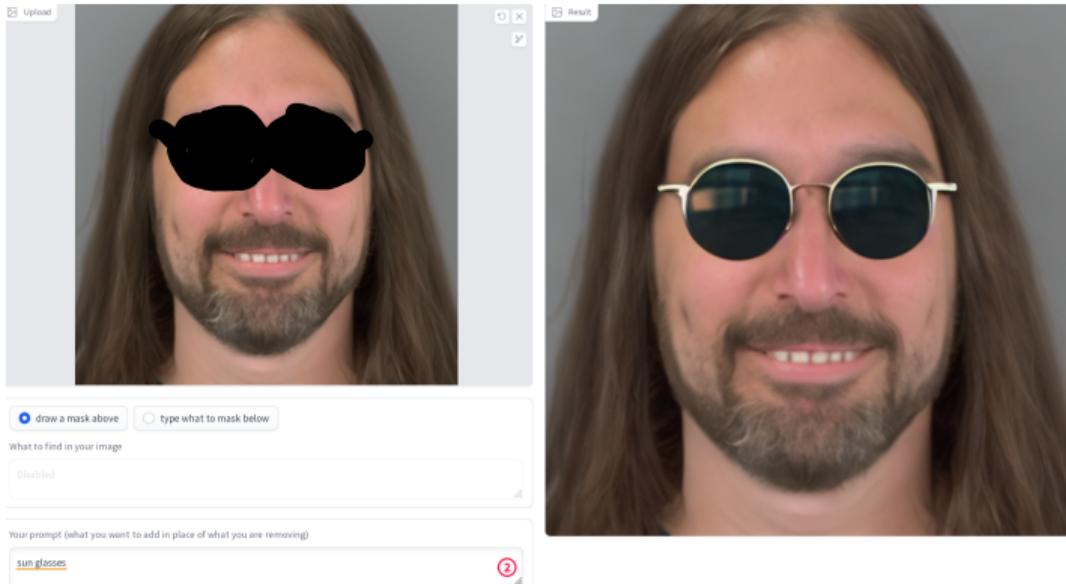
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# In-painting



<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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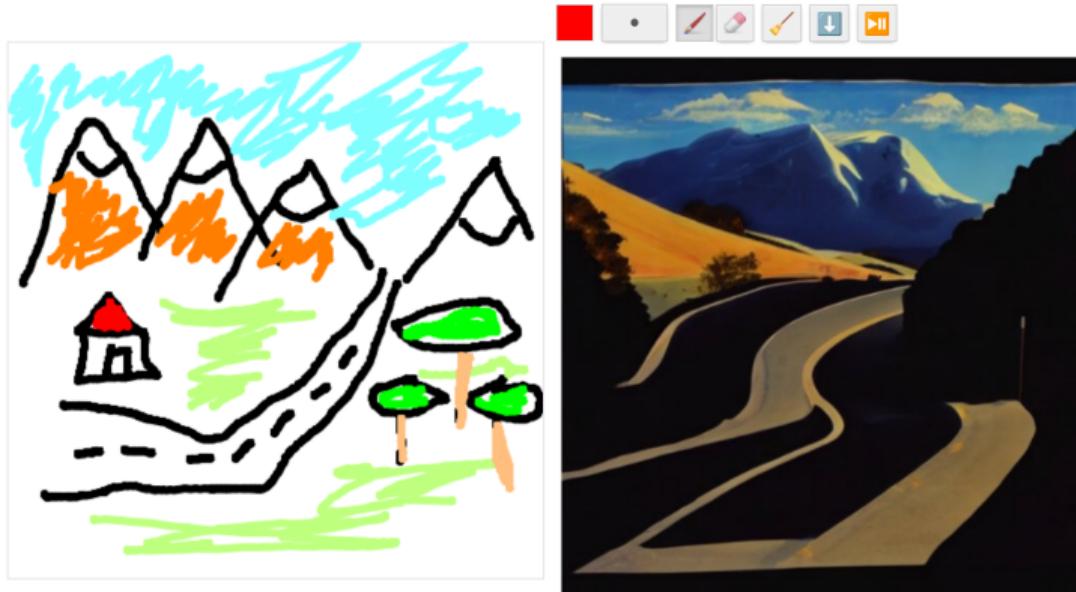
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Share to community

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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# 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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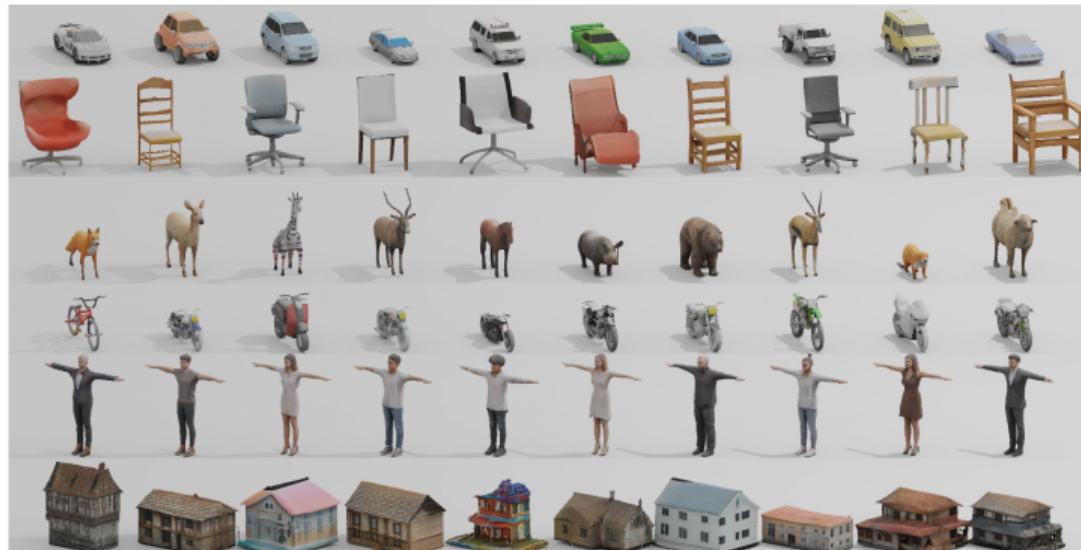
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# 3D assets



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

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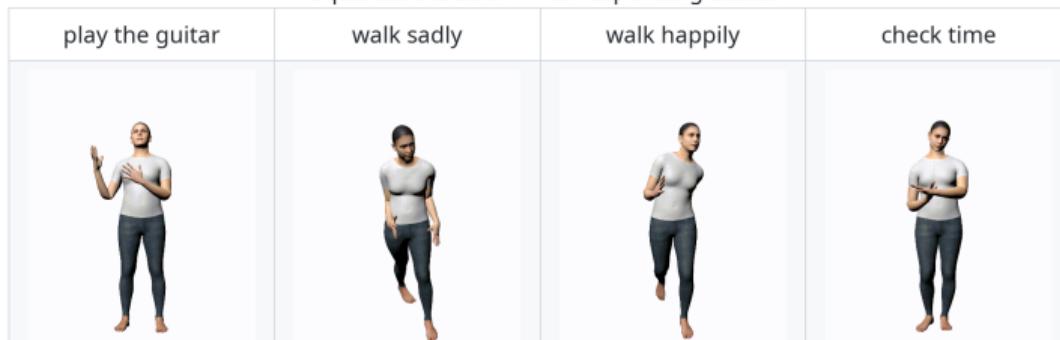
# 3D assets

## MotionDiffuse: Text-Driven Human Motion Generation with Diffusion Model

Mingyuan Zhang<sup>1\*</sup> Zhongang Cai<sup>1,2\*</sup> Liang Pan<sup>1</sup> Fangzhou Hong<sup>1</sup> Xinying Guo<sup>1</sup> Lei Yang<sup>2</sup> Ziwei Liu<sup>1+</sup>

<sup>1</sup>S-Lab, Nanyang Technological University <sup>2</sup>SenseTime Research

\*equal contribution +corresponding author



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

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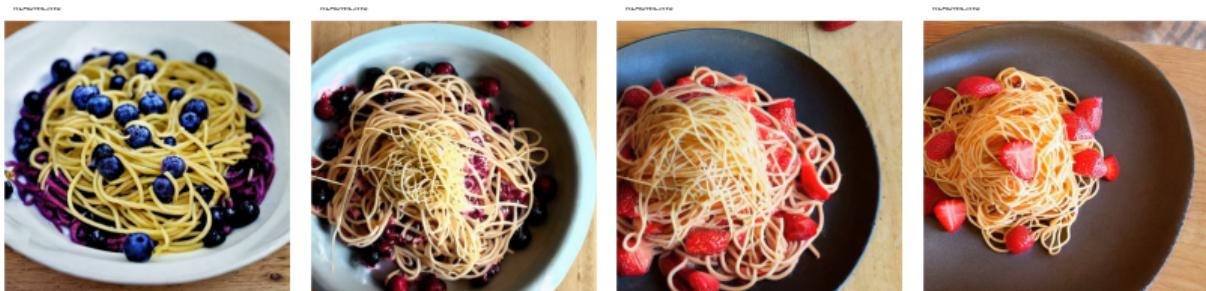
Many issues raised

The future

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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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# And much, much more

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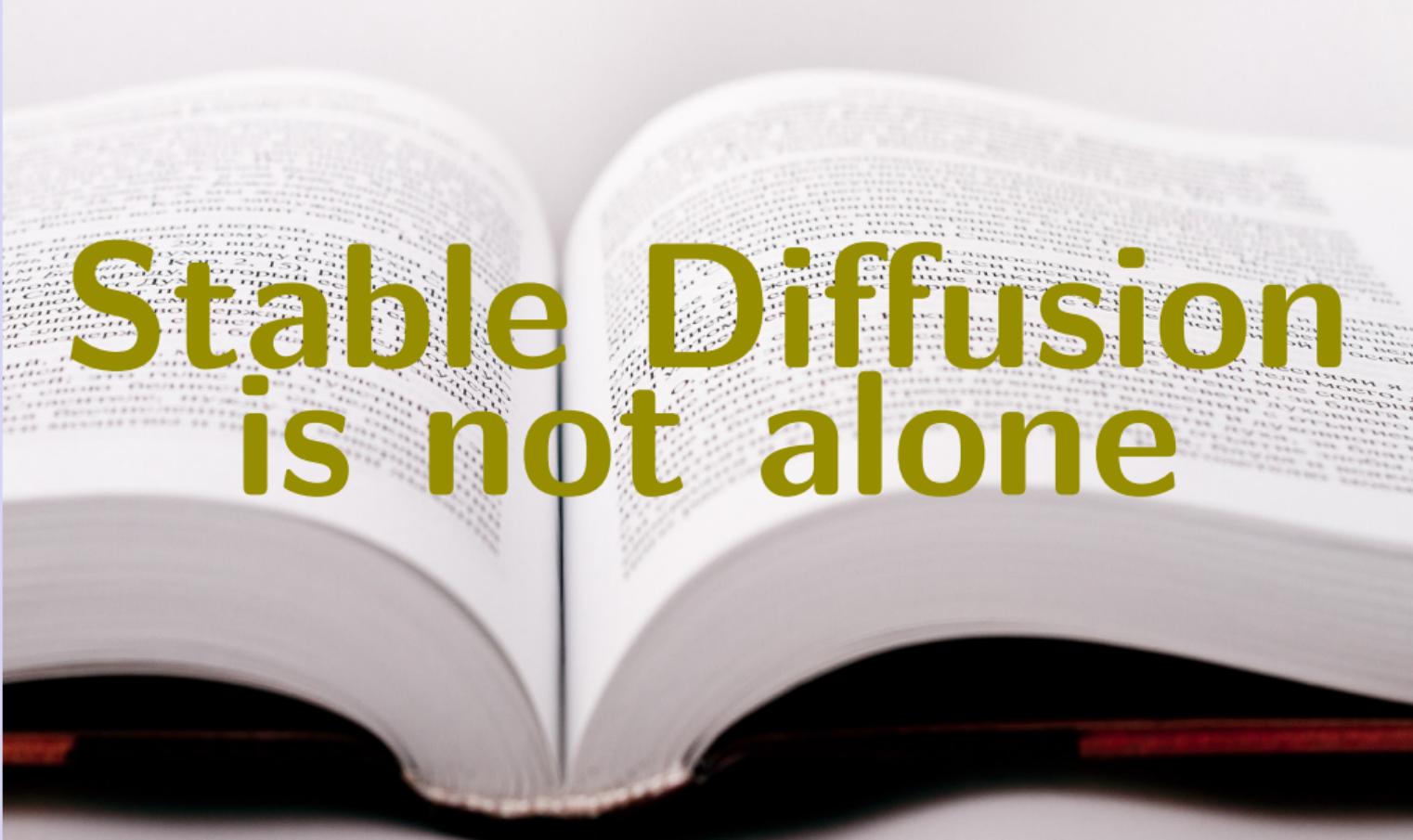
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# Whisper

## 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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# 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>

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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>

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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://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 ?



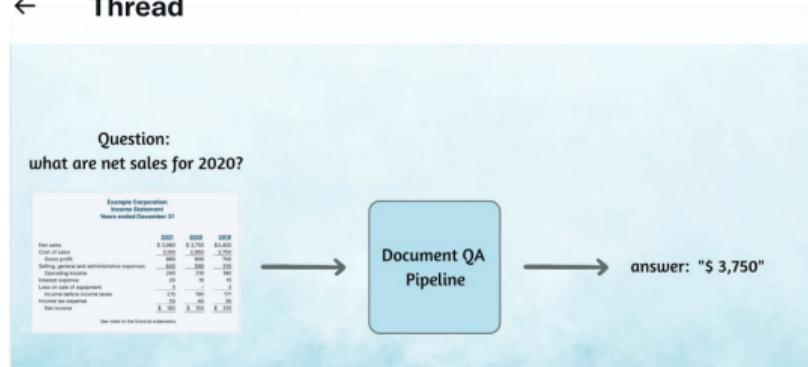
This is a pipeline you can use to extract information from PDFs! Let's take a closer look ☺

← Thread

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

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

1572168848622907393



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# Infrastructure to play, to share

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The screenshot shows the Hugging Face homepage. At the top, there's a search bar labeled "Search models, datasets, users...". Below the search bar, there are several sections:

- Tasks:** Includes Image Classification, Translation, Image Segmentation, Fill-Mask, Automatic Speech Recognition, Token Classification, Sentence Similarity, Audio Classification, Question Answering, Summarization, Zero-Shot Classification, and +23 Tasks.
- Libraries:** PyTorch, TensorFlow, JAX, +33.
- Datasets:** mozilla-foundation/common\_voice\_7\_0, squad, wikipedia, common\_voice, glue, emotion, xtreme, nelbert/seminal2012\_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.

On the right side, there's a list of models with their details:

- 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, 4.81M, 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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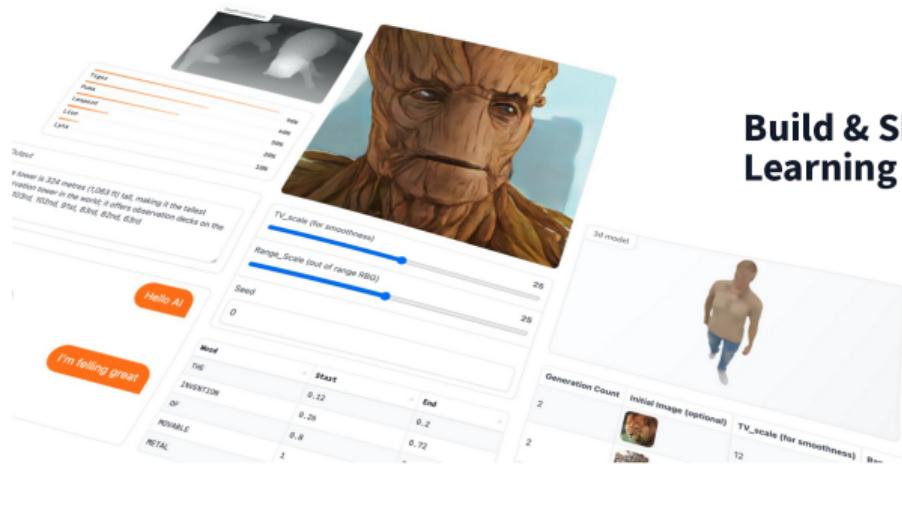
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# Gradio

**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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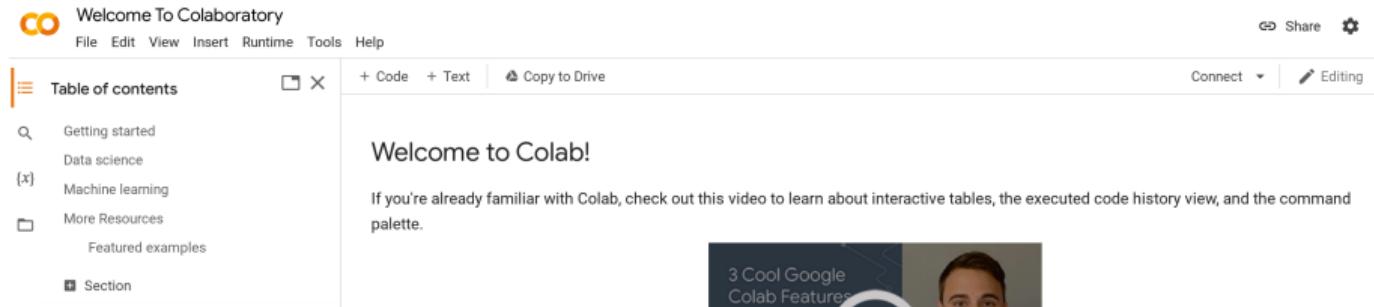
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# Collab



The screenshot shows the Google Colaboratory interface. At the top, there's a navigation bar with the 'Colab' 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' (which includes 'Featured examples' and 'Section'), and a search bar. The main content area features a large heading 'Welcome to Colab!', a brief description about interactive tables and command palettes, and a thumbnail image for a video titled '3 Cool Google Colab Features'.

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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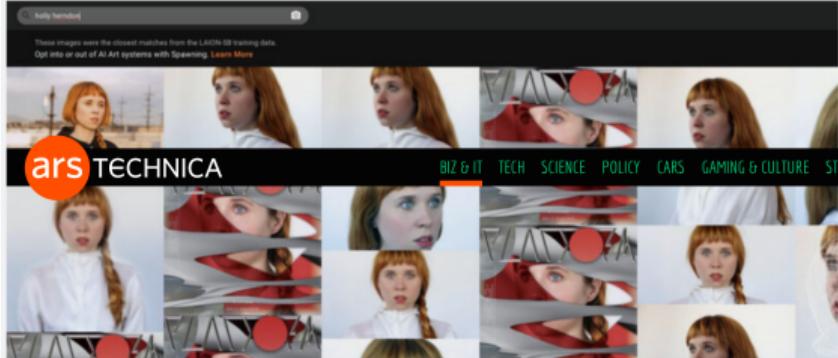
# Intellectual property (training set)

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. The headline is "Have AI image generators assimilated your art? New tool lets you check". Below the headline, it says "New search engine combs through harvested images used to train Stable Diffusion, others.". The author is Benj Edwards, dated 9/15/2022, 11:04 PM. The page includes a navigation bar with categories: BIZ & IT, TECH, SCIENCE, POLICY, CARS, GAMING & CULTURE, and STO. Below the navigation bar is a grid of images showing various portraits of a woman with red hair, some of which are highlighted with red circles.

[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

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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>

# 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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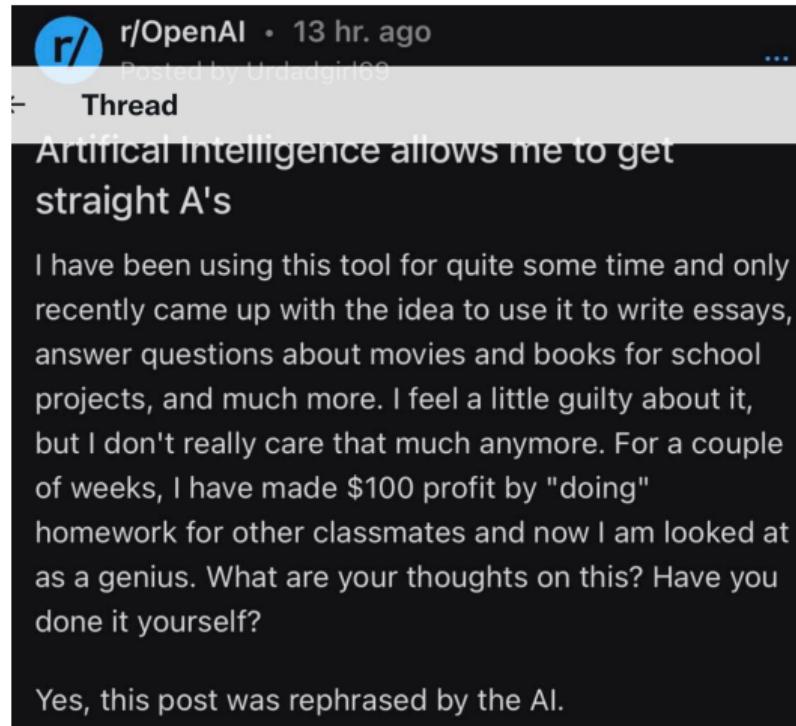
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# Assignments



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 narrative about how the user has been using AI for various school projects and assignments, making \$100 profit, and being looked at as a genius. The post ends with the statement "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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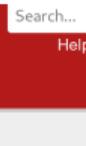
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# Programming



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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References

- **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>

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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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