

Stable Diffusion

Jesus M.
Gonzalez-Barahona

Simple Introduction to 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

Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

The plot

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

Stable Diffusion

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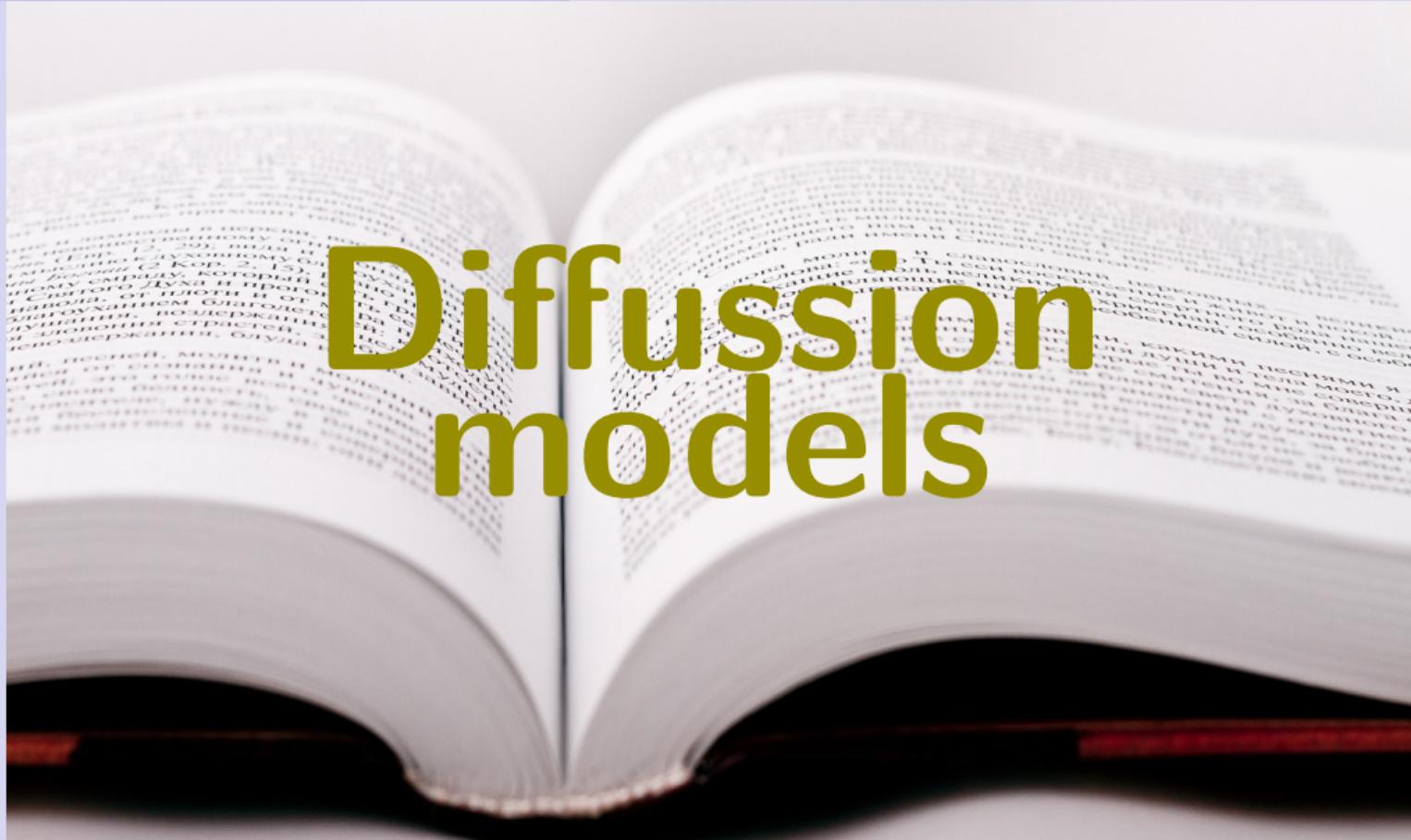
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Summarizing

Diffusion models



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What is FOSS(*)?

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Summarizing

Stable Diffusion release



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Summarizing

Stable Diffusion first release

Released on August 22nd
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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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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One week is just one week

Dream Studio Beta

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

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The future

Summarizing

Stable Diffusion 2

Announced last week

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

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Summarizing



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

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The future

Summarizing



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The future

Summarizing



Speaker presenting at Machine Learning Spain (25, 50)

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Stable Diffusion
release

Extensions,
integrations

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Infrastructure to
play, to share

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The future

Summarizing



Speaker presenting at Machine Learning China

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Diffusion models

Stable Diffusion
release

Extensions,
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The future

Summarizing

Extensions, integrations



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The future

Summarizing

Integration in toolchains

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Summarizing

In-painting

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Extensions,
integrations

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The future

Summarizing

Out-painting



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

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Summarizing

Image to image

Image + prompt produces an image
Even just with CPU!

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

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Extensions,
integrations

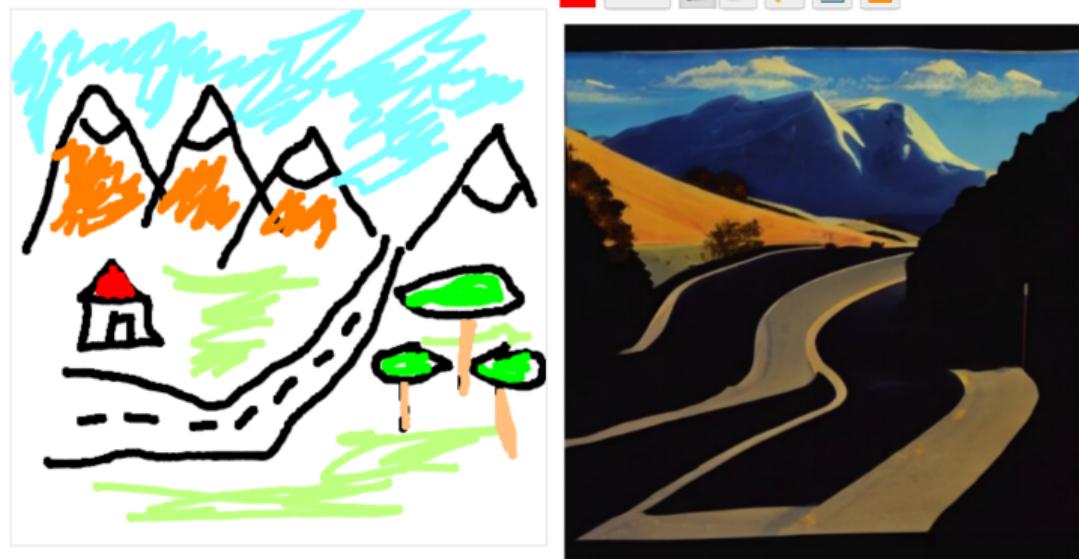
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Summarizing



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 f rest

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

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integrations

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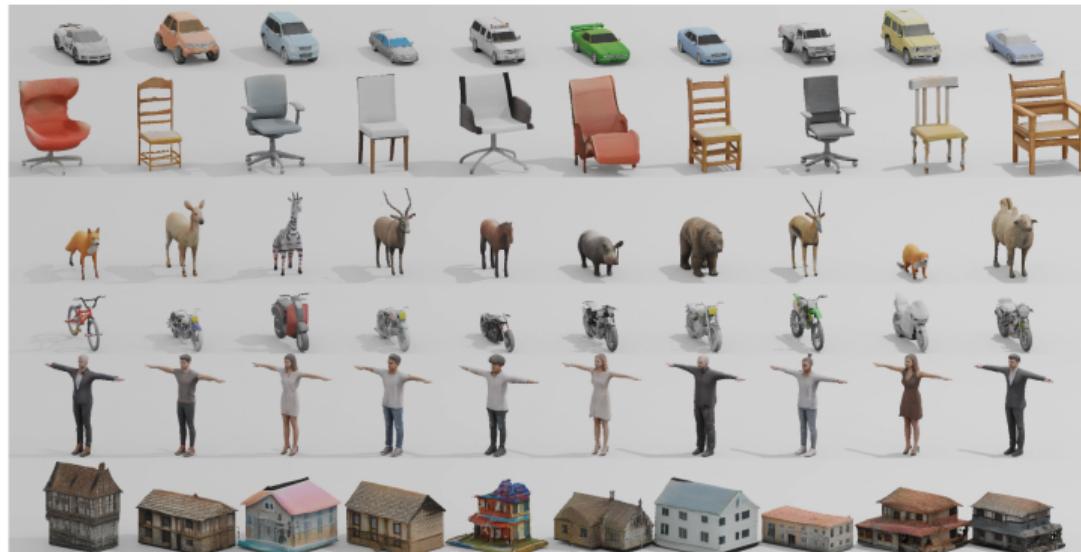
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Summarizing

3D assets



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

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Stable Diffusion
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not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

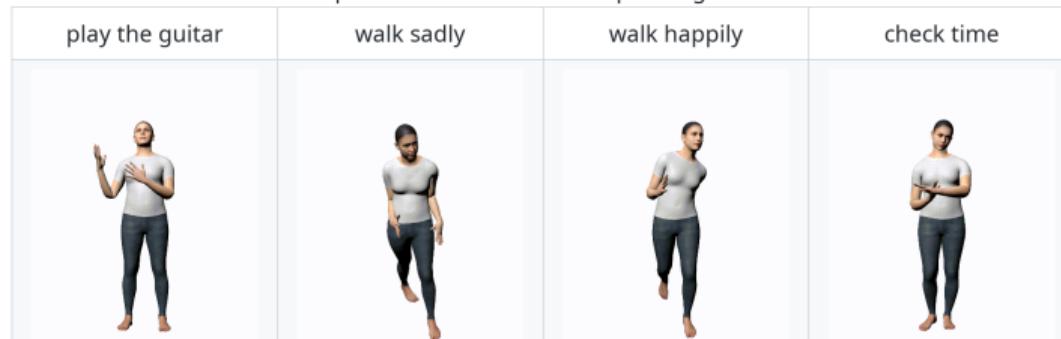
3D assets

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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Extensions,
integrations

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The future

Summarizing

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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Diffusion models

Stable Diffusion
release

Extensions,
integrations

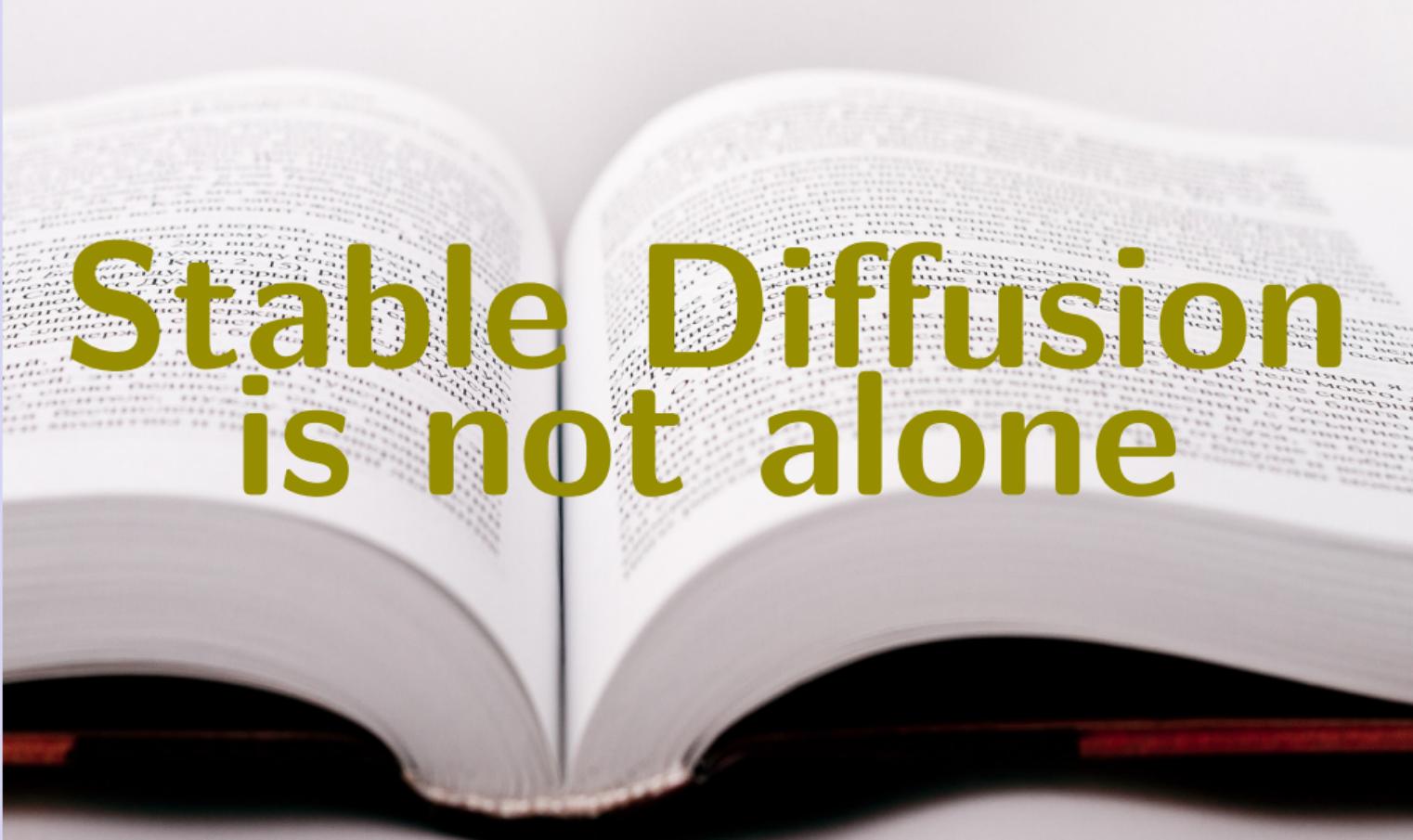
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not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing



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Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

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The future

Summarizing

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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Extensions,
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The future

Summarizing

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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Summarizing

Multilingual AI Assistant

Whisperfor 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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release

Extensions,
integrations

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Summarizing

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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release

Extensions,
integrations

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The future

Summarizing

Whisper fro Toutube 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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The future

Summarizing

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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integrations

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The future

Summarizing

Musika

Blazingly Fast 44.1 kHz Stereo Waveform Music Generation of Arbitrary Length

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

[https://
huggingface.co/spaces/marcop/musika](https://huggingface.co/spaces/marcop/musika)
License: MIT (open source)

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The future

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Queries to documents

merve (mostly at mastodon)
@mervenoyann

...

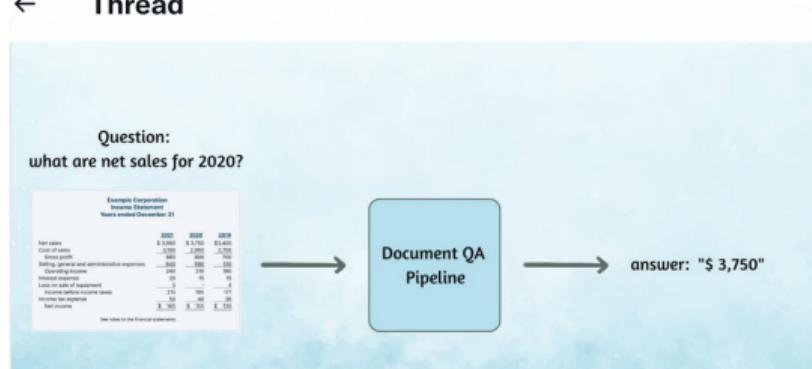
New release of [@huggingface](#) transformers includes a new pipeline called Document Question Answering ?



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

← Thread

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



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release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Infrastructure to play, to share

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

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The future

Summarizing

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, afl-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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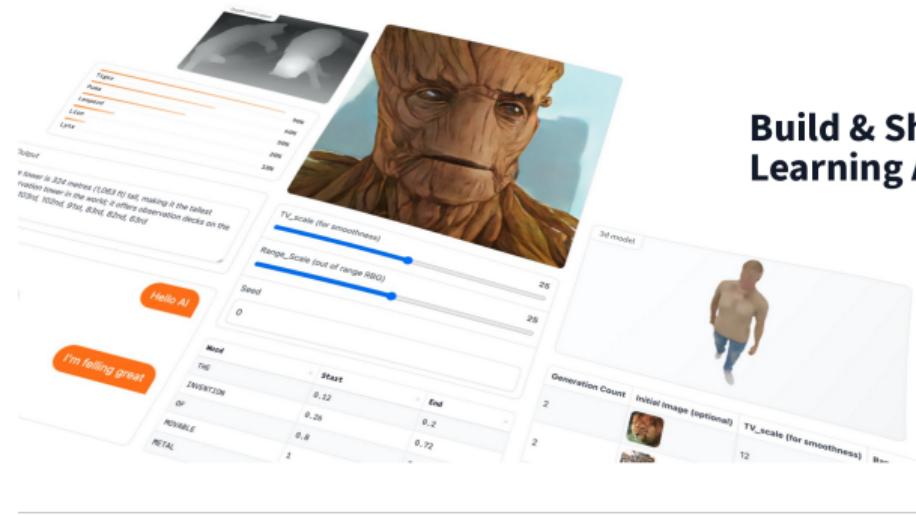
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The future

Summarizing



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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integrations

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Summarizing

Diffusers



Dffusers

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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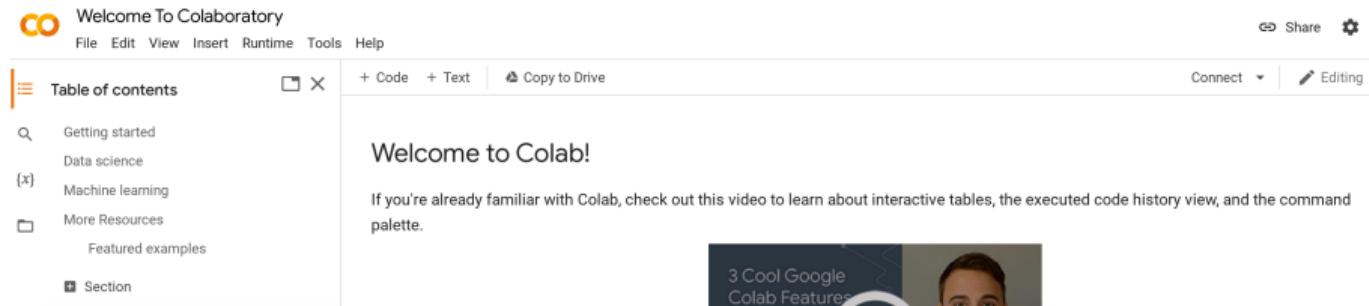
Infrastructure to
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Many issues raised

The future

Summarizing

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'. Below the bar, there's a 'Table of contents' sidebar with sections like 'Getting started', 'Data science', 'Machine learning', 'More Resources', and 'Featured examples'. 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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Summarizing



Python in the browser, easy

<https://jupyter.org/>

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Extensions,
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Infrastructure to
play, to share

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The future

Summarizing

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Diffusion models

Stable Diffusion
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Summarizing

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 search interface with the query 'Holly Herndon'. Below the search bar, a message reads: 'These images were the closest matches from the LADDIE-1B training data. Opt into or out of AI Art systems with Spawning. Learn More.' A grid of 12 thumbnail images is displayed, each featuring a woman with red hair, identified as Holly Herndon. Some images show her in different contexts, such as wearing a Mario hat or in a studio setting. The 'ars TECHNICA' logo is overlaid on one of the thumbnails. At the bottom of the page, there is a navigation menu with links to BIZ & IT, TECH, SCIENCE, POLICY, CARS, GAMING & CULTURE, and SPORTS.

[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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Summarizing

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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The future

Summarizing

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/metaseq/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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Extensions,
integrations

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The future

Summarizing

Bias



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

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Extensions,
integrations

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Infrastructure to
play, to share

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The future

Summarizing



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[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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Diffusion models

Stable Diffusion
release

Extensions,
integrations

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Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Impact on professionals

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Prompt engineers

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

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not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

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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release

Extensions,
integrations

Stable Diffusion is
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Infrastructure to
play, to share

Many issues raised

The future

Summarizing



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Diffusion models

Stable Diffusion
release

Extensions,
integrations

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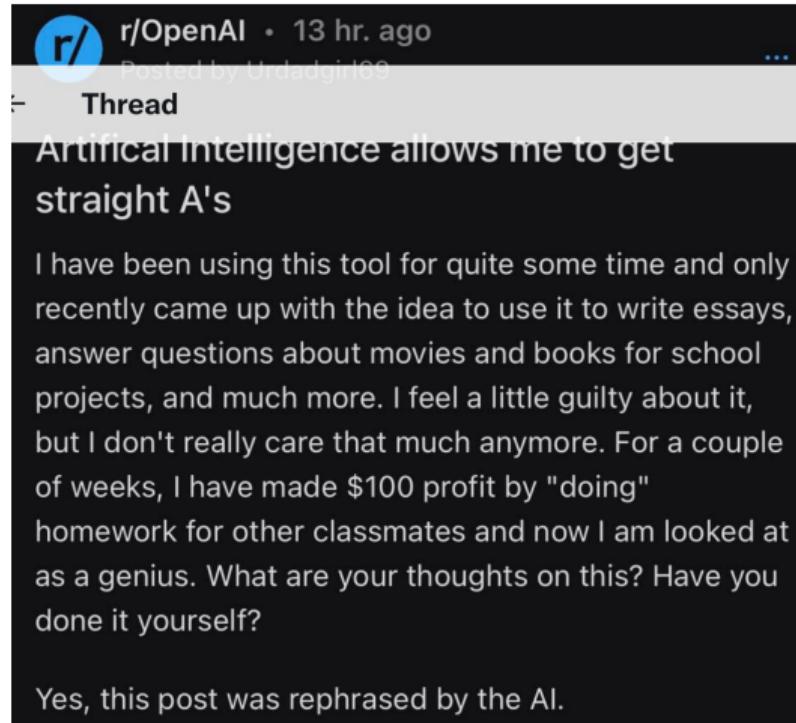
Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Assignments



A screenshot of a Reddit post from the r/OpenAI subreddit. The post was made 13 hours ago by a user named Urddadgirl09. The title of the post is "Artifical Intelligence allows me to get straight A's". The post content discusses the user's experience with AI, mentioning using it to write essays, answer school questions, and do homework, resulting in profit and being seen as a genius. The post ends with a note that it was rephrased by 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.

Stable Diffusion

Jesus M.
Gonzalez-Barahona

Diffusion models

Stable Diffusion
release

Extensions,
integrations

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Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Programming

The screenshot shows a red header with the arXiv logo and navigation links for 'Search...' and 'Help'. Below the header, the title 'Computer Science > Machine Learning' is displayed. A note indicates the submission date as 'Submitted on 29 Jul 2022 (v1), last revised 30 Sep 2022 (this version, v2)'. The main title of the paper is 'Language Models Can Teach Themselves to Program Better'. The authors listed are Patrick Halupczok, Matthew Bowers, and 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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Summarizing

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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Many issues raised

The future

Summarizing

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

The future just started

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

References, credits, license

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Diffusion models

Stable Diffusion
release

Extensions,
integrations

Stable Diffusion is
not alone

Infrastructure to
play, to share

Many issues raised

The future

Summarizing

- **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>
- **Awesome Diffusion Models**
<https://github.com/heejkoo/Awesome-Diffusion-Models>

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release

Extensions,
integrations

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Infrastructure to
play, to share

Many issues raised

The future

Summarizing

Credits



Book, by NikolayFrolochkin, Pixabay.
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integrations

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The future

Summarizing



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