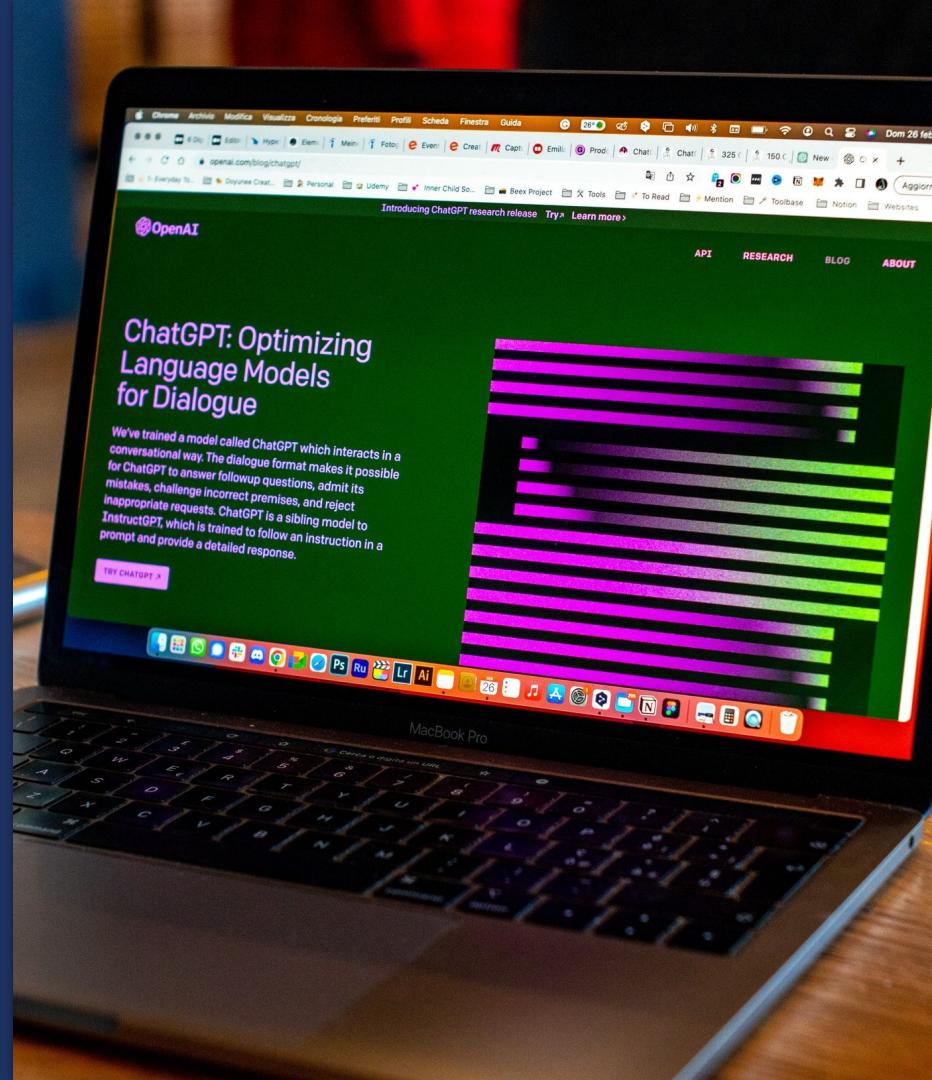


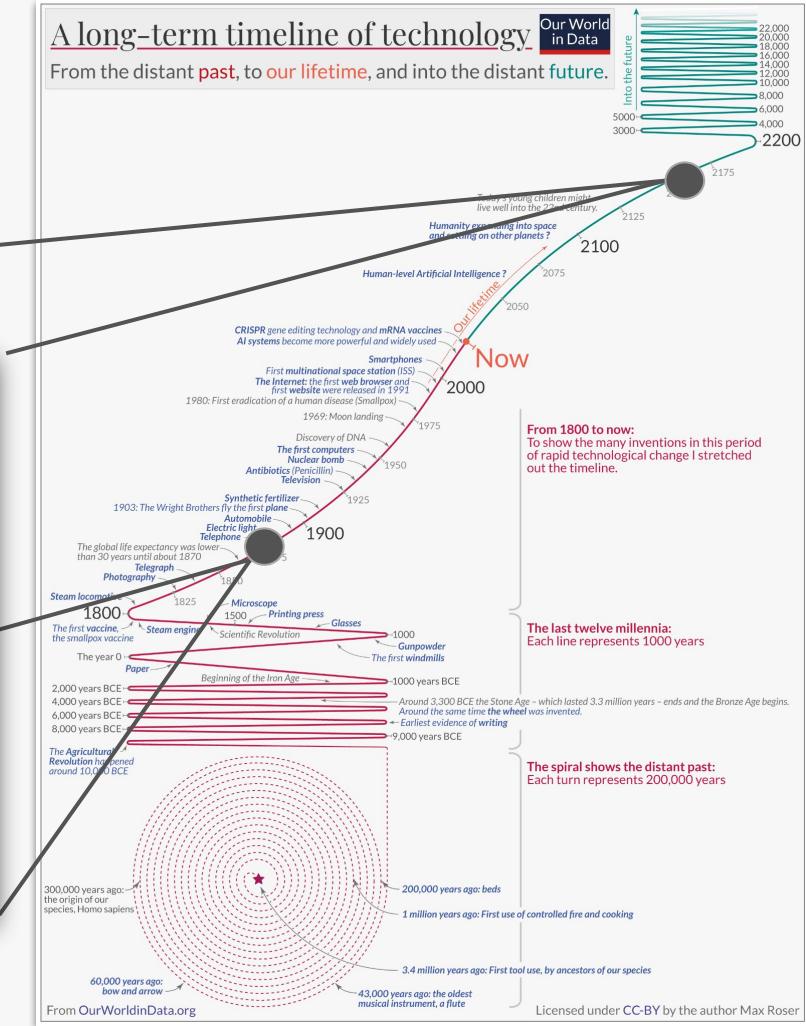
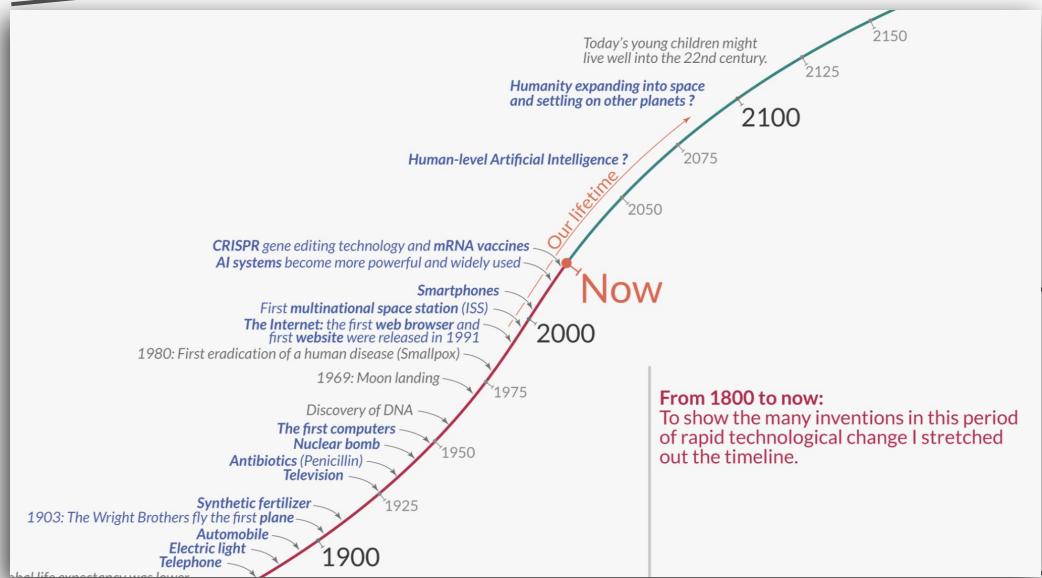
Machine Learning: Special Topics

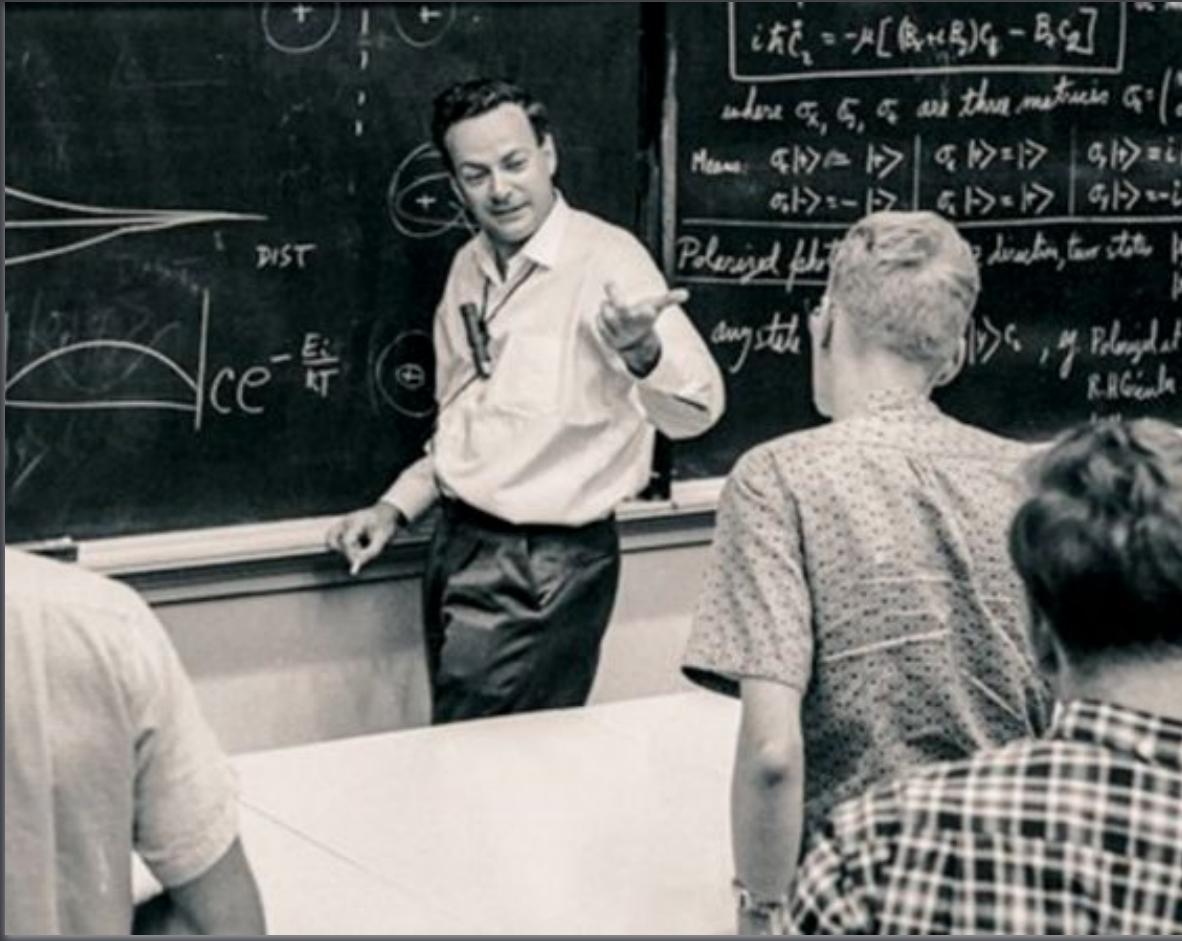
Course Outline

Ivanovitch Silva

ivanovitch.silva@ufrn.br





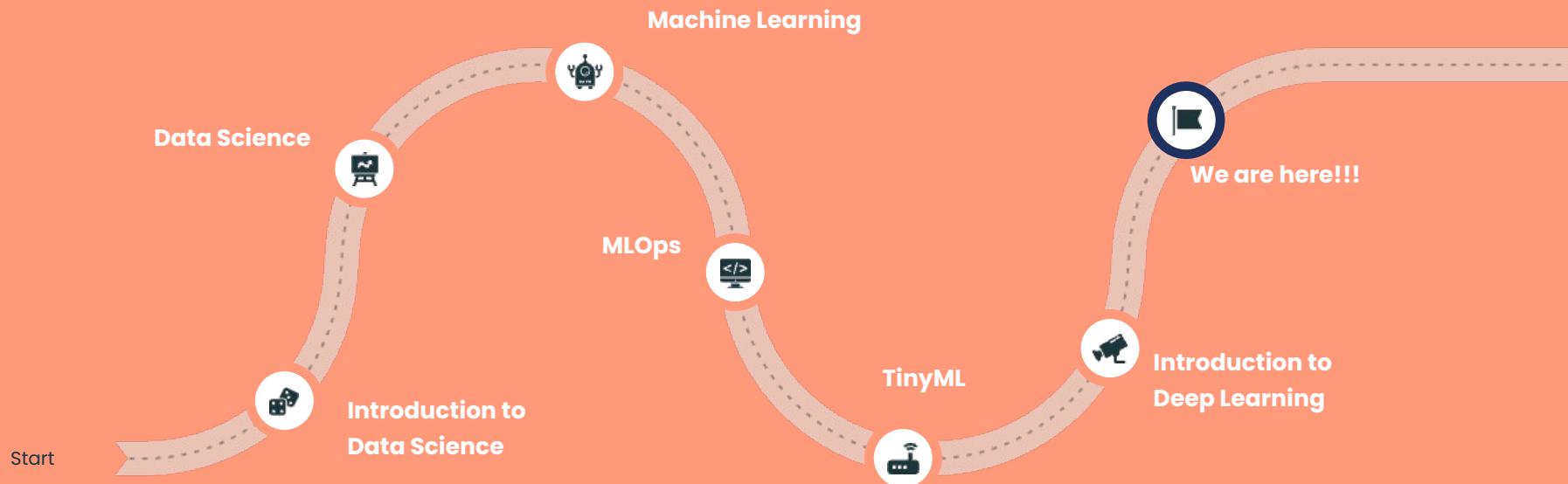


What I cannot
create, I do not
understand.

RICHARD FEYNMAN

A Journey to Become an AI Research Scientist

Exploring Different Paths to Acquire Knowledge and Skills for an AI Career

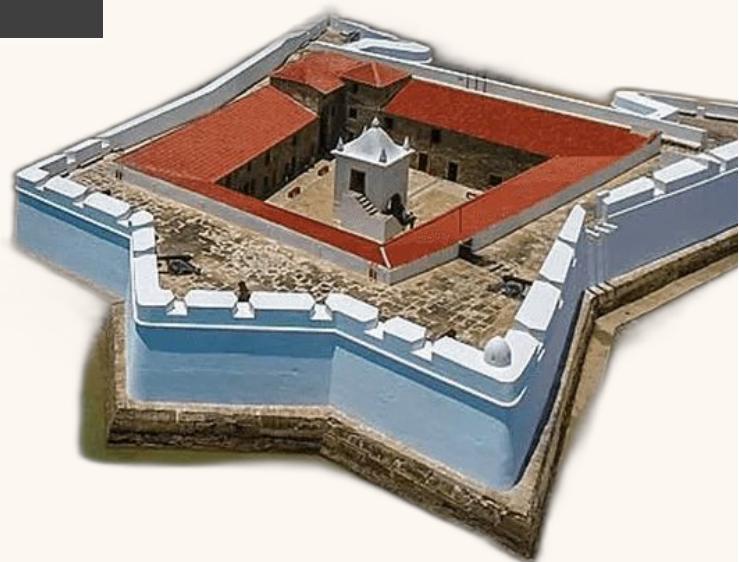


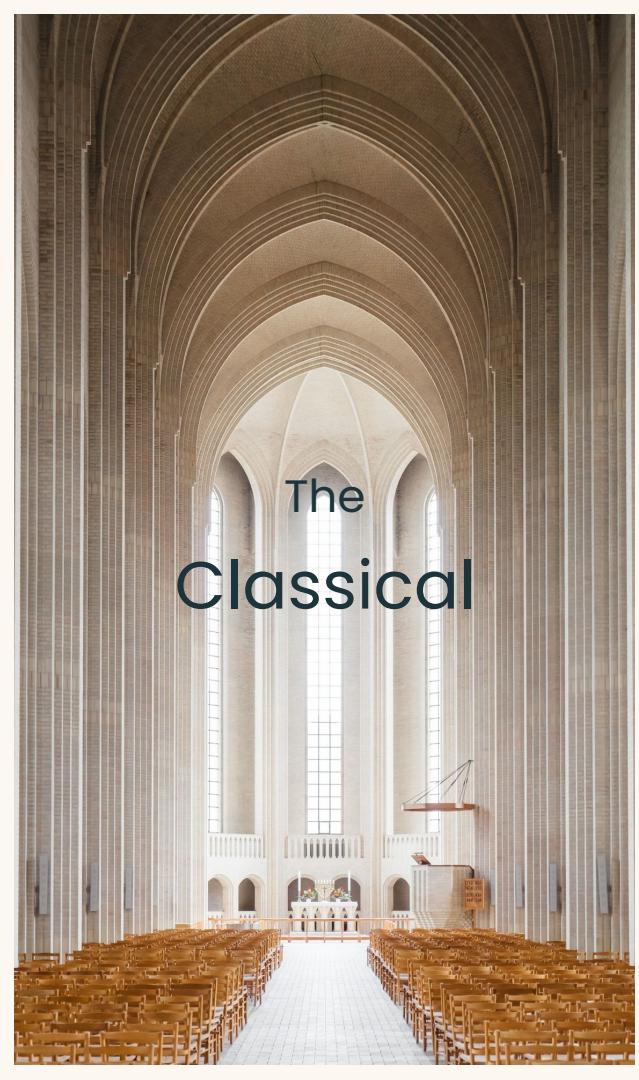


```
from rembg import remove

input_path = 'input.png'
output_path = 'output.png'

with open(input_path, 'rb') as i:
    with open(output_path, 'wb') as o:
        input = i.read()
        output = remove(input)
        o.write(output)
```





The
Classical



Discriminative
vs
Generative
Models

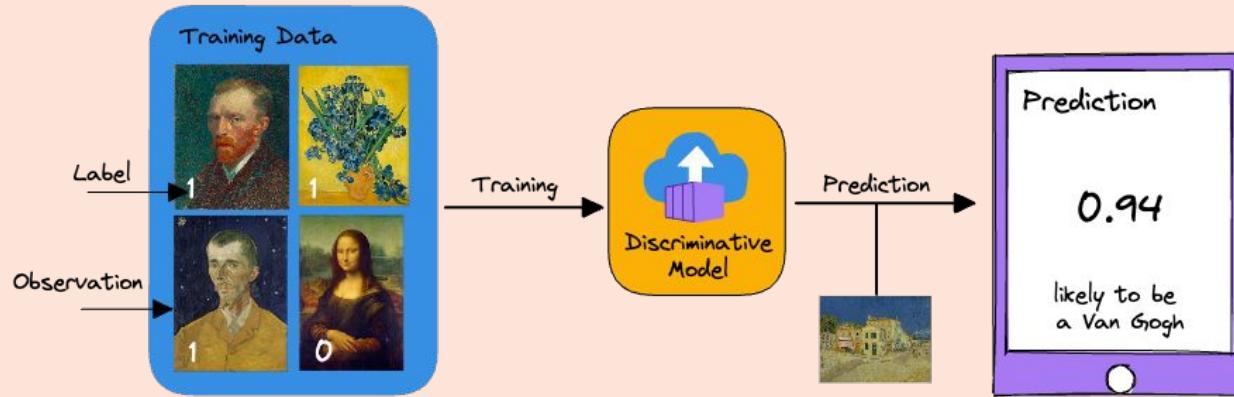


The
New

Discriminative Model

Van Gogh Paintings

Discriminative modeling estimates $p(y|x)$

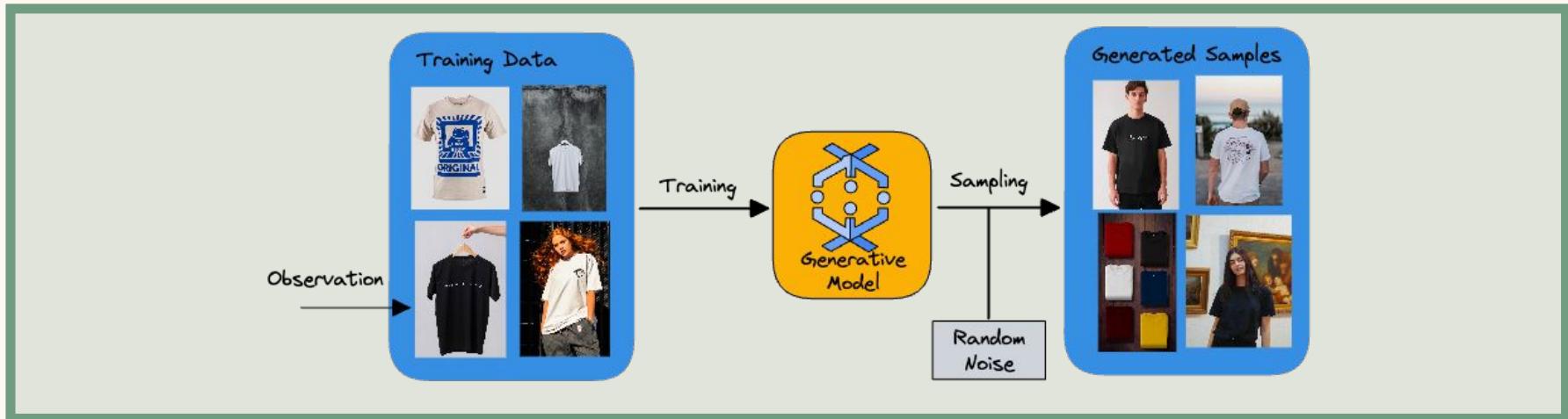


A discriminative model trained to predict if a given image is painted by Van Gogh.

Generative Model

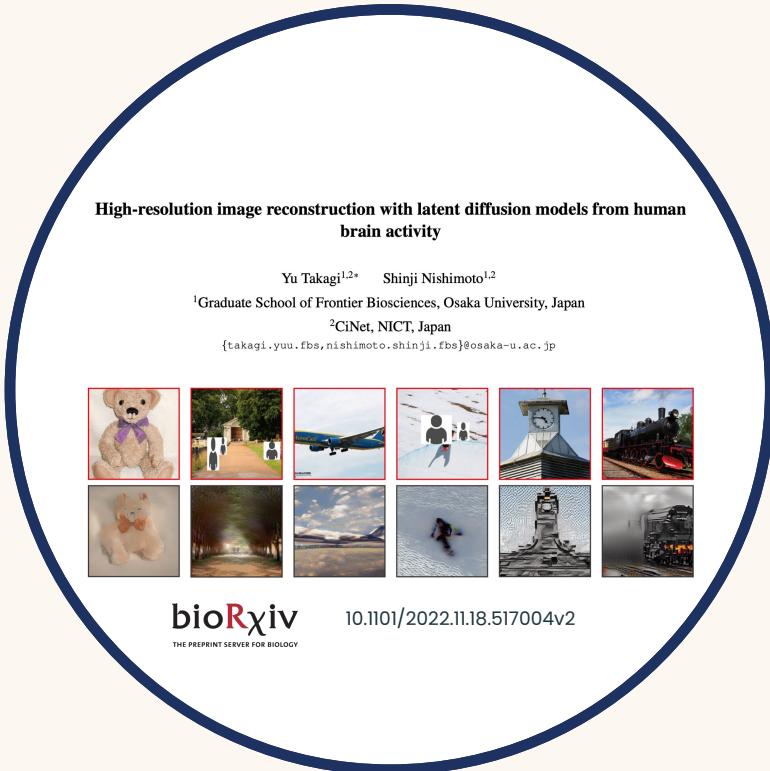
Generate realistic photos of t-shirts

Generative modeling estimates $P(x)$



Generative modeling is a branch of machine learning that involves training a model to produce new data that is similar to a given dataset.

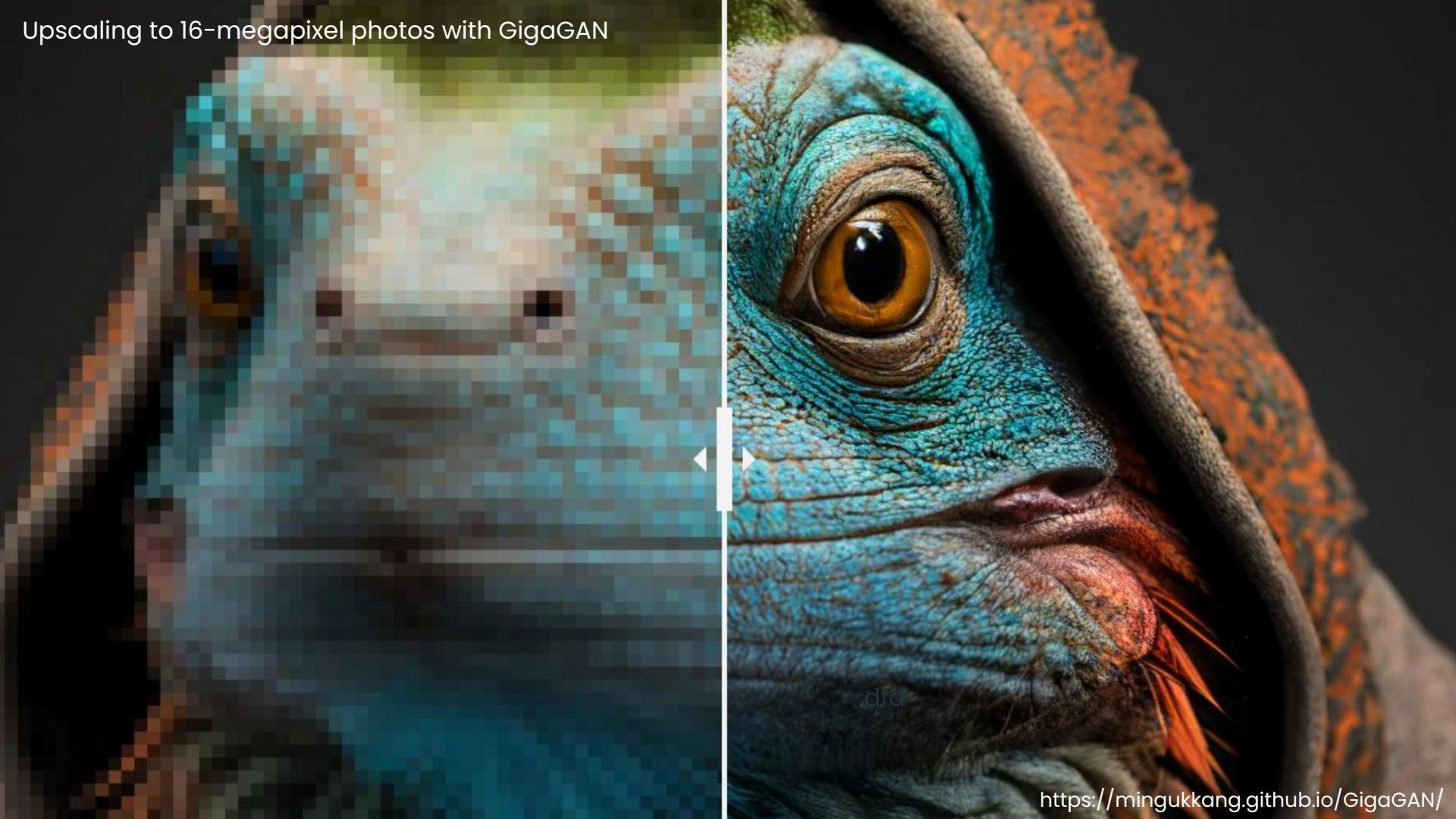
Brain to Image



What if Stable Diffusion can read mind?

- Send people to an MRI
- Show them an image
- Measure their brain waves
- Put their brain waves into an AI image model

Upscaling to 16-megapixel photos with GigaGAN



did

<https://mingukkang.github.io/GigaGAN/>

[FIQUE POR DENTRO](#) [TEC A SEU FAVOR](#) [NOVOS HÁBITOS](#) [PAPO CABEÇA](#) [FICÇÃO CIENTÍFICA?](#) [COLUNAS](#) [NEWSLETTERS](#) [ÚLTIMAS](#)**PEDRO E PAULO MARKUN****OPINIÃO**

Imagen de Trump preso prova que IA já ameaça nosso conhecimento da verdade



Imagen gerada por inteligência artificial coloca Donald Trump no que parece ser uma cela de presídio

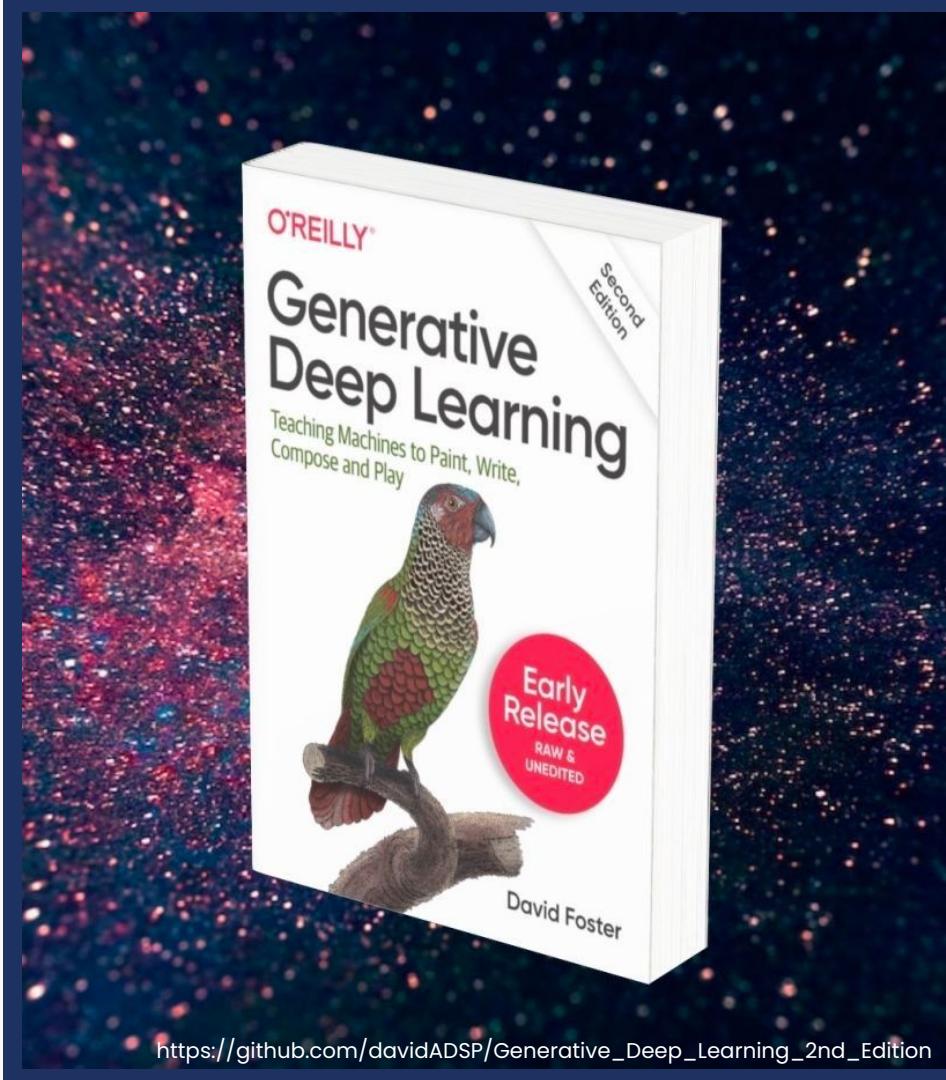
Imagen: Reprodução/ Twitter/ @EliotHiggins



Suggested Reference

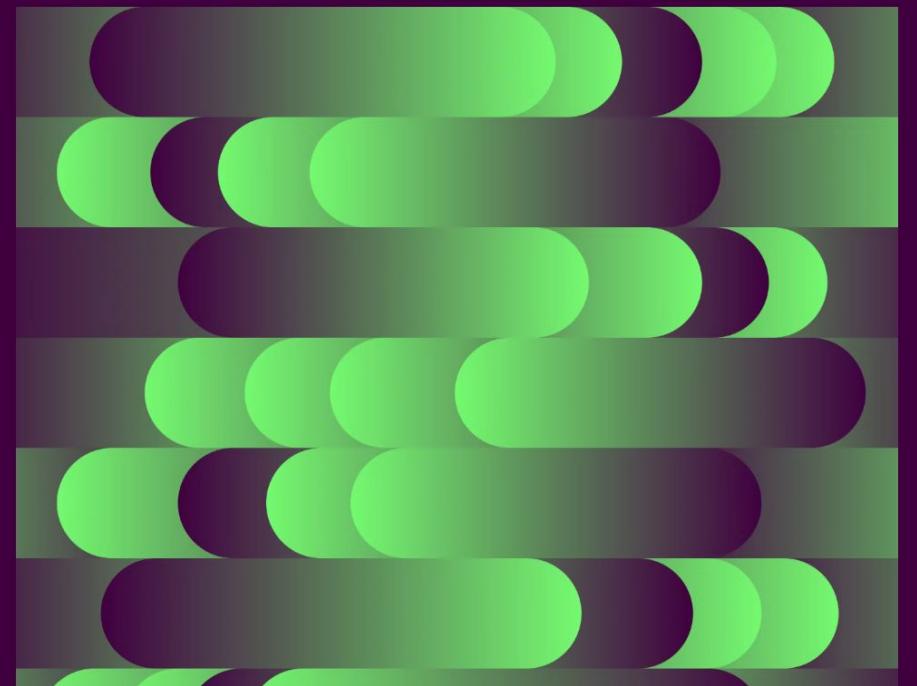
Early Release

Provides a map of the generative AI landscape with theory, practical applications, working examples, code and step-by-step instructions. Can be read cover-to-cover or used as a reference book.



Introducing ChatGPT and Whisper APIs

Developers can now integrate ChatGPT and Whisper models into their apps and products through our API.





Ask AI anything about your files

Understand Technical Papers 100X Faster.
Ask Questions & Get Answers About Any File Instantly.

The tablet screen shows a scientific paper by Vierbuchen et al. on page 7. The paper discusses the conversion of fibroblasts into functional neurons using a combination of transcription factors. A blue button at the top right of the paper's content area says "What is this paper about?". At the bottom left of the paper, there is a question: "Can you describe how this might have implications in neurological disease modeling?". On the right side of the tablet, there is a vertical sidebar labeled "H-MI Author Manuscript".

This paper discusses how a combination of three transcription factors, Ascl1, Brn2, and Myt1l, can be used to directly convert fibroblasts into functional neurons. The authors tested this hypothesis by infecting mouse embryonic and postnatal fibroblasts with a pool of nineteen candidate genes, and then narrowed down the number of transcription factors required for generation of iN cells. They found that the combination of Ascl1, Brn2, and Myt1l was sufficient to rapidly and efficiently convert fibroblasts into functional neurons. This could have important implications for studies of neural development, neurological disease modeling, and regenerative medicine.

What is this paper about?

Vierbuchen et al.

Page 7

Despite the heterogeneity of embryonic and tail-tip fibroblast cultures, the highly efficient nature of this process effectively rules out the possibility that directed differentiation of rare stem or precursor cells with neurogenic potential can explain our observations. Future studies will have to be performed to unequivocally demonstrate that terminally differentiated cells such as mature B- or T-lymphocytes can be directly converted into neurons using this approach.^{31,32}

It will now be of great interest to decipher the molecular mechanism of this fibroblast to neuron conversion. We assume that high expression levels of strong neural cell fate-determining transcription factors can activate salient features of the neuronal transcriptional program. Auto-regulatory feed-back and feed-forward activation of downstream transcriptional regulators could then reinforce the expression of important cell fate determining genes and help to further stabilize the induced transcriptional program. Robust

Can you describe how this might have implications in neurological disease modeling?

What if we could integrate?



Youtube



summarize.tech



ChatGPT



Speechify



Playlists

In this episode
Lex Fridman Podcast



LEX
 SUBSCRIBE

https://www.youtube.com/watch?v=L_Guz73e6fw



Skills for the next 18 months



Building Applications

LLMs or Text-To-Image models like ChatGPT, Stable Diffusion, or BLOOM



MLOps

Building and deploying ML applications locally and in the cloud



Engineers



Developers



Scientists

Journey Planning



To do

Variational
Autoencoders

Diffusion Models

Deep
Reinforcement
Learning

In progress

Unsupervised
Learning

Generative
Adversarial
Networks

Normalizing Flows

Completed

Transformers



Graph Neural Networks



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Datasets

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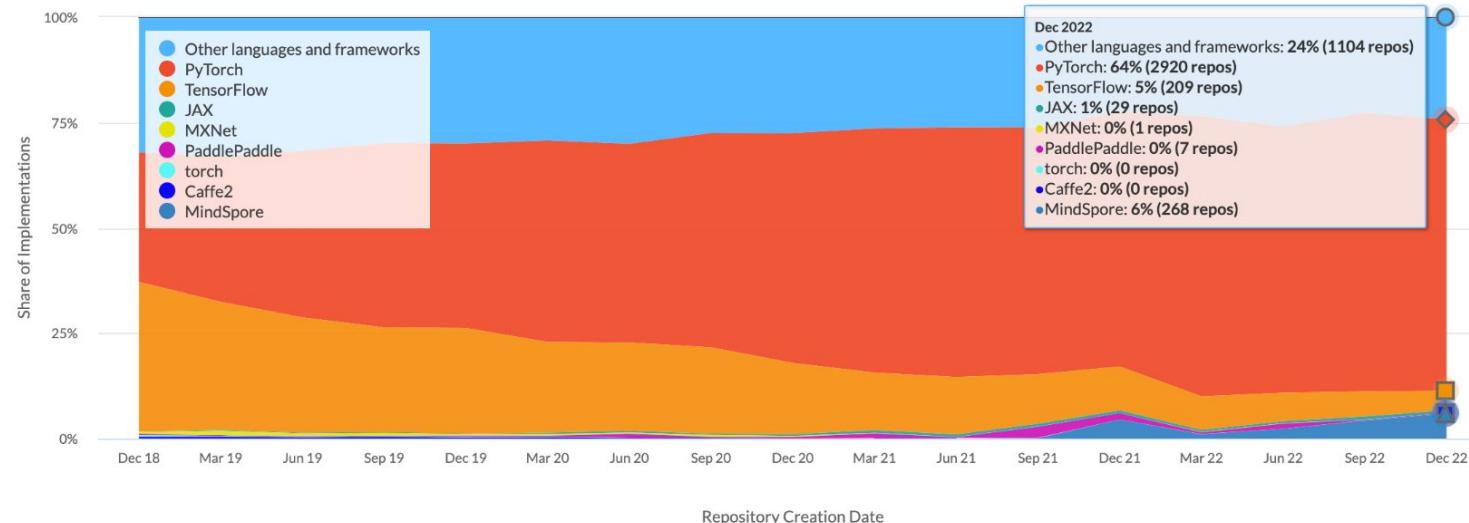
Trends

Quarter ▾

2018-12-01 to 2022-12-31

Frameworks

Paper Implementations grouped by framework



Syllabus



Applications

What can I do today with state-of-the-art AI applications?



Frameworks

Prioritize PyTorch and TensorFlow, we should also welcome Hugging Face and Keras.



Review

Reviewing the basics of deep learning is always important.



Write and Read

Reading articles and writing technical notes are some of the tasks we will be performing.



Flipped classroom

Agile teaching methodology where we will be using flexible methods for the study.



Sequential models is all you need

Transformers offer faster processing and improved accuracy approaches.

References

