Unione europea
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DATA LAB

GUARDA AVANTI

Big Data, nuove competenze
per nuove professioni.

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REISS ROMOLI la passione della conoscenza

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"Anticipare la crescita con le nuove competenze sui Big Data - Edizione 3" Operazione Rif. PA 2021-16029/RER approvata con DGR n° 927 del 21 giugno 2021 e co-finanziata dal Fondo Sociale Europeo PO 2014-2020 Regione Emilia-Romagna

Deep Learning

DISCRIMINATIVE

VS.

GENERATIVE

Discriminative Model

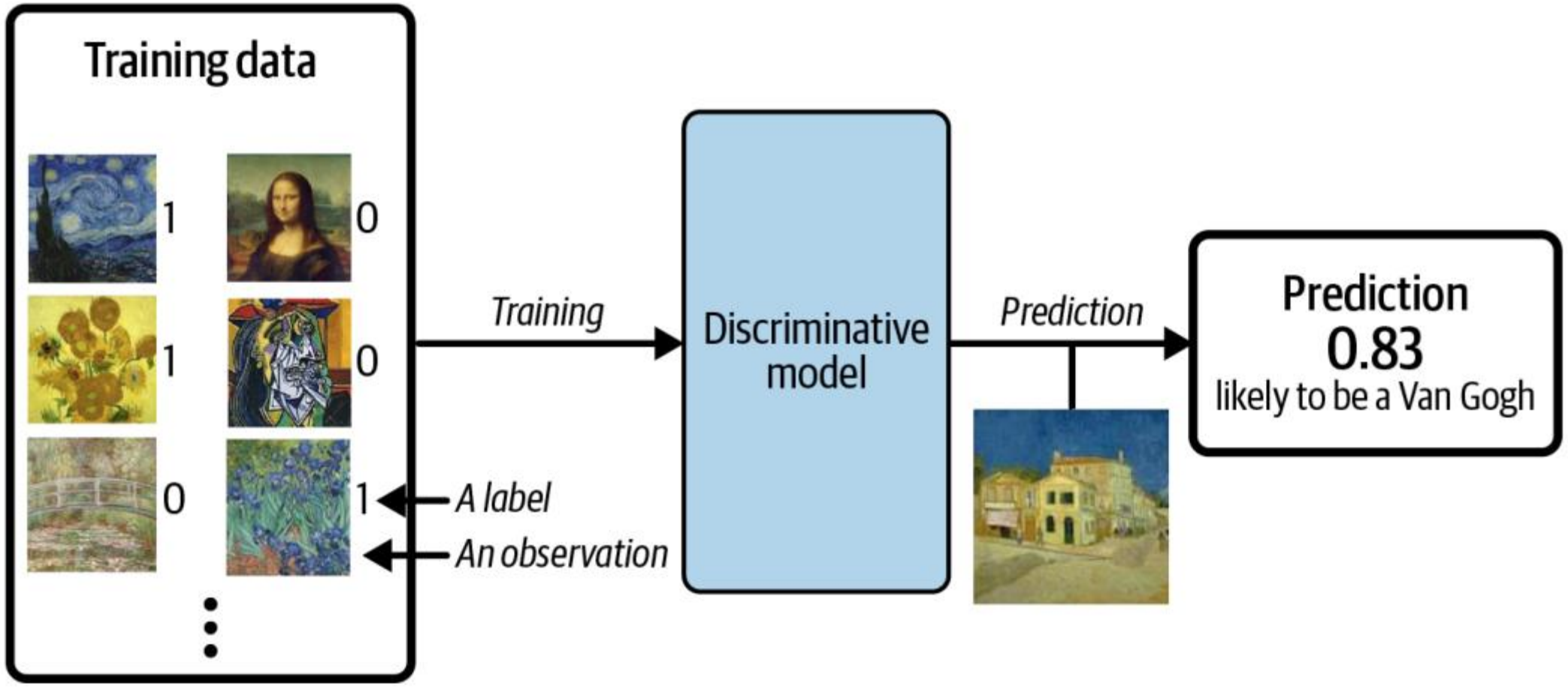


Figure 1-2. A discriminative model trained to predict if a given image is painted by Van Gogh

What Is Generative Modeling?

Generative modeling can be broadly defined as follows:

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

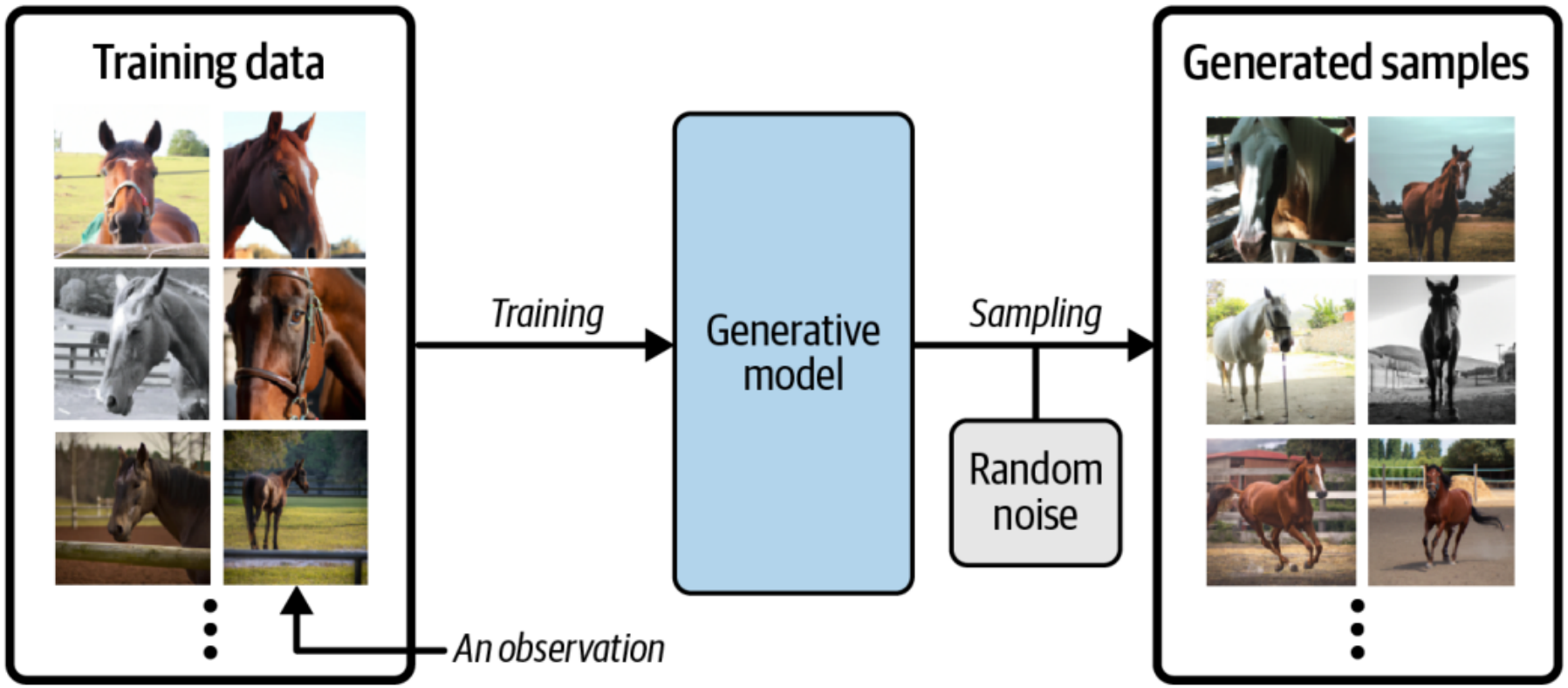
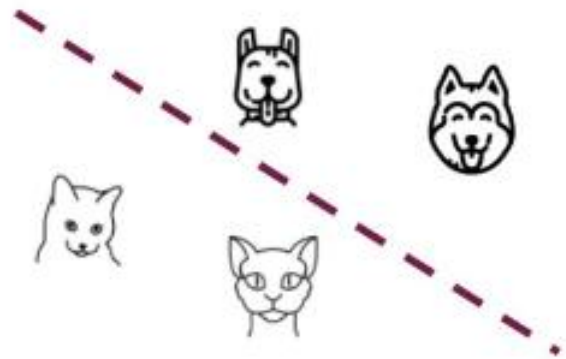


Figure 1-1. A generative model trained to generate realistic photos of horses

Generative Models vs. Discriminative Models

Discriminative models



Features Class

$$X \rightarrow Y$$

$$P(Y|X)$$

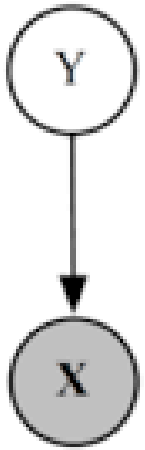
Generative models

Noise Class Features

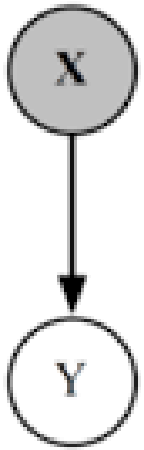
$$\xi, Y \rightarrow X$$

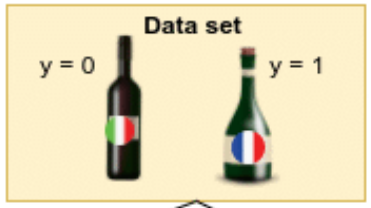
$$P(X|Y)$$

Generative



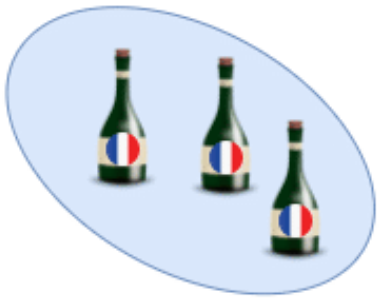
Discriminative

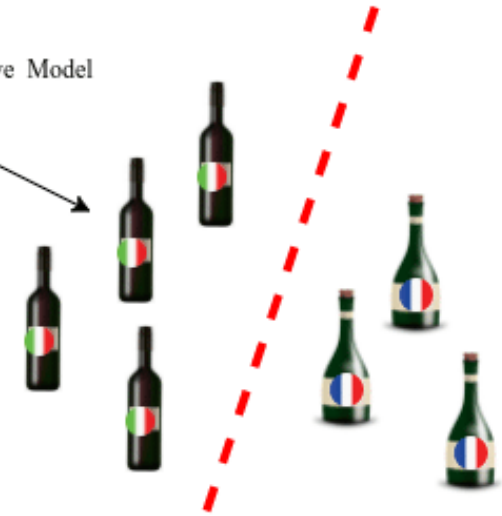


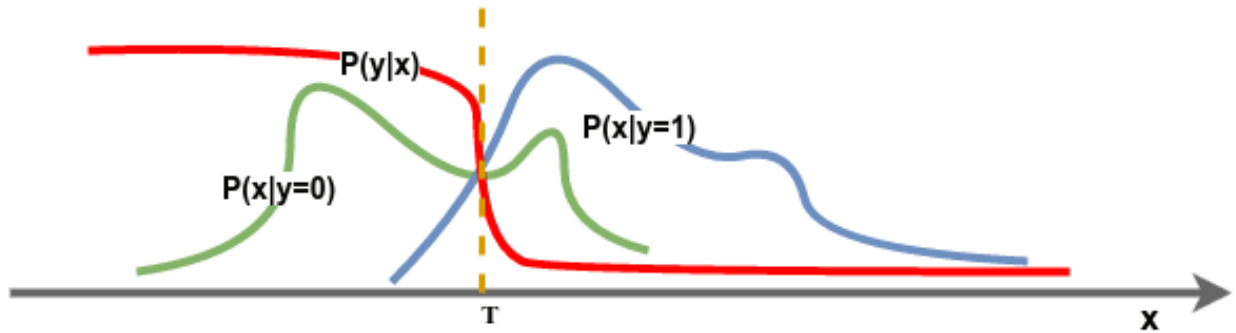


Generative Model

Discriminative Model





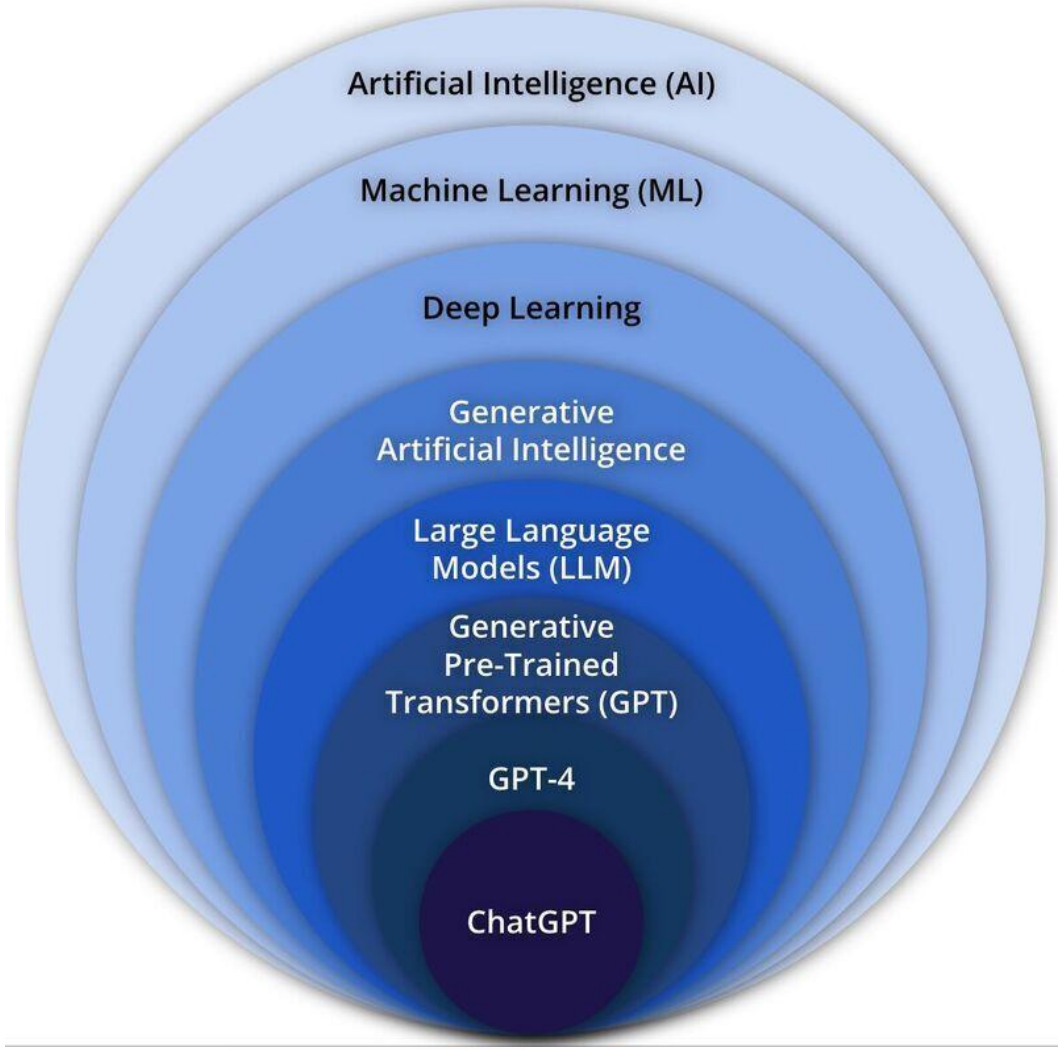


new wine to classify

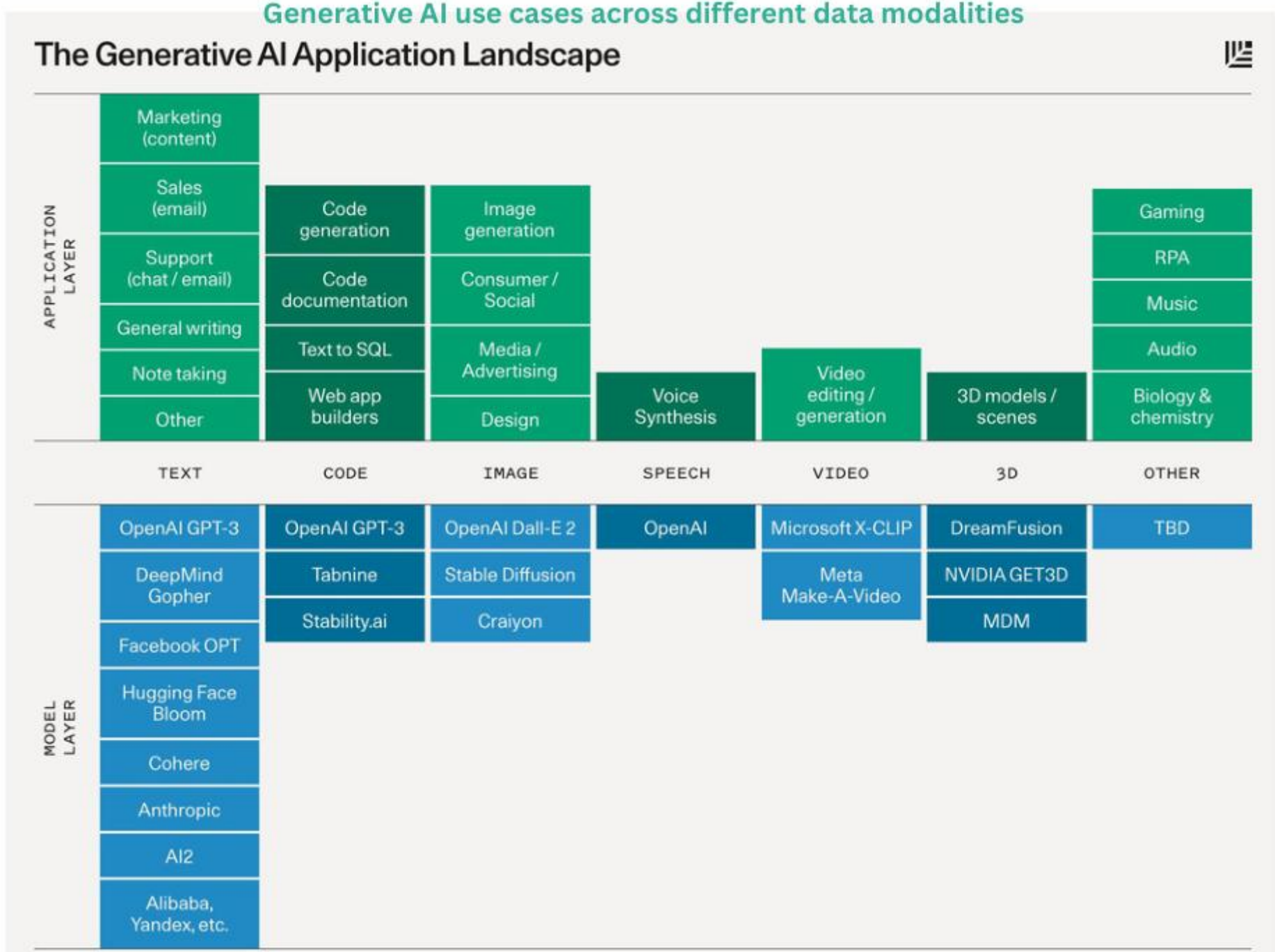
Generative Model - - - - - max(P(x|y=0), P(x|y=1))

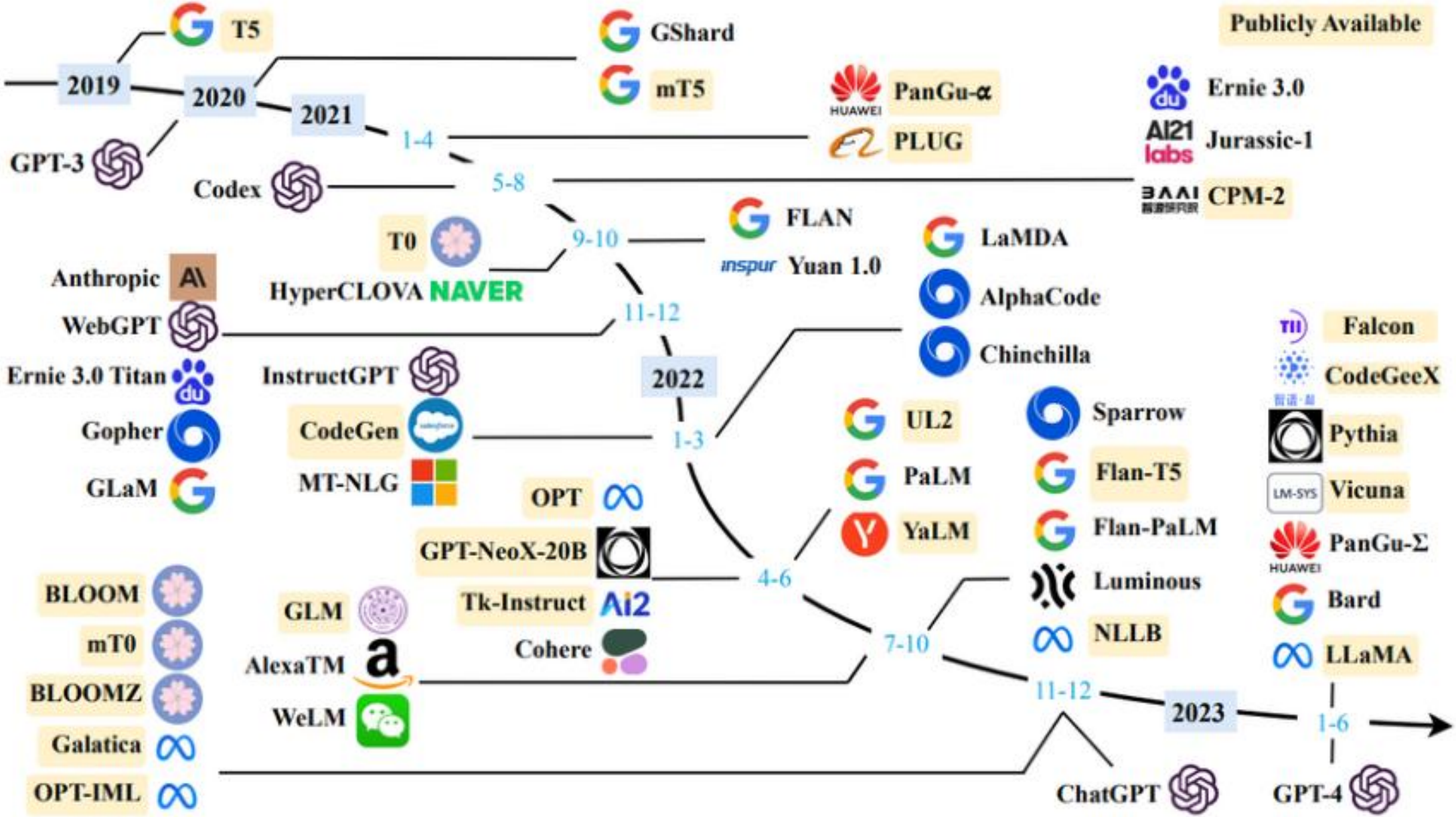
Discriminative Model - - - - - { y = 0 if P(y|x) <= T
y = 1 otherwise

Placing Generative AI and LLMs in the bigger picture



Generative AI use cases across different data modalities




Publicly Available
2019
2020
2021
2022
2023
T5
GPT-3
GShard
mT5
PanGu-α
PLUG
Ernie 3.0
Jurassic-1
CPM-2
1-4
5-8
9-10
11-12
1-3
4-6
7-10
11-12
1-6
Codex
T0
HyperCLOVA
FLAN
Yuan 1.0
LaMDA
AlphaCode
Chinchilla
Anthropic
WebGPT
Ernie 3.0 Titan
Gopher
GLaM
InstructGPT
CodeGen
MT-NLG
OPT
GPT-NeoX-20B
Tk-Instruct
Cohere
UL2
PaLM
YaLM
Sparrow
Flan-T5
Flan-PaLM
Luminous
NLLB
Falcon
CodeGeeX
Pythia
Vicuna
PanGu-Σ
Bard
LLaMA
BLOOM
mT0
BLOOMZ
Galatica
OPT-IML
GLM
AlexaTM
WeLM
ChatGPT
GPT-4

Generative Models

NeRF

2D GAN

3D GAN

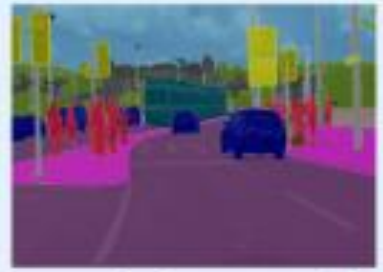
Text-to-Image

?

Computer Vision

Image Classification

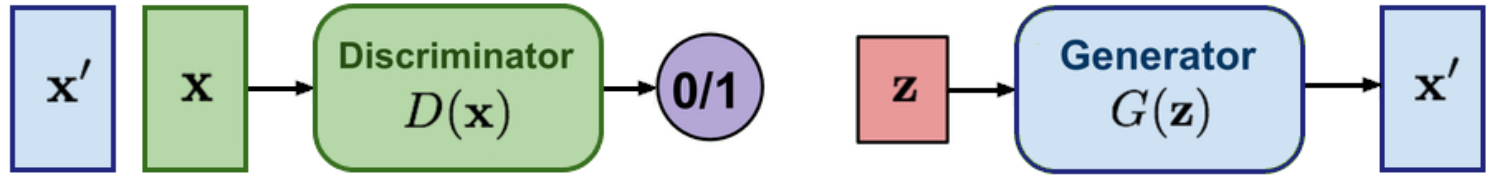
Object Detection



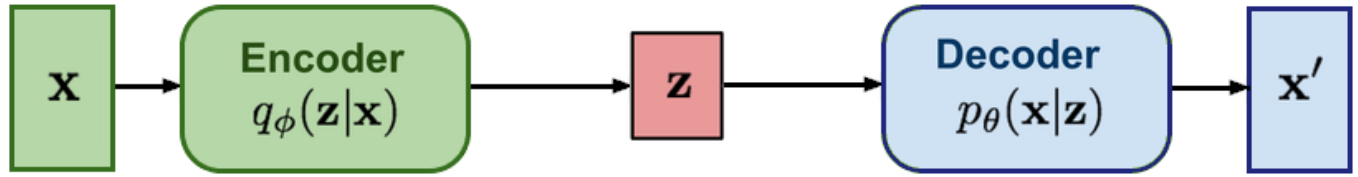
Semantic Segmentation

Pose Estimation

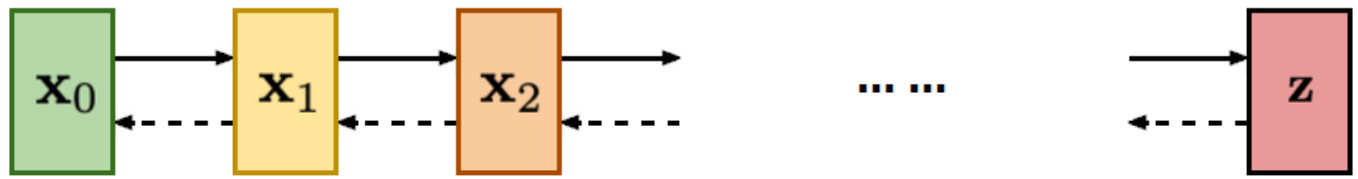
GAN: Adversarial training

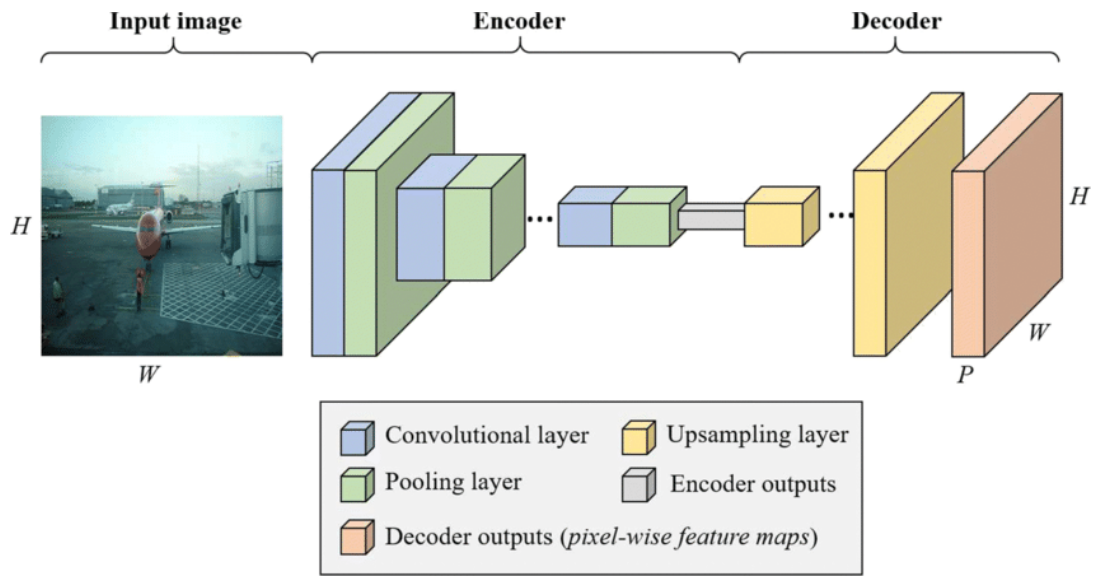


VAE: maximize variational lower bound

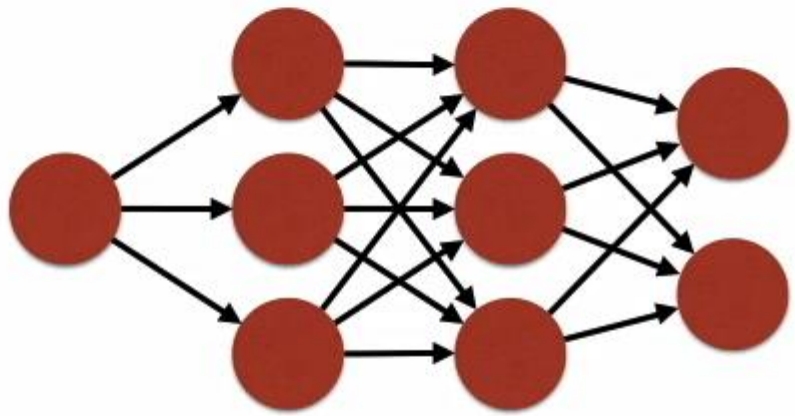


Diffusion models: Gradually add Gaussian noise and then reverse

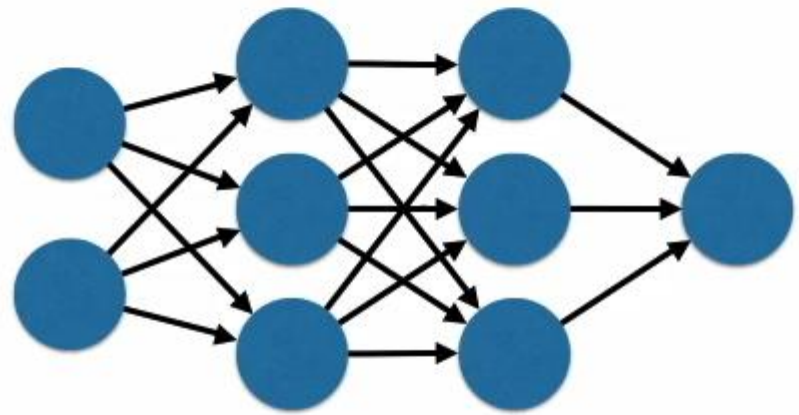




Generative Adversarial Networks



Generator



Discriminator

Generative Adversarial Networks

Generator

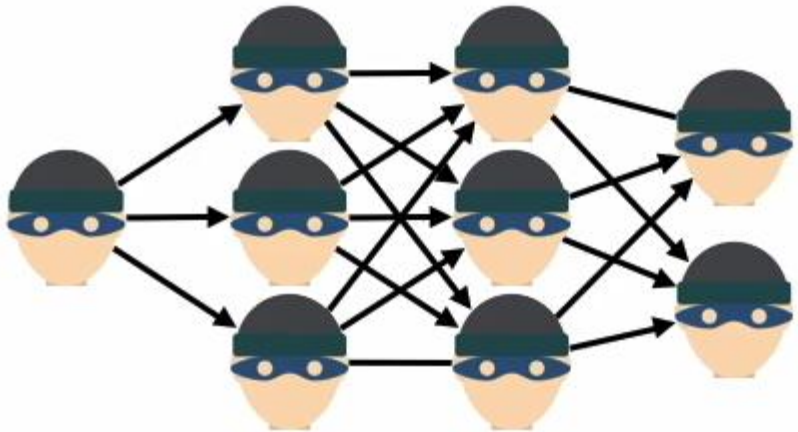
Discriminator

Generative Adversarial Networks

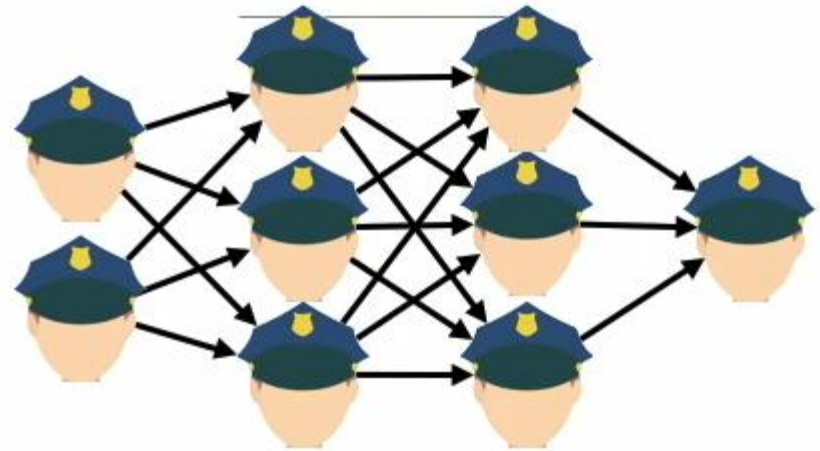
Generator

Discriminator

Generator

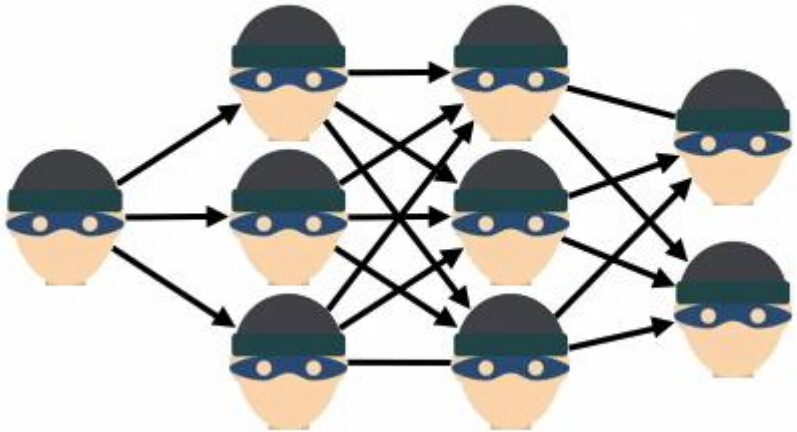


Discriminator

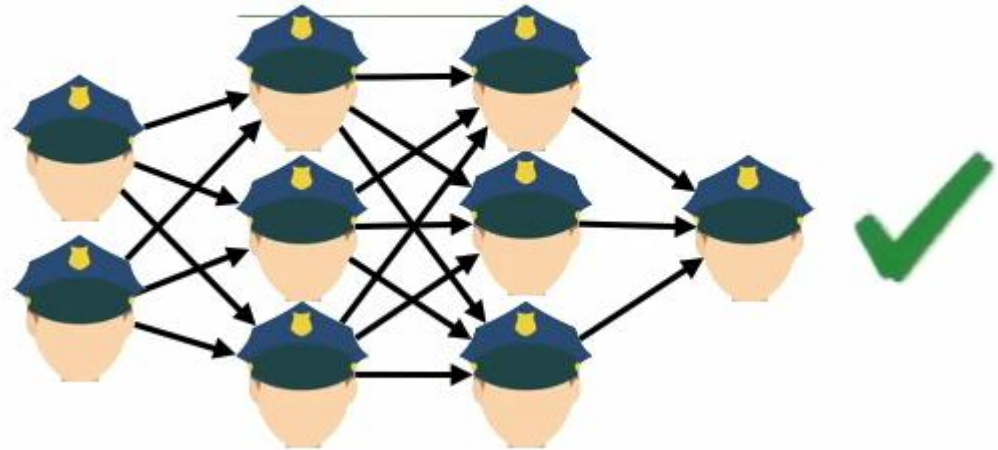


Real images

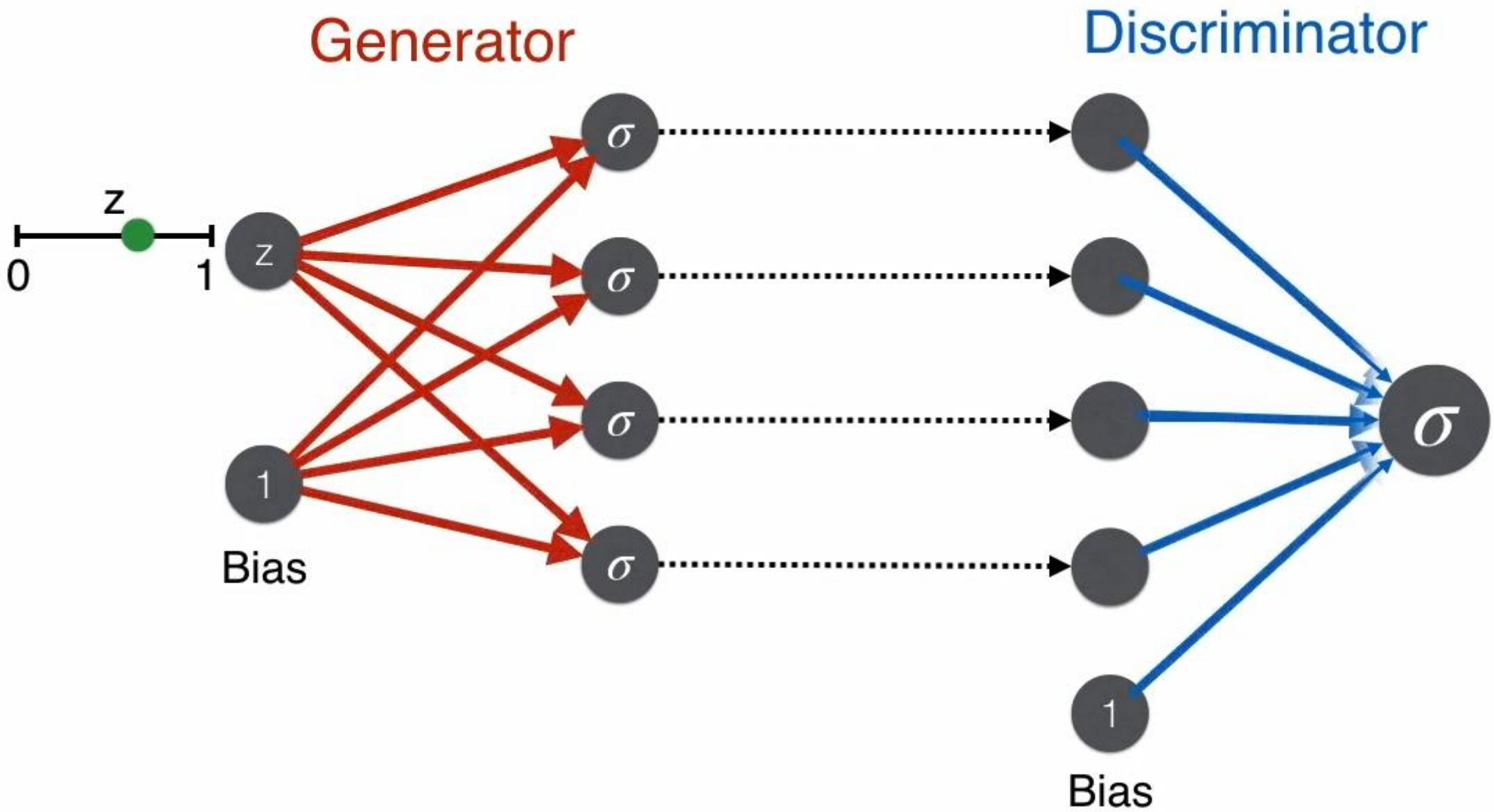
Generator

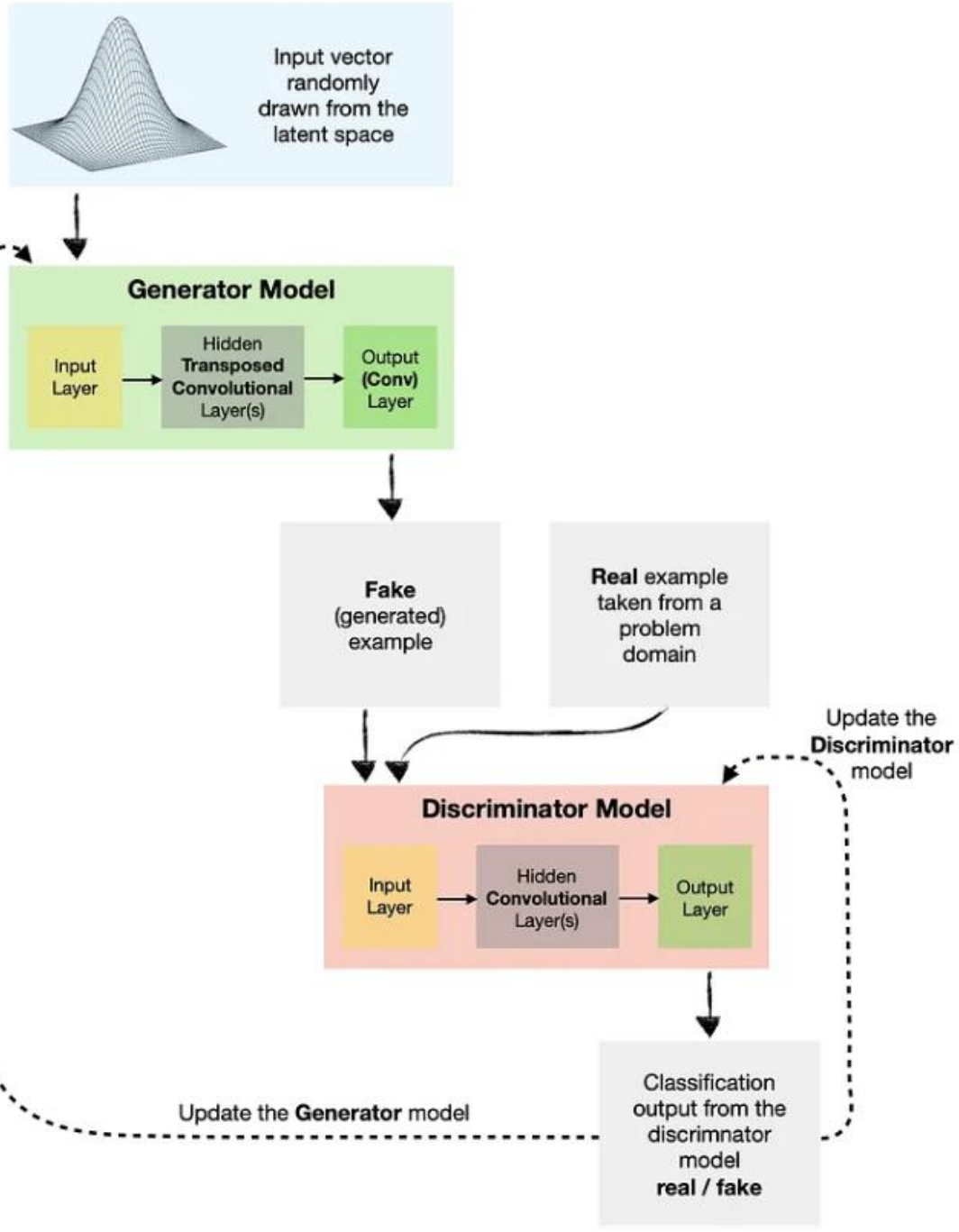


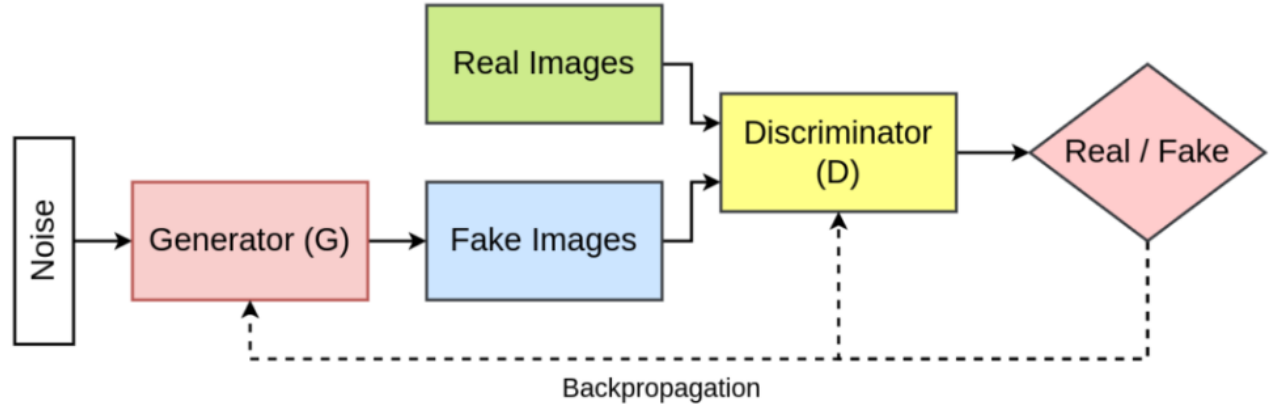
Discriminator



Real images

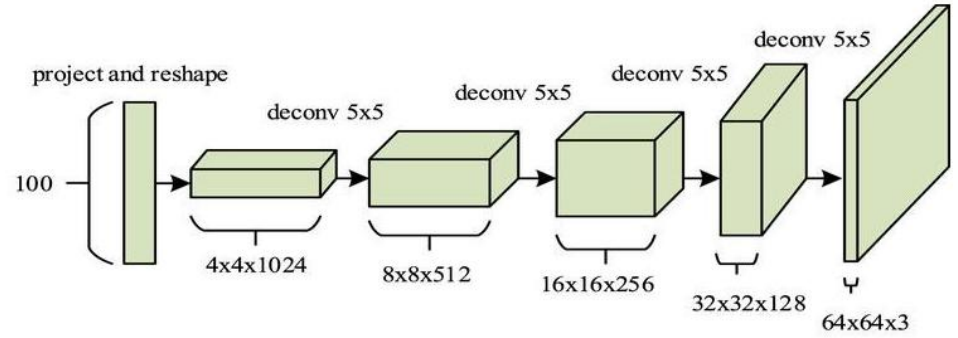

Generator
Discriminator
z
0
1
z
1
Bias
σ
σ
σ
σ
σ
1
Bias



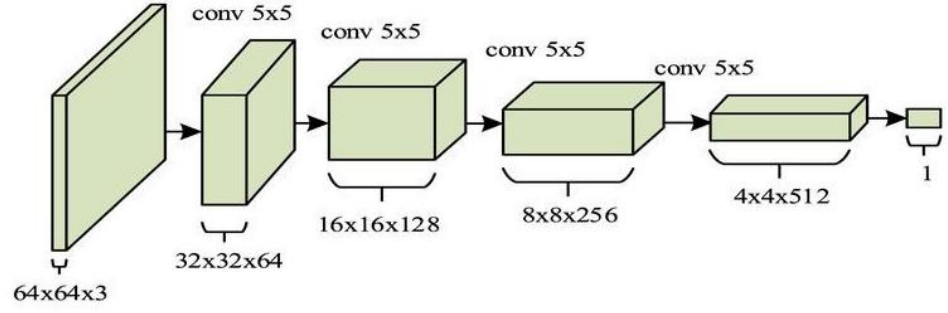


Architecture of DCGAN

DCGAN also consists of two parts: Generator and Discriminator.

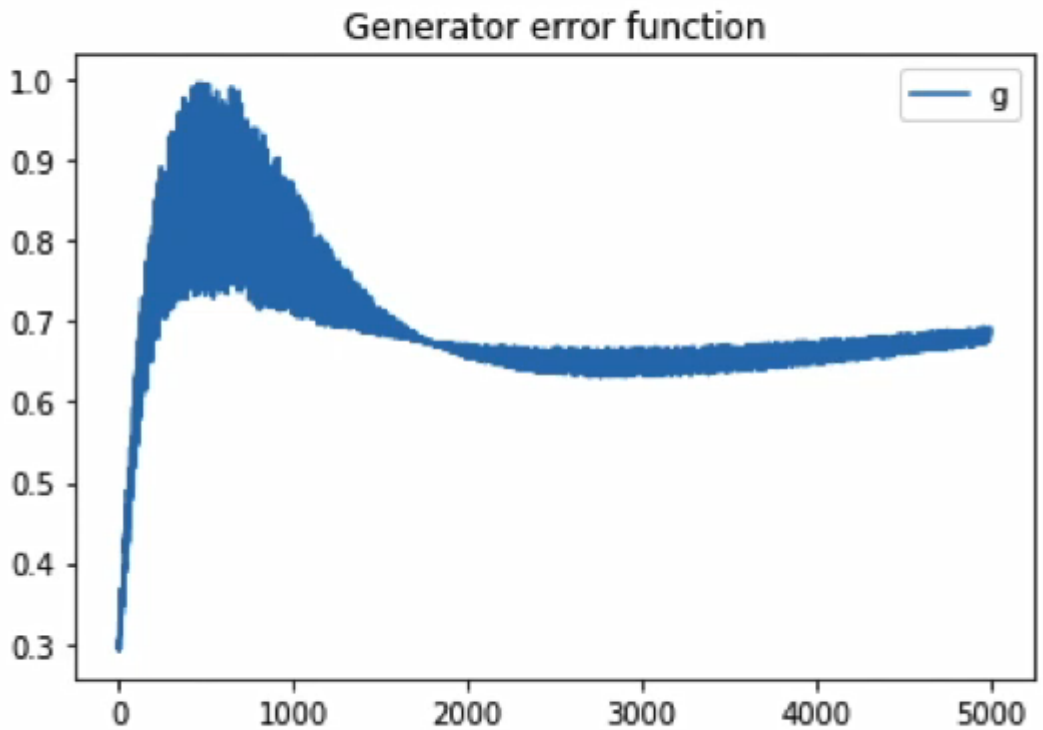


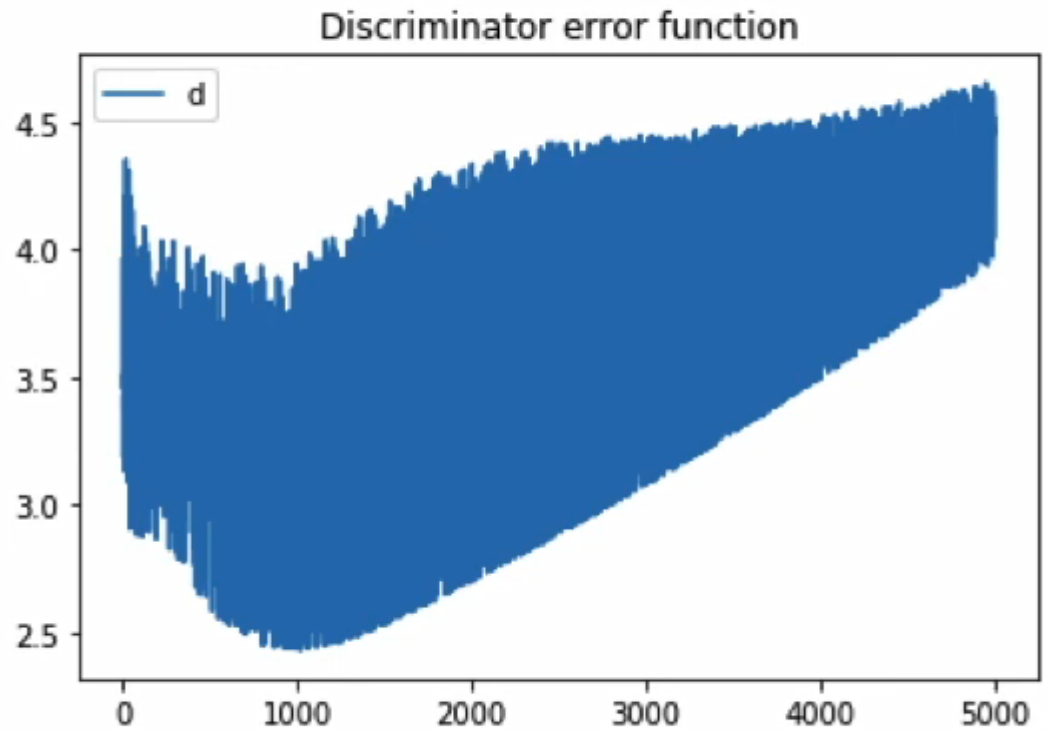
(a) Generator

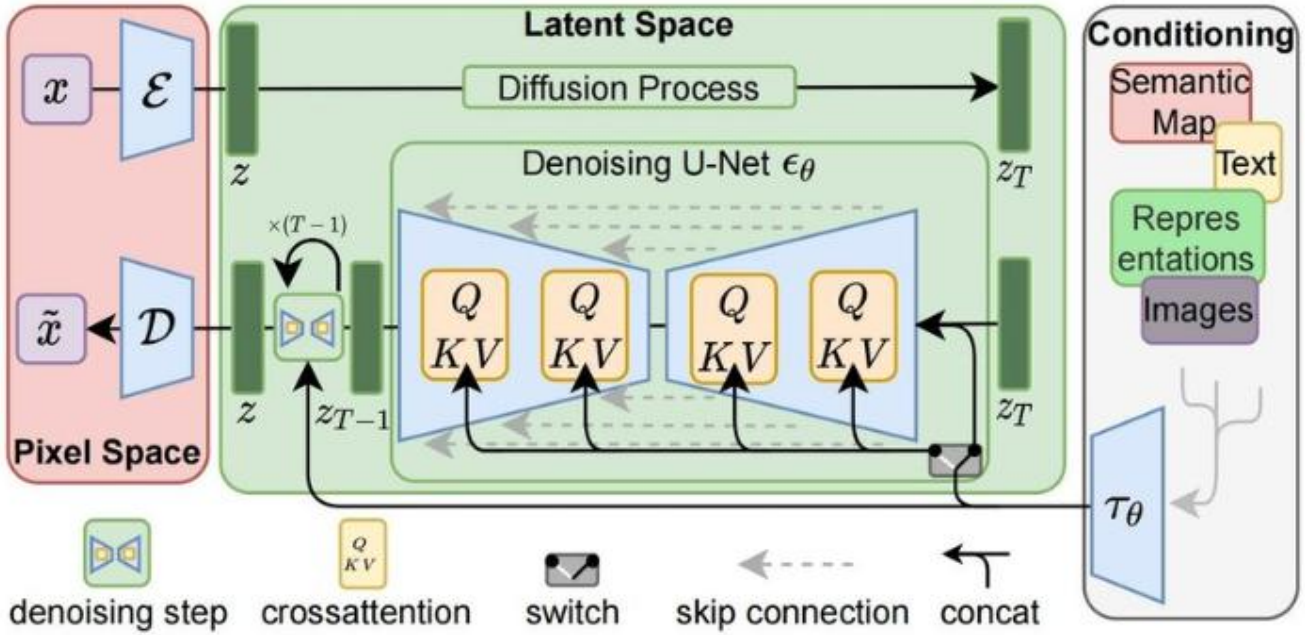


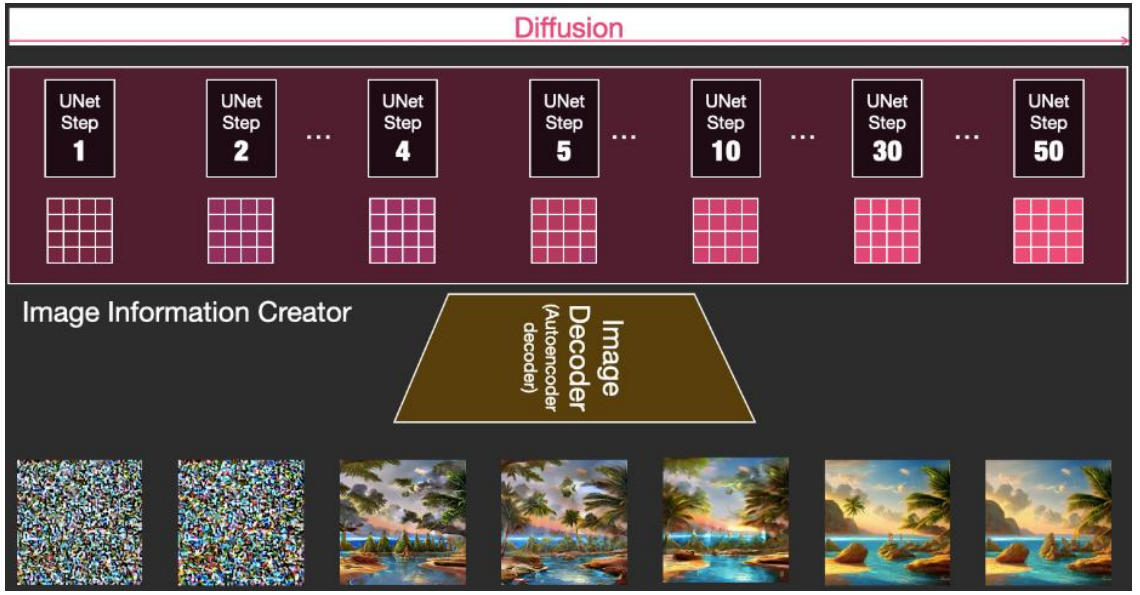
(b) Discriminator

Error function plots









Schematic diagram of Stable Diffusion Fig. 2. Stable Diffusion Web-UI interface


That's all Folks!