DIFFUSION MODELS
IN GENERATIVE AI

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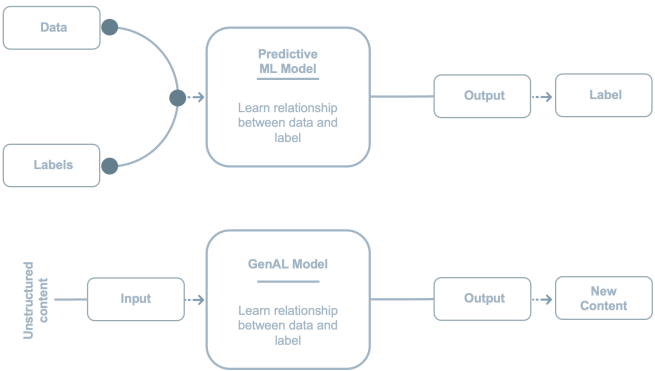
What is Generative AI?

Generative Artificial Intelligence pioneers creative data generation by utilizing algorithms and neural networks to produce original content, departing from traditional machine learning's predictive focus.



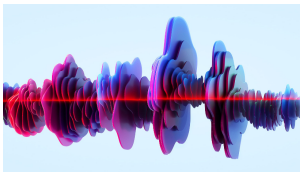
Generative AI

Realistic Image

Image
Video
3D image

Authentic Text

Document
Code



Realistic Audio

Music

Types of Generative Model

Generative Language Models

Learn about patterns in language through training data.
Then, given some text, they predict what comes next.

Generative Image Models

Produce new images using techniques like diffusion. Then, given prompt or related imagery, they transform random noise into images or generate images from prompts.

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Estimating Distributions and Densities

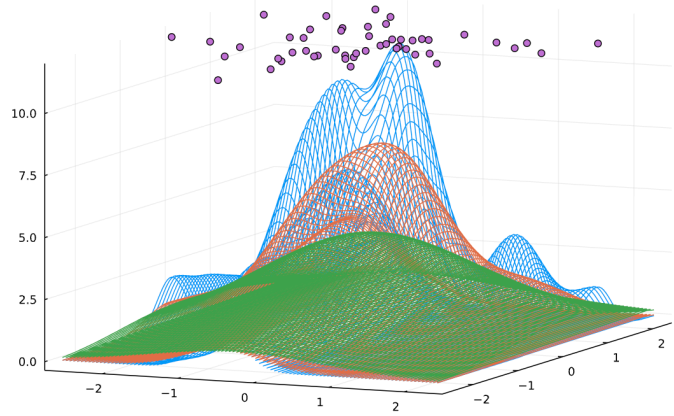
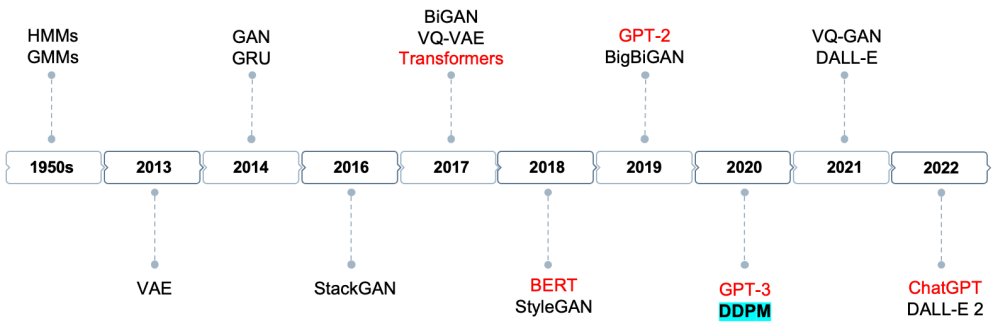


Image credit to noil reed[1]

[1] noil reed. "[ANN] MultiKDE.jl: A Lazy Evaluation Multivariate Kernel Density Estimator". In: *discourse.julialang.org.* (2021)

Review


HMMs
GMMs
GAN
GRU
BiGAN
VQ-VAE
Transformers
GPT-2
BigBiGAN
VQ-GAN
DALL-E
1950s
2013
2014
2016
2017
2018
2019
2020
2021
2022
VAE
StackGAN
BERT
StyleGAN
GPT-3
DDPM
ChatGPT
DALL-E 2

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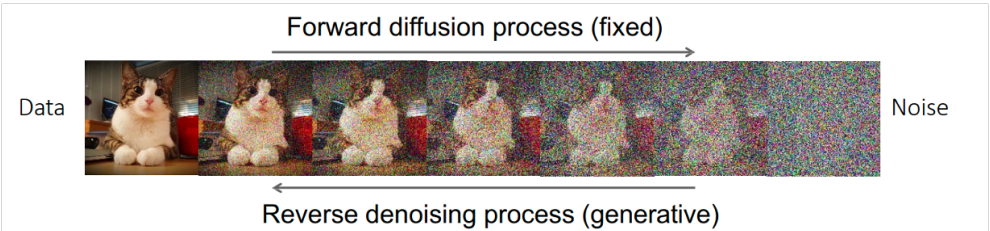
Diffusion Model for Image generation

Emerging as powerful generative models, outperforming GANs



From CVPR Tutorial on DDPM

Diffusion Models Abilities

- Generates high-quality images
- Diverse samples
- Evaluate exact log-likelihoods
- Easily adapted to conditional
- controlled generation tasks

How to accelerate sampling process?

Speed-up Improvement

Knowledge Distillation

ODE Trajectory

SDE Trajectory

Training Scheme

Noise Scale Design

Diffusion Scheme Learning

Training-Free Sampling

Implicit Sampling

Dynamic Programming

Model Merging

GAN based

VAE based

Flow based

Thanks!

Do you have any questions?

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