Advanced Topics in Artificial Intelligence & Machine Learning

Generative AI. GAN, Diffusion

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ML Research

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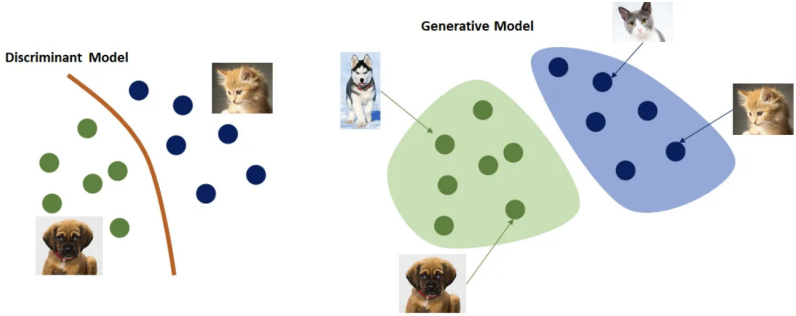
Content

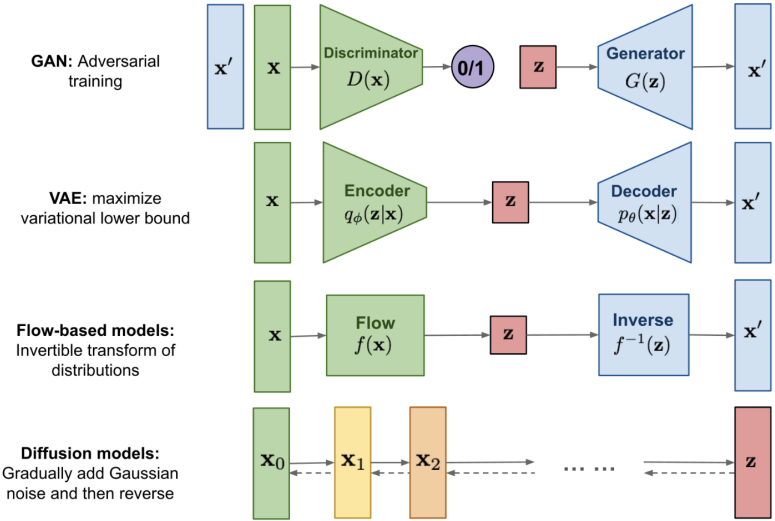
1. Generative AI
   - GAN
   - Diffusion

Generative AI

- Generative AI main goal: to work on top of distributions, not single data examples
- Generative models can be conditioned: e.g., generate the image given some textual caption for it
- Output is **probabilistic**: so we can produce multiple in-distribution outputs based on the same condition. This process is called **sampling**
- Read material: link

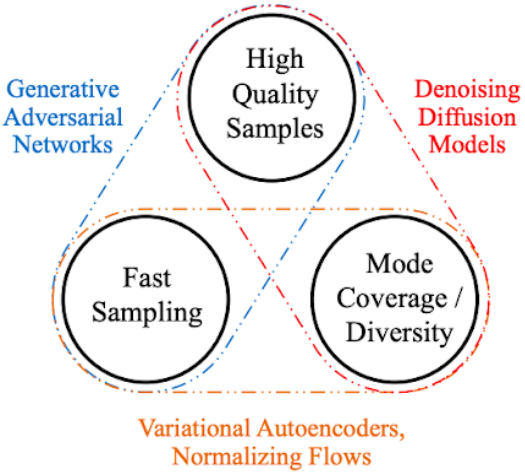


Generative AI: Approaches[1]



[1] Lil'Log

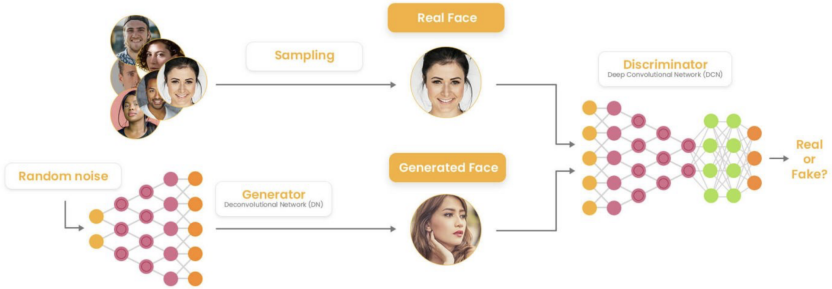
Generative AI: Approaches comparison[2]



[2]Nvidia blog

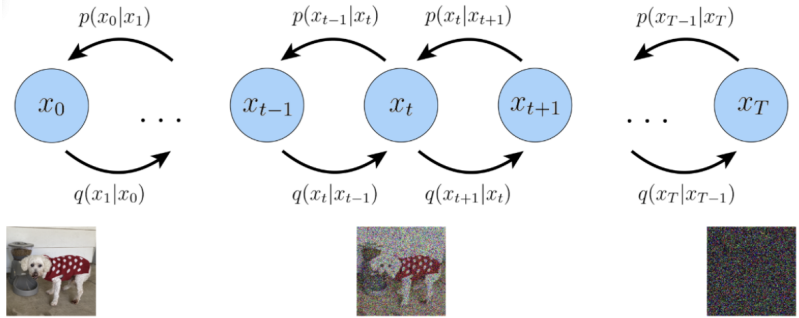
GAN

- Generative Adversarial Network (GAN): one more generative model
- Main idea is to train two model in parallel: 1) Generator to produce the in-distribution data, and 2) Discriminator to discriminate between the real (GT) and synthetic (generated) data
- Quite unstable because of minmax problem and now mostly replaced by Diffusion models
- Read material: link



AI Art Generator / Stable Diffusion

- Diffusion Model is the generative model based on hierarchical markovian variational auto encoder
- Main idea is to reverse the noise (diffusion) by the learned model
- Stable diffusion is the process to work on top of the (latent) representations that have much smaller dimensions making it quite stable
- Read material: link



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3. GAN is the first GenAI model that provided high-quality outputs
4. Diffusion added more distribution coverage
5. Generally speaking, diffusion models are slow because of the sequential inference

Thank you!