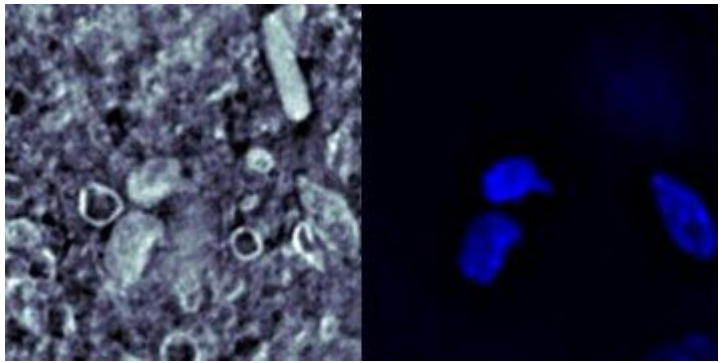
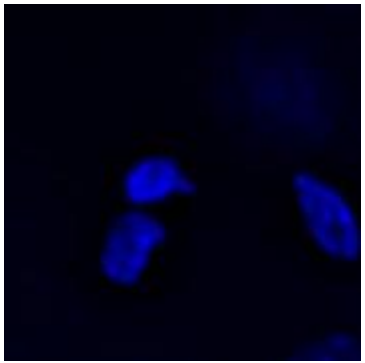
Lightweight Latent Consistency Model

Current Approach

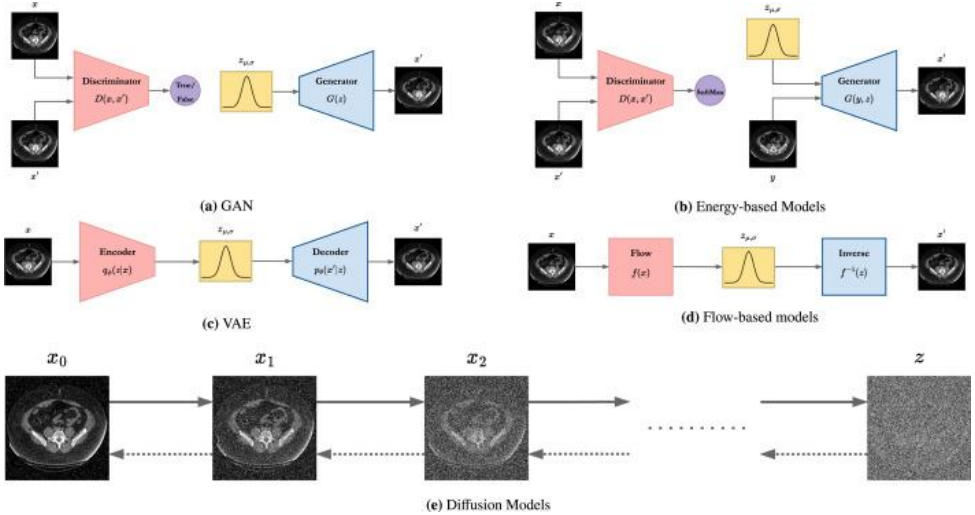
- Pix2Pix (cGAN)
- Fast and efficient
- Occasional unrealistic generation artifacts & hallucinations
    - Missing nuclei

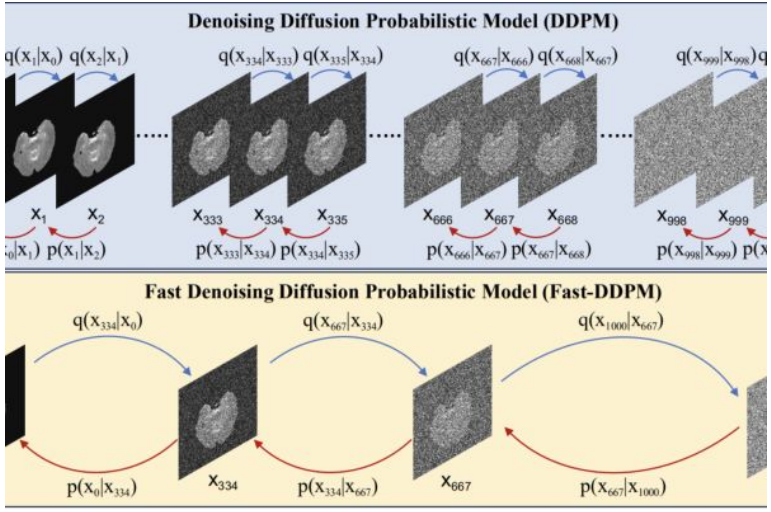


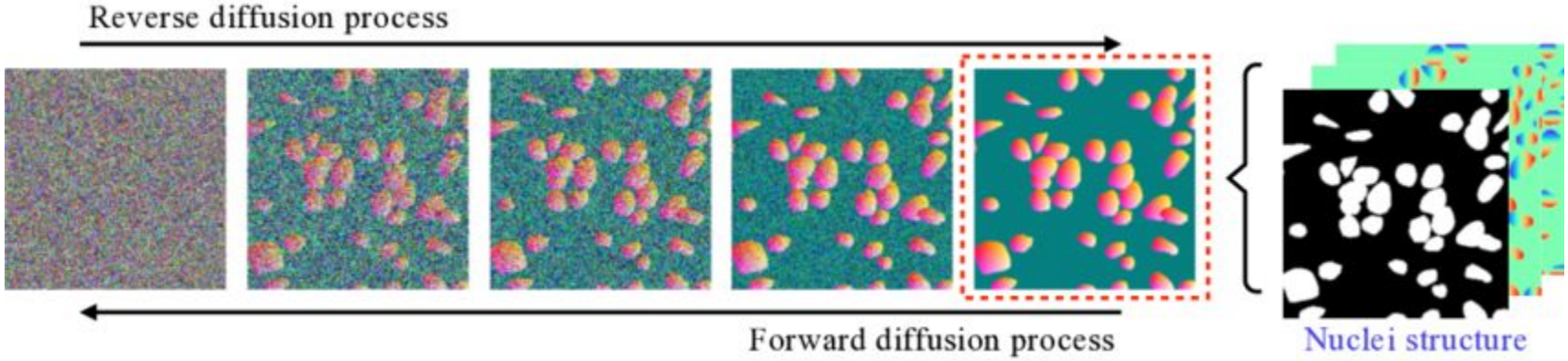


Diffusion Models

- Realistic outputs & better image quality
- Very slow to train and generate images
  - Not applicable for real-time use cases

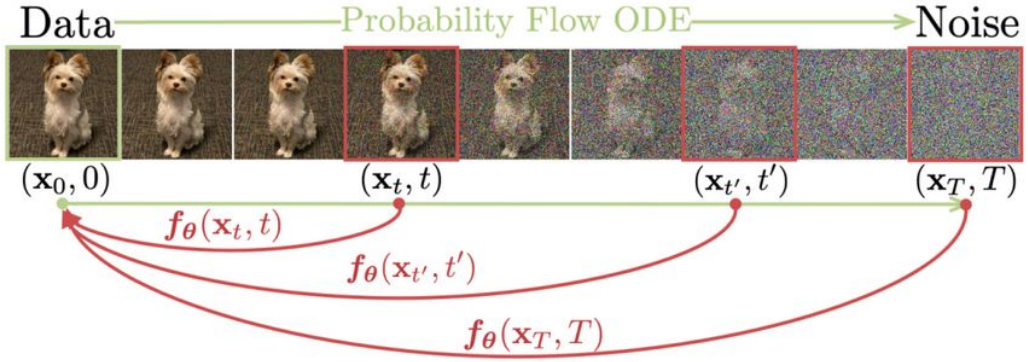

Discriminator
Generator
Encoder
Decoder
Flow
Inverse
(a) GAN
(b) Energy-based Models
(c) VAE
(d) Flow-based models
(e) Diffusion Models


Denoising Diffusion Probabilistic Model (DDPM)
Fast Denoising Diffusion Probabilistic Model (Fast-DDPM)


Reverse diffusion process
Forward diffusion process
Nuclei structure

Lightweight Latent Consistency Model

- Real-time image generation
- High image quality similar to diffusion model
  - Minimized artifacts/hallucinations
- Reduced training time from diffusion model



Lightweight Latent Consistency Model

- Components
  - VAE: Compress the input images into a latent space
  - U-Net: Translating inputs to outputs (qOBM → DAPI)
  - Consistency Model:
    - Distilled model that learns to model the reverse diffusion process in 1-step
    - Minimizes number of steps needed
    - Objective is self-consistency: produce same output from different noisy versions of the same input