

Distilling Diffusion Models into Conditional GANs

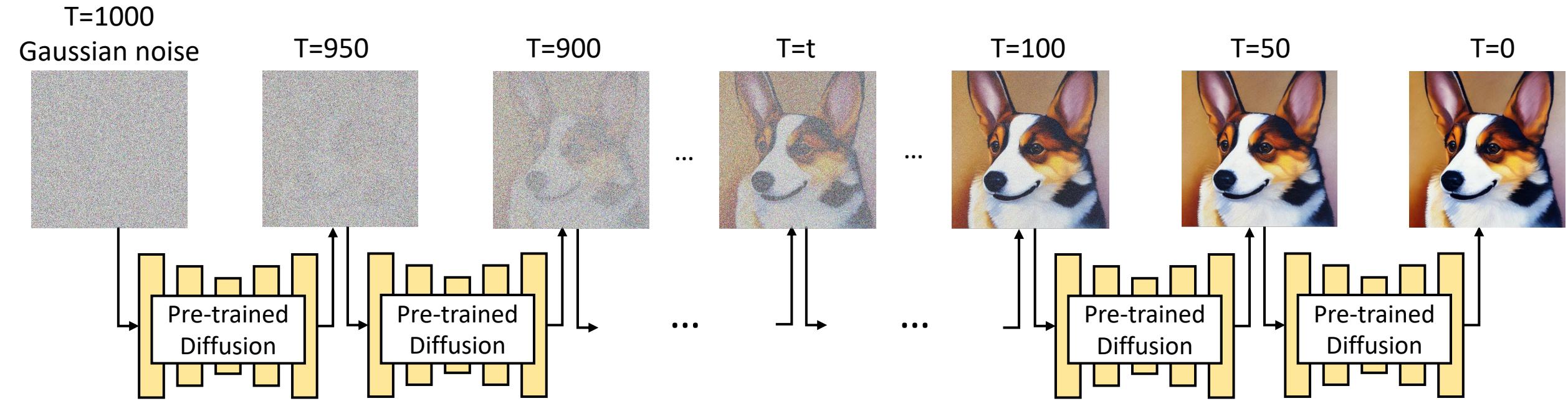
Minguk Kang, Richard Zhang, Connelly Barnes, Sylvain Paris, Suha Kwak,
Jaesik Park, Eli Shechtman, Jun-Yan Zhu, and Taesung Park



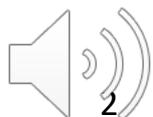
Carnegie
Mellon
University



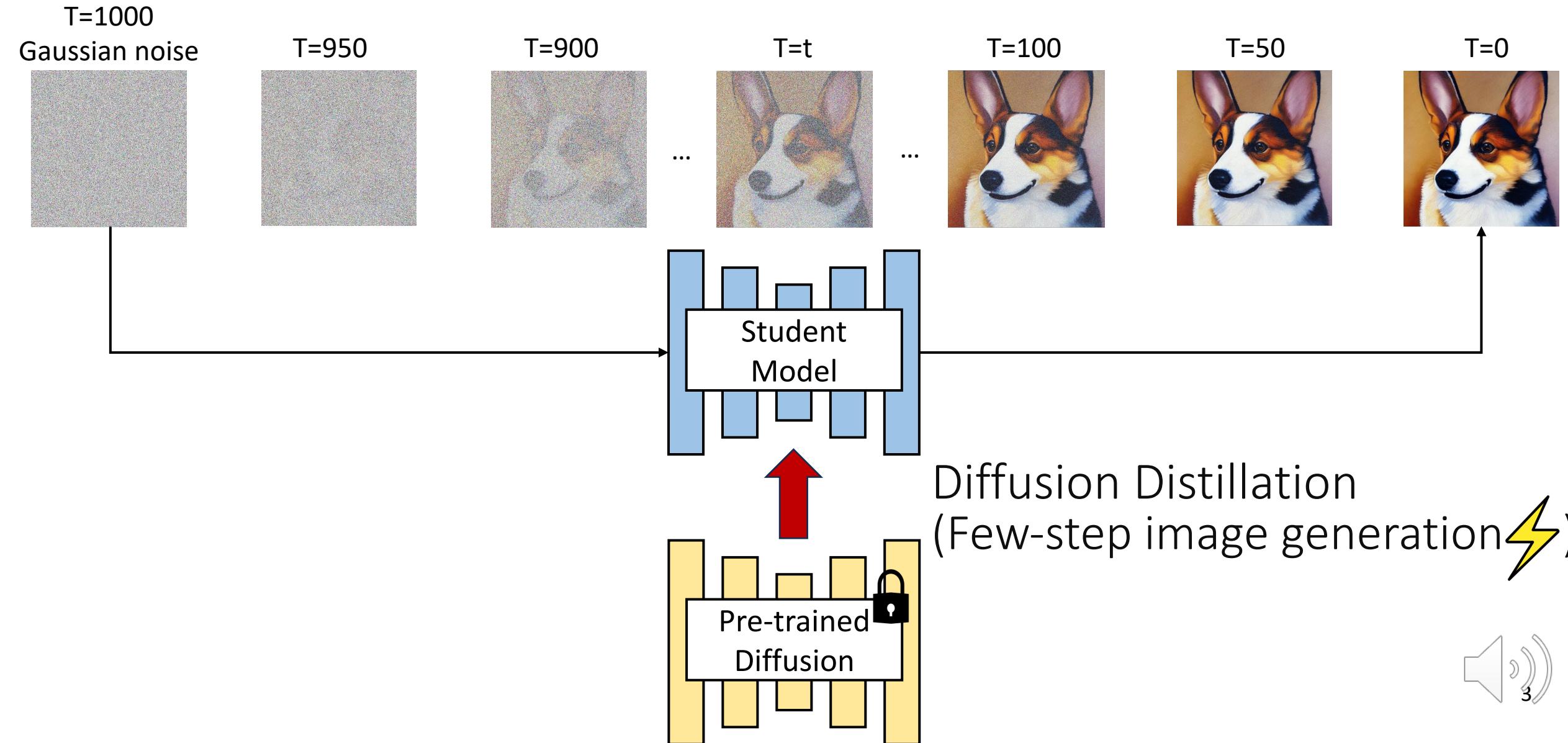
What is diffusion model distillation



Requires 20~50 steps of denoising to generate a single image.

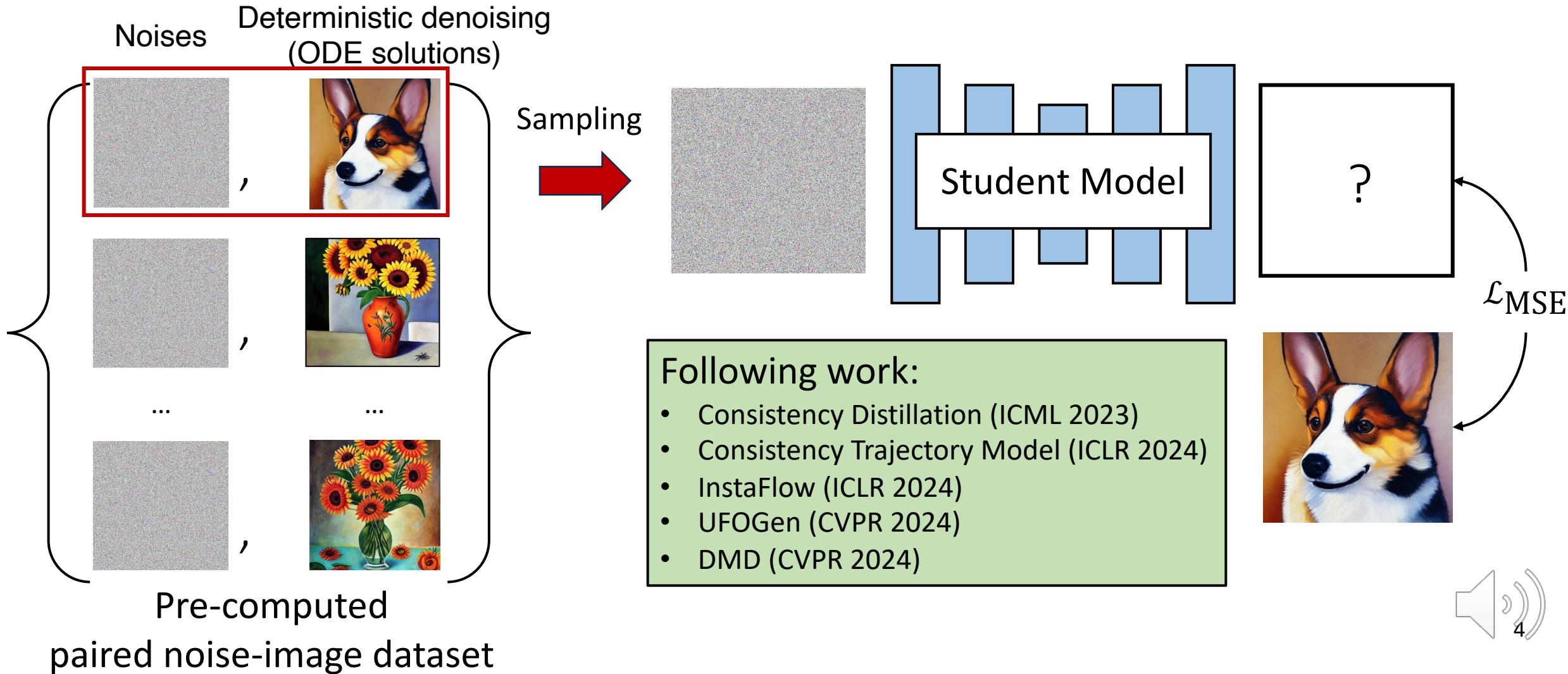


What is diffusion model distillation



How can we distill a diffusion model?

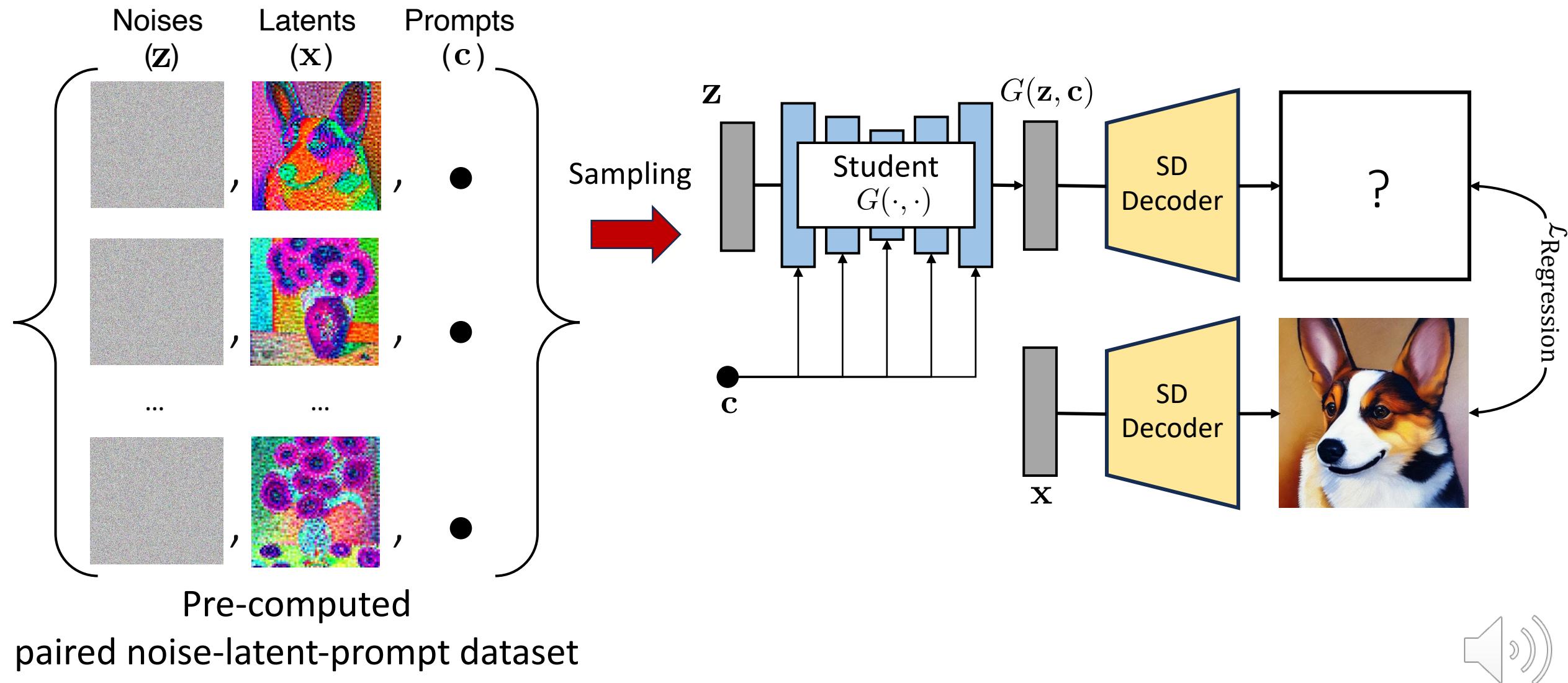
Direct regression approach: Luhman et al., 2021.



Is direct regression no longer not
necessary?



Re-discovery of direct regression training



Perceptual loss is what we need

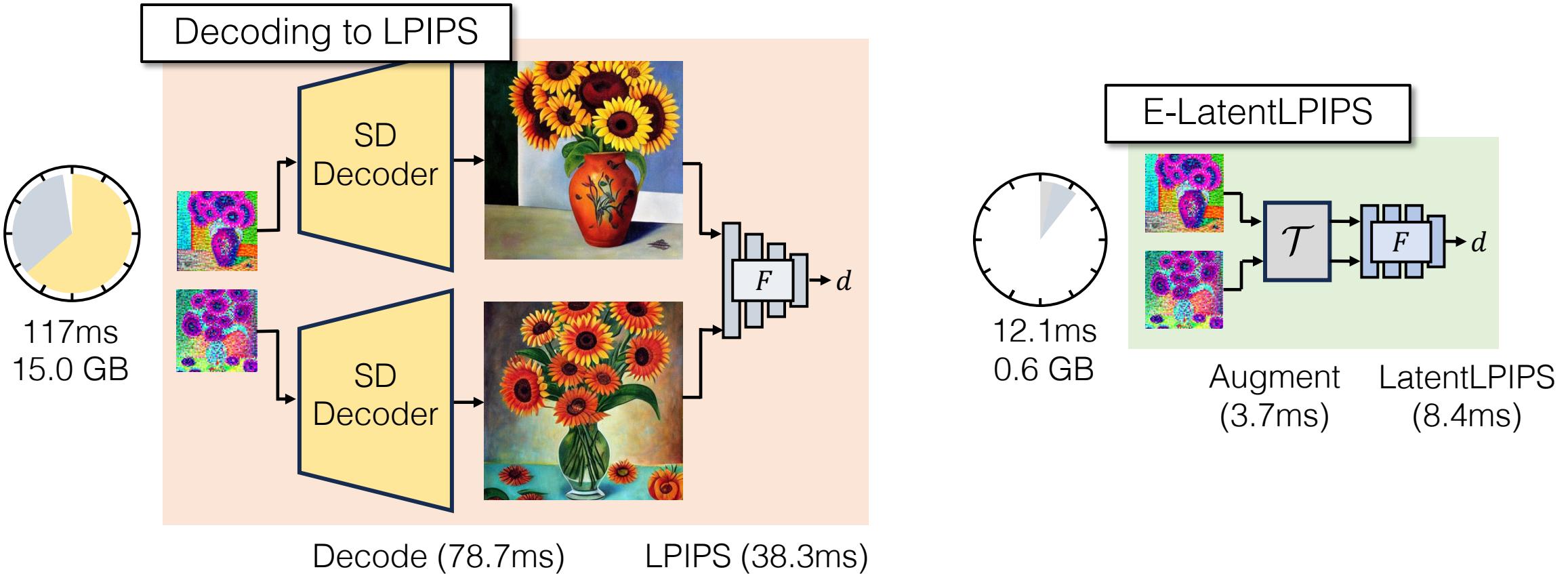


Loss function	img/sec	FID	CLIP-score
MSE	138.4	110.55	0.222
LPIPS	40.0	25.94	0.288

-  Direct regression using LPIPS = Good
-  Pixel-space LPIPS is expansive.
-  Decoding can introduce errors in LPIPS.



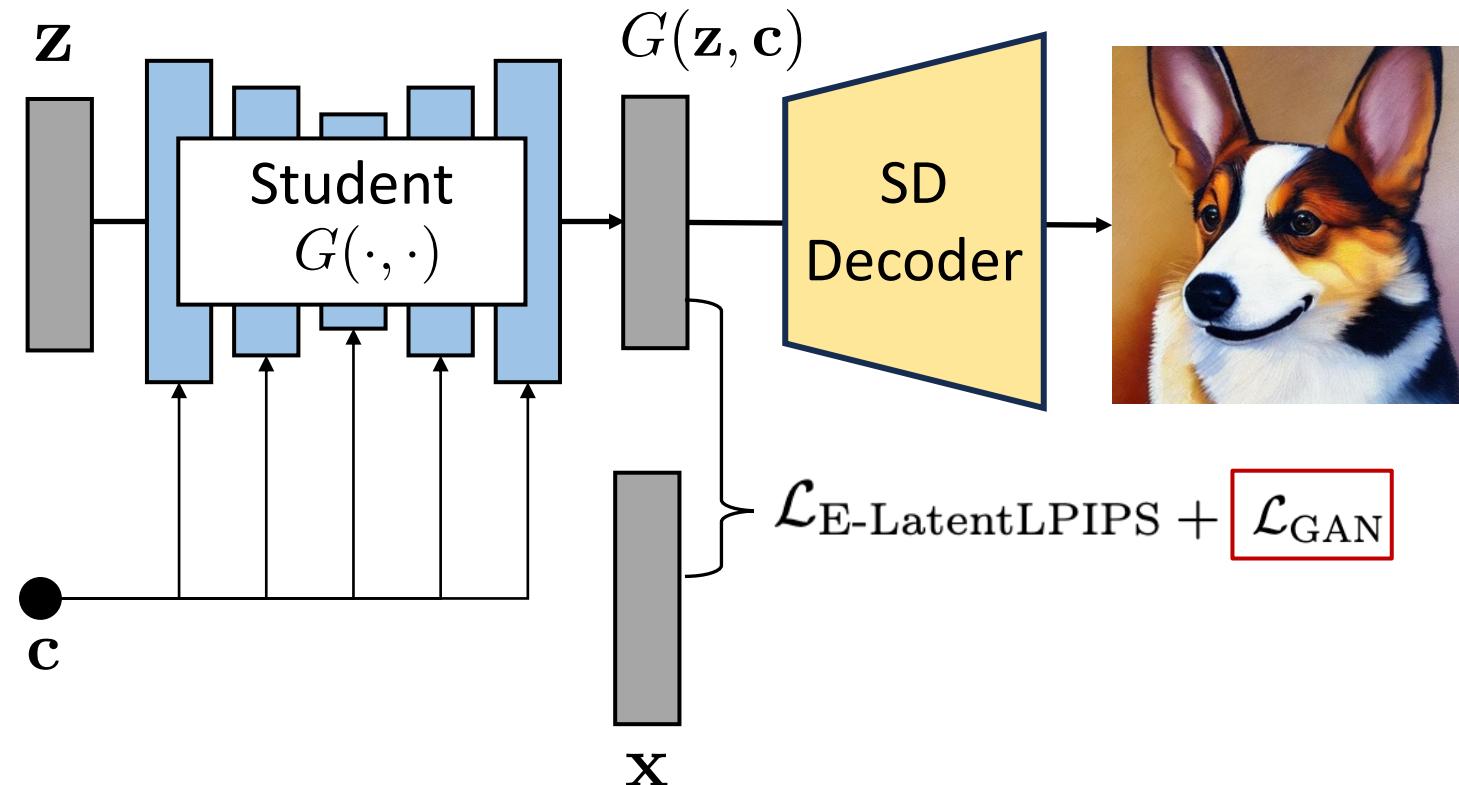
E-LatentLPIPS for efficient LPIPS



9.7× speedup achieved with E-LatentLPIPS! ⚡



View the distillation as image-to-image translation

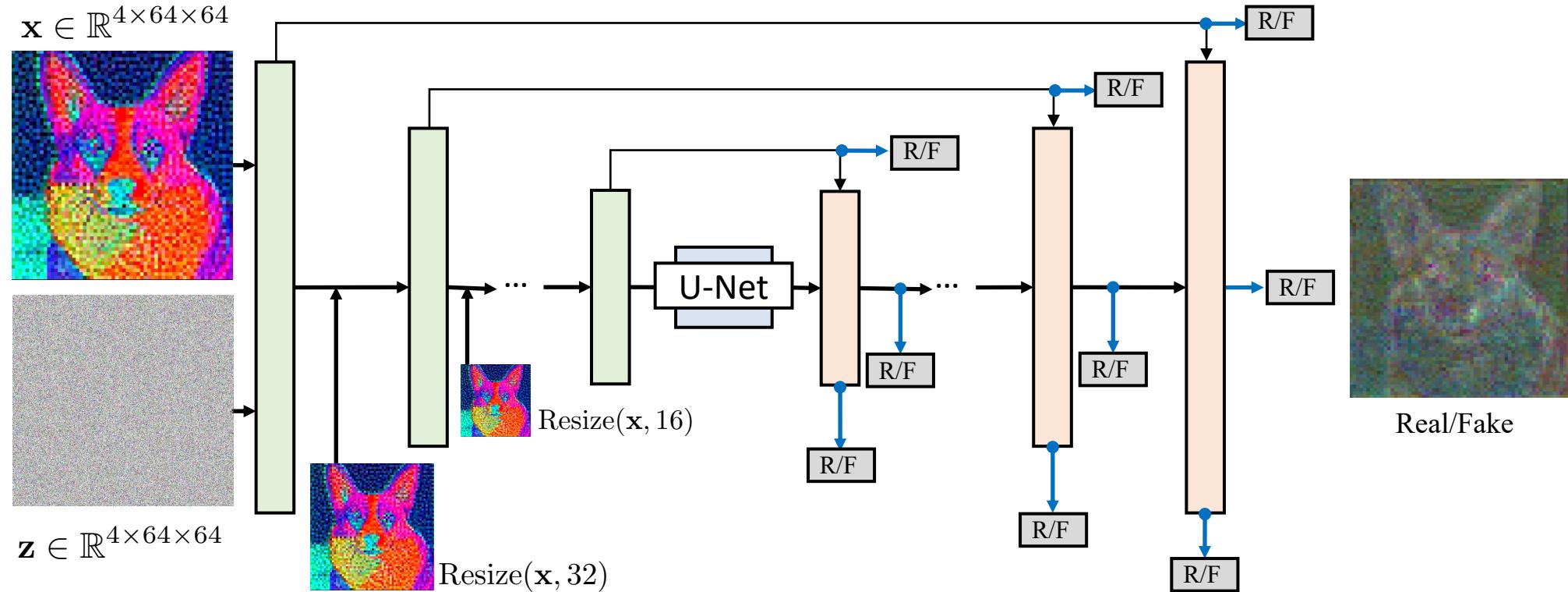


In practice, paired image translation yields better results when combined with conditional GAN losses.

(sources = **noise & prompt**, target = **ODE solution**)



Pre-trained diffusion as a strong discriminator

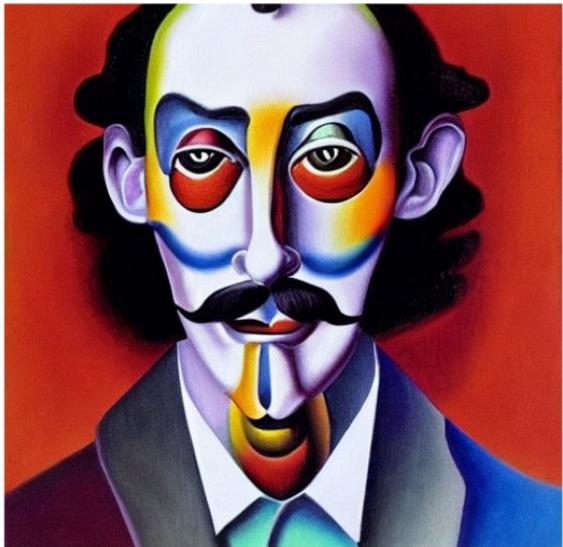


Multi-scale Input/output discriminator following GigaGAN.

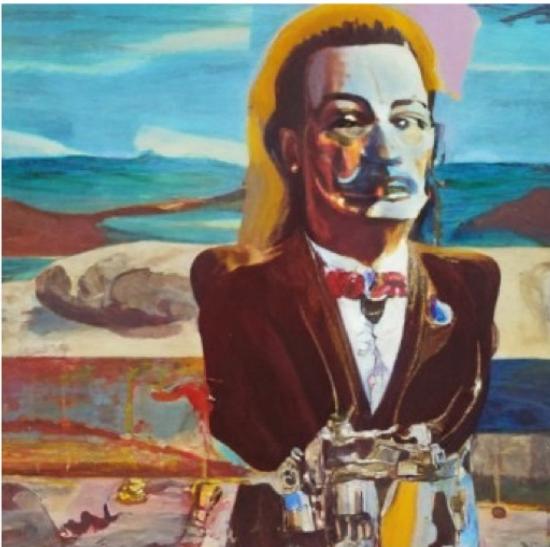


Visual comparison with previous models

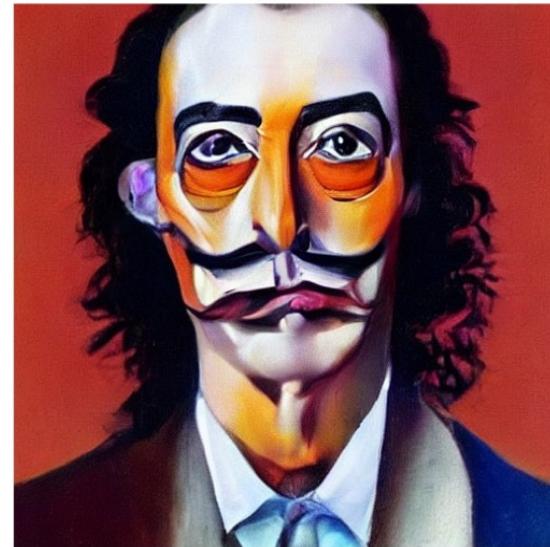
Stable Diffusion 1.5



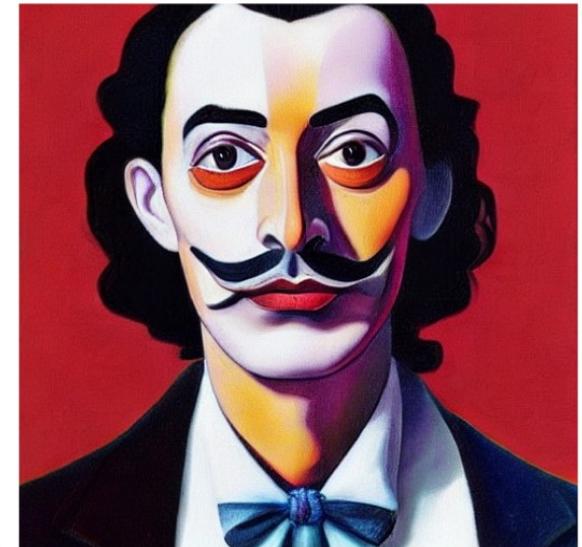
GigaGAN



InstaFlow-0.9B



Diffusion2GAN



Visual comparison with latest work



SDXL-Turbo (arXiv Nov., 2023)

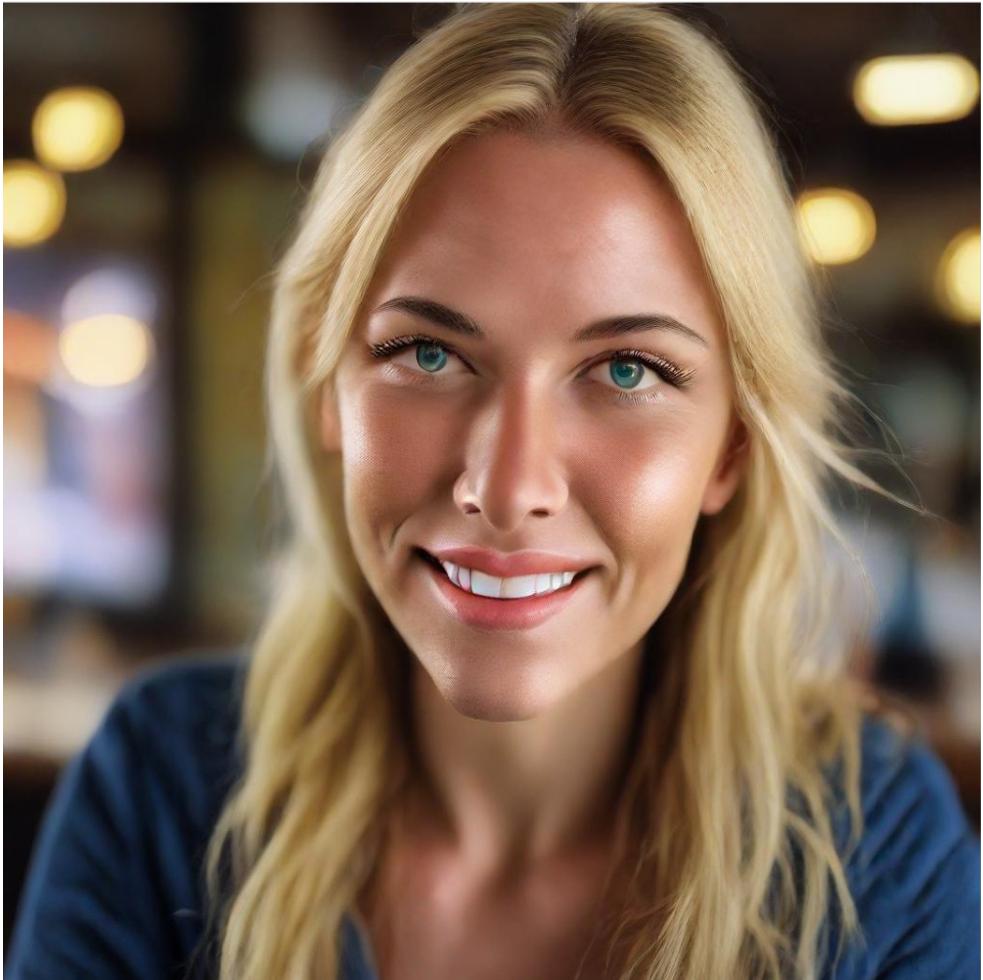
"A woman with bright blue eyes and curly blonde hair smiles warmly in a softly lit café."



Diffusion2GAN



Visual comparison with latest work



SDXL-Lightening (arXiv Feb., 2024)



Diffusion2GAN

"A woman with bright blue eyes and curly blonde hair smiles warmly in a softly lit café."



Visual comparison with latest work



SDXL-Turbo (arXiv Nov., 2023)

“A bald eagle made of chocolate powder, mango, and whipped cream”



Diffusion2GAN



Visual comparison with latest work



SDXL-Lightening (arXiv Feb., 2024)

“A bald eagle made of chocolate powder, mango, and whipped cream”



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Thank you!

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