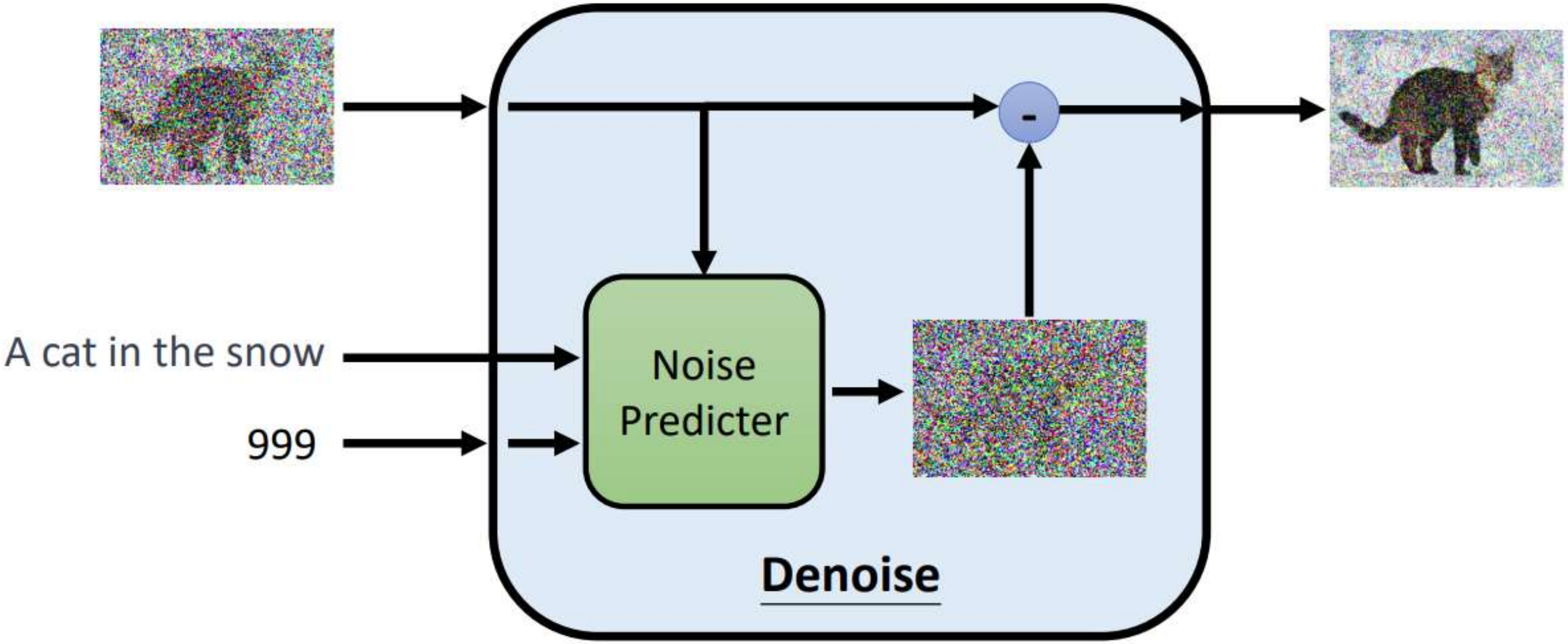
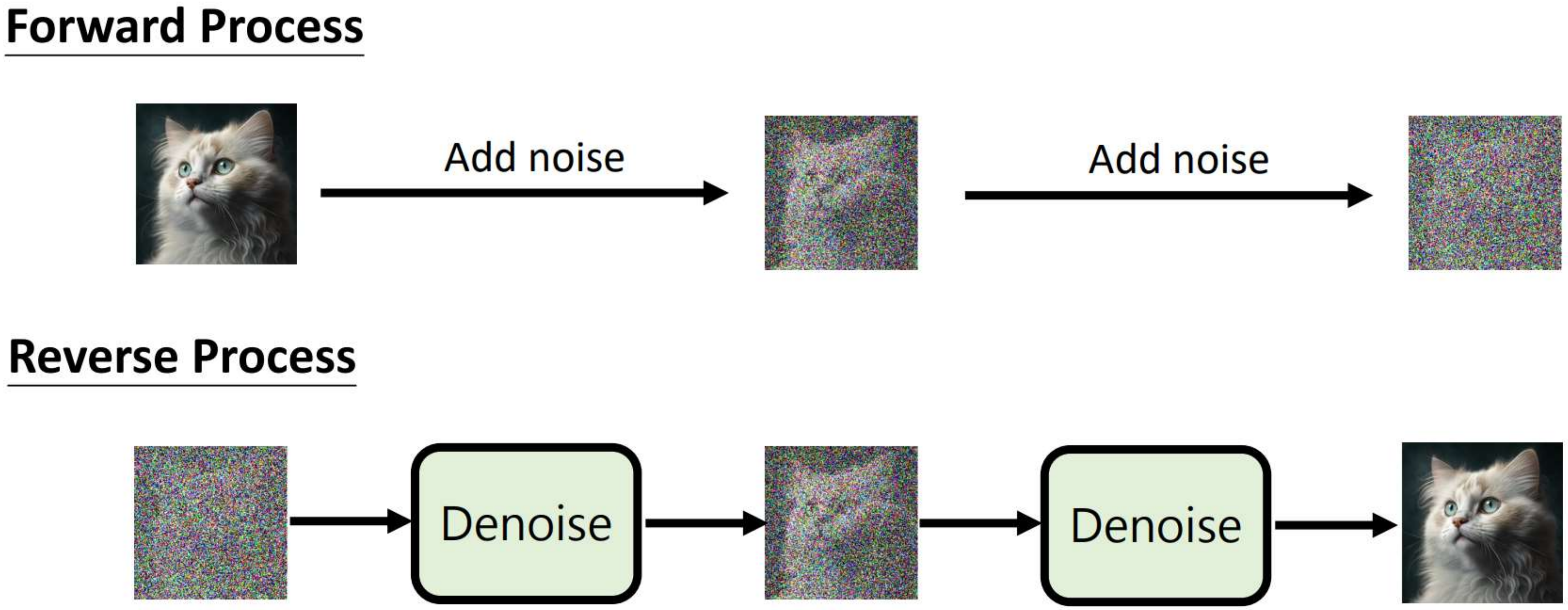
Topic: Diffusion Model

——Technique Project



[From ML 2023 Spring (ntu.edu.tw)]

How Diffusion Model Work?



From ML 2023 Spring (ntu.edu.tw)

Denoise Process

~~Paint~~ ×

Sculpt √

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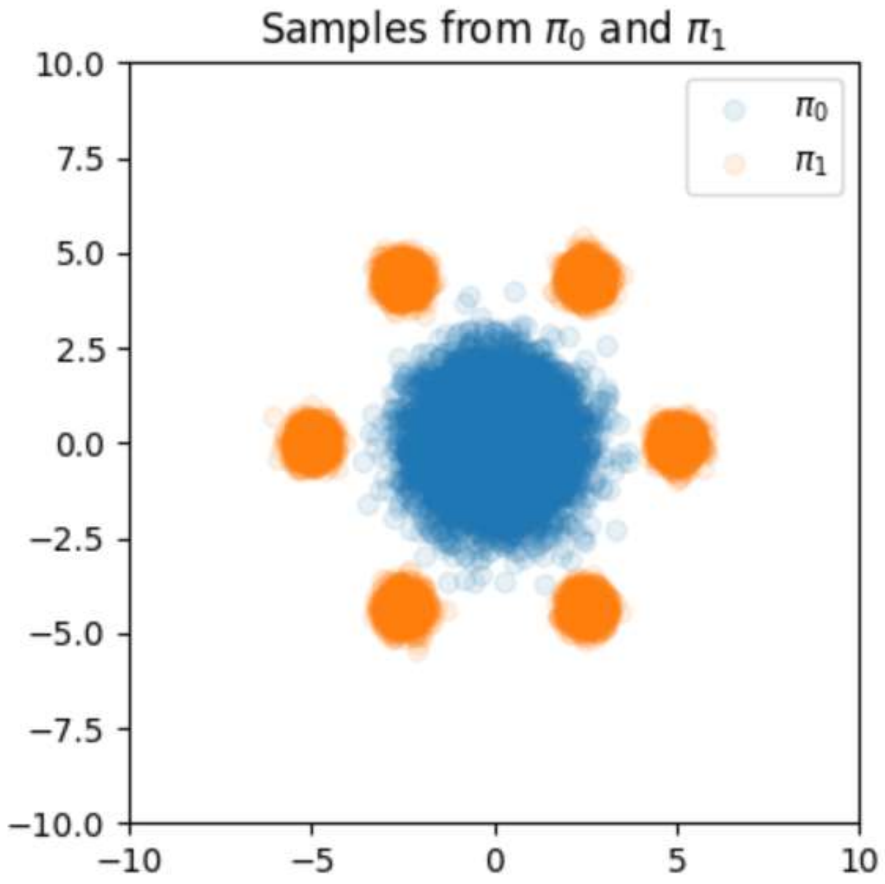
Technique Project of Group 5

——Pipeline of our work

Based on given incomplete project
→obtain samples
→construct diffusion model
→train and test model
→data visualization



Source code can be found in： https://www.kaggle.com/code/duankefeng/simplediffusion

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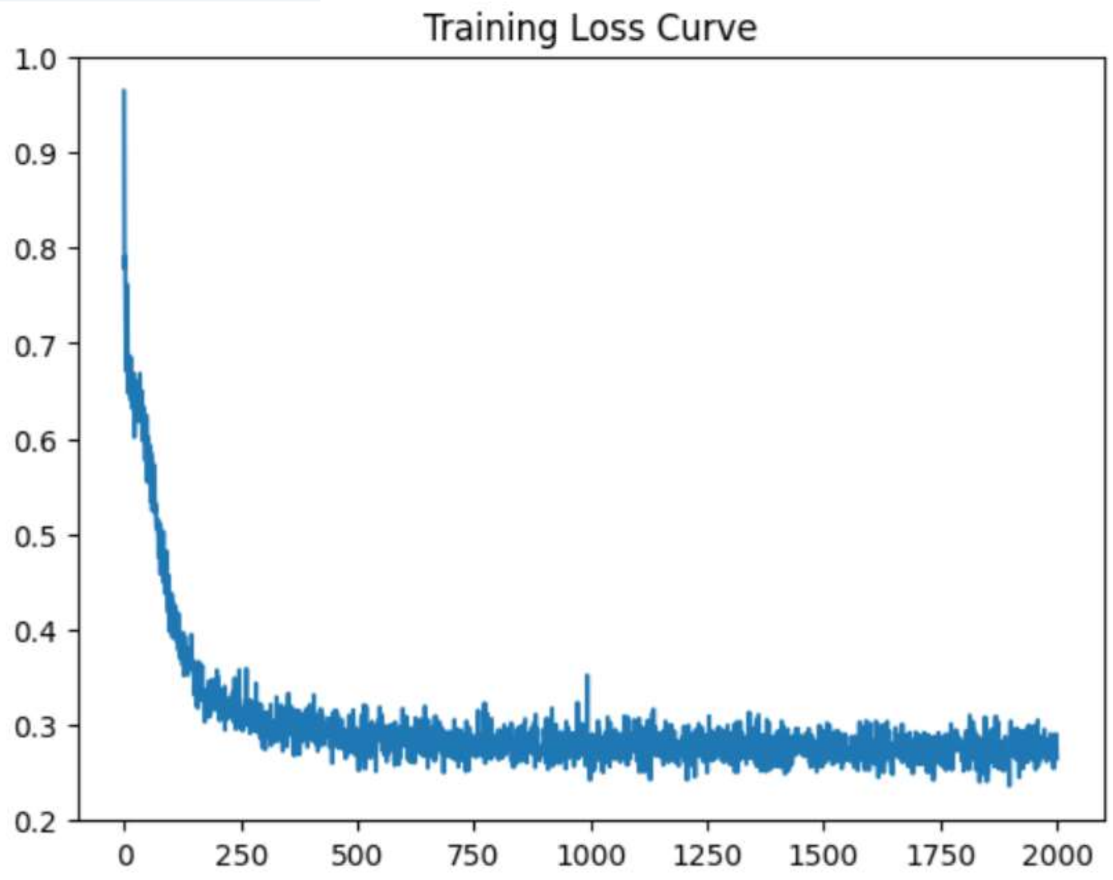
—— Train Diffusion Model

```
##### Question 3: You need to implement these lines by yourself!!
loss = torch.mean((pred*std + z) ** 2)
##### End of your implementation #####
```



Loss Function: MSE loss

➔**pred**: The output of the model at given time step t.
➔**std**: The standard deviation, typically computed from the marginal distribution of the SDE. In diffusion models, this represents the noise level.
➔**z**: The true data or noise sample used for calculating the model's loss.

Source code can be found in： https://www.kaggle.com/code/duankefeng/simplediffusion

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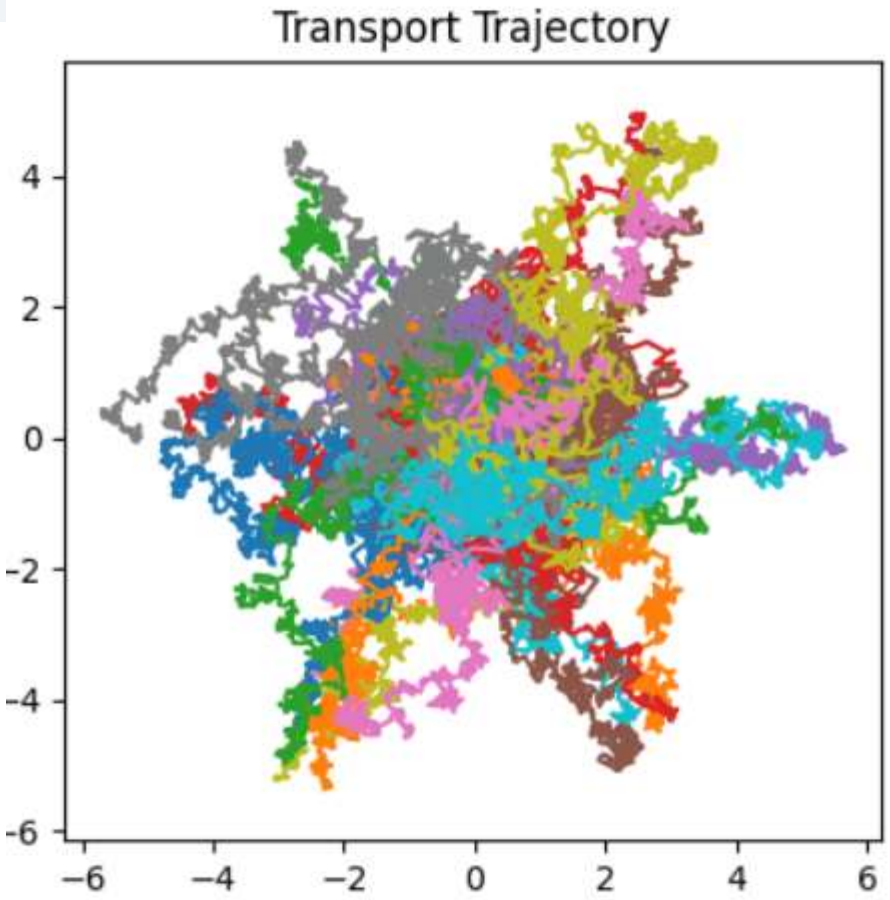
—— Sample based on well-trained Diffusion model

```
##### Question 3: You need to implement these lines by yourself!! Arour
z = z - drift * dt + diffusin * torch.sqrt(torch.tensor(dt)) * noise
##### End of your implementation #####
```



Euler-Maruyama method used for SDE

z - drift * dt:

➔ **Adjusts the sample z by the deterministic drift term over the time step dt.**

diffusin * torch.sqrt(torch.tensor(dt)) * noise

➔ **Adds the stochastic component to z, scaled by the diffusion term and the time step size.**

——simulating the reverse-time Stochastic Differential Equation (SDE)

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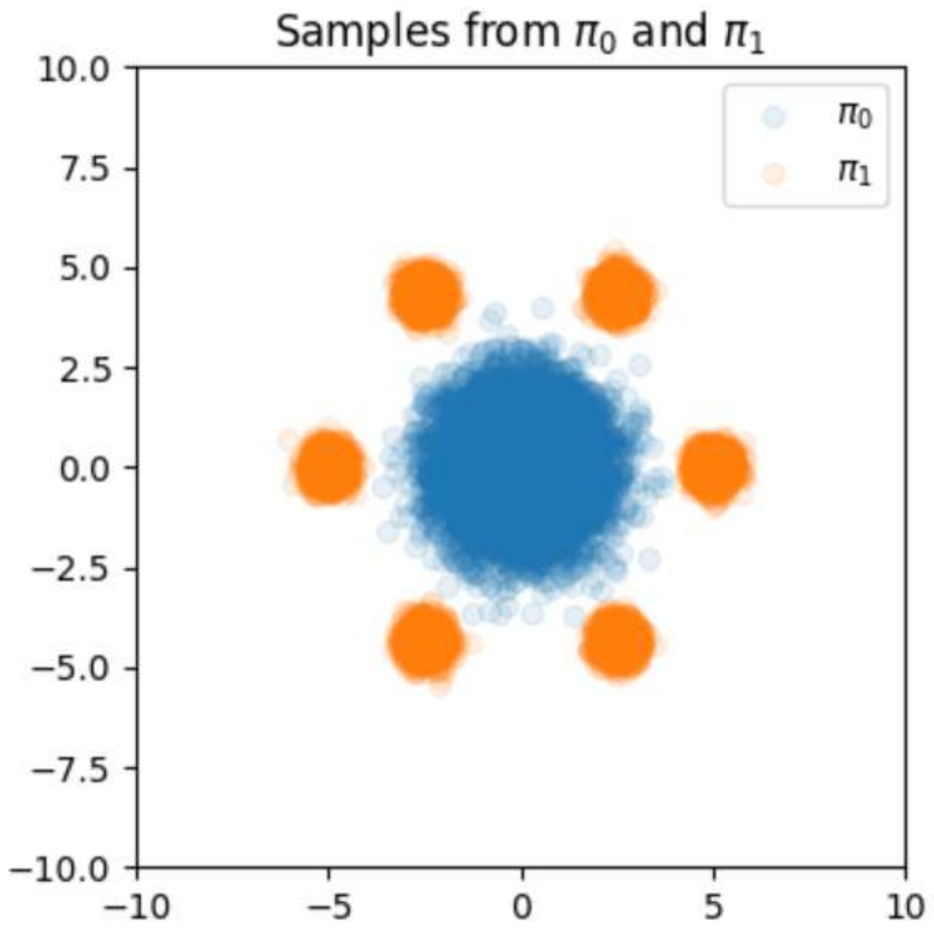
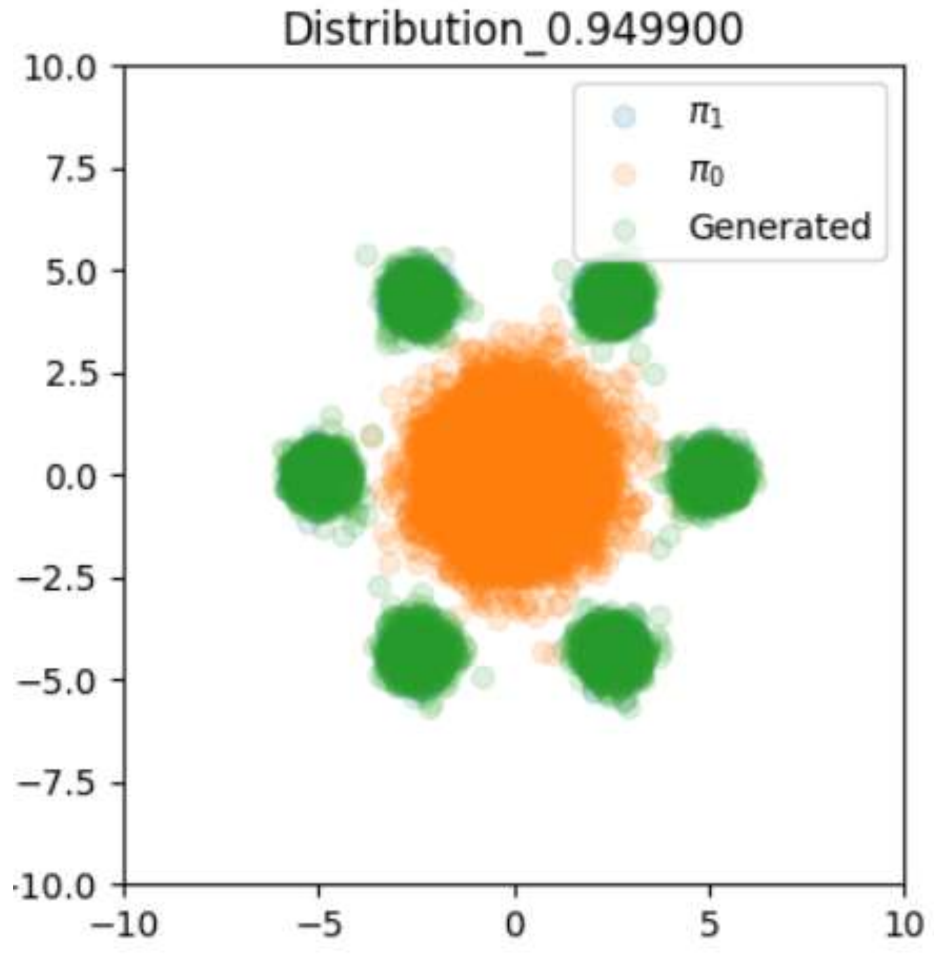
—— Data Visualization





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—— Related Work

- Song, Yang, et al. "Score-based generative modeling through stochastic differential equations." arXiv preprint arXiv:2011.13456 (2020).
- Ho, Jonathan, Ajay Jain, and Pieter Abbeel. "Denoising diffusion probabilistic models." Advances in neural information processing systems 33 (2020): 6840-6851.

That's all. Thank you!!!