EECS 498-014 Graphics and Generative Models
Homework 5

Yichen Lu nechy@umich.edu

December 6, 2024

1 Task 2: Please explain what is the difference between Ez_p(z) term in Eq. 2 and Eq. 1? And why there is such a difference between the Generator and the Discriminator? Briefly explain the difference between the objective of the Generator and the Discriminator loss function is adequate.

Differences:
Eq. (1) shows how well the generator G can fool the discriminator D.
Eq. (2) measures how well the discriminator D can correctly classify the samples generated by $G(z)$ as fake.

Reason:
This is because the first one aims to minimize this expectation, as the generator G wants the discriminator D to think it is not a fake image.
The second one aims to maximize this expectation, as the discriminator D wants to detect that the generator G is fake.
The goal of G is to generate data that is hard to distinguish from real data, while the goal of D is to distinguish them.

2 Task 3: Please report the time you need for DDPM and DDIM respectively and briefly talk about the pros and cons of using DDIM as the scheduler over DDPM. One sentence response is adequate

DDPM costs: 360.5335988998413 second.
DDIM costs: 31.939486026763916 second.
Pros: Faster, better quality Cons: lower diversity, sensitive to the noise

3 Task 5: What is the extra time cost for applying the DPS compared to DDIM? What will happen if we set fewer timesteps than usual (look at TODO in execute_DPS.py)? Please run the experiment in different timesteps and share your findings. The response can be as short as one sentence. Sticking some figures is recommended

DPS requires additional calculations for the probability score of the data distribution during the sampling process. Fewer timesteps: lower time cost, lower quality 1000 time steps: 213.9848029613495 second. 100 time steps: 21.861311435699463 second.

Figure 1: 1000 time steps

Figure 2: 100 time steps