MLSP HW3

Generative Models

Due date: 2024/06/03 23:55

Requirements:

- The code should be written in Python.
- Zip code (.py/.ipynb) and reports (PDF) and name the zipped file as "HW3_YOURSTUDENTID.zip" and submit it to the E3 system.
- We will deduct a late penalty of 20% per additional late day.

In this assignment, we will investigate:

1. The concept of Generative Adversarial Network (GAN)..
2. The concept of Denoising Diffusion Probabilistic Models (DDPM).

We already provide the example.ipynb to handle the problems below :

1. By using the MNIST dataset, implement GAN by **filling the TODO**. Plot the loss curve of GAN, the generation results of the generator, and describe the concept of GAN. You should find a metric, for example, FID score, to describe how you try your best to improve your GAN. You can try to modify the architecture of the GAN, or train more epochs to improve the results.

2. By using the MNIST dataset, implement DDPM by **filling the TODO**. Plot the loss curve of DDPM, the generation results of the diffusion model, and describe the concept of DDPM. You should find a metric, for example, FID score, to describe how you try your best to improve your diffusion model. You can try to modify the noise schedule, or train more epochs to improve the results.

The report should contain two parts:

1. Explain each step of your implementation in detail.
2. Result of problems 1, 2

Make sure that you find a metric that can explain why your method improves upon the original models.

References:

- Ho, Jonathan, Ajay Jain, and Pieter Abbeel. "Denoising diffusion probabilistic models." Advances in neural information processing systems 33 (2020): 6840-6851. Paper Link

Note:

Although you can easily find the implementation code on the web, we encourage you to implement these two generative models on your own first.