Assignment 4
CS7.601 (Monsoon 2023)
Deep Learning: Theory and Practices
Submission Deadline:
11:55 PM, November 22nd 2023

Max. Marks : 8

Instructions

1. Please submit your code for all the questions in **Jupyter Notebooks**.
2. Only the following libraries are allowed:
   - Numpy
   - Pandas
   - Matplotlib
   - Pytorch (version $\geq$ 2.0)
   - tqdm
   - scikit-learn
3. **Only submissions made on Moodle will be considered for evaluations.**

1 Mixture of Gaussians [2 Marks]

Consider the following bi-variate distribution.

$$p(\mathbf{z}) = \frac{1}{\sqrt{3}}[\mathcal{N}(\mu_1, \sigma^2\ I) + \mathcal{N}(\mu_2, \sigma^2\ I) + \mathcal{N}(\mu_3, \sigma^2\ I)] \tag{1}$$

where $\mathcal{N}(\mu, \Sigma)$ is a Gaussian distribution with mean μ and co-variance matrix Σ and $\mathbf{z} \in \mathbb{R}^2$. Let μ_1, μ_2, μ_3 be $[0, 0]^T, [2, 2]^T, [-2, 2]^T$ respectively and $\sigma = 2$. Generate 10000 samples i.i.d. from the distribution above. Train a GAN so that it can generate data from above distribution. Report the following.

1. Plot the Loss vs Epoch curve.

2. Once the training stops, generate 3000 points from the GAN. Generate histogram plot of the these 3000 points and report your observations.

2 GANs and Diffusion Models [3+3 = 6 Marks]

The objective is to implement a DC-GAN on CIFAR-10 dataset.

1. After training, generate 10 images from the learned distribution and save them.

2. Plot the Loss vs Epoch curve.

3. Report the inception score on the generated images.

Now, learn the same using Diffusion Models and compare the Inception scores on generated images. Mention the architecture used and repeat steps 1-3.

Reference : https://github.com/sbarratt/inception-score-pytorch/tree/master