Practical Report HW3

Mehdi Oudaoud

December 2022

1 VAE : Question 1.3

1.1 Question 1.3.a

Figure 1: The last sample given from VAE Model

Figure 2: The reconstruction given by the VAE Model

1.2 Question 1.3.b.

The samples are blurry but we can distinguish the digits a variety of colours and and digits like the 6 on the first colomn third lign of Figure 3.

1.3 Question 1.3.c.

Figure 3: The interpolation results from VAE

Here we can see that the image smoothly changes from the left to the right as it gets darker.

2 GAN Question 2.2/2.3/2.4

2.1 Question 2.2.a

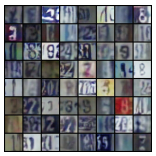

Figure 4: The last sample given from GAN Model

2.2 Question 2.2.b

The images are not blurry but the figures are hard to recognize, some weird looking images are produced.

2.3 Question 2.2.c.

Figure 5: The interpolation results from GAN

There is a continuity and a smooth one as well from the left to the right as the image gets darker and number changes from 3 to a odd figure.

2.4 Question 2.3.

The detach() function takes the fake_data out of the gradient propagation for the discriminator loss. It is essential because other wise the gradient flows through the fake_data and hence through the generator, but the aim is to **only compute** the disciminator's loss.

2.5 Question 2.4.

In its current state the model can be used to reconstruct new images mainly but it performs a bit poorly. It still needs to be tuned or trained on a larger dataset. However, for the log-likelihood, the model GAN cannot be used for this purpose. However, the model cannot be applied in reprsentation learning, for exmaple for generating images that highlight a certain strong visual feature like the color of the background or the color and shape of the lines used to write the numbers.

3 DDPM Question 3.2.

3.1 Question 3.2.a

Figure 6: The last sample given from DDPM Model

3.2 Question 3.2.b

Samples look clear and not blurry but also giving actual digits. So it is as clear as a GAN, but contrary to GAN, it does not generate odd looking images. For VAE, it also generates real digits but it is better because it is no blurry.

4 Question 4

4.1 VAE Models

Advantages: The main Advantage of VAE models is that we know the function we are trying to optimize the loss given in this HW to be the log-likelihood. So we would be able to follow the training and make sense of its evolution.

Disavantage The main disadvantage being that VAE use random noises that can be hard to trace back so the reconstruction is not always optimal.

4.2 GAN Models

Advantages The GAN is able to generate a new image based on the given data and that by using a really dive-in the data. That is why we can see images simiar to the dataset in shape and color of the objects whithin

Disavantages The GAN is hard to reproduce desired images. We dont get the digits we wanted to see. because the GAN is unsupervised we don't actually know exactly what it does improveunlike VAE.

4.3 DDPM Models

Advantages The main advantage is the performance, the DDPM in the HW performs better than GAN and VAE. The generated images look realistic.

Disavantages The biggest disavantage is the time of training that is quite long because of loop of sampling at each step, and this for the different probability distribution