HW4 – Machine Learning 2 – 097209

Generative Models

Submission due 4/2/2025

Question 1 - Generative models

In the following exercise, you will deal with a generative learning problem, precisely, VAE and GAN. You should write your training code and meet the following constraints.

In this exercise, you will create a generative model:

- choose VAE or GAN
- implement and train your model: The decoder/generator should get as input a vector z from the latent space and produce an image. For convolutions that upscale the input's spatial size (for the decoder/generator), use nn.ConvTranspose2d .
- Output visualization: Generate images from your model and visualize its latent spaces. You can compare different architectures for this purpose (e.g., low/high dimension of the latent spaces, etc.).
- Dataset: You will use the tiny-imagenet200 dataset (as you used in HW3 Q4). Images can be resized for efficiency but not smaller than 64x64.

You should provide:

- Code (python file) able to reproduce your results.
- The trained network with trained weights (.pkl file). If the model size is less than 500MB, you should submit it on Moodle. Otherwise, upload it to your Google-Drive.
- A function called "reproduce_hw3()". This function should be able to reproduce the results that you reported.

Discussion:

Discuss your results. You should provide the following:

- Model architecture description and illustration, training procedure (hyperparameters, optimization details, etc.).
- Training convergence plots as a function of training time:
    - GAN: discriminator and generator losses
    - VAE: reconstruction loss, and KL divergence.
- Summary of your attempts and conclusions. Your conclusions and explanations should be based on the actual results you received during your attempts. Include 1-2 pages of visualizations (the images your model produces).

Submission

- Submission in pairs unless otherwise authorized.
- The discussion should be typed. Hand-written submissions won't be accepted.

Moodle submission

You should submit a ZIP (not RAR!) file containing:

- Code - as many files as you need (one of them should be "main.py," which will include the running process).
- One pdf file (discussion of Q1).
- The .pkl file (If the file is too big for the Moodle, upload it to your Google-Drive and copy the link to your pdf report).
- Run 'pip freeze > requirements.txt' and attach it to your submission.