

Homework 8

INSTRUCTIONS

- The homework is due at 9:00am on June 5, 2025. Anything that is received after that time will be considered to be late and we do not receive late homeworks. We do however ignore your lowest homework grade.
- Homeworks need to be submitted electronically on ETL. Only PDF generated from LaTeX is accepted.
- Make sure you prepare the answers to each question separately. This helps us dispatch the problems to different graders.
- Collaboration on solving the homework is allowed. Discussions are encouraged but you should think about the problems on your own.
- If you do collaborate with someone or use a book or website, you are expected to write up your solution independently. That is, close the book and all of your notes before starting to write up your solution.

1 Setup [0 points]

In this homework, we will build a DDPM model using `pytorch`. Specifically, we will implement DDPM training and image sampling.

Run `pip install -r requirements.txt` to setup your environment for this homework.

Do not modify any code outside TODO blocks.

You should submit PDF generated from L^AT_EX, **trained checkpoint**, completed `todo.py`, and `inception.py`. Compress them into a single zip file and submit it to eTL. Name your PDF file as `hw8.pdf`.

2 DDPM Hyperparameters [10 Points]

Compute DDPM hyperparameters $\{\beta_t\}_{t=1}^T, \{\alpha_t\}_{t=1}^T, \{\bar{\alpha}_t\}_{t=1}^T, \{\sigma_t\}_{t=1}^T$ in `todo.py`. Use given initial value $T = 1000, \beta_1 = 10^{-4}$, and $\beta_T = 0.02$. Refer to the [DDPM paper](#). Attach your code at `hw8.pdf`.

3 DDPM Forward Step [30 Points]

Complete `ddpm_loss` function at `todo.py`. Attach your code at `hw8.pdf`.

4 DDPM Backward Step [30 Points]

Complete `sample_image` function at `todo.py`. Attach your code at `hw8.pdf`.

5 DDPM Training and Sampling [30 Points]

Run `python train.py` to train your DDPM model. it takes about 2 hours at TITAN Xp GPU. Then, implement inception score computation at `inception.py` and run `python inception.py`.

Your inception score should be larger then 9.3.

Attach your source code for inception score, screenshot of the result of `inception.py` and generated images.