



Assignment 3: GANs

March 2025

The purpose of this assignment is to give you hands-on experience designing and training GANs.

Due Data: The assignment is due March 17th, 2025 by 11:59 pm (electronic submission through UMLearn).

Assignments should be performed individually, but feel free to interact with your classmates. Plagiarism will not be tolerated. All codes should be well commented and any reference material used should be cited appropriately. If you use ChatGPT (or similar) you must include your prompts and responses as an appendix, along with an explanation of how you used the responses to guide your work and/or report writing.

Important: Please include the following signed statement with your submission.

I, [insert name] attest that the work I am submitting is my own work and that it has not been copied/plagiarized from online or other sources. Any sourced material used for completing this work has been properly cited. [Signature]

Introduction

You have been supplied with four Jupyter notebooks related to GANs taken from <https://keras.io/examples/generative/>. These codes can be found in Lectures 8-10.

Problem 1

As discussed in class we decided that WGAN-GP should be a significant improvement to DCGAN. Your job is to try and show that this is indeed the case by applying both models to the same problem. The codes provided in Lectures 8 and 9 are applied to two different problems. Make appropriate changes so that the models are effectively the same with the exception of the loss function, and are applied to the same data. Then:

1. Train and evaluate both models for the same choice of hyperparameters. Comment on training performance and support your arguments with training curve plots.
2. (**Graduate students only**) For either DCGAN or WGAN-GP (or both if you are feeling adventurous) change a hyperparameter (your choice) and comment on the effect that it has on training. Is the training sensitive or not? Justify your answer.

Problem 2

Given the Conditional GAN notebook (Lecture 10 Program a) explain, at a high level, how the conditional GAN is implemented focusing on the loss function and how attributes are handled. What flavour of Conditional GAN is this?

Problem 3

CycleGAN has a complicated loss function. For the code provided (Lecture 10 Program b) provide the following:

1. Explain how the loss function is implemented, including what terms are evaluated, why they are included, and how they are weighted. Note that there is a discussion of the loss function in Lecture 10 that was not covered in detail in class.
2. Explain the training process, focusing on the relationship between generators and discriminators.

3. Augment the code to monitor each component of the loss function and plot the loss function through training. Which loss term(s) dominate? Are there general trends? If so can you justify why?
4. (**Graduate students only**) Modify the loss function by dropping a term (your choice). Before running the code, predict what effect it will have on performance (consider both sides of the cycle). Run the code, plot the loss functions throughout training, and comment on the trends and final results.

Additional Discussion Questions

1. In class we discussed InfoGAN and what it means to randomly generate inputs and attributes. For the sake of solidifying our understanding, write a short (300 word max) explanation of why InfoGAN should/could work to give meaningful information about sample features. You may want to refer to Prince or the original paper for insight.

Hand-in Report

Submit a report summarizing the relevant answers to Problems 1-3, and the Discussion Question. Include code snippets and explanations that facilitate our understanding of your solutions and allow us to interpret your results without resorting to running your code.

A Jupyter Notebook that is easy to navigate, is pre-run, and has ample markdown answering questions is sufficient.

When you submit your report, also submit your code in the event that we need to run it to validate your claims.