ECS795P Deep Learning and Computer Vision, 2021

Course Work 2: Unsupervised Learning by Generative Adversarial Nets

Introduction

Aim:
(1) obtain practical knowledge and hands-on understanding of the basic concepts in Generative Adversarial Nets(GAN);
(2) obtain practical experience on how to implement basic GAN using PyTorch.

Start: Download and install PyTorch from its official website:
For Linux: https://pytorch.org/get-started/locally/#linux-installation .;
For Mac: https://pytorch.org/get-started/locally/#mac-installation ;
For Windows: https://pytorch.org/get-started/locally/#windows-installation .

Tasks: three subtasks are involved:

1. Coding: to add your code blocks in the required sections; (30% of this CW)
2. Demonstrating: to answer one question and to conduct one exercise, which are randomly selected from below during the lab demo session in WK11; (20% of this CW)
3. Report: to complete the questions in report. (50% of this CW)

Platform: python + PyTorch

Basic material:
Some of online materials for PyTorch-code may help you better complete this coursework (if you not familiar with PyTorch, you can follow this step by step)
https://pytorch.org/tutorials/
https://github.com/yunjey/pytorch-tutorial
https://github.com/MorvanZhou/PyTorch-Tutorial/blob/master/tutorial-contents-notebooks/404_autoencoder.ipynb

1. Understanding GAN models basic concepts

Objective: To become familiar with basic of GAN model and its basic usages.
The questions to think over:
Reference: https://towardsdatascience.com/understanding-generative-adversarial-networks-4dafc963f2ef
Reference:

1. What are two basic part in generative model ?
2. What is the specific objective of these two part?
3. What is the basic loss function of GAN.

4. What is training process of basic GAN model?

The exercises to conduct:

1. Check details of *GAN_pytorch.py,* understand the whole framework.
   For example:
   1) Dataset: What is dataset being used? How can you load this dataset?
   2) Model: Can you plot/draw the basic architecture in this case?
   3) Loss: What is loss function in this example?
   4) Training: How is this network being trained?
   5) Test: How do you test this model?
2. Change the learning rate to 0.01 and train for a few epochs to understand how learning rate will influence the model outcome.
3. Change the batch size to 256, and discuss how the batch size influence the model performance regarding its training speed and test accuracy.
4. Change the training epoch to 200, run it.

2. Generative Adversarial Networks with PyTorch

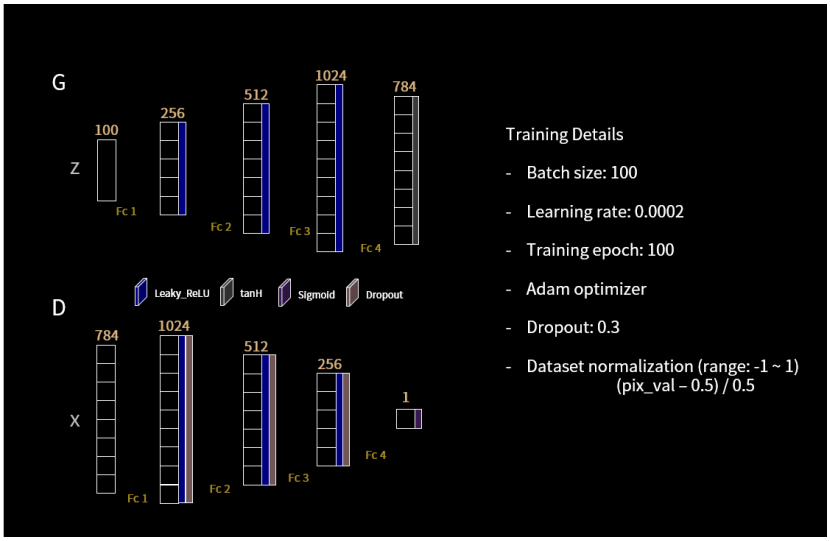
Objective: To become familiar with GAN and re-implement the original GAN model.

The questions to think over:

1. What is dropout in deep learning and its advantages.
2. List some typical optimizers in deep learning.
3. What optimizer we used for training in this case.
4. How do D-loss and G-loss change during training? Visualize how the D-loss and D-loss change during training and explain why.

The exercises to conduct:

1. **[coding]** Change the architecture of discriminator and generator as follow:



2. Remove dropout function for this architecture, and observe its training convergence.

3. **[coding]** Show the generated images at 10 epochs, 20 epochs,50 epochs,100 epochs.