ECS795P Deep Learning and Computer Vision, 2020

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 tensorflow.

Start: Download and install tensorflow from its official website: https://www.tensorflow.org/install/.

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 + tensorflow

Basic material:

Some of online materials for tensorflow-code may help you better complete this coursework (if you not familiar with tensorflow, you can follow this step by step)

https://www.tensorflow.org/versions/r1.1/get_started/mnist/beginners https://github.com/floydhub/tensorflow-notebooks-examples/blob/master/3_NeuralNetworks/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:

 $Reference: \underline{https://towardsdatascience.com/understanding-generative-adversarial-networks-4 \\ dafc 963 \\ f2ef$

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_tensorflow.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 TensorFlow

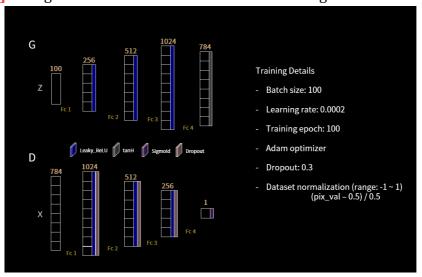
Objective: To become familiar with GAN and re-implement the original GAN model.

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.