San José State University
Computer Science Department
CS156, Introduction to Artificial Intelligence, Spring 2021

Homework #11

Objective:

This homework's objective is to implement a GAN model to generate fashion images.

Details:

For this assignment you will be working with *fashion_mnist* dataset again (just like in homework 10). This dataset provides 2-D black and white images of fashion items (clothing, shoes, etc.). You can load images in this dataset with the following python code:

(x_train, y_train), (x_test, y_test) = keras.datasets.fashion_mnist.load_data()

For this assignment you will create a GAN model to learn the latent space for representing fashion images in order to generate new images. For this task you do not need to split your data into training and test sets. Therefore, after loading the data combine the training and test sets into a single dataset of 7,000 images (for example, you can use *numpy.concatenate()* function):

```
(70000, 28, 28, 1)
```

For this assignment you can utilize a lot of code snippets from the *GAN.MNIST.ipynb* Jupyter notebook demonstrated in class.

Define the discriminator model with the architecture shown below (note that this is a modification to the discriminator model defined in *GAN.MNIST.ipynb* notebook).

```
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_21 (Conv2D)           (None, 14, 14, 64)        640

leaky_re_lu_32 (LeakyReLU)   (None, 14, 14, 64)        0

dropout_16 (Dropout)         (None, 14, 14, 64)        0

conv2d_22 (Conv2D)           (None, 7, 7, 64)          36928

leaky_re_lu_33 (LeakyReLU)   (None, 7, 7, 64)          0

dropout_17 (Dropout)         (None, 7, 7, 64)          0

conv2d_23 (Conv2D)           (None, 7, 7, 64)          102464

leaky_re_lu_34 (LeakyReLU)   (None, 7, 7, 64)          0

dropout_18 (Dropout)         (None, 7, 7, 64)          0

flatten_6 (Flatten)          (None, 3136)              0

dense_11 (Dense)             (None, 1)                 3137
=================================================================
```

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Your discriminator model should have:
1. Convolution layer with 3x3 filter, stride = (2, 2), same padding; leakyReLU activation and dropout of 0.4
2. Convolution layer with 3x3 filter, stride = (2, 2), same padding; leakyReLU activation and dropout of 0.4
3. Convolution layer with 5x5 filter, stride = (1, 1), same padding; leakyReLU activation and dropout of 0.4

Define the generator model with the architecture shown below (note that this is a modification to the discriminator model defined in *GAN.MNIST.ipynb* notebook).

Layer (type)	Output Shape	Param #
dense_19 (Dense)	(None, 6272)	633472
leaky_re_lu_56 (LeakyReLU)	(None, 6272)	0
reshape_9 (Reshape)	(None, 7, 7, 128)	0
conv2d_transpose_20 (Conv2DT	(None, 14, 14, 128)	262272
leaky_re_lu_57 (LeakyReLU)	(None, 14, 14, 128)	0
conv2d_transpose_21 (Conv2DT	(None, 14, 14, 128)	16512
leaky_re_lu_58 (LeakyReLU)	(None, 14, 14, 128)	0
conv2d_transpose_22 (Conv2DT	(None, 28, 28, 128)	262272
leaky_re_lu_59 (LeakyReLU)	(None, 28, 28, 128)	0
conv2d_36 (Conv2D)	(None, 28, 28, 1)	6273

Add the following additional Conv2DTranspose layer between the two Conv2DTranspose layers in the model shown in the *GAN.MNIST.ipynb* notebook:
model.add(Conv2DTranspose(128, (1,1), strides=(1,1), padding='same'))
model.add(LeakyReLU(alpha=0.2))

Your final GAN model should look like this:

Layer (type)	Output Shape	Param #
sequential_29 (Sequential)	(None, 28, 28, 1)	1180801
sequential_28 (Sequential)	(None, 1)	143169

You can utilize any code examples shown in the following Jupyter notebooks:
• GAN.MNIST.ipynb
• GAN.cats.ipynb

Submission:

Email your assignment submission to me at Yulia.Newton@sjsu.edu and the grader (Akshay Kajale) at akshay.kajale@sjsu.edu. Make sure to email this submission by 11:59pm on the due

date listed in Canvas. Your sent email is the proof of submission. The subject of the email should say "CS156 Assignment 11". In the body of the email list your name as it appears on the class roster and your student ID. Attach to this email both the pdf of your Jupyter notebook, which contains the solution for this homework assignment, as well as the notebook itself (the notebook file with .ipynb extension). Make sure to submit both files, otherwise the submission will not be considered complete.

Grading:

I will return the grades as fast as we can grade this homework. Normally it should not take more than a few weeks.

A total of 10 points are possible for this homework assignment.