Neural Network and Deep Learning-Assignment4

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Github link: https://github.com/SwethaNam/nnassign4.git

Video link: https://drive.google.com/drive/folders/17axn67p3vd-HmrO0awgHRz2YnZmRjUNX?usp=sharing

Question 1:Adding one more layer to the autoencoder:

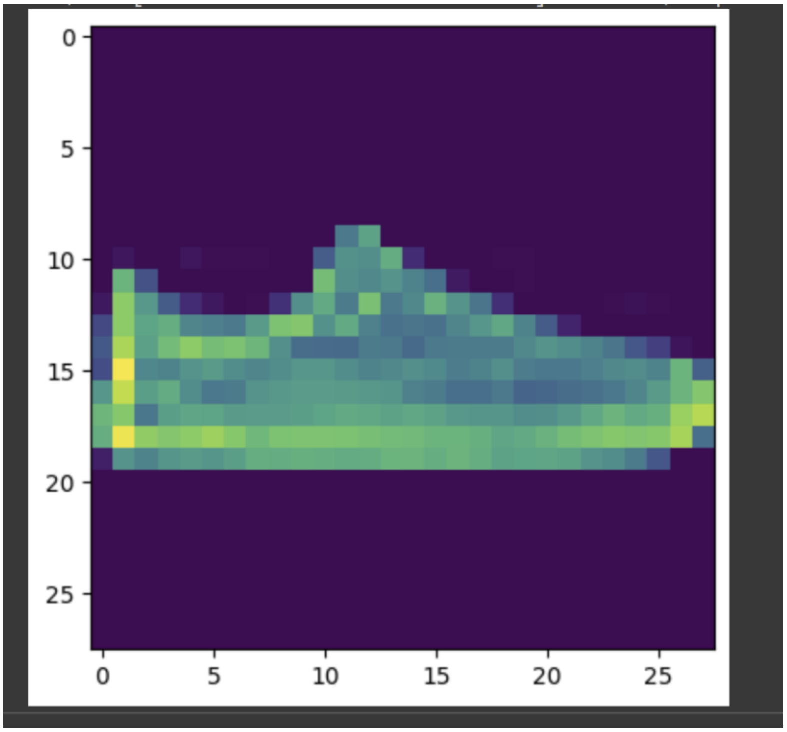
```
[1] from keras.layers import Input, Dense
    from keras.models import Model
    import matplotlib.pyplot as plt
```

```
#question 1
# this is the size of our encoded representations
encoding_dim = 32  # 32 floats -> compression of factor 24.5, assuming the input is 784 floats

# this is our input placeholder
input_img = Input(shape=(784,))
# "encoded" is the encoded representation of the input
encoded = Dense(encoding_dim, activation='relu')(input_img)
# Adding new layer to the encoder
encoded_new = Dense(4, activation='relu')(encoded)
# Adding new layer to the decoder
decoded_new = Dense(encoding_dim, activation='sigmoid')(encoded_new)
# "decoded" is the lossy reconstruction of the input
decoded = Dense(784, activation='sigmoid')(encoded)
# this model maps an input to its reconstruction
autoencoder = Model(input_img, decoded)
# this model maps an input to its encoded representation
autoencoder.compile(optimizer='adadelta', loss='binary_crossentropy' ,metrics=['accuracy'])
```

Question 2:prediction on test data and visualizing the reconstructed version on test data and the test data before reconstruction using Matploitlib.

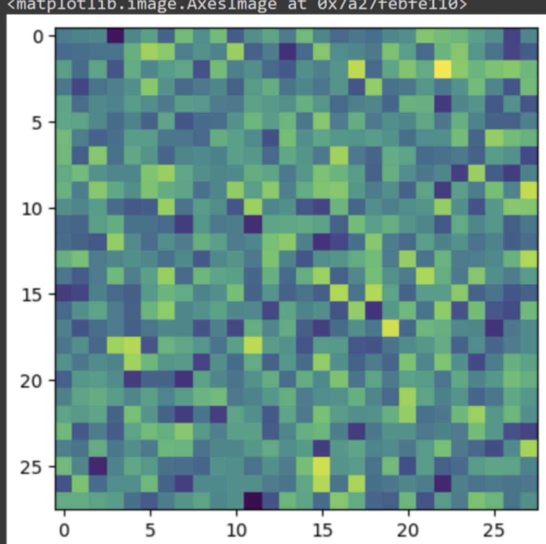
```
[7] #question2
    from keras.datasets import mnist, fashion_mnist
    import numpy as np
    (x_train, y_train), (x_test, y_test) = fashion_mnist.load_data()
    x_train = x_train.astype('float32') / 255.
    x_test = x_test.astype('float32') / 255.
    #Visualize the data before reconstructed.
    plt.imshow(x_test[12].reshape(28,28))
    x_train = x_train.reshape((len(x_train), np.prod(x_train.shape[1:])))
    x_test = x_test.reshape((len(x_test), np.prod(x_test.shape[1:])))

    history=autoencoder.fit(x_train, x_train,
                    epochs=5,
                    batch_size=256,
                    shuffle=True,
                    validation_data=(x_test, x_test))
```

```
Epoch 1/5
235/235 [==============================] - 1s 5ms/step - loss: 0.6941 - accuracy: 0.0024 - val_loss: 0.6941 - val_accuracy: 0.0021
Epoch 2/5
235/235 [==============================] - 1s 5ms/step - loss: 0.6940 - accuracy: 0.0024 - val_loss: 0.6939 - val_accuracy: 0.0022
Epoch 3/5
235/235 [==============================] - 1s 5ms/step - loss: 0.6939 - accuracy: 0.0025 - val_loss: 0.6938 - val_accuracy: 0.0023
Epoch 4/5
235/235 [==============================] - 1s 4ms/step - loss: 0.6937 - accuracy: 0.0025 - val_loss: 0.6937 - val_accuracy: 0.0024
Epoch 5/5
235/235 [==============================] - 1s 5ms/step - loss: 0.6936 - accuracy: 0.0026 - val_loss: 0.6935 - val_accuracy: 0.0025
```




```
[9] #After reconstructed version of that test data.
    X_test = autoencoder.predict(x_test)
    plt.imshow(X_test[12].reshape(28,28))
```

```
313/313 [==============================] - 0s 1ms/step
<matplotlib.image.AxesImage at 0x7a27febfe110>
```

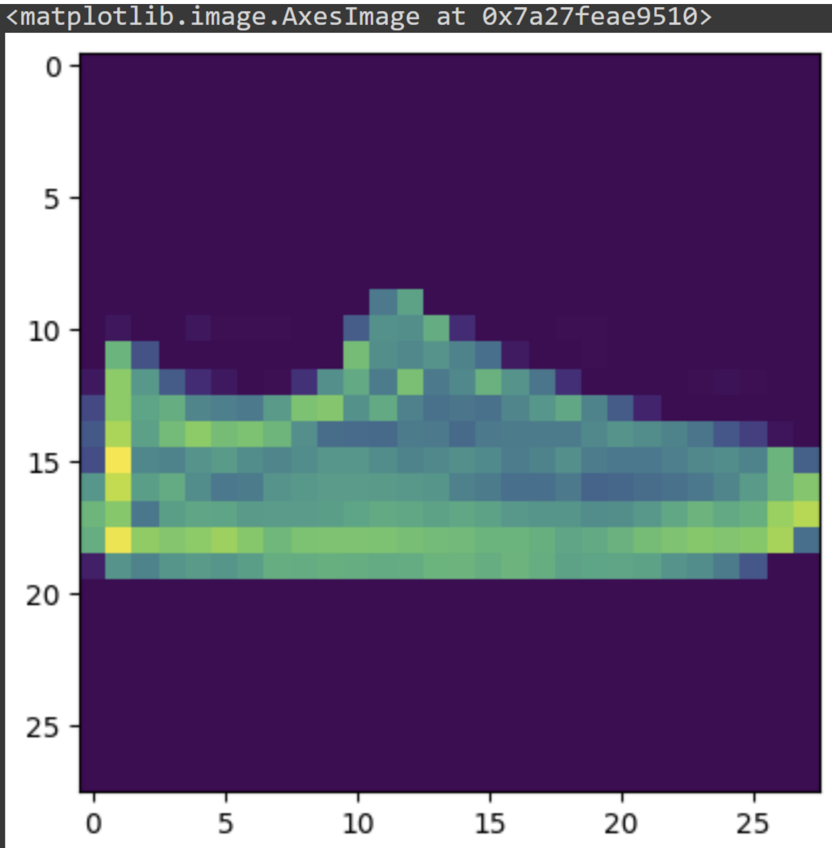


Question 3:Repeating the question 2 on the denoisening autoencoder.

```
[11] #question 3
from keras.layers import Input, Dense
from keras.models import Model

# this is the size of our encoded representations
encoding_dim = 32  # 32 floats -> compression of factor 24.5, assuming the input is 784 floats

# this is our input placeholder
input_img = Input(shape=(784,))
# "encoded" is the encoded representation of the input
encoded = Dense(encoding_dim, activation='relu')(input_img)
# "decoded" is the lossy reconstruction of the input
decoded = Dense(784, activation='sigmoid')(encoded)
# this model maps an input to its reconstruction
autoencoder = Model(input_img, decoded)
# this model maps an input to its encoded representation
autoencoder.compile(optimizer='adadelta', loss='binary_crossentropy')
```

```
[12] from keras.datasets import fashion_mnist
import numpy as np
(x_train, _), (x_test, _) = fashion_mnist.load_data()
x_train = x_train.astype('float32') / 255.
x_test = x_test.astype('float32') / 255.
x_train = x_train.reshape((len(x_train), np.prod(x_train.shape[1:])))
x_test = x_test.reshape((len(x_test), np.prod(x_test.shape[1:])))
plt.imshow(x_test[12].reshape(28,28))
```

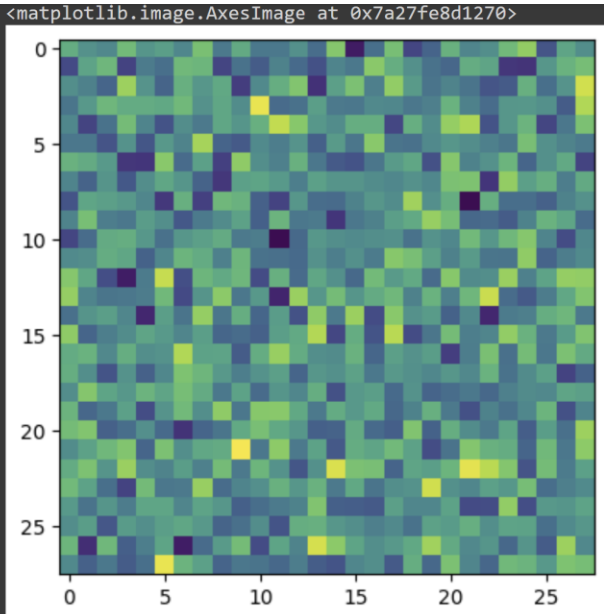
```
<matplotlib.image.AxesImage at 0x7a27feae9510>
```



```
[13] #introducing noise
     noise_factor = 0.5
     x_train_noisy = x_train + noise_factor * np.random.normal(loc=0.0, scale=1.0, size=x_train.shape)
     x_test_noisy = x_test + noise_factor * np.random.normal(loc=0.0, scale=1.0, size=x_test.shape)

     autoencoder.fit(x_train_noisy, x_train,
                     epochs=10,
                     batch_size=256,
                     shuffle=True,
                     validation_data=(x_test_noisy, x_test_noisy))

     X_test = autoencoder.predict(x_test)
     plt.imshow(X_test[12].reshape(28,28))
```

```
Epoch 1/10
235/235 [==============================] - 2s 5ms/step - loss: 0.6958 - val_loss: 0.6957
Epoch 2/10
235/235 [==============================] - 1s 4ms/step - loss: 0.6956 - val_loss: 0.6955
Epoch 3/10
235/235 [==============================] - 1s 4ms/step - loss: 0.6955 - val_loss: 0.6954
Epoch 4/10
235/235 [==============================] - 1s 4ms/step - loss: 0.6953 - val_loss: 0.6952
Epoch 5/10
```

```
<matplotlib.image.AxesImage at 0x7a27fe8d1270>
```



Question 4:Plot loss and accuracy using the history object.

```
[14] #question 4
     # summarize history for accuracy
     plt.plot(history.history['accuracy'])
     plt.plot(history.history['val_accuracy'])
     plt.title('Model accuracy')
     plt.legend(['Train', 'Test'], loc='upper left')
     plt.show()

     # summarize history for loss
     plt.plot(history.history['loss'])
     plt.plot(history.history['val_loss'])
     plt.title('Model loss')
     plt.legend(['Train', 'Test'], loc='upper left')
     plt.show()
```