Task 1:

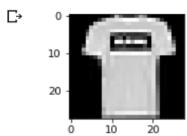
```
[10] from keras.layers import Input, Dense
     from keras.models import Model
     # this is the size of our encoded representations
     encoding_dim = 32 # 32 floats -> compression of factor 24.5, assuming the input is 784 floats
     # this is our input placeholder
     input_img = Input(shape=(784,))
[19] encoded = Dense(128, activation='relu')(input_img)
     encoded = Dense(64, activation='relu')(encoded)
     # "encoded" is the encoded representation of the input
     encoded = Dense(encoding_dim, activation='relu')(encoded)
     # "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)
[20] # this model maps an input to its encoded representation
     autoencoder.compile(optimizer='adadelta', loss='binary_crossentropy')
[21] 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.
     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:])))
```

```
autoencoder.fit(x_train, x_train,
                   epochs=5,
                   batch_size=256,
                   shuffle=True,
                   validation_data=(x_test, x_test))
Train on 60000 samples, validate on 10000 samples
    Epoch 1/5
    60000/60000 [============] - 3s 48us/step - loss: 0.5275 - val_loss: 0.4324
    Epoch 2/5
    60000/60000 [============] - 3s 49us/step - loss: 0.3911 - val_loss: 0.3793
    Epoch 3/5
    60000/60000 [============] - 3s 47us/step - loss: 0.3701 - val_loss: 0.3640
    Epoch 4/5
    60000/60000 [============] - 3s 48us/step - loss: 0.3577 - val_loss: 0.3518
    Epoch 5/5
    60000/60000 [============] - 3s 46us/step - loss: 0.3446 - val_loss: 0.3408
    <keras.callbacks.callbacks.History at 0x7efd5618cd68>
[28] prediction = autoencoder.predict(x_test)
[45] from matplotlib import pyplot as plt
    plt.figure(figsize=(5, 2))
    plt.imshow(x train[1].reshape(28,28))
    plt.gray()
    plt.show()
```

Task 2:

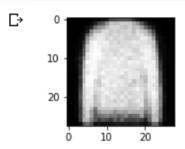
```
prediction = autoencoder.predict(x_test)

[45] from matplotlib import pyplot as plt
   plt.figure(figsize=(5, 2))
   plt.imshow(x_train[1].reshape(28,28))
   plt.gray()
   plt.show()
```



DEEP LEARNING ICP6

```
[46] from matplotlib import pyplot as plt
   plt.figure(figsize=(5, 2))
   plt.imshow(prediction[1].reshape(28,28))
   plt.gray()
   plt.show()
```



Task 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)

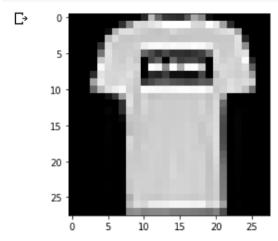
# this model maps an input to its reconstruction
    autoencoder = Model(input_img, decoded)
```

ightharpoonup Using TensorFlow backend.

```
[2] # this model maps an input to its encoded representation
   autoencoder.compile(optimizer='adadelta', loss='binary_crossentropy')
   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:])))
```

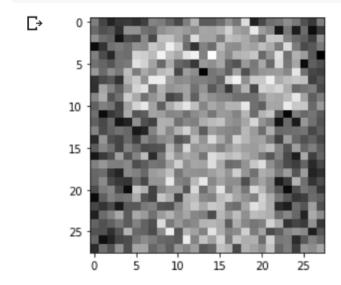
```
[2] Downloading data from <a href="http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-labels-idx1-ubyte.gz">http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-labels-idx1-ubyte.gz</a>
32768/29515 [======] - 0s 3us/step
   Downloading data from <a href="http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-images-idx3-ubyte.gz">http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/train-images-idx3-ubyte.gz</a>
   Downloading \ data \ from \ \underline{http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-labels-idx1-ubyte.gz}
   8192/5148 [=======] - 0s Ous/step
   Downloading data from http://fashion-mnist.s3-website.eu-central-1.amazonaws.com/t10k-images-idx3-ubyte.gz
   4423680/4422102 [============] - 1s Ous/step
[14] ENCODE_DIR = os.getcwd()
   tensorboard = TensorBoard(log_dir='ENCODE_DIR', histogram_freq=0,
                    write_graph=True, write_images=False)
[15] from tensorboardcolab import TensorBoardColabCallback
   tbc=TensorBoardColab()
   #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)
C→ Wait for 8 seconds...
   TensorBoard link:
   https://3bae3650.ngrok.io
 [17] history=autoencoder.fit(x_train_noisy, x_train,
                 epochs=10,
                 batch size=256,
                 shuffle=True,
                 validation_data=(x_test_noisy, x_test_noisy))
  Train on 60000 samples, validate on 10000 samples
     Epoch 1/10
     Fnoch 2/10
     60000/60000 [
                   Epoch 3/10
     60000/60000 [==============] - 3s 42us/step - loss: 0.3261 - val_loss: 0.3105
     Epoch 4/10
     60000/60000 [=
                Epoch 5/10
     60000/60000 [
                   Epoch 6/10
     60000/60000 [==============] - 3s 44us/step - loss: 0.3206 - val_loss: 0.3038
     Epoch 7/10
     Epoch 8/10
     60000/60000 [=
                Epoch 9/10
     Epoch 10/10
     prediction = autoencoder.predict(x_test_noisy)
```

```
[19] from matplotlib import pyplot as plt
   plt.imshow(x_train[1].reshape(28,28))
   plt.gray()
   plt.show()
```



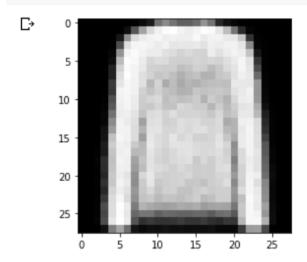
```
[20] from matplotlib import pyplot as plt
  plt.imshow(x_train_noisy[1].reshape(28,28))
  plt.show()
```

```
[20] from matplotlib import pyplot as plt
   plt.imshow(x_train_noisy[1].reshape(28,28))
   plt.show()
```



```
[21] from matplotlib import pyplot as plt
   plt.imshow(prediction[1].reshape(28,28))
   plt.show()
```

```
[21] from matplotlib import pyplot as plt
   plt.imshow(prediction[1].reshape(28,28))
   plt.show()
```



Task 4:

```
[22] plt.plot(history.history['loss'], 'r', linewidth=3.0)
    plt.plot(history.history['val_loss'], 'b', linewidth=3.0)
    plt.legend(['Training loss', 'Validation Loss'], fontsize=18)
    plt.xlabel('Epochs ', fontsize=16)
    plt.ylabel('Loss', fontsize=16)
    plt.title('Loss Curves : ', fontsize=16)
```

Text(0.5, 1.0, 'Loss Curves : ')

