59-dl-exp05

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[1]:
```
import keras
from keras import layers
from keras.datasets import mnist
import numpy as np
```

[2]:
```
(x_train, _), (x_test, _) = mnist.load_data()
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-
datasets/mnist.npz
11490434/11490434 [==============================] - 0s 0us/step
```

[3]:
```
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:])))
print(x_train.shape)
print(x_test.shape)
```

```
(60000, 784)
(10000, 784)
```

[4]:
```
encoding_dim = 32
input_img = keras.Input(shape=(784,))
encoded = layers.Dense(encoding_dim, activation='relu')(input_img)
decoded = layers.Dense(784, activation = 'sigmoid')(encoded)
autoencoder = keras.Model(input_img, decoded)
```

[5]:
```
encoder = keras.Model(input_img, encoded)
```

[6]:
```
encoded_input = keras.Input(shape=(encoding_dim,))
```

[7]:
```
decoder_layer = autoencoder.layers[-1]
```

[8]:
```
decoder = keras.Model(encoded_input, decoder_layer(encoded_input))
```

[9]:
```
autoencoder.compile(optimizer='adam', loss='binary_crossentropy')
```

[10]:
```
autoencoder.fit(x_train, x_train,epochs = 20, batch_size = 64, shuffle = True,␣
↪validation_data = (x_test, x_test))
```

```
Epoch 1/20
938/938 [==============================] - 7s 6ms/step - loss: 0.1929 -
val_loss: 0.1333
Epoch 2/20
938/938 [==============================] - 7s 7ms/step - loss: 0.1193 -
val_loss: 0.1086
Epoch 3/20
938/938 [==============================] - 6s 6ms/step - loss: 0.1030 -
val_loss: 0.0975
Epoch 4/20
938/938 [==============================] - 7s 8ms/step - loss: 0.0969 -
val_loss: 0.0944
Epoch 5/20
938/938 [==============================] - 6s 6ms/step - loss: 0.0950 -
val_loss: 0.0934
Epoch 6/20
938/938 [==============================] - 8s 9ms/step - loss: 0.0944 -
val_loss: 0.0928
Epoch 7/20
938/938 [==============================] - 5s 6ms/step - loss: 0.0940 -
val_loss: 0.0926
Epoch 8/20
938/938 [==============================] - 7s 7ms/step - loss: 0.0938 -
val_loss: 0.0924
Epoch 9/20
938/938 [==============================] - 6s 6ms/step - loss: 0.0937 -
val_loss: 0.0924
Epoch 10/20
938/938 [==============================] - 7s 7ms/step - loss: 0.0935 -
val_loss: 0.0922
Epoch 11/20
938/938 [==============================] - 5s 6ms/step - loss: 0.0934 -
val_loss: 0.0922
Epoch 12/20
938/938 [==============================] - 7s 7ms/step - loss: 0.0934 -
val_loss: 0.0920
Epoch 13/20
938/938 [==============================] - 5s 6ms/step - loss: 0.0933 -
val_loss: 0.0922
Epoch 14/20
938/938 [==============================] - 6s 7ms/step - loss: 0.0933 -
val_loss: 0.0920
Epoch 15/20
938/938 [==============================] - 7s 8ms/step - loss: 0.0932 -
```

```
val_loss: 0.0921
Epoch 16/20
938/938 [==============================] - 6s 7ms/step - loss: 0.0932 -
val_loss: 0.0920
Epoch 17/20
938/938 [==============================] - 5s 5ms/step - loss: 0.0931 -
val_loss: 0.0919
Epoch 18/20
938/938 [==============================] - 5s 5ms/step - loss: 0.0931 -
val_loss: 0.0919
Epoch 19/20
938/938 [==============================] - 6s 7ms/step - loss: 0.0931 -
val_loss: 0.0920
Epoch 20/20
938/938 [==============================] - 8s 9ms/step - loss: 0.0931 -
val_loss: 0.0919
```

[10]:
```
<keras.callbacks.History at 0x7f87694b1a20>
```

[11]:
```
encoded_imgs = encoder.predict(x_test)
decoded_imgs = decoder.predict(encoded_imgs)
```

```
313/313 [==============================] - 0s 1ms/step
313/313 [==============================] - 1s 2ms/step
```

[12]:
```
# Use Matplotlib (don't ask)
import matplotlib.pyplot as plt
```

[15]:
```
n = 10 # How many digits we will display
plt.figure(figsize=(20, 4))
for i in range(n):
  # Display original
  ax = plt.subplot(2, n, i + 1)
  plt.imshow(x_test[i].reshape(28, 28))
  plt.gray()
  ax.get_xaxis().set_visible(False)
  ax.get_yaxis().set_visible(False)

  # Display reconstruction
  ax = plt.subplot(2, n, i + 1 + n)
  plt.imshow(decoded_imgs[i].reshape(28, 28))
  plt.gray()
  ax.get_xaxis().set_visible(False)
  ax.get_yaxis().set_visible(False)
plt.show()
```