dl-lab-assignment-5

December 15, 2023

Q1. Implement Auto Encoder.

[9]:
```
#importing the libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from keras.utils import to_categorical
from keras.models import Model
from keras.layers import Dense,Input
from sklearn.model_selection import train_test_split
```

[10]:
```
mnist = tf.keras.datasets.mnist
(x_train, _), (x_test, _) = mnist.load_data()
```

[11]:
```
x_train = x_train.astype('float32') / 255.0
x_test = x_test.astype('float32') / 255.0
```

[12]:
```
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:])))
```

[13]:
```
input_size = 784
encoding_dim = 32
```

[14]:
```
input_img = tf.keras.layers.Input(shape=(input_size,))
encoded = tf.keras.layers.Dense(encoding_dim, activation='relu')(input_img)
decoded = tf.keras.layers.Dense(input_size, activation='sigmoid')(encoded)
```

[15]:
```
autoencoder = tf.keras.models.Model(input_img, decoded)
```

[16]:
```
autoencoder.compile(optimizer='adam', loss='binary_crossentropy')
```

[17]:
```
autoencoder.fit(x_train, x_train, epochs=50, batch_size=256, shuffle=True,␣
↪validation_data=(x_test, x_test))
```

```
Epoch 1/50
235/235 [==============================] - 3s 11ms/step - loss: 0.2725 -
val_loss: 0.1860
```

```
Epoch 2/50
235/235 [==============================] - 2s 10ms/step - loss: 0.1687 -
val_loss: 0.1523
Epoch 3/50
235/235 [==============================] - 4s 17ms/step - loss: 0.1433 -
val_loss: 0.1324
Epoch 4/50
235/235 [==============================] - 4s 18ms/step - loss: 0.1276 -
val_loss: 0.1204
Epoch 5/50
235/235 [==============================] - 3s 14ms/step - loss: 0.1178 -
val_loss: 0.1128
Epoch 6/50
235/235 [==============================] - 2s 10ms/step - loss: 0.1112 -
val_loss: 0.1072
Epoch 7/50
235/235 [==============================] - 2s 10ms/step - loss: 0.1063 -
val_loss: 0.1028
Epoch 8/50
235/235 [==============================] - 2s 10ms/step - loss: 0.1024 -
val_loss: 0.0996
Epoch 9/50
235/235 [==============================] - 3s 12ms/step - loss: 0.0995 -
val_loss: 0.0972
Epoch 10/50
235/235 [==============================] - 3s 13ms/step - loss: 0.0975 -
val_loss: 0.0956
Epoch 11/50
235/235 [==============================] - 2s 9ms/step - loss: 0.0962 -
val_loss: 0.0945
Epoch 12/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0954 -
val_loss: 0.0937
Epoch 13/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0948 -
val_loss: 0.0933
Epoch 14/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0944 -
val_loss: 0.0930
Epoch 15/50
235/235 [==============================] - 4s 15ms/step - loss: 0.0941 -
val_loss: 0.0927
Epoch 16/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0939 -
val_loss: 0.0925
Epoch 17/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0937 -
val_loss: 0.0924
```

```
Epoch 18/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0936 -
val_loss: 0.0923
Epoch 19/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0935 -
val_loss: 0.0922
Epoch 20/50
235/235 [==============================] - 3s 13ms/step - loss: 0.0934 -
val_loss: 0.0921
Epoch 21/50
235/235 [==============================] - 3s 12ms/step - loss: 0.0933 -
val_loss: 0.0921
Epoch 22/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0933 -
val_loss: 0.0920
Epoch 23/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0932 -
val_loss: 0.0920
Epoch 24/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0932 -
val_loss: 0.0919
Epoch 25/50
235/235 [==============================] - 3s 11ms/step - loss: 0.0931 -
val_loss: 0.0919
Epoch 26/50
235/235 [==============================] - 3s 15ms/step - loss: 0.0931 -
val_loss: 0.0919
Epoch 27/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0930 -
val_loss: 0.0918
Epoch 28/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0930 -
val_loss: 0.0917
Epoch 29/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0930 -
val_loss: 0.0917
Epoch 30/50
235/235 [==============================] - 3s 15ms/step - loss: 0.0929 -
val_loss: 0.0918
Epoch 31/50
235/235 [==============================] - 3s 14ms/step - loss: 0.0929 -
val_loss: 0.0917
Epoch 32/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0929 -
val_loss: 0.0917
Epoch 33/50
235/235 [==============================] - 2s 9ms/step - loss: 0.0929 -
val_loss: 0.0917
```

```
Epoch 34/50
235/235 [==============================] - 2s 9ms/step - loss: 0.0928 -
val_loss: 0.0917
Epoch 35/50
235/235 [==============================] - 2s 9ms/step - loss: 0.0928 -
val_loss: 0.0917
Epoch 36/50
235/235 [==============================] - 3s 14ms/step - loss: 0.0928 -
val_loss: 0.0918
Epoch 37/50
235/235 [==============================] - 3s 12ms/step - loss: 0.0928 -
val_loss: 0.0916
Epoch 38/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0928 -
val_loss: 0.0916
Epoch 39/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0928 -
val_loss: 0.0916
Epoch 40/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0927 -
val_loss: 0.0915
Epoch 41/50
235/235 [==============================] - 3s 12ms/step - loss: 0.0927 -
val_loss: 0.0916
Epoch 42/50
235/235 [==============================] - 3s 13ms/step - loss: 0.0927 -
val_loss: 0.0915
Epoch 43/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0927 -
val_loss: 0.0916
Epoch 44/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0927 -
val_loss: 0.0915
Epoch 45/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0927 -
val_loss: 0.0915
Epoch 46/50
235/235 [==============================] - 3s 11ms/step - loss: 0.0927 -
val_loss: 0.0916
Epoch 47/50
235/235 [==============================] - 3s 14ms/step - loss: 0.0927 -
val_loss: 0.0915
Epoch 48/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0927 -
val_loss: 0.0916
Epoch 49/50
235/235 [==============================] - 2s 11ms/step - loss: 0.0926 -
val_loss: 0.0915
```

```
Epoch 50/50
235/235 [==============================] - 2s 10ms/step - loss: 0.0926 -
val_loss: 0.0915
```

[17]:
```
<keras.src.callbacks.History at 0x7e71f16096f0>
```

[18]:
```
decoded_imgs = autoencoder.predict(x_test)
```

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

[19]:
```
n = 10
plt.figure(figsize=(20, 4))
for i in range(n):
    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)

    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()
```