```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import tensorflow as tf

from sklearn.metrics import accuracy_score, precision_score, recall_score
from sklearn.model_selection import train_test_split
from tensorflow.keras import layers, losses
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Model
```

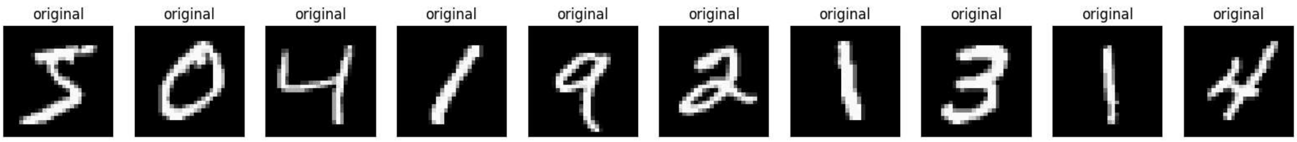
```
(x_train, _), (x_test, _) = mnist.load_data()
x_train, x_val = x_train[:-10000], x_train[-10000:]

x_train = x_train.astype('float32') / 255.
x_test = x_test.astype('float32') / 255.
x_val = x_val.astype('float32') / 255.

print(x_train.shape)
print(x_test.shape)
print(x_val.shape)
```

```
(50000, 28, 28)
(10000, 28, 28)
(10000, 28, 28)
```

```
#visualize
n=10
plt.figure(figsize=(20, 4))
for i in range(n):
    ax=plt.subplot(2, n, i+1)
    plt.imshow(x_train[i])
    plt.title("original")
    plt.gray()
    ax.get_xaxis().set_visible(False)
    ax.get_yaxis().set_visible(False)
```



```
latent_dim = 64

class Autoencoder(Model):
  def __init__(self, latent_dim):
    super(Autoencoder, self).__init__()
    self.latent_dim = latent_dim
    self.encoder = tf.keras.Sequential([
      layers.Flatten(),
      layers.Dense(latent_dim, activation='relu'),
    ])
    self.decoder = tf.keras.Sequential([
      layers.Dense(784, activation='sigmoid'),
      layers.Reshape((28, 28))
    ])

  def call(self, x):
    encoded = self.encoder(x)
    decoded = self.decoder(encoded)
    return decoded

autoencoder = Autoencoder(latent_dim)
```

```
#Define Autoencoder class

autoencoder.compile(optimizer='adam', loss=losses.MeanSquaredError())

#Train Autoencoder

autoencoder.fit(x_train, x_train,
                epochs=10,
                shuffle=True,
                validation_data=(x_val, x_val))
```

```
Epoch 1/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 6s 2ms/step - loss: 0.0477 - val_loss: 0.0112
Epoch 2/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 3s 2ms/step - loss: 0.0093 - val_loss: 0.0062
Epoch 3/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 3s 2ms/step - loss: 0.0058 - val_loss: 0.0050
Epoch 4/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 6s 4ms/step - loss: 0.0049 - val_loss: 0.0047
Epoch 5/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 4s 3ms/step - loss: 0.0045 - val_loss: 0.0044
Epoch 6/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 5s 3ms/step - loss: 0.0044 - val_loss: 0.0043
Epoch 7/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 8s 2ms/step - loss: 0.0043 - val_loss: 0.0042
Epoch 8/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 5s 2ms/step - loss: 0.0042 - val_loss: 0.0042
Epoch 9/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 5s 2ms/step - loss: 0.0041 - val_loss: 0.0042
Epoch 10/10
1563/1563 ━━━━━━━━━━━━━━━━━━━━ 5s 2ms/step - loss: 0.0041 - val_loss: 0.0041
<keras.src.callbacks.history.History at 0x7c8e8239ed70>
```

```
print(autoencoder.encoder.summary())
```

```
Model: "sequential_2"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━
┃ Layer (type)                        ┃ Output Shape                ┃       Param
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━
│ flatten_1 (Flatten)                 │ (None, 784)                 │
├─────────────────────────────────────┼─────────────────────────────┼────────────
│ dense_2 (Dense)                     │ (None, 64)                  │       50,24
└─────────────────────────────────────┴─────────────────────────────┴────────────
 Total params: 50,240 (196.25 KB)
 Trainable params: 50,240 (196.25 KB)
 Non-trainable params: 0 (0.00 B)
None
```

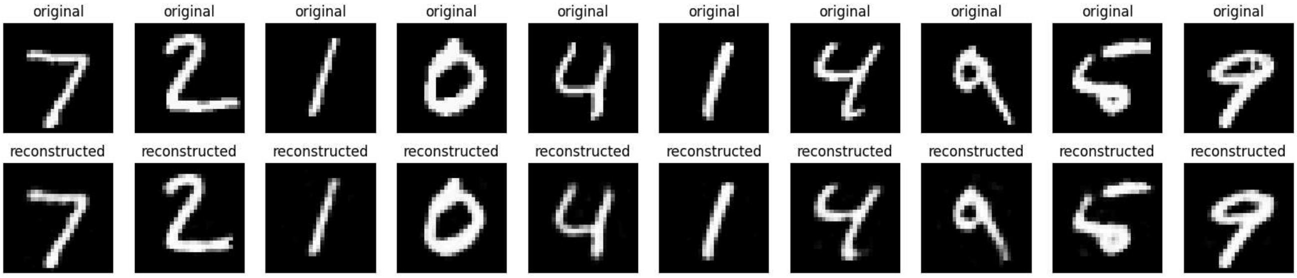
```
print(autoencoder.decoder.summary())
```

```
Model: "sequential_3"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━
┃ Layer (type)                        ┃ Output Shape                ┃       Param
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━
│ dense_3 (Dense)                     │ (None, 784)                 │       50,96
├─────────────────────────────────────┼─────────────────────────────┼────────────
│ reshape_1 (Reshape)                 │ (None, 28, 28)              │
└─────────────────────────────────────┴─────────────────────────────┴────────────
 Total params: 50,960 (199.06 KB)
 Trainable params: 50,960 (199.06 KB)
 Non-trainable params: 0 (0.00 B)
None
```

```
encoded_imgs = autoencoder.encoder(x_test).numpy()
decoded_imgs = autoencoder.decoder(encoded_imgs).numpy()
```

```
n = 10
plt.figure(figsize=(20, 4))
for i in range(n):
    # display original
    ax = plt.subplot(2, n, i +1)
    plt.imshow(x_test[i])
    plt.title("original")
    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])
    plt.title("reconstructed")
    plt.gray()
    ax.get_xaxis().set_visible(False)
    ax.get_yaxis().set_visible(False)
plt.show()
```



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