```
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras import layers, losses
from tensorflow.keras.datasets import mnist
from tensorflow.keras.models import Model
```

```
(x_train, _), (x_test, _) = tf.keras.datasets.mnist.load_data()
# declaring a variable with ( _ ) as we dont require labels from
#dataset ( _ )is a dummy variable

x_train = x_train.astype('float32') / 255.
# type casting the data and rescaling it will 255 to 0-1 values
x_test = x_test.astype('float32') / 255.

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

```
(60000, 28, 28)
(10000, 28, 28)
```

```
latent_dim = 64                                                              # input dimension for the model

class Autoencoder(Model):                                                    # creating a class for Autoencoder
  def __init__(self, latent_dim):                                            # initilizing the class with required objects of the model
    super(Autoencoder, self).__init__()                                      # creating a super class object to directly initilize the object
    self.latent_dim = latent_dim                                             # creating aclass attribute for future reference and local utili
                                                                             # here the model is split into 2 pares of encoder and decoder for
    self.encoder = tf.keras.Sequential([
                                    layers.Flatten(),
                                    layers.Dense(latent_dim, activation='relu')
    ])
# creating an attribute to store encoder part of the model using the
# sequential api from keras
# flatern the input and then pass it to a dense node and output
# the data to decoder
    self.decoder = tf.keras.Sequential([
                                    layers.Dense(784, activation='sigmoid'),
                                    layers.Reshape((28,28))
    ])                                                                       # creating an attribute to store decoder part of the model using
                                                                             # connect the input from encoder to the same no one nodes when fl

  def call(self, x):                                                         # defining the class function of the class
    encoded = self.encoder(x)                                                # calling the encoder part and sending the input into it  ::: i/p
    decoded = self.decoder(encoded)                                          # calling the decoder part and sending the encoder output as inpu
    return decoded                                                           # return only the decoder output as it contains the reconstructed

autoencoder = Autoencoder(latent_dim)                                        # initilizing the class object
```

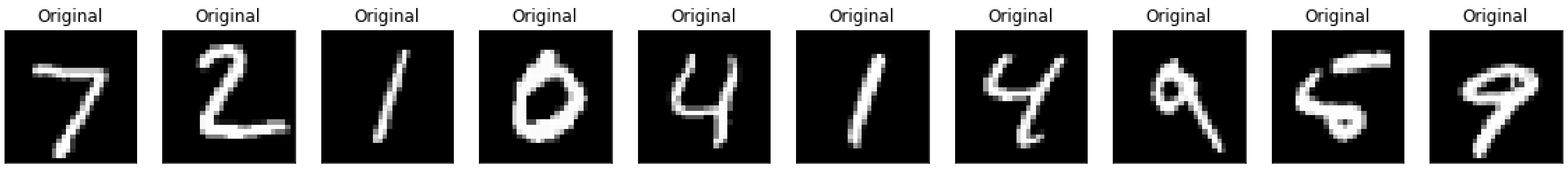
```
autoencoder.compile(optimizer='adam', loss=losses.MeanSquaredError())
# compiling the model with required loss function and optimizer
```

```
# here we train the model with same data for input and target as we need to reconstruct
# the same image so X_train,Y_train = X_train and same follows for the validation set also

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

```
Epoch 1/10
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0243 - val_loss: 0.0094
Epoch 2/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0070 - val_loss: 0.0054
Epoch 3/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0050 - val_loss: 0.0045
Epoch 4/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0046 - val_loss: 0.0043
Epoch 5/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0044 - val_loss: 0.0042
Epoch 6/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0042 - val_loss: 0.0041
Epoch 7/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0042 - val_loss: 0.0040
Epoch 8/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0041 - val_loss: 0.0040
Epoch 9/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0040 - val_loss: 0.0039
Epoch 10/10
1875/1875 [==============================] - 3s 2ms/step - loss: 0.0040 - val_loss: 0.0039
<tensorflow.python.keras.callbacks.History at 0x7f532ef91ed0>
```

```
# applying the model to new data
encoded_imgs = autoencoder.encoder(x_test).numpy()                           # calling the attributes of model to encode new data
decoded_imgs = autoencoder.decoder(encoded_imgs).numpy()                     # calling the attributes of model to decode new encoded data
```

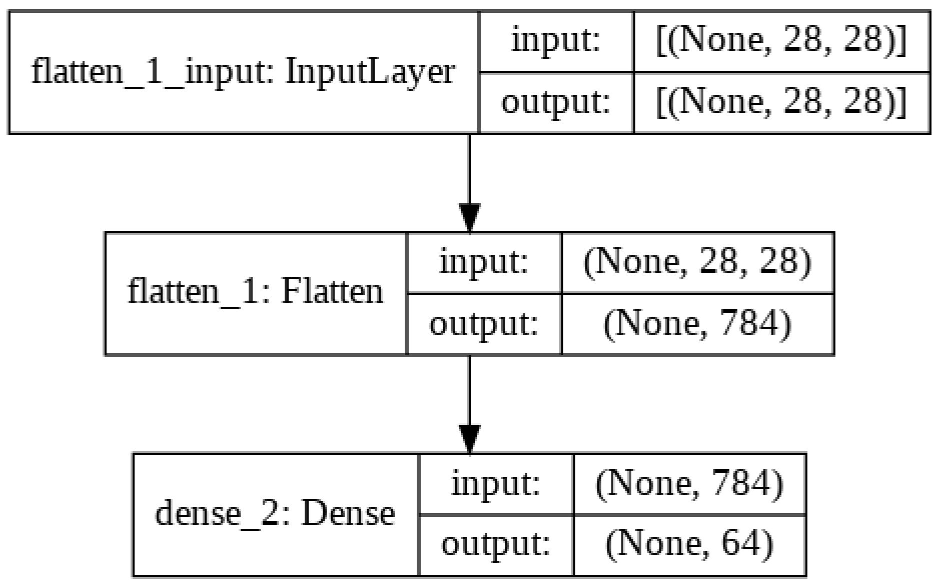
```
# plotting the images for comparision between original and reconstructed data
n = 10                                                                       # plotting only first 10 images
plt.figure(figsize=(20, 4))                                                  # initilizing the figure size for plot
for i in range(n):
  ax = plt.subplot(2, n, i + 1)                                              # creating subplot rules for 1st row in the plot of original imag
  plt.imshow(x_test[i])                                                      # plotting the original images
  plt.title("Original")
  plt.gray()                                                                 # The gray() function is used to set the colormap to “gray”.
  ax.get_xaxis().set_visible(False)                                          # removing the visiblity of grid lines in plot
  ax.get_yaxis().set_visible(False)

  ax = plt.subplot(2, n, i + 1 + n)                                          # creating subplot rules for 2nd row in the plot of original imag
  plt.imshow(decoded_imgs[i])                                                # plotting the original images
  plt.title("Reconstructed")
  plt.gray()                                                                 # The gray() function is used to set the colormap to “gray”.
  ax.get_xaxis().set_visible(False)                                          # removing the visiblity of grid lines in plot
  ax.get_yaxis().set_visible(False)

plt.show()
```



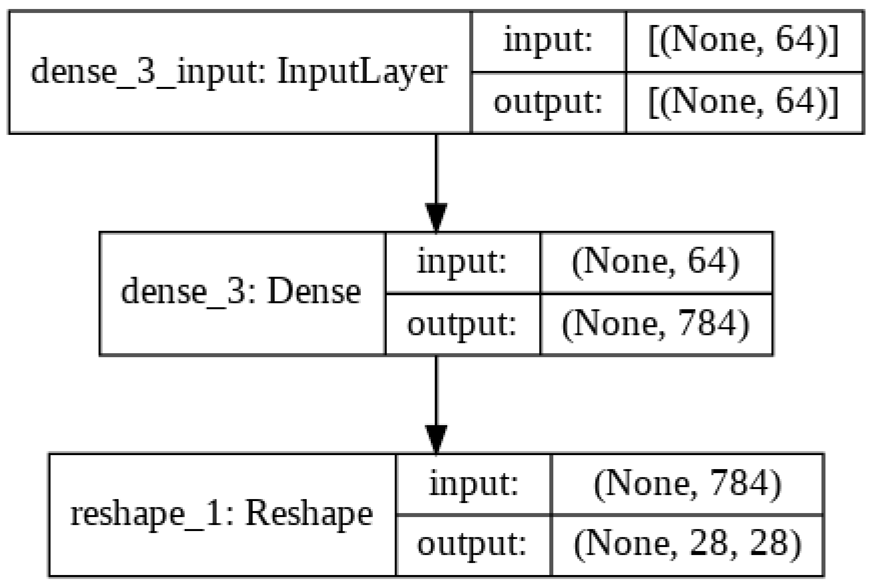

```
autoencoder.summary()                                                  # print the model summary to understand the layers present
```

```
Model: "autoencoder_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
sequential_2 (Sequential)    (None, 64)                50240     
_________________________________________________________________
sequential_3 (Sequential)    (None, 28, 28)            50960     
=================================================================
Total params: 101,200
Trainable params: 101,200
Non-trainable params: 0
_________________________________________________________________
```

```
tf.keras.utils.plot_model(autoencoder.encoder, show_shapes=True)                # plotting the encoder part of the model
```




```
tf.keras.utils.plot_model(autoencoder.decoder, show_shapes=True)                # plotting the decoder part of the model
```



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