# Exp No: 7

### BUILD AUTOENCODERS WITH KERAS/TENSORFLOW

#### Aim:

To build autoencoders with Keras/TensorFlow.

### **Procedure:**

- 1. Download and load the dataset.
- 2. Perform analysis and preprocessing of the dataset.
- 3. Build a simple neural network model using Keras/TensorFlow.
- 4. Compile and fit the model.
- 5. Perform prediction with the test dataset.
- 6. Calculate performance metrics.

## Program:

```
import numpy as np
import matplotlib.pyplot as plt
```

from keras import layers from keras.datasets import mnist from keras.models import Model

```
def preprocess(array):
```

```
"""Normalizes the supplied array and reshapes it."""

array = array.astype("float32") / 255.0

array = np.reshape(array, (len(array), 28, 28, 1))

return array

def noise(array):
```

"""Adds random noise to each image in the supplied array."""

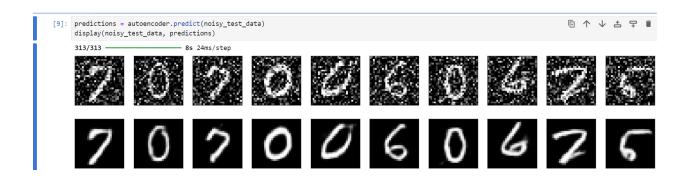
```
noise factor = 0.4
  noisy array = array + noise factor * np.random.normal(
     loc=0.0, scale=1.0, size=array.shape
  )
  return np.clip(noisy array, 0.0, 1.0)
def display(array1, array2):
  """Displays ten random images from each array."""
  n = 10
  indices = np.random.randint(len(array1), size=n)
  images1 = array1[indices, :]
  images2 = array2[indices, :]
  plt.figure(figsize=(20, 4))
  for i, (image1, image2) in enumerate(zip(images1, images2)):
     ax = plt.subplot(2, n, i + 1)
     plt.imshow(image1.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(image2.reshape(28, 28))
     plt.gray()
     ax.get xaxis().set visible(False)
     ax.get_yaxis().set_visible(False)
  plt.show()
# Since we only need images from the dataset to encode and decode, we
```

```
# won't use the labels.
(train data, ), (test data, ) = mnist.load data()
# Normalize and reshape the data
train data = preprocess(train data)
test data = preprocess(test data)
# Create a copy of the data with added noise
noisy train data = noise(train data)
noisy test data = noise(test data)
# Display the train data and a version of it with added noise
display(train data, noisy train data)
input = layers.Input(shape=(28, 28, 1))
# Encoder
x = layers.Conv2D(32, (3, 3), activation="relu", padding="same")(input)
x = layers.MaxPooling2D((2, 2), padding="same")(x)
x = layers.Conv2D(32, (3, 3), activation="relu", padding="same")(x)
x = layers.MaxPooling2D((2, 2), padding="same")(x)
# Decoder
x = layers.Conv2DTranspose(32, (3, 3), strides=2, activation="relu", padding="same")(x)
x = layers.Conv2DTranspose(32, (3, 3), strides=2, activation="relu", padding="same")(x)
x = layers.Conv2D(1, (3, 3), activation="sigmoid", padding="same")(x)
# Autoencoder
autoencoder = Model(input, x)
```

```
autoencoder.compile(optimizer="adam", loss="binary_crossentropy")
autoencoder.summary()
autoencoder.fit(
  x=train data,
  y=train_data,
  epochs=10,
  batch_size=128,
  shuffle=True,
  validation_data=(test_data, test_data),
)
predictions = autoencoder.predict(test_data)
display(test data, predictions)
autoencoder.fit(
  x=noisy_train_data,
  y=train data,
  epochs=10,
  batch size=128,
  shuffle=True,
  validation data=(noisy test data, test data),
predictions = autoencoder.predict(noisy test data)
display(noisy_test_data, predictions)
```

### **Output:**





### **Result:**

Autocoder has been successfully built using tensorflow/keras.