Ex No: 9 BUILD GENERATIVE ADVERSARIAL NEURAL NETWORK

Aim:

To build a generative adversarial neural network using 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.

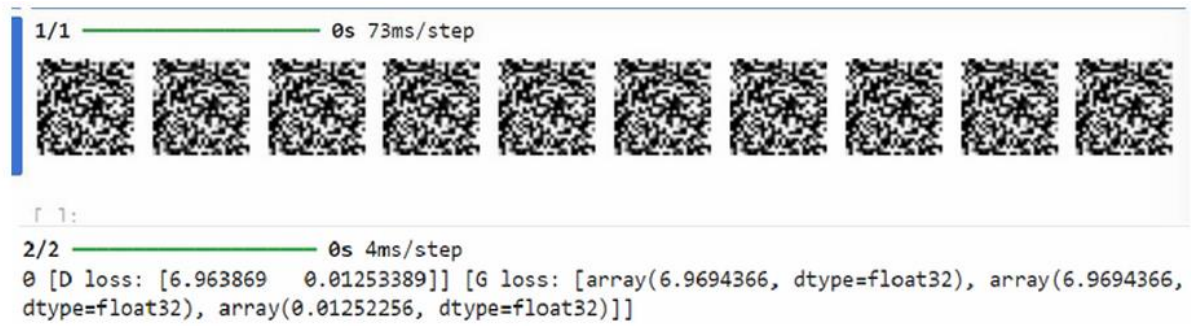
Program:

```
import tensorflow as tf
 from tensorflow.keras import layers
 import numpy as np
 import matplotlib.pyplot as plt
 def build_generator(noise_dim):
model = tf.keras.Sequential()
# Dense layer to project the noise into a larger dimension
model.add(layers.Dense(128, activation='relu', input_dim=noise_dim))
# Add more dense layers
model.add(layers.Dense(256, activation='relu'))
model.add(layers.Dense(512, activation='relu'))
# Final layer to output the data (usually using 'tanh' for image generation)
model.add(layers.Dense(28 * 28, activation='tanh')
model.add(layers.Reshape((28, 28))) # Shape output as 28x28 for images like MNIST
return model
def build_discriminator():
model = tf.keras.Sequential()
# Flatten the input image
model.add(layers.Flatten(input_shape=(28, 28)))
# Add dense layers to classify real/fake
model.add(layers.Dense(512, activation='relu'))
```

```
model.add(layers.Dense(256, activation='relu'))
# Final layer to output a single probability (real or fake)
model.add(layers.Dense(1, activation='sigmoid'))
return model
def build_gan(generator, discriminator):
model = tf.keras.Sequential()
model.add(generator)
model.add(discriminator)
return model
# Compile the discriminator
discriminator = build_discriminator()
discriminator.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
# Build the generator
generator = build_generator(noise_dim=100)
# Compile the GAN (discriminator is untrainable when training the generator)
 discriminator.trainable = False
 gan = build_gan(generator, discriminator)
 gan.compile(loss='binary_crossentropy', optimizer='adam')
def train_gan(generator, discriminator, gan, epochs, batch_size, noise_dim):
(X_train, _), _ = tf.keras.datasets.mnist.load_data() # Use MNIST as example
X_train = X_train / 127.5 - 1.0 # Normalize images to [-1, 1]
for epoch in range(epochs):
# Select a random batch of real images
idx = np.random.randint(0, X_train.shape[0], batch_size)
real_images = X_train[idx]
# Generate a batch of fake images
noise = np.random.normal(0, 1, (batch_size, noise_dim))
fake_images = generator.predict(noise)
# Train the discriminator (real = 1, fake = 0)
d_loss_real = discriminator.train_on_batch(real_images, np.ones((batch_size, 1)))
d_loss_fake = discriminator.train_on_batch(fake_images, np.zeros((batch_size, 1)))
# Train the generator (wants discriminator to predict all as real)
noise = np.random.normal(0, 1, (batch_size, noise_dim))
g_loss = gan.train_on_batch(noise, np.ones((batch_size, 1)))
```

```
# Print progress
if epoch % 100 == 0:
print(f"{epoch} [D loss: {0.5 * np.add(d_loss_real, d_loss_fake)}] [G loss: {g_loss}]")
# Optionally save generated samples to visualize progress
train_gan(generator, discriminator, gan, epochs=1000, batch_size=64, noise_dim=100)
def generate_images(generator, noise_dim, examples=10):
noise = np.random.normal(0, 1, (examples, noise_dim))
gen_images = generator.predict(noise)
plt.figure(figsize=(10, 10))
for i in range(examples):
plt.subplot(1, 10, i+1)
plt.imshow(gen_images[i], cmap='gray')
plt.axis('off')
plt.show()
# Call this function after training to visualize generated images
generate_images(generator, noise_dim=100)
```

Output:



Result:

A generative adversarial neural network using Keras/TensorFlow is successfully build.