## 2. BUILD A SIMPLE CNN MODEL FOR IMAGE SEGMENTATION

| | |
|---|---|
| **EX.N0 : 2** | **BUILD A SIMPLE CNN MODEL FOR IMAGE SEGMENTATION** |
| **DATE : 03/02/2025** | |

**AIM:**

To build and train a simple Convolutional Neural Network (CNN) for performing binary image segmentation using the CIFAR-10 dataset.

**ALGORITHM:**

Step 1: Import necessary libraries like TensorFlow, NumPy, and Matplotlib.

Step 2: Load the CIFAR-10 dataset and normalize the images.

Step 3: Create binary segmentation masks using a threshold on image brightness.

Step 4: Design a simple CNN-based encoder-decoder architecture for segmentation.

Step 5: Compile the model using binary cross entropy loss and accuracy metric.

Step 6: Train the model with training images and corresponding masks.

Step 7: Evaluate the model using test data.

Step 8: Visualize the original image, ground truth mask, and predicted segmentation mask.

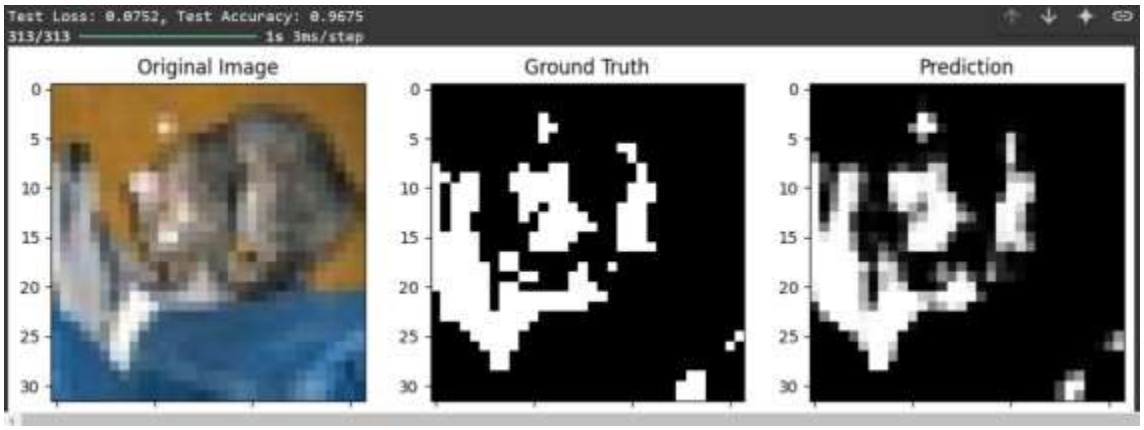
**PROGRAM:**

```
import tensorflow as tf
from tensorflow.keras import layers, models
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras.datasets import cifar10
(x_train, y_train), (x_test, y_test) = cifar10.load_data()
```

```
x_train = x_train.astype("float32") / 255.0
x_test = x_test.astype("float32") / 255.0
y_train_segmentation = np.where(x_train.mean(axis=-1, keepdims=True) > 0.5, 1, 0)
y_test_segmentation = np.where(x_test.mean(axis=-1, keepdims=True) > 0.5, 1, 0)
def create_segmentation_model(input_shape):
model = models.Sequential([
layers.InputLayer(input_shape=input_shape),
layers.Conv2D(32, (3, 3), activation="relu", padding="same"),
layers.MaxPooling2D((2, 2)),
layers.Conv2D(64, (3, 3), activation="relu", padding="same"),
layers.MaxPooling2D((2, 2)),
layers.Conv2D(128, (3, 3), activation="relu", padding="same"),
layers.Conv2DTranspose(64, (3, 3), strides=2, activation="relu", padding="same"),
layers.Conv2DTranspose(32, (3, 3), strides=2, activation="relu", padding="same"),
layers.Conv2D(1, (1, 1), activation="sigmoid", padding="same")
])
return model
input_shape = x_train.shape[1:]  # (32, 32, 3)
model = create_segmentation_model(input_shape)
model.compile(optimizer="adam", loss="binary_crossentropy", metrics=["accuracy"])
model.summary()
history = model.fit(
x_train, y_train_segmentation,
validation_data=(x_test, y_test_segmentation),
epochs=5,
batch_size=32
)
loss, accuracy = model.evaluate(x_test, y_test_segmentation)
print(f"Test Loss: {loss:.4f}, Test Accuracy: {accuracy:.4f}")
predictions = model.predict(x_test)
num_images = 3
```

```
plt.figure(figsize=(12, num_images * 4))
for i in range(num_images):
plt.subplot(num_images, 3, i * 3 + 1)
plt.title("Original Image")
plt.imshow(x_test[i])
plt.axis('off')
plt.subplot(num_images, 3, i * 3 + 2)
plt.title("Ground Truth")
plt.imshow(y_test_segmentation[i].squeeze(), cmap="gray")
plt.axis('off')
plt.subplot(num_images, 3, i * 3 + 3)
plt.title("Prediction")
plt.imshow(predictions[i].squeeze(), cmap="gray")
plt.axis('off')
plt.tight_layout()
plt.show()
```

**OUTPUT:**




**RESULT:**

Thus, the Program has been executed successfully and verified.