```
from google.colab import drive
drive.mount('/content/drive')
```

```
     Mounted at /content/drive
```

```
import os
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow import keras
import tensorflow.keras.models as Models
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.callbacks import ModelCheckpoint, EarlyStopping
import cv2
```

```
IMAGE_SIZE = (228, 228)

BATCH_SIZE = 32
```

```
train_dir='/content/drive/MyDrive/seg_train'
test_dir='/content/drive/MyDrive/seg_test'
```

```
train_ds = tf.keras.utils.image_dataset_from_directory(
  train_dir,
  seed=123,
  image_size=IMAGE_SIZE,
  batch_size=BATCH_SIZE)
```

```
     Found 152 files belonging to 1 classes.
```

```
val_ds = tf.keras.utils.image_dataset_from_directory(
  test_dir,
  seed=123,
  image_size=IMAGE_SIZE,
  batch_size=BATCH_SIZE)
```

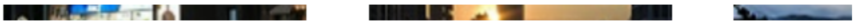
```
     Found 145 files belonging to 1 classes.
```

```
class_names = train_ds.class_names
print(class_names)
```

```
     ['seg_train']
```

```
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    for i in range(9):
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype("uint8"))
        plt.title(class_names[labels[i]])
        plt.axis("off")
```

```
num_classes = len(class_names)
```



```
model = Models.Sequential()
model.add(tf.keras.layers.Conv2D(32, kernel_size=(3, 3), activation='relu', input_shape=(228,228,3)))
model.add(tf.keras.layers.MaxPooling2D(2,2))
model.add(tf.keras.layers.Conv2D(32, kernel_size=(3, 3), activation='relu'))
model.add(tf.keras.layers.MaxPooling2D(2,2))
model.add(tf.keras.layers.Conv2D(64, kernel_size=(3, 3), activation='relu'))
model.add(tf.keras.layers.MaxPooling2D(2,2))
model.add(tf.keras.layers.Conv2D(64, kernel_size=(3, 3), activation='relu'))
model.add(tf.keras.layers.MaxPooling2D(2,2))
model.add(tf.keras.layers.Conv2D(64, kernel_size=(3, 3), activation='relu'))
model.add(tf.keras.layers.MaxPooling2D(2,2))
model.add(tf.keras.layers.Flatten())
model.add(tf.keras.layers.Dense(1024, activation='relu'))
model.add(tf.keras.layers.Dropout(0.2))
model.add(tf.keras.layers.Dense(128, activation='relu'))
model.add(tf.keras.layers.Dropout(0.2))
model.add(tf.keras.layers.Dense(num_classes, activation='softmax'))
```

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 226, 226, 32)      896

 max_pooling2d (MaxPooling2  (None, 113, 113, 32)      0
 D)

 conv2d_1 (Conv2D)           (None, 111, 111, 32)      9248

 max_pooling2d_1 (MaxPoolin  (None, 55, 55, 32)        0
 g2D)

 conv2d_2 (Conv2D)           (None, 53, 53, 64)        18496

 max_pooling2d_2 (MaxPoolin  (None, 26, 26, 64)        0
 g2D)

 conv2d_3 (Conv2D)           (None, 24, 24, 64)        36928

 max_pooling2d_3 (MaxPoolin  (None, 12, 12, 64)        0
 g2D)

 conv2d_4 (Conv2D)           (None, 10, 10, 64)        36928

 max_pooling2d_4 (MaxPoolin  (None, 5, 5, 64)          0
 g2D)

 flatten (Flatten)           (None, 1600)              0

 dense (Dense)               (None, 1024)              1639424

 dropout (Dropout)           (None, 1024)              0

 dense_1 (Dense)             (None, 128)               131200

 dropout_1 (Dropout)         (None, 128)               0

 dense_2 (Dense)             (None, 1)                 129
```

```
=================================================================
Total params: 1873249 (7.15 MB)
Trainable params: 1873249 (7.15 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
model.compile(
  optimizer='adam',
  loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
  metrics=['accuracy'])
```

```
earlystopping = EarlyStopping(monitor='val_loss',
                                              patience=5,
                                              verbose=1,
                                              mode='min'
                                              )
checkpointer = ModelCheckpoint(filepath='bestvalue', verbose=0, save_best_only=True)
callback_list = [checkpointer, earlystopping]
```

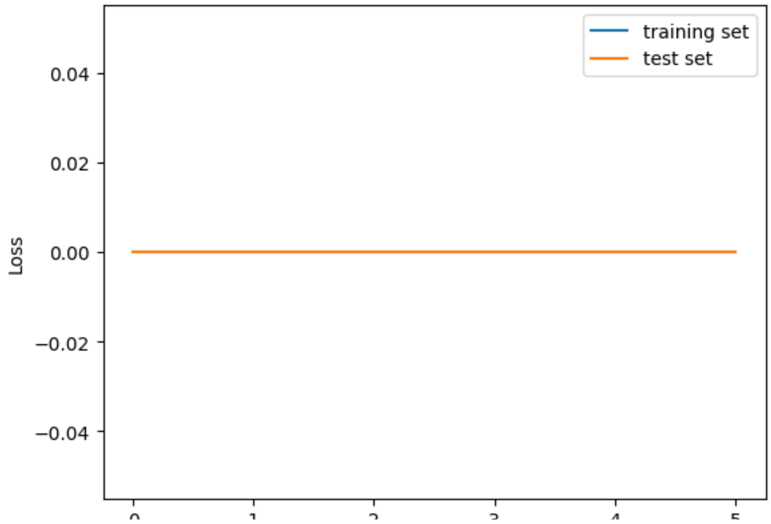
```
history = model.fit(
    train_ds,
    validation_data=val_ds,
    epochs=10,
    callbacks=callback_list
)
```

```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 conv2d (Conv2D)             (None, 226, 226, 32)      896       
                                                                 
 max_pooling2d (MaxPooling2  (None, 113, 113, 32)      0         
 D)                                                              
                                                                 
 conv2d_1 (Conv2D)           (None, 111, 111, 32)      9248      
                                                                 
 max_pooling2d_1 (MaxPoolin  (None, 55, 55, 32)        0         
 g2D)                                                            
                                                                 
 conv2d_2 (Conv2D)           (None, 53, 53, 64)        18496     
                                                                 
 max_pooling2d_2 (MaxPoolin  (None, 26, 26, 64)        0         
 g2D)                                                            
                                                                 
 conv2d_3 (Conv2D)           (None, 24, 24, 64)        36928     
                                                                 
 max_pooling2d_3 (MaxPoolin  (None, 12, 12, 64)        0         
 g2D)                                                            
                                                                 
 conv2d_4 (Conv2D)           (None, 10, 10, 64)        36928     
                                                                 
 max_pooling2d_4 (MaxPoolin  (None, 5, 5, 64)          0         
 g2D)                                                            
                                                                 
 flatten (Flatten)           (None, 1600)              0         
                                                                 
 dense (Dense)               (None, 1024)              1639424   
                                                                 
 dropout (Dropout)           (None, 1024)              0         
                                                                 
 dense_1 (Dense)             (None, 128)               131200    
                                                                 
 dropout_1 (Dropout)         (None, 128)               0         
                                                                 
 dense_2 (Dense)             (None, 1)                 129       
                                                                 
=================================================================
Total params: 1873249 (7.15 MB)
Trainable params: 1873249 (7.15 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

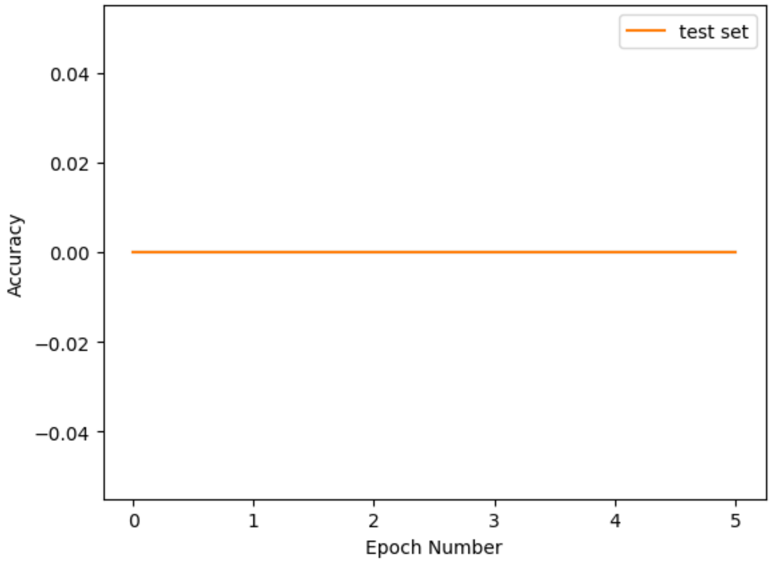
```
plt.xlabel('Epoch Number')
plt.ylabel('Loss')
plt.plot(history.history['loss'], label='training set')
plt.plot(history.history['val_loss'], label='test set')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7dfa881df7c0>
```



```
plt.xlabel('Epoch Number')
plt.ylabel('Accuracy')
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'], label='test set')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7dfa88301f00>
```



```
def getImagePaths(path):
    image_names = []
    for dirname, _, filenames in os.walk(path):
        for filename in filenames:
            fullpath = os.path.join(dirname, filename)
            image_names.append(fullpath)
    return image_names

pred_dir = ''

images_paths = getImagePaths(pred_dir)
len(images_paths)
```

```
0
```

```
file_array = []

for file in images_paths[:9]:
    img_ = image.load_img(file, target_size=(228, 228))
    img_array = image.img_to_array(img_)
    img_processed = np.expand_dims(img_array, axis=0)
    img_processed /= 255.
    file_array.append(img_processed)

file_array = np.array(file_array)
```

```
classes = train_ds.class_names
print(classes)
```

```
['seg_train']
```

```
def predict_image(filename, model):
    img_ = image.load_img(filename, target_size=(228, 228))
    img_array = image.img_to_array(img_)
    img_processed = np.expand_dims(img_array, axis=0)
    img_processed /= 255.

    prediction = model.predict(img_processed)

    index = np.argmax(prediction)

    plt.title("Prediction - {}".format(str(classes[index]).title()), size=18, color='red')
    plt.imshow(img_array)
```

```
predict_image('/content/drive/MyDrive/seg_pred/seg_pred/25.jpg', model)
```

```
1/1 [==============================] - 0s 157ms/step
```