```
import os

# Create a directory for Kaggle config
os.makedirs("/root/.kaggle", exist_ok=True)

# Upload `kaggle.json`
from google.colab import files
files.upload()  # Select and upload the downloaded kaggle.json file

# Move `kaggle.json` to the correct directory
!mv kaggle.json /root/.kaggle/

# Set permissions
!chmod 600 /root/.kaggle/kaggle.json

# Verify Kaggle API works
!kaggle datasets list
```

```
Choose Files kaggle.json
• kaggle.json(application/json) - 67 bytes, last modified: 3/20/2025 - 100% done
Saving kaggle.json to kaggle.json
ref                                                                 title                                                size
------------------------------------------------------------------  ---------------------------------------------------  ---------
atharvasoundankar/chocolate-sales                                   Chocolate Sales Data 📊🍫                                  14
abdulmalik1518/mobiles-dataset-2025                                 Mobiles Dataset (2025)                                20314
ricgomes/global-fashion-retail-stores-dataset                       Global Fashion Retail Sales                        234910599
mahmoudelhemaly/students-grading-dataset                            Student Performance & Behavior Dataset               520428
atharvasoundankar/global-water-consumption-dataset-2000-2024        Global Water Consumption Dataset (2000-2024) 🌍💧          17
adilshamim8/student-depression-dataset                              Student Depression Dataset                           467026
atharvasoundankar/global-food-wastage-dataset-2018-2024             🌍 Global Food Wastage Dataset (2018-2024) 🍽️             108
adilshamim8/temperature                                             Global Environmental Trends 2000-2024                22391
parsabahramsari/wdi-education-health-and-employment-2011-2021       WDI: Education, Health & Employment (2011-2021)      136185
bhargavchirumamilla/netflix-movies-and-tv-shows-till-2025           Netflix Movies and TV shows till 2025               6471169
smayanj/netflix-users-database                                      Netflix Users Database                               362559
atharvasoundankar/global-energy-consumption-2000-2024               Global Energy Consumption (2000-2024) 🔥⚡                 258
aniruddhawankhede/mental-heath-analysis-among-teenagers             Mental_Heath_Analysis_Among_Teenagers                177089
atharvasoundankar/global-music-streaming-trends-and-listener-insights  Global Music Streaming Trends & Listener Insights     97474
abdulmoiz12/amazon-stock-data-2025                                  Amazon Stock Data 2025                               160519
brsahan/genomic-data-for-cancer                                     Genomic Data for Cancer                                9134
atharvasoundankar/viral-social-media-trends-and-engagement-analysis  🚀 Viral Social Media Trends & Engagement Analysis     1072
adilshamim8/student-performance-on-an-entrance-examination          Student Performance on an Entrance Examination         4402
anandshaw2001/video-game-sales                                      Video Game Sales                                     390286
meharshanali/amazon-stocks-2025                                     Amazon Stocks 2025                                   165462
```

```
!kaggle datasets download -d jaiharish11499/wastedata
```

```
Dataset URL: https://www.kaggle.com/datasets/jaiharish11499/wastedata
License(s): CC0-1.0
```

```
import zipfile

with zipfile.ZipFile("wastedata.zip", 'r') as zip_ref:
    zip_ref.extractall("waste_data")
```

```
import os
print(os.listdir("/content/"))
```

```
['.config', 'wastedata.zip', 'waste_data', 'sample_data']
```

```
train_folder = "/content/waste_data/d/Train"
test_folder = "/content/waste_data/d/Test"
```

```
import pandas as pd
import numpy as np
import glob
import os
from datetime import datetime
from packaging import version

import tensorflow as tf
from tensorflow import keras
from tensorflow.keras.applications import InceptionV3
from tensorflow.keras.preprocessing import image_dataset_from_directory
from tensorflow.keras.preprocessing.image import load_img, img_to_array
from tensorflow.keras.callbacks import ModelCheckpoint, History
```

```
from tensorflow.keras.models import Sequential, load_model
from tensorflow.keras.layers import Conv2D, Lambda, MaxPooling2D, Dense, Dropout, Flatten
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.utils import to_categorical

from skimage.io import imread, imshow
from skimage.transform import resize
from IPython import display
import matplotlib.pyplot as plt
import seaborn as sns
from seaborn import heatmap
from sklearn.metrics import confusion_matrix
```

```
from tensorflow.keras.applications.inception_v3 import preprocess_input
train_datagen = ImageDataGenerator(
    preprocessing_function=preprocess_input,  # InceptionV3-specific preprocessing
    rotation_range=30,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest'
)
```

```
# No augmentation for validation/test
test_datagen = ImageDataGenerator(rescale=1./255)
```

```
# Load dataset
train_generator = train_datagen.flow_from_directory(
    train_folder,
    target_size=(299, 299),
    batch_size=32,
    class_mode='binary')
```

```
Found 336 images belonging to 2 classes.
```

```
test_generator = test_datagen.flow_from_directory(
    test_folder,
    target_size=(299, 299),
    batch_size=32,
    class_mode='binary',
    shuffle=False)
```

```
Found 64 images belonging to 2 classes.
```

```
from sklearn.utils.class_weight import compute_class_weight
# Compute class weights to address imbalance
class_labels = np.array(train_generator.classes)
class_weights = compute_class_weight(class_weight='balanced', classes=np.unique(class_labels), y=class_labels)
class_weight_dict = {i: class_weights[i] for i in range(len(class_weights))}
```

```
# Load InceptionV3 base model (pre-trained on ImageNet)
base_model = InceptionV3(weights='imagenet', include_top=False, input_shape=(299, 299, 3))  # 299x299 input size
base_model.trainable = False
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/inception_v3/inception_v3_weights_tf_dim_ordering
87910968/87910968 ━━━━━━━━━━━━━━━━━━━━ 0s 0us/step
```

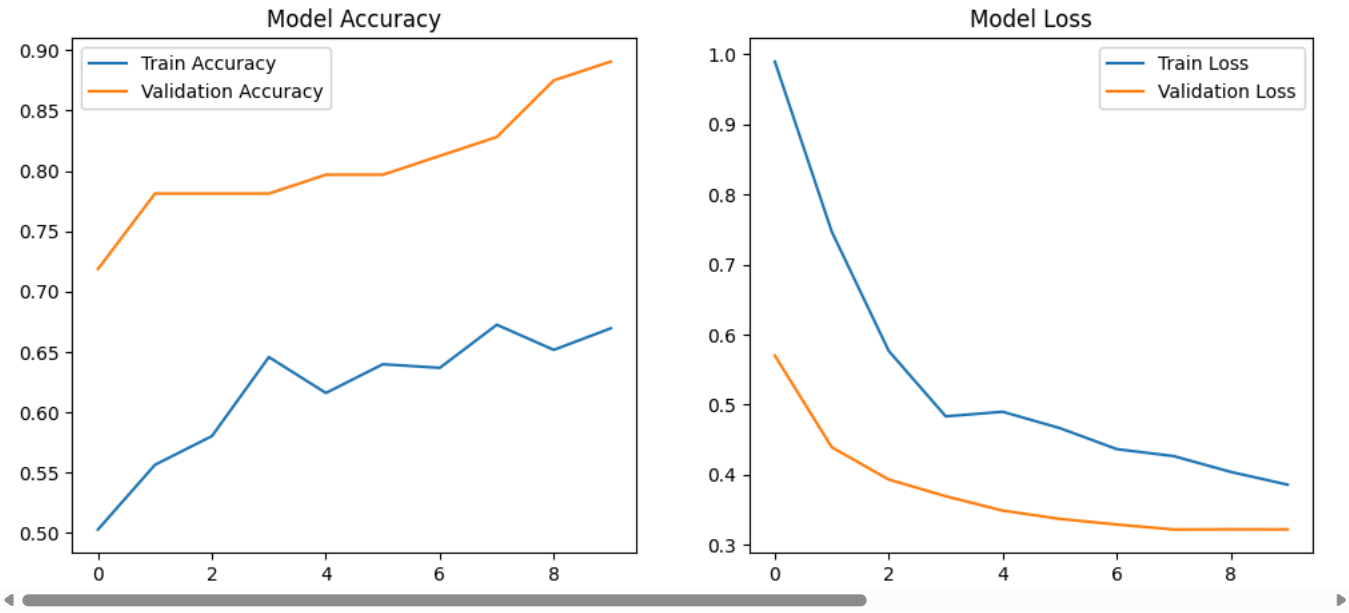
```
# Build model
model = keras.Sequential([
    base_model,
    keras.layers.GlobalAveragePooling2D(),  # Efficient feature extraction
    keras.layers.Dense(128, activation='relu'),
    keras.layers.BatchNormalization(),  # Improves stability
    keras.layers.Dropout(0.5),
    keras.layers.Dense(1, activation='sigmoid')  # Binary classification
])
```

```
from tensorflow.keras.optimizers import Adam
#Compile the model
model.compile(optimizer=Adam(learning_rate=0.0001), loss='binary_crossentropy', metrics=['accuracy'])
```

```
# Train model
history = model.fit(
    train_generator,
    epochs=10,
    validation_data=test_generator,
    class_weight=class_weight_dict)
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/trainers/data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset` cl
  self._warn_if_super_not_called()
Epoch 1/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 122s 10s/step - accuracy: 0.4875 - loss: 0.9676 - val_accuracy: 0.7188 - val_loss: 0.5701
Epoch 2/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 106s 10s/step - accuracy: 0.5236 - loss: 0.9029 - val_accuracy: 0.7812 - val_loss: 0.4393
Epoch 3/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 112s 10s/step - accuracy: 0.5713 - loss: 0.6073 - val_accuracy: 0.7812 - val_loss: 0.3934
Epoch 4/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 107s 10s/step - accuracy: 0.6305 - loss: 0.4762 - val_accuracy: 0.7812 - val_loss: 0.3695
Epoch 5/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 106s 10s/step - accuracy: 0.6412 - loss: 0.4438 - val_accuracy: 0.7969 - val_loss: 0.3490
Epoch 6/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 107s 10s/step - accuracy: 0.5999 - loss: 0.4940 - val_accuracy: 0.7969 - val_loss: 0.3373
Epoch 7/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 142s 10s/step - accuracy: 0.6831 - loss: 0.4130 - val_accuracy: 0.8125 - val_loss: 0.3293
Epoch 8/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 110s 10s/step - accuracy: 0.6509 - loss: 0.4614 - val_accuracy: 0.8281 - val_loss: 0.3221
Epoch 9/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 117s 10s/step - accuracy: 0.6507 - loss: 0.3802 - val_accuracy: 0.8750 - val_loss: 0.3225
Epoch 10/10
11/11 ━━━━━━━━━━━━━━━━━━━━ 107s 10s/step - accuracy: 0.6922 - loss: 0.3814 - val_accuracy: 0.8906 - val_loss: 0.3223
```

```
# Plot accuracy and loss
fig, axes = plt.subplots(1, 2, figsize=(12, 5))
axes[0].plot(history.history['accuracy'], label='Train Accuracy')
axes[0].plot(history.history['val_accuracy'], label='Validation Accuracy')
axes[0].set_title('Model Accuracy')
axes[0].legend()
axes[1].plot(history.history['loss'], label='Train Loss')
axes[1].plot(history.history['val_loss'], label='Validation Loss')
axes[1].set_title('Model Loss')
axes[1].legend()
plt.show()
```

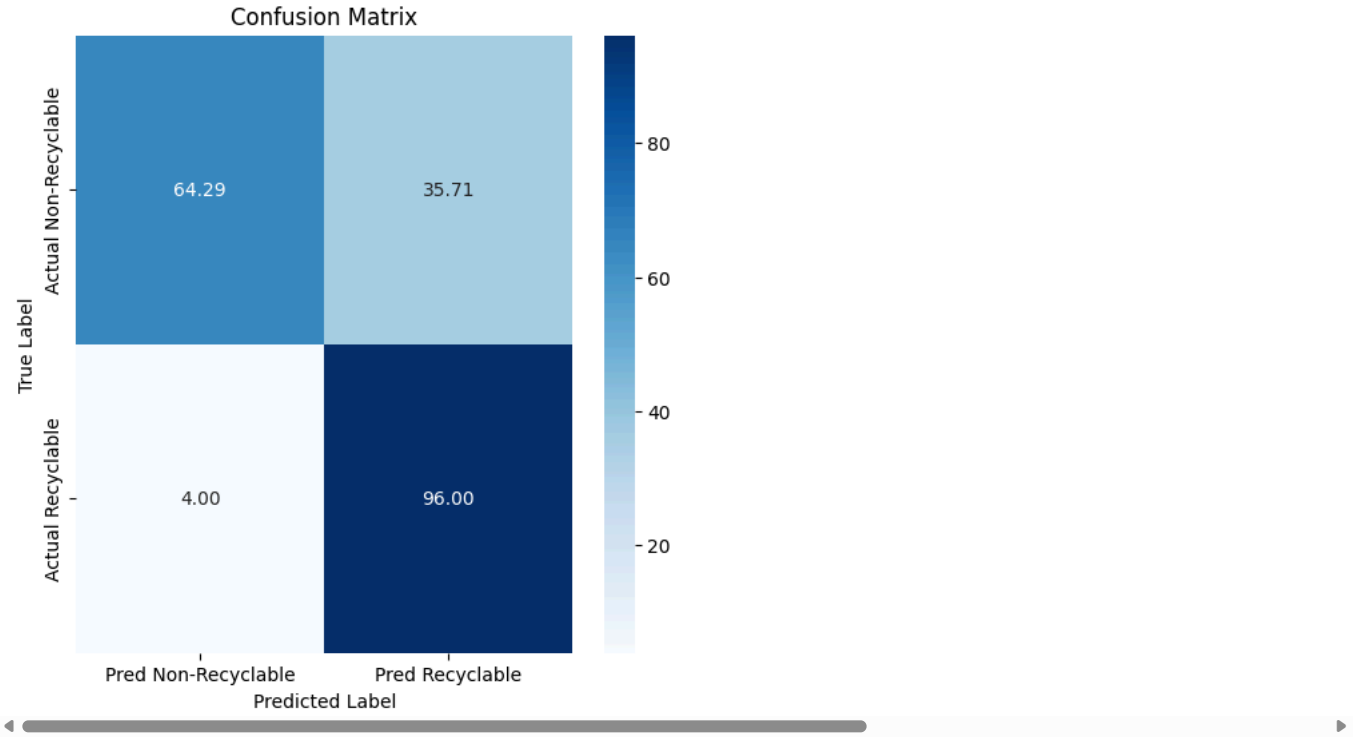



```
# Confusion matrix
y_true = test_generator.classes
y_pred = model.predict(test_generator) > 0.5
cm = confusion_matrix(y_true, y_pred)
```

```
2/2 ━━━━━━━━━━━━━━━━━━━━ 20s 8s/step
```

```
# Display confusion matrix with labels and percentages
fig, ax = plt.subplots(figsize=(6, 6))
cm_percent = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis] * 100
sns.heatmap(cm_percent, annot=True, fmt='.2f', cmap='Blues', xticklabels=['Pred Non-Recyclable', 'Pred Recyclable'],
            yticklabels=['Actual Non-Recyclable', 'Actual Recyclable'])
plt.xlabel('Predicted Label')
plt.ylabel('True Label')
plt.title('Confusion Matrix')
```

```
Text(0.5, 1.0, 'Confusion Matrix')
```




```
from sklearn.metrics import classification_report
# Classification report
print("Classification Report:")
print(classification_report(y_true, y_pred, target_names=['Non-Recyclable', 'Recyclable']))
```

```
Classification Report:
                precision    recall  f1-score   support

Non-Recyclable       0.82      0.64      0.72        14
    Recyclable       0.91      0.96      0.93        50

      accuracy                           0.89        64
     macro avg       0.86      0.80      0.83        64
  weighted avg       0.89      0.89      0.89        64
```

```
# Convert accuracy and loss to percentage
train_acc = [x * 100 for x in history.history['accuracy']]
val_acc = [x * 100 for x in history.history['val_accuracy']]
train_loss = [x * 100 for x in history.history['loss']]
val_loss = [x * 100 for x in history.history['val_loss']]
# Print accuracy and loss values
print("Final Training Accuracy: {:.2f}%".format(train_acc[-1]))
print("Final Validation Accuracy: {:.2f}%".format(val_acc[-1]))
print("Final Training Loss: {:.2f}%".format(train_loss[-1]))
print("Final Validation Loss: {:.2f}%".format(val_loss[-1]))
```

```
Final Training Accuracy: 66.96%
Final Validation Accuracy: 89.06%
Final Training Loss: 38.60%
Final Validation Loss: 32.23%
```