```
!pip install kaggle tensorflow opencv-python matplotlib
```

```
Requirement already satisfied: kaggle in /usr/local/lib/python3.11/dist-packages (1.7.4.2)
Requirement already satisfied: tensorflow in /usr/local/lib/python3.11/dist-packages (2.18.0)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.11/dist-packages (4.11.0.86)
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Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.11/dist-packages (from tensorflow) (1.4.0)
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```

```
import random
random.seed(0)

import numpy as np
np.random.seed(0)

import tensorflow as tf
tf.random.set_seed(0)



import os
import json
from zipfile import ZipFile
from PIL import Image

import numpy as np
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras import layers, models
```

```
kaggle_credentails = json.load(open("kaggle.json"))
```

```
import os
import zipfile

# Set Kaggle configuration path
os.environ['KAGGLE_CONFIG_DIR'] = "/content"

# Download the dataset
!kaggle datasets download -d rashikrahmanpritom/plant-disease-recognition-dataset

# Unzip the dataset
with zipfile.ZipFile('plant-disease-recognition-dataset.zip', 'r') as zip_ref:
    zip_ref.extractall('/content/plant_disease')
```

```
Warning: Your Kaggle API key is readable by other users on this system! To fix this, you can run 'chmod 600 /content/kaggle.json'
Dataset URL: https://www.kaggle.com/datasets/rashikrahmanpritom/plant-disease-recognition-dataset
License(s): CC0-1.0
```

```
import os

dataset_path = '/content/plant_disease'
categories = os.listdir(dataset_path)
print("Categories:", categories)
```

```
Categories: ['Train', 'Validation', 'Test']
```

```
for split in ['Train', 'Validation', 'Test']:
    split_path = os.path.join(dataset_path, split)
    classes = os.listdir(split_path)
    print(f"{split} classes:", classes)
```

```
Train classes: ['Train']
Validation classes: ['Validation']
Test classes: ['Test']
```

```
dataset_path = '/content/plant_disease'
for split in ['Train', 'Validation', 'Test']:
    split_path = os.path.join(dataset_path, split, split)
    print(f"{split} classes:", os.listdir(split_path))
```

```
Train classes: ['Powdery', 'Rust', 'Healthy']
Validation classes: ['Powdery', 'Rust', 'Healthy']
Test classes: ['Powdery', 'Rust', 'Healthy']
```

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator

# Image settings
IMG_SIZE = (128, 128)
BATCH_SIZE = 32

# Correct folder paths
train_dir = '/content/plant_disease/Train/Train'
val_dir = '/content/plant_disease/Validation/Validation'
test_dir = '/content/plant_disease/Test/Test'

# Image preprocessing
train_gen = ImageDataGenerator(rescale=1./255)
val_gen = ImageDataGenerator(rescale=1./255)
test_gen = ImageDataGenerator(rescale=1./255)

train_data = train_gen.flow_from_directory(train_dir, target_size=IMG_SIZE, batch_size=BATCH_SIZE, class_mode='categorical')
val_data = val_gen.flow_from_directory(val_dir, target_size=IMG_SIZE, batch_size=BATCH_SIZE, class_mode='categorical')
test_data = test_gen.flow_from_directory(test_dir, target_size=IMG_SIZE, batch_size=BATCH_SIZE, class_mode='categorical')
```

```
Found 1322 images belonging to 3 classes.
Found 60 images belonging to 3 classes.
Found 150 images belonging to 3 classes.
```

```
import tensorflow as tf

model = tf.keras.Sequential([
    tf.keras.layers.Conv2D(32, (3,3), activation='relu', input_shape=(128, 128, 3)),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(64, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Conv2D(128, (3,3), activation='relu'),
    tf.keras.layers.MaxPooling2D(2,2),
    tf.keras.layers.Flatten(),
    tf.keras.layers.Dense(128, activation='relu'),
    tf.keras.layers.Dense(train_data.num_classes, activation='softmax')
])

model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

history = model.fit(train_data, epochs=10, validation_data=val_data)
```

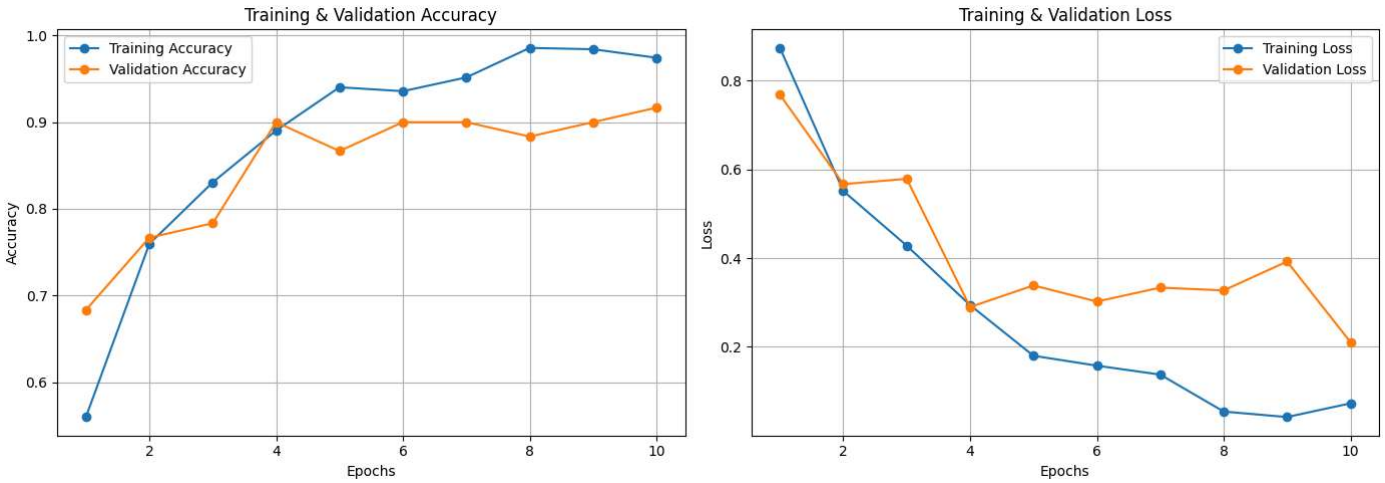
```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/`inpu
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
/usr/local/lib/python3.11/dist-packages/keras/src/trainers/data_adapters/py_dataset_adapter.py:121: UserWarning: Your `PyDataset` class
  self._warn_if_super_not_called()
Epoch 1/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 84s 2s/step - accuracy: 0.4909 - loss: 1.0536 - val_accuracy: 0.6833 - val_loss: 0.7681
Epoch 2/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 72s 2s/step - accuracy: 0.7310 - loss: 0.5968 - val_accuracy: 0.7667 - val_loss: 0.5666
Epoch 3/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 79s 2s/step - accuracy: 0.8365 - loss: 0.4293 - val_accuracy: 0.7833 - val_loss: 0.5786
Epoch 4/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 73s 2s/step - accuracy: 0.8819 - loss: 0.3110 - val_accuracy: 0.9000 - val_loss: 0.2898
Epoch 5/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 73s 2s/step - accuracy: 0.9480 - loss: 0.1810 - val_accuracy: 0.8667 - val_loss: 0.3384
Epoch 6/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 72s 2s/step - accuracy: 0.9430 - loss: 0.1344 - val_accuracy: 0.9000 - val_loss: 0.3022
Epoch 7/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 73s 2s/step - accuracy: 0.9588 - loss: 0.1212 - val_accuracy: 0.9000 - val_loss: 0.3334
Epoch 8/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 70s 2s/step - accuracy: 0.9820 - loss: 0.0736 - val_accuracy: 0.8833 - val_loss: 0.3272
Epoch 9/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 72s 2s/step - accuracy: 0.9881 - loss: 0.0336 - val_accuracy: 0.9000 - val_loss: 0.3922
Epoch 10/10
42/42 ━━━━━━━━━━━━━━━━━━━━ 68s 2s/step - accuracy: 0.9826 - loss: 0.0447 - val_accuracy: 0.9167 - val_loss: 0.2108
```

```
test_loss, test_accuracy = model.evaluate(test_data)
print(f"Test accuracy: {test_accuracy:.2f}")
```

```
5/5 ━━━━━━━━━━━━━━━━━━━━ 9s 2s/step - accuracy: 0.9265 - loss: 0.2609
Test accuracy: 0.92
```

```
import matplotlib.pyplot as plt

# Get values from history
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs_range = range(1, len(acc) + 1)

# Plot Accuracy
plt.figure(figsize=(14, 5))

plt.subplot(1, 2, 1)
plt.plot(epochs_range, acc, label='Training Accuracy', marker='o')
plt.plot(epochs_range, val_acc, label='Validation Accuracy', marker='o')
plt.title('Training & Validation Accuracy')
plt.xlabel('Epochs')
plt.ylabel('Accuracy')
plt.legend()
plt.grid(True)

# Plot Loss
plt.subplot(1, 2, 2)
plt.plot(epochs_range, loss, label='Training Loss', marker='o')
plt.plot(epochs_range, val_loss, label='Validation Loss', marker='o')
```

```
plt.title('Training & Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.grid(True)

plt.tight_layout()
plt.show()
```




```
model.save('plant_disease_model.h5')

from google.colab import files
files.download('plant_disease_model.h5')
```

```
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This file format is consi
```

```
print(train_data.class_indices)
```

```
{'Healthy': 0, 'Powdery': 1, 'Rust': 2}
```