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Colab link: https://colab.research.google.com/drive/1u-ho-Y8LDJ0ro-0agSKmyRpdwa6jms_f?usp=sharing

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```
!pip install tensorflow tensorflow-datasets
```

```
Requirement already satisfied: tensorflow in /usr/local/lib/python3.12/dist-packages (2.19.0)
Requirement already satisfied: tensorflow-datasets in /usr/local/lib/python3.12/dist-packages (4.9.9)
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (1.4.0)
Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=24.3.25 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (25.12.19)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (0.7.0)
Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (0.2.0)
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Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (3.4.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.12/dist-packages (from tensorflow) (25.0)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<6.0.0dev,>=3.20.3 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (5.2
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (2.32.4)
Requirement already satisfied: setuptools in /usr/local/lib/python3.12/dist-packages (from tensorflow) (75.2.0)
Requirement already satisfied: six>=1.12.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (1.17.0)
Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (3.3.0)
Requirement already satisfied: typing-extensions>=3.6.6 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (4.15.0)
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Requirement already satisfied: tensorboard~=2.19.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (2.19.0)
Requirement already satisfied: keras>=3.5.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (3.10.0)
Requirement already satisfied: numpy<2.2.0,>=1.26.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (2.0.2)
Requirement already satisfied: h5py>=3.11.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (3.15.1)
Requirement already satisfied: ml-dtypes<1.0.0,>=0.5.1 in /usr/local/lib/python3.12/dist-packages (from tensorflow) (0.5.4)
Requirement already satisfied: array_record>=0.5.0 in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (0.8.3)
Requirement already satisfied: dm-tree in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (0.1.9)
Requirement already satisfied: etils>=1.9.1 in /usr/local/lib/python3.12/dist-packages (from etils[edc,enp,epath,epy,etree]>=1.9.1; python_version >= "3.11"->tensorflow-datasets
Requirement already satisfied: immutabledict in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (4.2.2)
Requirement already satisfied: promise in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (2.3)
Requirement already satisfied: psutil in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (5.9.5)
Requirement already satisfied: pyarrow in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (18.1.0)
Requirement already satisfied: simple_parsing in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (0.1.7)
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Requirement already satisfied: toml in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (0.10.2)
Requirement already satisfied: tqdm in /usr/local/lib/python3.12/dist-packages (from tensorflow-datasets) (4.67.1)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.12/dist-packages (from astunparse>=1.6.0->tensorflow) (0.45.1)
Requirement already satisfied: einops in /usr/local/lib/python3.12/dist-packages (from etils[edc,enp,epath,epy,etree]>=1.9.1; python_version >= "3.11"->tensorflow-datasets) (0.8
Requirement already satisfied: fsspec in /usr/local/lib/python3.12/dist-packages (from etils[edc,enp,epath,epy,etree]>=1.9.1; python_version >= "3.11"->tensorflow-datasets) (202
Requirement already satisfied: importlib_resources in /usr/local/lib/python3.12/dist-packages (from etils[edc,enp,epath,epy,etree]>=1.9.1; python_version >= "3.11"->tensorflow-d
Requirement already satisfied: zipp in /usr/local/lib/python3.12/dist-packages (from etils[edc,enp,epath,epy,etree]>=1.9.1; python_version >= "3.11"->tensorflow-datasets) (3.23
Requirement already satisfied: rich in /usr/local/lib/python3.12/dist-packages (from keras>=3.5.0->tensorflow) (13.9.4)
Requirement already satisfied: namex in /usr/local/lib/python3.12/dist-packages (from keras>=3.5.0->tensorflow) (0.1.0)
Requirement already satisfied: optree in /usr/local/lib/python3.12/dist-packages (from keras>=3.5.0->tensorflow) (0.18.0)
Requirement already satisfied: charset_normalizer<4,>=2 in /usr/local/lib/python3.12/dist-packages (from requests<3,>=2.21.0->tensorflow) (3.4.4)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.12/dist-packages (from requests<3,>=2.21.0->tensorflow) (3.11)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.12/dist-packages (from requests<3,>=2.21.0->tensorflow) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.12/dist-packages (from requests<3,>=2.21.0->tensorflow) (2026.1.4)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.12/dist-packages (from tensorboard~=2.19.0->tensorflow) (3.10)
```

```
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in /usr/local/lib/python3.12/dist-packages (from tensorboard~=2.19.0->tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.12/dist-packages (from tensorboard~=2.19.0->tensorflow) (3.1.5)
Requirement already satisfied: attrs>=18.2.0 in /usr/local/lib/python3.12/dist-packages (from dm-tree->tensorflow-datasets) (25.4.0)
Requirement already satisfied: docstring-parser<1.0,>=0.15 in /usr/local/lib/python3.12/dist-packages (from simple_parsing->tensorflow-datasets) (0.17.0)
Requirement already satisfied: googleapis-common-protos<2,>=1.56.4 in /usr/local/lib/python3.12/dist-packages (from tensorflow-metadata->tensorflow-datasets) (1.72.0)
Requirement already satisfied: markupsafe>=2.1.1 in /usr/local/lib/python3.12/dist-packages (from werkzeug>=1.0.1->tensorboard~=2.19.0->tensorflow) (3.0.3)
Requirement already satisfied: markdown-it-py>=2.2.0 in /usr/local/lib/python3.12/dist-packages (from rich->keras>=3.5.0->tensorflow) (4.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.12/dist-packages (from rich->keras>=3.5.0->tensorflow) (2.19.2)
Requirement already satisfied: mdurl~=0.1 in /usr/local/lib/python3.12/dist-packages (from markdown-it-py>=2.2.0->rich->keras>=3.5.0->tensorflow) (0.1.2)
```

```
import tensorflow as tf
from tensorflow.keras import layers, models
import tensorflow_datasets as tfds
import matplotlib.pyplot as plt
```

```
# Load dataset
(ds_train, ds_test), ds_info = tfds.load(
    'plant_village',
    split=['train[:20%]', 'train[20%:25%]'],  # small subset
    as_supervised=True,
    with_info=True
)
```

```
WARNING:absl:Variant folder /root/tensorflow_datasets/plant_village/1.0.2 has no dataset_info.json
Downloading and preparing dataset Unknown size (download: Unknown size, generated: Unknown size, total: Unknown size) to /root/tensorflow_datasets/plant_village/1.0.2...
```

DI Completed...: 100% 1/1 [03:32<00:00, 38.36s/ url]

DI Size...: 100% 827/827 [03:32<00:00, 17.02 MiB/s]

Extraction completed...: 100% 55448/55448 [03:32<00:00, 1343.21 file/s]

```
Dataset plant_village downloaded and prepared to /root/tensorflow_datasets/plant_village/1.0.2. Subsequent calls will reuse this data.
```

```
print("Number of classes:", ds_info.features['label'].num_classes)
```

```
Number of classes: 38
```

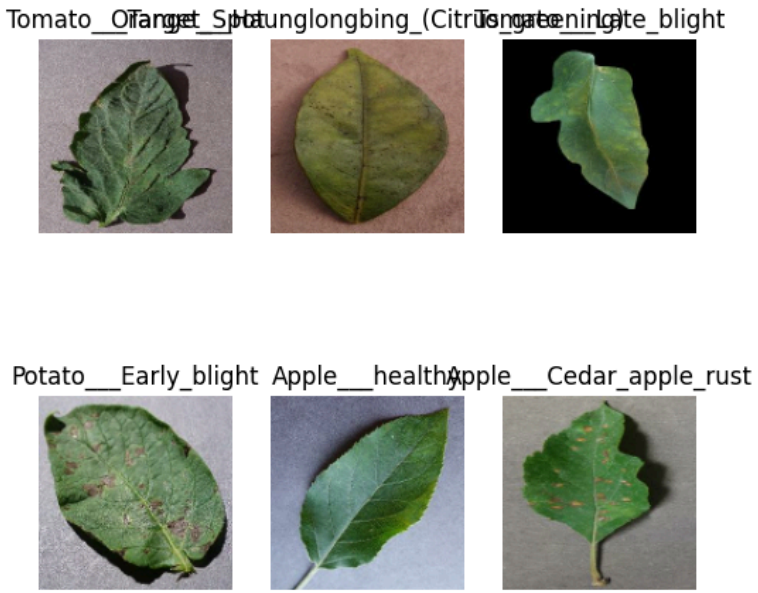
```
IMG_SIZE = 128
BATCH_SIZE = 32

def preprocess(image, label):
    image = tf.image.resize(image, (IMG_SIZE, IMG_SIZE))
    image = image / 255.0
    return image, label

ds_train = ds_train.map(preprocess).batch(BATCH_SIZE).prefetch(tf.data.AUTOTUNE)
ds_test = ds_test.map(preprocess).batch(BATCH_SIZE).prefetch(tf.data.AUTOTUNE)
```

```
class_names = ds_info.features['label'].names
```

```
plt.figure(figsize=(6,6))
for images, labels in ds_train.take(1):
    for i in range(6):
        ax = plt.subplot(2, 3, i + 1)
        plt.imshow(images[i])
        plt.title(class_names[labels[i]])
        plt.axis("off")
plt.show()
```




```
model = models.Sequential([
    layers.Conv2D(32, (3,3), activation='relu', input_shape=(IMG_SIZE, IMG_SIZE, 3)),
    layers.MaxPooling2D(2,2),

    layers.Conv2D(64, (3,3), activation='relu'),
    layers.MaxPooling2D(2,2),

    layers.Flatten(),
    layers.Dense(128, activation='relu'),
    layers.Dropout(0.5),
    layers.Dense(ds_info.features['label'].num_classes, activation='softmax')
])
```

```
/usr/local/lib/python3.12/dist-packages/keras/src/layers/convolutional/base_conv.py:113: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Se
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

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

model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_1 (Conv2D)	(None, 61, 61, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 30, 30, 64)	0
flatten (Flatten)	(None, 57600)	0
dense (Dense)	(None, 128)	7,372,928
dropout (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 38)	4,902

Total params: 7,397,222 (28.22 MB)

```
history = model.fit(
    ds_train,
    validation_data=ds_test,
    epochs=10
)
```

```
Epoch 1/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 328s 956ms/step - accuracy: 0.2330 - loss: 3.0900 - val_accuracy: 0.5208 - val_loss: 1.6796
Epoch 2/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 375s 937ms/step - accuracy: 0.4981 - loss: 1.8260 - val_accuracy: 0.6534 - val_loss: 1.1818
Epoch 3/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 321s 935ms/step - accuracy: 0.5849 - loss: 1.4457 - val_accuracy: 0.6832 - val_loss: 1.0504
Epoch 4/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 319s 938ms/step - accuracy: 0.6391 - loss: 1.2009 - val_accuracy: 0.7282 - val_loss: 0.9019
Epoch 5/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 332s 977ms/step - accuracy: 0.6783 - loss: 1.0435 - val_accuracy: 0.7521 - val_loss: 0.8117
Epoch 6/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 320s 940ms/step - accuracy: 0.7018 - loss: 0.9410 - val_accuracy: 0.7716 - val_loss: 0.7347
Epoch 7/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 312s 918ms/step - accuracy: 0.7281 - loss: 0.8358 - val_accuracy: 0.7687 - val_loss: 0.7759
Epoch 8/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 321s 943ms/step - accuracy: 0.7555 - loss: 0.7504 - val_accuracy: 0.7720 - val_loss: 0.7638
Epoch 9/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 328s 964ms/step - accuracy: 0.7778 - loss: 0.6623 - val_accuracy: 0.7761 - val_loss: 0.7287
Epoch 10/10
340/340 ━━━━━━━━━━━━━━━━━━━━ 316s 930ms/step - accuracy: 0.7943 - loss: 0.6199 - val_accuracy: 0.7831 - val_loss: 0.7162
```

```
test_loss, test_accuracy = model.evaluate(ds_test)
print("Test Accuracy:", test_accuracy)
```

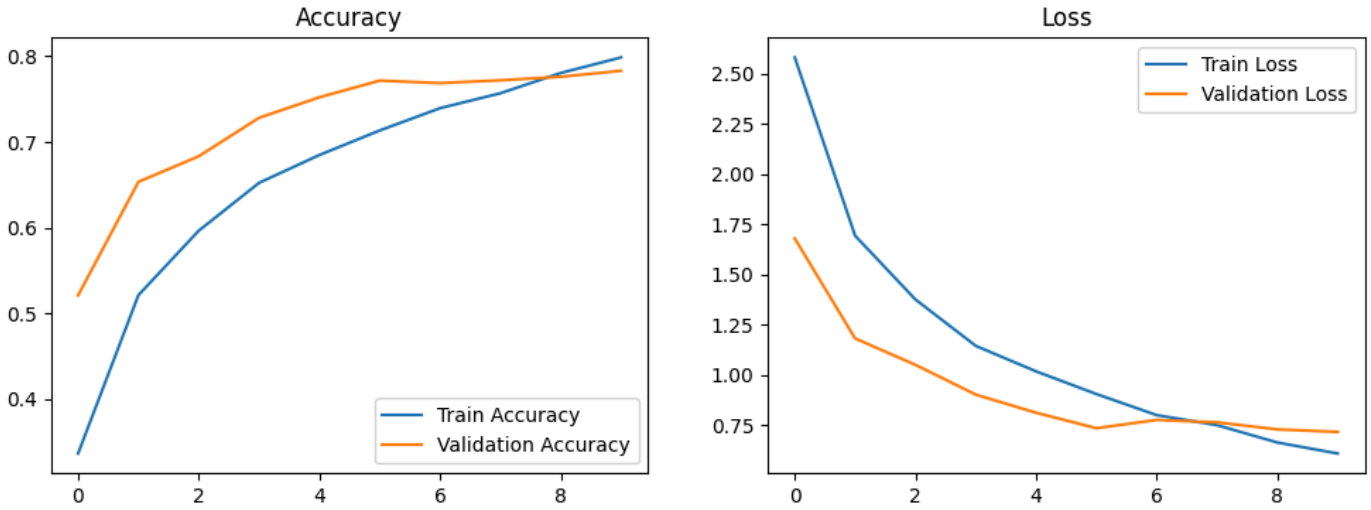
```
85/85 ━━━━━━━━━━━━━━━━━━━━ 23s 273ms/step - accuracy: 0.7868 - loss: 0.7094
Test Accuracy: 0.7830570936203003
```

```
plt.figure(figsize=(12,4))

plt.subplot(1,2,1)
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.legend()
plt.title('Accuracy')

plt.subplot(1,2,2)
plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.legend()
plt.title('Loss')

plt.show()
```




```
from google.colab import files
uploaded = files.upload()
```

```
Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving WhatsApp Image 2026-01-28 at 8.38.32 PM.jpeg to WhatsApp Image 2026-01-28 at 8.38.32 PM.jpeg
```

```
import numpy as np
from tensorflow.keras.preprocessing import image
```

```
img_path = list(uploaded.keys())[0]

img = image.load_img(img_path, target_size=(IMG_SIZE, IMG_SIZE))
img_array = image.img_to_array(img) / 255.0
img_array = np.expand_dims(img_array, axis=0)

prediction = model.predict(img_array)
predicted_class = class_names[np.argmax(prediction)]

print("Predicted Disease:", predicted_class)

plt.imshow(img)
plt.axis("off")
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 179ms/step
Predicted Disease: Pepper,_bell___healthy
(np.float64(-0.5), np.float64(127.5), np.float64(127.5), np.float64(-0.5))
```