```
In [ ]: !pip install tensorflow
```

Requirement already satisfied: tensorflow in /usr/local/lib/python3.10/dist-packages (2.
15.0)
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.10/dist-packages
(from tensorflow) (1.4.0)
Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.10/dist-packa
ges (from tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=23.5.26 in /usr/local/lib/python3.10/dist-pa
ckages (from tensorflow) (24.3.25)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in /usr/local/lib/pyt
hon3.10/dist-packages (from tensorflow) (0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.10/dist-pac
kages (from tensorflow) (0.2.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.10/dist-packages (f
rom tensorflow) (3.11.0)
Requirement already satisfied: libclang>=13.0.0 in /usr/local/lib/python3.10/dist-packag
es (from tensorflow) (18.1.1)
Requirement already satisfied: ml-dtypes~=0.2.0 in /usr/local/lib/python3.10/dist-packag
es (from tensorflow) (0.2.0)
Requirement already satisfied: numpy<2.0.0,>=1.23.5 in /usr/local/lib/python3.10/dist-pa
ckages (from tensorflow) (1.26.4)
Requirement already satisfied: opt-einsum>=2.3.2 in /usr/local/lib/python3.10/dist-packa
ges (from tensorflow) (3.3.0)
Requirement already satisfied: packaging in /usr/local/lib/python3.10/dist-packages (fro
m tensorflow) (24.1)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.
21.5,<5.0.0dev,>=3.20.3 in /usr/local/lib/python3.10/dist-packages (from tensorflow) (3.
20.3)
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (fr
om tensorflow) (71.0.4)
Requirement already satisfied: six>=1.12.0 in /usr/local/lib/python3.10/dist-packages (f
rom tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in /usr/local/lib/python3.10/dist-packag
es (from tensorflow) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in /usr/local/lib/python3.10/dis
t-packages (from tensorflow) (4.12.2)
Requirement already satisfied: wrapt<1.15,>=1.11.0 in /usr/local/lib/python3.10/dist-pac
kages (from tensorflow) (1.14.1)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in /usr/local/lib/py
thon3.10/dist-packages (from tensorflow) (0.37.1)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in /usr/local/lib/python3.10/dist-pac
kages (from tensorflow) (1.64.1)
Requirement already satisfied: tensorboard<2.16,>=2.15 in /usr/local/lib/python3.10/dist
-packages (from tensorflow) (2.15.2)
Requirement already satisfied: tensorflow-estimator<2.16,>=2.15.0 in /usr/local/lib/pyth
on3.10/dist-packages (from tensorflow) (2.15.0)
Requirement already satisfied: keras<2.16,>=2.15.0 in /usr/local/lib/python3.10/dist-pac
kages (from tensorflow) (2.15.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.10/dist-pack
ages (from astunparse>=1.6.0->tensorflow) (0.43.0)
Requirement already satisfied: google-auth<3,>=1.6.3 in /usr/local/lib/python3.10/dist-p
ackages (from tensorboard<2.16,>=2.15->tensorflow) (2.27.0)
Requirement already satisfied: google-auth-oauthlib<2,>=0.5 in /usr/local/lib/python3.1
0/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (1.2.1)
Requirement already satisfied: markdown>=2.6.8 in /usr/local/lib/python3.10/dist-package
s (from tensorboard<2.16,>=2.15->tensorflow) (3.6)
Requirement already satisfied: requests<3,>=2.21.0 in /usr/local/lib/python3.10/dist-pac
kages (from tensorboard<2.16,>=2.15->tensorflow) (2.31.0)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in /usr/local/lib/p
ython3.10/dist-packages (from tensorboard<2.16,>=2.15->tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in /usr/local/lib/python3.10/dist-package
s (from tensorboard<2.16,>=2.15->tensorflow) (3.0.3)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in /usr/local/lib/python3.10/dist-

```
packages (from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (5.4.0)
Requirement already satisfied: pyasn1-modules>=0.2.1 in /usr/local/lib/python3.10/dist-p
ackages (from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (0.4.0)
Requirement already satisfied: rsa<5,>=3.1.4 in /usr/local/lib/python3.10/dist-packages
(from google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tensorflow) (4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in /usr/local/lib/python3.10/dis
t-packages (from google-auth-oauthlib<2,>=0.5->tensorboard<2.16,>=2.15->tensorflow) (1.
3.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.10/dis
t-packages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.10/dist-packages
(from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.10/dist-pack
ages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (2.0.7)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.10/dist-pack
ages (from requests<3,>=2.21.0->tensorboard<2.16,>=2.15->tensorflow) (2024.7.4)
Requirement already satisfied: MarkupSafe>=2.1.1 in /usr/local/lib/python3.10/dist-packa
ges (from werkzeug>=1.0.1->tensorboard<2.16,>=2.15->tensorflow) (2.1.5)
Requirement already satisfied: pyasn1<0.7.0,>=0.4.6 in /usr/local/lib/python3.10/dist-pa
ckages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard<2.16,>=2.15->tens
orflow) (0.6.0)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.10/dist-package
s (from requests-oauthlib>=0.7.0->google-auth-oauthlib<2,>=0.5->tensorboard<2.16,>=2.15-
>tensorflow) (3.2.2)
```

In [ ]:
```python
from tensorflow.keras.layers import Input, Lambda, Dense, Flatten
from tensorflow.keras.models import Model
from tensorflow.keras.applications.resnet50 import ResNet50
#from keras.applications.vgg16 import VGG16
from tensorflow.keras.applications.resnet50 import preprocess_input
from tensorflow.keras.preprocessing import image
from tensorflow.keras.preprocessing.image import ImageDataGenerator,load_img
from tensorflow.keras.models import Sequential
import numpy as np
import tensorflow as tf
```

In [ ]:
```python
from tensorflow.compat.v1 import ConfigProto
from tensorflow.compat.v1 import InteractiveSession

config = ConfigProto()
config.gpu_options.per_process_gpu_memory_fraction = 0.5
config.gpu_options.allow_growth = True
session = InteractiveSession(config=config)
```

In [ ]:
```python
IMAGE_SIZE=[224,224]

train_path='Datasets/train'
valid_path='Datasets/val'
```

In [ ]:
```python
resnet=ResNet50(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)
```
```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/resne
t/resnet50_weights_tf_dim_ordering_tf_kernels_notop.h5
94765736/94765736 [==============================] - 1s 0us/step
```

In [ ]:
```python
for layer in resnet.layers:
    layer.trainable=False
```

In [ ]:
```python
import glob
folders=glob.glob("/content/drive/MyDrive/Datasets/train/*")
folders
```

Out[ ]:
```
['/content/drive/MyDrive/Datasets/train/diseased cotton leaf',
 '/content/drive/MyDrive/Datasets/train/fresh cotton plant',
```

```
    '/content/drive/MyDrive/Datasets/train/diseased cotton plant',
    '/content/drive/MyDrive/Datasets/train/fresh cotton leaf']
```

In [ ]:
```python
train_datagen = ImageDataGenerator(rescale=1./255)
val_datagen = ImageDataGenerator(rescale=1./255)

training_set = train_datagen.flow_from_directory(
    '/content/drive/MyDrive/Datasets/train',
    target_size=(224, 224),
    batch_size=32,
    class_mode='categorical'
)

validation_set = val_datagen.flow_from_directory(
    '/content/drive/MyDrive/Datasets/val',
    target_size=(224, 224),
    batch_size=32,
    class_mode='categorical'
)
```

```
Found 1951 images belonging to 4 classes.
Found 324 images belonging to 4 classes.
```

In [ ]:
```python
train_dataset = tf.data.Dataset.from_generator(
    lambda: training_set,
    output_signature=(
        tf.TensorSpec(shape=(None, 224, 224, 3), dtype=tf.float32),
        tf.TensorSpec(shape=(None, training_set.num_classes), dtype=tf.float32)
    )
).repeat()

val_dataset = tf.data.Dataset.from_generator(
    lambda: validation_set,
    output_signature=(
        tf.TensorSpec(shape=(None, 224, 224, 3), dtype=tf.float32),
        tf.TensorSpec(shape=(None, validation_set.num_classes), dtype=tf.float32)
    )
).repeat()
```

In [ ]:
```python
base_model = ResNet50(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Add Custom Layers
x = Flatten()(base_model.output)
x = Dense(1024, activation='relu')(x)
predictions = Dense(training_set.num_classes, activation='softmax')(x)

# Create the Model
model = Model(inputs=base_model.input, outputs=predictions)

# Compile the Model
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])
```

In [ ]:
```python
steps_per_epoch = training_set.samples // training_set.batch_size
validation_steps = validation_set.samples // validation_set.batch_size

# Train the Model
r = model.fit(
    train_dataset,
    validation_data=val_dataset,
    epochs=20,
    steps_per_epoch=steps_per_epoch,
    validation_steps=validation_steps
)
```

```
Epoch 1/20
```

```
60/60 [==============================] - 2085s 34s/step - loss: 7.2444 - accuracy: 0.600
5 - val_loss: 860.1390 - val_accuracy: 0.1656
Epoch 2/20
60/60 [==============================] - 1945s 32s/step - loss: 0.7220 - accuracy: 0.759
2 - val_loss: 15.7675 - val_accuracy: 0.2432
Epoch 3/20
60/60 [==============================] - 1777s 30s/step - loss: 0.5088 - accuracy: 0.887
4 - val_loss: 15.0211 - val_accuracy: 0.2432
Epoch 4/20
60/60 [==============================] - 1679s 28s/step - loss: 0.3020 - accuracy: 0.930
7 - val_loss: 8.9411 - val_accuracy: 0.2432
Epoch 5/20
60/60 [==============================] - 1648s 28s/step - loss: 0.2450 - accuracy: 0.943
7 - val_loss: 4.8900 - val_accuracy: 0.2500
Epoch 6/20
60/60 [==============================] - 1742s 29s/step - loss: 0.2870 - accuracy: 0.930
2 - val_loss: 18.4505 - val_accuracy: 0.2363
Epoch 7/20
60/60 [==============================] - 1682s 28s/step - loss: 0.0803 - accuracy: 0.977
6 - val_loss: 7.2107 - val_accuracy: 0.3048
Epoch 8/20
60/60 [==============================] - ETA: 0s - loss: 0.0601 - accuracy: 0.9828
```

In [ ]: