In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import os

import keras
```

In [2]:
```
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras import layers
from tensorflow.keras.callbacks import EarlyStopping
```

In [3]:
```
# Set up data generators with data augmentation
train_datagen = ImageDataGenerator(
    zoom_range=0.5,              # Randomly zoom in/out on the image
    shear_range=0.3,             # Randomly apply shearing transformation
    rescale=1/255,               # Rescale pixel values to [0, 1]
    horizontal_flip=True,        # Randomly flip the image horizontally
    vertical_flip=True,          # Randomly flip the image vertically
    rotation_range=90,           # Randomly rotate the image between -90 and 90 degrees
    brightness_range=[0.2, 1.0], # Randomly adjust the brightness of the image
)

val_datagen = ImageDataGenerator(rescale=1/255)

# Create a generator for training data with augmentation
train_generator = train_datagen.flow_from_directory(
    directory='Dataset/train',
    target_size=(256, 256),
    batch_size=32,
    class_mode='categorical'
)

# Create a generator for validation data without augmentation
val_generator = val_datagen.flow_from_directory(
    directory='Dataset/valid',
    target_size=(256, 256),
    batch_size=32,
    class_mode='categorical'
)
```

```
Found 70295 images belonging to 38 classes.
Found 17572 images belonging to 38 classes.
```

In [4]:
```
t_img, label = train_generator.next()
```

In [5]:
```
t_img.shape
```

Out[5]:
```
(32, 256, 256, 3)
```

In [6]:
```
class_names = list(train_generator.class_indices.keys())
class_names
```

Out[6]:
```
['Apple___Apple_scab',
 'Apple___Black_rot',
 'Apple___Cedar_apple_rust',
 'Apple___healthy',
 'Blueberry___healthy',
 'Cherry_(including_sour)___Powdery_mildew',
 'Cherry_(including_sour)___healthy',
 'Corn_(maize)___Cercospora_leaf_spot Gray_leaf_spot',
 'Corn_(maize)___Common_rust_',
 'Corn_(maize)___Northern_Leaf_Blight',
 'Corn_(maize)___healthy',
 'Grape___Black_rot',
 'Grape___Esca_(Black_Measles)',
 'Grape___Leaf_blight_(Isariopsis_Leaf_Spot)',
 'Grape___healthy',
 'Orange___Haunglongbing_(Citrus_greening)',
 'Peach___Bacterial_spot',
 'Peach___healthy',
 'Pepper,_bell___Bacterial_spot',
 'Pepper,_bell___healthy',
 'Potato___Early_blight',
 'Potato___Late_blight',
 'Potato___healthy',
 'Raspberry___healthy',
 'Soybean___healthy',
 'Squash___Powdery_mildew',
 'Strawberry___Leaf_scorch',
 'Strawberry___healthy',
 'Tomato___Bacterial_spot',
 'Tomato___Early_blight',
 'Tomato___Late_blight',
 'Tomato___Leaf_Mold',
 'Tomato___Septoria_leaf_spot',
 'Tomato___Spider_mites Two-spotted_spider_mite',
 'Tomato___Target_Spot',
 'Tomato___Tomato_Yellow_Leaf_Curl_Virus',
 'Tomato___Tomato_mosaic_virus',
 'Tomato___healthy']
```

In [*]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 10))
images, labels = next(train_generator)

for i in range(12):
    ax = plt.subplot(4, 3, i+1)
    plt.imshow(images[i])
    plt.title(class_names[labels[i].argmax()])
    plt.axis("off")
```

In [8]:
```
# Define the model architecture
model = tf.keras.Sequential([
    layers.Conv2D(32, (3, 3), activation='relu', input_shape=(256, 256, 3)),
    layers.MaxPooling2D((2, 2)),

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

    layers.Conv2D(128, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),

    layers.Conv2D(256, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),

    layers.Flatten(),

    layers.Dense(512, activation='relu'),
    layers.Dropout(0.5),

    layers.Dense(38, activation='softmax')
])
```

```
Metal device set to: Apple M1
```

In [9]:
```
# Compile the model
model.compile(
    optimizer='adam',
    loss='categorical_crossentropy',
    metrics=['accuracy']
)
```

In [10]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 254, 254, 32)      896

 max_pooling2d (MaxPooling2D  (None, 127, 127, 32)     0
 )

 conv2d_1 (Conv2D)           (None, 125, 125, 64)      18496

 max_pooling2d_1 (MaxPooling  (None, 62, 62, 64)       0
 2D)

 conv2d_2 (Conv2D)           (None, 60, 60, 128)       73856

 max_pooling2d_2 (MaxPooling  (None, 30, 30, 128)      0
 2D)

 conv2d_3 (Conv2D)           (None, 28, 28, 256)       295168

 max_pooling2d_3 (MaxPooling  (None, 14, 14, 256)      0
 2D)

 flatten (Flatten)           (None, 50176)             0

 dense (Dense)               (None, 512)               25690624

 dropout (Dropout)           (None, 512)               0

 dense_1 (Dense)             (None, 38)                19494

=================================================================
Total params: 26,098,534
Trainable params: 26,098,534
Non-trainable params: 0
_________________________________________________________________
```

In [11]:
```
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint

# Define the callbacks
early_stop = EarlyStopping(monitor='val_loss', patience=5)

model_checkpoint = ModelCheckpoint('best_model.h5',
                                   save_best_only=True,
                                   save_weights_only=False)



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



# Train the model with the callbacks
history = model.fit(train_generator,
                    validation_data=val_generator,
                    epochs=40,
                    callbacks=[early_stop, model_checkpoint],
                   shuffle=True)
```

```
Epoch 1/40

2023-04-22 08:53:12.037942: W tensorflow/tsl/platform/profile_utils/cpu_utils.cc:128] Failed to get CPU frequency: 0 Hz

2197/2197 [==============================] - 786s 358ms/step - loss: 1.8716 - accuracy: 0.4507 - val_loss: 0.9362 - val_accurac
y: 0.7095
Epoch 2/40
2197/2197 [==============================] - 842s 383ms/step - loss: 0.8128 - accuracy: 0.7450 - val_loss: 0.5604 - val_accurac
y: 0.8202
Epoch 3/40
2197/2197 [==============================] - 802s 365ms/step - loss: 0.5964 - accuracy: 0.8110 - val_loss: 0.3796 - val_accurac
y: 0.8818
Epoch 4/40
2197/2197 [==============================] - 798s 363ms/step - loss: 0.4987 - accuracy: 0.8436 - val_loss: 0.3743 - val_accurac
y: 0.8860
Epoch 5/40
2197/2197 [==============================] - 822s 374ms/step - loss: 0.4405 - accuracy: 0.8609 - val_loss: 0.3389 - val_accurac
y: 0.8958
Epoch 6/40
2197/2197 [==============================] - 811s 369ms/step - loss: 0.3939 - accuracy: 0.8745 - val_loss: 0.3062 - val_accurac
y: 0.9062
Epoch 7/40
2197/2197 [==============================] - 818s 372ms/step - loss: 0.3720 - accuracy: 0.8817 - val_loss: 0.4674 - val_accurac
y: 0.8654
Epoch 8/40
2197/2197 [==============================] - 833s 379ms/step - loss: 0.3449 - accuracy: 0.8910 - val_loss: 0.2446 - val_accurac
y: 0.9274
Epoch 9/40
2197/2197 [==============================] - 807s 367ms/step - loss: 0.3306 - accuracy: 0.8957 - val_loss: 0.2450 - val_accurac
y: 0.9208
Epoch 10/40
2197/2197 [==============================] - 795s 362ms/step - loss: 0.3201 - accuracy: 0.9017 - val_loss: 0.2292 - val_accurac
y: 0.9324
Epoch 11/40
2197/2197 [==============================] - 799s 364ms/step - loss: 0.2991 - accuracy: 0.9065 - val_loss: 0.2582 - val_accurac
y: 0.9261
Epoch 12/40
2197/2197 [==============================] - 793s 361ms/step - loss: 0.2981 - accuracy: 0.9070 - val_loss: 0.2035 - val_accurac
y: 0.9362
Epoch 13/40
2197/2197 [==============================] - 803s 365ms/step - loss: 0.2810 - accuracy: 0.9136 - val_loss: 0.2948 - val_accurac
y: 0.9116
Epoch 14/40
2197/2197 [==============================] - 792s 360ms/step - loss: 0.2845 - accuracy: 0.9116 - val_loss: 0.2038 - val_accurac
y: 0.9377
Epoch 15/40
2197/2197 [==============================] - 775s 353ms/step - loss: 0.2737 - accuracy: 0.9164 - val_loss: 0.1864 - val_accurac
y: 0.9408
Epoch 16/40
2197/2197 [==============================] - 783s 356ms/step - loss: 0.2660 - accuracy: 0.9182 - val_loss: 0.2185 - val_accurac
y: 0.9328
Epoch 17/40
2197/2197 [==============================] - 796s 362ms/step - loss: 0.2622 - accuracy: 0.9187 - val_loss: 0.1384 - val_accurac
y: 0.9565
Epoch 18/40
2197/2197 [==============================] - 948s 431ms/step - loss: 0.2534 - accuracy: 0.9212 - val_loss: 0.1462 - val_accurac
y: 0.9545
Epoch 19/40
2197/2197 [==============================] - 910s 414ms/step - loss: 0.2522 - accuracy: 0.9234 - val_loss: 0.1785 - val_accurac
y: 0.9449
Epoch 20/40
2197/2197 [==============================] - 915s 417ms/step - loss: 0.2502 - accuracy: 0.9229 - val_loss: 0.2465 - val_accurac
y: 0.9303
Epoch 21/40
2197/2197 [==============================] - 961s 437ms/step - loss: 0.2517 - accuracy: 0.9242 - val_loss: 0.2139 - val_accurac
y: 0.9364
Epoch 22/40
2197/2197 [==============================] - 999s 455ms/step - loss: 0.2423 - accuracy: 0.9263 - val_loss: 0.2282 - val_accurac
y: 0.9368
```

In [12]:
```
# # Define early stopping to prevent overfitting
# early_stop = EarlyStopping(monitor='val_loss', patience=)

# # Train the model
# history = model.fit(
#     train_generator,
#     validation_data=val_generator,
#     epochs=40,
#     callbacks=[early_stop]
# )
```

In [13]:
```
model.save('my_model_v5.h5')
```

In [14]:
```
acc = model.evaluate_generator(val_generator)[1]

print(f"The accuracy of your model is {acc *100} %")
```

```
/var/folders/f5/xb4v70_j0lj5t85gdv_td55c0000gn/T/ipykernel_8787/2485115042.py:1: UserWarning: `Model.evaluate_generator` is depr
ecated and will be removed in a future version. Please use `Model.evaluate`, which supports generators.
  acc = model.evaluate_generator(val_generator)[1]

The accuracy of your model is 93.67744326591492 %
```

In [15]:
```
ref = dict(zip(list(train_generator.class_indices.values()) , list(train_generator.class_indices.keys())))
```

In [16]:
```
import pickle
with open('ref.pickle', 'wb') as handle:
    pickle.dump(ref, handle, protocol=pickle.HIGHEST_PROTOCOL)
```

In [26]:
```
from keras.models import load_model
model = load_model("/Users/shankalpapokharel/AI Projects/gpu_ipd/best_model.h5")
```

In [30]:
```
from tensorflow.keras.preprocessing.image import load_img, img_to_array

def prediction(path):

    # Load the image and resize it to (256, 256)
    img = load_img(path, target_size = (256, 256))

    # Convert the image to a NumPy array
    x = img_to_array(img)

    # Add an extra dimension to the array to create a batch of size 1
    x = np.expand_dims(x, axis=0)

    # Scale the pixel values to the range [0, 1]
    x = x/255.0

    # Make a prediction using the trained model
    predictions = model.predict(x)

    # Get the index of the predicted class
    pred = np.argmax(predictions)

    # Look up the predicted class name using the ref dictionary
    predicted_class = ref[pred]

    # Calculate the confidence level for the prediction
    confidence = round(100 * np.max(predictions[0]), 2)

    # Return the predicted class name and confidence level
    return predicted_class, confidence
```

In [31]:
```
path = "/Users/shankalpapokharel/AI Projects/gpu_ipd/Dataset/test/AppleCedarRust2.JPG"
```

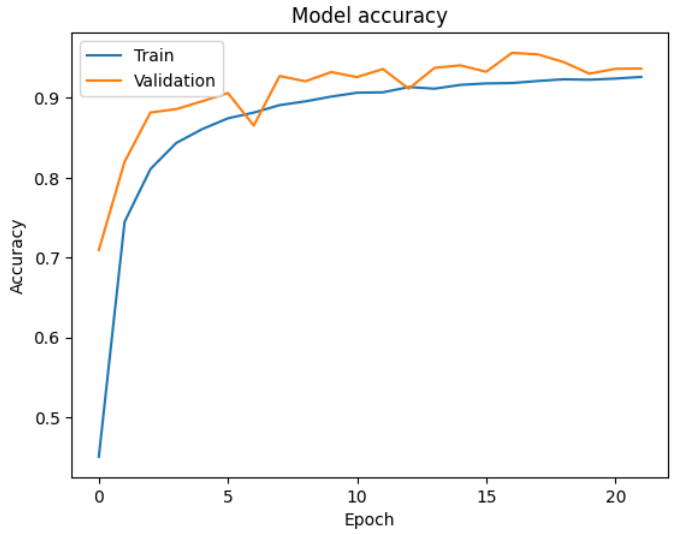
In [32]:
```
prediction(path)
```

```
1/1 [==============================] - 1s 778ms/step
```

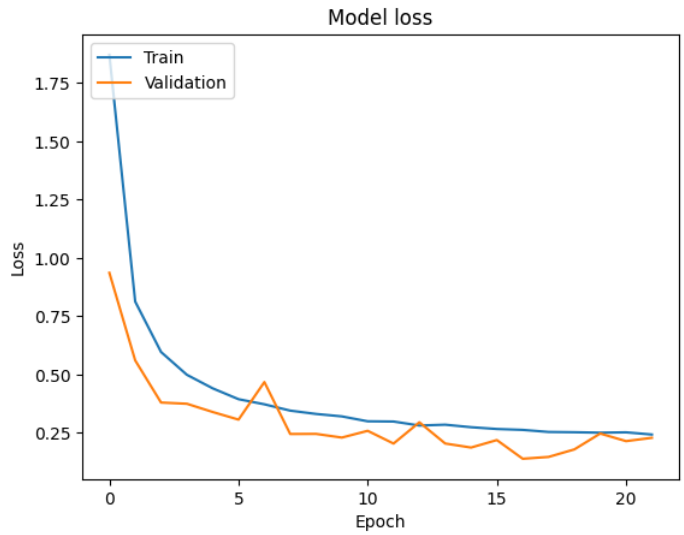
Out[32]:
```
('Apple___Cedar_apple_rust', 99.67)
```

In [33]:
```
import matplotlib.pyplot as plt

# Plot training & validation accuracy values
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



In [34]:
```
# Plot training & validation loss values
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Model loss')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



In [35]:
```
train_generator.class_indices
```

Out[35]:
```
{'Apple___Apple_scab': 0,
 'Apple___Black_rot': 1,
 'Apple___Cedar_apple_rust': 2,
 'Apple___healthy': 3,
 'Blueberry___healthy': 4,
 'Cherry_(including_sour)___Powdery_mildew': 5,
 'Cherry_(including_sour)___healthy': 6,
 'Corn_(maize)___Cercospora_leaf_spot Gray_leaf_spot': 7,
 'Corn_(maize)___Common_rust_': 8,
 'Corn_(maize)___Northern_Leaf_Blight': 9,
 'Corn_(maize)___healthy': 10,
 'Grape___Black_rot': 11,
 'Grape___Esca_(Black_Measles)': 12,
 'Grape___Leaf_blight_(Isariopsis_Leaf_Spot)': 13,
 'Grape___healthy': 14,
 'Orange___Haunglongbing_(Citrus_greening)': 15,
 'Peach___Bacterial_spot': 16,
 'Peach___healthy': 17,
 'Pepper,_bell___Bacterial_spot': 18,
 'Pepper,_bell___healthy': 19,
 'Potato___Early_blight': 20,
 'Potato___Late_blight': 21,
 'Potato___healthy': 22,
 'Raspberry___healthy': 23,
 'Soybean___healthy': 24,
 'Squash___Powdery_mildew': 25,
 'Strawberry___Leaf_scorch': 26,
 'Strawberry___healthy': 27,
 'Tomato___Bacterial_spot': 28,
 'Tomato___Early_blight': 29,
 'Tomato___Late_blight': 30,
 'Tomato___Leaf_Mold': 31,
 'Tomato___Septoria_leaf_spot': 32,
 'Tomato___Spider_mites Two-spotted_spider_mite': 33,
 'Tomato___Target_Spot': 34,
 'Tomato___Tomato_Yellow_Leaf_Curl_Virus': 35,
 'Tomato___Tomato_mosaic_virus': 36,
 'Tomato___healthy': 37}
```

In [37]:
```
train_generator.class_indices.keys()
```

Out[37]:
```
dict_keys(['Apple___Apple_scab', 'Apple___Black_rot', 'Apple___Cedar_apple_rust', 'Apple___healthy', 'Blueberry___healthy', 'Cherry_(including_sour)___Powdery_mildew', 'Cherry_(including_sour)___healthy', 'Corn_(maize)___Cercospora_leaf_spot Gray_leaf_spot', 'Corn_(maize)___Common_rust_', 'Corn_(maize)___Northern_Leaf_Blight', 'Corn_(maize)___healthy', 'Grape___Black_rot', 'Grape___Esca_(Black_Measles)', 'Grape___Leaf_blight_(Isariopsis_Leaf_Spot)', 'Grape___healthy', 'Orange___Haunglongbing_(Citrus_greening)', 'Peach___Bacterial_spot', 'Peach___healthy', 'Pepper,_bell___Bacterial_spot', 'Pepper,_bell___healthy', 'Potato___Early_blight', 'Potato___Late_blight', 'Potato___healthy', 'Raspberry___healthy', 'Soybean___healthy', 'Squash___Powdery_mildew', 'Strawberry___Leaf_scorch', 'Strawberry___healthy', 'Tomato___Bacterial_spot', 'Tomato___Early_blight', 'Tomato___Late_blight', 'Tomato___Leaf_Mold', 'Tomato___Septoria_leaf_spot', 'Tomato___Spider_mites Two-spotted_spider_mite', 'Tomato___Target_Spot', 'Tomato___Tomato_Yellow_Leaf_Curl_Virus', 'Tomato___Tomato_mosaic_virus', 'Tomato___healthy'])
```

In [38]:
```
list(train_generator.class_indices.keys())
```

Out[38]:
```
['Apple___Apple_scab',
 'Apple___Black_rot',
 'Apple___Cedar_apple_rust',
 'Apple___healthy',
 'Blueberry___healthy',
 'Cherry_(including_sour)___Powdery_mildew',
 'Cherry_(including_sour)___healthy',
 'Corn_(maize)___Cercospora_leaf_spot Gray_leaf_spot',
 'Corn_(maize)___Common_rust_',
 'Corn_(maize)___Northern_Leaf_Blight',
 'Corn_(maize)___healthy',
 'Grape___Black_rot',
 'Grape___Esca_(Black_Measles)',
 'Grape___Leaf_blight_(Isariopsis_Leaf_Spot)',
 'Grape___healthy',
 'Orange___Haunglongbing_(Citrus_greening)',
 'Peach___Bacterial_spot',
 'Peach___healthy',
 'Pepper,_bell___Bacterial_spot',
 'Pepper,_bell___healthy',
 'Potato___Early_blight',
 'Potato___Late_blight',
 'Potato___healthy',
 'Raspberry___healthy',
 'Soybean___healthy',
 'Squash___Powdery_mildew',
 'Strawberry___Leaf_scorch',
 'Strawberry___healthy',
 'Tomato___Bacterial_spot',
 'Tomato___Early_blight',
 'Tomato___Late_blight',
 'Tomato___Leaf_Mold',
 'Tomato___Septoria_leaf_spot',
 'Tomato___Spider_mites Two-spotted_spider_mite',
 'Tomato___Target_Spot',
 'Tomato___Tomato_Yellow_Leaf_Curl_Virus',
 'Tomato___Tomato_mosaic_virus',
 'Tomato___healthy']
```

In [39]:
```
r = dict(zip(list(train_generator.class_indices.values()) , list(train_generator.class_indices.keys())))
```

In [40]:
```
print(r)
```

```
{0: 'Apple___Apple_scab', 1: 'Apple___Black_rot', 2: 'Apple___Cedar_apple_rust', 3: 'Apple___healthy', 4: 'Blueberry___healthy',
5: 'Cherry_(including_sour)___Powdery_mildew', 6: 'Cherry_(including_sour)___healthy', 7: 'Corn_(maize)___Cercospora_leaf_spot G
ray_leaf_spot', 8: 'Corn_(maize)___Common_rust_', 9: 'Corn_(maize)___Northern_Leaf_Blight', 10: 'Corn_(maize)___healthy', 11: 'G
rape___Black_rot', 12: 'Grape___Esca_(Black_Measles)', 13: 'Grape___Leaf_blight_(Isariopsis_Leaf_Spot)', 14: 'Grape___healthy',
15: 'Orange___Haunglongbing_(Citrus_greening)', 16: 'Peach___Bacterial_spot', 17: 'Peach___healthy', 18: 'Pepper,_bell___Bacteri
al_spot', 19: 'Pepper,_bell___healthy', 20: 'Potato___Early_blight', 21: 'Potato___Late_blight', 22: 'Potato___healthy', 23: 'Ra
spberry___healthy', 24: 'Soybean___healthy', 25: 'Squash___Powdery_mildew', 26: 'Strawberry___Leaf_scorch', 27: 'Strawberry___he
althy', 28: 'Tomato___Bacterial_spot', 29: 'Tomato___Early_blight', 30: 'Tomato___Late_blight', 31: 'Tomato___Leaf_Mold', 32: 'T
omato___Septoria_leaf_spot', 33: 'Tomato___Spider_mites Two-spotted_spider_mite', 34: 'Tomato___Target_Spot', 35: 'Tomato___Toma
to_Yellow_Leaf_Curl_Virus', 36: 'Tomato___Tomato_mosaic_virus', 37: 'Tomato___healthy'}
```

In [44]:
```
import os

test_dir = '/Users/shankalpapokharel/AI Projects/gpu_ipd/Dataset/test/'

for filename in os.listdir(test_dir):
    try:
        path = os.path.join(test_dir, filename)
        predicted_class, confidence = prediction(path)
        print(f"File: {filename}, Predicted class: {predicted_class}, Confidence: {confidence}%")
    except:
        print("Couldn't read the file")
```

```
1/1 [==============================] - 0s 20ms/step
File: AppleScab3.JPG, Predicted class: Potato___Early_blight, Confidence: 95.59%
1/1 [==============================] - 0s 10ms/step
File: TomatoEarlyBlight2.JPG, Predicted class: Tomato___Early_blight, Confidence: 53.99%
1/1 [==============================] - 0s 10ms/step
File: TomatoEarlyBlight3.JPG, Predicted class: Tomato___Early_blight, Confidence: 99.03%
1/1 [==============================] - 0s 11ms/step
File: PotatoHealthy1.JPG, Predicted class: Potato___healthy, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: AppleScab2.JPG, Predicted class: Apple___Apple_scab, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoEarlyBlight1.JPG, Predicted class: Tomato___Early_blight, Confidence: 95.98%
1/1 [==============================] - 0s 14ms/step
File: PotatoHealthy2.JPG, Predicted class: Potato___healthy, Confidence: 99.99%
1/1 [==============================] - 0s 13ms/step
File: AppleScab1.JPG, Predicted class: Cherry_(including_sour)___Powdery_mildew, Confidence: 77.53%
1/1 [==============================] - 0s 13ms/step
File: TomatoEarlyBlight4.JPG, Predicted class: Tomato___Early_blight, Confidence: 100.0%
Couldn't read the file
1/1 [==============================] - 0s 15ms/step
File: TomatoEarlyBlight5.JPG, Predicted class: Tomato___Early_blight, Confidence: 97.38%
1/1 [==============================] - 0s 12ms/step
File: TomatoEarlyBlight6.JPG, Predicted class: Tomato___Early_blight, Confidence: 99.55%
1/1 [==============================] - 0s 12ms/step
File: PotatoEarlyBlight4.JPG, Predicted class: Potato___Early_blight, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: PotatoEarlyBlight5.JPG, Predicted class: Potato___Early_blight, Confidence: 100.0%
1/1 [==============================] - 0s 14ms/step
File: PotatoEarlyBlight2.JPG, Predicted class: Potato___Early_blight, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: PotatoEarlyBlight3.JPG, Predicted class: Apple___healthy, Confidence: 98.33%
1/1 [==============================] - 0s 13ms/step
File: PotatoEarlyBlight1.JPG, Predicted class: Potato___Early_blight, Confidence: 100.0%
1/1 [==============================] - 0s 14ms/step
File: TomatoYellowCurlVirus2.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 100.0%
1/1 [==============================] - 0s 12ms/step
File: TomatoYellowCurlVirus3.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 97.19%
1/1 [==============================] - 0s 14ms/step
File: TomatoYellowCurlVirus1.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoHealthy4.JPG, Predicted class: Tomato___healthy, Confidence: 100.0%
1/1 [==============================] - 0s 11ms/step
File: TomatoYellowCurlVirus4.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoHealthy1.JPG, Predicted class: Tomato___healthy, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoYellowCurlVirus5.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoHealthy3.JPG, Predicted class: Tomato___healthy, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: TomatoHealthy2.JPG, Predicted class: Tomato___healthy, Confidence: 99.74%
1/1 [==============================] - 0s 13ms/step
File: TomatoYellowCurlVirus6.JPG, Predicted class: Tomato___Tomato_Yellow_Leaf_Curl_Virus, Confidence: 100.0%
1/1 [==============================] - 0s 13ms/step
File: AppleCedarRust2.JPG, Predicted class: Apple___Cedar_apple_rust, Confidence: 99.67%
1/1 [==============================] - 0s 13ms/step
File: CornCommonRust1.JPG, Predicted class: Corn_(maize)___Common_rust_, Confidence: 99.93%
1/1 [==============================] - 0s 31ms/step
File: AppleCedarRust3.JPG, Predicted class: Apple___Cedar_apple_rust, Confidence: 56.0%
1/1 [==============================] - 0s 12ms/step
File: AppleCedarRust1.JPG, Predicted class: Apple___Cedar_apple_rust, Confidence: 94.18%
1/1 [==============================] - 0s 15ms/step
File: CornCommonRust3.JPG, Predicted class: Corn_(maize)___Common_rust_, Confidence: 100.0%
1/1 [==============================] - 0s 14ms/step
File: AppleCedarRust4.JPG, Predicted class: Apple___Cedar_apple_rust, Confidence: 99.94%
```

In [ ]:

In [ ]:

In [62]:
```
path = "/Users/shankalpapokharel/Downloads/7.jpg"
```

In [63]:
```
prediction(path)
```

```
1/1 [==============================] - 0s 10ms/step
```

Out[63]:
```
('Tomato___Leaf_Mold', 99.89)
```

In [66]:
```
test_datagen = ImageDataGenerator(rescale=1./255)

test_data = test_datagen.flow_from_directory(
        'Dataset/valid',
        target_size=(256, 256),
        class_mode='categorical')

# evaluate the model on the test dataset
loss, accuracy = model.evaluate(test_data)

print('Test accuracy:', accuracy*100,"%")
```

```
Found 17572 images belonging to 38 classes.
550/550 [==============================] - 49s 89ms/step - loss: 0.1384 - accuracy: 0.9565
Test accuracy: 95.652174949646 %
```

In [73]:
```
path = "/Users/shankalpapokharel/Downloads/cc.jpg"
prediction(path)
```

```
1/1 [==============================] - 0s 20ms/step
```

Out[73]:
```
('Tomato___Spider_mites Two-spotted_spider_mite', 99.94)
```