# Machine Learning Project

## Detection of Diseases in Plants


### Group 1

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**Overview**

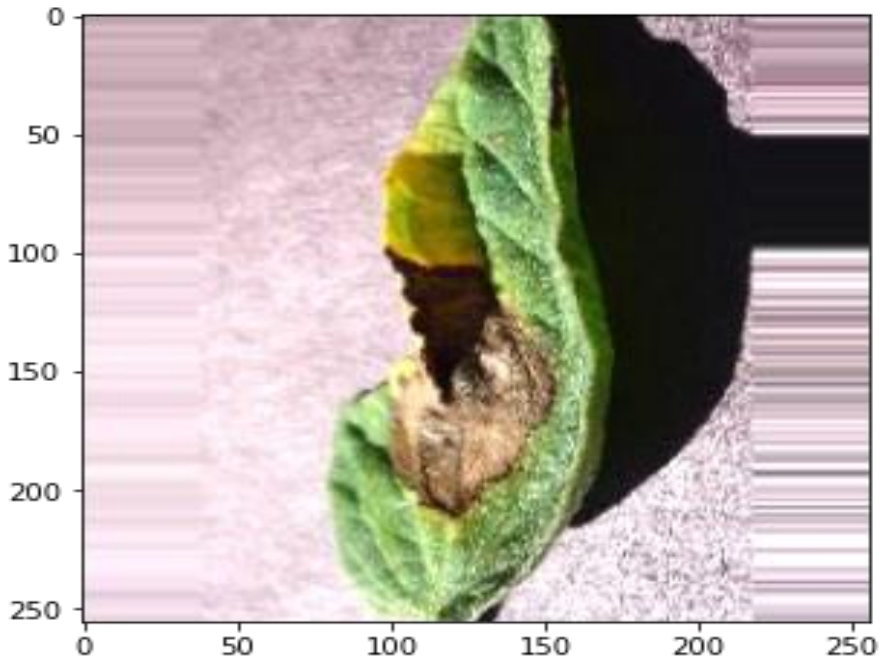
The code below demonstrates a supervised machine learning model that is used to detect and classify the plant diseases into its respective categories. The dataset that is used throughout the project is the Plant disease Dataset obtained from an open-source platform and was contributed by SAMIR BHATTARAI. The plant diseases are categorised into the types that are listed in the dataset which are a total of 38. The model is able to classify these diseases accurately and can further be evolved by experimenting around with different architectures. We built and trained our own baseline model in *CNN* and checked the accuracy of the model which was about *71%*. To further improve our accuracy we used the base model as *EfficientNetB0* and applied the transfer learning technique to train the model to get accuracy to 81% The future scope of this project is to classify plants with dual diseases and sub-classify them into their respective sub-categories.

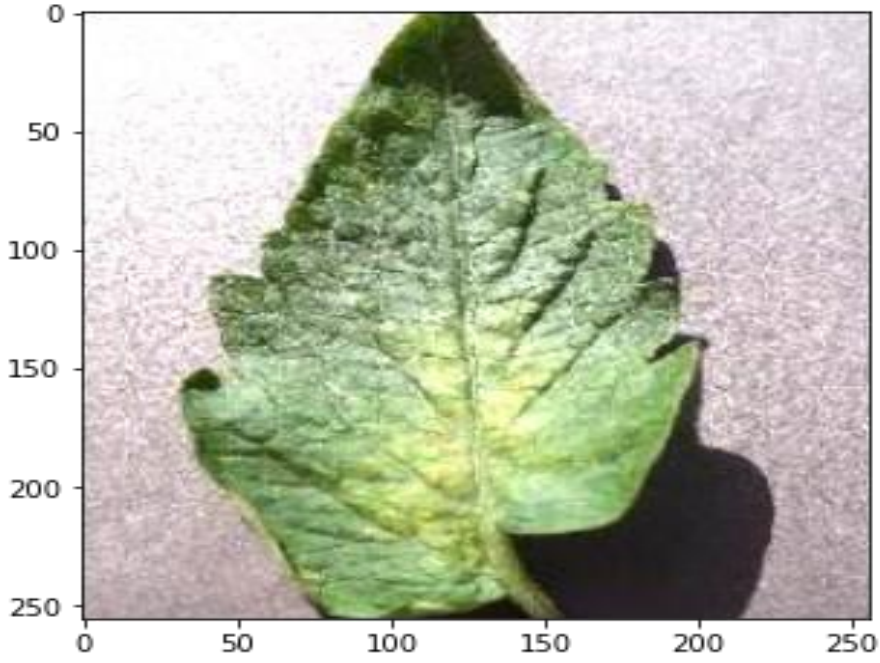
```
import numpy as np import pandas as pd
import matplotlib.pyplot as plt import os
import keras

from tensorflow.keras.preprocessing.image import ImageDataGenerator ,
img_to_array, load_img

from tensorflow.keras.applications import EfficientNetB0

len(os.listdir('E:/NU courses/ML 475/Project/Dataset/New Plant
Diseases Dataset(Augmented)/New Plant Diseases
Dataset(Augmented)/train'))
```

```
38
```

```
from tensorflow.keras.applications.efficientnet import preprocess_input
from tensorflow.keras.applications.efficientnet import decode_predictions

train_datagen=ImageDataGenerator(zoom_range=0.5, shear_range=0.3,
horizontal_flip=True, preprocessing_function=preprocess_input)
val_datagen=ImageDataGenerator(preprocessing_function=preprocess_input
)

train=train_datagen.flow_from_directory(directory='E:/NU courses/ML
475/Project/Dataset/New Plant Diseases Dataset(Augmented)/New Plant Diseases
Dataset(Augmented)/train',
target_size=(256,256), batch_size=32)
val=val_datagen.flow_from_directory(directory='E:/NU courses/ML
475/Project/Dataset/New Plant Diseases Dataset(Augmented)/New Plant Diseases
Dataset(Augmented)/valid',
target_size=(256,256), batch_size=32)
```

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

17572 images belonging to 38 classes. t_img,

label=train.next() t_img.shape (32, 256, 256, 3)

def plotImage(img_arr, label):     for im, l in
zip(img_arr, label):
plt.figure(figsize=(5,5))
plt.imshow(im/180) plotImage(t_img[:3],
label[:2])

Clipping input data to the valid range for imshow with RGB data
([0..1] for floats or [0..255] for integers).
Clipping input data to the valid range for imshow with RGB data ([0..1] for
floats or [0..255] for integers).
```



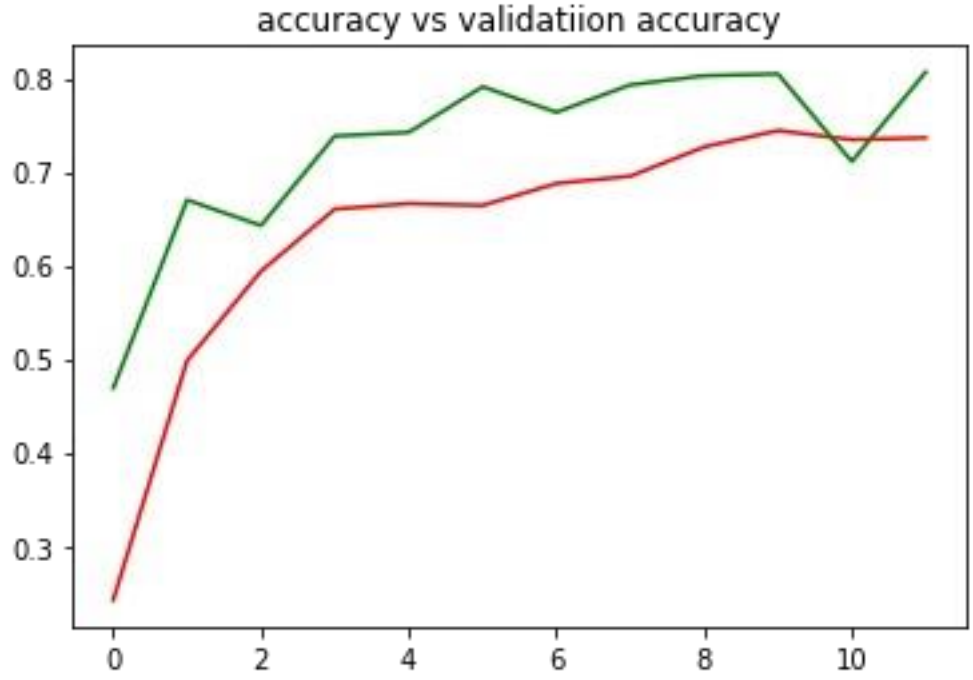
## Building the model Model

```
from tensorflow.keras.layers import Dense, Flatten from

tensorflow.keras.models import Model

import keras

base_model1=EfficientNetB0(input_shape=(256,256,3), include_top=False)

for layer in base_model1.layers:     layer.trainable=False

X = Flatten()(base_model1.output)
X = Dense(units=38, activation='softmax')(X) model=Model(base_model1.input, X)
```

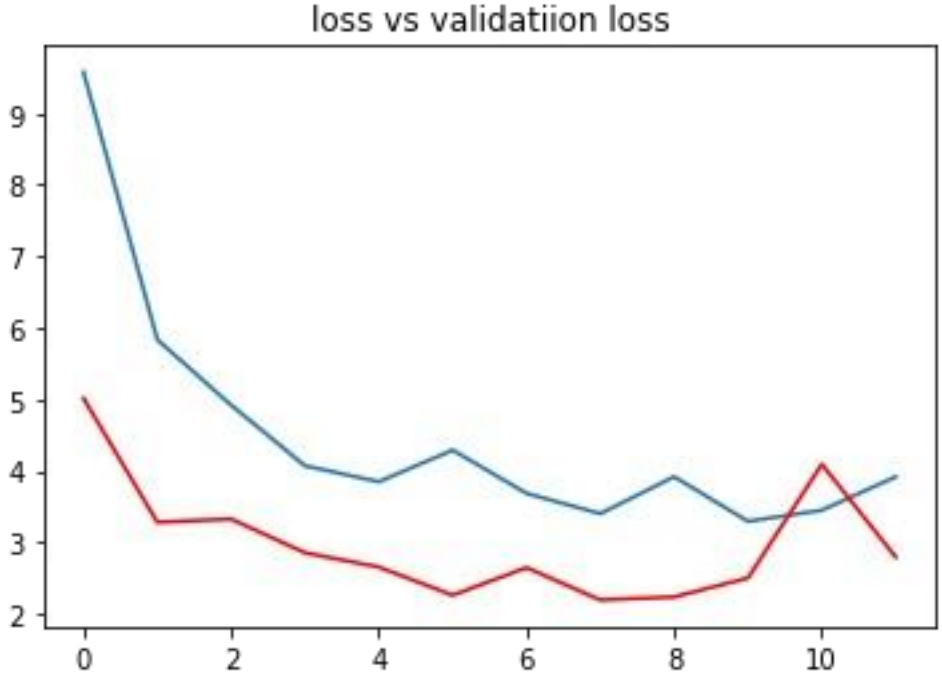
## Early Stopping

```
from tensorflow.keras.callbacks import ModelCheckpoint, EarlyStopping

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

es=EarlyStopping(monitor='val_accuracy', min_delta=0.01,patience=3,verbose=1)

mc=ModelCheckpoint(filepath="my_model1.h5",monitor='val_accuracy',
min_delta=0.01,patience=3, verbose=1,save_best_only=True) cb=[es,mc]

his=model.fit(train,steps_per_epoch=16, epochs=50
              , verbose=1,
callbacks=cb,validation_data=val,validation_steps=16)

Epoch 1/50
16/16 [==============================] - ETA: 0s - loss: 9.5761 - accuracy:
0.2422
Epoch 1: val_accuracy improved from -inf to 0.46875, saving model to my_model1.h5
16/16 [==============================] - 100s 5s/step - loss: 9.5761 -
accuracy: 0.2422 - val_loss: 5.0176 - val_accuracy: 0.4688
Epoch 2/50
16/16 [==============================] - ETA: 0s - loss: 5.8366 - accuracy:
0.4980
Epoch 2: val_accuracy improved from 0.46875 to 0.66992, saving model to
my_model1.h5
16/16 [==============================] - 75s 5s/step - loss: 5.8366 -
accuracy: 0.4980 - val_loss: 3.2856 - val_accuracy: 0.6699
.
.
.
.
Epoch 11: val_accuracy did not improve from 0.80469
16/16 [==============================] - 71s 4s/step - loss: 3.4528 -
accuracy: 0.7344 - val_loss: 4.0953 - val_accuracy: 0.7109
Epoch 12/50
16/16 [==============================] - ETA: 0s - loss: 3.9204 - accuracy:
0.7363
Epoch 12: val_accuracy improved from 0.80469 to 0.80664, saving model to
my_model1.h5
16/16 [==============================] - 69s 4s/step - loss: 3.9204 -
accuracy: 0.7363 - val_loss: 2.7995 - val_accuracy: 0.8066
```

```
Epoch 12: early stopping

h=his.history h.keys()

dict_keys(['loss', 'accuracy', 'val_loss', 'val_accuracy'])

plt.plot(h['accuracy'],c='red')
plt.plot(h['val_accuracy'],c='green') plt.title('accuracy vs
validatiion accuracy') plt.show()
```




```
plt.plot(h['loss']) plt.plot(h['val_loss'],c='red')
plt.title('loss vs validatiion loss') plt.show()
```




## Loading the Best model

```
from keras.models import load_model
```

```
model=load_model("C:/Users/shami/Downloads/my_model1.h5")

acc=model.evaluate(val)[1]
print(f"Accuracy of the model is {acc*100}%")
```

```
550/550 [==============================] - 1063s 2s/step - loss:
2.4383 - accuracy: 0.8131
Accuracy of the model is 81.31117820739746%
```

```
ref=dict(zip(list(train.class_indices.values()),list(train.class_indic
es.keys())))
```

## Prediction of Image and classifying them

```
def Prediction(path):

img=load_img(path,target_size=(256,256))
i=img_to_array(img)

im=preprocess_input(i)

img=np.expand_dims(im,axis=0)
pred=np.argmax(model.predict(img))

print(f" The image belongs to {ref[pred]}")

path="E:/NU courses/ML 475/Project/PlantVillage/New
Folder/Tomato_Spider_mites_Two_spotted_spider_mite/00c8e9a0-1fb8-434b-
8981-25511358ddc9___Com.G_SpM_FL 8717.JPG"
Prediction(path)
```

```
1/1 [==============================] - 1s 1s/step
 The image belongs to Tomato___Spider_mites Two-spotted_spider_mite
```

**URL:** https://youtu.be/SQ2ZIfFTLJE