In [1]:

```
ls
```

```
 Volume in drive C is Local disk :
 Volume Serial Number is EE22-D61B

 Directory of C:\Users\Kavi Bharath

11/03/2022  03:45 AM    <DIR>          .
07/30/2022  09:28 AM    <DIR>          ..
10/25/2022  01:24 PM             6,329 .bash_history
10/25/2022  12:29 AM               212 .gitconfig
11/03/2022  03:45 AM    <DIR>          .ipynb_checkpoints
11/03/2022  01:16 AM    <DIR>          .ipython
11/03/2022  03:35 AM    <DIR>          .jupyter
11/03/2022  01:12 AM    <DIR>          .keras
09/22/2022  11:10 PM                20 .lesshst
11/03/2022  01:06 AM    <DIR>          .matplotlib
11/02/2022  09:06 PM    <DIR>          .node-red
11/03/2022  01:02 AM    <DIR>          .spyder-py3
09/30/2022  07:10 PM    <DIR>          .ssh
11/03/2022  12:57 AM    <DIR>          anaconda3
05/14/2022  09:14 PM    <DIR>          Contacts
08/14/2022  10:41 PM    <DIR>          Documents
09/21/2022  02:05 PM    <DIR>          Dropbox
09/18/2022  10:51 PM    <DIR>          Favorites
11/03/2022  01:16 AM       339,185,106 Fertilizers_Recommendation_ System_For_Disease_ Pr
ediction (2).zip
11/03/2022  03:11 AM         9,184,528 fruit.h5
11/03/2022  01:29 AM             2,951 ImagePreProcessing for Fruit and veg dataset.ipynb
09/18/2022  10:51 PM    <DIR>          Links
11/03/2022  03:44 AM           112,467 Model Building For Fruit Disease Prediction.ipynb
08/12/2022  09:36 PM    <DIR>          Music
09/20/2022  09:20 PM    <DIR>          OneDrive
05/14/2022  09:14 PM    <DIR>          Saved Games
09/24/2022  08:15 PM    <DIR>          Searches
11/03/2022  01:28 AM             2,951 Untitled.ipynb
11/03/2022  03:45 AM                72 Untitled1.ipynb
08/12/2022  09:37 PM    <DIR>          Videos
               9 File(s)    348,494,636 bytes
              21 Dir(s)  206,472,675,328 bytes free
```

In [2]:

```
pwd
```

Out[2]:

```
'C:\\Users\\Kavi Bharath'
```

Image Augmentation

In [3]:

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

In [4]:

```
train_datagen=ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,verti
cal_flip=False)
```

In [5]:

```
test_datagen=ImageDataGenerator(rescale=1./255)
```

In [7]:

```
x_train=train_datagen.flow_from_directory(r"E:\IBM\Fertilizers_Recommendation_ System_For
_Disease_ Prediction\Dataset Plant Disease\Veg-dataset\Veg-dataset\train_set",target_size
=(128,128),
                                           class_mode='categorical',batch_size=24)
x_test=test_datagen.flow_from_directory(r'E:\IBM\Fertilizers_Recommendation_ System_For_D
isease_ Prediction\Dataset Plant Disease\Veg-dataset\Veg-dataset\test_set',target_size=(1
28,128),
                                           class_mode='categorical',batch_size=24)
```

Found 11385 images belonging to 9 classes.
Found 3416 images belonging to 9 classes.

In [8]:

```
x_train.class_indices
```

Out[8]:

```
{'Pepper,_bell___Bacterial_spot': 0,
 'Pepper,_bell___healthy': 1,
 'Potato___Early_blight': 2,
 'Potato___Late_blight': 3,
 'Potato___healthy': 4,
 'Tomato___Bacterial_spot': 5,
 'Tomato___Late_blight': 6,
 'Tomato___Leaf_Mold': 7,
 'Tomato___Septoria_leaf_spot': 8}
```

CNN

In [9]:

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
```

In [10]:

```
model=Sequential()
```

In [11]:

```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

In [12]:

```
model.add(MaxPooling2D(pool_size=(2,2)))
```

In [13]:

```
model.add(Flatten())
```

In [14]:

```
model.summary()
```

Model: "sequential"

```
_____
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 126, 126, 32)      896

 max_pooling2d (MaxPooling2D  (None, 63, 63, 32)       0
 )

 flatten (Flatten)           (None, 127008)            0

=================================================================
Total params: 896
Trainable params: 896
```

```
Non-trainable params: 0
```

Hidden Layers

In [15]:

```python
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
```

Output Layer

In [16]:

```python
model.add(Dense(6,activation='softmax'))
```

In [17]:

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

In [18]:

```python
len(x_train)
```

Out[18]:

```
475
```

In [19]:

```
1238/24
```

Out[19]:

```
51.583333333333336
```

Saving Model

In [21]:

```
ls
```

```
 Volume in drive C is Local disk :
 Volume Serial Number is EE22-D61B

 Directory of C:\Users\Kavi Bharath

11/03/2022  03:56 AM    <DIR>          .
07/30/2022  09:28 AM    <DIR>          ..
10/25/2022  01:24 PM            6,329 .bash_history
10/25/2022  12:29 AM              212 .gitconfig
11/03/2022  03:49 AM    <DIR>          .ipynb_checkpoints
11/03/2022  01:16 AM    <DIR>          .ipython
11/03/2022  03:35 AM    <DIR>          .jupyter
11/03/2022  01:12 AM    <DIR>          .keras
09/22/2022  11:10 PM               20 .lesshst
11/03/2022  01:06 AM    <DIR>          .matplotlib
11/02/2022  09:06 PM    <DIR>          .node-red
11/03/2022  01:02 AM    <DIR>          .spyder-py3
09/30/2022  07:10 PM    <DIR>          .ssh
11/03/2022  12:57 AM    <DIR>          anaconda3
05/14/2022  09:14 PM    <DIR>          Contacts
08/14/2022  10:41 PM    <DIR>          Documents
09/21/2022  02:05 PM    <DIR>          Dropbox
09/18/2022  10:51 PM    <DIR>          Favorites
11/03/2022  01:16 AM      339,185,106 Fertilizers_Recommendation_ System_For_Disease_ Pr
```

```
ediction (2).zip
11/03/2022  03:11 AM          9,184,528 fruit.h5
11/03/2022  01:29 AM              2,951 ImagePreProcessing for Fruit and veg dataset.ipynb
09/18/2022  10:51 PM    <DIR>          Links
11/03/2022  03:44 AM            112,467 Model Building For Fruit Disease Prediction.ipynb
11/03/2022  03:49 AM            112,467 Model Building For Fruit Disease Prediction-Copy1.
ipynb
11/03/2022  03:55 AM              9,061 Model Building For Vegetable Disease Prediction.ip
ynb
08/12/2022  09:36 PM    <DIR>          Music
09/20/2022  09:20 PM    <DIR>          OneDrive
05/14/2022  09:14 PM    <DIR>          Saved Games
09/24/2022  08:15 PM    <DIR>          Searches
11/03/2022  01:28 AM              2,951 Untitled.ipynb
11/03/2022  03:56 AM        152,619,128 vegetable.h5
08/12/2022  09:37 PM    <DIR>          Videos
              11 File(s)      501,235,220 bytes
              21 Dir(s)   206,326,890,496 bytes free
```

In [20]:

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

In [22]:

```
ls
```

```
 Volume in drive C is Local disk :
 Volume Serial Number is EE22-D61B

 Directory of C:\Users\Kavi Bharath

11/03/2022  03:56 AM    <DIR>          .
07/30/2022  09:28 AM    <DIR>          ..
10/25/2022  01:24 PM              6,329 .bash_history
10/25/2022  12:29 AM                212 .gitconfig
11/03/2022  03:49 AM    <DIR>          .ipynb_checkpoints
11/03/2022  01:16 AM    <DIR>          .ipython
11/03/2022  03:35 AM    <DIR>          .jupyter
11/03/2022  01:12 AM    <DIR>          .keras
09/22/2022  11:10 PM                 20 .lesshst
11/03/2022  01:06 AM    <DIR>          .matplotlib
11/02/2022  09:06 PM    <DIR>          .node-red
11/03/2022  01:02 AM    <DIR>          .spyder-py3
09/30/2022  07:10 PM    <DIR>          .ssh
11/03/2022  12:57 AM    <DIR>          anaconda3
05/14/2022  09:14 PM    <DIR>          Contacts
08/14/2022  10:41 PM    <DIR>          Documents
09/21/2022  02:05 PM    <DIR>          Dropbox
09/18/2022  10:51 PM    <DIR>          Favorites
11/03/2022  01:16 AM        339,185,106 Fertilizers_Recommendation_ System_For_Disease_ Pr
ediction (2).zip
11/03/2022  03:11 AM          9,184,528 fruit.h5
11/03/2022  01:29 AM              2,951 ImagePreProcessing for Fruit and veg dataset.ipynb
09/18/2022  10:51 PM    <DIR>          Links
11/03/2022  03:44 AM            112,467 Model Building For Fruit Disease Prediction.ipynb
11/03/2022  03:49 AM            112,467 Model Building For Fruit Disease Prediction-Copy1.
ipynb
11/03/2022  03:55 AM              9,061 Model Building For Vegetable Disease Prediction.ip
ynb
08/12/2022  09:36 PM    <DIR>          Music
09/20/2022  09:20 PM    <DIR>          OneDrive
05/14/2022  09:14 PM    <DIR>          Saved Games
09/24/2022  08:15 PM    <DIR>          Searches
11/03/2022  01:28 AM              2,951 Untitled.ipynb
11/03/2022  03:56 AM        152,619,128 vegetable.h5
08/12/2022  09:37 PM    <DIR>          Videos
              11 File(s)      501,235,220 bytes
              21 Dir(s)   206,326,886,400 bytes free
```

Test The Model

In [23]:

```python
import numpy as np
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
```

In [24]:

```python
model=load_model('vegetable.h5')
```

In [28]:

```python
img=image.load_img(r"E:\IBM\Fertilizers_Recommendation_ System_For_Disease_ Prediction\Da
taset  Plant  Disease\Veg-dataset\Veg-dataset\test_set\Pepper,_bell__Bacterial_spot\bcf56f
7d-d584-4fed-b42e-5cbf3b8707b7__JR_B.Spot 3197.JPG")
```

In [29]:

```python
img
```

Out[29]:

In [30]:

```python
img=image.load_img(r"E:\IBM\Fertilizers_Recommendation_ System_For_Disease_ Prediction\Da
taset  Plant  Disease\Veg-dataset\Veg-dataset\test_set\Pepper,_bell__Bacterial_spot\c27c09
cc-acf8-4e46-a828-a48a96249642__JR_B.Spot 3232.JPG")
```

In [31]:

```python
img
```

Out[31]:

In [32]:

```python
x=image.img_to_array(img)
```

```
In [33]:
```

```
x
```

```
Out[33]:
```

```
array([[[120., 115., 145.],
        [116., 111., 141.],
        [130., 125., 155.],
        ...,
        [102.,  94., 118.],
        [ 42.,  34.,  58.],
        [ 69.,  61.,  85.]],

       [[121., 116., 146.],
        [124., 119., 149.],
        [125., 120., 150.],
        ...,
        [ 52.,  44.,  68.],
        [ 76.,  68.,  92.],
        [ 75.,  67.,  91.]],

       [[131., 126., 156.],
        [135., 130., 160.],
        [126., 121., 151.],
        ...,
        [ 84.,  76., 100.],
        [ 80.,  72.,  96.],
        [ 84.,  76., 100.]],

       ...,

       [[ 65.,  56.,  75.],
        [ 62.,  53.,  72.],
        [115., 106., 125.],
        ...,
        [ 52.,  37.,  56.],
        [ 96.,  81., 100.],
        [ 80.,  65.,  84.]],

       [[ 87.,  78.,  97.],
        [ 72.,  63.,  82.],
        [ 53.,  44.,  63.],
        ...,
        [ 43.,  28.,  47.],
        [ 99.,  84., 103.],
        [ 89.,  74.,  93.]],

       [[ 81.,  72.,  91.],
        [ 66.,  57.,  76.],
        [ 64.,  55.,  74.],
        ...,
        [100.,  85., 104.],
        [ 81.,  66.,  85.],
        [117., 102., 121.]]], dtype=float32)
```

```
In [ ]:
```

```
x=np.expand_dims(x,axis=0)
```

```
In [35]:
```

```
x
```

```
Out[35]:
```

```
array([[[[120., 115., 145.],
         [116., 111., 141.],
         [130., 125., 155.],
         ...,
         [102.,  94., 118.],
         [ 42.,  34.,  58.],
```

```
         [ 69.,   61.,   85.]],

       [[121., 116., 146.],
        [124., 119., 149.],
        [125., 120., 150.],
        ...,
        [ 52.,   44.,   68.],
        [ 76.,   68.,   92.],
        [ 75.,   67.,   91.]],

       [[131., 126., 156.],
        [135., 130., 160.],
        [126., 121., 151.],
        ...,
        [ 84.,   76., 100.],
        [ 80.,   72.,   96.],
        [ 84.,   76., 100.]],

       ...,

       [[ 65.,   56.,   75.],
        [ 62.,   53.,   72.],
        [115., 106., 125.],
        ...,
        [ 52.,   37.,   56.],
        [ 96.,   81., 100.],
        [ 80.,   65.,   84.]],

       [[ 87.,   78.,   97.],
        [ 72.,   63.,   82.],
        [ 53.,   44.,   63.],
        ...,
        [ 43.,   28.,   47.],
        [ 99.,   84., 103.],
        [ 89.,   74.,   93.]],

       [[ 81.,   72.,   91.],
        [ 66.,   57.,   76.],
        [ 64.,   55.,   74.],
        ...,
        [100.,   85., 104.],
        [ 81.,   66.,   85.],
        [117., 102., 121.]]]], dtype=float32)
```

In [ ]:

```python
y=np.argmax(model.predict(x),axis=1)
```

In [ ]:

```
1/1 [==============================] - 0s 92ms/step
```

In [47]:

```python
x_train.class_indices
```

Out[47]:

```
{'Pepper,_bell___Bacterial_spot': 0,
 'Pepper,_bell___healthy': 1,
 'Potato___Early_blight': 2,
 'Potato___Late_blight': 3,
 'Potato___healthy': 4,
 'Tomato___Bacterial_spot': 5,
 'Tomato___Late_blight': 6,
 'Tomato___Leaf_Mold': 7,
 'Tomato___Septoria_leaf_spot': 8}
```

In [48]:

```python
index=['Pepper,_bell___Bacterial_spot','Pepper,_bell___healthy','Potato___Early_blight','
```

```
Potato___Late_blight','Potato___healthy','Tomato___Bacterial_spot','Tomato___Late_blight'
,'Tomato___Leaf_Mold','Tomato___Septoria_leaf_spot']
```

In [ ]:

```
index[y[0]]
```

In [ ]:

```
'Potato___Late_blight'
```

In [ ]:

```
img=image.load_img(r"E:\IBM\Fertilizers_Recommendation_ System_For_Disease_ Prediction\Da
taset  Plant  Disease\Veg-dataset\Veg-dataset\test_set\Potato__healthy\f4b5ec24-d318-4309-
8294-9126450d5d7f__RS_HL 1824".JPG",target_size=(128,128))
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
index=['Pepper,_bell___Bacterial_spot','Pepper,_bell___healthy','Potato___Early_blight','
Potato__Late_blight','Potato___healthy','Tomato___Bacterial_spot','Tomato___Leaf_Mold','
Tomato__Septoria_leaf_spot']
index[y[0]]
```

In [ ]:

```
1/1 [==============================] - 0s 25ms/step
'Potato___Late_blight'
```