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## Assignment-3

```
import tensorflow as tf
```

In [7]:

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

In [ ]:

```
#Augmenting the input training images
```

In [11]:

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

```
training_set = train_datagen.flow_from_directory(  
    'training',  
    target_size=(64, 64),  
    batch_size=32,  
    class_mode='categorical')
```

Found 4103 images belonging to 5 classes.

In [12]:

```
test_datagen = ImageDataGenerator(  
    rescale=1./255)  
  
test_data = test_datagen.flow_from_directory(  
    'Testing',  
    target_size=(64, 64),  
    batch_size=32,  
    class_mode='categorical')
```

Found 214 images belonging to 5 classes.

In [ ]:

```
#Building the model
```

In [13]:

```
cnn = tf.keras.models.Sequential()
```

In [ ]:

```
#Adding convolution layer
```

In [14]:

```
cnn.add(tf.keras.layers.Conv2D(filters=64, kernel_size=3, activation  
="relu", input_shape = [64, 64, 3]))
```

```
cnn.add(tf.keras.layers.MaxPool2D(pool_size = 2, strides=2))
```

In [15]:

```
cnn.add(tf.keras.layers.Conv2D(filters=64, kernel_size=3, activation ="relu"))
```

```
cnn.add(tf.keras.layers.MaxPool2D(pool_size = 2, strides=2))
```

In [16]:

```
cnn.add(tf.keras.layers.Dropout(0.5))
```

```
In []:
```

```
# Flattening the layers
```

```
In [17]:
```

```
cnn.add(tf.keras.layers.Flatten())
```

```
In []:
```

```
# Adding dense layers (Hidden Layers)
```

```
In [18]:
```

```
cnn.add(tf.keras.layers.Dense(units=128 ,activation ="relu"))
```

```
In [19]:
```

```
cnn.add(tf.keras.layers.Dense(units=5,activation="softmax"))
```

```
In []:
```

```
#compilation of the neural network model
```

```
In [20]:
```

```
cnn.compile(optimizer="rmsprop",loss="categorical_crossentropy" ,metrics  
=["accuracy"])
```

```
In []:
```

```
#Fitting the neural network model and training it
```

```
In [41]:
```

```
cnn.fit(x = training_set , validation_data =test_data , epochs = 30 )
```

```
Epoch 1/30
```

```
129/129 [=====] - 34s 254ms/step - loss: 1.3400 -  
accuracy: 0.4350 - val_loss: 1.0596 - val_accuracy: 0.6168
```

```
Epoch 2/30
```

129/129 [=====] - 33s 253ms/step - loss: 1.0957 -  
accuracy: 0.5659 - val\_loss: 1.1546 - val\_accuracy: 0.6168

Epoch 3/30

129/129 [=====] - 36s 279ms/step - loss: 0.9823 -  
accuracy: 0.6176 - val\_loss: 1.0383 - val\_accuracy: 0.5841

Epoch 4/30

129/129 [=====] - 37s 285ms/step - loss: 0.9194 -  
accuracy: 0.6432 - val\_loss: 0.8612 - val\_accuracy: 0.6776

Epoch 5/30

129/129 [=====] - 37s 289ms/step - loss: 0.8707 -  
accuracy: 0.6727 - val\_loss: 1.1994 - val\_accuracy: 0.5514

Epoch 6/30

129/129 [=====] - 41s 315ms/step - loss: 0.8155 -  
accuracy: 0.6856 - val\_loss: 0.9825 - val\_accuracy: 0.6916

Epoch 7/30

129/129 [=====] - 37s 285ms/step - loss: 0.7836 -  
accuracy: 0.7002 - val\_loss: 0.9143 - val\_accuracy: 0.6636

Epoch 8/30

129/129 [=====] - 36s 280ms/step - loss: 0.7603 -  
accuracy: 0.7090 - val\_loss: 0.8084 - val\_accuracy: 0.7243

Epoch 9/30

129/129 [=====] - 33s 257ms/step - loss: 0.7361 -  
accuracy: 0.7187 - val\_loss: 0.8042 - val\_accuracy: 0.7150

Epoch 10/30

129/129 [=====] - 32s 250ms/step - loss: 0.6901 -  
accuracy: 0.7387 - val\_loss: 0.9286 - val\_accuracy: 0.6589

Epoch 11/30

129/129 [=====] - 35s 273ms/step - loss: 0.6722 -  
accuracy: 0.7453 - val\_loss: 1.0362 - val\_accuracy: 0.6822

Epoch 12/30

129/129 [=====] - 35s 270ms/step - loss: 0.6659 -  
accuracy: 0.7534 - val\_loss: 0.7733 - val\_accuracy: 0.7056

Epoch 13/30

129/129 [=====] - 34s 261ms/step - loss: 0.6291 -  
accuracy: 0.7655 - val\_loss: 0.8955 - val\_accuracy: 0.6916

Epoch 14/30

129/129 [=====] - 37s 284ms/step - loss: 0.6128 -  
accuracy: 0.7702 - val\_loss: 0.9361 - val\_accuracy: 0.6542

Epoch 15/30

129/129 [=====] - 36s 279ms/step - loss: 0.5988 -  
accuracy: 0.7780 - val\_loss: 0.8789 - val\_accuracy: 0.6916

Epoch 16/30

129/129 [=====] - 36s 281ms/step - loss: 0.5822 -  
accuracy: 0.7775 - val\_loss: 0.9812 - val\_accuracy: 0.6729

Epoch 17/30

129/129 [=====] - 38s 298ms/step - loss: 0.5802 -  
accuracy: 0.7870 - val\_loss: 0.8973 - val\_accuracy: 0.7056

Epoch 18/30

129/129 [=====] - 40s 306ms/step - loss: 0.5724 -  
accuracy: 0.7875 - val\_loss: 0.8542 - val\_accuracy: 0.7056

Epoch 19/30

129/129 [=====] - 39s 305ms/step - loss: 0.5624 -  
accuracy: 0.7955 - val\_loss: 0.7468 - val\_accuracy: 0.7430

Epoch 20/30

129/129 [=====] - 39s 303ms/step - loss: 0.5542 -  
accuracy: 0.7919 - val\_loss: 0.8988 - val\_accuracy: 0.7150

Epoch 21/30

129/129 [=====] - 43s 329ms/step - loss: 0.5241 -  
accuracy: 0.8040 - val\_loss: 1.0677 - val\_accuracy: 0.6963

Epoch 22/30

129/129 [=====] - 38s 296ms/step - loss: 0.5146 -  
accuracy: 0.8172 - val\_loss: 0.8774 - val\_accuracy: 0.7243

Epoch 23/30

129/129 [=====] - 39s 302ms/step - loss: 0.5153 -  
accuracy: 0.8172 - val\_loss: 0.8348 - val\_accuracy: 0.6963

Epoch 24/30

129/129 [=====] - 45s 348ms/step - loss: 0.5067 -  
accuracy: 0.8153 - val\_loss: 0.9380 - val\_accuracy: 0.6916

Epoch 25/30

129/129 [=====] - 44s 342ms/step - loss: 0.4726 -  
accuracy: 0.8284 - val\_loss: 0.9572 - val\_accuracy: 0.7056

Epoch 26/30

129/129 [=====] - 41s 318ms/step - loss: 0.4762 -  
accuracy: 0.8360 - val\_loss: 0.8506 - val\_accuracy: 0.7056

Epoch 27/30

129/129 [=====] - 39s 302ms/step - loss: 0.4734 -  
accuracy: 0.8216 - val\_loss: 1.2935 - val\_accuracy: 0.6168

Epoch 28/30

129/129 [=====] - 39s 300ms/step - loss: 0.4611 -  
accuracy: 0.8272 - val\_loss: 0.8751 - val\_accuracy: 0.6869

Epoch 29/30

129/129 [=====] - 37s 290ms/step - loss: 0.4375 -  
accuracy: 0.8372 - val\_loss: 0.9651 - val\_accuracy: 0.6729

Epoch 30/30

129/129 [=====] - 39s 299ms/step - loss: 0.4292 -  
accuracy: 0.8501 - val\_loss: 1.0778 - val\_accuracy: 0.6963

Out[41]:

<keras.callbacks.History at 0x2bf28ab59b0>

In [42]:

```
cnn.fit(x = training_set , validation_data =test_data , epochs = 30 )
```

Epoch 1/30

```
129/129 [=====] - 45s 347ms/step - loss: 0.4250 -  
accuracy: 0.8496 - val_loss: 0.9867 - val_accuracy: 0.6729
```

Epoch 2/30

```
129/129 [=====] - 44s 341ms/step - loss: 0.4170 -  
accuracy: 0.8469 - val_loss: 1.0115 - val_accuracy: 0.7056
```

Epoch 3/30

```
129/129 [=====] - 44s 341ms/step - loss: 0.4203 -  
accuracy: 0.8550 - val_loss: 0.8851 - val_accuracy: 0.7150
```

Epoch 4/30

```
129/129 [=====] - 44s 341ms/step - loss: 0.4077 -  
accuracy: 0.8513 - val_loss: 1.1110 - val_accuracy: 0.6916
```

Epoch 5/30

```
129/129 [=====] - 40s 309ms/step - loss: 0.3930 -  
accuracy: 0.8603 - val_loss: 1.2546 - val_accuracy: 0.7103
```

Epoch 6/30

```
129/129 [=====] - 42s 327ms/step - loss: 0.4018 -  
accuracy: 0.8630 - val_loss: 0.9946 - val_accuracy: 0.6916
```

Epoch 7/30

```
129/129 [=====] - 41s 313ms/step - loss: 0.3879 -  
accuracy: 0.8640 - val_loss: 1.0004 - val_accuracy: 0.7243
```

Epoch 8/30

```
129/129 [=====] - 42s 324ms/step - loss: 0.3729 -  
accuracy: 0.8655 - val_loss: 1.0725 - val_accuracy: 0.6916
```

Epoch 9/30

129/129 [=====] - 41s 319ms/step - loss: 0.3805 -  
accuracy: 0.8582 - val\_loss: 1.0544 - val\_accuracy: 0.6916

Epoch 10/30

129/129 [=====] - 42s 327ms/step - loss: 0.3742 -  
accuracy: 0.8652 - val\_loss: 0.9719 - val\_accuracy: 0.6963

Epoch 11/30

129/129 [=====] - 42s 326ms/step - loss: 0.3737 -  
accuracy: 0.8686 - val\_loss: 0.9270 - val\_accuracy: 0.7336

Epoch 12/30

129/129 [=====] - 43s 334ms/step - loss: 0.3898 -  
accuracy: 0.8647 - val\_loss: 0.9987 - val\_accuracy: 0.7196

Epoch 13/30

129/129 [=====] - 44s 338ms/step - loss: 0.3701 -  
accuracy: 0.8718 - val\_loss: 0.8642 - val\_accuracy: 0.7196

Epoch 14/30

129/129 [=====] - 44s 339ms/step - loss: 0.3546 -  
accuracy: 0.8786 - val\_loss: 1.1820 - val\_accuracy: 0.6822

Epoch 15/30

129/129 [=====] - 50s 390ms/step - loss: 0.3510 -  
accuracy: 0.8762 - val\_loss: 1.0773 - val\_accuracy: 0.7150

Epoch 16/30

129/129 [=====] - 41s 315ms/step - loss: 0.3433 -  
accuracy: 0.8852 - val\_loss: 1.3577 - val\_accuracy: 0.7009

Epoch 17/30

129/129 [=====] - 68s 527ms/step - loss: 0.3400 -  
accuracy: 0.8796 - val\_loss: 1.0770 - val\_accuracy: 0.7150

Epoch 18/30



129/129 [=====] - 63s 477ms/step - loss: 0.3444 -  
accuracy: 0.8755 - val\_loss: 0.9273 - val\_accuracy: 0.7243

Epoch 19/30

129/129 [=====] - 70s 539ms/step - loss: 0.3386 -  
accuracy: 0.8835 - val\_loss: 1.1471 - val\_accuracy: 0.6776

Epoch 20/30

129/129 [=====] - 71s 548ms/step - loss: 0.3300 -  
accuracy: 0.8869 - val\_loss: 1.1275 - val\_accuracy: 0.7103

Epoch 21/30

129/129 [=====] - 77s 599ms/step - loss: 0.3330 -  
accuracy: 0.8864 - val\_loss: 1.2780 - val\_accuracy: 0.6963

Epoch 22/30

129/129 [=====] - 66s 515ms/step - loss: 0.3249 -  
accuracy: 0.8867 - val\_loss: 1.0580 - val\_accuracy: 0.7056

Epoch 23/30

129/129 [=====] - 82s 622ms/step - loss: 0.3225 -  
accuracy: 0.8903 - val\_loss: 1.2799 - val\_accuracy: 0.7383

Epoch 24/30

129/129 [=====] - 101s 785ms/step - loss: 0.3164 -  
accuracy: 0.8884 - val\_loss: 1.3724 - val\_accuracy: 0.7056

Epoch 25/30

129/129 [=====] - 50s 382ms/step - loss: 0.3218 -  
accuracy: 0.8945 - val\_loss: 1.2431 - val\_accuracy: 0.7009

Epoch 26/30

129/129 [=====] - 61s 469ms/step - loss: 0.3212 -  
accuracy: 0.8945 - val\_loss: 0.9750 - val\_accuracy: 0.7056

Epoch 27/30

129/129 [=====] - 111s 851ms/step - loss: 0.3087 -  
accuracy: 0.9020 - val\_loss: 1.4106 - val\_accuracy: 0.7056

Epoch 28/30

```
129/129 [=====] - 61s 466ms/step - loss: 0.3077 -  
accuracy: 0.8935 - val_loss: 0.9878 - val_accuracy: 0.7243
```

Epoch 29/30

```
129/129 [=====] - 59s 458ms/step - loss: 0.3071 -  
accuracy: 0.8976 - val_loss: 1.1608 - val_accuracy: 0.6963
```

Epoch 30/30

```
129/129 [=====] - 38s 295ms/step - loss: 0.3014 -  
accuracy: 0.8913 - val_loss: 1.4083 - val_accuracy: 0.7336
```

Out[42]:

```
<keras.callbacks.History at 0x2bf223fcfd0>
```

In [ ]:

```
#preprocess the test image
```

In [43]:

```
import numpy as np
```

In [55]:

```
image =  
tf.keras.preprocessing.image.load_img("prediction/tu.jpg",target_size=(64,64)  
)  
input_arr = tf.keras.preprocessing.image.img_to_array(image)  
input_arr = np.expand_dims(input_arr,axis=0)  
result = cnn.predict(input_arr)
```

```
1/1 [=====] - 0s 79ms/step
```

In [52]:

```
training_set.class_indices
```

Out[52]:

```
{'Daisy': 0, 'Dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}
```

In [56]:

```
print(result)
```

```
[[0. 0. 0. 0. 1.]]
```

In []:

```
#Mapping the result to the values
```

In [57]:

```
if result[0][0] == 1:
```

```
    print("daisy")
```

```
elif result[0][1] == 1:
```

```
    print("dandelion")
```

```
elif result[0][2] == 1:
```

```
    print("rose")
```

```
elif result[0][3] ==1:
```

```
    print("suflower")
```

```
elif result[0][4] == 1:
```

```
    print("tulip")
```

```
tulip
```

In []: