ASSIGNMENT-3

Built CNN Model for Classification of Flowers

Assignment Date	03 October 2022
Team ID	PNT2022TMID45335
Project Name	AI BASED DISCOURSE FOR BANKING INDUSTRY
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Student Roll Number	E1195046
Maximum Marks	2 Marks

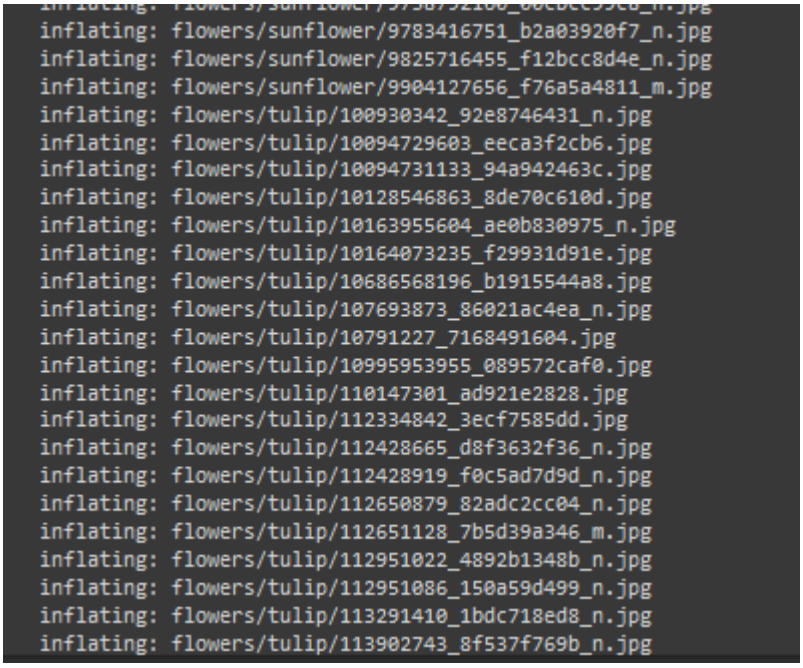
1. Download the Dataset

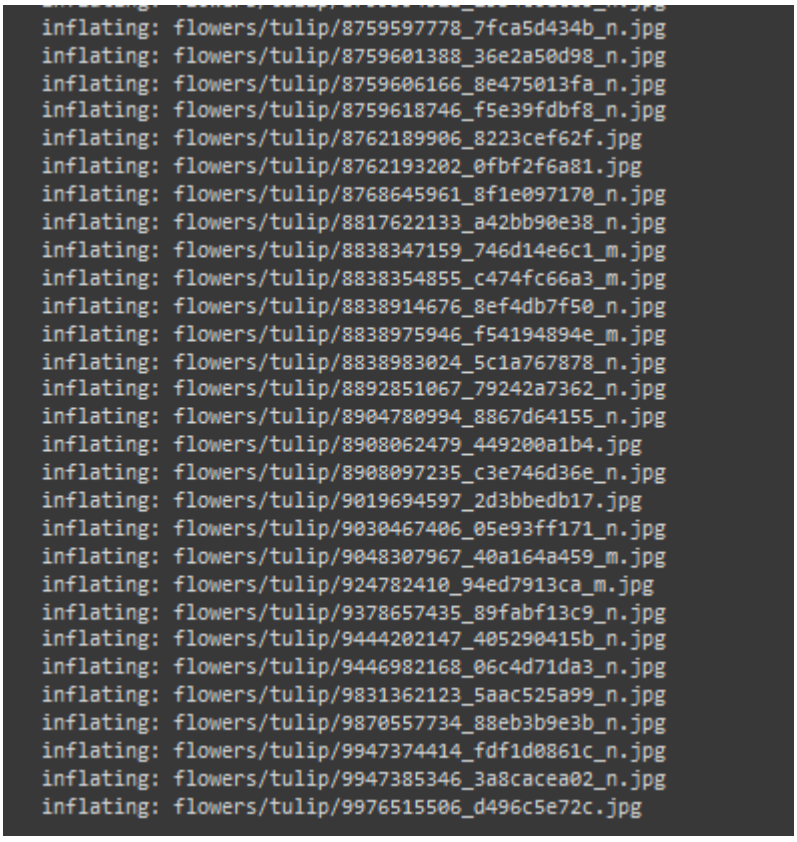
```
!unzip Flowers-Dataset.zip
```

```
Archive:  Flowers-Dataset.zip
replace flowers/daisy/100080576_f52e8ee070_n.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: n
replace flowers/daisy/10140303196_b88d3d6cec.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: A
  inflating: flowers/daisy/10140303196_b88d3d6cec.jpg
  inflating: flowers/daisy/10172379554_b296050f82_n.jpg
  inflating: flowers/daisy/10172567486_2748826a8b.jpg
  inflating: flowers/daisy/10172636503_21bededa75_n.jpg
  inflating: flowers/daisy/102841525_bd6628ae3c.jpg
  inflating: flowers/daisy/10300722094_28fa978807_n.jpg
  inflating: flowers/daisy/1031799732_e7f4008c03.jpg
  inflating: flowers/daisy/10391248763_1d16681106_n.jpg
  inflating: flowers/daisy/10437754174_22ec990b77_m.jpg
  inflating: flowers/daisy/10437770546_8bb6f7bdd3_m.jpg
  inflating: flowers/daisy/10437929963_bc13eebe0c.jpg
  inflating: flowers/daisy/10466290366_cc72e33532.jpg
  inflating: flowers/daisy/10466558316_a7198b87e2.jpg
  inflating: flowers/daisy/10555749515_13a12a026e.jpg
  inflating: flowers/daisy/10555815624_dc211569b0.jpg
  inflating: flowers/daisy/10555826524_423eb8bf71_n.jpg
  inflating: flowers/daisy/10559679065_50d2b16f6d.jpg
  inflating: flowers/daisy/105806915_a9c13e2106_n.jpg
  inflating: flowers/daisy/10712722853_5632165b04.jpg
  inflating: flowers/daisy/107592979_aaa9cdfe78_m.jpg
  inflating: flowers/daisy/10770585085_4742b9dac3_n.jpg
  inflating: flowers/daisy/10841136265_af473efc60.jpg
  inflating: flowers/daisy/10993710036_2033222c91.jpg
  inflating: flowers/daisy/10993818044_4c19b86c82.jpg
```

```
inflating: flowers/dandelion/9300335851_cdf1cef7a9.jpg
inflating: flowers/dandelion/9301891790_971dcfb35d_m.jpg
inflating: flowers/dandelion/9472854850_fc9e1db673.jpg
inflating: flowers/dandelion/9517326597_5d116a0166.jpg
inflating: flowers/dandelion/9533964635_f38e6fa3c3.jpg
inflating: flowers/dandelion/9595369280_dd88b61814.jpg
inflating: flowers/dandelion/9613826015_f345354874.jpg
inflating: flowers/dandelion/9617087594_ec2a9b16f6.jpg
inflating: flowers/dandelion/9646730031_f3d5014416_n.jpg
inflating: flowers/dandelion/9719816995_8f211abf02_n.jpg
inflating: flowers/dandelion/9726260379_4e8ee66875_m.jpg
inflating: flowers/dandelion/9759608055_9ab623d193.jpg
inflating: flowers/dandelion/9818247_e2eac18894.jpg
inflating: flowers/dandelion/9853885425_4a82356f1d_m.jpg
inflating: flowers/dandelion/98992760_53ed1d26a9.jpg
inflating: flowers/dandelion/9939430464_5f5861ebab.jpg
inflating: flowers/dandelion/9965757055_ff01b5ee6f_n.jpg
inflating: flowers/rose/10090824183_d02c613f10_m.jpg
inflating: flowers/rose/102501987_3cdb8e5394_n.jpg
inflating: flowers/rose/10503217854_e66a804309.jpg
inflating: flowers/rose/10894627425_ec76bbc757_n.jpg
inflating: flowers/rose/110472418_87b6a3aa98_m.jpg
inflating: flowers/rose/11102341464_508d558dfc_n.jpg
inflating: flowers/rose/11233672494_d8bf0a3dbf_n.jpg
inflating: flowers/rose/11694025703_9a906fedc1_n.jpg
inflating: flowers/rose/118974357_0faa23cce9_n.jpg
```

```
inflating: flowers/rose/9458445402_79e4dfa89c.jpg
inflating: flowers/rose/9609569441_eeb8566e94.jpg
inflating: flowers/rose/9614492283_66020fb4eb_n.jpg
inflating: flowers/rose/9633056561_6f1b7e8faf_m.jpg
inflating: flowers/rose/9702378513_229a96b754_m.jpg
inflating: flowers/rose/99383371_37a5ac12a3_n.jpg
inflating: flowers/sunflower/1008566138_6927679c8a.jpg
inflating: flowers/sunflower/1022552002_2b93faf9e7_n.jpg
inflating: flowers/sunflower/1022552036_67d33d5bd8_n.jpg
inflating: flowers/sunflower/10386503264_e05387e1f7_m.jpg
inflating: flowers/sunflower/10386522775_4f8c616999_m.jpg
inflating: flowers/sunflower/10386525005_fd0b7d6c55_n.jpg
inflating: flowers/sunflower/10386525695_2c38fea555_n.jpg
inflating: flowers/sunflower/10386540106_1431e73086_m.jpg
inflating: flowers/sunflower/10386540696_0a95ee53a8_n.jpg
inflating: flowers/sunflower/10386702973_e74a34c806_n.jpg
inflating: flowers/sunflower/1043442695_4556c4c13d_n.jpg
inflating: flowers/sunflower/1044296388_912143e1d4.jpg
inflating: flowers/sunflower/10541580714_ff6b171abd_n.jpg
inflating: flowers/sunflower/1064662314_c5a7891b9f_m.jpg
inflating: flowers/sunflower/10862313945_e8ed9202d9_m.jpg
inflating: flowers/sunflower/11881770944_22b4f2f8f6_n.jpg
inflating: flowers/sunflower/1217254584_4b3028b93d.jpg
inflating: flowers/sunflower/12282924083_fb80aa17d4_n.jpg
inflating: flowers/sunflower/12323859023_447387dbf0_n.jpg
inflating: flowers/sunflower/1240624822_4111dde542.jpg
inflating: flowers/sunflower/1240625276_fb3bd0c7b1.jpg
```





Solution:

import numpy as np

import tensorflow as tf

from tensorflow.keras import layers

from tensorflow.keras.models import Sequential

import matplotlib.pyplot as plt

batch_size = 32

img_height = 180

data_dir ="/content/flowers"

import ImageDataGenerator

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

x_train = train_datagen.flow_from_directory(r"/content/flowers", target_size = (64,64) , class_mode = "categorical", batch_size = 100)

```
[ ]  import numpy as np
     import tensorflow as tf
     from tensorflow.keras import layers
     from tensorflow.keras.models import Sequential
     import matplotlib.pyplot as plt
     batch_size = 32
     img_height = 180
     img_width = 180
     data_dir = "/content/flowers"

[ ]  from tensorflow.keras.preprocessing.image import ImageDataGenerator

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

```
[ ] x_train = train_datagen.flow_from_directory(r"/content/flowers", target_size = (64,64) , class_mode = "categorical", batch_size = 100)

    Found 4317 images belonging to 5 classes.
```

2. Image Argumentation

#Image Augmentation accuracy

data_augmentation = Sequential(

[

layers.RandomFlip("horizontal",input_shape=(img_height, img_width, 3)),

layers.RandomRotation(0.1),

layers.RandomZoom(0.1),

]

)

2. Image augumentation

```
[ ]  #Image Augumentation accuracy
     data_augmentation = Sequential(
       [
         layers.RandomFlip("horizontal",input_shape=(img_height, img_width, 3)),
         layers.RandomRotation(0.1),
         layers.RandomZoom(0.1),
       ]
     )
```

3. Create Model

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

model = Sequential()

train_ds = tf.keras.utils.image_dataset_from_directory(

   data_dir,

   validation_split=0.2,

   subset="training",

   seed=123,

   image_size=(img_height, img_width),

   batch_size=batch_size)
```

Found 4317 files belonging to 5

classes. Using 3454 files for training.

```
val_ds = tf.keras.utils.image_dataset_from_directory(

   data_dir,

   validation_split=0.2,

   subset="validation"

   , seed=123,

   image_size=(img_height, img_width),

   batch_size=batch_size)
```

Found 4317 files belonging to 5 classes.

Using 863 files for validation.

```
class_names = train_ds.class_names
print(class_names)
```

```
['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']
```

```
plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
    for i in range(9):
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype("uint8"))
        plt.title(class_names[labels[i]])
        plt.axis("off")
```

3.Create Model

```
[ ]  from tensorflow.keras.models import Sequential
     from tensorflow.keras.layers import Convolution2D,MaxPooling2D,Flatten,Dense
     model = Sequential()
```

```
[ ]  train_ds = tf.keras.utils.image_dataset_from_directory(
       data_dir,
       validation_split=0.2,
       subset="training",
       seed=123,
       image_size=(img_height, img_width),
       batch_size=batch_size)
```

```
Found 4317 files belonging to 5 classes.
Using 3454 files for training.
```

```
[ ]  val_ds = tf.keras.utils.image_dataset_from_directory(
       data_dir,
       validation_split=0.2,
       subset="validation",
       seed=123,
       image_size=(img_height, img_width),
       batch_size=batch_size)
```

```
Found 4317 files belonging to 5 classes.
Using 863 files for validation.
```

```
[ ]  class_names = train_ds.class_names
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['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']
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```
[ ]  plt.figure(figsize=(10, 10))
     for images, labels in train_ds.take(1):
       for i in range(9):
         ax = plt.subplot(3, 3, i + 1)
         plt.imshow(images[i].numpy().astype("uint8"))
         plt.title(class_names[labels[i]])
         plt.axis("off")
```

4. Add Layers (Convolution,Max Pooling,Flatten,Dense-(Hidden Layer),Output)

Solution:

```
model.add(Convolution2D(32, (3,3), activation = "relu", input_shape = (64,64,3) ))
model.add(MaxPooling2D(pool_size = (2,2)))
model.add(Flatten())
model.add(Dense(300, activation = "relu"))
model.add(Dense(150, activation = "relu")) #mulitple dense layers
model.add(Dense(5, activation = "softmax")) #output layer
#Adding the layers for accuracy
num_classes = len(class_names)

model = Sequential([
data_augmentation,
  layers.Rescaling(1./255, input_shape=(img_height, img_width, 3)),
  layers.Conv2D(16, 3, padding='same', activation='relu'),
  layers.MaxPooling2D(),
  layers.Conv2D(32, 3, padding='same', activation='relu'),
  layers.MaxPooling2D(),
  layers.Conv2D(64, 3, padding='same', activation='relu'),
  layers.MaxPooling2D(),
  layers.Flatten(),
  layers.Dense(128, activation='relu'),
  )
```

4.Adding the layers (Convolution,MaxPooling,Flatten,Dense-(HiddenLayers),Output)

```
model.add(Convolution2D(32, (3,3), activation = "relu", input_shape = (64,64,3) ))
model.add(MaxPooling2D(pool_size = (2,2)))
model.add(Flatten())
model.add(Dense(300, activation = "relu"))
model.add(Dense(150, activation = "relu")) #mulitple dense layers
model.add(Dense(5, activation = "softmax")) #output layer
```

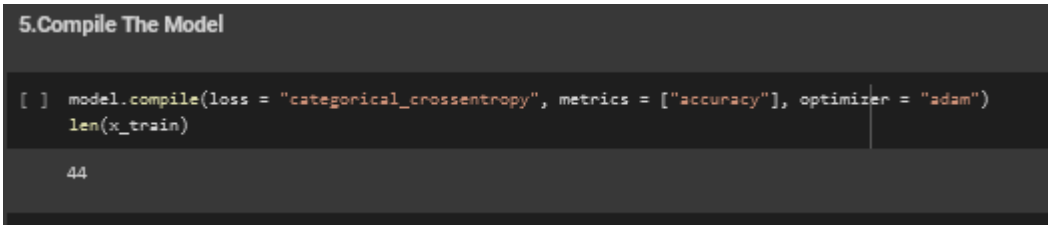
```
[ ]  #Adding the layers for accuracy
     num_classes = len(class_names)

     model = Sequential([
       data_augmentation,
       layers.Rescaling(1./255, input_shape=(img_height, img_width, 3)),
       layers.Conv2D(16, 3, padding='same', activation='relu'),
       layers.MaxPooling2D(),
       layers.Conv2D(32, 3, padding='same', activation='relu'),
       layers.MaxPooling2D(),
       layers.Conv2D(64, 3, padding='same', activation='relu'),
       layers.MaxPooling2D(),
       layers.Flatten(),
       layers.Dense(128, activation='relu'),
       layers.Dense(num_classes)
     ])
```

5. Compile The Model

Solution:

model.compile(loss = “categorical_crossrentropy”,metries =[”accuracy”],optimizer =’adam”)
len(x_train)



model.compile(optimizer='adam',

loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),

metrics=['accuracy'])

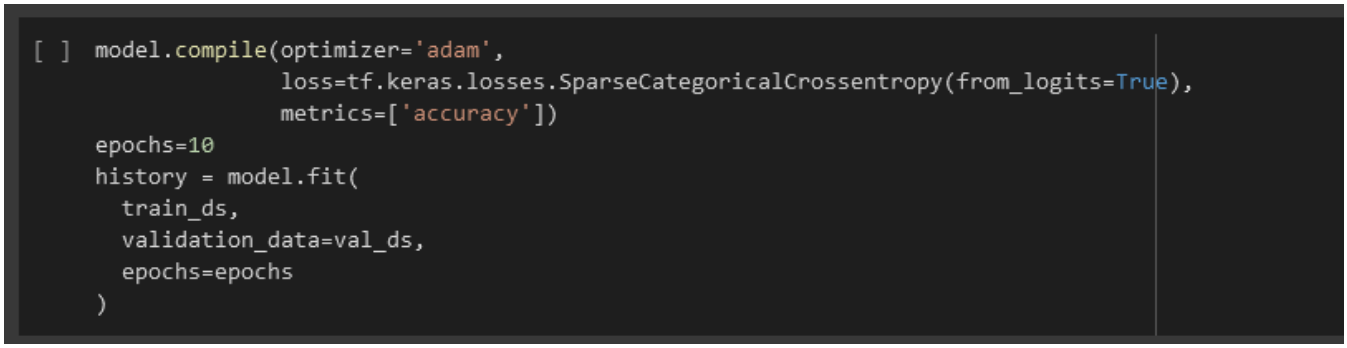
epochs=10

history = model.fit(

train_ds,

validation_data=val_ds,

epochs=epochs



```
Epoch 1/10
108/108 [==============================] - 128s 1s/step - loss: 1.3816 - accuracy: 0.4091 - val_loss: 1.2008 - val_accuracy: 0.4913
Epoch 2/10
108/108 [==============================] - 125s 1s/step - loss: 1.0935 - accuracy: 0.5608 - val_loss: 1.0211 - val_accuracy: 0.5794
Epoch 3/10
108/108 [==============================] - 126s 1s/step - loss: 0.9751 - accuracy: 0.6167 - val_loss: 0.9680 - val_accuracy: 0.6130
Epoch 4/10
108/108 [==============================] - 126s 1s/step - loss: 0.9249 - accuracy: 0.6372 - val_loss: 0.8913 - val_accuracy: 0.6512
Epoch 5/10
108/108 [==============================] - 125s 1s/step - loss: 0.8490 - accuracy: 0.6859 - val_loss: 0.8196 - val_accuracy: 0.6744
Epoch 6/10
108/108 [==============================] - 126s 1s/step - loss: 0.8293 - accuracy: 0.6737 - val_loss: 0.9374 - val_accuracy: 0.6477
Epoch 7/10
108/108 [==============================] - 125s 1s/step - loss: 0.7899 - accuracy: 0.7006 - val_loss: 0.7637 - val_accuracy: 0.6871
Epoch 8/10
108/108 [==============================] - 125s 1s/step - loss: 0.7297 - accuracy: 0.7290 - val_loss: 0.7591 - val_accuracy: 0.7196
Epoch 9/10
108/108 [==============================] - 126s 1s/step - loss: 0.7160 - accuracy: 0.7279 - val_loss: 0.8055 - val_accuracy: 0.7115
Epoch 10/10
108/108 [==============================] - 125s 1s/step - loss: 0.6868 - accuracy: 0.7276 - val_loss: 0.8471 - val_accuracy: 0.7022
```

To find the Training and Validation- Accuracy & Loss (Visualization)

acc = history.history['accuracy']

val_acc = history.history['val_accuracy']

loss = history.history['loss'] val_loss

= history.history['val_loss']

epochs_range = range(epochs)

plt.figure(figsize=(8, 8))

plt.subplot(1, 2, 1)

plt.plot(epochs_range, acc, label='Training Accuracy')

plt.plot(epochs_range, val_acc, label='Validation Accuracy')

plt.legend(loc='lower right')

plt.title('Training and Validation Accuracy')

plt.subplot(1, 2, 2)

plt.plot(epochs_range, loss, label='Training Loss')

plt.plot(epochs_range, val_loss, label='Validation Loss')

plt.legend(loc='upper right')

plt.title('Training and Validation Loss')

plt.show()

```
[ ]  #To find the Training and Validation- Accuracy & Loss (Visualization)

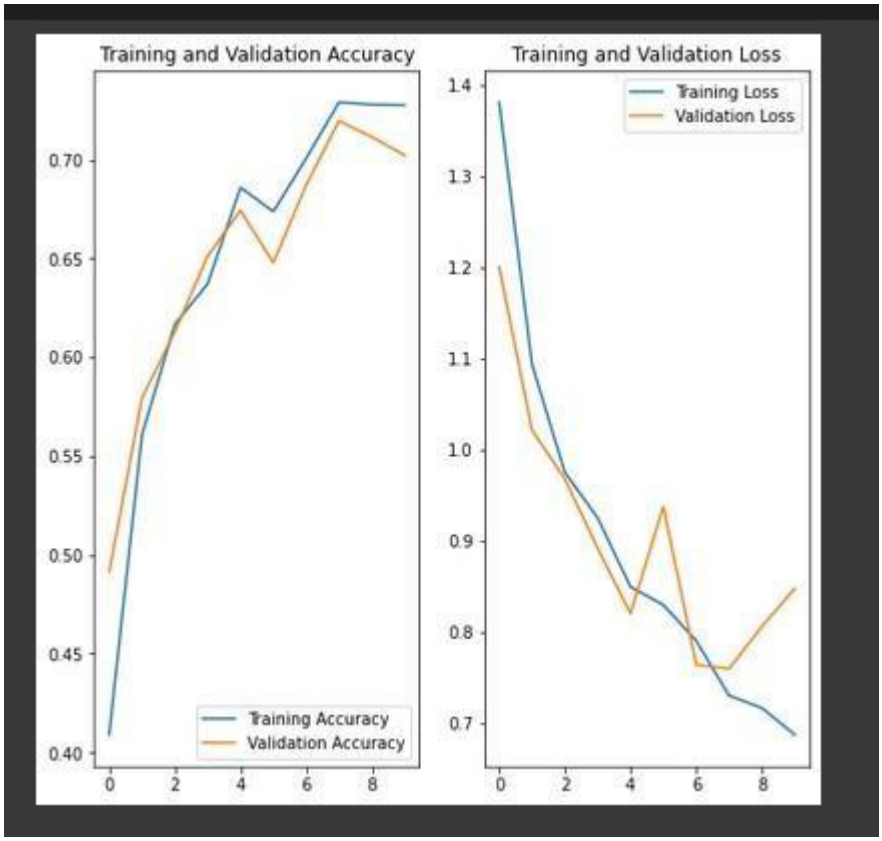
     acc = history.history['accuracy']
     val_acc = history.history['val_accuracy']

     loss = history.history['loss']
     val_loss = history.history['val_loss']

     epochs_range = range(epochs)

     plt.figure(figsize=(8, 8))
     plt.subplot(1, 2, 1)
     plt.plot(epochs_range, acc, label='Training Accuracy')
     plt.plot(epochs_range, val_acc, label='Validation Accuracy')
     plt.legend(loc='lower right')
     plt.title('Training and Validation Accuracy')

     plt.subplot(1, 2, 2)
     plt.plot(epochs_range, loss, label='Training Loss')
     plt.plot(epochs_range, val_loss, label='Validation Loss')
     plt.legend(loc='upper right')
     plt.title('Training and Validation Loss')
     plt.show()
```



6. Fit The Model

Solution:

model.fit(x_train,epochs = 15,steps_per_epoch =len(x_train))

6.Fit The Model

```
model.fit(x_train, epochs = 15, steps_per_epoch = len(x_train))
```

```
Epoch 1/15
44/44 [==============================] - 31s 684ms/step - loss: 1.7914 - accuracy: 0.3588
Epoch 2/15
44/44 [==============================] - 29s 648ms/step - loss: 1.1730 - accuracy: 0.5045
Epoch 3/15
44/44 [==============================] - 29s 650ms/step - loss: 1.0967 - accuracy: 0.5529
Epoch 4/15
44/44 [==============================] - 29s 648ms/step - loss: 1.0351 - accuracy: 0.5939
Epoch 5/15
44/44 [==============================] - 29s 645ms/step - loss: 0.9920 - accuracy: 0.6127
Epoch 6/15
44/44 [==============================] - 30s 677ms/step - loss: 0.9659 - accuracy: 0.6259
Epoch 7/15
44/44 [==============================] - 29s 648ms/step - loss: 0.9129 - accuracy: 0.6426
Epoch 8/15
44/44 [==============================] - 29s 647ms/step - loss: 0.9085 - accuracy: 0.6433
Epoch 9/15
44/44 [==============================] - 32s 717ms/step - loss: 0.8597 - accuracy: 0.6620
Epoch 10/15
44/44 [==============================] - 30s 674ms/step - loss: 0.8350 - accuracy: 0.6824
Epoch 11/15
44/44 [==============================] - 29s 648ms/step - loss: 0.8420 - accuracy: 0.6718
Epoch 12/15
44/44 [==============================] - 29s 650ms/step - loss: 0.7857 - accuracy: 0.7030
Epoch 13/15
44/44 [==============================] - 29s 649ms/step - loss: 0.7868 - accuracy: 0.7000
Epoch 14/15
44/44 [==============================] - 29s 650ms/step - loss: 0.7542 - accuracy: 0.7132
Epoch 15/15
44/44 [==============================] - 30s 676ms/step - loss: 0.7467 - accuracy: 0.7107
<keras.callbacks.History at 0x7f602ce90090>
```

7. Save The Model

Solution:

model.save(“flowers.h1”)
model.save(“flowers.m5”)

7.Save The Model

```
[ ]  model.save("flowers.h1")
```

```
[ ]  model.save("flowers.m5")
```

8. Test The Model

Solution:

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
model = load_model("/content/flowers.h1")
#Testing with a random rose image from Google
img = image.load_img("/content/daisy.gif", target_size = (64,64) ) img
x = image.img_to_array(img) x.ndim 3
x = np.expand_dims(x,axis = 0) x.ndim


labels = ['daisy','dandelion','roses','sunflowers','tulips'] x_pred=model.predict
x_pred

labels[np.argmax(x_pred)]
```

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

```
[ ]  model = load_model("/content/flowers.h1")
```

```
[ ]  #Testing with a random rose image from Google

     img = image.load_img("/content/daisy.gif", target_size = (64,64) )
```

```
[ ]  img
```

```
[ ]  x = image.img_to_array(img)
     x.ndim
```

```
     3
```

```
[ ]  x = np.expand_dims(x,axis = 0)
     x.ndim

     4

[ ]  labels = ['daisy','dandelion','roses','sunflowers','tulips']


[ ]  x_pred=model.predict



[ ]  x_pred

     <bound method Model.predict of <keras.engine.sequential.Sequential object at 0x7f3901f2d850>>

[ ]  labels[np.argmax(x_pred)]

     'daisy'
```

#Testing the model with accuracy

daisy_url = "http://m.gettywallpapers.com/wp-content/uploads/2022/07/Daisy-Wallpaper-Images.jpg"

daisy_path = tf.keras.utils.get_file('Daisy-Wallpaper-Images', origin=daisy_url)

img = tf.keras.utils.load_img(

daisy_path, target_size=(img_height, img_width)

)

img_array = tf.keras.utils.img_to_array(img)

img_array = tf.expand_dims(img_array, 0) # Create a batch

predictions = model.predict(img_array) score = tf.nn.softmax(predictions[0])

print("This image most likely belongs to {} with a {:.2f} percent confidence."

.format(class_names[np.argmax(x_pred)], 100 * np.max(score))

)

```
[ ]  #Testing the model with accuracy

     daisy_url = "http://m.gettywallpapers.com/wp-content/uploads/2022/07/Daisy-Wallpaper-Images.jpg"
     daisy_path = tf.keras.utils.get_file('Daisy-Wallpaper-Images', origin=daisy_url)

     img = tf.keras.utils.load_img(
         daisy_path, target_size=(img_height, img_width)
     )
     img_array = tf.keras.utils.img_to_array(img)
     img_array = tf.expand_dims(img_array, 0) # Create a batch

     predictions = model.predict(img_array)
     score = tf.nn.softmax(predictions[0])

     print(
         "This image most likely belongs to {} with a {:.2f} percent confidence."
         .format(class_names[np.argmax(x_pred)], 100 * np.max(score))
     )
```

```
Downloading data from http://m.gettywallpapers.com/wp-content/uploads/2022/07/Daisy-Wallpaper-Images.jpg
901120/897455 [==============================] - 0s 0us/step
909312/897455 [==============================] - 0s 0us/step
This image most likely belongs to daisy with a 94.37 percent confidence.
```