ASSIGNMENT-3

Built CNN Model for Classification Of Flowers

Assignment Date	03 October 2022
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Maximum Marks	2marks
Team ID	PNT2022TMID45335
Project	AI BASED DISCOURSE FOR BAKING INDUSTRY

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
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inflating: flowers/sunflower/10386522775_4f8c616999_m.jpg
inflating: flowers/sunflower/10386525005_fd0b7d6c55_n.jpg
inflating: flowers/sunflower/10386525695_2c38fea555_n.jpg
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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
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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
```

```
inflating: flowers/sunflower/9783416751_b2a03920f7_n.jpg
inflating: flowers/sunflower/9825716455_f12bcc8d4e_n.jpg
inflating: flowers/sunflower/9904127656_f76a5a4811_m.jpg
inflating: flowers/tulip/100930342_92e8746431_n.jpg
inflating: flowers/tulip/10094729603_eeca3f2cb6.jpg
inflating: flowers/tulip/10094731133_94a942463c.jpg
inflating: flowers/tulip/10128546863_8de70c610d.jpg
inflating: flowers/tulip/10163955604_ae0b830975_n.jpg
inflating: flowers/tulip/10164073235_f29931d91e.jpg
inflating: flowers/tulip/10686568196_b1915544a8.jpg
inflating: flowers/tulip/107693873_86021ac4ea_n.jpg
inflating: flowers/tulip/10791227_7168491604.jpg
inflating: flowers/tulip/10995953955_089572caf0.jpg
inflating: flowers/tulip/110147301_ad921e2828.jpg
inflating: flowers/tulip/112334842_3ecf7585dd.jpg
inflating: flowers/tulip/112428665_d8f3632f36_n.jpg
inflating: flowers/tulip/112428919_f0c5ad7d9d_n.jpg
inflating: flowers/tulip/112650879_82adc2cc04_n.jpg
inflating: flowers/tulip/112651128_7b5d39a346_m.jpg
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inflating: flowers/tulip/112951086_150a59d499_n.jpg
inflating: flowers/tulip/113291410_1bdc718ed8_n.jpg
inflating: flowers/tulip/113902743_8f537f769b_n.jpg
```

```
inflating: flowers/tulip/8759597778_7fca5d434b_n.jpg
inflating: flowers/tulip/8759601388_36e2a50d98_n.jpg
inflating: flowers/tulip/8759606166_8e475013fa_n.jpg
inflating: flowers/tulip/8759618746_f5e39fdbf8_n.jpg
inflating: flowers/tulip/8762189906_8223cef62f.jpg
inflating: flowers/tulip/8762193202_0fbf2f6a81.jpg
inflating: flowers/tulip/8768645961_8f1e097170_n.jpg
inflating: flowers/tulip/8817622133_a42bb90e38_n.jpg
inflating: flowers/tulip/8838347159_746d14e6c1_m.jpg
inflating: flowers/tulip/8838354855_c474fc66a3_m.jpg
inflating: flowers/tulip/8838914676_8ef4db7f50_n.jpg
inflating: flowers/tulip/8838975946 f54194894e m.jpg
inflating: flowers/tulip/8838983024 5c1a767878 n.jpg
inflating: flowers/tulip/8892851067_79242a7362_n.jpg
inflating: flowers/tulip/8904780994_8867d64155_n.jpg
inflating: flowers/tulip/8908062479_449200a1b4.jpg
inflating: flowers/tulip/8908097235_c3e746d36e_n.jpg
inflating: flowers/tulip/9019694597_2d3bbedb17.jpg
inflating: flowers/tulip/9030467406_05e93ff171_n.jpg
inflating: flowers/tulip/9048307967_40a164a459_m.jpg
inflating: flowers/tulip/924782410 94ed7913ca m.jpg
inflating: flowers/tulip/9378657435 89fabf13c9 n.jpg
inflating: flowers/tulip/9444202147_405290415b_n.jpg
inflating: flowers/tulip/9446982168_06c4d71da3_n.jpg
inflating: flowers/tulip/9831362123_5aac525a99_n.jpg
inflating: flowers/tulip/9870557734_88eb3b9e3b_n.jpg
inflating: flowers/tulip/9947374414_fdf1d0861c_n.jpg
inflating: flowers/tulip/9947385346_3a8cacea02_n.jpg
inflating: flowers/tulip/9976515506_d496c5e72c.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 Augmentation

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

3.Create the 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 The 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.

```
[ ] 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.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'),
  )
```

3.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)
])
```

4. Compile The Model

Solution:

model.compile(loss = "categorical_crossrentropy",metries =["accuracy"],optimizer = 'adam") len(x_train)

```
4.Compile The Model

[ ] model.compile(loss = "categorical_crossentropy", metrics = ["accuracy"], optimizer = "adam")
    len(x_train)

44
```

5.Fit The Model

Solution:

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

7. Save The Model

Solution:

model.save("flowers.h1")
model.save("flowers.m5")

```
7.Save The Model

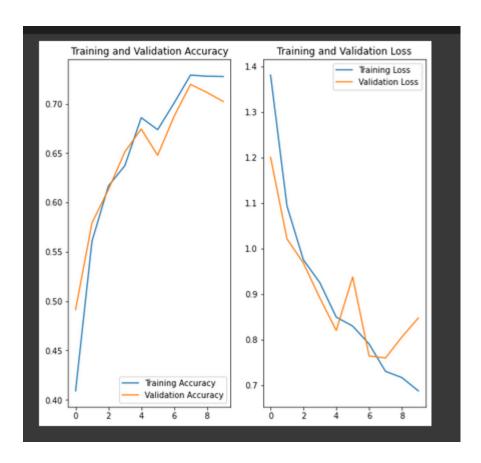
[ ] model.save("flowers.h1")

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

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()
```



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'
```

8. Test The Model

Solution:

```
#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))
)
```