Assignment -3
Build CNN model for classification of Flowers

Assignment Date	28 October 2022
Team ID	PNT2022TMID54140
Project Name	AI BASED DISCOURSE FOR BANKING INDUSTRY
Student Name	SANTHOSH KUMAR.R
Student Roll Number	310619205090
Maximum Marks	2 Marks

Question-1. Load the dataset

Solution:

!unzip Flowers-Dataset.zip

```
inflating: flowers/daisy/1396526833_fb867165be_n.jpg
inflating: flowers/daisy/13977181862_f8237b6b52.jpg
inflating: flowers/daisy/14021430525_e06baf93a9.jpg
inflating: flowers/daisy/14073784469_ffb12f3387_n.jpg
inflating: flowers/daisy/14087947408_9779257411_n.jpg
inflating: flowers/daisy/14088053307_1a13a0bf91_n.jpg
inflating: flowers/daisy/14114116486_0bb6649bc1_m.jpg
inflating: flowers/daisy/14147016029_8d3cf2414e.jpg
inflating: flowers/daisy/14163875973_467224aaf5_m.jpg
inflating: flowers/daisy/14167534527_781ceb1b7a_n.jpg
inflating: flowers/daisy/14167543177_cd36b54ac6_n.jpg
inflating: flowers/daisy/14219214466_3ca6104eae_m.jpg
inflating: flowers/daisy/14221836990_90374e6b34.jpg
inflating: flowers/daisy/14221848160_7f0a37c395.jpg
inflating: flowers/daisy/14245834619_153624f836.jpg
inflating: flowers/daisy/14264136211_9531fbc144.jpg
inflating: flowers/daisy/14272874304_47c0a46f5a.jpg
inflating: flowers/daisy/14307766919_fac3c37a6b_m.jpg
inflating: flowers/daisy/14330343061_99478302d4_m.jpg
inflating: flowers/daisy/14332947164_9b13513c71_m.jpg
inflating: flowers/daisy/14333681205_a07c9f1752_m.jpg
inflating: flowers/daisy/14350958832_29bdd3a254.jpg
inflating: flowers/daisy/14354051035_1037b30421_n.jpg
inflating: flowers/daisy/14372713423_61e2daae88.jpg
inflating: flowers/daisy/14399435971_ea5868c792.jpg
inflating: flowers/daisy/14402451388_56545a374a_n.jpg
inflating: flowers/daisy/144076848_57e1d662e3_m.jpg
```

```
inflating: flowers/daisy/14372713423_61e2daae88.jpg
inflating: flowers/daisy/14399435971_ea5868c792.jpg
inflating: flowers/daisy/14402451388_56545a374a_n.jpg
inflating: flowers/daisy/144076848_57e1d662e3_m.jpg
inflating: flowers/daisy/144099102_bf63a41e4f_n.jpg
inflating: flowers/daisy/1441939151_b271408c8d_n.jpg
inflating: flowers/daisy/14421389519_d5fd353eb4.jpg
inflating: flowers/daisy/144603918_b9de002f60_m.jpg
inflating: flowers/daisy/14471433500_cdaa22e3ea_m.jpg
inflating: flowers/daisy/14485782498_fb342ec301.jpg
inflating: flowers/daisy/14507818175_05219b051c_m.jpg
inflating: flowers/daisy/14523675369_97c31d0b5b.jpg
inflating: flowers/daisy/14551098743_2842e7a004_n.jpg
inflating: flowers/daisy/14554906452_35f066ffe9_n.jpg
inflating: flowers/daisy/14564545365_1f1d267bf1_n.jpg
inflating: flowers/daisy/14569895116_32f0dcb0f9.jpg
inflating: flowers/daisy/14591326135_930703dbed_m.jpg
inflating: flowers/daisy/14600779226_7bbc288d40_m.jpg
inflating: flowers/daisy/14613443462_d4ed356201.jpg
inflating: flowers/daisy/14621687774_ec52811acd_n.jpg
inflating: flowers/daisy/14674743211_f68b13f6d9.jpg
inflating: flowers/daisy/14698531521_0c2f0c6539.jpg
inflating: flowers/daisy/147068564_32bb4350cc.jpg
inflating: flowers/daisy/14707111433_cce08ee007.jpg
inflating: flowers/daisy/14716799982_ed6d626a66.jpg
inflating: flowers/daisy/14816364517_2423021484_m.jpg
inflating: flowers/daisy/14866200659_6462c723cb_m.jpg
```

```python
#importing required libraries to build a CNN classification model with accuracy

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"
```

Question-2. Image Augmentation

Solution:

from tensorflow.keras.preprocessing.image import ImageDataGenerator

train_datagen = ImageDataGenerator(rescale = 1./255, horizontal_flip = True, vertical_flip = True, z oom_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.
```

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

Question-3. Create model - Model Building and also Split dataset into training and testing sets

Solution:

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")
```

Question-4. Add the layers (Convolution,MaxPooling,Flatten,Dense-(HiddenLayers),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'),
  layers.Dense(num_classes)
])
```

Question-5. Compile The Model

Solution:

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

```
44
```

#Compile the model for further accuracy

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 [==============================] - 132s 1s/step - loss: 1.2821 - accuracy: 0.4537 - val_loss: 1.0988 - val_accuracy: 0.5458
Epoch 2/10
108/108 [==============================] - 130s 1s/step - loss: 1.0298 - accuracy: 0.5921 - val_loss: 0.9494 - val_accuracy: 0.6304
Epoch 3/10
108/108 [==============================] - 129s 1s/step - loss: 0.9274 - accuracy: 0.6448 - val_loss: 0.9927 - val_accuracy: 0.6130
Epoch 4/10
108/108 [==============================] - 129s 1s/step - loss: 0.9000 - accuracy: 0.6642 - val_loss: 0.9264 - val_accuracy: 0.6419
Epoch 5/10
108/108 [==============================] - 136s 1s/step - loss: 0.8432 - accuracy: 0.6778 - val_loss: 0.8499 - val_accuracy: 0.6674
Epoch 6/10
108/108 [==============================] - 130s 1s/step - loss: 0.8166 - accuracy: 0.6888 - val_loss: 0.8714 - val_accuracy: 0.6732
Epoch 7/10
108/108 [==============================] - 130s 1s/step - loss: 0.7726 - accuracy: 0.7064 - val_loss: 0.7873 - val_accuracy: 0.6895
Epoch 8/10
108/108 [==============================] - 130s 1s/step - loss: 0.7262 - accuracy: 0.7250 - val_loss: 0.7957 - val_accuracy: 0.6860
Epoch 9/10
108/108 [==============================] - 128s 1s/step - loss: 0.7094 - accuracy: 0.7284 - val_loss: 0.7960 - val_accuracy: 0.7068
Epoch 10/10
108/108 [==============================] - 130s 1s/step - loss: 0.6820 - accuracy: 0.7383 - val_loss: 0.7914 - val_accuracy: 0.6941
```

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

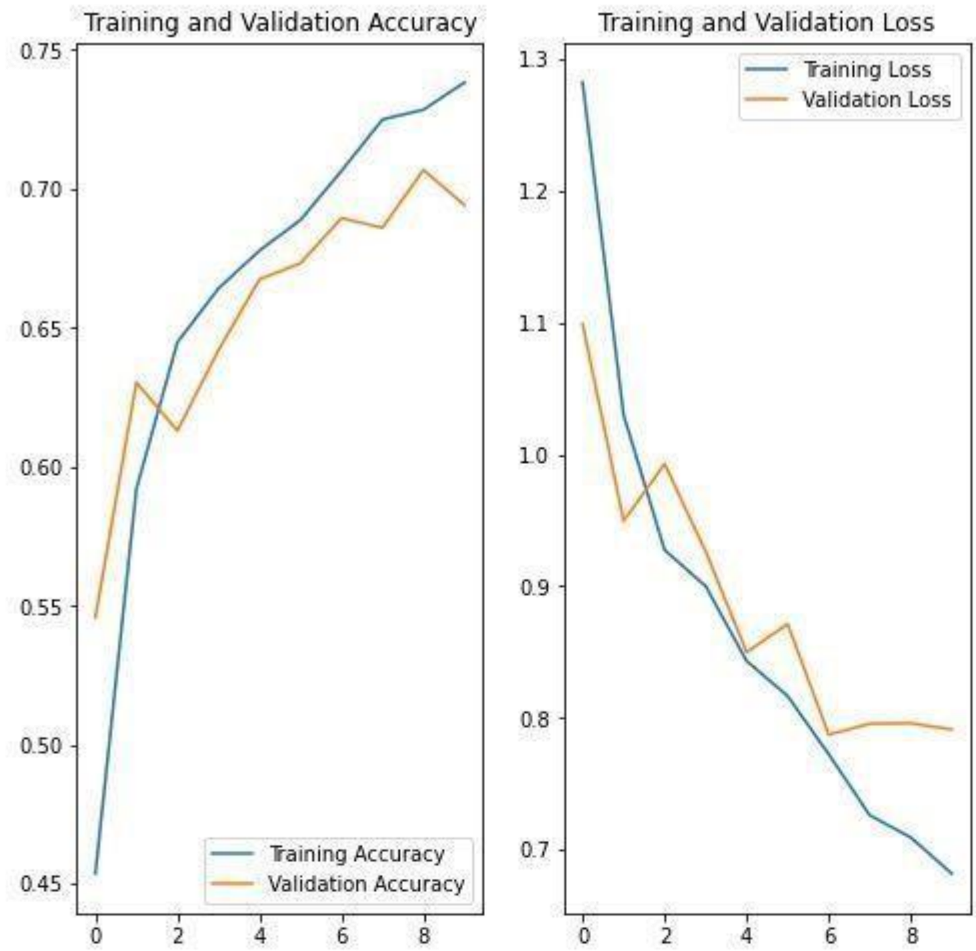
```
acc = history.history['accuracy'] val_acc
= history.history['val_accuracy']

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()
```



Question-6. Fit The Model

Solution:

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>
```

Question-7. Save The Model

Solution:

model.save("flowers.h1")

model.save("flowers.m5")#another model to show the accuracy

Question-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/rose.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
```

pred = model.predict(x) pred

```
array([[0., 0., 1., 0., 0.]], dtype=float32)
```

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

labels[np.argmax(pred)]

```
'roses'
```

#Testing the alternative model with accuracy

sunflower_url = "https://storage.googleapis.com/download.tensorflow.org/example_images/592 px-Red_sunflower.jpg" sunflower_path = tf.keras.utils.get_file('Red_sunflower',

origin=sunflower_url) img = tf.keras.utils.load_img(sunflower_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(score)], 100 * np.max(score))

)

```
Downloading data from https://storage.googleapis.com/download.tensorflow.org/example_images/592px-Red_sunflower.jpg
122880/117948 [===============================] - 0s 0us/step
131072/117948 [=================================] - 0s 0us/step
This image most likely belongs to sunflower with a 99.85 percent confidence.
```