Assignment – 3

Flower Classification using CNN

Assignment Date	01 October 2022
Student Name	Koushik M
Student Roll Number	2019504540
Maximum Marks	2 Marks

Task - 1: Import the necessary libraries

1. Import the necessary libraries

In [1]:
```
import splitfolders
import numpy as np
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential
from tensorflow.keras.models import load_model
from tensorflow.keras.layers import Dense,Convolution2D,MaxPooling2D,Flatten
from tensorflow.keras.applications.resnet50 import preprocess_input, decode_predictions
from tensorflow.keras.preprocessing import image
import matplotlib.pyplot as plt
```

Task - 2: Download the dataset and perform image augmentation

2. Download the dataset and perform image augmentation

In [2]:
```
train_datagen = ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=True,vertical_flip=False)
```

In [3]:
```
test_datagen = ImageDataGenerator(rescale=1./255)
```

In [4]:
```
input_folder = 'C:\\Users\\kumar\\OneDrive\\Documents\\IBM\\assignment_3\\flowers'
```

In [5]:
```
splitfolders.ratio(input_folder,output="C:\\Users\\kumar\\OneDrive\\Documents\\IBM\\assignment_3\\flowers\\flowersdataset",ratio=(
```

```
Copying files: 4317 files [00:25, 170.99 files/s]
```

In [6]:
```
x_train=train_datagen.flow_from_directory(r"C:\Users\kumar\OneDrive\Documents\IBM\assignment_3\flowers\flowersdataset\train",targe
```

```
Found 3452 images belonging to 5 classes.
```

In [7]:
```
x_test=test_datagen.flow_from_directory(r"C:\Users\kumar\OneDrive\Documents\IBM\assignment_3\flowers\flowersdataset\test",target_s
```

```
Found 865 images belonging to 5 classes.
```

In [8]:
```
x_train.class_indices
```

Out[8]:
```
{'daisy': 0, 'dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}
```

Task - 3: Create the model

Model should contain a Convolution Layer, MaxPooling Layer, Flatten Layer, Dense Layer and Output layer

3. Create the model

Model should contain a Convolution Layer, MaxPooling Layer, Flatten Layer, Dense Layer and Output layer

In [9]:
```
model=Sequential()
model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activation='relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Flatten())
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
```

In [10]:
```
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 62, 62, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 31, 31, 32)        0
_________________________________________________________________
flatten (Flatten)            (None, 30752)             0
_________________________________________________________________
dense (Dense)                (None, 300)               9225900
_________________________________________________________________
dense_1 (Dense)              (None, 150)               45150
=================================================================
Total params: 9,271,946
Trainable params: 9,271,946
Non-trainable params: 0
_________________________________________________________________
```

In [11]:
```
model.add(Dense(5,activation='softmax'))
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 62, 62, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 31, 31, 32)        0
_________________________________________________________________
flatten (Flatten)            (None, 30752)             0
_________________________________________________________________
dense (Dense)                (None, 300)               9225900
_________________________________________________________________
dense_1 (Dense)              (None, 150)               45150
_________________________________________________________________
dense_2 (Dense)              (None, 5)                 755
=================================================================
Total params: 9,272,701
Trainable params: 9,272,701
Non-trainable params: 0
_________________________________________________________________
```

Task – 4: Compile the model and train it for 20 epochs using model.fit() method

4. Compile the model and train it for 20 epochs using model.fit() method

In [12]:
```
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)
```

Out[12]: 144

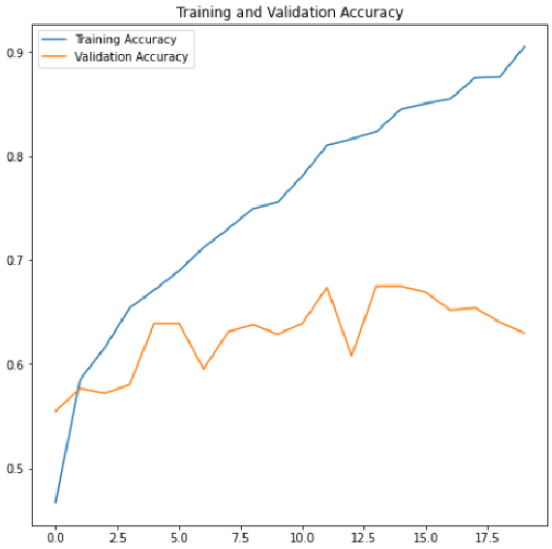
In [13]:
```
epoch=20
history = model.fit(x_train,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test),epochs=epoch)
```

```
Epoch 1/20
144/144 [==============================] - 44s 158ms/step - loss: 1.2757 - accuracy: 0.4676 - val_loss: 1.1261 - val_accuracy: 0.
5549
Epoch 2/20
144/144 [==============================] - 8s 57ms/step - loss: 1.0409 - accuracy: 0.5855 - val_loss: 1.1483 - val_accuracy: 0.57
69
Epoch 3/20
144/144 [==============================] - 7s 52ms/step - loss: 0.9904 - accuracy: 0.6162 - val_loss: 1.1175 - val_accuracy: 0.57
23
Epoch 4/20
144/144 [==============================] - 7s 49ms/step - loss: 0.8925 - accuracy: 0.6541 - val_loss: 1.0778 - val_accuracy: 0.58
03
Epoch 5/20
144/144 [==============================] - 7s 51ms/step - loss: 0.8504 - accuracy: 0.6715 - val_loss: 1.0019 - val_accuracy: 0.63
93
Epoch 6/20
144/144 [==============================] - 7s 51ms/step - loss: 0.8065 - accuracy: 0.6897 - val_loss: 1.0034 - val_accuracy: 0.63
93
Epoch 7/20
144/144 [==============================] - 7s 50ms/step - loss: 0.7544 - accuracy: 0.7123 - val_loss: 1.1677 - val_accuracy: 0.59
54
Epoch 8/20
144/144 [==============================] - 7s 51ms/step - loss: 0.7005 - accuracy: 0.7303 - val_loss: 1.0580 - val_accuracy: 0.63
12
Epoch 9/20
144/144 [==============================] - 7s 51ms/step - loss: 0.6536 - accuracy: 0.7497 - val_loss: 1.0528 - val_accuracy: 0.63
82
Epoch 10/20
144/144 [==============================] - 7s 51ms/step - loss: 0.6092 - accuracy: 0.7558 - val_loss: 1.1169 - val_accuracy: 0.62
89
Epoch 11/20
144/144 [==============================] - 8s 56ms/step - loss: 0.5679 - accuracy: 0.7810 - val_loss: 1.1217 - val_accuracy: 0.63
93
Epoch 12/20
144/144 [==============================] - 8s 55ms/step - loss: 0.5288 - accuracy: 0.8105 - val_loss: 1.0372 - val_accuracy: 0.67
40
Epoch 13/20
144/144 [==============================] - 7s 51ms/step - loss: 0.4846 - accuracy: 0.8166 - val_loss: 1.1872 - val_accuracy: 0.60
81
Epoch 14/20
144/144 [==============================] - 7s 51ms/step - loss: 0.4804 - accuracy: 0.8236 - val_loss: 1.1117 - val_accuracy: 0.67
51
Epoch 15/20
144/144 [==============================] - 7s 51ms/step - loss: 0.4333 - accuracy: 0.8453 - val_loss: 1.1388 - val_accuracy: 0.67
51
Epoch 16/20
144/144 [==============================] - 7s 51ms/step - loss: 0.4119 - accuracy: 0.8508 - val_loss: 1.1882 - val_accuracy: 0.66
94
Epoch 17/20
144/144 [==============================] - 7s 51ms/step - loss: 0.3981 - accuracy: 0.8552 - val_loss: 1.3760 - val_accuracy: 0.65
20
Epoch 18/20
144/144 [==============================] - 9s 62ms/step - loss: 0.3456 - accuracy: 0.8754 - val_loss: 1.3123 - val_accuracy: 0.65
43
Epoch 19/20
144/144 [==============================] - 10s 66ms/step - loss: 0.3341 - accuracy: 0.8763 - val_loss: 1.4009 - val_accuracy: 0.6
405
Epoch 20/20
144/144 [==============================] - 8s 52ms/step - loss: 0.2888 - accuracy: 0.9053 - val_loss: 1.4764 - val_accuracy: 0.63
01
```

Task – 5: Plot the training and validation accuracy along with training and validation loss

In [15]:
```
epochs_range = range(epoch)

plt.figure(figsize=(8, 8))
plt.plot(epochs_range, history.history['accuracy'], label='Training Accuracy')
plt.plot(epochs_range, history.history['val_accuracy'], label='Validation Accuracy')
plt.legend()
plt.title('Training and Validation Accuracy')
plt.show()
```



Task – 6: Save the model

6. Save the Model

In [17]:
```
model.save('flowers.h5')
```

Task – 7: Test the model

7. Test the model

In [18]:
```
img=image.load_img(r"C:\Users\kumar\OneDrive\Documents\IBM\assignment_3\flowers\flowersdataset\test\daisy\3706420943_66f3214862_n.
x=image.img_to_array(img)
x=np.expand_dims(x,axis=0)
y=np.argmax(model.predict(x),axis=1)
x_train.class_indices
index=['daisy','dandellion','rose','sunflower','tulip']
index[y[0]]
```

Out[18]:
```
'daisy'
```

In [19]:
```
img_url = "https://storage.googleapis.com/download.tensorflow.org/example_images/592px-Red_sunflower.jpg"
img_path = tf.keras.utils.get_file('Red_sunflower', origin=img_url)

img = image.load_img(img_path, target_size=(224, 224))
img_array = image.img_to_array(img)
img_batch = np.expand_dims(img_array, axis=0)

img_preprocessed = preprocess_input(img_batch)
model = tf.keras.applications.resnet50.ResNet50()
prediction = model.predict(img_preprocessed)

print(decode_predictions(prediction, top=3)[0])

score = tf.nn.softmax(prediction[0])
```

```
Downloading data from https://storage.googleapis.com/download.tensorflow.org/example_images/592px-Red_sunflower.jpg (https://storage.googleapis.com/download.tensorflow.org/example_images/592px-Red_sunflower.jpg)
122880/117948 [==============================] - 0s 1us/step
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/resnet/resnet50_weights_tf_dim_ordering_tf_kernels.h5 (https://storage.googleapis.com/tensorflow/keras-applications/resnet/resnet50_weights_tf_dim_ordering_tf_kernels.h5)
102973440/102967424 [==============================] - 9s 0us/step
Downloading data from https://storage.googleapis.com/download.tensorflow.org/data/imagenet_class_index.json (https://storage.googleapis.com/download.tensorflow.org/data/imagenet_class_index.json)
40960/35363 [==============================] - 0s 0us/step
[('n11939491', 'daisy', 0.58117616), ('n02206856', 'bee', 0.24989876), ('n03991062', 'pot', 0.01135167)]
```