Assignment 3 - Build CNN Model for Classification Of Flowers

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In [1]:
```python
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_predicti
from tensorflow.keras.preprocessing import image
import matplotlib.pyplot as plt
```

2. Image Augmentation

In [2]:
```python
train_datagen = ImageDataGenerator(rescale=1./255,zoom_range=0.2,horizontal_flip=Tru
```

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

In [4]:
```python
input_folder = '.\Flowers-Dataset\\flowers'
```

In [5]:
```python
splitfolders.ratio(input_folder,output="flowers",ratio=(.8,0,.2),group_prefix=None)
```

```
Copying files: 4317 files [00:03, 1292.11 files/s]
```

In [6]:
```python
x_train=train_datagen.flow_from_directory(r".\flowers\train",target_size=(64,64),cla
```

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

In [7]:
```python
x_test=test_datagen.flow_from_directory(r".\flowers\test",target_size=(64,64),class_
```

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

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

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

3. Create Model

In [9]:
```python
model=Sequential()
```

4. Add Layers

4.1. Convolution Layer

In [10]:
```python
model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activation='relu'))
```

4.2. MaxPooling Layer

In [11]:
```python
model.add(MaxPooling2D(pool_size=(2,2)))
```

4.3. Flatten Layer

In [12]:
```python
model.add(Flatten())
```

4.4. Dense Layer

In [13]:
```python
model.add(Dense(300,activation='relu'))
model.add(Dense(150,activation='relu'))
```

In [14]:
```python
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

4.5. Output Layer

In [15]:
```python
model.add(Dense(5,activation='softmax'))
```

In [16]:
```python
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
```

5. Compile The Model

In [17]:
```python
model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
len(x_train)
```

Out[17]: 144

6. Fit The Model

In [18]:
```python
epo=20
history  =  model.fit(x_train,steps_per_epoch=len(x_train),validation_data=x_test,vali
```

```
Epoch 1/20
144/144 [==============================] - 29s 202ms/step - loss: 1.4725 - accuracy:
0.4293 - val_loss: 1.1148 - val_accuracy: 0.5538
Epoch 2/20
144/144 [==============================] - 15s 101ms/step - loss: 1.0813 - accuracy:
0.5640 - val_loss: 1.0807 - val_accuracy: 0.5653
Epoch 3/20
144/144 [==============================] -15s 102ms/step  - loss: 0.9676 - accuracy:
0.6185 - val_loss: 1.0689 - val_accuracy: 0.5977
Epoch 4/20
144/144 [==============================] - 15s 101ms/step - loss: 0.9144 - accuracy:
0.6411 - val_loss: 0.9561 - val_accuracy: 0.6497
Epoch 5/20
144/144 [==============================] - 17s 116ms/step - loss: 0.8731 - accuracy:
0.6561 - val_loss: 0.9766 - val_accuracy: 0.6370
Epoch 6/20
144/144 [==============================] - 15s 107ms/step - loss: 0.8303 - accuracy:
0.6784 - val_loss: 1.0373 - val_accuracy: 0.6324
Epoch 7/20
144/144 [==============================] -16s 108ms/step  - loss: 0.7858 - accuracy:
0.6947 - val_loss: 1.1446 - val_accuracy: 0.5734
Epoch 8/20
144/144 [==============================] - 15s 105ms/step - loss: 0.7539 - accuracy:
0.7138 - val_loss: 1.1979 - val_accuracy: 0.5873
Epoch 9/20
144/144 [==============================] - 15s 107ms/step - loss: 0.7262 - accuracy:
0.7135 - val_loss: 1.0924 - val_accuracy: 0.6231
Epoch 10/20
144/144 [==============================] - 15s 101ms/step - loss: 0.6684 - accuracy:
0.7445 - val_loss: 1.1218 - val_accuracy: 0.6220
```

```
Epoch 11/20
144/144 [==============================] - 15s 106ms/step - loss: 0.6142 - accuracy:
0.7683 - val_loss: 1.0576 - val_accuracy: 0.6486
Epoch 12/20
144/144 [==============================] - 15s 106ms/step - loss: 0.6006 - accuracy:
0.7703 - val_loss: 1.0454 - val_accuracy: 0.6520
Epoch 13/20
144/144 [==============================] - 15s 105ms/step - loss: 0.5584 - accuracy:
0.7859 - val_loss: 1.0735 - val_accuracy: 0.6566
Epoch 14/20
144/144 [==============================] -15s 102ms/step  - loss: 0.5387 - accuracy:
0.7966 - val_loss: 1.1083 - val_accuracy: 0.6451
Epoch 15/20
144/144 [==============================] - 15s 103ms/step - loss: 0.4935 - accuracy:
0.8134 - val_loss: 1.0815 - val_accuracy: 0.6462
Epoch 16/20
144/144 [==============================] - 14s 100ms/step - loss: 0.4961 - accuracy:
0.8172 - val_loss: 1.0991 - val_accuracy: 0.6520
Epoch 17/20
144/144 [==============================] - 15s 103ms/step - loss: 0.4373 - accuracy:
0.8418 - val_loss: 1.2605 - val_accuracy: 0.6728
Epoch 18/20
144/144 [==============================] -15s 102ms/step  - loss: 0.4228 - accuracy:
0.8444 - val_loss: 1.1316 - val_accuracy: 0.6543
Epoch 19/20
144/144 [==============================] - 15s 104ms/step - loss: 0.3853 - accuracy:
0.8612 - val_loss: 1.1264 - val_accuracy: 0.6636
Epoch 20/20
144/144 [==============================] - 14s 100ms/step - loss: 0.3900 - accuracy:
0.8502 - val_loss: 1.1911 - val_accuracy: 0.6532
```
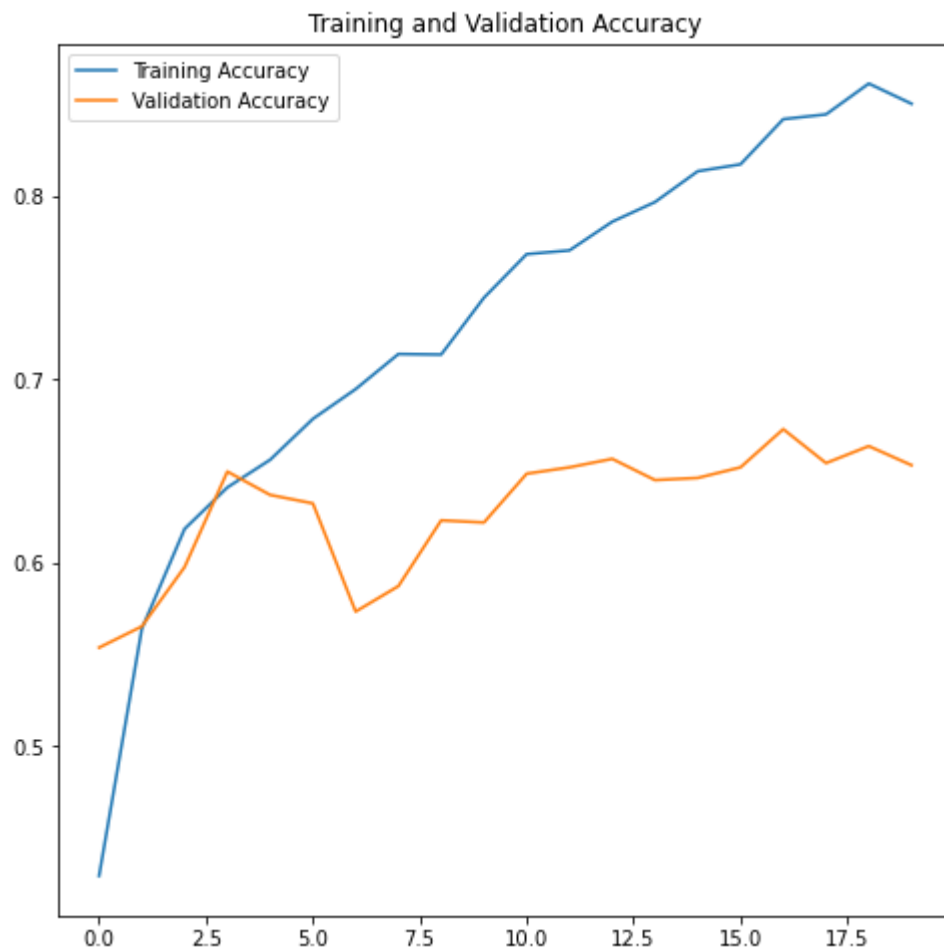
In [19]:
```python
epochs_range = range(epo)

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()
```

Training and Validation Accuracy

```
In [20]:  plt.figure(figsize=(8, 8))
          plt.plot(epochs_range, history.history['loss'], label='Training Loss')
          plt.plot(epochs_range, history.history['val_loss'], label='Validation Loss')
          plt.legend()
          plt.title('Training and Validation Loss')
          plt.show()
```

Training and Validation Loss
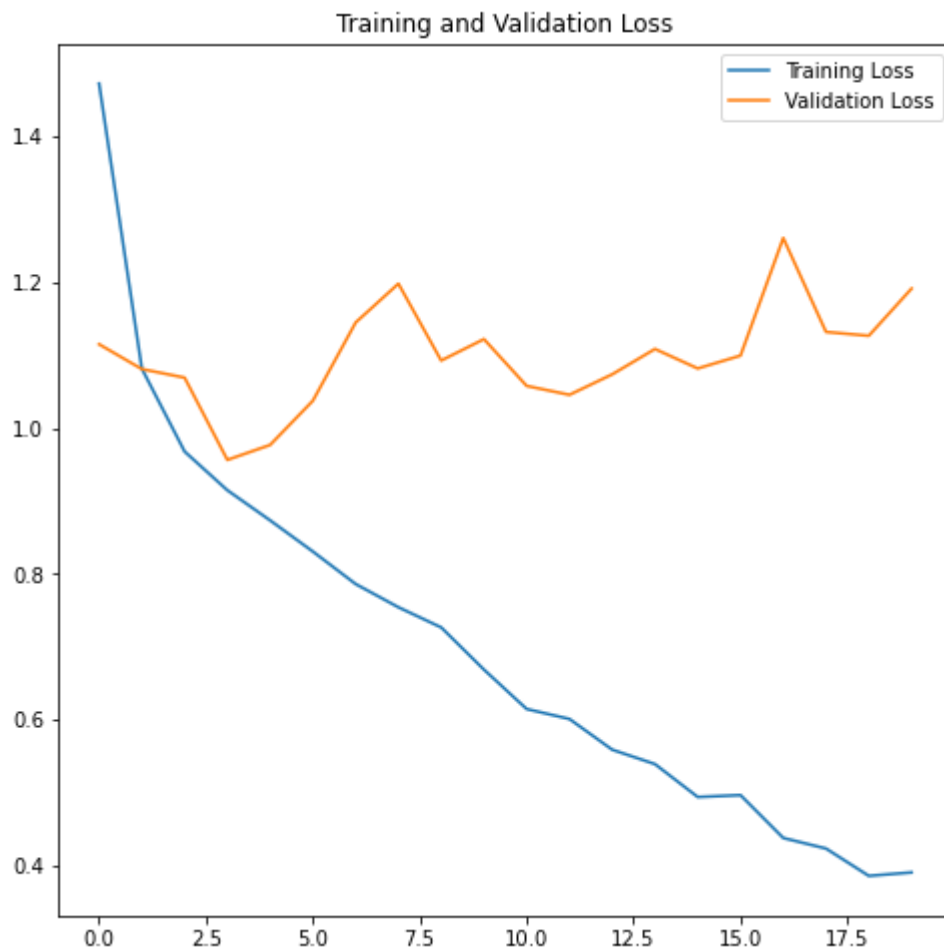
7. Save the Model

In [21]:
```python
model.save('flowers.h5')
```

8. Test the Model

In [22]:
```python
img=image.load_img(r".\flowers\test\daisy\3706420943_66f3214862_n.jpg",target_size=(
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]]
```

```
1/1 [==============================] - 0s 77ms/step
```
Out[22]: 'daisy'

In [23]:
```python
img_url = "https://storage.googleapis.com/download.tensorflow.org/example_images/592
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)
```

```python
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
117948/117948 [==============================] - 0s 0us/step
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/r
esnet/resnet50_weights_tf_dim_ordering_tf_kernels.h5
102967424/102967424 [==============================] - 3s 0us/step
1/1 [==============================] - 1s 868ms/step
Downloading data from https://storage.googleapis.com/download.tensorflow.org/data/im
agenet_class_index.json
35363/35363 [==============================] - 0s 0us/step
[('n11939491', 'daisy', 0.5775759), ('n02206856', 'bee', 0.24938338), ('n03991062',
'pot', 0.01181931)]
```