Assignment_3

November 17, 2022

Assignment Date	01 October 2022
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Maximum Marks	2 Marks

1 Build CNN Model for Classification Of Flowers

[24]:
```
import tensorflow as tf
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential

import numpy as np
```

[25]:
```
batch_size = 32
img_height = 180
img_width = 180

data_dir = "../input/flowers-ibmntp/flowers"
```

1.0.1 Image augmentation

[26]:
```
data_augmentation = Sequential(
  [
    layers.RandomFlip("horizontal",input_shape=(img_height, img_width, 3)),
    layers.RandomRotation(0.1),
    layers.RandomZoom(0.1),
  ]
)
```

1.0.2 Split dataset into training and testing sets

[27]:
```
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.
```

[28]:

```
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.
```

[29]:

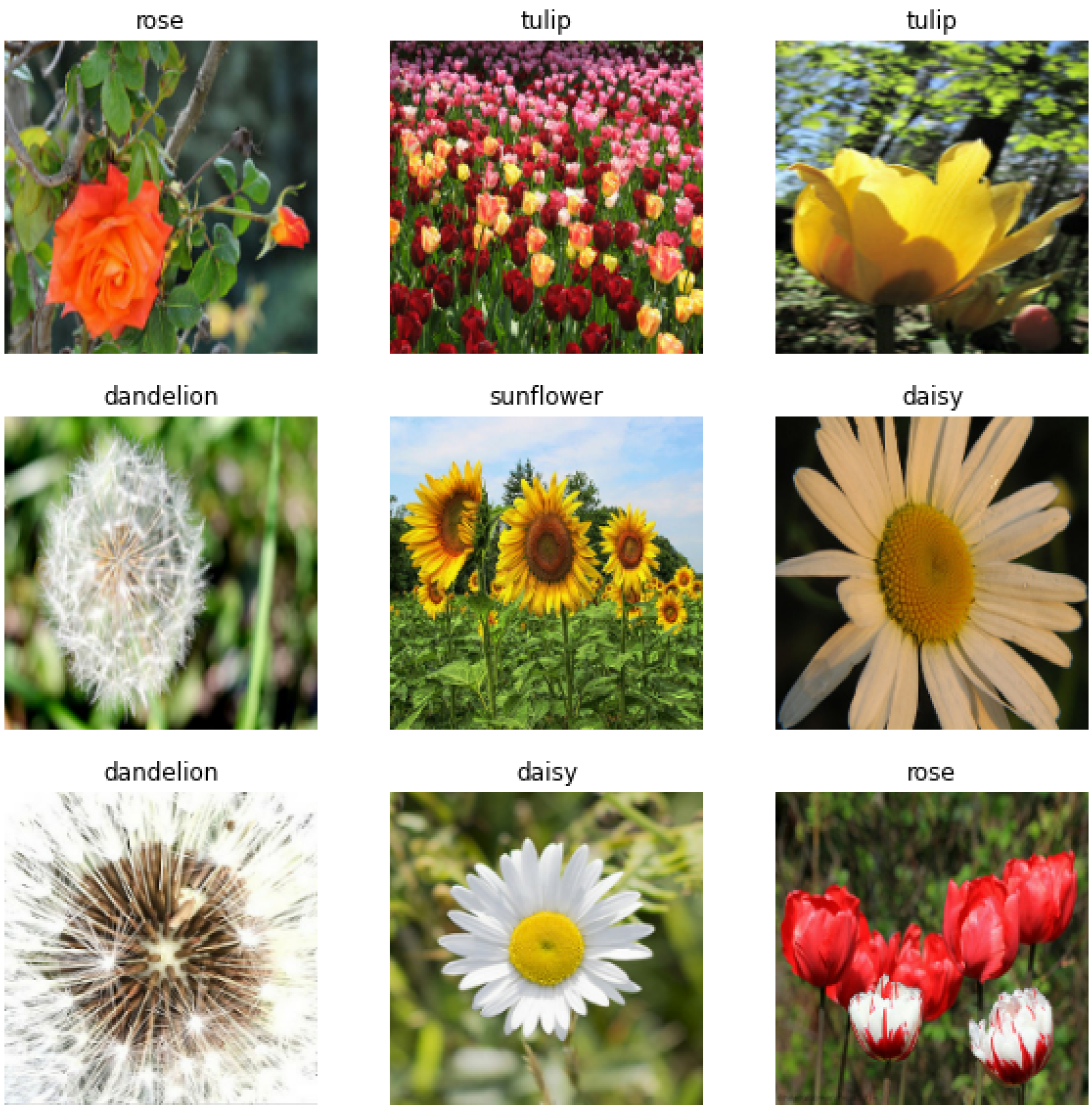
```
class_names = train_ds.class_names
print(class_names)
```

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

[30]:

```
import matplotlib.pyplot as plt

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")
```




```
[31]: normalization_layer = layers.Rescaling(1./255)
```

```
[32]: normalized_ds = train_ds.map(lambda x, y: (normalization_layer(x), y))
      image_batch, labels_batch = next(iter(normalized_ds))
      first_image = image_batch[0]
      # Notice the pixel values are now in `[0,1]`.
      print(np.min(first_image), np.max(first_image))
```

```
0.0 0.97046
```

1.0.3 Create the model and adding layers

[33]:
```
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)
])
```

1.0.4 Compile the model

[34]:
```
model.compile(optimizer='adam',
              loss=tf.keras.losses.
 ↪SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])
```

[35]:
```
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
sequential_1 (Sequential)    (None, 180, 180, 3)       0
_________________________________________________________________
rescaling_3 (Rescaling)      (None, 180, 180, 3)       0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 180, 180, 16)      448
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 90, 90, 16)        0
_________________________________________________________________
conv2d_4 (Conv2D)            (None, 90, 90, 32)        4640
_________________________________________________________________
max_pooling2d_4 (MaxPooling2 (None, 45, 45, 32)        0
_________________________________________________________________
conv2d_5 (Conv2D)            (None, 45, 45, 64)        18496
_________________________________________________________________
max_pooling2d_5 (MaxPooling2 (None, 22, 22, 64)        0
_________________________________________________________________
```

```
flatten_1 (Flatten)          (None, 30976)             0

_________________________________________________________________
dense_2 (Dense)              (None, 128)               3965056

_________________________________________________________________
dense_3 (Dense)              (None, 5)                 645
=================================================================
Total params: 3,989,285
Trainable params: 3,989,285
Non-trainable params: 0

_________________________________________________________________
```

1.0.5 Fit the model

[36]:
```
epochs=10
history = model.fit(
  train_ds,
  validation_data=val_ds,
  epochs=epochs
)
```

```
Epoch 1/10
108/108 [==============================] - 12s 98ms/step - loss: 1.3587 -
accuracy: 0.4311 - val_loss: 1.1208 - val_accuracy: 0.5481
Epoch 2/10
108/108 [==============================] - 8s 63ms/step - loss: 1.0440 -
accuracy: 0.5926 - val_loss: 1.0209 - val_accuracy: 0.6083
Epoch 3/10
108/108 [==============================] - 8s 57ms/step - loss: 0.9654 -
accuracy: 0.6283 - val_loss: 0.9353 - val_accuracy: 0.6431
Epoch 4/10
108/108 [==============================] - 8s 66ms/step - loss: 0.8782 -
accuracy: 0.6726 - val_loss: 0.8580 - val_accuracy: 0.6582
Epoch 5/10
108/108 [==============================] - 7s 61ms/step - loss: 0.8522 -
accuracy: 0.6699 - val_loss: 0.9512 - val_accuracy: 0.6211
Epoch 6/10
108/108 [==============================] - 7s 61ms/step - loss: 0.8144 -
accuracy: 0.6957 - val_loss: 0.8153 - val_accuracy: 0.6651
Epoch 7/10
108/108 [==============================] - 7s 58ms/step - loss: 0.7433 -
accuracy: 0.7215 - val_loss: 0.7417 - val_accuracy: 0.7115
Epoch 8/10
108/108 [==============================] - 7s 65ms/step - loss: 0.7176 -
accuracy: 0.7336 - val_loss: 0.7869 - val_accuracy: 0.6813
Epoch 9/10
108/108 [==============================] - 7s 62ms/step - loss: 0.6884 -
accuracy: 0.7360 - val_loss: 0.7605 - val_accuracy: 0.7080
Epoch 10/10
```

```
108/108 [==============================] - 7s 62ms/step - loss: 0.6594 -
accuracy: 0.7417 - val_loss: 0.7304 - val_accuracy: 0.7149
```

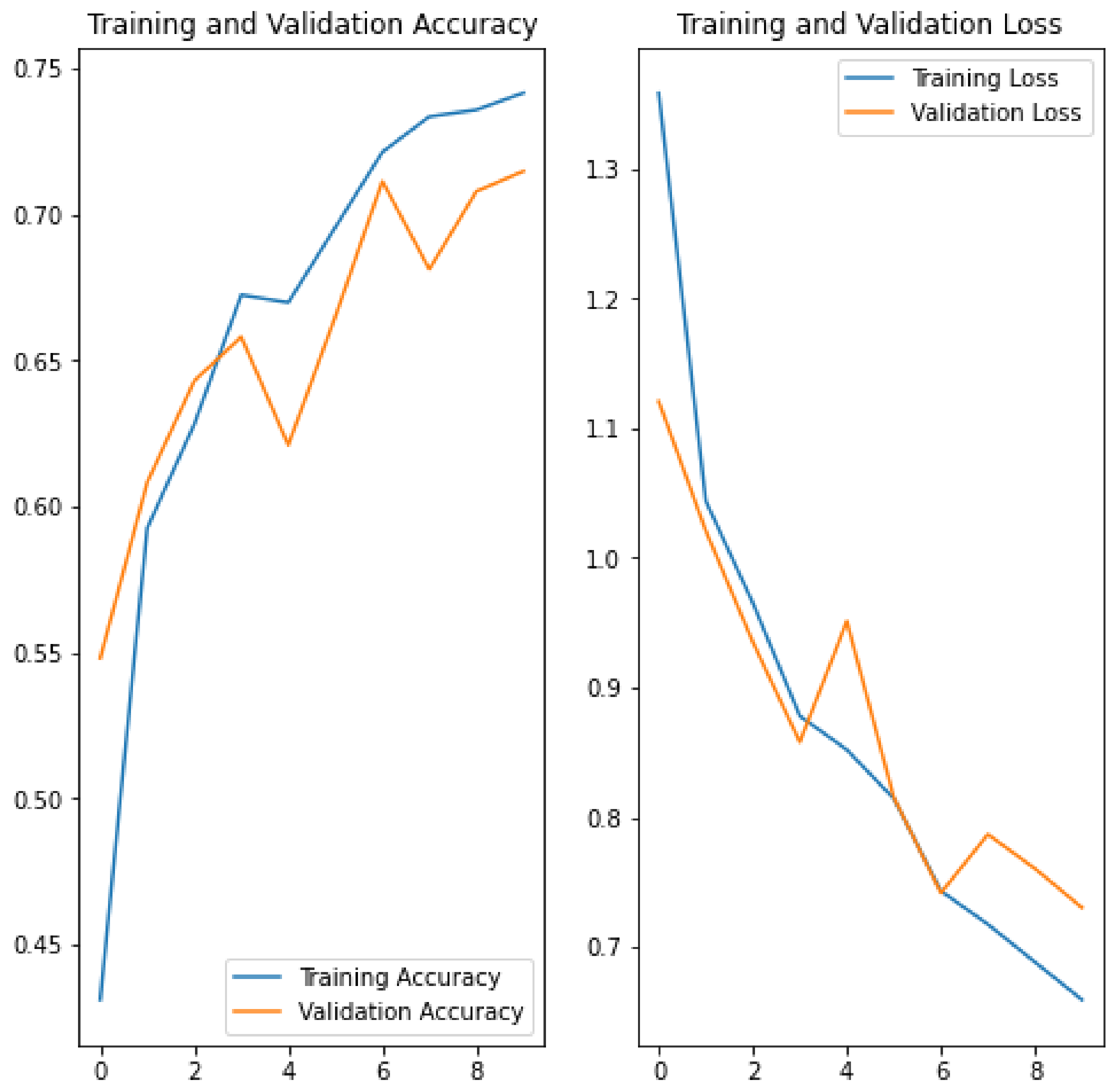
[37]:
```
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

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()
```



1.0.6 Save the model

[38]:
```
model.save("flowers.m5")
```

1.0.7 Testing the model

[39]:
```
sunflower_url = "https://storage.googleapis.com/download.tensorflow.org/
↪example_images/592px-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)
)
```

```python
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 99.81 percent confidence.
```