# Assignment_3

November 17, 2022

| | |
|---|---|
| Assignment Date | 01 October 2022 |
| Student Name | Harish G |
| Student Roll Number | 2019504026 |
| 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)
```

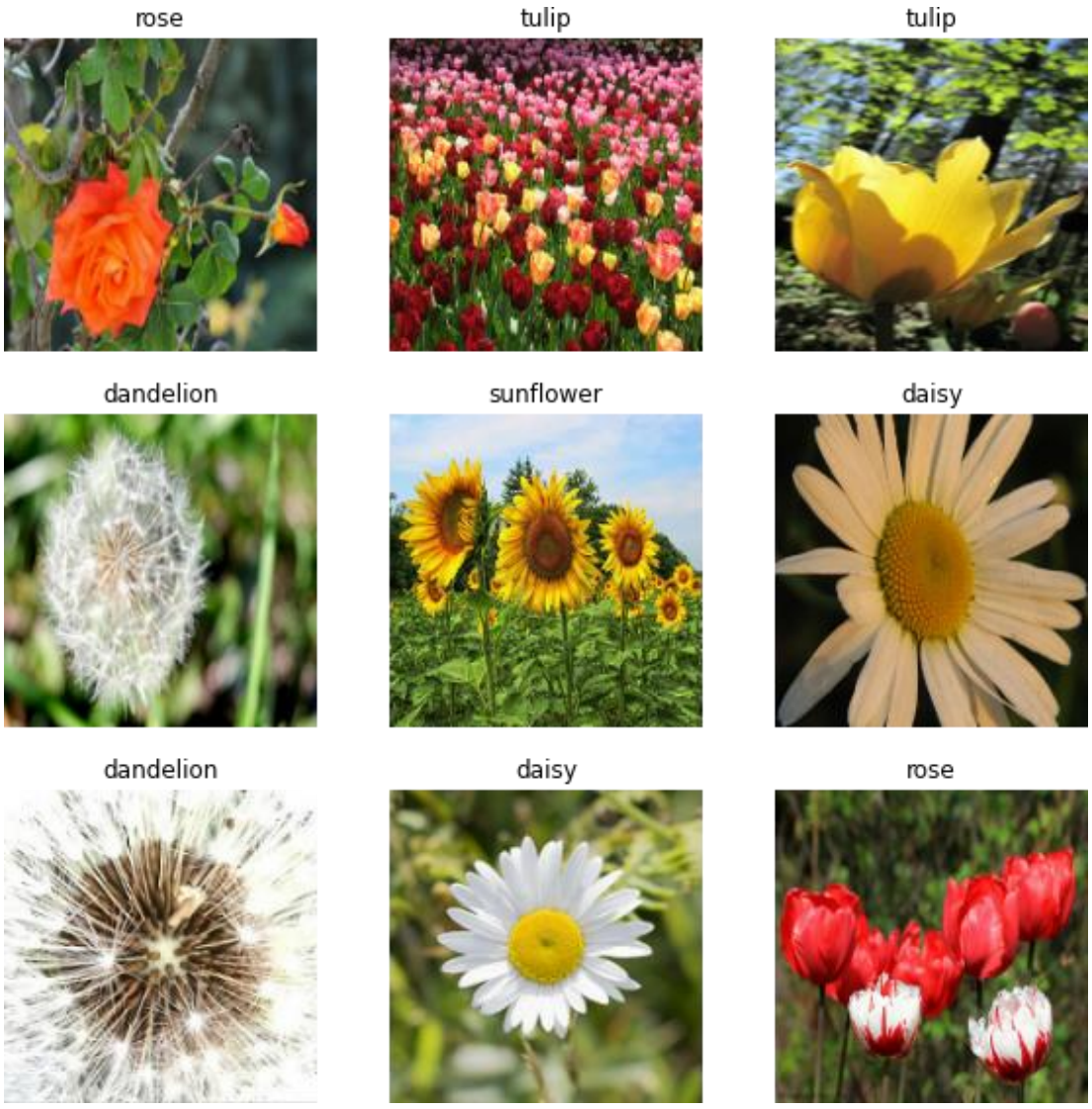
Found 4317 files belonging to 5 classes. Using 863 files
for validation.

[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='ValidationAccuracy') 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='ValidationLoss') 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)
)
```

```
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} percentconfidence."
        .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.
```