

### ASSIGNMENT-3

#### Build CNN Model for Classification Of Flowers

Assignment Date	07 October 2022
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Maximum Marks	2 marks

#### 1. Download the data set : Dataset

<https://drive.google.com/file/d/1xkynpL15pt6KT3YSIDimu4A5iRU9qYck/view>

## 2. Image Augmentation

```
✓ [4] from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

```
✓ [5] train_datagen = ImageDataGenerator(  
    featurewise_center=False, # set input mean to 0 over the dataset  
    samplewise_center=False, # set each sample mean to 0  
    featurewise_std_normalization=False, # divide inputs by std of the dataset  
    samplewise_std_normalization=False, # divide each input by its std  
    zca_whitening=False, # apply ZCA whitening  
    rotation_range=10, # randomly rotate images in the range (degrees, 0 to 180)  
    zoom_range = 0.1, # Randomly zoom image  
    width_shift_range=0.2, # randomly shift images horizontally (fraction of total width)  
    height_shift_range=0.2, # randomly shift images vertically (fraction of total height)  
    horizontal_flip=True, # randomly flip images  
    vertical_flip=False) # randomly flip image
```

```
✓ [6] test_datagen = ImageDataGenerator(  
    featurewise_center=False, # set input mean to 0 over the dataset  
    samplewise_center=False, # set each sample mean to 0  
    featurewise_std_normalization=False, # divide inputs by std of the dataset  
    samplewise_std_normalization=False, # divide each input by its std  
    zca_whitening=False, # apply ZCA whitening  
    rotation_range=10, # randomly rotate images in the range (degrees, 0 to 180)  
    zoom_range = 0.1, # Randomly zoom image  
    width_shift_range=0.2, # randomly shift images horizontally (fraction of total width)  
    height_shift_range=0.2, # randomly shift images vertically (fraction of total height)  
    horizontal_flip=True, # randomly flip images  
    vertical_flip=False) # randomly flip image
```

```
[ ] train = train_datagen.flow_from_directory(r"E:\SB\Dataset\Training",target_size=(64,64),batch_size=32,class_mode="categorical")
```

Found 1717 images belonging to 2 classes

```
[ ] test = test_datagen.flow_from_directory(r"E:\SB\Dataset\Testing",target_size=(64,64),batch_size=32,class_mode="categorical")
```

Found 2600 images belonging to 3 classes

### 3. Create the Model

```
#build the model
import tensorflow as tf
from tensorflow import keras
from keras.models import Sequential
from keras.layers import Dense, Flatten, Conv2D, MaxPooling2D
from tensorflow.keras import layers

model = tf.keras.Sequential()
model.add(layers.Conv2D(32, (5, 5), activation='relu', input_shape=(32,32,3)))
model.add(layers.MaxPooling2D(pool_size=(2, 2)))
model.add(layers.Conv2D(64, (5, 5), activation='relu'))
model.add(layers.MaxPooling2D(pool_size=(2, 2)))
model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(5, activation='softmax'))
```

### 4.Add Layers (Convolution, Max Pooling ,Flatten,Dense-(Hidden Layers),Output)

#### Convolution layer:

```
model.add(Conv2D(filters = 32, kernel_size = (5,5),padding = 'Same',activation = 'relu', input_shape = (150,150,3)))
# 32 indicates => no of feature detectors
#(5,5)=> kernel size (feature detector size)
```

#### Max Pooling Layer:

```
[ ] model.add(MaxPooling2D(pool_size=(2,2)))
```



## Flatten layer:

```
[ ] model.add(Flatten())
```



## Dense (hidden layer):

```
[ ]  
model.add(Dense(units=3, kernel_initializer="random_uniform", activation="relu"))  
model.add(Dense(units=2, kernel_initializer="random_uniform", activation="relu"))
```

## Output layer:

```
[ ] model.add(Dense(units=5, kernel_initializer="random_uniform", activation="softmax"))
```

```
Number of types of flowers: 5  
Types of flowers: ['daisy', 'rose', 'tulip', 'dandelion', 'sunflower']  
Out[2]:
```

	category	image
0	daisy	flowersData/daisy/14167534527_781ceb1b7a_n.jpg
1	daisy	flowersData/daisy/34718882165_68cdc9def9_n.jpg
2	daisy	flowersData/daisy/5512287917_9f5d3f0f98_n.jpg
3	daisy	flowersData/daisy/476857510_d2b30175de_n.jpg
4	daisy	flowersData/daisy/521762040_f26f2e08dd.jpg

## 4. Compile the Model

Compile the model:

```
[ ] model.compile(optimizer=Adam(lr=0.001), loss='categorical_crossentropy', metrics=['accuracy'])
```

```
dandelion : 26.07 %  
tulip : 21.12 %  
sunflower : 20.52 %  
rose : 16.19 %  
daisy : 16.09 %
```

## 5. Fit the Model

```
4 history = model.fit_generator(datagen.flow(X_train,y_train, batch_size=batch_size),
5                               epochs = epochs,
6                               validation_data = (X_test,y_test),
7                               verbose = 1)
```

```
max_pooling2d_1 (MaxPooling (None, 37, 37, 64) 0
2D)
conv2d_2 (Conv2D) (None, 37, 37, 96) 55392
max_pooling2d_2 (MaxPooling (None, 18, 18, 96) 0
2D)
conv2d_3 (Conv2D) (None, 18, 18, 96) 83040
max_pooling2d_3 (MaxPooling (None, 9, 9, 96) 0
2D)
flatten (Flatten) (None, 7776) 0
dense (Dense) (None, 512) 3981824
activation (Activation) (None, 512) 0
dense_1 (Dense) (None, 5) 2565

=====
Total params: 4,143,749
Trainable params: 4,143,749
Non-trainable params: 0
```

## 6. Save the Model

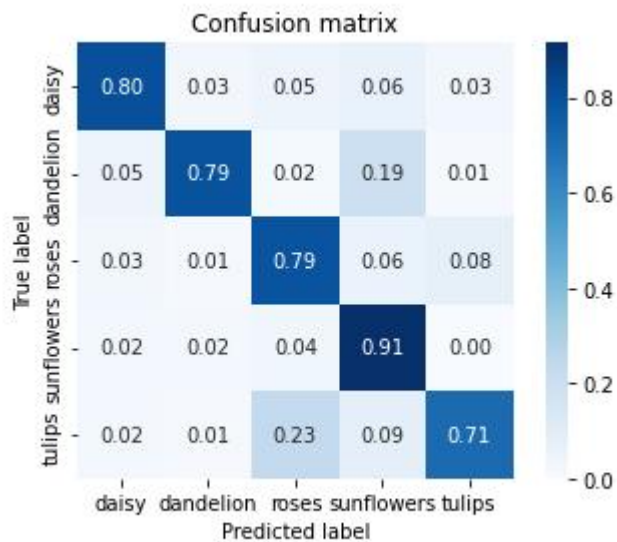
```
model.save("flowers.h5")
```



## 7. Test the Model

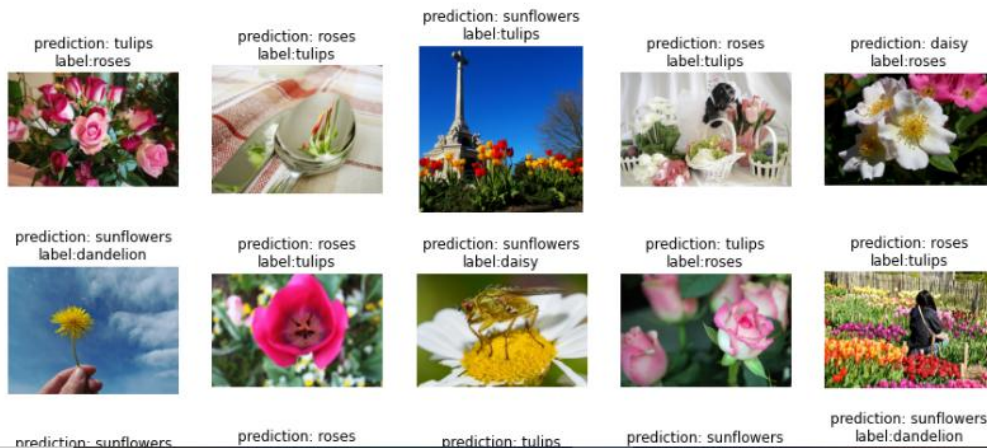
### Prediction Test:

```
def show_confusion_matrix(test_labels, predictions):  
    """Compute confusion matrix and normalize."""  
    confusion = sk_metrics.confusion_matrix(  
        np.argmax(test_labels, axis=1), predictions)  
    confusion_normalized = confusion.astype("float") / confusion.sum(axis=1)  
    axis_labels = list(CLASSES.values())  
    ax = sns.heatmap(  
        confusion_normalized, xticklabels=axis_labels, yticklabels=axis_labels,  
        cmap='Blues', annot=True, fmt='.2f', square=True)  
    plt.title("Confusion matrix")  
    plt.ylabel("True label")  
    plt.xlabel("Predicted label")  
  
show_confusion_matrix(batch_labels, test_prediction)
```



## Incorrect Prediction test:

```
incorrect = [
    (example, CLASSES[prediction])
    for example, prediction, is_correct in zip(test_batch, test_prediction, correct_predicate)
    if not is_correct
]
display_images(
    [(get_image(example), "prediction: {0}\nlabel:{1}".format(incorrect_prediction, get_class(example)
    for (example, incorrect_prediction) in incorrect[:20]))]
```



## Count test:

```
In [4]: # Let's do some visualization and see how many samples we have for each category
f, ax = plt.subplots(1,1,figsize=(14,6))
sns.barplot(x = flowerNum.index, y = flowerNum.values, ax = ax, palette="rocket")
ax.set_title("Flowers count for each category", fontsize=16)
ax.set_xlabel("Category", fontsize=14)
ax.set_ylabel("Count", fontsize=14)
plt.show()
```

