

## Assignment-3

### Build CNN Model for Classification Of Flowers

Assignment Date	:	11 October 2022
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Maximum Marks	:	2 Marks

#### Task 1:

#### Question- 1:

Download the dataset

Assignment-3 Build CNN Model for Classification of Flowers

#### Download Dataset

```
In [2]: # the dataset of images of flowers is downloaded and uploaded into the colab files and then unzipped
```

#### Solution:

```
import warnings
warnings.filterwarnings('ignore')
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Convolution2D
from tensorflow.keras.layers import MaxPooling2D
from tensorflow.keras.layers import Flatten
```

#### Output:

```
In [3]: import warnings
warnings.filterwarnings('ignore')
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense
from tensorflow.keras.layers import Convolution2D
from tensorflow.keras.layers import MaxPooling2D
from tensorflow.keras.layers import Flatten
```

Solution:

```
from tensorflow.keras.preprocessing.image import  
ImageDataGenerator
```

Output:

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

Solution:

```
!unzip '/content/Flowers-Dataset.zip'
```

Output:

```
In [5]: !unzip '/content/Flowers-Dataset.zip'  
  
Archive: /content/Flowers-Dataset.zip  
  inflating: flowers/daisy/100080576_f52e8ee070_n.jpg  
  inflating: flowers/daisy/10140303196_b88d3d6cec.jpg  
  inflating: flowers/daisy/10172379554_b296050f82_n.jpg  
  inflating: flowers/daisy/10172567486_2748826a8b.jpg  
  inflating: flowers/daisy/10172636503_21bededa75_n.jpg  
  inflating: flowers/daisy/102841525_bd6628ae3c.jpg  
  inflating: flowers/daisy/10300722094_28fa978807_n.jpg  
  inflating: flowers/daisy/1031799732_e7f4008c03.jpg  
  inflating: flowers/daisy/10391248763_1d16681106_n.jpg  
  inflating: flowers/daisy/10437754174_22ec990b77_m.jpg  
  inflating: flowers/daisy/10437770546_8bb6f7bdd3_m.jpg  
  inflating: flowers/daisy/10437929963_bc13eebe0c.jpg  
  inflating: flowers/daisy/10466290366_cc72e33532.jpg  
  inflating: flowers/daisy/10466558316_a7198b87e2.jpg  
  inflating: flowers/daisy/10555749515_13a12a026e.jpg  
  inflating: flowers/daisy/10555815624_dc211569b0.jpg  
  inflating: flowers/daisy/10555826524_423eb8bf71_n.jpg  
  inflating: flowers/daisy/10559679065_50d2b16f6d.jpg  
  inflating: flowers/daisy/105806915_a9c13e2106_n.jpg  
  inflating: flowers/daisy/10712722853_5632165b04.jpg  
  inflating: flowers/daisy/107592979_aaa9cdf7e78_m.jpg  
  inflating: flowers/daisy/10770585085_4742b9dac3_n.jpg  
  inflating: flowers/daisy/10841136265_af473efc60.jpg  
  inflating: flowers/daisy/10993710036_2033222c91.jpg  
  inflating: flowers/daisy/10993818044_4c19b86c82.jpg  
  inflating: flowers/daisy/10994032453_ac7f8d9e2e.jpg  
  inflating: flowers/daisy/11023214096_b5b39fab08.jpg  
  inflating: flowers/daisy/11023272144_fce94401f2_m.jpg  
  inflating: flowers/daisy/11023277956_8980d53169_m.jpg  
  inflating: flowers/daisy/11124324295_503f3a0804.jpg  
  inflating: flowers/daisy/1140299375_3aa7024466.jpg
```

## Task 2:

### Question- 2:

#### Image Augmentation

#### Solution:

```
#Image Augmentation on training variable
train_datagen = ImageDataGenerator(rescale=1./255,
                                    zoom_range=0.2,
                                    horizontal_flip=True)
```

#### Output:

#### Image Augmentation

```
In [6]: #Image Augmentation on training variable
train_datagen = ImageDataGenerator(rescale=1./255,
                                    zoom_range=0.2,
                                    horizontal_flip=True)
```

#### Solution:

```
#Image Augmentation on testing variable
test_datagen = ImageDataGenerator(rescale=1./255)
```

#### Output:

```
In [7]: #Image Augmentation on testing variable
test_datagen = ImageDataGenerator(rescale=1./255)
```

Solution:

```
#Image Augmentation on training data
```

```
Xtrain=train_datagen.flow_from_directory('/content/flowers',target_size=(64,64),class_mode='categorical',batch_size=100)
```

Output:

```
In [8]: #Image Augmentation on training data

xtrain = train_datagen.flow_from_directory('/content/flowers',
                                           target_size=(64,64),
                                           class_mode='categorical',
                                           batch_size=100)

Found 4317 images belonging to 5 classes.
```

Solution:

```
#Image Augmentation on training data
```

```
Xtrain=train_datagen.flow_from_directory('/content/flowers',target_size=(64,64),class_mode='categorical',batch_size=100)
```

Output:

```
In [8]: #Image Augmentation on training data

xtrain = train_datagen.flow_from_directory('/content/flowers',
                                           target_size=(64,64),
                                           class_mode='categorical',
                                           batch_size=100)

Found 4317 images belonging to 5 classes.
```

Solution:

```
xtrain.class_indices
```

Output:

```
In [10]: xtrain.class_indices
Out[10]: {'daisy': 0, 'dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}
```

Task 3:

Question- 3:

Create Model

Solution:

```
# Initializing sequential model
model = Sequential()
```

Output:

Create Model

```
In [13]: # Initializing sequential model
          model = Sequential()
```

## Task 4:

### Question- 4:

## Add Layers

A .Convolution Layer

### Solution:

```
model.add(Convolution2D(32, (3, 3), activation='relu',  
input_shape=(64, 64, 3)))
```

### Output:

## Add Layers

a.Convolution Layer

```
In [14]: model.add(Convolution2D(32, (3, 3), activation='relu', input_shape=(64, 64, 3)))
```

B .Max-Pooling Layer

### Solution:

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

### Output:

b.Max-Pooling Layer

```
In [15]: model.add(MaxPooling2D(pool_size=(2, 2)))
```

C .Flatten Layer

Solution:

```
model.add(Flatten())
```

Output:

c.Flatten Layer

```
In [16]: model.add(Flatten())
```

D .Hidden Layer

Solution:

```
model.add(Dense(300,activation='relu')) # Hidden layer 1
model.add(Dense(150,activation='relu')) # Hidden layer 2
```

Output:

d.Hidden Layer

```
In [17]: model.add(Dense(300,activation='relu')) # Hidden Layer 1
          model.add(Dense(150,activation='relu')) # Hidden Layer 2
```

E .Output Layer

Solution:

```
model.add(Dense(5,activation='softmax'))
```

Output:

e.Output Layer

```
In [18]: model.add(Dense(5,activation='softmax'))
```

## Task 5:

Question- 5:

Add Layers

Solution:

```
from tensorflow.keras.models import Sequential
```

Output:

Add Layers

```
In [19]: from tensorflow.keras.models import Sequential
```

Solution:

```
from tensorflow.keras.layers import Dense,  
Convolution2D, MaxPooling2D, Flatten
```



Output:

```
In [20]: from tensorflow.keras.layers import Dense, Convolution2D, MaxPooling2D, Flatten
```

Solution:

```
model = Sequential()
```

Output:

```
In [21]: model = Sequential()
```

Solution:

```
model.add(Convolution2D(32, (3, 3),  
input_shape=(64, 64, 3), activation = 'relu'))
```

Output:

```
In [22]: model.add(Convolution2D(32, (3,3), input_shape=(64,64,3), activation = 'relu'))
```

Solution:

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

Output:

```
In [23]: model.add(MaxPooling2D(pool_size = (2,2)))
```

Solution:

```
model.add(Flatten())
```

Output:

```
In [24]: model.add(Flatten())
```

Solution:

```
model.summary()
```

```
In [25]: model.summary()
```

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
conv2d_1 (Conv2D)	(None, 62, 62, 32)	896
max_pooling2d_1 (MaxPooling 2D)	(None, 31, 31, 32)	0
flatten_1 (Flatten)	(None, 30752)	0

=====  
Total params: 896  
Trainable params: 896  
Non-trainable params: 0  
=====

## Task 6:

### Question- 6:

Compile the Model

Solution:

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

Output:

Compile the Model

```
In [35]: model.compile(loss='categorical_crossentropy',optimizer='adam',metrics=['accuracy'])
```

## Task 7:

### Question- 7:

Fit the Model

Solution:

```
model.fit_generator(xtrain, steps_per_epoch=len(xtrain),  
epochs=10, validation_data=xtest, validation_steps=len  
(xtest)))
```

Output:

### Fit the Model

```
In [40]: model.fit_generator(xtrain,
                             steps_per_epoch=len(xtrain),
                             epochs=10,
                             validation_data=xtest,
                             validation_steps=len(xtest))

Epoch 1/10
44/44 [=====] - 47s 1s/step - loss: 1.6499 - accuracy: 0.3929 - val_loss: 1.2271 - val_accuracy: 0.4786
Epoch 2/10
44/44 [=====] - 45s 1s/step - loss: 1.0959 - accuracy: 0.5622 - val_loss: 1.0450 - val_accuracy: 0.5775
Epoch 3/10
44/44 [=====] - 45s 1s/step - loss: 1.0182 - accuracy: 0.6064 - val_loss: 1.0093 - val_accuracy: 0.6030
Epoch 4/10
44/44 [=====] - 45s 1s/step - loss: 0.9608 - accuracy: 0.6264 - val_loss: 0.8904 - val_accuracy: 0.6599
Epoch 5/10
44/44 [=====] - 45s 1s/step - loss: 0.8963 - accuracy: 0.6565 - val_loss: 0.8500 - val_accuracy: 0.6789
Epoch 6/10
44/44 [=====] - 45s 1s/step - loss: 0.8545 - accuracy: 0.6743 - val_loss: 0.8376 - val_accuracy: 0.6847
Epoch 7/10
44/44 [=====] - 45s 1s/step - loss: 0.8489 - accuracy: 0.6729 - val_loss: 0.8133 - val_accuracy: 0.6963
Epoch 8/10
44/44 [=====] - 45s 1s/step - loss: 0.7921 - accuracy: 0.6989 - val_loss: 0.7343 - val_accuracy: 0.7246
Epoch 9/10
44/44 [=====] - 45s 1s/step - loss: 0.7630 - accuracy: 0.7107 - val_loss: 0.6698 - val_accuracy: 0.7424
Epoch 10/10
44/44 [=====] - 46s 1s/step - loss: 0.7413 - accuracy: 0.7188 - val_loss: 0.6815 - val_accuracy: 0.7352
Out[40]: <keras.callbacks.History at 0x7fa3653ede50>
```

## Task 8:

Question- 8:

### Save the Model

Solution:

```
model.save('CNN_Flowe.rs.h5')
```

Output:

### Save the Model

```
In [41]: model.save('CNN_Flowe.rs.h5')
```

Solution:

```
ls
```

Output:

```
In [42]: ls
CNN_Flowe.rs.h5  flowers/  Flowe.rs-Dataset.zip  sample_data/
```

## Task 9:

Question- 9:

Test the Model

Solution:

```
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

Output:

Test the Model

```
In [43]: from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

Solution:

```
import numpy as np
from tensorflow.keras.models import load_model
```

Output:

```
In [44]: import numpy as np
         from tensorflow.keras.models import load_model
```

Solution:

```
from tensorflow.keras.preprocessing import image
```

Output:

```
In [45]: from tensorflow.keras.preprocessing import image
```

Solution:

```
model=load_model('CNN_Flowe.rs.h5')
```

Output:

```
In [46]: model=load_model('CNN_Flowe.rs.h5')
```

Solution:

```
pwd
```

Output:

```
In [47]:  
pwd  
Out[47]: '/content'
```

Solution:

```
img =  
    image.load_img('/content/flowers/rose/1233  
8444334_72fcc2fc58_m.jpg')
```

Output:

```
In [48]:  
img = image.load_img('/content/flowers/rose/12338444334_72fcc2fc58_m.jpg')
```

Solution:

Img

Output:

```
In [49]: img
```

```
Out[49]:
```



Solution:

```
img =  
    image.load_img('/content/flowers/dandelion/  
14003401241_543535b385.jpg', target_size=(64,  
64))
```

Output:

```
In [52]: img = image.load_img('/content/flowers/dandelion/14003401241_543535b385.jpg', target_size=(64,64))
```

```
Out[52]:
```



Solution:

Img

Output:

```
In [53]: img
```

```
Out[53]:
```



Solution:

```
x=image.img_to_array(img)
```

Output:

```
In [54]: x=image.img_to_array(img)
```

Solution:

X

Output:

```
In [55]: x
Out[55]: array([[137., 181., 238.],
 [137., 183., 233.],
 [138., 182., 231.],
 ...,
 [103., 157., 227.],
 [106., 158., 231.],
 [102., 155., 225.]],
 [[142., 185., 230.],
 [141., 184., 235.],
 [135., 181., 231.],
 ...,
 [102., 155., 225.],
 [111., 168., 226.],
 [107., 168., 230.]],
 [[141., 184., 229.],
 [146., 188., 238.],
 [143., 188., 233.],
 ...,
 [106., 155., 221.],
 [104., 158., 228.],
 [111., 164., 234.]],
 ...,
 [[ 12., 29., 11.],
 [ 84., 86., 46.],
 [ 63., 72., 41.],
 ...,
 [ 67., 77., 48.],
 [ 87., 94., 53.],
 [ 67., 73., 39.]],
 [[ 25., 48., 19.],
 [ 71., 75., 48.],
 [ 41., 54., 26.],
 ...,
 [ 37., 45., 21.],
 [ 56., 63., 29.],
 [ 51., 64., 34.]],
 [[ 58., 63., 31.],
 [ 57., 64., 38.],
 [ 45., 58., 27.],
 ...,
 [ 34., 46., 22.],
 [ 48., 49., 28.],
 [107., 107., 57.]]) dtype=float32)
```

Solution:

`x.shape`

Output:

```
In [56]: x.shape
Out[56]: (64, 64, 3)
```

Solution:

`x=np.expand_dims(x,axis=0)`

Output:

```
In [57]: x=np.expand_dims(x,axis=0)
```

Solution:

X

Output:

```
In [58]: x
Out[58]: array([[[[137., 181., 230.],
 [137., 183., 233.],
 [138., 182., 231.],
 ...,
 [183., 157., 227.],
 [186., 158., 231.],
 [182., 155., 225.]],
 ...,
 [[142., 185., 230.],
 [141., 184., 235.],
 [135., 181., 231.],
 ...,
 [182., 155., 225.],
 [111., 168., 226.],
 [187., 168., 230.]],
 ...,
 [[141., 184., 229.],
 [146., 188., 238.],
 [143., 189., 233.],
 ...,
 [188., 155., 221.],
 [184., 158., 228.],
 [111., 164., 234.]],
 ...,
 [[ 12., 29., 11.],
 [ 84., 86., 46.],
 [ 53., 72., 41.],
 ...,
 [ 57., 77., 48.],
 [ 87., 94., 53.],
 [ 57., 73., 39.]],
 ...,
 [[ 25., 48., 19.],
 [ 71., 75., 48.],
 [ 41., 54., 26.],
 ...,
 [ 37., 45., 21.],
 [ 56., 63., 29.],
 [ 51., 64., 34.]],
 ...,
 [[ 58., 63., 31.],
 [ 57., 64., 38.],
 [ 45., 58., 27.],
 ...,
 [ 34., 46., 22.],
 [ 48., 49., 28.],
 [187., 187., 57.]]], dtype=float32)
```

Solution:

```
x.shape
```

Output:

```
In [59]: x.shape
Out[59]: (1, 64, 64, 3)
```

Solution:

```
xtrain.class_indices
```

Output:

```
In [60]: xtrain.class_indices
Out[60]: {'daisy': 0, 'dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}
```

Solution:

```
index=["Daisy", "Dandelion", "Rose", "Sunflower", "Tulip"]
```

Output:

```
In [61]: index=["Daisy", "Dandelion", "Rose", "Sunflower", "Tulip"]
```

Solution:

```
index[0]
```

Output:

```
In [62]: index[0]
Out[62]: 'Daisy'
```

Solution:

```
img =
image.load_img('/content/flowers/sunflower/151
45607875_e87204d78c_n.jpg', target_size=(64, 64))
```

Output:

```
img = image.load_img('/content/flowers/sunflower/15145607875_e87204d78c_n.jpg', target_size=(64, 64))
```

Solution:

```
img
```

Output:

In [64]:

```
img
```

Out[64]:



Solution:

```
xtrain.class_indices
```

Output:

In [77]:

```
xtrain.class_indices
```

Out[77]:

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

Solution:

```
op = ['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']  
pred = np.argmax(model.predict(x))  
op[pred]
```

Output:

In [68]:

```
op = ['daisy', 'dandelion', 'rose', 'sunflower', 'tulip']  
pred = np.argmax(model.predict(x))  
op[pred]
```

Out[68]:

```
'sunflower'
```

Solution:

```
dandelion =  
    image.load_img('/content/flowers/dandelion/1356015  
    2823_9da5e48c87_m.jpg', target_size=(64, 64))  
x = image.img_to_array(dandelion)  
x = np.expand_dims(x, axis=0)  
pred = np.argmax(model.predict(x))  
op[pred]
```

Output:

```
In [74]: dandelion = image.load_img('/content/flowers/dandelion/13560152823_9da5e48c87_m.jpg', target_size=(64,64))  
x = image.img_to_array(dandelion)  
x = np.expand_dims(x,axis=0)  
pred = np.argmax(model.predict(x))  
op[pred]
```

```
Out[74]: 'sunflower'
```