

### Assignment -3

#### Convolutional Neural Networks

Assignment Date	31 October 2022
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Maximum Marks	2 Marks

#### #Import necessary libraries

```
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
```

#### #Image augmentation

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator  
  
train_datagen =  
ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True,  
vertical_flip=True)  
  
test_datagen = ImageDataGenerator(rescale=1./255)
```

```
In [1]: #Import necessary libraries  
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  
  
In [2]: #Image augmentation  
from tensorflow.keras.preprocessing.image import ImageDataGenerator  
train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True,vertical_flip=True)  
test_datagen = ImageDataGenerator(rescale=1./255)
```

#### #data set

```
x_train =  
train_datagen.flow_from_directory(r"E:\Flowers\Training",target_size=(128,128),batch_size  
=32,class_mode="categorical")
```

```
x_test =  
test_datagen.flow_from_directory(r"E:\Flowers\Testing",target_size=(128,128),batch_size=3  
2,class_mode="categorical")
```

```
x_train.class_indices
```

```
model = Sequential()
```

```
In [2]: #Image augmentation  
from tensorflow.keras.preprocessing.image import ImageDataGenerator  
train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True,vertical_flip=True)  
test_datagen = ImageDataGenerator(rescale=1./255)  
  
In [3]: x_train = train_datagen.flow_from_directory(r"E:\Flowers\Training",target_size=(128,128),batch_size=32,class_mode="categorical")  
x_test = test_datagen.flow_from_directory(r"E:\Flowers\Testing",target_size=(128,128),batch_size=32,class_mode="categorical")  
x_train.class_indices  
  
Found 3003 images belonging to 5 classes.  
Found 1325 images belonging to 5 classes.  
  
Out[3]: {'daisy': 0, 'dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}
```

## #Add layers

### #Convolution layer

```
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
```

### #Maxpooling layer

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

### #flatten layer

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

### #hidden layer

```
model.add(Dense(units=300,kernel_initializer="random_uniform",activation="relu"))
```

```
model.add(Dense(units=200,kernel_initializer="random_uniform",activation="relu"))
```

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

```
model.summary()
```

```
In [4]: model = Sequential()
#Add layers
#Convolution Layer
model.add(Convolution2D(32,(3,3),input_shape=(128,128,3),activation='relu'))
#Maxpooling Layer
model.add(MaxPooling2D(pool_size=(2,2)))
#flatten layer
model.add(Flatten())
#hidden layer
model.add(Dense(units=300,kernel_initializer="random_uniform",activation="relu"))
model.add(Dense(units=200,kernel_initializer="random_uniform",activation="relu"))
model.add(Dense(units=5,kernel_initializer="random_uniform",activation="softmax"))
model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d (MaxPooling2D)	(None, 63, 63, 32)	0
flatten (Flatten)	(None, 127008)	0
dense (Dense)	(None, 300)	38102700
dense_1 (Dense)	(None, 200)	60200
dense_2 (Dense)	(None, 5)	1005

```
=====
Total params: 38,164,801
Trainable params: 38,164,801
Non-trainable params: 0
=====
```

### #compile the model

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

### #Fit the model

```
model.fit_generator(x_train,steps_per_epoch=75,epochs=15,validation_data=x_test,validation_steps=80)
```

```
In [6]: #compile the model
model.compile(loss="categorical_crossentropy",optimizer="adam",metrics=["accuracy"])
#Fit the model
model.fit_generator(x_train,steps_per_epoch=75,epochs=15,validation_data=x_test,validation_steps=80)

C:\Users\hp\Anaconda3\lib\site-packages\ipykernel_launcher.py:4: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.
after removing the cwd from sys.path.
```

```
Epoch 1/15
75/75 [=====] - ETA: 0s - loss: 1.0726 - accuracy: 0.5791WARNING:tensorflow:Your input ran out of data; interrupting training. Make sure that your dataset or generator can generate at least `steps_per_epoch * epochs` batches (in this case, 80 batches). You may need to use the repeat() function when building your dataset.
75/75 [=====] - 83s 1s/step - loss: 1.0726 - accuracy: 0.5791 - val_loss: 1.2372 - val_accuracy: 0.5049
Epoch 2/15
75/75 [=====] - 68s 906ms/step - loss: 0.9907 - accuracy: 0.6125
Epoch 3/15
75/75 [=====] - 69s 917ms/step - loss: 0.8981 - accuracy: 0.6489
Epoch 4/15
75/75 [=====] - 70s 922ms/step - loss: 0.8850 - accuracy: 0.6522
Epoch 5/15
75/75 [=====] - 73s 962ms/step - loss: 0.8177 - accuracy: 0.6789
Epoch 6/15
75/75 [=====] - 75s 997ms/step - loss: 0.8101 - accuracy: 0.6917
Epoch 7/15
75/75 [=====] - 73s 966ms/step - loss: 0.8099 - accuracy: 0.6868
Epoch 8/15
75/75 [=====] - 72s 957ms/step - loss: 0.7574 - accuracy: 0.7229
Epoch 9/15
75/75 [=====] - 70s 926ms/step - loss: 0.7146 - accuracy: 0.7215
Epoch 10/15
```

```
75/75 [=====] - 69s 911ms/step - loss: 0.6867 - accuracy: 0.7446
Epoch 11/15
75/75 [=====] - 69s 920ms/step - loss: 0.6735 - accuracy: 0.7404
Epoch 12/15
75/75 [=====] - 70s 931ms/step - loss: 0.6735 - accuracy: 0.7562
Epoch 13/15
75/75 [=====] - 69s 919ms/step - loss: 0.6310 - accuracy: 0.7595
Epoch 14/15
75/75 [=====] - 75s 995ms/step - loss: 0.6296 - accuracy: 0.7724
Epoch 15/15
75/75 [=====] - 75s 988ms/step - loss: 0.6024 - accuracy: 0.7775
```

## #Save the model

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

```
from tensorflow.keras.models import load_model
```

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

```
import numpy as np
```

```
model = load_model("Flower.h5")
```

```
In [7]: #Save the model
model.save("flower.h5")
```

## #Test the model:

```
img = image.load_img(r"C:\Users\hp\Downloads\rose.jpg",target_size=(128,128))
```

```
img
```

```
type(img)
```

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

```
x
```

```
x.shape
```

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

```
x.shape
```

```
pred_prob = model.predict(x)
```

```
pred_prob
```

```
In [8]: from tensorflow.keras.models import load_model
        from tensorflow.keras.preprocessing import image
        import numpy as np
        model = load_model("Flower.h5")
```

```
In [10]: #Testing with the image
        img = image.load_img(r"C:\Users\hp\Downloads\rose.jpg",target_size=(128,128))
        img
        type(img)
```

```
Out[10]: PIL.Image.Image
```

```
In [11]: x = image.img_to_array(img)
        x
        x.shape
        x = np.expand_dims(x,axis=0)
        x.shape
```

```
Out[11]: (1, 128, 128, 3)
```

```
In [12]: pred_prob = model.predict(x)
        pred_prob
```

```
Out[12]: array([[0., 0., 1., 0., 0.]], dtype=float32)
```

```
class_name = ["daisy","dandelion","rose","sunflower","tulip"]
```

```
pred_id = pred_prob.argmax(axis=1)[0]
```

```
pred_id
```

```
print("Predicted flower is",str(class_name[pred_id]))
```

```
In [13]: class_name = ["daisy","dandelion","rose","sunflower","tulip"]
```

```
In [15]: pred_id = pred_prob.argmax(axis=1)[0]  
pred_id  
print("Predicted flower is",str(class_name[pred_id]))
```

Predicted flower is rose