Assignment-3

Build CNN Model for Classification Of Flowers

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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:

```
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_aaa9cdfe78_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 varaible
train_datagen = ImageDataGenerator(rescale=1./255,
                                   zoom_range=0.2,
                                   horizontal_flip=True)
```

Output:

Image Augmentation

In [6]:
```
#Image Augmentation on training varaible
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='cate
        gorical',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='cate
        gorical',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  (None, 31, 31, 32)       0
 2D)

 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_Flowers.h5')
```

Output:

Save the Model

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

Solution:

```
ls
```

Output:

```
In [42]: ls
CNN_Flowers.h5  flowers/  Flowers-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_Flowers.h5')
```

Output:

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

Solution:

pwd

Output:

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

Solution:

img = image.load_img('/content/flowers/rose/12338444334_72fcc2fc58_m.jpg')

Output:

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

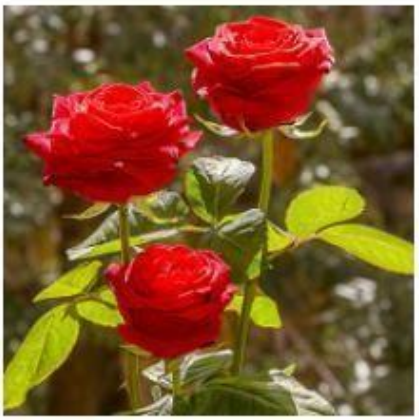
Solution:

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))
```

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 [56]: x

Out[56]: array([[[137., 181., 238.],
                 [137., 183., 233.],
                 [138., 182., 231.],
                 ...,
                 [103., 157., 227.],
                 [106., 158., 231.],
                 [102., 155., 225.]],

                [[142., 185., 238.],
                 [141., 184., 235.],
                 [135., 181., 231.],
                 ...,
                 [102., 155., 225.],
                 [111., 160., 226.],
                 [107., 160., 238.]],

                [[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.,  40.,  19.],
                 [ 71.,  75.,  48.],
                 [ 41.,  54.,  26.],
                 ...,
                 [ 37.,  45.,  21.],
                 [ 56.,  63.,  29.],
                 [ 51.,  64.,  34.]],

                [[ 58.,  63.,  31.],
                 [ 57.,  64.,  38.],
                 [ 45.,  50.,  27.],
                 ...,
                 [ 34.,  46.,  12.],
                 [ 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., 238.],
                  [137., 183., 233.],
                  [138., 182., 231.],
                  ...,
                  [103., 157., 227.],
                  [106., 158., 231.],
                  [102., 155., 225.]],

                 [[142., 185., 238.],
                  [141., 184., 235.],
                  [135., 181., 231.],
                  ...,
                  [102., 155., 225.],
                  [111., 160., 226.],
                  [107., 160., 230.]],

                 [[141., 184., 229.],
                  [146., 188., 238.],
                  [143., 180., 233.],
                  ...,
                  [106., 155., 221.],
                  [104., 158., 228.],
                  [111., 164., 234.]],

                 ...,

                 [[ 12.,  29.,  11.],
                  [ 84.,  86.,  46.],
                  [ 83.,  72.,  41.],
                  ...,
                  [ 57.,  77.,  48.],
                  [ 87.,  94.,  53.],
                  [ 67.,  73.,  39.]],

                 [[ 25.,  40.,  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.],
                  [ 40.,  49.,  28.],
                  [107., 107.,  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/15145607875_e87204d78c_n.jpg',target_size=(64,64))

Output:

```
In [63]: 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:

```
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/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]
```

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'
```