

WORKSPACE INITIALISATION

```
ls
```

```
Flowers.zip  Untitled0.ipynb
```

```
cd /content/drive/MyDrive/CNN
```

```
/content/drive/MyDrive/CNN
```

```
pwd
```

```
'/content/drive/MyDrive/CNN'
```

ZIP FILE EXTRACTION

```
!unzip Flowers.zip
```

```
Archive:  Flowers.zip
```

```
  inflating: flowers/daisy/100000576_f52e8ee070_n.jpg
  inflating: flowers/daisy/10140303196_b08d3d6cec.jpg
  inflating: flowers/daisy/10172379554_b296050f82_n.jpg
  inflating: flowers/daisy/10172567486_2748826a8b.jpg
  inflating: flowers/daisy/10172636503_21bededa75_n.jpg
  inflating: flowers/daisy/102041525_bd6628ee3c.jpg
  inflating: flowers/daisy/10300722004_28fe978807_n.jpg
  inflating: flowers/daisy/1031799732_e7f4000c03.jpg
  inflating: flowers/daisy/10391240763_d16681106_n.jpg
  inflating: flowers/daisy/10437754174_22ec990b77_n.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_58d2b16f6d.jpg
  inflating: flowers/daisy/1058006915_a9c13e2106_n.jpg
  inflating: flowers/daisy/10712722853_5632165804.jpg
  inflating: flowers/daisy/107592079_aaa9cdfc78_m.jpg
  inflating: flowers/daisy/10770585085_4742b9dac3_n.jpg
  inflating: flowers/daisy/10841136285_af473efc60.jpg
  inflating: flowers/daisy/10993710036_2033222c91.jpg
  inflating: flowers/daisy/10993010044_4c19b06c02.jpg
  inflating: flowers/daisy/10994032453_ac7f8d9e2e.jpg
  inflating: flowers/daisy/11023214096_b5b39fab00.jpg
```

inflating: flowers/daisy/13953307149_780e58760c_m.jpg
inflating: flowers/daisy/1396520833_fb067105be_n.jpg
inflating: flowers/daisy/13977101062_f8237b0b52.jpg
inflating: flowers/daisy/14021430525_e0b0af93a9.jpg
inflating: flowers/daisy/14073784460_ffb12f3307_n.jpg
inflating: flowers/daisy/14087947408_9779257411_n.jpg
inflating: flowers/daisy/14088053307_3a13a0b791_n.jpg
inflating: flowers/daisy/14114116486_0bb0640bcl_m.jpg
inflating: flowers/daisy/14147010829_8d3cf2414e.jpg
inflating: flowers/daisy/14163875973_467224aaf5_m.jpg
inflating: flowers/daisy/14167934527_781ceb1b7a_n.jpg
inflating: flowers/daisy/14167943177_cd30054ac6_n.jpg
inflating: flowers/daisy/14219214466_3ca0104ee0_m.jpg
inflating: flowers/daisy/14211836990_90374e0b34.jpg
inflating: flowers/daisy/14211848160_7f0a37c295.jpg
inflating: flowers/daisy/14245834610_153624f836.jpg
inflating: flowers/daisy/14264136211_9531fbc144.jpg
inflating: flowers/daisy/14272874304_47c0a46f5e.jpg
inflating: flowers/daisy/14307766019_fac3c37a05_m.jpg
inflating: flowers/daisy/14330343001_99478502d4_m.jpg
inflating: flowers/daisy/14332947164_9013513c71_m.jpg
inflating: flowers/daisy/14335681205_a07c0f1752_m.jpg
inflating: flowers/daisy/14350958852_290d3a254.jpg
inflating: flowers/daisy/14354051035_1037b30421_n.jpg
inflating: flowers/daisy/14372713423_61e2daae88.jpg
inflating: flowers/daisy/14399435971_ea5868c792.jpg
inflating: flowers/daisy/14402451388_56545a374a_n.jpg
inflating: flowers/daisy/144070648_57e1d662e3_m.jpg
inflating: flowers/daisy/144099102_bf63a41e4f_n.jpg
inflating: flowers/daisy/1441930151_b271400c8d_n.jpg
inflating: flowers/daisy/14421389510_d9fd353eb4.jpg
inflating: flowers/daisy/144603918_b9de002f60_m.jpg
inflating: flowers/daisy/14471433500_cda21e3ea_m.jpg
inflating: flowers/daisy/14485782490_fb342ec301.jpg
inflating: flowers/daisy/14507818175_05219a051c_m.jpg
inflating: flowers/daisy/14523675305_97c31d0b5b.jpg

inflating: flowers/daisy/9310226774_d1b8f5d0c9.jpg
inflating: flowers/daisy/9321854387_5f77c936cb_n.jpg
inflating: flowers/daisy/9345273630_af3550031d.jpg
inflating: flowers/daisy/9346508462_f0af3163f4.jpg
inflating: flowers/daisy/9350942387_5b1d0a3c26_n.jpg
inflating: flowers/daisy/9467543719_c4000becb0_m.jpg
inflating: flowers/daisy/9489270024_1b05f08492_m.jpg
inflating: flowers/daisy/9496209717_25a6ebdab6_m.jpg
inflating: flowers/daisy/9515186037_3be48fe40f.jpg
inflating: flowers/daisy/9529916002_de70623523_n.jpg
inflating: flowers/daisy/9593034725_0062f0d24e_n.jpg
inflating: flowers/daisy/9595857626_979c45e3bf_n.jpg
inflating: flowers/daisy/9611023744_013b20e4da_n.jpg
inflating: flowers/daisy/9922116524_ab4a2537fe_n.jpg
inflating: flowers/daisy/99306615_739eb94b0e_m.jpg
inflating: flowers/dandelion/10043234166_0cdd015111_n.jpg
inflating: flowers/dandelion/10200780773_c0051a7d71_n.jpg
inflating: flowers/dandelion/10294487305_02a0676c7d_m.jpg
inflating: flowers/dandelion/10437652406_aa86c14005.jpg
inflating: flowers/dandelion/10443973_ach07513fc_n.jpg
inflating: flowers/dandelion/1047737051a_0ffbc0c4cf_m.jpg
inflating: flowers/dandelion/10480992895_20b344ce2d_n.jpg
inflating: flowers/dandelion/10617162044_074064dd0f_n.jpg
inflating: flowers/dandelion/10617191174_9a01753241_n.jpg
inflating: flowers/dandelion/10683189_b06e371097.jpg
inflating: flowers/dandelion/1074999133_1e4a1e042e.jpg
inflating: flowers/dandelion/10777350353_5a200b218c.jpg
inflating: flowers/dandelion/10778387133_9141024b10.jpg
inflating: flowers/dandelion/10779476016_9130714dc0.jpg
inflating: flowers/dandelion/1080179750_5f05350a50.jpg
inflating: flowers/dandelion/10828951100_c3cd47983f.jpg
inflating: flowers/dandelion/10919961_0e76574e8.jpg
inflating: flowers/dandelion/10946896405_01d2d50941_m.jpg
inflating: flowers/dandelion/11124381625_24817662bd_n.jpg
inflating: flowers/dandelion/1128626197_3f53424215_n.jpg
inflating: flowers/dandelion/11296320473_1d9261ddch.jpg
inflating: flowers/dandelion/11405131433_847c4fa261.jpg

inflating: flowers/rose/15081454551_b0f73ce445_n.jpg
inflating: flowers/rose/15097072470_ed40e8dd73_n.jpg
inflating: flowers/rose/15099509054_d3e125206f_n.jpg
inflating: flowers/rose/1581180728_5053455c50_n.jpg
inflating: flowers/rose/15811411368_fa72cd8873_n.jpg
inflating: flowers/rose/15810400948_c551da2212_n.jpg
inflating: flowers/rose/15810051327_9a40bf6244_n.jpg
inflating: flowers/rose/15820572326_9e2ea4a55c_n.jpg
inflating: flowers/rose/15821950372_518b9dcf57_n.jpg
inflating: flowers/rose/15822837396_96b992fda0_m.jpg
inflating: flowers/rose/15859434664_67bf1ef29f.jpg
inflating: flowers/rose/15901230359_1819e96b09_n.jpg
inflating: flowers/rose/159079265_d77a0ec920_n.jpg
inflating: flowers/rose/15922772250_1107a00020.jpg
inflating: flowers/rose/15940087024_8ff565229c_m.jpg
inflating: flowers/rose/15951588433_c0713cbfc6_m.jpg
inflating: flowers/rose/15965652160_d691389965_m.jpg
inflating: flowers/rose/15972975056_3a770ca5d4_n.jpg
inflating: flowers/rose/15972976206_d32feeb79b_n.jpg
inflating: flowers/rose/15973362155_461030c196_m.jpg
inflating: flowers/rose/15978010586_5fa5905af1_n.jpg
inflating: flowers/rose/15978020586_6cb322b120_n.jpg
inflating: flowers/rose/15990510051_7f2fea25cb_n.jpg
inflating: flowers/rose/15990818377_4b85e00538_n.jpg
inflating: flowers/rose/16061846141_30546407e_n.jpg
inflating: flowers/rose/1608000000_c073d4b773.jpg
inflating: flowers/rose/16081111035_0f0620e241_n.jpg
inflating: flowers/rose/1608000000_3a-8d7a1a.jpg

Question 1:

IMAGE AUGMENTATION

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

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

```
test_datagen = ImageDataGenerator(rescale=1./255)
```

```
pip install split-folders[full]
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Collecting split-folders[full]
  Downloading split_folders-0.5.1-py3-none-any.whl (8.4 kB)
Requirement already satisfied: tqdm in /usr/local/lib/python3.7/dist-packages (from split-folders[full]) (4.64.1)
Installing collected packages: split-folders
Successfully installed split-folders-0.5.1
```

```
import splitfolders
```

```
input_folder = 'flowers/'
```

```
Copying files: 4317 files [00:49, 87.73 files/s]
```

```
x_train=train_datagen.flow_from_directory(r"/content/drive/MyDrive/CNN/flowers2/train",target_size=(64,64),class_mode="categorical",batch_size=24)
```

```
Found 3019 images belonging to 5 classes.
```

```
x_test=train_datagen.flow_from_directory(r"/content/drive/MyDrive/CNN/flowers2/val",target_size=(64,64),class_mode="categorical",batch_size=24)
```

```
Found 860 images belonging to 5 classes.
```

```
x_train.class_indices
```

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

Question 2:
CREATE MODEL

```
from tensorflow.keras.models import Sequential

from tensorflow.keras.layers import Dense, Convolution2D, MaxPool2D, Flatten

model=Sequential()
```

Question 3:

Add Layers (Convolution,MaxPooling,Flatten,Dense-(Hidden Layers),Output) Convolution layer

```
model.add(Convolution2D(32,(3,3),activation="relu",strides=(1,1),input_shape=(64,64,3)))
```

Max Pooling layer

```
model.add(MaxPool2D(pool_size=(2,2)))
```

Flatten

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

```
model.summary()
```

Model: "sequential"

Layer (type)	Output Shape	Param #

conv2d_1 (Conv2D)	(None, 62, 62, 32)	896
max_pooling2d (MaxPooling2D)	(None, 31, 31, 32)	0
}		
flatten (Flatten)	(None, 30752)	0

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

Dense (Hidden) layers

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

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

Output Layer

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

Question 4,5:

COMPILE THE MODEL FIT THE MODEL

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

```
model.fit(x_train,epochs=10,steps_per_epoch=len(x_train),validation_data=x_test,validation_steps=len(x_test))
```

```
Epoch 1/10
126/126 [=====] - 37s 285ms/step - loss: 1.3769 - accuracy: 0.4342 - val_loss: 1.1170 - val_accuracy: 0.5279
Epoch 2/10
126/126 [=====] - 36s 283ms/step - loss: 1.1045 - accuracy: 0.5446 - val_loss: 1.0759 - val_accuracy: 0.5465
Epoch 3/10
126/126 [=====] - 35s 277ms/step - loss: 1.0413 - accuracy: 0.5840 - val_loss: 1.1999 - val_accuracy: 0.5279
Epoch 4/10
126/126 [=====] - 35s 279ms/step - loss: 0.9741 - accuracy: 0.6260 - val_loss: 0.9568 - val_accuracy: 0.6140
Epoch 5/10
126/126 [=====] - 35s 280ms/step - loss: 0.9277 - accuracy: 0.6346 - val_loss: 0.9006 - val_accuracy: 0.5872
Epoch 6/10
126/126 [=====] - 35s 280ms/step - loss: 0.8803 - accuracy: 0.6568 - val_loss: 0.9918 - val_accuracy: 0.6209
Epoch 7/10
126/126 [=====] - 35s 280ms/step - loss: 0.8460 - accuracy: 0.6727 - val_loss: 0.8860 - val_accuracy: 0.6372
Epoch 8/10
126/126 [=====] - 35s 281ms/step - loss: 0.8211 - accuracy: 0.6837 - val_loss: 0.9205 - val_accuracy: 0.6163
Epoch 9/10
126/126 [=====] - 35s 279ms/step - loss: 0.8057 - accuracy: 0.6913 - val_loss: 0.8887 - val_accuracy: 0.6628
Epoch 10/10
126/126 [=====] - 35s 278ms/step - loss: 0.7575 - accuracy: 0.7079 - val_loss: 0.9187 - val_accuracy: 0.6419
<keras.callbacks.History at 0x7f1437da8e50>
```

Question 6:

SAVE THE MODEL

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

TEST THE MODEL

```
import numpy as np
```

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

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

```
model=load_model('flowers.h5')
```

```
img=image.load_img(r"/content/drive/MyDrive/CNN/flowers2/test/rose/11233672494_d8bf0a3dbf_n.jpg")
```

```
img
```



```
img=image.load_img(r"/content/drive/MyDrive/CNN/flowers2/test/rose/11233672494_d8bf0a3dbf_n.jpg",target_size=(64,64))
```

```
img
```



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

```
x
```

```
array([[[[ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         ...,
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.]],
        [[ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         ...,
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.]],
        [[ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         ...,
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.],
         [ 0.,  0.,  0.]]],
       ...,
       [[ 2.,  1.,  6.],
        [ 83., 83., 81.],
        [ 92., 92., 92.],
        ...,
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.]],
       [[ 39., 39., 41.],
        [ 82., 82., 84.],
        [196., 196., 196.],
        ...,
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.]],
       [[ 10.,  9., 15.],
        [ 4.,  4.,  4.],
        [ 4.,  4.,  4.],
        ...,
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.],
        [ 0.,  0.,  0.]]) dtype=float32)
```

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

```
x
```