Assignment -3

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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/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_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/13953307149_f8de6a768c_m.jpg
inflating: flowers/daisy/1396526833_fb867165be_n.jpg
inflating: flowers/daisy/13977181862_f8237b6b52.jpg
inflating: flowers/daisy/14021430525_e06baf93a9.jpg
inflating: flowers/daisy/14073784469_ffb12f3387_n.jpg
inflating: flowers/daisy/14087947408_9779257411_n.jpg
inflating: flowers/daisy/14088053307_1a13a0bf91_n.jpg
inflating: flowers/daisy/14114116486_0bb6649bc1_m.jpg
inflating: flowers/daisy/14147016029_8d3cf2414e.jpg
inflating: flowers/daisy/14163875973_467224aaf5_m.jpg
inflating: flowers/daisy/14167534527_781ceb1b7a_n.jpg
inflating: flowers/daisy/14167543177_cd36b54ac6_n.jpg
inflating: flowers/daisy/14219214466_3ca6104eae_m.jpg
inflating: flowers/daisy/14221836990_90374e6b34.jpg
inflating: flowers/daisy/14221848160_7f0a37c395.jpg
inflating: flowers/daisy/14245834619_153624f836.jpg
inflating: flowers/daisy/14264136211_9531fbc144.jpg
inflating: flowers/daisy/14272874304_47c0a46f5a.jpg
inflating: flowers/daisy/14307766919_fac3c37a6b_m.jpg
inflating: flowers/daisy/14330343061_99478302d4_m.jpg
inflating: flowers/daisy/14332947164_9b13513c71_m.jpg
inflating: flowers/daisy/14333681205_a07c9f1752_m.jpg
inflating: flowers/daisy/14350958832_29bdd3a254.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/144076848_57e1d662e3_m.jpg
inflating: flowers/daisy/144099102_bf63a41e4f_n.jpg
inflating: flowers/daisy/1441939151_b271408c8d_n.jpg
inflating: flowers/daisy/14421389519_d5fd353eb4.jpg
inflating: flowers/daisy/144603918_b9de002f60_m.jpg
inflating: flowers/daisy/14471433500_cdaa22e3ea_m.jpg
inflating: flowers/daisy/14485782498_fb342ec301.jpg
inflating: flowers/daisy/14507818175_05219b051c_m.jpg
inflating: flowers/daisy/14523675369_97c31d0b5b.jpg

inflating: flowers/daisy/9310226774_d1b8f5d9c9.jpg
inflating: flowers/daisy/9321854387_5f77c926cb_n.jpg
inflating: flowers/daisy/9345273630_af3550031d.jpg
inflating: flowers/daisy/9346508462_f0af3163f4.jpg
inflating: flowers/daisy/9350942387_5b1d043c26_n.jpg
inflating: flowers/daisy/9467543719_c4800becbb_m.jpg
inflating: flowers/daisy/9489270024_1b05f08492_m.jpg
inflating: flowers/daisy/9496209717_25a6ebdab6_m.jpg
inflating: flowers/daisy/9515186037_3be48fe68f.jpg
inflating: flowers/daisy/9529916092_de70623523_n.jpg
inflating: flowers/daisy/9593034725_0062f0d24e_n.jpg
inflating: flowers/daisy/9595857626_979c45e5bf_n.jpg
inflating: flowers/daisy/9611923744_013b29e4da_n.jpg
inflating: flowers/daisy/9922116524_ab4a2533fe_n.jpg
inflating: flowers/daisy/99306615_739eb94b9e_m.jpg
inflating: flowers/dandelion/10043234166_e6dd915111_n.jpg
inflating: flowers/dandelion/10200780773_c6051a7d71_n.jpg
inflating: flowers/dandelion/10294487385_92a0676c7d_m.jpg
inflating: flowers/dandelion/10437652486_aa86c14985.jpg
inflating: flowers/dandelion/10443973_aeb97513fc_m.jpg
inflating: flowers/dandelion/10477378514_9ffbcec4cf_m.jpg
inflating: flowers/dandelion/10486992895_20b344ce2d_n.jpg
inflating: flowers/dandelion/10617162044_8740d4dd9f_n.jpg
inflating: flowers/dandelion/10617191174_9a01753241_n.jpg
inflating: flowers/dandelion/10683189_bd6e371b97.jpg
inflating: flowers/dandelion/1074999133_1e4a1e042e.jpg
inflating: flowers/dandelion/10777398353_5a20bb218c.jpg
inflating: flowers/dandelion/10778387133_9141024b10.jpg
inflating: flowers/dandelion/10779476016_9130714dc0.jpg
inflating: flowers/dandelion/1080179756_5f05350a59.jpg
inflating: flowers/dandelion/10828951106_c3cd47983f.jpg
inflating: flowers/dandelion/10919961_0af657c4e8.jpg
inflating: flowers/dandelion/10946896405_81d2d50941_m.jpg
inflating: flowers/dandelion/11124381625_24b17662bd_n.jpg
inflating: flowers/dandelion/1128626197_3f52424215_n.jpg
inflating: flowers/dandelion/11296320473_1d9261ddcb.jpg
inflating: flowers/dandelion/11405573_24a8a838cc_n.jpg
inflating: flowers/dandelion/11465213433_847c4fa261.jpg

inflating: flowers/rose/15681454551_b6f73ce443_n.jpg
inflating: flowers/rose/15697872479_ed48e9dd73_n.jpg
inflating: flowers/rose/15699509054_d3e125286f_n.jpg
inflating: flowers/rose/15811380728_5053455c50_n.jpg
inflating: flowers/rose/15811411368_f4f2cd8873_n.jpg
inflating: flowers/rose/15816400548_c551da2212_n.jpg
inflating: flowers/rose/15818051327_9a44bf6244_n.jpg
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inflating: flowers/rose/15821959372_518b9dcf57_n.jpg
inflating: flowers/rose/15822837396_96b392fda8_m.jpg
inflating: flowers/rose/15859434664_67bf3ef29f.jpg
inflating: flowers/rose/15901230359_1819e96b89_n.jpg
inflating: flowers/rose/159079265_d77a9ac920_n.jpg
inflating: flowers/rose/15922772266_1167a06620.jpg
inflating: flowers/rose/15949087094_a8f565295c_m.jpg
inflating: flowers/rose/15951588433_c0713cbfc6_m.jpg
inflating: flowers/rose/15965652160_de91389965_m.jpg
inflating: flowers/rose/15972975956_9a770ca9dd_n.jpg
inflating: flowers/rose/15972976206_d32feeb79b_n.jpg
inflating: flowers/rose/15977362155_461030c196_m.jpg
inflating: flowers/rose/15978010566_5fa5905af1_n.jpg
inflating: flowers/rose/15978020586_6cb322b120_n.jpg
inflating: flowers/rose/15996816031_7f2fea25cb_n.jpg
inflating: flowers/rose/15999816377_4b95e0b538_n.jpg
inflating: flowers/rose/16001846141_393fdb887e_n.jpg
inflating: flowers/rose/16018886851_c32746cb72.jpg
inflating: flowers/rose/16051111039_0f0626a241_n.jpg
inflating: flowers/rose/16078501836_3ac067e18a.jpg
inflating: flowers/rose/160954292_6c2b4fda65_n.jpg
inflating: flowers/rose/16100313047_c2e23cbb3d_n.jpg
inflating: flowers/rose/16152175716_55d6968e08_n.jpg
inflating: flowers/rose/16152205512_9d6cb80fb6.jpg
inflating: flowers/rose/16155980245_6ab8d7b888.jpg
inflating: flowers/rose/16157873719_bf0bdf8558_n.jpg
inflating: flowers/rose/16209331331_343c899d38.jpg
inflating: flowers/rose/16229215579_e7dd808e9c.jpg
inflating: flowers/rose/16258946661_f9739cdc0a.jpg
inflating: flowers/rose/16374919860_4e445de29f_n.jpg
```

```
inflating: flowers/tulip/130685347_afbffe3afa_n.jpg
inflating: flowers/tulip/13176521023_4d7cc74856_m.jpg
inflating: flowers/tulip/13176576813_50e77cc1d9.jpg
inflating: flowers/tulip/13197345653_0f685b3c97_n.jpg
inflating: flowers/tulip/132538272_63658146d9_n.jpg
inflating: flowers/tulip/132538273_335240fe5b_n.jpg
inflating: flowers/tulip/13289268363_b9337d751e.jpg
inflating: flowers/tulip/133692329_c1150ed811_n.jpg
inflating: flowers/tulip/13385823_3eaa8a91fd_n.jpg
inflating: flowers/tulip/133960364_d87f883c15_n.jpg
inflating: flowers/tulip/134143359_71fa8dd9a4.jpg
inflating: flowers/tulip/13471563274_471fc1db33_m.jpg
inflating: flowers/tulip/13472141763_f2517e7f0d.jpg
inflating: flowers/tulip/13472387874_d844478dbb.jpg
inflating: flowers/tulip/13472393854_b2530f7029_n.jpg
inflating: flowers/tulip/13509967925_eaaeefa396_m.jpg
inflating: flowers/tulip/13509973805_bda5fa8982.jpg
inflating: flowers/tulip/13510057763_01b832d919.jpg
inflating: flowers/tulip/13510068773_c925c5517c.jpg
inflating: flowers/tulip/13513851673_9d813dc7b0.jpg
inflating: flowers/tulip/13514131694_d91da4f4fc.jpg
inflating: flowers/tulip/13514136074_ab1b827e4f.jpg
inflating: flowers/tulip/13529687904_3d60abb479_n.jpg
inflating: flowers/tulip/13530687085_9b515735ef_m.jpg
inflating: flowers/tulip/13530690445_9f1f5cf43a_n.jpg
inflating: flowers/tulip/13530786873_0d34880300_n.jpg
inflating: flowers/tulip/13530796853_e5993f57d6_n.jpg
inflating: flowers/tulip/1353001134_72052100e1_m.jpg
inflating: flowers/tulip/13531007054_c88deaf302_n.jpg
inflating: flowers/tulip/13537485222_b9c630b162.jpg
inflating: flowers/tulip/13539384593_23449f7332_n.jpg
inflating: flowers/tulip/13539404903_cd113e3e9b.jpg
inflating: flowers/tulip/13539827514_79b60b6c22_n.jpg
inflating: flowers/tulip/13542672763_20c3cb9272.jpg
inflating: flowers/tulip/13555215723_cf2c11626b_b.jpg
inflating: flowers/tulip/13561908485_7e4f8d508b.jpg
inflating: flowers/tulip/13561912705_e5eeb41433_z.jpg
inflating: flowers/tulip/13562266594_69b807f90c.jpg
```

Question 1:
IMAGE AUGMENTATION

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

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

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

```python
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
```

```python
import splitfolders
```

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

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

```python
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.
```

```python
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.
```

```python
x_train.class_indices
```

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

Question 2:
CREATE MODEL

```python
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

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

Max Pooling layer

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

Flatten

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

```python
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

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

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

Output Layer

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

Question 4,5:

COMPILE THE MODEL FIT THE MODEL

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

```python
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: 0.9806 - 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 0x7f1437da8a50>
```

Question 6:

SAVE THE MODEL

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

TEST THE MODEL

```python
import numpy as np
```

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

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

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

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

```python
img
```



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

```python
img
```

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

```python
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.],
```

```
       [[  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)
```

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

```python
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.]],
```

```
[[ 0.,  0.,  0.],
 [ 0.,  0.,  0.],
 [ 0.,  0.,  0.],
 ...,
 [ 0.,  0.,  0.],
 [ 0.,  0.,  0.],
 [ 0.,  0.,  0.]],

...,

[[ 5.,  4., 10.],
 [ 7.,  6., 12.],
 ...

 ...,

 [[ 5.,  4., 10.],
  [ 7.,  6., 12.],
  [ 5.,  4.,  9.],
  ...,
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.]],

 [[11., 10., 16.],
  [ 8.,  7., 13.],
  [10.,  9., 15.],
  ...,
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.]],

 [[ 8.,  7., 13.],
  [ 4.,  3.,  9.],
  [ 7.,  6., 12.],
  ...,
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.],
  [ 0.,  0.,  0.]]]], dtype=float32)
```

```
index=['daisy','dandelion','rose','sunflower','tulip']
```

```
index[np.argmax(pred)]
```

```
'rose'
```