In [1]:

```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?cli
ent_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleuserconten
t.com&redirect_uri=urn%3aietf%3awg%3aoauth%3a2.0%3aoob&response_type=code&
scope=email%20https%3a%2f%2fwww.googleapis.com%2fauth%2fdocs.test%20https%
3a%2f%2fwww.googleapis.com%2fauth%2fdrive%20https%3a%2f%2fwww.googleapis.c
om%2fauth%2fdrive.photos.readonly%20https%3a%2f%2fwww.googleapis.com%2faut
h%2fpeopleapi.readonly

Enter your authorization code:
..........
Mounted at /content/gdrive
```

In [0]:

```
!unzip -qq '/content/gdrive/My Drive/dataset/Actor_Age_Detection'
```

In [3]:

```
from keras.models import Sequential
from keras_preprocessing.image import ImageDataGenerator
from keras.layers import Dense, Activation, Flatten, Dropout,  BatchNormalization
from keras.layers import Conv2D, MaxPooling2D
from keras import regularizers, optimizers
import pandas as pd
import numpy as np
```

```
Using TensorFlow backend.
```

The default version of TensorFlow in Colab will soon switch to TensorFlow 2.x.
We recommend you upgrade (https://www.tensorflow.org/guide/migrate) now or ensure your notebook will continue to use TensorFlow 1.x via the `%tensorflow_version 1.x` magic:
more info (https://colab.research.google.com/notebooks/tensorflow_version.ipynb).

In [0]:

```
df= pd.read_csv('/content/gdrive/My Drive/dataset/Actor_Age-Detection/Actor_age_train.c
sv')
```

In [6]:

```
df.head(10)
```

Out[6]:

	ID	Class
0	377.jpg	MIDDLE
1	17814.jpg	YOUNG
2	21283.jpg	MIDDLE
3	16496.jpg	YOUNG
4	4487.jpg	MIDDLE
5	6283.jpg	MIDDLE
6	23495.jpg	YOUNG
7	7100.jpg	YOUNG
8	6028.jpg	YOUNG
9	22617.jpg	OLD

In [7]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 19906 entries, 0 to 19905
Data columns (total 2 columns):
ID       19906 non-null object
Class    19906 non-null object
dtypes: object(2)
memory usage: 311.2+ KB
```

In [0]:

```
df['Class']=df['Class'].apply (lambda x:x.split(','))
```

In [11]:

```
df.head()
```

Out[11]:

	ID	Class
0	377.jpg	[MIDDLE]
1	17814.jpg	[YOUNG]
2	21283.jpg	[MIDDLE]
3	16496.jpg	[YOUNG]
4	4487.jpg	[MIDDLE]

In [0]:

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

In [13]:

```
train_generator=datagen.flow_from_dataframe(
    dataframe=df[:1800],
    directory='/content/Train_AD_img',
    x_col='ID',
    y_col='Class',
    batch_size=32,
    seed=42,
    shuffle=True,
    class_mode= 'categorical',
    classes=['YOUNG','MIDDLE','OLD'],
    target_size= (100,100)
)
```

```
Found 341 validated image filenames belonging to 3 classes.

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/image/dataframe
_iterator.py:273: UserWarning: Found 1459 invalid image filename(s) in x_c
ol="ID". These filename(s) will be ignored.
  .format(n_invalid, x_col)
```

In [14]:

```
valid_generator=test_datagen.flow_from_dataframe(
    dataframe=df[1800:1900],
    directory='/content/Train_AD_img',
    x_col='ID',
    y_col='Class',
    batch_size=32,
    seed=42,
    shuffle=True,
    class_mode= 'categorical',
    classes=['YOUNG','MIDDLE','OLD'],
    target_size= (100,100)

)
```

```
Found 27 validated image filenames belonging to 3 classes.

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/image/dataframe
_iterator.py:273: UserWarning: Found 73 invalid image filename(s) in x_col
="ID". These filename(s) will be ignored.
  .format(n_invalid, x_col)
```

In [15]:

```
test_generator=test_datagen.flow_from_dataframe(
    dataframe=df[1900:],
    directory='/content/Train_AD_img',
    x_col='ID',
    y_col='Class',
    batch_size=32,
    seed=42,
    shuffle=True,
    class_mode= None,
    classes=['YOUNG','MIDDLE','OLD'],
    target_size= (100,100)

)
```

```
Found 3392 validated image filenames.

/usr/local/lib/python3.6/dist-packages/keras_preprocessing/image/dataframe
_iterator.py:211: UserWarning: `classes` will be ignored given the class_m
ode="None"
  .format(self.class_mode))
/usr/local/lib/python3.6/dist-packages/keras_preprocessing/image/dataframe
_iterator.py:273: UserWarning: Found 14614 invalid image filename(s) in x_
col="ID". These filename(s) will be ignored.
  .format(n_invalid, x_col)
```

In [16]:

```
model= Sequential()
model.add(Conv2D(32,(3,3),padding='same',input_shape=(100,100,3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Dropout(0.25))

model.add(Conv2D(32,(3,3),padding='same'))
model.add(Activation('relu'))

model.add(Conv2D(32,(3,3)))
model.add(Activation('relu'))

model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Dropout(0.25))

model.add(Flatten())
model.add(Dense(512))
model.add(Activation('relu'))
model.add(Dropout(0.5))
model.add(Dense(3,activation='sigmoid'))
model.compile(optimizers.rmsprop(lr=0.0001, decay=1e-6),loss='binary_crossentropy',metr
ics=['accuracy'])
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:66: The name tf.get_default_graph is deprecated.
Please use tf.compat.v1.get_default_graph instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:541: The name tf.placeholder is deprecated. Pleas
e use tf.compat.v1.placeholder instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:4432: The name tf.random_uniform is deprecated. P
lease use tf.random.uniform instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:4267: The name tf.nn.max_pool is deprecated. Plea
se use tf.nn.max_pool2d instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:148: The name tf.placeholder_with_default is depr
ecated. Please use tf.compat.v1.placeholder_with_default instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:3733: calling dropout (from tensorflow.python.op
s.nn_ops) with keep_prob is deprecated and will be removed in a future ver
sion.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1
- keep_prob`.
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/optim
izers.py:793: The name tf.train.Optimizer is deprecated. Please use tf.com
pat.v1.train.Optimizer instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:3657: The name tf.log is deprecated. Please use t
f.math.log instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow_
core/python/ops/nn_impl.py:183: where (from tensorflow.python.ops.array_op
s) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
```

In [0]:

```
STEP_SIZE_TRAIN= train_generator.n//train_generator.batch_size
STEP_SIZE_VALID= valid_generator.n//valid_generator.batch_size
STEP_SIZE_TEST= test_generator.n//test_generator.batch_size
```

In [18]:

```
model.fit_generator(generator=train_generator,
                    steps_per_epoch=STEP_SIZE_TRAIN,
                    validation_data=valid_generator,
                    validation_steps=STEP_SIZE_VALID,
                    epochs=10)
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:1033: The name tf.assign_add is deprecated. Pleas
e use tf.compat.v1.assign_add instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:1020: The name tf.assign is deprecated. Please us
e tf.compat.v1.assign instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:3005: The name tf.Session is deprecated. Please u
se tf.compat.v1.Session instead.

Epoch 1/10
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:190: The name tf.get_default_session is deprecate
d. Please use tf.compat.v1.get_default_session instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:197: The name tf.ConfigProto is deprecated. Pleas
e use tf.compat.v1.ConfigProto instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:207: The name tf.global_variables is deprecated.
Please use tf.compat.v1.global_variables instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:216: The name tf.is_variable_initialized is depre
cated. Please use tf.compat.v1.is_variable_initialized instead.

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backe
nd/tensorflow_backend.py:223: The name tf.variables_initializer is depreca
ted. Please use tf.compat.v1.variables_initializer instead.

10/10 [==============================] - 8s 761ms/step - loss: 0.5948 - ac
c: 0.6729 - val_loss: 0.5409 - val_acc: 0.7531
Epoch 2/10
10/10 [==============================] - 7s 660ms/step - loss: 0.5594 - ac
c: 0.7083 - val_loss: 0.5501 - val_acc: 0.7531
Epoch 3/10
10/10 [==============================] - 6s 619ms/step - loss: 0.5406 - ac
c: 0.7054 - val_loss: 0.5411 - val_acc: 0.7531
Epoch 4/10
10/10 [==============================] - 6s 634ms/step - loss: 0.5508 - ac
c: 0.6766 - val_loss: 0.5573 - val_acc: 0.7407
Epoch 5/10
10/10 [==============================] - 6s 634ms/step - loss: 0.5233 - ac
c: 0.7088 - val_loss: 0.5454 - val_acc: 0.7531
Epoch 6/10
10/10 [==============================] - 6s 631ms/step - loss: 0.5461 - ac
c: 0.7062 - val_loss: 0.5758 - val_acc: 0.6914
Epoch 7/10
10/10 [==============================] - 6s 636ms/step - loss: 0.5369 - ac
c: 0.7218 - val_loss: 0.5726 - val_acc: 0.7284
Epoch 8/10
10/10 [==============================] - 6s 649ms/step - loss: 0.5380 - ac
c: 0.6979 - val_loss: 0.5754 - val_acc: 0.7284
Epoch 9/10
10/10 [==============================] - 6s 629ms/step - loss: 0.5066 - ac
c: 0.7382 - val_loss: 0.5598 - val_acc: 0.7531
Epoch 10/10
```

```
10/10 [==============================] - 6s 614ms/step - loss: 0.5001 - ac
c: 0.7357 - val_loss: 0.5609 - val_acc: 0.7531
```

Out[18]:

```
<keras.callbacks.History at 0x7fb13e7259b0>
```

In [0]:

```
model.save('/content/gdrive/My Drive/dataset/actor_age_model.h5')
```

In [25]:

```
test_generator.reset()
pred=model.predict_generator(test_generator,
steps=STEP_SIZE_TEST,
verbose=1)
```

```
106/106 [==============================] - 18s 166ms/step
```

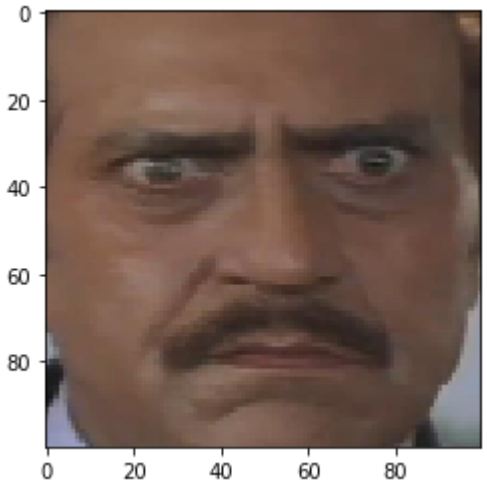
In [0]:

```
pred_bool = (pred >0.5)
predictions = pred_bool.astype(int)
columns=["young", "middle","old"]
#columns should be the same order of y_col
results=pd.DataFrame(predictions, columns=columns)
results["Filenames"]=test_generator.filenames
ordered_cols=["Filenames"]+columns
results=results[ordered_cols]#To get the same column order
results.to_csv("results.csv",index=False)
```

In [32]:

```
from tensorflow.keras.models import load_model
classifier= load_model('/content/gdrive/My Drive/dataset/actor_age_model.h5')
#Prediction of image
%matplotlib inline
import tensorflow
from tensorflow.keras.preprocessing import image
import matplotlib.pyplot as plt
import numpy as np
img1 = image.load_img('/content/Train_AD_img/10126.jpg', target_size=(100, 100))
img = image.img_to_array(img1)
img = img/255
# create a batch of size 1 [N,H,W,C]
img = np.expand_dims(img, axis=0)
prediction = classifier.predict(img, batch_size=None) #gives all class prob.
print(prediction)
print(columns)
prediction_result= pd.DataFrame()
prediction_result['Labels']= columns
#prediction_result['Values']= prediction
print(prediction_result)
plt.imshow(img1)
plt.show()
```

```
[[0.5358389  0.31258225 0.34748858]]
['young', 'middle', 'old']
   Labels
0   young
1  middle
2     old
```



In [0]:

```
%%capture

#Model Accuracy
x1=model.evaluate_generator(train_generator)
x2=model.evaluate_generator(valid_generator)
```

In [35]:

```
print('Training Accuracy  : %1.2f%%     Training loss  : %1.6f'%(x1[1]*100,x1[0]))
print('Validation Accuracy: %1.2f%%     Validation loss: %1.6f'%(x2[1]*100,x2[0]))
```

```
Training Accuracy  : 71.26%     Training loss  : 0.531113
Validation Accuracy: 75.31%     Validation loss: 0.560939
```