```
# importing all the required libraries
import keras
from keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
from keras.layers import Dense,Dropout,Activation,Flatten,BatchNormalization
from keras.layers import Conv2D,MaxPooling2D
import os
```

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

```
    Mounted at /content/drive
```

```
# Declaring no. of classes and batch size
num_classes = 7
img_rows,img_cols = 48,48
batch_size = 64
```

```
# Assigning train and validation Directory
train_data = '/content/drive/MyDrive/Project/images/train'
validation_data = '/content/drive/MyDrive/Project/images/validation'
```

```
# Scaling pixals from 1- 255
train_datagenerator = ImageDataGenerator(rescale = 1./255)

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

```
# converting the image to grayscale
train_gen = train_datagenerator.flow_from_directory(
                    train_data,
                    color_mode='grayscale',
                    target_size=(img_rows,img_cols),
                    batch_size=batch_size,
                    class_mode='categorical',
                    shuffle=True)

validation_gen = validation_datagenerator.flow_from_directory(
                            validation_data,
                            color_mode='grayscale',
                            target_size=(img_rows,img_cols),
                            batch_size=batch_size,
                            class_mode='categorical',
                            shuffle=True)
```

```
    Found 28821 images belonging to 7 classes.
    Found 7066 images belonging to 7 classes.
```

```
# adding sequential type of neural network and adding layers
model = Sequential()

model.add(Conv2D(32,(3,3),padding='same',kernel_initializer='he_normal',input_shape=(img_rows,img_cols,1)))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Conv2D(32,(3,3),padding='same',kernel_initializer='he_normal',input_shape=(img_rows,img_cols,1)))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Dropout(0.2))


model.add(Conv2D(64,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Conv2D(64,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Dropout(0.2))


model.add(Conv2D(128,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Conv2D(128,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2,2)))

model.add(Conv2D(256,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Conv2D(256,(3,3),padding='same',kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2,2)))
model.add(Dropout(0.2))


model.add(Flatten())
model.add(Dense(64,kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Dropout(0.5))


model.add(Dense(64,kernel_initializer='he_normal'))
model.add(Activation('relu'))
model.add(BatchNormalization())
model.add(Dropout(0.5))


model.add(Dense(num_classes,kernel_initializer='he_normal'))
model.add(Activation('softmax'))


# This is the model summary, shows the number of layers , params and output shape
model.summary()
```

```
      activation_5 (Activation)   (None, 12, 12, 128)       0

      batch_normalization_5 (Batc  (None, 12, 12, 128)      512
      hNormalization)

      max_pooling2d_2 (MaxPooling  (None, 6, 6, 128)        0
# Declaring Hyper parameters
from keras.optimizers import RMSprop

model.compile(loss='categorical_crossentropy',
              optimizer = RMSprop(lr=0.001),
              metrics=['accuracy'])
```

```
/usr/local/lib/python3.8/dist-packages/keras/optimizers/optimizer_v2/rmsprop.py:135: UserWarning: The `lr` argument is deprecated,
  super(RMSprop, self).__init__(name, **kwargs)
```

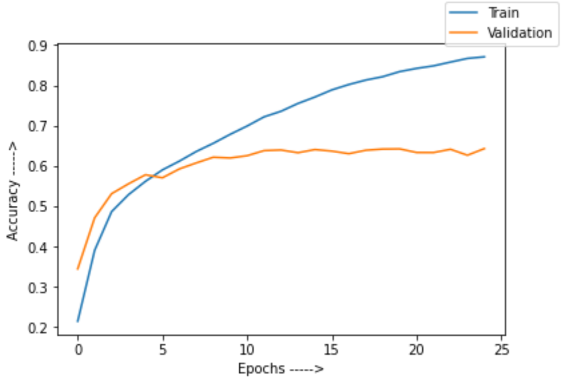
```
# Training the Neural Network
nb_train_samples = train_gen.samples
nb_validation_samples = validation_gen.samples
epochs=25

history=model.fit_generator(
                train_gen,
                steps_per_epoch=nb_train_samples//batch_size,
                epochs=epochs,
                validation_data = validation_gen,
                validation_steps = nb_validation_samples//batch_size)
```

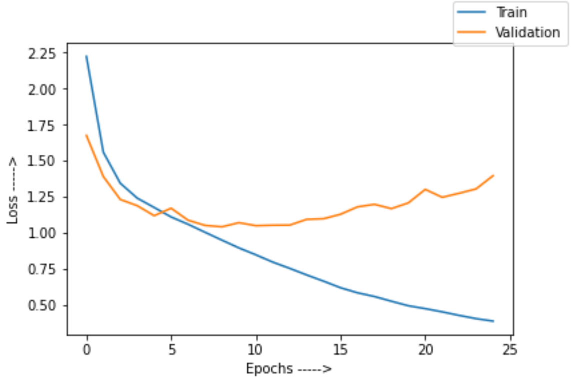
```
<ipython-input-16-ab160b013368>:6: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please
  history=model.fit_generator(
Epoch 1/25
450/450 [==============================] - 8863s 20s/step - loss: 2.2225 - accuracy: 0.2150 - val_loss: 1.6746 - val_accuracy: 0.34
Epoch 2/25
450/450 [==============================] - 473s 1s/step - loss: 1.5586 - accuracy: 0.3908 - val_loss: 1.3897 - val_accuracy: 0.4714
Epoch 3/25
450/450 [==============================] - 474s 1s/step - loss: 1.3435 - accuracy: 0.4867 - val_loss: 1.2308 - val_accuracy: 0.5312
Epoch 4/25
450/450 [==============================] - 473s 1s/step - loss: 1.2402 - accuracy: 0.5289 - val_loss: 1.1878 - val_accuracy: 0.5558
Epoch 5/25
450/450 [==============================] - 474s 1s/step - loss: 1.1753 - accuracy: 0.5620 - val_loss: 1.1184 - val_accuracy: 0.5783
Epoch 6/25
450/450 [==============================] - 477s 1s/step - loss: 1.1098 - accuracy: 0.5904 - val_loss: 1.1701 - val_accuracy: 0.5707
Epoch 7/25
450/450 [==============================] - 476s 1s/step - loss: 1.0590 - accuracy: 0.6121 - val_loss: 1.0871 - val_accuracy: 0.5928
Epoch 8/25
450/450 [==============================] - 479s 1s/step - loss: 1.0037 - accuracy: 0.6360 - val_loss: 1.0512 - val_accuracy: 0.6077
Epoch 9/25
450/450 [==============================] - 477s 1s/step - loss: 0.9490 - accuracy: 0.6563 - val_loss: 1.0414 - val_accuracy: 0.6217
Epoch 10/25
450/450 [==============================] - 478s 1s/step - loss: 0.8952 - accuracy: 0.6786 - val_loss: 1.0699 - val_accuracy: 0.6199
Epoch 11/25
450/450 [==============================] - 476s 1s/step - loss: 0.8474 - accuracy: 0.6992 - val_loss: 1.0493 - val_accuracy: 0.6256
Epoch 12/25
450/450 [==============================] - 478s 1s/step - loss: 0.7968 - accuracy: 0.7219 - val_loss: 1.0524 - val_accuracy: 0.6382
Epoch 13/25
450/450 [==============================] - 477s 1s/step - loss: 0.7534 - accuracy: 0.7358 - val_loss: 1.0533 - val_accuracy: 0.6396
Epoch 14/25
450/450 [==============================] - 478s 1s/step - loss: 0.7079 - accuracy: 0.7552 - val_loss: 1.0930 - val_accuracy: 0.6330
Epoch 15/25
450/450 [==============================] - 478s 1s/step - loss: 0.6646 - accuracy: 0.7711 - val_loss: 1.0974 - val_accuracy: 0.6408
Epoch 16/25
450/450 [==============================] - 479s 1s/step - loss: 0.6191 - accuracy: 0.7888 - val_loss: 1.1283 - val_accuracy: 0.6369
Epoch 17/25
450/450 [==============================] - 484s 1s/step - loss: 0.5842 - accuracy: 0.8021 - val_loss: 1.1796 - val_accuracy: 0.6305
Epoch 18/25
450/450 [==============================] - 483s 1s/step - loss: 0.5583 - accuracy: 0.8132 - val_loss: 1.1971 - val_accuracy: 0.6391
Epoch 19/25
450/450 [==============================] - 483s 1s/step - loss: 0.5256 - accuracy: 0.8215 - val_loss: 1.1673 - val_accuracy: 0.6420
Epoch 20/25
450/450 [==============================] - 481s 1s/step - loss: 0.4942 - accuracy: 0.8342 - val_loss: 1.2071 - val_accuracy: 0.6425
Epoch 21/25
450/450 [==============================] - 479s 1s/step - loss: 0.4742 - accuracy: 0.8422 - val_loss: 1.3005 - val_accuracy: 0.6335
Epoch 22/25
450/450 [==============================] - 478s 1s/step - loss: 0.4520 - accuracy: 0.8484 - val_loss: 1.2458 - val_accuracy: 0.6334
Epoch 23/25
450/450 [==============================] - 480s 1s/step - loss: 0.4274 - accuracy: 0.8578 - val_loss: 1.2739 - val_accuracy: 0.6415
Epoch 24/25
450/450 [==============================] - 480s 1s/step - loss: 0.4050 - accuracy: 0.8668 - val_loss: 1.3041 - val_accuracy: 0.6267
Epoch 25/25
450/450 [==============================] - 480s 1s/step - loss: 0.3878 - accuracy: 0.8708 - val_loss: 1.3956 - val_accuracy: 0.6432
```

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

```
from matplotlib import pyplot as plt

acc = history.history['accuracy']
```

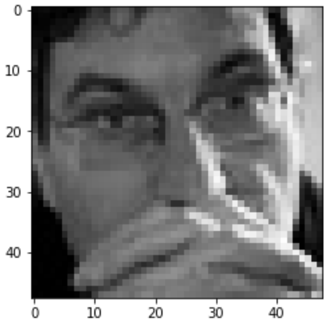
```
val_acc = history.history['val_accuracy']
loss = history.history['loss']
val_loss = history.history['val_loss']


ax1 = plt.figure(0)
plt.plot(acc,label = 'Train')
plt.plot(val_acc, label = 'Validation')
plt.xlabel('Epochs ----->')
plt.ylabel('Accuracy ----->')
leg = ax1.legend()


ax2 = plt.figure(1)
plt.plot(loss,label = 'Train')
plt.plot(val_loss,label = 'Validation')
plt.xlabel('Epochs ----->')
plt.ylabel('Loss ----->')
leg = ax2.legend()
```





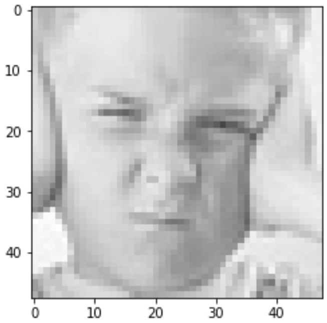
```
import cv2

import numpy as np

import tensorflow as tf



classes = ['angry','disguisted','fearful','happy','neutral','sad','suprised']



I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/fear/10099.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))
print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

```
     IG shape: (48, 48)
     IGP Shape:(1, 48, 48, 1)
     1/1 [==============================] - 0s 284ms/step
     Predicted Emotion is: fearful
```



```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/angry/10079.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

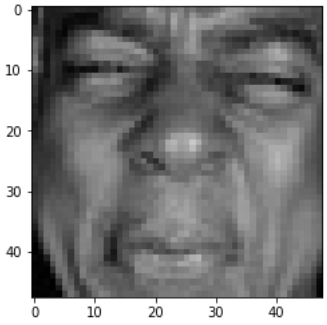
```
     IG shape: (48, 48)
     IGP Shape:(1, 48, 48, 1)
     1/1 [==============================] - 0s 18ms/step
     Predicted Emotion is: angry
```



```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/disgust/10435.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)
```

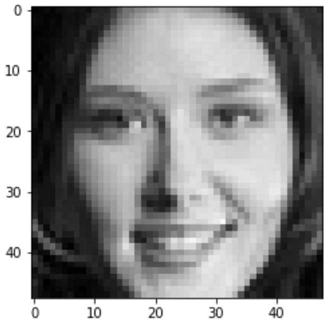
```
print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

```
IG shape: (48, 48)
IGP Shape:(1, 48, 48, 1)
1/1 [==============================] - 0s 18ms/step
Predicted Emotion is: disguisted
```



```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/happy/10362.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

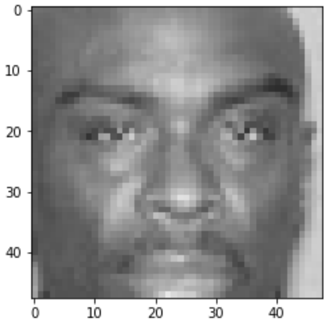
```
IG shape: (48, 48)
IGP Shape:(1, 48, 48, 1)
1/1 [==============================] - 0s 21ms/step
Predicted Emotion is: happy
```



```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/neutral/10266.jpg')
```

```
ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

```
     IG shape: (48, 48)
     IGP Shape:(1, 48, 48, 1)
     1/1 [==============================] - 0s 18ms/step
     Predicted Emotion is: neutral
```



```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/sad/1026.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

```
IG shape: (48, 48)
IGP Shape:(1, 48, 48, 1)
1/1 [==============================] - 0s 21ms/step
Predicted Emotion is: sad
```

```
I1 = cv2.imread('/content/drive/MyDrive/Project/images/validation/surprise/10545.jpg')

ID = cv2.cvtColor(I1,cv2.COLOR_BGR2RGB)

I1 = cv2.cvtColor(I1,cv2.COLOR_BGR2GRAY)


IG = tf.cast(I1, tf.float32)

plt.imshow(ID)

print("IG shape: " + str(IG.shape))

IG = IG/255

IGP = np.expand_dims(IG,axis = 0)

IGP = np.expand_dims(IGP,axis = 3)

print("IGP Shape:" + str(IGP.shape))

predictions = model.predict(IGP)

index = np.argmax(predictions)

print("Predicted Emotion is: " + str(classes[index]))
```

```
IG shape: (48, 48)
IGP Shape:(1, 48, 48, 1)
1/1 [==============================] - 0s 20ms/step
Predicted Emotion is: suprised
```