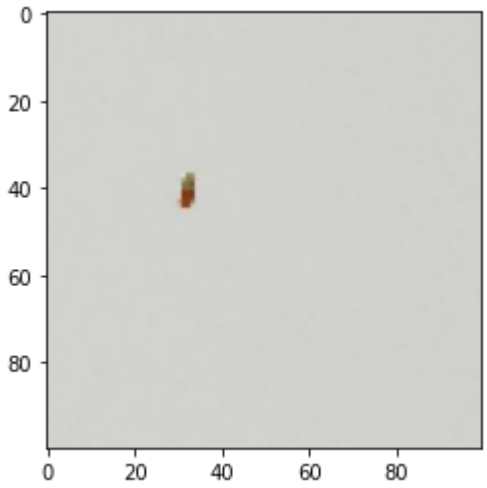
```
import time
start = time.time()
name = 'MedicineImageClassifier'
```

```
# !pip install split-folders
```

```
# import splitfolders

# input_folder = '/content/drive/MyDrive/archive/Drug Vision/Data Combined'
# splitfolders.ratio(input_folder, output="/content/drive/MyDrive/archive/Drug Vision/Data
#                     seed=42, ratio=(.7, .3),
#                     group_prefix=None)
```

```
import os
import cv2
import seaborn as sns
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
from keras.models import Sequential
from keras.layers import Flatten, MaxPooling2D, Conv2D, Dense
from sklearn.metrics import f1_score, confusion_matrix, ConfusionMatrixDisplay
from sklearn.pipeline import Pipeline, make_pipeline
from keras.callbacks import EarlyStopping, ModelCheckpoint, ReduceLROnPlateau
```

```
img_array = cv2.imread('/content/drive/MyDrive/archive/Drug Vision/Data Combined/Alaxan/00
img_array = cv2.cvtColor(img_array,cv2.COLOR_BGR2RGB)
img_array = cv2.resize(img_array, (100, 100))
plt.imshow(img_array)
plt.show()
```




```
categories = ['Alaxan', 'Bactidol', 'Bioflu', 'Biogesic', 'DayZinc', 'Decolgen', 'Fish Oil
IMG_Size = 100
```

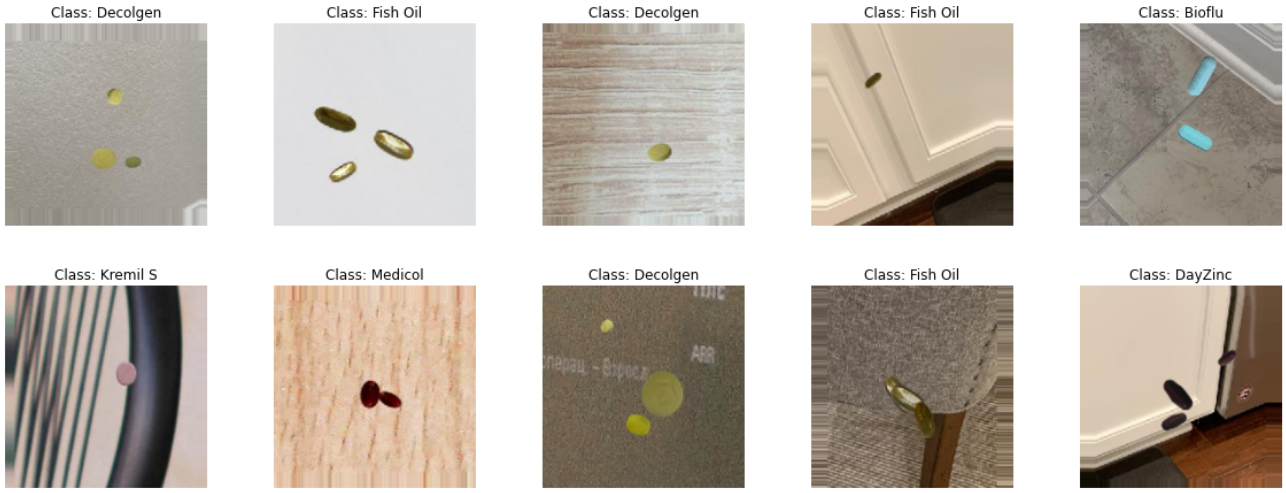
```
train_data_path = '/content/drive/MyDrive/archive/Drug Vision/Data Combined/SplitImages/tr
test_data_path = '/content/drive/MyDrive/archive/Drug Vision/Data Combined/SplitImages/val
```

```
training_data = []
test_data = []

def create_data(my_data_path,my_data):
    for ct in categories:
      path = os.path.join(my_data_path,ct)
      class_num = categories.index(ct)
      for img in os.listdir(path):
        try:
          img_array = cv2.imread(os.path.join(path,img))
          img_array = cv2.cvtColor(img_array,cv2.COLOR_BGR2RGB)
          img_array = cv2.resize(img_array, (100, 100))
          my_data.append([img_array,class_num])
        except Exception as e:
          pass


img_size = 200
batch_size = 32

from keras.preprocessing.image import ImageDataGenerator, img_to_array, load_img

datagen = ImageDataGenerator(rescale=1/255.,
                             zoom_range=0.2,
                             horizontal_flip=True)

test_datagen = ImageDataGenerator(rescale=1/255.)

train_generator = datagen.flow_from_directory(train_data_path,
                                              target_size=(img_size, img_size),
                                              batch_size=batch_size,
                                              shuffle=True,
                                              subset='training',
                                              class_mode='categorical')

test_generator = test_datagen.flow_from_directory(test_data_path,
                                               target_size=(img_size, img_size),
                                               batch_size=batch_size,
                                               shuffle=False,
                                               class_mode='categorical')
```

```
Found 7000 images belonging to 10 classes.
Found 3000 images belonging to 10 classes.
```

```
labels = [k for k,v in train_generator.class_indices.items()]
sample_generate = train_generator.__next__()
images = sample_generate[0]
titles = sample_generate[1]
plt.figure(figsize = (20 , 20))
```

```
for i in range(10):
    plt.subplot(5 , 5, i+1)
    plt.subplots_adjust(hspace = 0.3 , wspace = 0.3)
    plt.imshow(images[i])
    plt.title(f'Class: {labels[np.argmax(titles[i],axis=0)]}')
    plt.axis("off")
```




```
create_data(train_data_path,training_data)
create_data(test_data_path,test_data)


x = []
y = []

for features, label in training_data:
  x.append(features)
  y.append(label)

x_test = []
y_test = []

for features, label in test_data:
  x_test.append(features)
  y_test.append(label)


len(x),len(y),len(x_test),len(y_test)
```

```
(7000, 7000, 3000, 3000)
```

```
y = np.array(y)
```

```
y_test = np.array(y_test)

x = np.array(x)
x_test = np.array(x_test)



# y = np.array(y)
# y_test = np.array(y_test)

# x = np.array(x).reshape(-1, IMG_Size, IMG_Size, 27)
# x_test = np.array(x_test).reshape(-1, IMG_Size, IMG_Size, 27)


x.shape, y.shape, x_test.shape, y_test.shape
```

```
((7000, 100, 100, 3), (7000,), (3000, 100, 100, 3), (3000,))
```

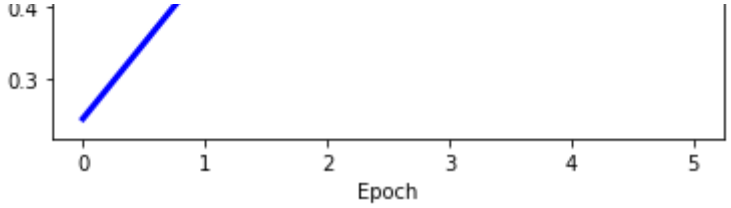
```
early_stopping_monitor = EarlyStopping(monitor='val_accuracy', patience=5, restore_best_we

reduce_lr_on_plateau = tf.keras.callbacks.ReduceLROnPlateau(
    monitor='val_accuracy',
    patience=3,
)

learning_rate_reduction = ReduceLROnPlateau(monitor='val_accuracy',
                                            patience=5,
                                            verbose=1,
                                            factor=0.5,
                                            min_lr=0.00001)

best_model = ModelCheckpoint('/content/drive/MyDrive/bestmodel.hdf5', monitor='accuracy',
best_val_acc = ModelCheckpoint('/content/drive/MyDrive/best_val_acc.hdf5', monitor='val_ac


from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Dropout, Flatten, Dense, Activation, BatchN
from tensorflow.keras.utils import to_categorical

model = Sequential()

model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(IMG_Size, IMG_Size, 3)))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(128, (3, 3), activation='relu'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))
```

```
model.add(Flatten())
model.add(Dense(512, activation='relu'))
model.add(BatchNormalization())
model.add(Dropout(0.5))
model.add(Dense(10, activation='softmax'))

model.compile(loss='categorical_crossentropy', optimizer='rmsprop', metrics=['accuracy'])


# from keras.utils import to_categorical
y_one_hot=to_categorical(y)

hist = model.fit(x, y_one_hot, validation_split=.1, verbose=2, epochs=20, shuffle=True, ba
    early_stopping_monitor,
    learning_rate_reduction,
    best_model, best_val_acc])
```

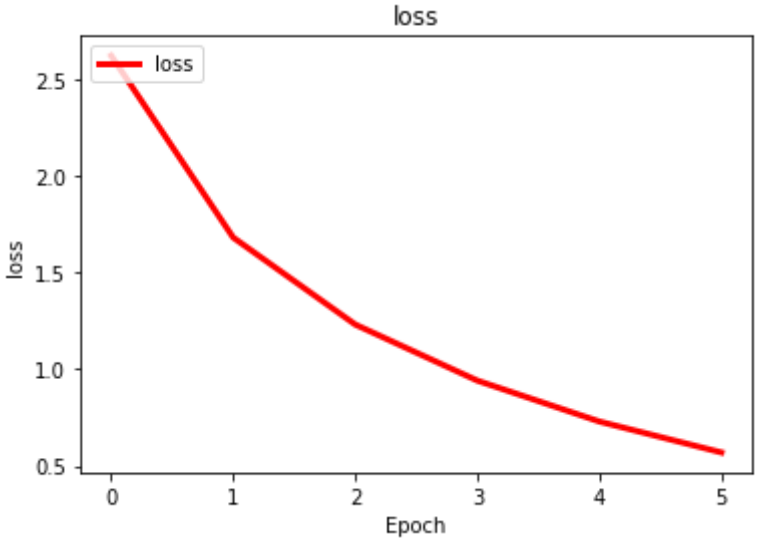
```
Epoch 1/20
99/99 - 162s - loss: 2.6203 - accuracy: 0.2441 - val_loss: 3.4479 - val_accuracy: 0.
Epoch 2/20
99/99 - 160s - loss: 1.6806 - accuracy: 0.4546 - val_loss: 4.7110 - val_accuracy: 0.
Epoch 3/20
99/99 - 161s - loss: 1.2308 - accuracy: 0.5803 - val_loss: 5.2768 - val_accuracy: 0.
Epoch 4/20
99/99 - 159s - loss: 0.9410 - accuracy: 0.6794 - val_loss: 5.3929 - val_accuracy: 0.
Epoch 5/20
99/99 - 159s - loss: 0.7293 - accuracy: 0.7476 - val_loss: 6.4794 - val_accuracy: 0.
Epoch 6/20

Epoch 6: ReduceLROnPlateau reducing learning rate to 0.0005000000237487257.
99/99 - 163s - loss: 0.5694 - accuracy: 0.7981 - val_loss: 7.9178 - val_accuracy: 0.
```

```
# model = Sequential()

# model.add(Conv2D(64, (3,3), input_shape=(IMG_Size, IMG_Size, 3) , activation='relu'))
# model.add(MaxPooling2D(2,2))
# model.add(Conv2D(128, (3,3), activation='relu'))
# model.add(MaxPooling2D(2,2))
# model.add(Conv2D(64, (3,3), activation='relu'))
# model.add(tf.keras.layers.Dropout(.2))
# model.add(Flatten())
# model.add(Dense(64, activation='relu'))
# model.add(tf.keras.layers.Dropout(.2))
# model.add(Dense(10, activation='softmax'))


# opt = tf.keras.optimizers.Adam(learning_rate=0.001, decay=1e-6)


# model.compile(
#     loss='sparse_categorical_crossentropy', # binary_crossentropy, sparse_categorical_cr
#     optimizer=opt,
#     run_eagerly=True,
#     metrics=['accuracy']
```

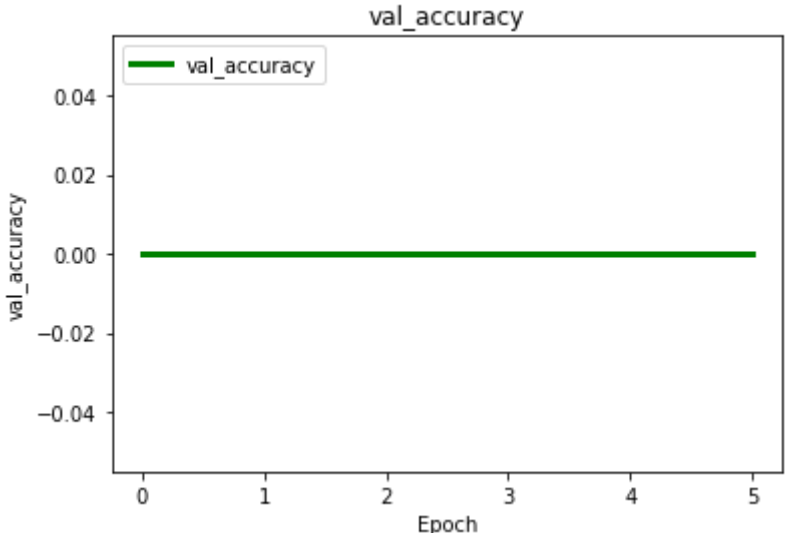
```
# )

# hist = model.fit(x, y, validation_split=.1, verbose=2, epochs=20, shuffle=True, batch_si
#     early_stopping_monitor,
#     reduce_lr_on_plateau,
#     best_model, best_val_acc])


hist.history??


def visualization(name,h,color):
  t = h.history[name]
  my_max = max(t)
  my_min = min(t)
  print(f'Name : {name} max : {my_max} min : {my_min}')
  plt.plot(t,color=color,linewidth=3.0)
  plt.title(name)
  plt.ylabel(name)
  plt.xlabel('Epoch')
  plt.legend([name],loc='upper left')
  plt.show()


visualization('accuracy',hist,'Blue')
visualization('loss',hist,'Red')
visualization('val_accuracy',hist,'Green')
visualization('val_loss',hist,'Black')
```




```
Name : loss max : 2.6203322410583496 min : 0.5693948864936829
```




```
Name : val_accuracy max : 0.0 min : 0.0
```



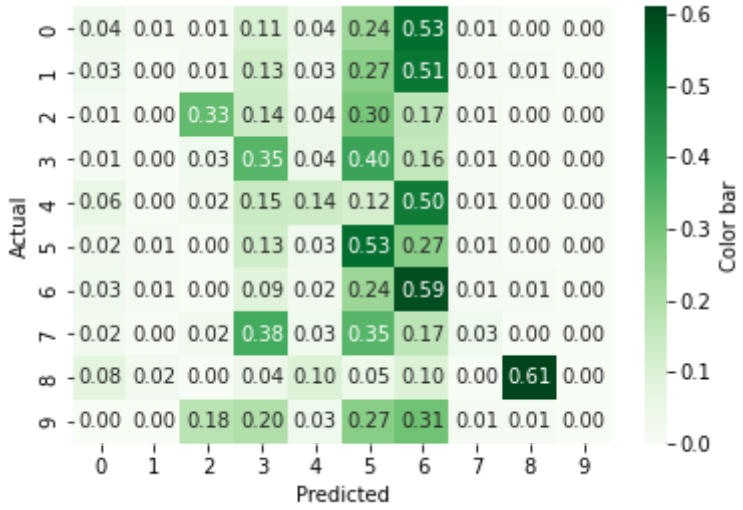

```
model.load_weights('/content/drive/MyDrive/bestmodel.hdf5')
yt_one_hot=to_categorical(y_test)
res = model.evaluate(x_test, yt_one_hot)
print("test loss, test acc:", res)
```

```
94/94 [==============================] - 17s 185ms/step - loss: 2.2085 - accuracy: 0
test loss, test acc: [2.208545207977295, 0.2633333206176758]
```

```
def my_predict(my_model,my_x_test):
  y_pred = my_model.predict(my_x_test)
  return y_pred

def my_f1_score(my_y_test,my_y_pred):
  f1 = f1_score(my_y_test, my_y_pred, average="micro")
  return f1
```

```
def my_conf_matrix(my_y_test,my_y_pred):
  cm = confusion_matrix(my_y_test, my_y_pred)
  cm_norm = np.round(cm/np.sum(cm,axis=1).reshape(-1,1),2)
  sns.heatmap(cm_norm,cmap='Greens',annot=True,
              cbar_kws={'orientation' : 'vertical','label' : 'Color bar'},
              fmt='.2f'
              )
  plt.xlabel('Predicted')
  plt.ylabel('Actual')
  plt.show()

y_pred_res = my_predict(model,x_test)
y_pred_res = np.argmax(y_pred_res, axis=-1)
print(my_f1_score(y_test,y_pred_res))
my_conf_matrix(y_test,y_pred_res)
```

```
0.2633333333333333
```

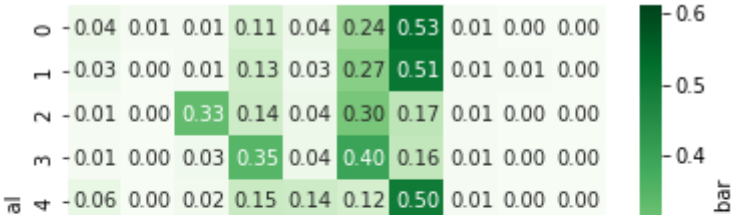



```
model.load_weights('/content/drive/MyDrive/best_val_acc.hdf5')
res = model.evaluate(x_test, yt_one_hot)
print("test loss, test acc:", res)
```

```
94/94 [==============================] - 24s 253ms/step - loss: 2.2085 - accuracy: 0
test loss, test acc: [2.208545207977295, 0.2633333206176758]
```

```
y_pred_res = my_predict(model,x_test)
y_pred_res = np.argmax(y_pred_res, axis=-1)
print(my_f1_score(y_test,y_pred_res))
my_conf_matrix(y_test,y_pred_res)
```

```
0.2633333333333333
```




```
newpath = r'/content/drive/MyDrive/Model/' + name

if not os.path.exists(newpath):
    os.makedirs(newpath)

import pickle

pickle_out = open('/content/drive/MyDrive/Model/' + name + 'model.pickle','wb')
pickle.dump(model,pickle_out)
pickle_out.close()


model.summary()
```

```
Model: "sequential_6"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_18 (Conv2D)          (None, 98, 98, 32)        896

 batch_normalization_16 (Bat  (None, 98, 98, 32)       128
 chNormalization)

 max_pooling2d_16 (MaxPoolin  (None, 49, 49, 32)       0
 g2D)

 dropout_18 (Dropout)        (None, 49, 49, 32)        0

 conv2d_19 (Conv2D)          (None, 47, 47, 64)        18496

 batch_normalization_17 (Bat  (None, 47, 47, 64)       256
 chNormalization)

 max_pooling2d_17 (MaxPoolin  (None, 23, 23, 64)       0
 g2D)

 dropout_19 (Dropout)        (None, 23, 23, 64)        0

 conv2d_20 (Conv2D)          (None, 21, 21, 128)       73856

 batch_normalization_18 (Bat  (None, 21, 21, 128)      512
 chNormalization)

 max_pooling2d_18 (MaxPoolin  (None, 10, 10, 128)      0
 g2D)

 dropout_20 (Dropout)        (None, 10, 10, 128)       0

 flatten_6 (Flatten)         (None, 12800)             0
```

```
 dense_12 (Dense)            (None, 512)               6554112

 batch_normalization_19 (Bat  (None, 512)              2048
 chNormalization)

 dropout_21 (Dropout)        (None, 512)               0

 dense_13 (Dense)            (None, 10)                5130

=================================================================
Total params: 6,655,434
Trainable params: 6,653,962
Non-trainable params: 1,472
_________________________________________________________________
```

```
end = time.time()
print((end - start)/60)
```

```
72.82741411526997
```

```
pickle_in = open('/content/drive/MyDrive/Model/' + name + 'model.pickle','rb')
model = pickle.load(pickle_in)
```