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# University of St Thomas
# SEIS 764 AI Fall 2022, Prof. Chih Lai
#
# TEAM PROJECT
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from datetime import datetime
from tensorflow import keras
from keras import Sequential
from keras.layers import Conv2D, Dense, Flatten, Activation, Dropout, Flatten, MaxPooling2
from keras.losses import CategoricalCrossentropy
from keras.preprocessing.image import ImageDataGenerator
import numpy as np
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
#from keras.applications.vgg19 import preprocess_input
#from keras.applications.inception_v3 import preprocess_input
#from keras.applications.inception_resnet_v2 import preprocess_input
from keras.applications.resnet import preprocess_input
from PIL import Image
from torchvision import transforms

# parameters for image data

from google.colab import drive
drive.mount('/content/drive')
dir_path = "/content/drive/My Drive/Crops-Clean"


img_class_mode_ = 'categorical'
rotation_range_ = 15       # 15 degrees rotation range for image augmentation
width_shift_range_ = 0.15  # 15% horizontal shift range for image augmentation
height_shift_range_ = 0.15 # 15% pixels veritcal shift range for image augmentation
zoom_range_ = 0.3          # zoom range 0.7 - 1.3 for image augmentation
brightness_range_ = (0.3, 1.0)   # brightness range 50% to 100% for image augmentation
horizontal_flip_ = True    # horizontal flip on for image augmentation
interpolation_mode_ = "lanczos"  # higher quality interpolation for re-scaling (when appli
fill_mode_ = "reflect"  # reflect margin for shifted regions for image augmentation
keep_aspect_ratio_ = True

# parameters for learning
img_batch_size_ = 10
checkpoint_path = "model_checkpoint_" + datetime.now().strftime('%Y%m%d-%H%M%S') + ".h5"

# fix model.py: Line #170 in_channels = inputs.shape[-1]
!git clone https://github.com/rkuo2000/keras-deeplab-v3-plus
%cd keras-deeplab-v3-plus
```

```
# load data and split into training and test/validation data sets
images_data = ImageDataGenerator(
    rescale=1. / 255,
    preprocessing_function = preprocess_input,  # Ref. https://keras.io/api/applications/v
    validation_split = 0.25,
    rotation_range = rotation_range_, width_shift_range = width_shift_range_,
    height_shift_range = height_shift_range_, zoom_range = zoom_range_,
    horizontal_flip = horizontal_flip_, fill_mode = fill_mode_,
    brightness_range = brightness_range_)
trainD_shuffle = images_data.flow_from_directory(
    dir_path, shuffle = True, target_size = (224, 224), interpolation = interpolation_mode
    keep_aspect_ratio = keep_aspect_ratio_,
    class_mode = img_class_mode_, batch_size = img_batch_size_, subset = 'training')
trainD_mask = images_data.flow_from_directory(
    dir_path, shuffle = True, target_size = (224, 224), interpolation = interpolation_mode
    keep_aspect_ratio = keep_aspect_ratio_,
    class_mode = img_class_mode_, batch_size = img_batch_size_, subset = 'training')
trainD_noshuffle = images_data.flow_from_directory(
    dir_path, shuffle = False, target_size = (224, 224), interpolation = interpolation_mod
    keep_aspect_ratio = keep_aspect_ratio_,
    class_mode = img_class_mode_, batch_size = img_batch_size_, subset = 'training')
testD_noshuffle = images_data.flow_from_directory(
    dir_path, shuffle = False, target_size = (224, 224), interpolation = interpolation_mod
    keep_aspect_ratio = keep_aspect_ratio_,
    class_mode = img_class_mode_, batch_size = img_batch_size_, subset = 'validation')
testD_mask = images_data.flow_from_directory(
    dir_path, shuffle = False, target_size = (224, 224), interpolation = interpolation_mod
    keep_aspect_ratio = keep_aspect_ratio_,
    class_mode = img_class_mode_, batch_size = img_batch_size_, subset = 'validation')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.m
Cloning into 'keras-deeplab-v3-plus'...
remote: Enumerating objects: 375, done.
remote: Total 375 (delta 0), reused 0 (delta 0), pack-reused 375
Receiving objects: 100% (375/375), 5.12 MiB | 34.03 MiB/s, done.
Resolving deltas: 100% (202/202), done.
/content/keras-deeplab-v3-plus/keras-deeplab-v3-plus/keras-deeplab-v3-plus
Found 635 images belonging to 30 classes.
Found 635 images belonging to 30 classes.
Found 635 images belonging to 30 classes.
Found 194 images belonging to 30 classes.
Found 194 images belonging to 30 classes.
```

```
train_img_class_count = len(trainD_noshuffle.class_indices)
test_img_class_count = len(testD_noshuffle.class_indices)
if (train_img_class_count != test_img_class_count):
    raise Exception("Training and Testing Data Sets Not Aligned.")
img_class_count = test_img_class_count
print("image class count", img_class_count)
```

```
image class count 30
```

```
# get pre-trained CNN
#from keras.applications import InceptionResNetV2
#from keras.applications import InceptionV3
from keras.applications import ResNet50V2
cnn = ResNet50V2(weights = 'imagenet', include_top = False, input_shape = (224, 224, 3))
cnn.trainable = False


opt = keras.optimizers.Adam(learning_rate=0.0001)
epochs_ = 100

model = Sequential([
    cnn,
    Flatten(),
    Dense(500, activation = 'relu'),
    Dropout(.3),
    Dense(360, activation = 'relu'),
    Dropout(.3),
    Dense(180, activation = 'relu'),
    Dropout(.2),
    Dense(90, activation = 'relu'),
    Dropout(.2),
    Dense(img_class_count, activation = 'softmax')
])

model.compile(loss = CategoricalCrossentropy(),
    optimizer=opt,
     metrics = ['accuracy'])


model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
resnet50v2 (Functional)      (None, 7, 7, 2048)        23564800

flatten_2 (Flatten)          (None, 100352)            0

dense_10 (Dense)             (None, 500)               50176500

dropout_4 (Dropout)          (None, 500)               0

dense_11 (Dense)             (None, 360)               180360

dropout_5 (Dropout)          (None, 360)               0

dense_12 (Dense)             (None, 180)               64980

dropout_6 (Dropout)          (None, 180)               0

dense_13 (Dense)             (None, 90)                16290

dropout_7 (Dropout)          (None, 90)                0
```

```
 dense_14 (Dense)            (None, 30)                2730

=================================================================
Total params: 74,005,660
Trainable params: 50,440,860
Non-trainable params: 23,564,800
_________________________________________________________________
```

```
# set up logging
# and train nerual net

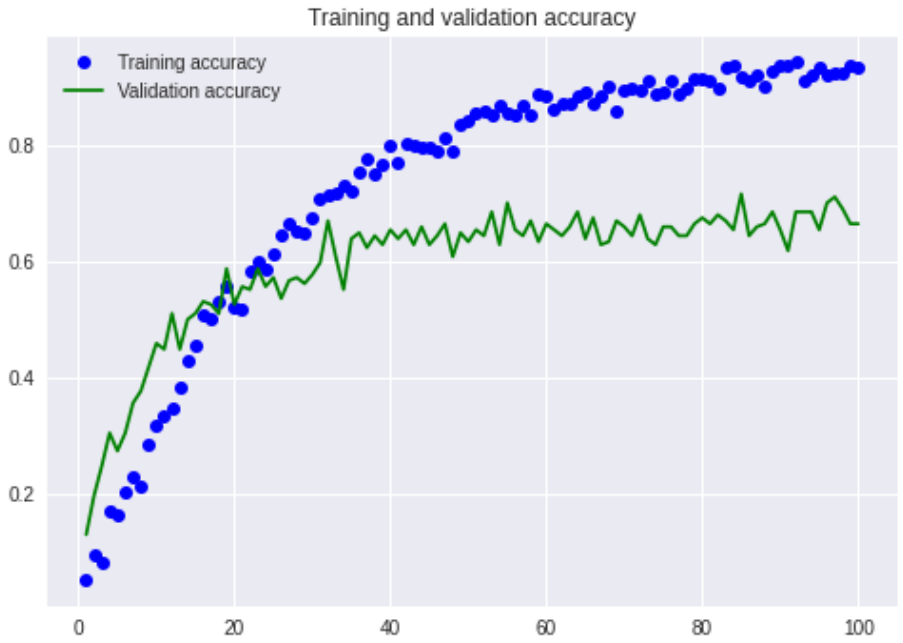
%load_ext tensorboard

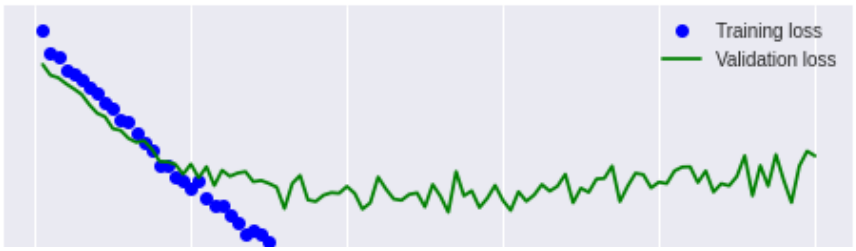
log_dir = 'logs/batch/' + datetime.now().strftime('%Y%m%d-%H%M%S') + '/train'
tensorboard_callback = keras.callbacks.TensorBoard(log_dir = log_dir)
checkpoint_callback = keras.callbacks.ModelCheckpoint(
    filepath = checkpoint_path, monitor="val_accuracy", batch_size = img_batch_size_,
    verbose=1, mode="max", save_weights_only=True, save_best_only=True)
history = model.fit(trainD_shuffle, epochs = epochs_, validation_data = testD_noshuffle,
    callbacks=[tensorboard_callback, checkpoint_callback])
```

```
Epoch 86: val_accuracy did not improve from 0.71649
64/64 [==============================] - 23s 359ms/step - loss: 0.3187 - accuracy: 0.
Epoch 87/100
64/64 [==============================] - ETA: 0s - loss: 0.2975 - accuracy: 0.9228
Epoch 87: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 344ms/step - loss: 0.2975 - accuracy: 0.
Epoch 88/100
64/64 [==============================] - ETA: 0s - loss: 0.3082 - accuracy: 0.9024
Epoch 88: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 343ms/step - loss: 0.3082 - accuracy: 0.
Epoch 89/100
64/64 [==============================] - ETA: 0s - loss: 0.2386 - accuracy: 0.9291
Epoch 89: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 339ms/step - loss: 0.2386 - accuracy: 0.
Epoch 90/100
64/64 [==============================] - ETA: 0s - loss: 0.2386 - accuracy: 0.9370
Epoch 90: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 340ms/step - loss: 0.2386 - accuracy: 0.
Epoch 91/100
64/64 [==============================] - ETA: 0s - loss: 0.1953 - accuracy: 0.9386
Epoch 91: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 341ms/step - loss: 0.1953 - accuracy: 0.
Epoch 92/100
64/64 [==============================] - ETA: 0s - loss: 0.1761 - accuracy: 0.9433
Epoch 92: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 338ms/step - loss: 0.1761 - accuracy: 0.
Epoch 93/100
64/64 [==============================] - ETA: 0s - loss: 0.3000 - accuracy: 0.9118
Epoch 93: val_accuracy did not improve from 0.71649
64/64 [==============================] - 23s 364ms/step - loss: 0.3000 - accuracy: 0.
Epoch 94/100
64/64 [==============================] - ETA: 0s - loss: 0.2500 - accuracy: 0.9228
Epoch 94: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 340ms/step - loss: 0.2500 - accuracy: 0.
Epoch 95/100
64/64 [==============================] - ETA: 0s - loss: 0.2945 - accuracy: 0.9339
```

```
64/64 [==============================] - ETA: 0s - loss: 0.2945 - accuracy: 0.9339
Epoch 95: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 342ms/step - loss: 0.2945 - accuracy: 0.
Epoch 96/100
64/64 [==============================] - ETA: 0s - loss: 0.2758 - accuracy: 0.9228
Epoch 96: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 340ms/step - loss: 0.2758 - accuracy: 0.
Epoch 97/100
64/64 [==============================] - ETA: 0s - loss: 0.2477 - accuracy: 0.9260
Epoch 97: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 342ms/step - loss: 0.2477 - accuracy: 0.
Epoch 98/100
64/64 [==============================] - ETA: 0s - loss: 0.2359 - accuracy: 0.9260
Epoch 98: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 338ms/step - loss: 0.2359 - accuracy: 0.
Epoch 99/100
64/64 [==============================] - ETA: 0s - loss: 0.2385 - accuracy: 0.9370
Epoch 99: val_accuracy did not improve from 0.71649
64/64 [==============================] - 22s 336ms/step - loss: 0.2385 - accuracy: 0.
Epoch 100/100
64/64 [==============================] - ETA: 0s - loss: 0.2033 - accuracy: 0.9339
Epoch 100: val_accuracy did not improve from 0.71649
64/64 [==============================] - 23s 357ms/step - loss: 0.2033 - accuracy: 0.
```

```
# CHANGE:  Plot training and validation accuracy over epochs
import matplotlib.pyplot as plt
accuracy = history.history["accuracy"]
val_accuracy = history.history["val_accuracy"]
loss = history.history["loss"]
val_loss = history.history["val_loss"]
epochs = range(1, len(accuracy) + 1)
plt.plot(epochs, accuracy, "bo", label = "Training accuracy")
plt.plot(epochs, val_accuracy, "g", label = "Validation accuracy")
plt.title("Training and validation accuracy")
plt.legend()
plt.figure()
plt.plot(epochs, loss, "bo", label = "Training loss")
plt.plot(epochs, val_loss, "g", label = "Validation loss")
plt.yscale("log")
plt.legend()
plt.show()
```




```
# restore checkpoint model
#model = keras.models.load_model(checkpoint_path)
model.load_weights(checkpoint_path)
```

```
# run prediction based on training data
train_scores = model.predict(trainD_noshuffle)
train_pred_labels = train_scores.argmax(axis = 1)
```

```
64/64 [==============================] - 19s 282ms/step
```

```
# evaluate trained network
print('')
print('')
print('Model Evaluation Using Training Data:')

print("Accuracy Score")
print(accuracy_score(trainD_noshuffle.labels, train_pred_labels))

print("Confusion Matrix")
print(confusion_matrix(trainD_noshuffle.labels, train_pred_labels))
```

```
[ 0 22  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 24  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 18  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 21  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 23  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 29  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0
  0  0  0  0  0  0]
[ 0  0  0  0  0  0  0 25  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 16  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 24  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 16  0  0  0  0  0  0  0  0  0  0  0  0  0
  0  0  1  0  0  0]
[ 0  0  0  0  0  0  0  0  0  0  0 18  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 23  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 19  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 24  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 19  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 23  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 18  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 24  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 21  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 18  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 19  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 22  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 23
  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
 19  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 18  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 18  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 20  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 21  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 24]]


# run prediction based on test data
test_scores = model.predict(testD_noshuffle)
```

```
test_pred_labels = test_scores.argmax(axis = 1)
```

```
     20/20 [==============================] - 5s 260ms/step
```

```
# print confusion matrix
print('')
print('')
print('Model Evaluation Using Test Data:')


print("Accuracy Score")
print(accuracy_score(testD_noshuffle.labels, test_pred_labels))

print("Confusion Matrix")
print(confusion_matrix(testD_noshuffle.labels, test_pred_labels))
```

```
     Model Evaluation Using Test Data:
     Accuracy Score
     0.6494845360824743
     Confusion Matrix
     [[2 1 0 0 2 0 0 0 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0]
      [0 3 0 0 1 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0]
      [0 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0]
      [0 0 0 5 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 6 1 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 4 0 0 3 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 3 0 0 0 0 0 0 0 0 0 4 1 0 0 0 0 0 0 1 0 0 0 0 0]
      [0 0 0 0 0 0 0 6 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 0 1 0 0 3 0 0 1 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 1 0 4 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0]
      [0 0 1 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0]
      [0 2 0 0 0 0 0 1 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 0 7 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 4 0 0 0 0 0 0 0 0 0 1 0 0 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6 0 1 0 0 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 3 0 0 0 0 0 0 0 0 1 0 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7 0 0 0 0 0 0 0 0 0 0 0]
      [0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6 0 0 0 0 0 0 0 0 0 0]
      [0 0 0 0 1 0 0 0 0 1 0 0 0 1 0 0 0 1 0 0 1 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 6 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 1 0 0 0 1 0 0 1]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 4 0 0 0 0 2 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 1 0 4 0 0 0 0 0]
      [0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 4 0 0 0 0]
      [0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4 0 0 0]
      [1 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 0 0]
      [0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 0 0 0 1 0 0 0 2 0 0 0 0 0 1 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 7]]
```

```
# Create lookup to convert class labels (index-numbers) to string labels
nameToLabelDict = testD_noshuffle.class_indices
```

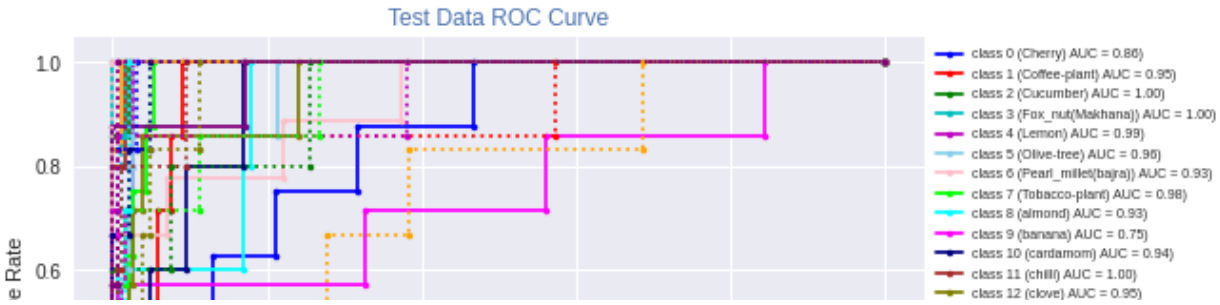
```
labelToNameDict = dict([(value, key) for key, value in nameToLabelDict.items()])


# set up lists of colors and styles for use in plotting
from itertools import cycle
from itertools import product
from sklearn.linear_model import LassoCV
import matplotlib as mpl
color_list = [\
    "b", "r", "g", "c", "m", \
    "skyblue", "pink", "lime", "cyan", "magenta", \
    "navy", "brown", "olive", "orange", "purple"]
    # note "cyan" is brighter than "c", "magenta" is brighter than "m"

# repeat each style times number of colors
base_style_list = ['solid', 'dotted', 'dashed', 'dashdot']
line_style_list = \
    [cartesian[0] for  cartesian in product(base_style_list, color_list)]

# set up plot styling
mpl.style.use('seaborn')


# Plot ROC (Receiver Operating Characteristic) Curve and compute area under curve for each
# using test data
import matplotlib as mpl
import seaborn as sms
mpl.style.use('seaborn')
import matplotlib.pyplot as plt
# Compute ROC curve and ROC area for each class
from sklearn.metrics import roc_curve, auc
fig, ax = plt.subplots()
for i, c, l in zip(range(img_class_count), cycle(color_list), line_style_list):
    fpr_, tpr_, _ = roc_curve(testD_noshuffle.labels, test_scores[:, i], pos_label=i)
    auc_ = auc(fpr_, tpr_)
    label_ = 'class ' + str(i) + " (" + labelToNameDict[i] + ") AUC = %0.2f)" % auc_
    plt.plot(fpr_, tpr_, marker='.', label=label_, color = c, linestyle = l)
plt.title("Test Data ROC Curve", color='C6')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
ax.legend(bbox_to_anchor = (1.0,1.0), loc = "upper left", fontsize = "x-small")
#plt.legend()
plt.show()
```




```
# Print precision, recall, F-score for each class
# using test data
from sklearn.metrics import classification_report
scores = classification_report(testD_noshuffle.labels, test_pred_labels)
print(scores)
```

| | precision | recall | f1-score | support |
|---|---|---|---|---|
| 0 | 0.67 | 0.25 | 0.36 | 8 |
| 1 | 0.43 | 0.43 | 0.43 | 7 |
| 2 | 0.83 | 0.71 | 0.77 | 7 |
| 3 | 1.00 | 1.00 | 1.00 | 5 |
| 4 | 0.50 | 0.86 | 0.63 | 7 |
| 5 | 0.67 | 0.57 | 0.62 | 7 |
| 6 | 1.00 | 0.33 | 0.50 | 9 |
| 7 | 0.50 | 0.75 | 0.60 | 8 |
| 8 | 0.43 | 0.60 | 0.50 | 5 |
| 9 | 0.67 | 0.57 | 0.62 | 7 |
| 10 | 0.67 | 0.40 | 0.50 | 5 |
| 11 | 0.57 | 0.80 | 0.67 | 5 |
| 12 | 0.60 | 0.43 | 0.50 | 7 |
| 13 | 0.83 | 0.83 | 0.83 | 6 |
| 14 | 1.00 | 0.88 | 0.93 | 8 |
| 15 | 0.80 | 0.67 | 0.73 | 6 |
| 16 | 0.55 | 0.86 | 0.67 | 7 |
| 17 | 0.33 | 0.60 | 0.43 | 5 |
| 18 | 0.70 | 1.00 | 0.82 | 7 |
| 19 | 0.67 | 0.86 | 0.75 | 7 |
| 20 | 0.33 | 0.20 | 0.25 | 5 |
| 21 | 1.00 | 1.00 | 1.00 | 6 |
| 22 | 0.80 | 0.57 | 0.67 | 7 |
| 23 | 0.57 | 0.57 | 0.57 | 7 |
| 24 | 0.80 | 0.67 | 0.73 | 6 |
| 25 | 0.80 | 0.67 | 0.73 | 6 |
| 26 | 0.57 | 0.80 | 0.67 | 5 |
| 27 | 0.75 | 0.50 | 0.60 | 6 |
| 28 | 0.20 | 0.17 | 0.18 | 6 |
| 29 | 0.88 | 1.00 | 0.93 | 7 |
| accuracy | | | 0.65 | 194 |
| macro avg | 0.67 | 0.65 | 0.64 | 194 |
| weighted avg | 0.68 | 0.65 | 0.64 | 194 |

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0s completed at 3:56 PM