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EE5353 NEURAL NETWORKS and DEEP LEARNING

ASSIGNMENT 7 :

CHARACTER RECOGNITION USING CONVOLUTIONAL NEURAL NETS using KERAS using GOOGLE COLAB

```
# -*- coding: utf-8 -*-
"""Character_Recognition_for_Students.ipynb

Automatically generated by Colaboratory.

Original file is located at
    https://colab.research.google.com/drive/1KDJ-tXKqHR5YafdcC5ajfnch3MJsZS-u
"""

# -*- coding: utf-8 -*-
"""
Created on Thur Nov 7 14:20:37 2019
Reference from https://github.com/anujshah1003/own_data_cnn_implementation_keras/blob/mast
@author: RaneChinmayAppa
"""

import numpy as np
import os,cv2

import glob

from sklearn.utils import shuffle

from sklearn.model_selection import train_test_split

import re

from keras.utils import np_utils

import matplotlib.pyplot as plt
from keras.utils import to_categorical
from keras.models import Sequential
from keras.layers import Dense, Conv2D, Flatten, MaxPooling2D, Dropout


def sorted_aphanumeric(data):
    convert = lambda text: int(text) if text.isdigit() else text.lower()
    alphanum_key = lambda key: [ convert(c) for c in re.split('([0-9]+)', key) ]
    return sorted(data, key=alphanum_key)

def gen_image(arr):
    two_d = (np.reshape(arr, (28, 28)) * 255).astype(np.uint8)
    plt.imshow(two_d, interpolation='nearest')
    return  plt

def unique(list1):

    # insert the list to the set
    list_set = set(list1)
    # convert the set to the list
    unique_list = (list(list_set))
    for x in unique_list:
        print(x)
```

```
#from sklearn.cross_validation import train_test_split

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

PATH = os.getcwd()
# Define data path
data_path = '/content/drive/My Drive/Colab Notebooks/Character Images'   # inset your path

data_dir_list = sorted_aphanumeric(os.listdir(data_path)) # os.listdir(data_path)


img_rows=128
img_cols=128
num_channel=1
num_epoch=20

# Define the number of classes
num_classes = 34

labels_name={'0':0,'1':1,'2':2,'3':3,'4':4,'5':5,'6':6,'7':7,'8':8,'9':9,'A':10,'B':11,'C'

img_data_list=[]
labels_list = []

for dataset in data_dir_list:
    img_list = glob.glob(data_path+'/'+ dataset +'/*.png')

    label = labels_name[dataset] # label is generated as the library updated above
    for img in img_list:
        input_img=cv2.imread(img,1 )
        input_img=cv2.cvtColor(input_img, cv2.COLOR_BGR2GRAY)
        input_img_resize=cv2.resize(input_img,(28,28))
        img_data_list.append(input_img_resize)
        labels_list.append(label)

#print(unique(labels_list))
img_data = np.array(img_data_list)
img_data = img_data.astype('float32')

labels = np.array(labels_list)

#print(unique(labels))
print(np.unique(labels,return_counts=True))
Y = np_utils.to_categorical(labels, num_classes)


#Shuffle the dataset
x,y = shuffle(img_data,Y, random_state=2)


X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=2) #

#Normalization of the data
X train = X train / 255
```

```
X_test = X_test / 255

Nv = X_train.shape[0]
Nv_test = X_test.shape[0]

#reshape data to fit model
X_train = X_train.reshape(int(Nv),28,28,1)
X_test = X_test.reshape(int(Nv_test),28,28,1)


model = Sequential()
##################   add model layers described in the assignment   ######################


model.add(Conv2D(32, kernel_size=5, activation='relu', input_shape=(28,28,1)))
        # 64 are the number of filters, kernel size is the size of the filters example 3*3
#model.add(Conv2D(32, kernel_size=5, activation='relu'))
model.add(MaxPooling2D(pool_size=(3,3)))
model.add(Dropout(0.35))
model.add(Flatten())
model.add(Dense(64, activation='relu'))
model.add(Dropout(0.35))
model.add(Dense(34, activation='softmax'))


#################################################################################################

# 8. Compile model
model.compile(loss='categorical_crossentropy',
              optimizer='adam',
              metrics=['accuracy'])

# 9. Fit model on training data
model.fit(X_train, y_train,
          batch_size=32, nb_epoch=10, verbose=1) #epochs  = iterations(Nit)

# 10. Evaluate model on test data
score = model.evaluate(X_test, y_test, verbose=1)

print('Testing accuracy - > ',score[1] * 100)

ytested = model.predict_classes(X_test)
for i in range(10):
  print("The Predicted Testing image is =%s verify below" % ((list(labels_name.keys())[lis
  gen_image(X_test[i]).show() # printing image vs the predicted image below
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.m
(array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16,
       17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33]), array([5
       50, 18, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50, 50]))
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl
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/optimizers.py:79

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow_core/python
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
/usr/local/lib/python3.6/dist-packages/ipykernel_launcher.py:143: UserWarning: The `n
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

Epoch 1/10
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

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WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorfl

1334/1334 [==============================] - 9s 7ms/step - loss: 3.1074 - acc: 0.1769
Epoch 2/10
1334/1334 [==============================] - 0s 179us/step - loss: 1.5432 - acc: 0.58
Epoch 3/10
1334/1334 [==============================] - 0s 184us/step - loss: 0.6982 - acc: 0.80
Epoch 4/10
1334/1334 [==============================] - 0s 183us/step - loss: 0.4639 - acc: 0.87
Epoch 5/10
1334/1334 [==============================] - 0s 179us/step - loss: 0.3151 - acc: 0.90
Epoch 6/10
1334/1334 [==============================] - 0s 171us/step - loss: 0.2524 - acc: 0.94
Epoch 7/10
1334/1334 [==============================] - 0s 187us/step - loss: 0.2108 - acc: 0.94
Epoch 8/10
1334/1334 [==============================] - 0s 166us/step - loss: 0.1607 - acc: 0.95
Epoch 9/10
1334/1334 [==============================] - 0s 178us/step - loss: 0.1553 - acc: 0.95
Epoch 10/10
1334/1334 [==============================] - 0s 165us/step - loss: 0.1322 - acc: 0.95
```
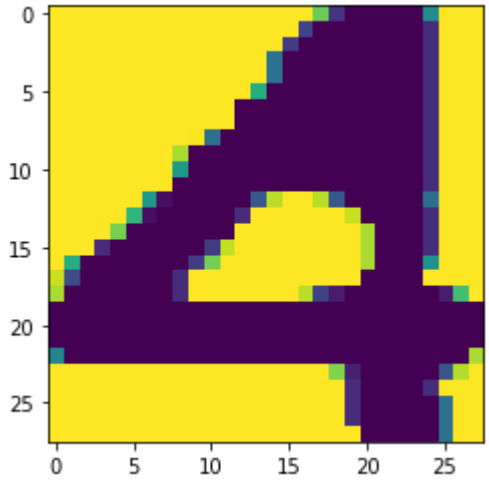
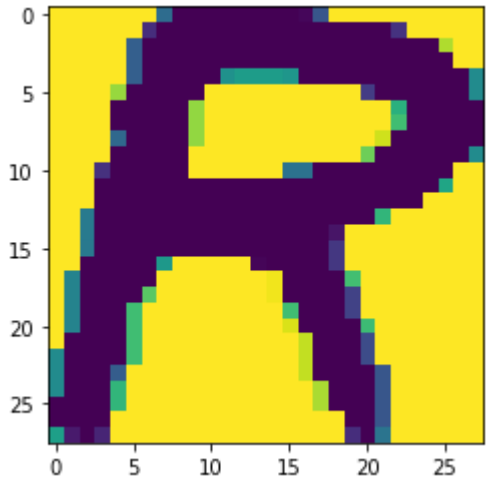
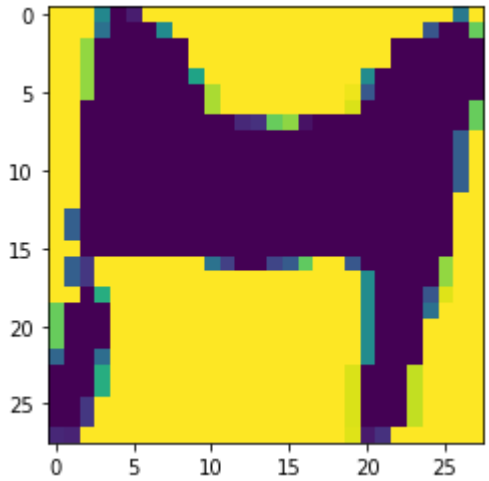

```
334/334 [==============================] - 0s 237us/step
Testing accuracy - >  98.20359281437125
The Predicted Testing image is =4 verify below
```



```
The Predicted Testing image is =R verify below
```

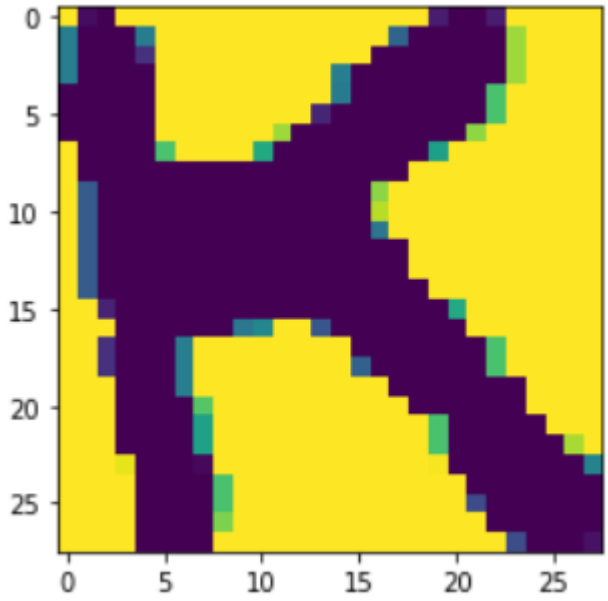


```
The Predicted Testing image is =M verify below
```

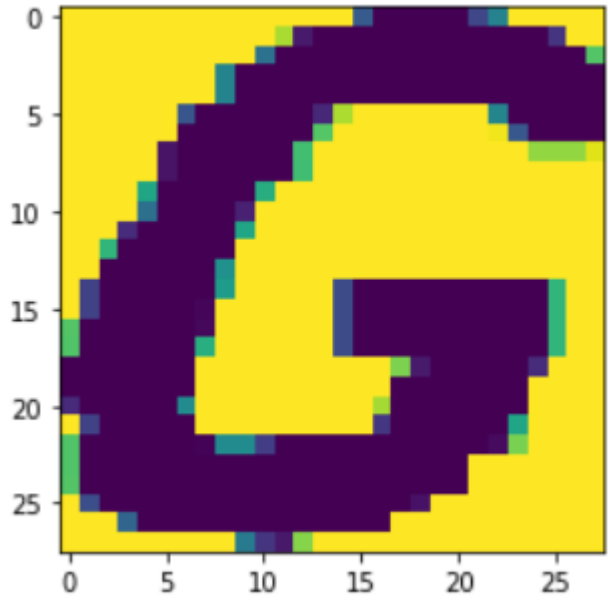


```
The Predicted Testing image is =R verify below
```

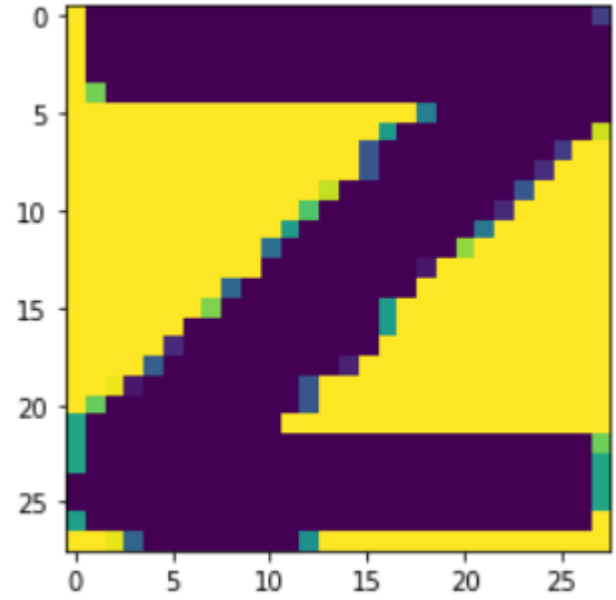
The Predicted Testing image is =K verify below



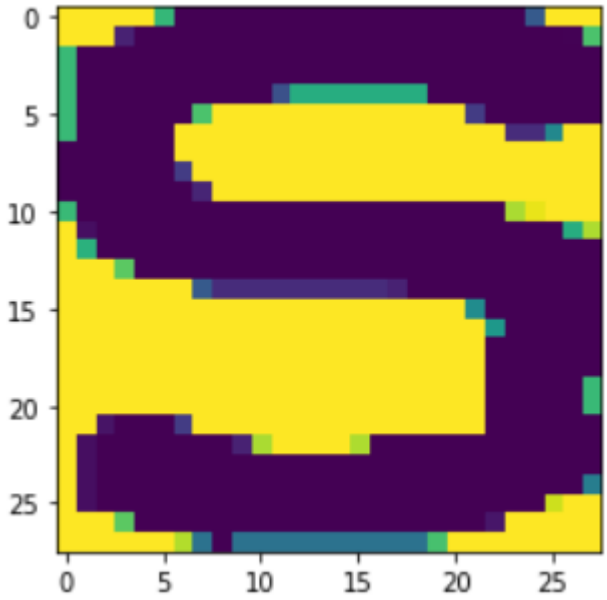
The Predicted Testing image is =G verify below



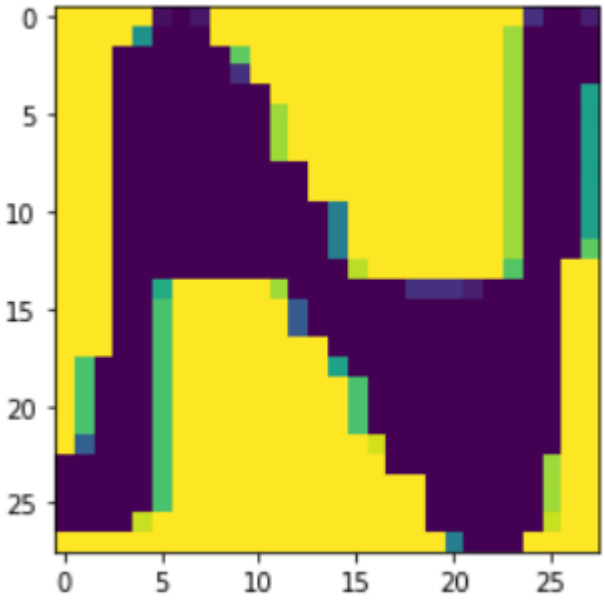
The Predicted Testing image is =Z verify below



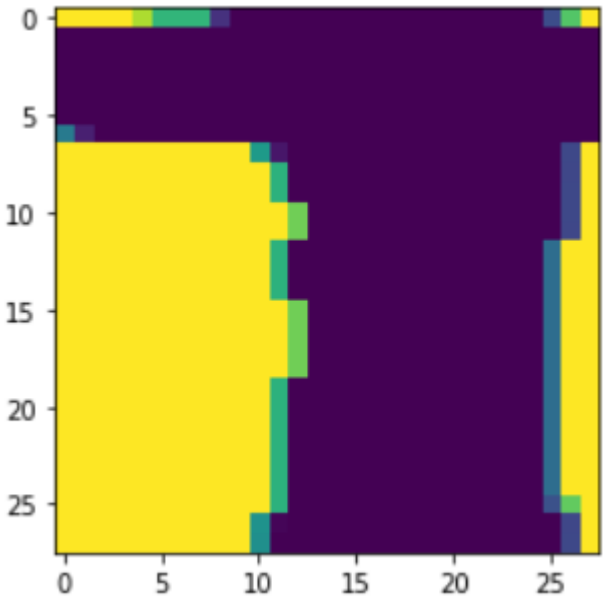
The Predicted Testing image is =5 verify below



The Predicted Testing image is =N verify below



The Predicted Testing image is =1 verify below



Explanation of code:

- First, we are importing the required files
- Then we use the “Lambda func” to sort the image and generate image. The lambda function is used for higher order functions.
- In generation of image we use tensor flow reshape function.
- Then we create path for importing the character file.
- Then we are creating python data structures for inputs like we are creating list and tuples.
- Then we print shuffle reshape and normalize the data.
- At the end we are calling different model layers to recognition the image.
- We are calling the convolution library file and passing 4 arguments and these arguments are “filter size, kernel size, activation function, input shape”.
- Generally, convolution layer has more than 10 arguments since we require only 4 arguments for our project, we don’t use the rest.
- Then we call the pooling library file with 1 argument and that argument is “pool size”.
- Similarly, the pooling function has 4 arguments and we use only one of those arguments.
- Then we add the dropout layer with one argument and that one argument corresponds to “rate”. The other two arguments are noise shape and seed
- Next layer that we add would be flatten with no arguments, however, flatten accepts one arguments so if we don’t specify it will by default take an argument.
- Then we add the dense layer with 2 arguments and these 2 are the “ hidden units and activation function”.
- The relu activation function is similar to that of the sigmoid function but faster.
- Similarly like the convolution and pooling layer dense also has more arguments but we only use two of those.
- We again call the dropout layer
- And finally, we call the dense layer with SoftMax activation function.
- The SoftMax function has input with tensor axis.
- Then we train and test the data for 10 epochs to recognize the image.

CONCLUSION:

In this assignment we run the code that is capable of recognizing the image with different model layers. These model layers are imported as a library file and are executed. We give necessary arguments to generate the and reshape the image. The image file is mentioned as a data path and then 10 epochs are executed to predict the image. The training and testing of the image are done with an Accuracy of 98.2%