Python for Deep. Learning Project Increment-1

Traffic Signs Recognition

Team 7 contribution:

Avinash Ganguri (Class ID – 6), *CNN Model Analysis and Evaluation*
Sri Sai Nikhil Kantipudi (Class ID – 10), *Plotting and testing the model accuracy*
Dileep Reddy Peddakam (Class ID – 19), *Preprocessing the Data in different formats*

Done so far:

1. *Preprocessed the Data,*

- Resizing the images
- Scaling the data
- One hot encoding using to_categorial

2. *Building our CNN Model using keras.*

3. *Plotted the loss and accuracy using history object.*

4. *Displayed a sample image from the test data set*

5. *Predicting the accuracy of our model with test labels data file*

Remaining Parts to be Done:

a. *Improve the accuracy of our model.*

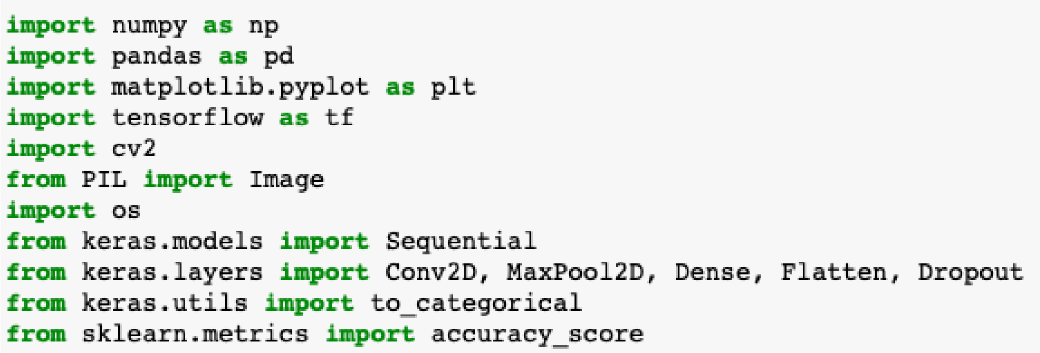
b. *Create a Desktop Application, a User interface to upload the image and get the meaningful result.*

Challenges faced:

- Running the environment in local machine is quite hard with package dependency issues.
- Even with Google Co-Lab's gpu and tpu, to train the large dataset is tedious and time taking as it requires the Colab pro, so we preferred running it on Jupyter Notebook instead.
- Running more epochs again and again when changing the model features is such a drag.

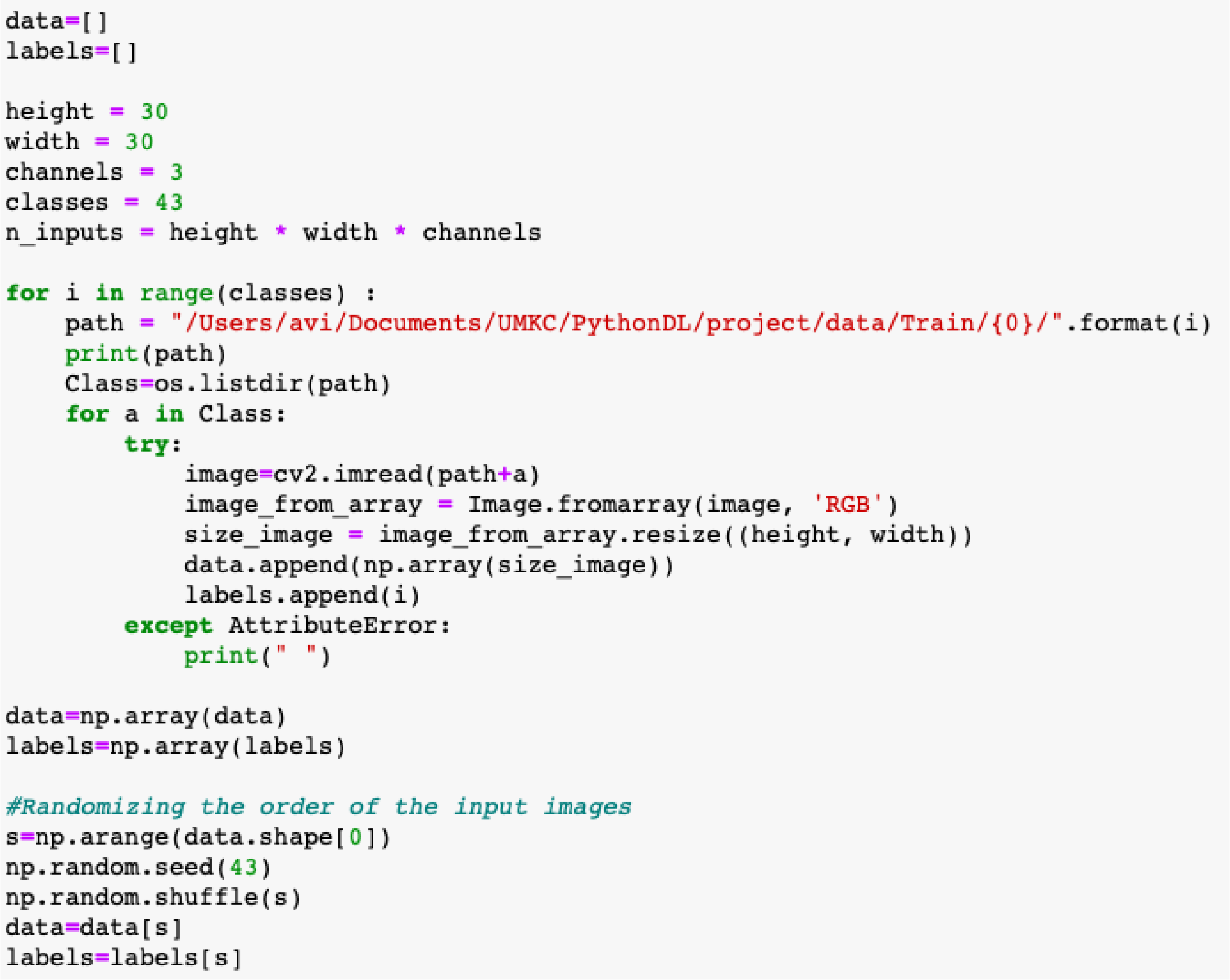
Screenshots:

Importing the Libraries,



```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
import cv2
from PIL import Image
import os
from keras.models import Sequential
from keras.layers import Conv2D, MaxPool2D, Dense, Flatten, Dropout
from keras.utils import to_categorical
from sklearn.metrics import accuracy_score
```

Loading the data and resizing it,



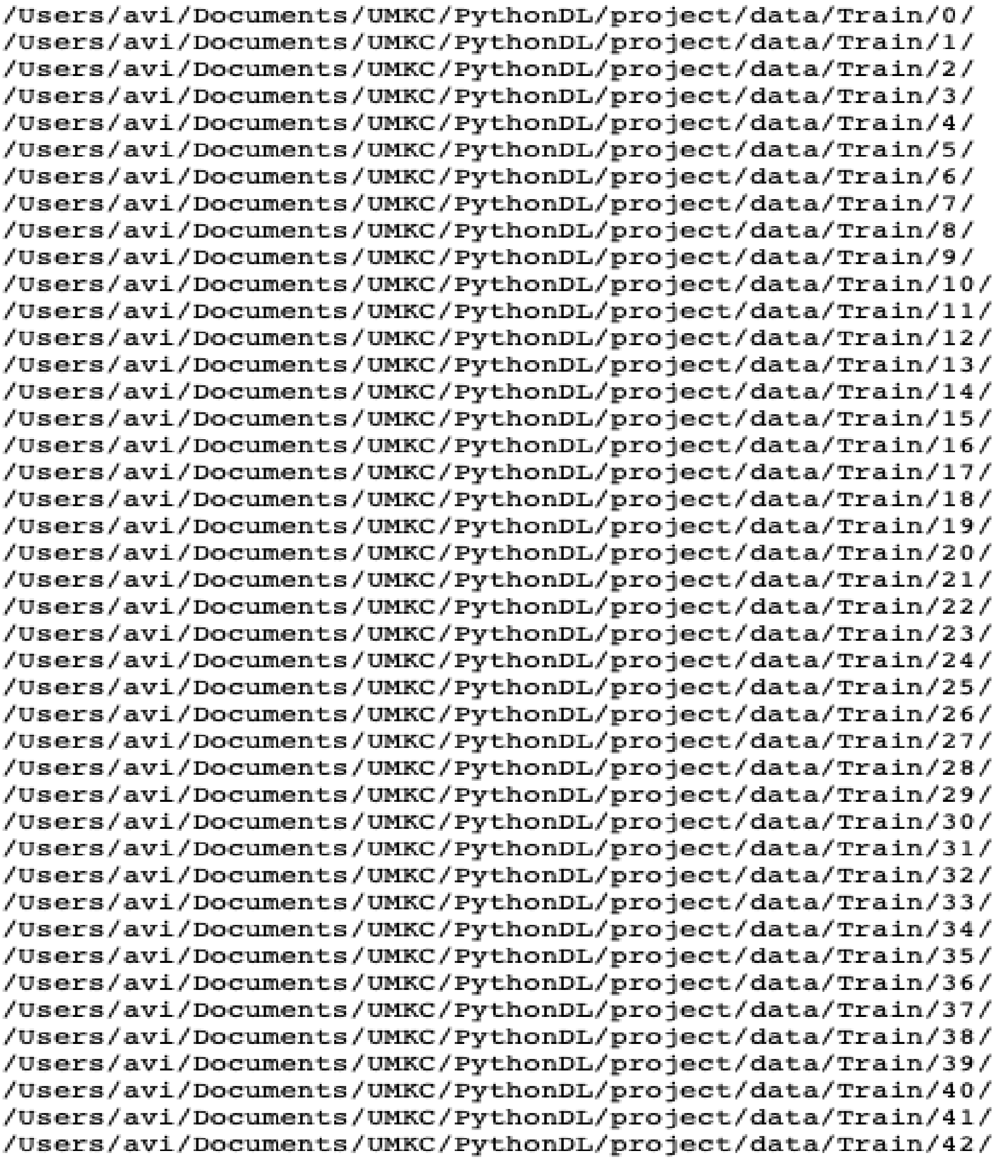
```
data=[]
labels=[]

height = 30
width = 30
channels = 3
classes = 43
n_inputs = height * width * channels

for i in range(classes) :
    path = "/Users/avi/Documents/UMKC/PythonDL/project/data/Train/{0}/".format(i)
    print(path)
    Class=os.listdir(path)
    for a in Class:
        try:
            image=cv2.imread(path+a)
            image_from_array = Image.fromarray(image, 'RGB')
            size_image = image_from_array.resize((height, width))
            data.append(np.array(size_image))
            labels.append(i)
        except AttributeError:
            print(" ")

data=np.array(data)
labels=np.array(labels)

#Randomizing the order of the input images
s=np.arange(data.shape[0])
np.random.seed(43)
np.random.shuffle(s)
data=data[s]
labels=labels[s]
```



```
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/0/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/1/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/2/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/3/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/4/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/5/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/6/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/7/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/8/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/9/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/10/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/11/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/12/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/13/
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/Users/avi/Documents/UMKC/PythonDL/project/data/Train/16/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/17/
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/Users/avi/Documents/UMKC/PythonDL/project/data/Train/31/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/32/
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/Users/avi/Documents/UMKC/PythonDL/project/data/Train/38/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/39/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/40/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/41/
/Users/avi/Documents/UMKC/PythonDL/project/data/Train/42/
```
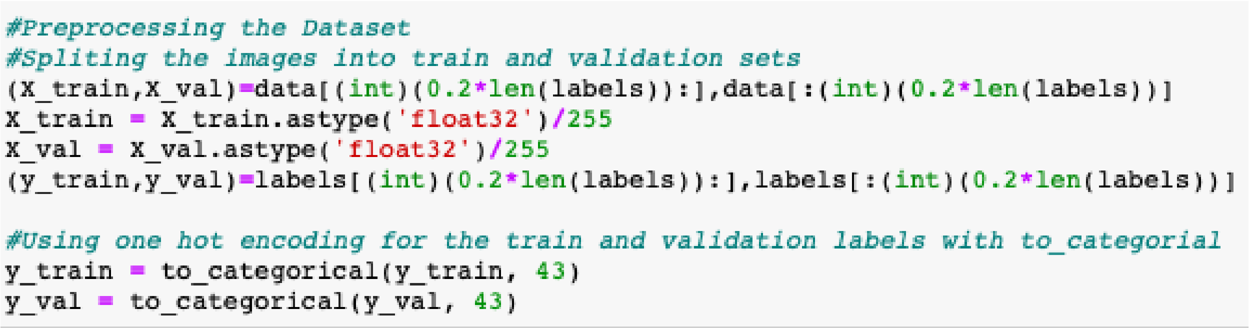
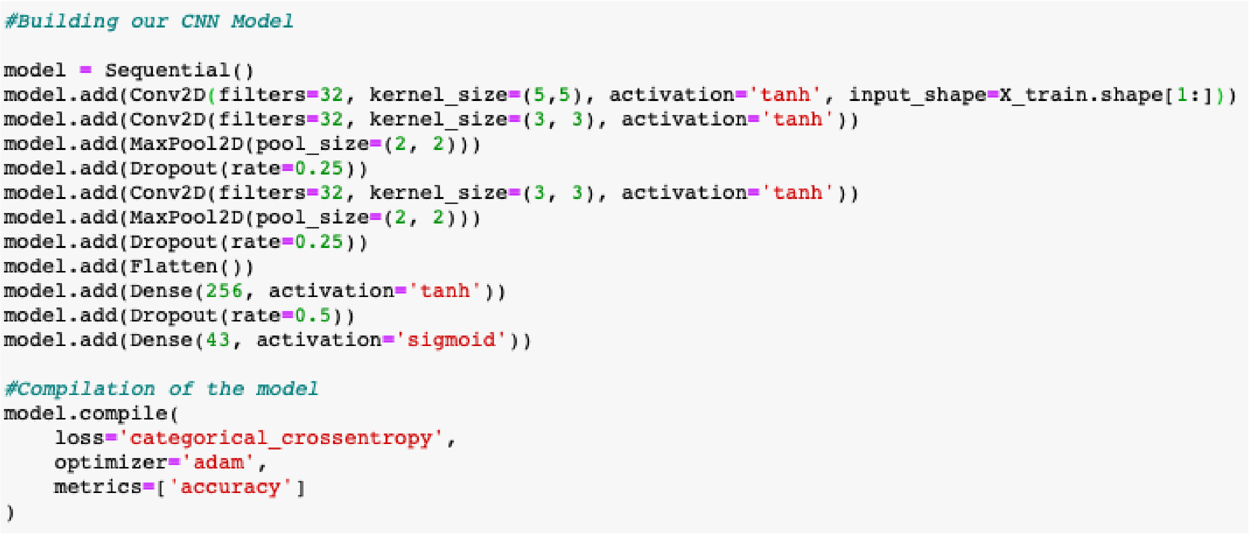

Preprocessing the data,

- ***Splitting and scaling the data***
- ***One hot encoding***



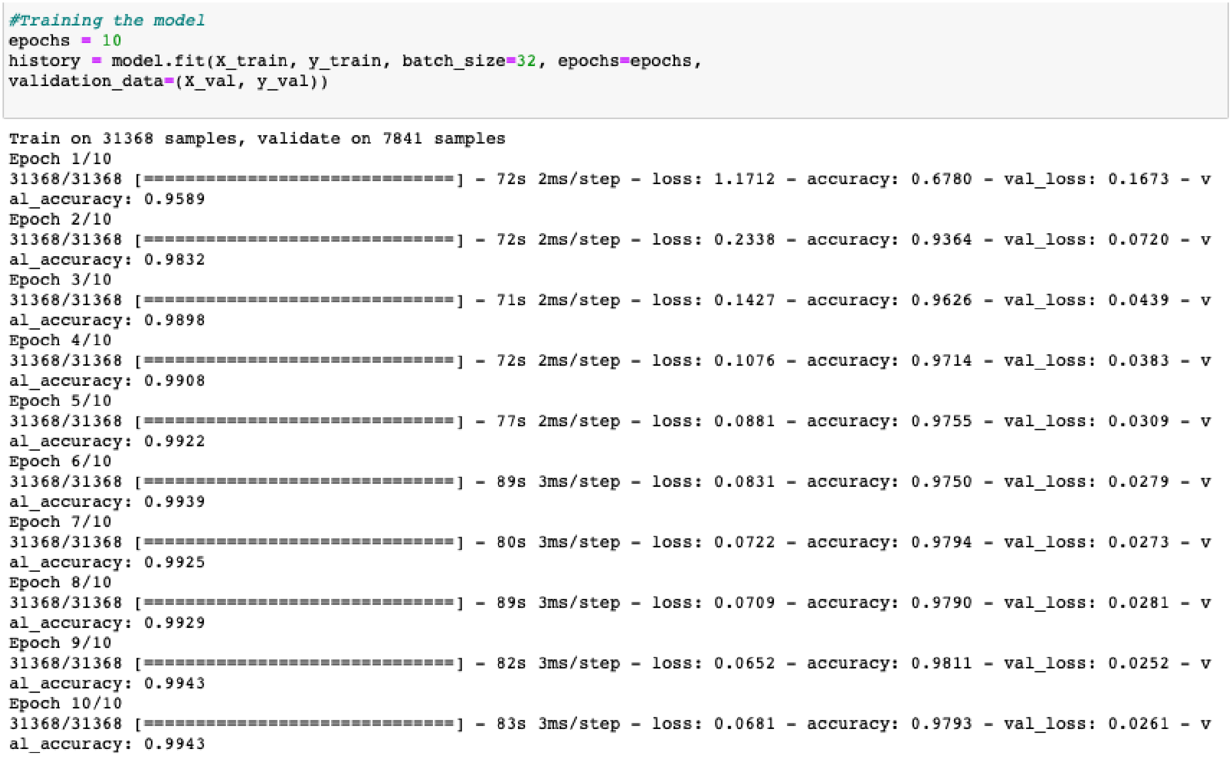
```
#Preprocessing the Dataset
#Spliting the images into train and validation sets
(X_train,X_val)=data[(int)(0.2*len(labels)):],data[:(int)(0.2*len(labels))]
X_train = X_train.astype('float32')/255
X_val = X_val.astype('float32')/255
(y_train,y_val)=labels[(int)(0.2*len(labels)):],labels[:(int)(0.2*len(labels))]

#Using one hot encoding for the train and validation labels with to_categorial
y_train = to_categorical(y_train, 43)
y_val = to_categorical(y_val, 43)
```

Building the CNN Model and Compiling it,



```
#Building our CNN Model

model = Sequential()
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='tanh', input_shape=X_train.shape[1:]))
model.add(Conv2D(filters=32, kernel_size=(3, 3), activation='tanh'))
model.add(MaxPool2D(pool_size=(2, 2)))
model.add(Dropout(rate=0.25))
model.add(Conv2D(filters=32, kernel_size=(3, 3), activation='tanh'))
model.add(MaxPool2D(pool_size=(2, 2)))
model.add(Dropout(rate=0.25))
model.add(Flatten())
model.add(Dense(256, activation='tanh'))
model.add(Dropout(rate=0.5))
model.add(Dense(43, activation='sigmoid'))

#Compilation of the model
model.compile(
    loss='categorical_crossentropy',
    optimizer='adam',
    metrics=['accuracy']
)
```

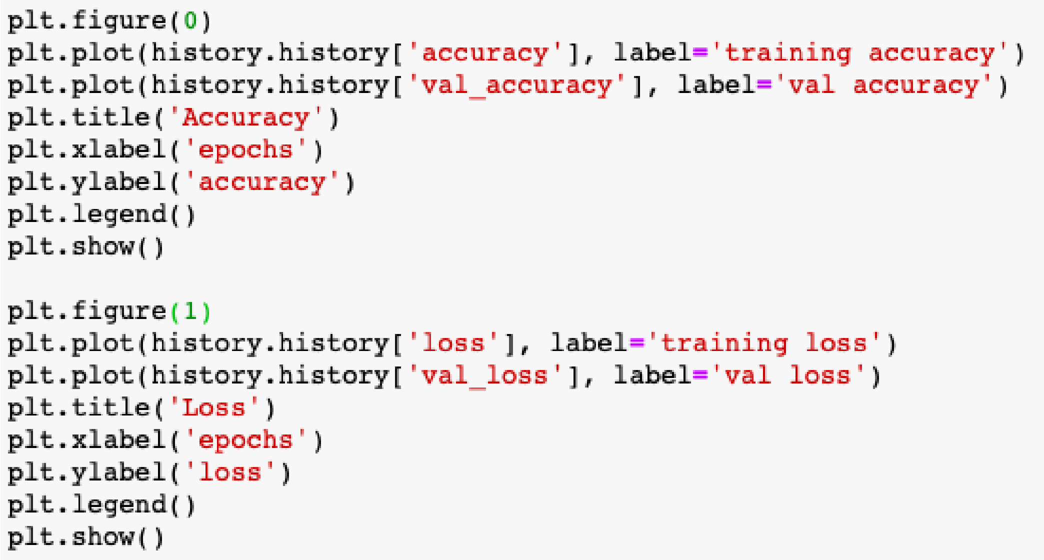
Training the model with 10 epochs,



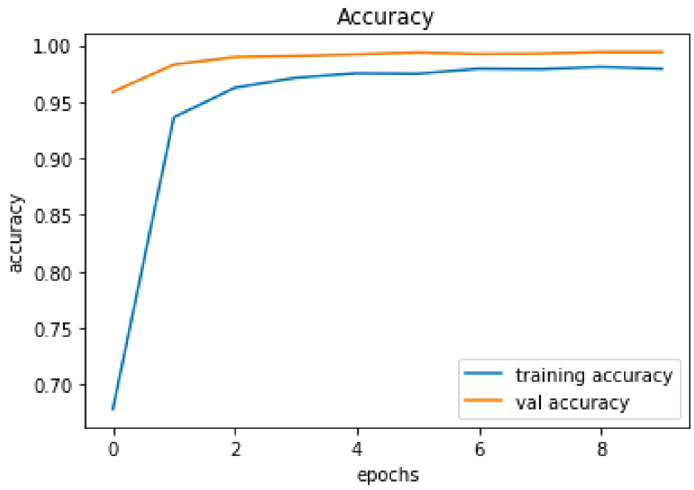
```
#Training the model
epochs = 10
history = model.fit(X_train, y_train, batch_size=32, epochs=epochs,
validation_data=(X_val, y_val))
```

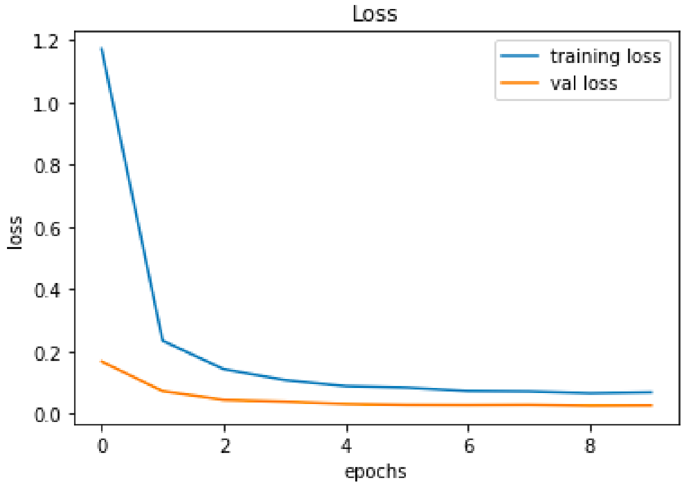
```
Train on 31368 samples, validate on 7841 samples
Epoch 1/10
31368/31368 [==============================] - 72s 2ms/step - loss: 1.1712 - accuracy: 0.6780 - val_loss: 0.1673 - v
al_accuracy: 0.9589
Epoch 2/10
31368/31368 [==============================] - 72s 2ms/step - loss: 0.2338 - accuracy: 0.9364 - val_loss: 0.0720 - v
al_accuracy: 0.9832
Epoch 3/10
31368/31368 [==============================] - 71s 2ms/step - loss: 0.1427 - accuracy: 0.9626 - val_loss: 0.0439 - v
al_accuracy: 0.9898
Epoch 4/10
31368/31368 [==============================] - 72s 2ms/step - loss: 0.1076 - accuracy: 0.9714 - val_loss: 0.0383 - v
al_accuracy: 0.9908
Epoch 5/10
31368/31368 [==============================] - 77s 2ms/step - loss: 0.0881 - accuracy: 0.9755 - val_loss: 0.0309 - v
al_accuracy: 0.9922
Epoch 6/10
31368/31368 [==============================] - 89s 3ms/step - loss: 0.0831 - accuracy: 0.9750 - val_loss: 0.0279 - v
al_accuracy: 0.9939
Epoch 7/10
31368/31368 [==============================] - 80s 3ms/step - loss: 0.0722 - accuracy: 0.9794 - val_loss: 0.0273 - v
al_accuracy: 0.9925
Epoch 8/10
31368/31368 [==============================] - 89s 3ms/step - loss: 0.0709 - accuracy: 0.9790 - val_loss: 0.0281 - v
al_accuracy: 0.9929
Epoch 9/10
31368/31368 [==============================] - 82s 3ms/step - loss: 0.0652 - accuracy: 0.9811 - val_loss: 0.0252 - v
al_accuracy: 0.9943
Epoch 10/10
31368/31368 [==============================] - 83s 3ms/step - loss: 0.0681 - accuracy: 0.9793 - val_loss: 0.0261 - v
al_accuracy: 0.9943
```

Plotting the Loss and Accuracy using the History Object,

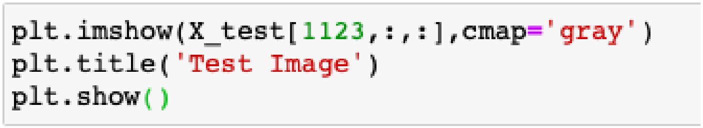


```
plt.figure(0)
plt.plot(history.history['accuracy'], label='training accuracy')
plt.plot(history.history['val_accuracy'], label='val accuracy')
plt.title('Accuracy')
plt.xlabel('epochs')
plt.ylabel('accuracy')
plt.legend()
plt.show()

plt.figure(1)
plt.plot(history.history['loss'], label='training loss')
plt.plot(history.history['val_loss'], label='val loss')
plt.title('Loss')
plt.xlabel('epochs')
plt.ylabel('loss')
plt.legend()
plt.show()
```

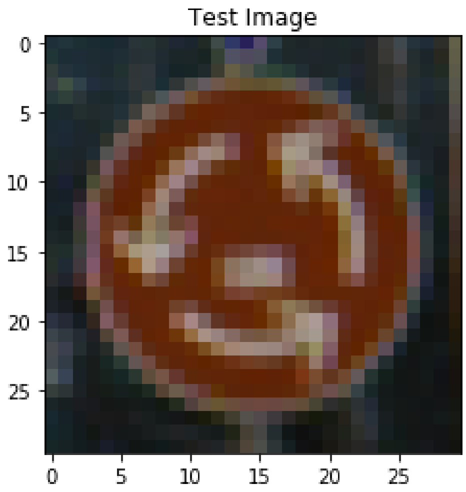




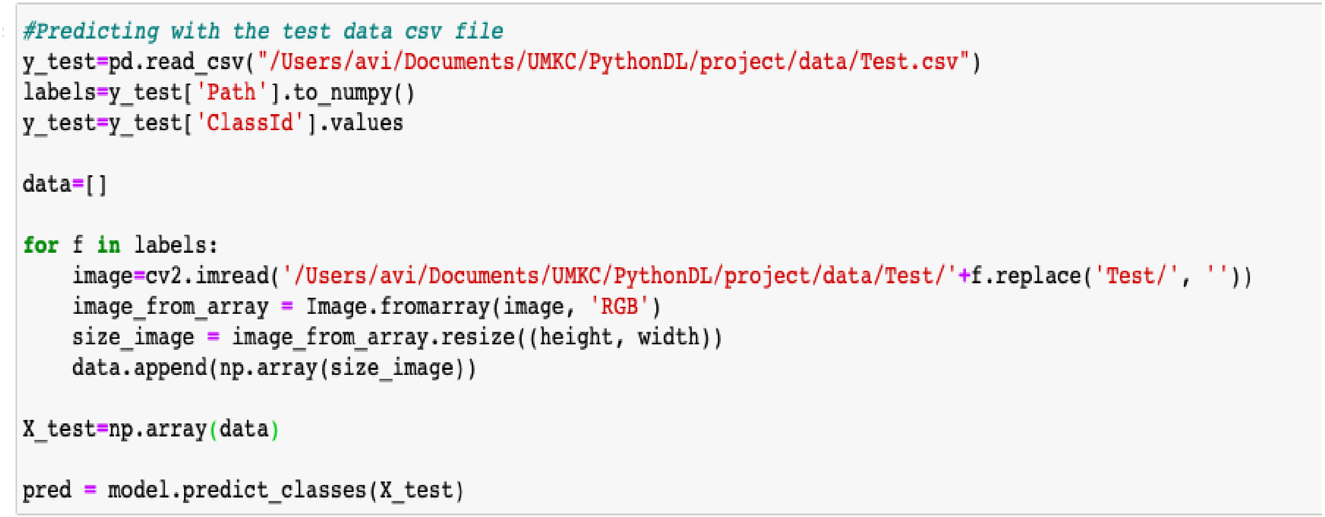
Displaying a Test Image,



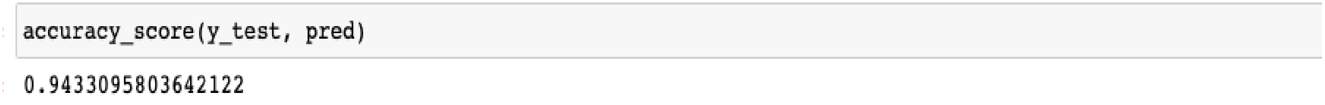
```
plt.imshow(X_test[1123,:,:],cmap='gray')
plt.title('Test Image')
plt.show()
```



Predicting the model with Test data file and displaying the accuracy of the model,



```
#Predicting with the test data csv file
y_test=pd.read_csv("/Users/avi/Documents/UMKC/PythonDL/project/data/Test.csv")
labels=y_test['Path'].to_numpy()
y_test=y_test['ClassId'].values

data=[]

for f in labels:
    image=cv2.imread('/Users/avi/Documents/UMKC/PythonDL/project/data/Test/'+f.replace('Test/', ''))
    image_from_array = Image.fromarray(image, 'RGB')
    size_image = image_from_array.resize((height, width))
    data.append(np.array(size_image))

X_test=np.array(data)

pred = model.predict_classes(X_test)
```



```
accuracy_score(y_test, pred)
```

```
0.9433095803642122
```