Traffic Board Sign Detector

TEAM 3
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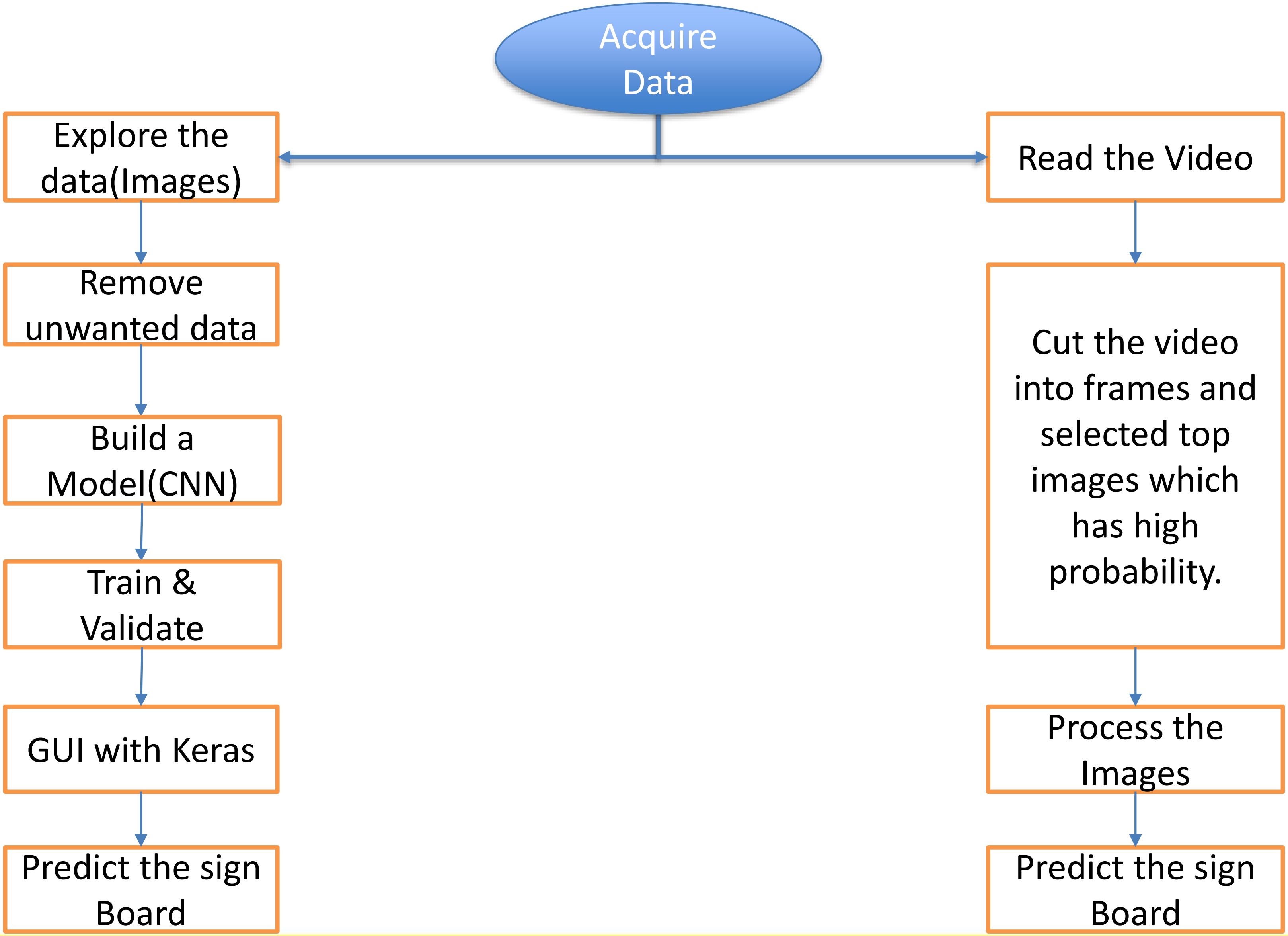
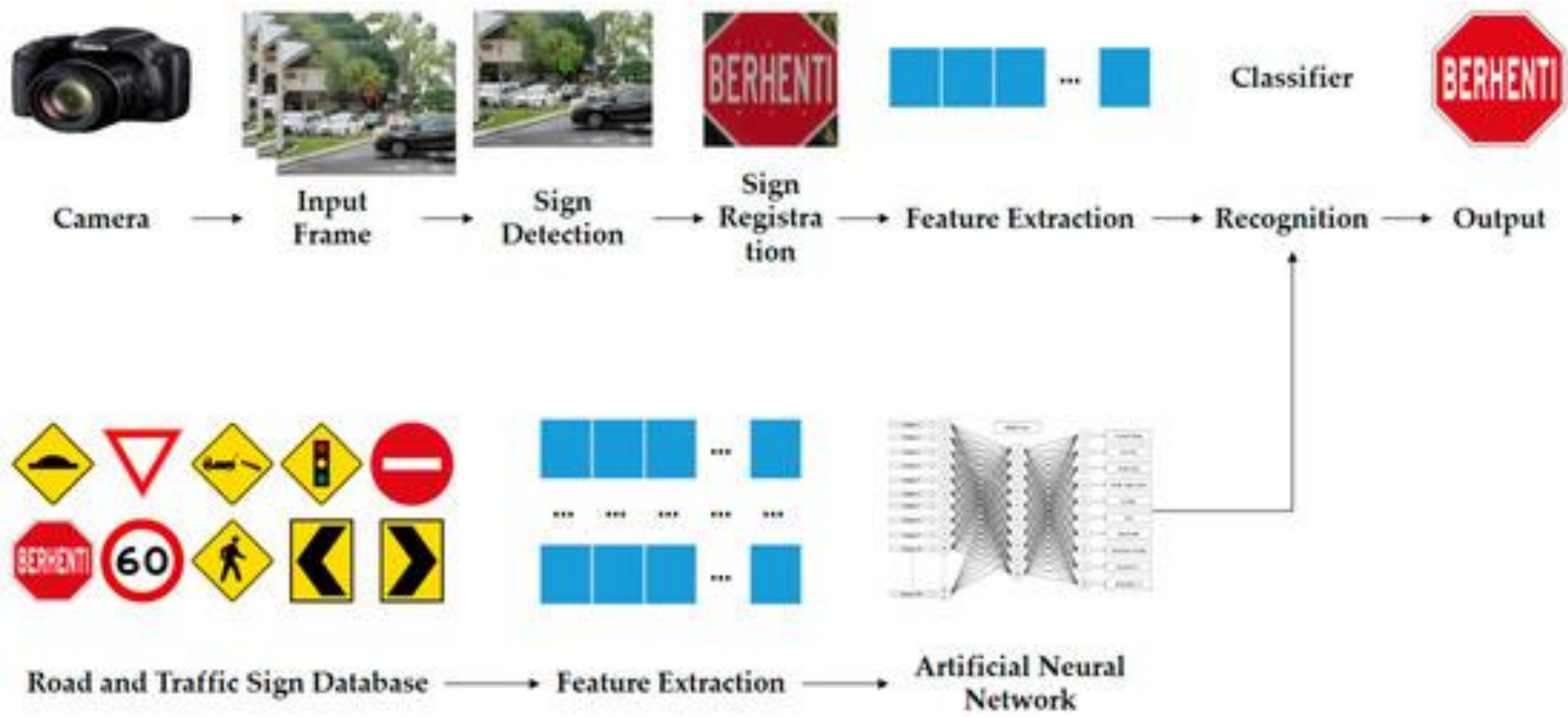
Project Purpose

- To develop a responsive model that allows to vehicles to detect the traffic boards accurately.

- This model can be linked to vehicle software.


Acquire Data
Explore the data(Images)
Remove unwanted data
Build a Model(CNN)
Train & Validate
GUI with Keras
Predict the sign Board
Read the Video
Cut the video into frames and selected top images which has high probability.
Process the Images
Predict the sign Board

Model


BERHENTI
Classifier
BERHENTI
Camera
Input Frame
Sign Detection
Sign Registra tion
Feature Extraction
Recognition
Output
BERHENTI
60
Road and Traffic Sign Database
Feature Extraction
Artificial Neural Network

Progress in the project

- We want to do the project in two parts:
  1. Predicting the sign boards from images
  2. Predicting the sign boards in videos.
- So far, we have completed the first part, i.e predicting the sign boards from images
- We will continue our work on the other part too.

Steps followed in the code

1. Importing the libraries and data.
2. Overlook into data.
3. Building a CNN model and finding the accuracy.
4. Accuracy and loss plots over train and test data
5. Saving the model.
6. Building a GUI by using above sequential model
7. Creating tkinter:
    1. Design
    2. Prediction function
    3. Display prediction
    4. Upload an Image

1. Importing the libraries and data.

```
#Importing the libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import tensorflow as tf
from PIL import Image
import os
from sklearn.model_selection import train_test_split
from keras.utils import to_categorical
from keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D
from keras.layers import Dense, Dropout, Flatten
```

```
#Loading the data
Images_data = [] #Loading Images to Images_data List
Images_labels = [] #Loading labels to Images_labels List
classes = 43 #Classes

for i in range(classes): #Looping all the classes
    path = os.path.join('C:\\Users\\suren\\Downloads\\Project','Train',str(i))
    images = os.listdir(path)

    for a in images:#Looping through all the images
        image = Image.open(path + '\\' + a)
        image = image.resize((32,32)) #Resizing the images
        image = np.array(image)
        Images_data.append(image) #Appending all the images to Images_data list
        Images_labels.append(i) #Appending all the labels to Image_labels list

Images_data = np.array(Images_data) #list to arrays
Images_labels = np.array(Images_labels) #list to arrays
```

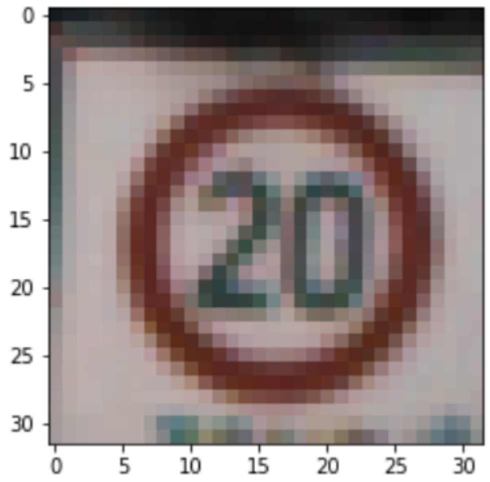
2. Overlook into data.

```
#printing the size of data and labels
print('Size of Images : ' ,Images_data.shape)
print('SIze of Labels : ' ,Images_labels.shape)
```

```
Size of Images :  (39209, 32, 32, 3)
SIze of Labels :  (39209,)
```

(39209, 32, 32, 3) - tells us there are 39209 images and of size 32*32 pixels and last 3 indicates colored images.

```
#display the first image in the training data
plt.imshow(Images_data[105,:,:],cmap='gray')
plt.show()
```



2. Overlook into data.

```
#Splitting the data into train and test
train_images,test_images,train_labels,test_labels = train_test_split(Images_data,Images_labels,test_size=0.2,random_state = 42)
```

```
#printing the size of train and test data
print('train_images size : ' ,train_images.shape)
print('train_labels size : ' ,train_labels.shape)
print('test_images size :  ' ,test_images.shape)
print('test_labels size :  ' ,test_labels.shape)
```

```
train_images size :  (31367, 32, 32, 3)
train_labels size :  (31367,)
test_images size :   (7842, 32, 32, 3)
test_labels size :   (7842,)
```

```
#change the labels from integer to one-hot encoding
train_labels = to_categorical(train_labels,43)
test_labels = to_categorical(test_labels,43)
```

3. Building a CNN model and finding the accuracy.

```
#Building the model
model = Sequential()
#hidden layer using activation relu
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='relu', input_shape=train_images.shape[1:]))
model.add(MaxPooling2D(pool_size=(2, 2))) #Adding extra hidden layers
model.add(Dropout(rate=0.25)) #Dropout frequency
#Flattening the model
model.add(Flatten())
model.add(Dense(256, activation='relu')) #more layers
model.add(Dropout(rate=0.5))
model.add(Dense(43, activation='softmax')) #out layer
```

Built the sequential model using Conv2D, Maxpooling2D and used activation as relu, softmax.
Included Dropout rate.

3. Building a CNN model and finding the accuracy.

```
#Compilation
model.compile(optimizer='rmsprop', loss='categorical_crossentropy', metrics=['accuracy'])
#Fitting or passing the data to the model
history = model.fit(train_images, train_labels, batch_size=256, epochs=5, verbose=1,validation_data=(test_images, test_labels))
```

```
Epoch 1/5
123/123 [==============================] - 11s 90ms/step - loss: 7.6071 - accuracy: 0.3674 - val_loss: 0.9950 - val_accuracy:
0.7394
Epoch 2/5
123/123 [==============================] - 11s 88ms/step - loss: 1.2157 - accuracy: 0.6929 - val_loss: 0.4634 - val_accuracy:
0.8790
Epoch 3/5
123/123 [==============================] - 11s 88ms/step - loss: 0.8279 - accuracy: 0.7975 - val_loss: 0.6577 - val_accuracy:
0.8244
Epoch 4/5
123/123 [==============================] - 11s 88ms/step - loss: 0.6847 - accuracy: 0.8438 - val_loss: 0.2356 - val_accuracy:
0.9429
Epoch 5/5
123/123 [==============================] - 11s 88ms/step - loss: 0.5522 - accuracy: 0.8731 - val_loss: 0.1837 - val_accuracy:
0.9588
```

```
#Evaluating the model
[test_loss, test_acc] = model.evaluate(test_images, test_labels)
print("Evaluation result on Test Data : Loss = {}, accuracy = {}".format(test_loss, test_acc)) #Printing the accuracy
```

```
246/246 [==============================] - 1s 5ms/step - loss: 0.1837 - accuracy: 0.9588
Evaluation result on Test Data : Loss = 0.18372522294521332, accuracy = 0.9588115215301514
```

- Model got accuracy of 95% and loss of 18%

3. Building a CNN model and finding the accuracy.

- However, we got a good accuracy and loss, will try to add more dense layers and will see the model accuracy and loss again.

```
#Adding more dense layers
model = Sequential()
#hidden layer using activation relu
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='relu', input_shape=train_images.shape[1:]))
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='relu')) #adding more layers
model.add(MaxPooling2D(pool_size=(2, 2))) #adding more layers
model.add(Dropout(rate=0.25))
#Adding more Conv2D, Maxpooling, Dense layers
model.add(Conv2D(filters=64, kernel_size=(3, 3), activation='relu')) #adding more layers
model.add(Conv2D(filters=64, kernel_size=(3, 3), activation='relu')) #adding more layers
model.add(MaxPooling2D(pool_size=(2, 2))) #adding more layers
model.add(Dropout(rate=0.25))
#Flattening the model
model.add(Flatten())
model.add(Dense(256, activation='relu')) #adding more layers
model.add(Dropout(rate=0.5))
model.add(Dense(43, activation='softmax')) #out layer
```

3. Building a CNN model and finding the accuracy.

```
#Compilation
model.compile(optimizer='rmsprop', loss='categorical_crossentropy', metrics=['accuracy'])
#Fitting or passing the data to the model
history = model.fit(train_images, train_labels, batch_size=256, epochs=5, verbose=1,validation_data=(test_images, test_labels))
```

```
Epoch 1/5
123/123 [==============================] - 42s 338ms/step - loss: 3.4409 - accuracy: 0.3198 - val_loss: 0.8909 - val_accuracy:
0.8017
Epoch 2/5
123/123 [==============================] - 42s 338ms/step - loss: 0.8440 - accuracy: 0.7730 - val_loss: 0.1911 - val_accuracy:
0.9570
Epoch 3/5
123/123 [==============================] - 42s 345ms/step - loss: 0.3785 - accuracy: 0.8992 - val_loss: 0.0989 - val_accuracy:
0.9774
Epoch 4/5
123/123 [==============================] - 43s 347ms/step - loss: 0.2468 - accuracy: 0.9387 - val_loss: 0.0941 - val_accuracy:
0.9787
Epoch 5/5
123/123 [==============================] - 44s 359ms/step - loss: 0.1968 - accuracy: 0.9502 - val_loss: 0.0485 - val_accuracy:
0.9892
```

```
#Evaluating the model
[test_loss, test_acc] = model.evaluate(test_images, test_labels)
print("Evaluation result on Test Data : Loss = {}, accuracy = {}".format(test_loss, test_acc)) #Printing the accuracy
```

```
246/246 [==============================] - 3s 10ms/step - loss: 0.0485 - accuracy: 0.9892
Evaluation result on Test Data : Loss = 0.04851296916604042, accuracy = 0.98916095495224
```

- Accuracy increased for the model from 95 to 98.9% and loss looks like same

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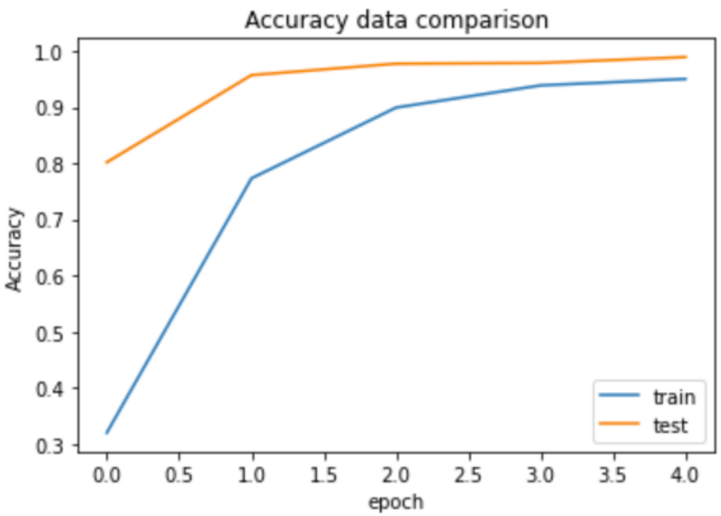
4. Accuracy and loss plots over train and test data

- Accuracy :

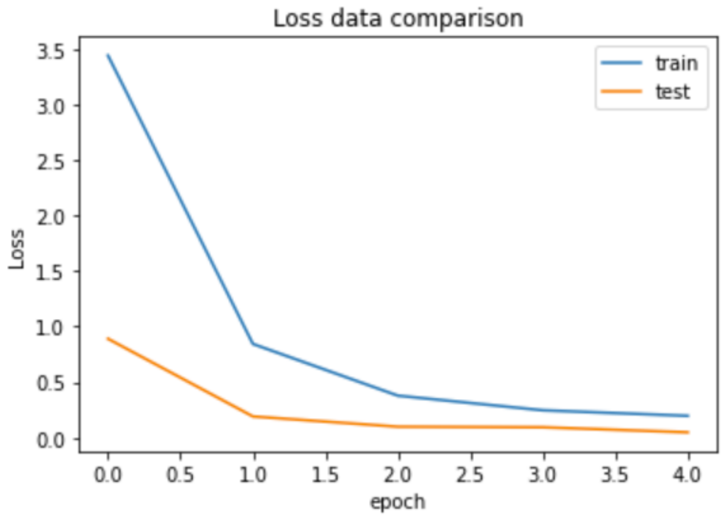
```
# Plotting the Accuracy for both training data and validation data using the history object.
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.legend(['train', 'test'], loc='lower right')
plt.title('Accuracy data comparison')
plt.ylabel('Accuracy')
plt.xlabel('epoch')
plt.show()
```



4. Accuracy and loss plots over train and test data

- Loss :

```
# Plotting the loss for both training data and validation data using the history object.
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Loss data comparison')
plt.legend(['train', 'test'], loc='upper right')
plt.xlabel('epoch')
plt.ylabel('Loss')
plt.show()
```



5. Saving the model

- model.save('traffic_sign_board_detector.h5')

Building a GUI by using above sequential model

- Imported libraries for building GUI
- Loaded the classes using CSV file
- Created tkinter by following functions

  1.Design

  2.Prediction function

  3.Display prediction

  4.Upload an Image

1.Design

```
#https://realpython.com/python-gui-tkinter/

window=tk.Tk()
window.geometry('800x600')
window.title('Traffic sign board detector')
window.configure(background='#466df0')
label=Label(window,background='#466df0', font=('arial',15,'bold'))
sign_image = Label(window)
```

- Created a tkinter using below reference
  https://realpython.com/python-gui-tkinter/
- Geometrical dimension of 800*600
- Done basic configuration

2. Prediction

```
#prediction_function : By using this function we can pass the uploaded image to model and model will predict the image.

def prediction(file_path):
    global label_packed
    sign_board = Image.open(file_path) #Opening the random image from test data
    sign_board = sign_board.resize((30,30)) #Reshaping the size of image
    sign_board = numpy.expand_dims(sign_board, axis=0) #Expanding the dimensions
    sign_board = numpy.array(sign_board)
    pred = model.predict_classes([sign_board])[0] #Predecting the traffic sign using the model built above
    sign = classes[pred+1]
    print(sign) #Printing the traffic sign what model has predected
    label.configure(foreground='yellow', text=sign) #adding some color configuration
```

- This function will request the image from test data and will pass the image to the model and model will predict the image.
- Done basic configuration for the predicted answer.

3. Display prediction

```
#display_prediction : By using this function we will display the prediction button after uploding the image

def display_prediction(file_path):
    classification=Button(window,text="Predict", command=lambda: prediction(file_path),padx=10,pady=5) #predicting the imag
    classification.configure(background='#466df0',foreground='yellow',font=('arial',10,'bold'))
    classification.place(relx=0.79,rely=0.46)
```

- Display prediction function will display the prediction button after uploading the image and will prediction function is called.
- Done basic configuration to the button

4. Upload an Image

```
#Upload_Button : By using this function will request for uploading an image

def upload_sign_board():
    try:
        file_path=filedialog.askopenfilename()   #Opening the file location where images are stored
        uploaded=Image.open(file_path)
        uploaded.thumbnail(((window.winfo_width()/2.25),(window.winfo_height()/2.25)))
        uploaded=uploaded.resize((180,180))    #Resizing the images which are uploaded
        ima=ImageTk.PhotoImage(uploaded)
        sign_image.configure(image=ima)
        sign_image.image=ima
        label.configure(text='')
        display_prediction(file_path)     #Displaying the prediction
    except:
        pass
```

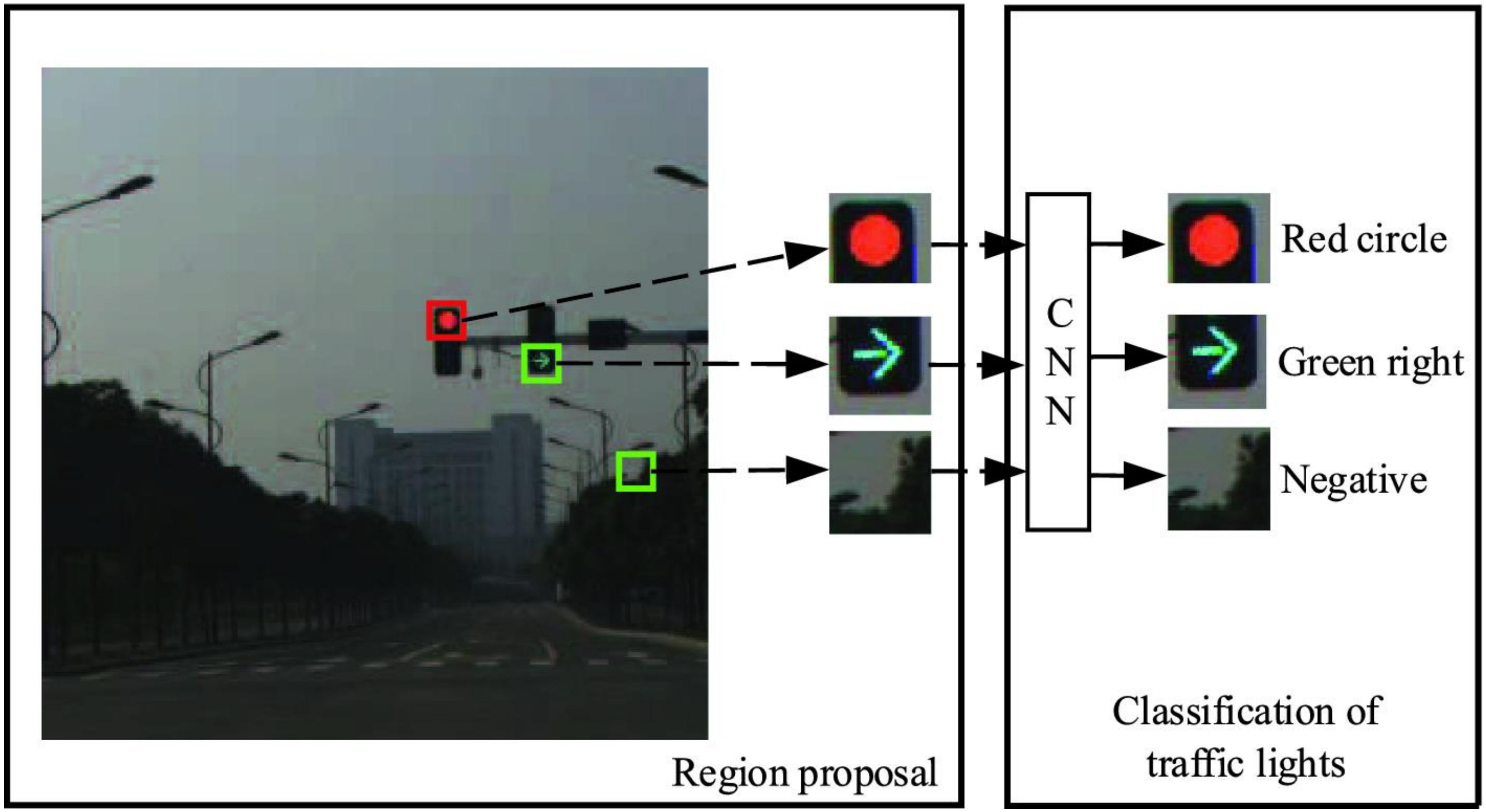
- By using upload_sign_board function , images are uploaded to the tkinter.
- Done resizing of 180*180 for better display.
- display_function is called after uploading an image.

```
#Uploloading the image and classifying the type of image
upload=Button(window,text="Upload an image",command=upload_sign_board,padx=10,pady=5)  #Button configuration
upload.configure(background='#466df0', foreground='yellow',font=('calibri',10,'bold'))
upload.pack(side=BOTTOM,pady=50)
sign_image.pack(side=BOTTOM,expand=True) #Button location
label.pack(side=BOTTOM,expand=True)
heading = Label(window, text="Predict the traffic sign",pady=20, font=('calibri',20,'bold'))
heading.configure(background='#466df0', foreground='white')
heading.pack()
window.mainloop()
```

- Upload button configuration was done.
- Flow of the functions:

  Upload an Image → display prediction → prediction

Results



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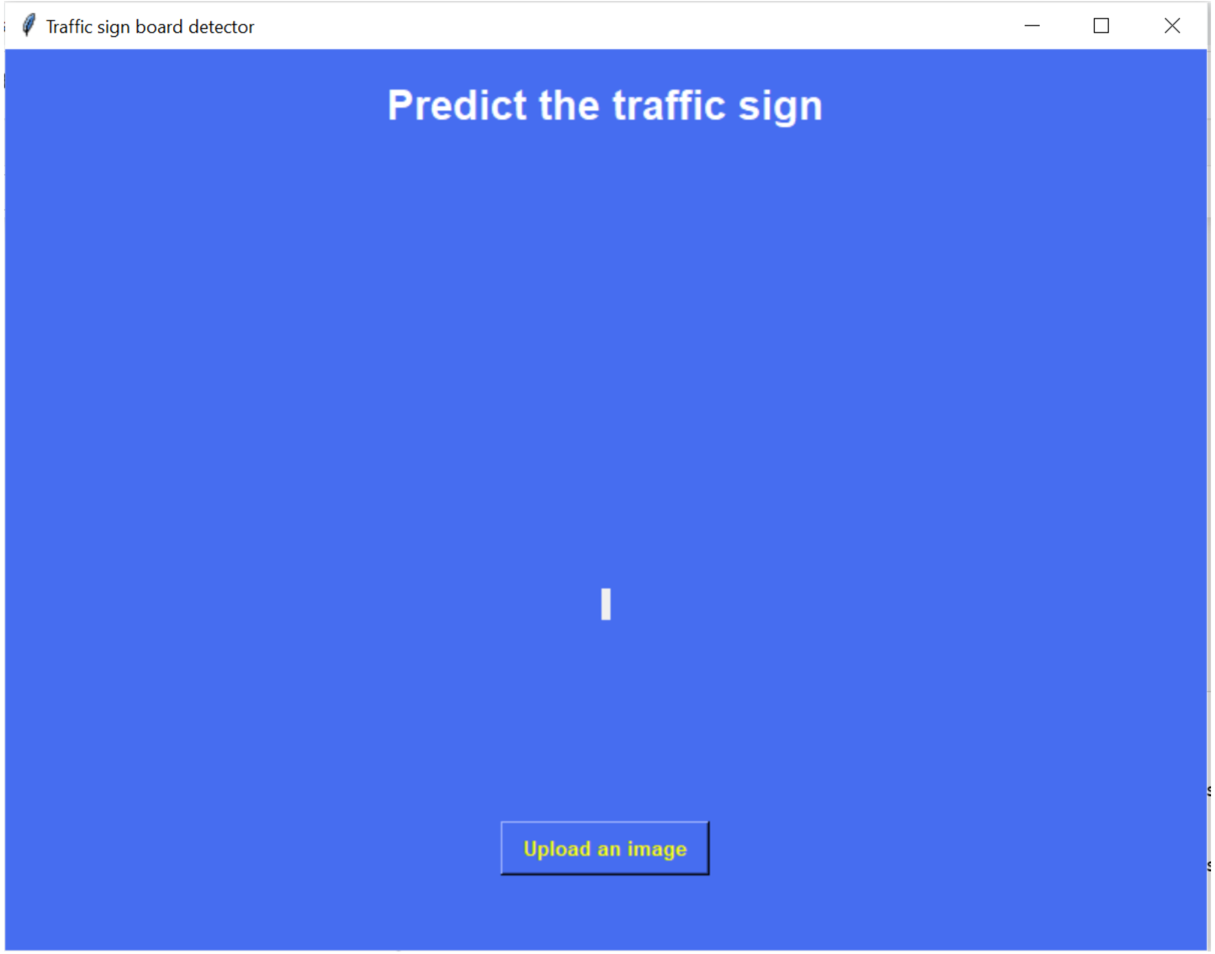
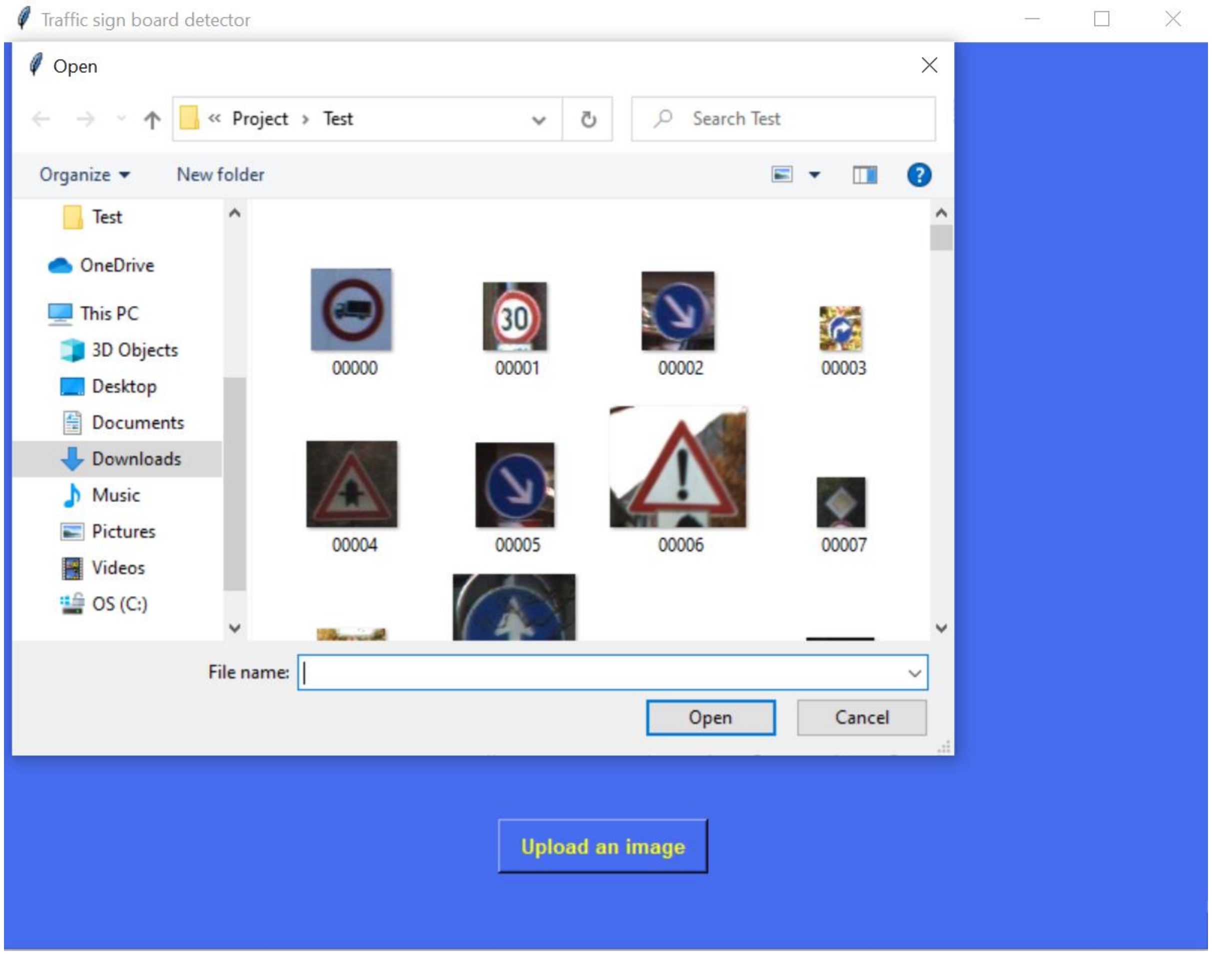
Results


Traffic sign board detector
Predict the traffic sign
Upload an image

Results


Traffic sign board detector
Open
« Project › Test
Search Test
Organize
New folder
Test
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
OS (C:)
00000
00001
00002
00003
00004
00005
00006
00007
File name:
Open
Cancel
Upload an image

Results


Traffic sign board detector
Predict the traffic sign
Predict
Upload an image

Results

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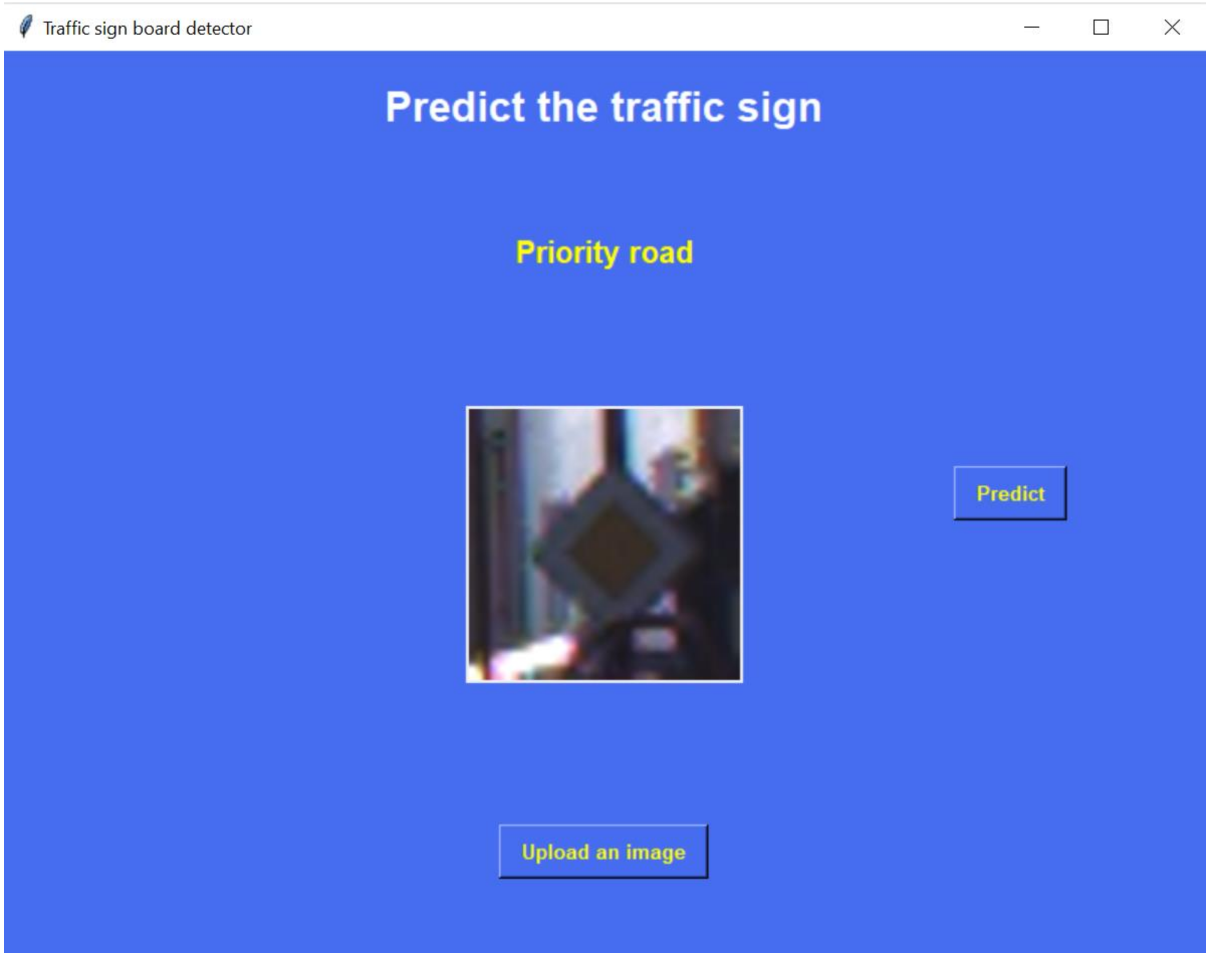
Results


Traffic sign board detector
Predict the traffic sign
Priority road
Predict
Upload an image

Results


Traffic sign board detector
Predict the traffic sign
Keep right
Predict
Upload an image

Technologies Used

- Python
- Deep Learning

Future Scope

- Can be used in self driving cars

Thank you