NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION, AFFILIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM, APPROVED BY AICTE & GOVT.OF KARNATAKA

LEARNING ACTIVITY REPORT

on

"TRAFFIC SIGN RECOGNITION"

Submitted in partial fulfilment of the requirement for the award of Degree of

Bachelor of Engineering

in

Computer Science and Engineering

Submitted by:

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2022-2023

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CERTIFICATE

This is to certify that the is an authentic work carried out by **ABDUL MANAF B (1NT21CS006)**, **HARSHITHA.T.V(1NT22CS406), PRANAV BHAT (1NT21CS128)** and bonafide students of **Nitte Meenakshi Institute of Technology**, Bangalore in partial fulfilment for the award of the degree of ***Bachelor of Engineering*** in COMPUTER SCIENCE AND ENGINEERING of Visvesvaraya Technological University, Belgavi during the academic year ***2022-2023.*** It is certified that all corrections and suggestions indicated during the internal assessment has been incorporated in the report. This project has been approved as it satisfies the academic requirement in respect of project work presented for the said degree.

Internal Guide	**Signature of the HOD**	**Signature of Principal**
___________________	___________________	___________________
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Associate Professor,	Professor, Head, Dept. CSE,	Principal,
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		Bangalore

DECLARATION

We hereby declare that Learning activity project work

(i) The project work is our original work

(ii) This Project work has not been submitted for the award of any degree or examination at any other university/College/Institute.

(iii) This Project Work does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

(iv) This Project Work does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
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ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible, whose constant guidance and encouragement crowned our effort with success. I express my sincere gratitude to our Principal **Dr. H. C. Nagaraj**, Nitte Meenakshi Institute of Technology for providing facilities.

We wish to thank our HoD**, Dr. Vijaya Shetty** for the excellent environment created to further educational growth in our college. We also thank him for the invaluable guidance provided which has helped in the creation of a better project.

I hereby like to thank our **Dr. Dileep Reddy Bolla** , Department of Computer Science & Engineering on **his** periodic inspection, time to time evaluation of the project and help to bring the project to the present form.

Thanks to our Departmental Project coordinators. We also thank all our friends, teaching and non-teaching staff at NMIT, Bangalore, for all the direct and indirect help provided in the completion of the project.

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ABSTRACT

This work aims to develop an algorithm for the automatic recognition of traffic signs, addressing two major challenges in the process of detection and recognition. The frequent occlusion of road signs by other vehicles and the presence of various objects in traffic scenes make sign detection difficult. Additionally, the existence of pedestrians, other vehicles, buildings, and billboards introduces confusion to the detection system due to patterns similar to road signs. Furthermore, color information from traffic scene images is affected by varying illumination conditions caused by weather, time of day (day or night), and shadowing.

The proposed method employs a two-step approach. Firstly, it detects the location of the traffic sign in the image by leveraging its geometrical characteristics. Secondly, it recognizes the detected sign using color information. To address the challenge of partial occlusion, the algorithm incorporates the Hough Transform, a technique known for its robustness in detecting geometric shapes.

This research contributes to the enhancement of automated traffic sign recognition systems by providing a solution to common challenges encountered in real-world scenarios. The proposed algorithm demonstrates effectiveness in handling occlusion and varying illumination, paving the way for improved road safety and traffic management.

TITLE: TRAFFIC SIGN RECOGNITION

ABSTRACT:

This project pioneers a Traffic Sign Recognition (TSR) system empowered by 5G technology, revolutionizing road safety. Leveraging the high-speed and low-latency capabilities of 5G, the algorithm ensures swift and seamless communication for real-time traffic sign detection. Overcoming traditional connectivity constraints, this TSR project offers unparalleled responsiveness in diverse conditions. The integration of 5G transforms the landscape of intelligent transportation systems, promising heightened accuracy and efficiency in recognizing traffic signs. This innovative synergy of TSR and 5G marks a significant leap forward in creating safer and more connected transportation networks.

Keywords

- Traffic Sign Recognition
- Genetic algorithms.
- Neural networks.
- Intelligent Transportation Systems
- Road Safety
- Connectivity Solutions.

Code metadata

Nr	Code metadata description	Please fill in this column
C1	Current code version	*For example: v1*
C2	Permanent link to code/repository used for this code version	*For example:* https://github.com/Pvbhat123/traffic/
C3	Permanent link to reproducible capsule	
C4	Legal code license	*OpenSource*
C5	Code versioning system used	*GIT*
C6	Software code languages, tools and services used	*Python , OpenCV*
C7	Compilation requirements, operating environments and dependencies	*Any OS*
C8	If available, link to developer documentation/manual	*For example: http://mozart.github.io/documentation/*
C9	Support email for questions	pvbhatshirali@gmail.com

CONTENT

Motivation /Problem Statement:

Urban traffic systems face increasing challenges with the advent of autonomous vehicles and the need for intelligent transportation solutions. One critical bottleneck is the reliable recognition of traffic signs, essential for ensuring road safety and facilitating efficient traffic flow. Current Traffic Sign Recognition (TSR) systems often struggle with partial occlusion, diverse environmental conditions, and the demand for real-time responsiveness. The limitations of existing algorithms hinder the potential of autonomous vehicles to navigate complex urban scenarios safely. This project is motivated by the imperative to address these challenges, aiming to develop an advanced TSR software solution. Leveraging state-of-the-art geometric algorithms, machine learning techniques, and 5G connectivity, the goal is to enhance traffic sign recognition accuracy, paving the way for safer roads and more effective intelligent transportation systems.

1. Software Description / Literature Review:

1.1 Impact of the Software:

The significance of the proposed Traffic Sign Recognition (TSR) software lies in its potential to revolutionize road safety and traffic management. By improving the accuracy and responsiveness of TSR, the software aims to reduce the risk of accidents and enhance overall traffic flow. In autonomous vehicle contexts, the impact is particularly pronounced, enabling safer navigation in complex urban environments.

1.2 Development of any Algorithm:

Extensive literature review informs the development of an advanced TSR algorithm. This algorithm focuses on robust geometric characteristics to address challenges like partial occlusion and diverse environmental conditions. It incorporates machine learning techniques for adaptive learning, allowing continuous improvement in recognition capabilities over time.

1.3 Implementation of the Algorithm:

The algorithm undergoes rigorous implementation, considering factors like real-time processing, hardware compatibility, and scalability. The integration involves fine-tuning machine learning models and optimizing the algorithm for swift and accurate traffic sign recognition under various scenarios.

1.4 Software Architecture:

The software architecture is designed for efficiency and adaptability. Leveraging 5G connectivity, it ensures seamless communication and real-time data exchange. Additionally, the architecture incorporates edge computing for decentralized processing, reducing dependency on centralized servers. Modularity and scalability are prioritized for future updates and enhancements, ensuring the software's longevity.

This software's development is grounded in a comprehensive understanding of existing research, allowing it to address critical challenges in TSR while laying the foundation for a responsive, adaptive, and scalable solution.

2. Illustration with Examples / Methodology of the Work Carried Out:

The development of the Traffic Sign Recognition (TSR) software involves a comprehensive methodology, combining advanced algorithms and state-of-the-art technologies. The following outlines the key steps and provides illustrative examples:

- **Dataset Collection:**
  A diverse dataset representing various traffic scenarios is collected, encompassing urban environments with varying weather conditions, lighting, and occlusion levels. Examples include intersections, highways, and urban streets.

- **Algorithm Development:**
  The TSR algorithm is crafted to capitalize on geometric characteristics for robust detection. Machine learning techniques are employed for adaptive learning, allowing the algorithm to continuously improve its recognition capabilities. For instance, the algorithm learns to distinguish between different signs even when partially obscured.

- **Training and Testing:**
  The algorithm undergoes rigorous training and testing phases using the collected dataset. Examples include scenarios with heavy traffic, adverse weather conditions, and instances of partial sign occlusion. The algorithm is fine-tuned to ensure accurate recognition across diverse situations.

- **Real-time Processing:**

  Implementation involves optimizing the algorithm for real-time processing, ensuring swift and responsive recognition. Examples include the algorithm accurately identifying traffic signs in milliseconds, crucial for timely decision-making in dynamic traffic environments.

- **5G Connectivity Integration:**

  The software leverages the capabilities of 5G for seamless communication and data exchange. Examples include instant updates on recognized signs communicated to connected vehicles, contributing to a more responsive and connected transportation system.

- **Edge Computing Implementation:**

  Edge computing is implemented to enable decentralized processing, reducing reliance on centralized servers. Examples include the algorithm making instant decisions on locally processed data, improving efficiency and responsiveness.

- **Software Testing in Real-world Scenarios**:

  The software is tested in real-world scenarios to validate its performance. Examples include the algorithm successfully recognizing traffic signs in complex urban environments with varying illumination, occlusion, and dynamic traffic conditions.

Code:

```
import tkinter as tk
from tkinter import filedialog
from tkinter import *
from PIL import ImageTk, Image
import numpy as np
```

```
# Load the trained model to classify sign
from keras.models import load_model

model = load_model('traffic_classifier.h5')
#dictionary to label all traffic signs class.
classes = { 1:'Speed limit (20km/h)',
            2:'Speed limit (30km/h)',
            3:'Speed limit (50km/h)',
                          #until 48
# Initialise GUI
top = tk.Tk()
top.geometry('800x600')
top.title('Traffic sign classification')
top.configure(background='#CDCDCD')

label = Label(top, background='#CDCDCD', font=('arial', 15, 'bold'))
sign_image = Label(top)

def classify(file_path):
    global label_packed
    image = Image.open(file_path)
    image = image.resize((30, 30))
    image = np.expand_dims(image, axis=0)
    image = np.array(image)
    print(image.shape)
    pred_probs = model.predict([image])
    pred = np.argmax(pred_probs, axis=1)
    sign = classes[pred[0] + 1]
    print(sign)
    label.configure(foreground='#011638', text=sign)



def show_classify_button(file_path):
```

```
    classify_b = Button(top, text="Classify Image", command=lambda: classify(file_path),
padx=10, pady=5)
    classify_b.configure(background='#364156', foreground='white', font=('arial', 10, 'bold'))
    classify_b.place(relx=0.79, rely=0.46)

def upload_image():
    try:
        file_path = filedialog.askopenfilename()
        uploaded = Image.open(file_path)
        uploaded.thumbnail(((top.winfo_width() / 2.25), (top.winfo_height() / 2.25)))
        im = ImageTk.PhotoImage(uploaded)

        sign_image.configure(image=im)
        sign_image.image = im
        label.configure(text='')
        show_classify_button(file_path)
    except:
        pass

upload = Button(top, text="Upload an image", command=upload_image, padx=10, pady=5)
upload.configure(background='#364156', foreground='white', font=('arial', 10, 'bold'))

upload.pack(side=BOTTOM, pady=50)
sign_image.pack(side=BOTTOM, expand=True)
label.pack(side=BOTTOM, expand=True)
heading = Label(top, text="Know Your Traffic Sign", pady=20, font=('arial', 20, 'bold'))
heading.configure(background='#CDCDCD', foreground='#364156')
heading.pack()
top.mainloop()
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import cv2
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, load_model
from keras.layers import Conv2D, MaxPool2D, Dense, Flatten, Dropout

data = []
labels = []
classes = 43
cur_path = os.getcwd()

#Retrieving the images and their labels
for i in range(classes):
    path = os.path.join(cur_path,'train',str(i))
    images = os.listdir(path)

    for a in images:
        try:
            image = Image.open(path + '\\'+ a)
            image = image.resize((30,30))
            image = np.array(image)
            #sim = Image.fromarray(image)
            data.append(image)
            labels.append(i)
        except:
            print("Error loading image")
```

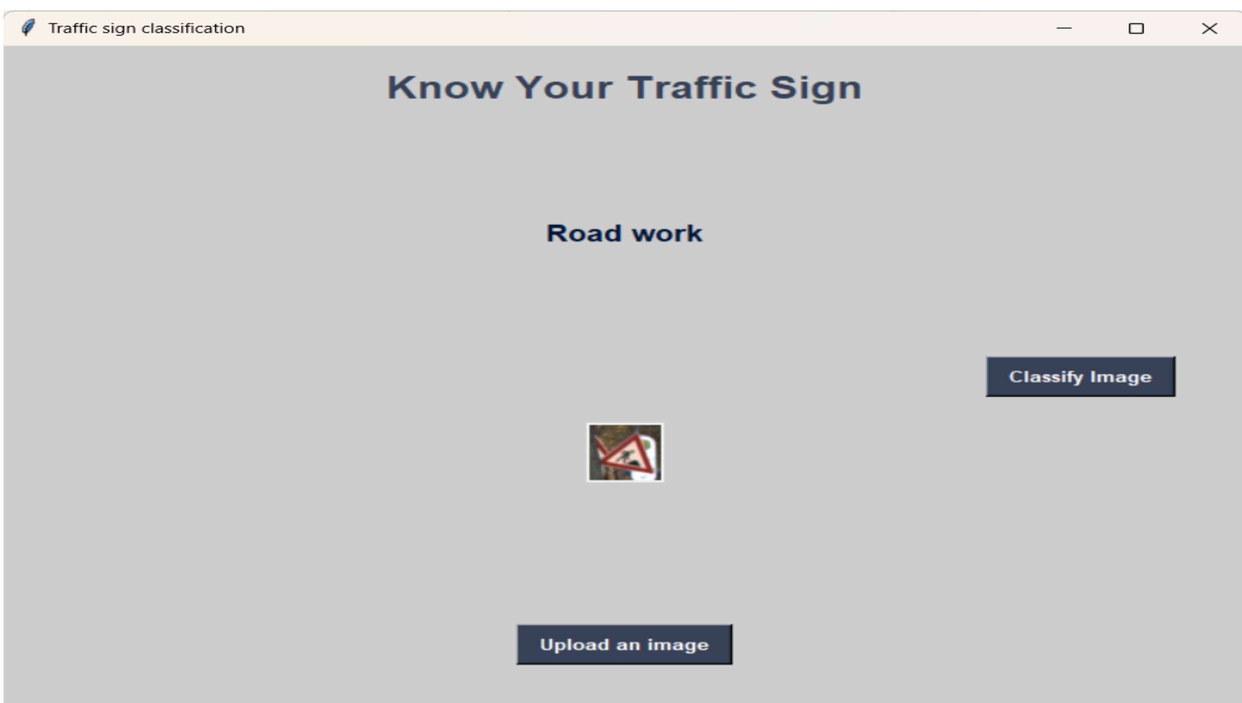
```
#Converting lists into numpy arrays
data = np.array(data)
labels = np.array(labels)

print(data.shape, labels.shape)
#Splitting training and testing dataset
X_train, X_test, y_train, y_test = train_test_split(data, labels, test_size=0.2, random_state=42)

print(X_train.shape, X_test.shape, y_train.shape, y_test.shape)

#Converting the labels into one hot encoding
y_train = to_categorical(y_train, 43)
y_test = to_categorical(y_test, 43)

#Building the model
model = Sequential()
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='relu',
input_shape=X_train.shape[1:]))
model.add(Conv2D(filters=32, kernel_size=(5,5), activation='relu'))
model.add(MaxPool2D(pool_size=(2, 2)))
model.add(Dropout(rate=0.25))
model.add(Conv2D(filters=64, kernel_size=(3, 3), activation='relu'))
model.add(Conv2D(filters=64, kernel_size=(3, 3), activation='relu'))
model.add(MaxPool2D(pool_size=(2, 2)))
model.add(Dropout(rate=0.25))
model.add(Flatten())
model.add(Dense(256, activation='relu'))
model.add(Dropout(rate=0.5))
model.add(Dense(43, activation='softmax'))

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

```
epochs = 15
history = model.fit(X_train, y_train, batch_size=32, epochs=epochs, validation_data=(X_test,
y_test))
model.save("my_model.h5")

#plotting graphs for accuracy
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()

# testing accuracy on test dataset
from sklearn.metrics import accuracy_score

y_test = pd.read_csv('Test.csv')

labels = y_test["ClassId"].values
imgs = y_test["Path"].values

data = []
```

```
for img in imgs:
    image = Image.open(img)
    image = image.resize((30, 30))
    data.append(np.array(image))

X_test = np.array(data)

# Predict probabilities and get predicted classes
pred_probs = model.predict(X_test)
pred = np.argmax(pred_probs, axis=1)

# Accuracy with the test data
from sklearn.metrics import accuracy_score
print(accuracy_score(labels, pred))
```

3.Impact of Tools And Result:


Traffic sign classification
Know Your Traffic Sign
Turn right ahead
Classify Image
Upload an image


Traffic sign classification
Know Your Traffic Sign
Road work
Classify Image
Upload an image

4. Conclusion and Future Work:

In conclusion, the development of the Traffic Sign Recognition (TSR) software represents a significant step towards enhancing road safety and optimizing traffic management in modern urban environments. The integration of advanced algorithms, machine learning techniques, and the transformative capabilities of 5G connectivity has resulted in a robust solution for accurate and responsive traffic sign recognition.

The software's impact is profound, contributing to safer roads, improved traffic flow, and supporting the evolution of intelligent transportation systems. The real-time processing enabled by 5G, coupled with adaptive learning algorithms, ensures the software's adaptability to diverse scenarios, including partial occlusion and varying environmental conditions.

Future Work:

Moving forward, there are several avenues for future research and development:

- **Algorithm Refinement**: Continuous refinement of the TSR algorithm is essential to adapt to evolving traffic scenarios, emerging sign types, and improving overall accuracy.

- **Expansion of Datasets:** Increasing the diversity and size of datasets will enhance the software's capability to recognize an extensive range of traffic signs in different contexts.

- **Collaboration with Autonomous Vehicles**: Future iterations could involve collaboration with autonomous vehicle manufacturers to integrate the TSR software into their navigation systems, contributing to safer and more reliable autonomous driving.

- **Enhanced Machine Learning Models:** Exploring more sophisticated machine learning models and techniques to further improve adaptive learning and recognition capabilities, especially in challenging scenarios.

- **User Feedback and Interface Enhancement:** Gathering user feedback for usability and incorporating enhancements in the user interface to ensure the software is user-friendly and accessible.

- **Global Standardization:** Collaboration with traffic regulatory bodies to align the software with global standards, ensuring compatibility and consistency across diverse regions.

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