CV & DL Project Report

Problem Statement - Integrated System for Traffic Sign Recognition Using YOLOv8 and CNN Models and lane detection using computer vision.

Domain – Intelligent Transport System

Technologies Used:

1. Traffic Sign Detection and Classification:

- YOLOv8: Used for object detection to extract traffic signs from the input image.
- Convolutional Neural Network (CNN): Used for classifying the detected traffic signs into specific categories.

2. Lane Detection:

- Custom Code (as provided): Implemented for detecting lane markings in the image using the following Computer Vision (CV) techniques:
- Grayscale Conversion: Simplifies image processing by reducing it to a single intensity channel.
- Gaussian Blurring: Removes noise and smoothens the image for better edge detection.
- Canny Edge Detection: Identifies edges in the image by detecting areas with significant intensity gradients.
- Region of Interest Masking (ROI): Focuses on the area where lanes are expected (e.g., the road).
- Hough Line Transformation: Detects lines in the masked edge image using a probabilistic approach.
- Slope and Intercept Averaging: Groups lines into left and right lanes and averages them to produce a smooth lane line representation.

This combination of deep learning and computer vision ensures accurate traffic sign recognition and lane detection for enhanced road safety and automated assistance. **The code is particularly suited for detecting lanes that are primarily straight, as the Hough Transform and averaging techniques are optimized for such patterns**.

Input type – RGB Image with dimension (32,32,3)

Output –

1. For traffic sign using cnn –

   - Prediction for input image
   - Prediction for extracted sign from input image
   - Prediction for enhanced sign by CV techniques.

2. Lane detection using cv –

   - Canny edge detection
   - Region of Intrest
   - Final lane

Sample input output

1.

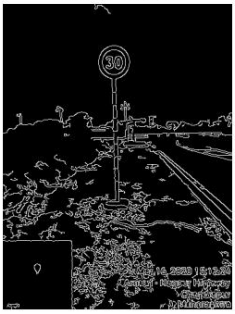
- As the lane are not straight ,lane detection is not able to detect the lane.
- Direct input to cnn is not able to detect sign accurately(class 17) as extracted from yolo works accurately(class 1)

Input Image -17, Meaning: No entry

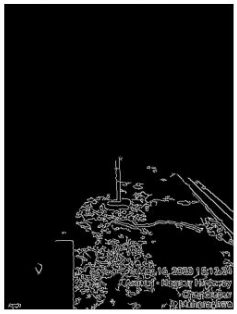
Sign - 1, Meaning: Speed limit (30km/h)

Enhanced Sign - 1, Meaning: Speed limit (30km/h)

Canny Image



Region of intrest



Final image

2.

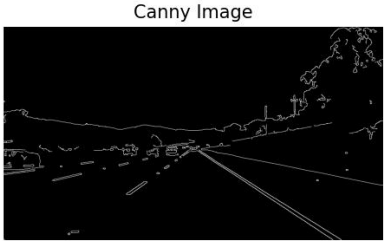
- Lane Detection works as expected

No sign detected

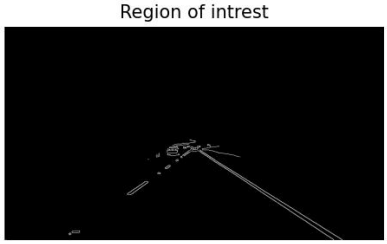
No sign detected

Input Image -0, Meaning: 0

Canny Image



Region of intrest



Final image

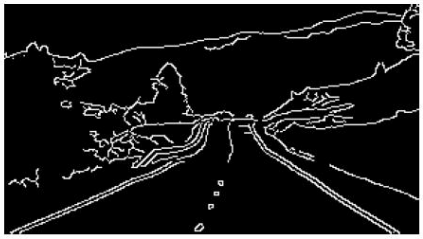
3.

No sign detected

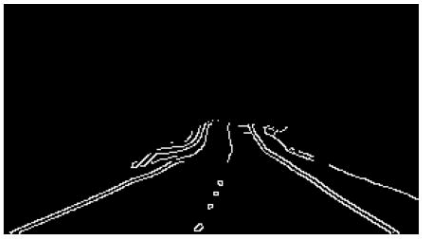
No sign detected

Input Image -0, Meaning: 0

Canny Image

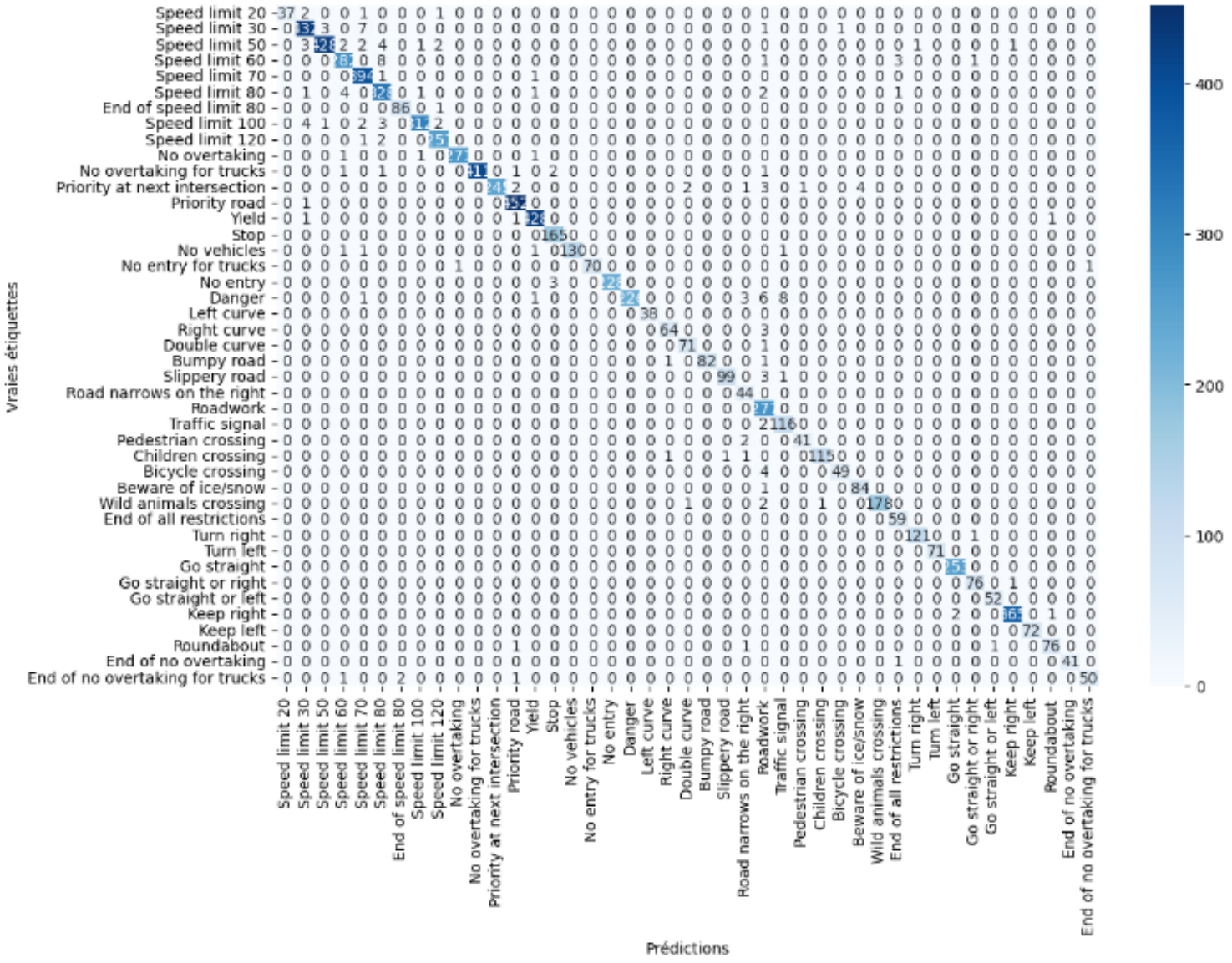


Region of intrest



Final image

Cnn Classification results – confusion matrix



Conclusion and Learnings –

1. The approach of first extracting traffic signs using YOLO and then classifying them with CNN is effective because directly predicting traffic signs from road images often leads to low accuracy.
2. Lane detection works well here because the images are taken from a center perspective with straight lanes, but it may not perform well on curved or complex lane scenarios.

3. Computer vision is useful for improving safety in transportation by helping detect traffic signs and lanes automatically.
4. Lane detection needs a huge perspective like use of deep learning models and image processing techniques accurately to get the desire result.
5. I learnt how the cv and dl techniques can be used as a complete pipeline to get the desire result Ex – hough transform,edge detection.
6. From this project , I understood the importance of choosing the right technique according to the nature of the problem.