GRAD 695-51- B-2025/Late Summer - Research Methodology & Writing

Assignment 2 - Project/Thesis Title Submission

Proposed Title:

Vehicle Detection and Number Plate Recognition Using Image Processing and Deep Learning Techniques.

Abstract:

This applied project is about designing an intelligent vehicle detection and number plate recognition system which utilizes image processing and deep learning models. Due to the rapid urbanization and the increase in the number of vehicles on the roads, monitoring and managing road activity through automated systems have become indispensable parts of smart city initiatives. This project exploits computer vision to carry out vehicle identification from images and video feeds automatically, thus setting the ground for more advanced systems like traffic analysis, congestion detection, and automated law enforcement.

The main aim of the project is to find vehicles instantly and get their number plates by using pre-trained object detection models. At the start, Haar Cascade Classifiers decide the cars and number plates because they have a simpler architecture and are easy to use. According to detection accuracy and performance, further experiments with advanced models such as YOLO (You Only Look Once) will be carried out to improve the system's reliability under different light and weather conditions.

The COCO (Common Objects in Context) dataset is going to be the source of training and testing of object detection models and also it offers a diverse range of labeled images containing various classes of vehicles. Image processing strategies with the help of OpenCV will be utilized for various operations like extraction of frames, converting them into grayscale, noise removal, and bounding box detection. After vehicles being recognized, an OCR (optical character recognition) procedure will be carried out to extract the text from car number plates, which will then be visualized in a simple-to-understand interface.

For a demonstration, this system will be implemented in the form of a simple web app, which permits users to upload video clips, get live feeds, or just watch the detection happening in real-time. The interface will be created with the help of Python-based web frameworks (such as Flask or Django), which makes both functionality and accessibility possible.

The thing that makes this topic really important to me is its applicability and my existing computer vision and Python programming skills. I have done similar academic projects before, which involved Haar cascades, CNNs, and vehicle classification tasks using COCO, so I have a solid base to start this work without the need to get a lot of new knowledge.

Even though the main aspect of this project is on detection and number plate recognition, the subsequent versions—most probably in the follow-up project—may also consider including more advanced analytics like vehicle tracking, traffic flow estimation, and congestion prediction.

For the undertaking of this applied project, the deliverables will consist of:

- The vehicle detection and number plate recognition system is operational.
- Model comparison and evaluation between the Haar Cascade method and the modern alternatives.
- A web-based interface that allows for demo and user testing.
- Documentation that describes the plan, design decisions, problems, and ways to improve in the future.

This applied project marks a large step in realizing the AI-driven traffic systems of the future as well as providing a practical implementation opportunity that is compatible with my academic and professional