DEPLOYMENT OF AI FOR REAL TIME VEHICLE DETECTION

Submitted in partial fulfillment of the requirements for the degree of

**Bachelor of Technology (Information Technology)**

**of**

**Maulana Abul Kalam Azad University of Technology, West Bengal**

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(Year of Submission 2024)

**Declaration**

We declare that this written submission of BTech Project [DEPLOYMENT OF AI FOR REAL TIME VEHICLE DETECTION] represents our ideas in our own words and where others’ ideas or words have been included, we have adequately cited and referenced the original sources.

We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any ideas/data/fact/source in my submission.

We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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CERTIFICATE OF APPROVAL

BTech Project

The BTech Project Thesis titled: [DEPLOYMENT OF AI FOR REAL TIME VEHICLE DETECTION] prepared by NITIN CHOWDHURY, 12000220032, ADARSH TIWARI, 12000220053, and RAHUL SINGH, 12000220003 is hereby approved for acceptance, for partial fulfillment of the requirements of the degree Bachelor of Technology (Information Technology).

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# Abstract

Let’s talk about India’s traffic conditions. As we know, India is experiencing a rapid increase in population, which can cause more urbanization, more people, and more traffic. It led to areas needing proper road infrastructure, resulting in poorly maintained highways, and limited public transportation options for commuters. This project is on detect and count vehicles in real-time is crucial for applications such as traffic management, security surveillance, and autonomous driving systems. This report discusses on the deployment of an artificial intelligence (AI) solution that leverages OpenCV, YOLOv4, and deep learning techniques for accurate and efficient vehicle detection and counting in live video streams.

Real-time vehicle detection and counting is crucial for applications like traffic management, security surveillance, and autonomous driving systems. This project presents an innovative AI-powered solution that leverages the state-of-the-art YOLOv4 (You Only Look Once, Version 4) object detection algorithm integrated with the versatile OpenCV library to address this challenge. The proposed methodology involves training the YOLOv4 model on a diverse dataset of annotated vehicle images, employing techniques such as transfer learning and data augmentation to enhance accuracy.

The trained model is seamlessly integrated with OpenCV's deep learning module, enabling real-time vehicle detection and tracking on live video streams. Advanced algorithms like Kalman Filters or Deep SORT are employed to maintain consistent identification and tracking of individual vehicles across frames, facilitating reliable vehicle counting even in challenging scenarios with occlusions or dense traffic.

The optimized pipeline is designed for efficient deployment leveraging hardware acceleration via GPU processing on systems with dedicated NVIDIA GPUs (GeForce GTX 750 or higher, Quadro series). Alternatively, it can be deployed on edge AI hardware like NVIDIA Jetson, Google Coral, or Intel NCS with quantization and pruning optimizations applied to the model for real-time performance on resource-constrained devices.

A user-friendly visualization system displays detected vehicles, bounding boxes, and counts, enabling integration with monitoring systems. Metrics like precision, recall, and mean Average Precision (mAP) evaluate accuracy, guiding continuous improvement through model updates and fine-tuning. This robust solution addresses complex environments, enabling informed decision-making for transportation, security, and autonomous applications.

***Keyword: OpenCV, YOLOv4(You Only Look Once), CNN(Convolutional neural network), DeepSORT, Mean Average Precision), R-CNN, SSD(Speed Shot Multi Detector) and SVM(Support Vector Machine).***