JP INFOTECH

OUR PROPOSED PROJECT TITLE:

Helmet and Number Plate Detection using Deep Learning

IEEE BASE PAPER TITLE:

YOLO-ESCA: A High-Performance Safety Helmet Standard Wearing Behavior Detection Model Based on Improved YOLOv5

IEEE BASE PAPER ABSTRACT:

To solve the problem of workers incorrectly wearing helmets, this study proposes a standard helmet wear detection model, YOLO-ESCA based on improved YOLOv5n. This model can monitor workers' helmet wear in real time via UAVs and other means and automatically reduce video streaming detection results. The model is trained using a self-built dataset that containing 4400 images. To address the shortcomings of the original YOLOv5, an improved version of the proposed approach, in which the efficient intersection over union loss function (EIOU-loss), Soft-NMS non-maximal suppression, and the convolutional block attention module (CBAM) are employed, is proposed, and a small target detection layer (ADL) is added to improve model performance. The experimental results show that the mAP@0.5 of the improved model is up to 94.7%, the FPS is up to 65.3, the model size is only 4.47MB, and that the number of detections on the self-constructed dataset and SHWD dataset is 41.7% and 73% greater, respectively, than that of the original model, respectively.

OUR PROPOSED PROJECT ABSTRACT:

The project titled "Helmet and Number Plate Detection using Deep Learning" employs advanced machine learning and computer vision techniques to address critical aspects of traffic management and safety enforcement. The system is developed using Python and leverages the powerful YOLOv8 (You Only Look Once, Version 8) object detection architecture for real-time identification of helmets and vehicle number plates. The front-end interface is built with HTML, CSS, and JavaScript, and is supported by the Flask web framework, providing a responsive and user-friendly environment for interacting with the detection system.

The YOLOv8 model, known for its speed and accuracy in object detection tasks, is trained on a diverse dataset to recognize helmets and number plates in various conditions and orientations. The model achieved a training accuracy of 88.00% and a validation accuracy of 79.00%, indicating a strong generalization capability to unseen data. These metrics reflect the model's proficiency in handling real-world variations and complexities in the input data.

The detection system operates in three distinct modes: 1) Image Mode: Allows users to upload and analyze static images to detect helmets and number plates. 2) Video Mode: Processes pre-recorded video files, extracting frames and applying the YOLOv8 model to detect and annotate the objects of interest throughout the video sequence. 3) Web Camera Mode: Utilizes a live feed from a web camera to perform real-time detection, making it suitable for dynamic and on-the-fly monitoring applications.

The integration of these modes provides versatility, catering to a range of use cases from stationary analysis to live traffic surveillance. The backend, powered by

Flask, ensures smooth data handling and processing, while the front-end design focuses on ease of use and accessibility.

In summary, this project demonstrates the effective application of deep learning in enhancing road safety and regulatory compliance. By automating the detection of helmet usage and vehicle identification, it offers a practical solution for traffic authorities to monitor and enforce safety regulations efficiently. The high accuracy rates achieved during training and validation phases underscore the potential of YOLOv8 in real-world deployment scenarios.

SYSTEM REQUIREMENTS:

HARDWARE REQUIREMENTS:

- System : Pentium i3 Processor.
- Hard Disk : 500 GB.
- Monitor : 15'' LED.
- Input Devices : Keyboard, Mouse.
- Ram : 8 GB.
- Camera : Web Camera

SOFTWARE REQUIREMENTS:

- Operating System : Windows 10 / 11.
- Coding Language : Python 3.10.9
- Web Framework : Flask.
- Frontend : HTML, CSS, JavaScript.

REFERENCE:

PEIJIAN JIN, HANG LI , WEILONG YAN, AND JINRONG XU, “YOLO-ESCA: A High-Performance Safety Helmet Standard Wearing Behavior Detection Model Based on Improved YOLOv5”, IEEE Access (Volume: 12), 2024.