Intel® Unnati Industrial Training Program 2024

PS-8: VEHICLE CUT-IN DETECITON

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Problem Statement

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Artificial Intelligence (AI)-based machine learning techniques are increasingly deployed in real-world applications. Autonomous driving, in particular, relies heavily on large volumes of diverse data for training and testing. The challenge lies in detecting sudden cut-ins by vehicles (including two/three/four-wheelers and pushcarts) into the direction of travel. The goal is to develop and train a new machine learning model that accurately identifies cut-in events. Augmenting the training data with additional sources and evaluating the model's accuracy in detection are essential outcomes of this problem.

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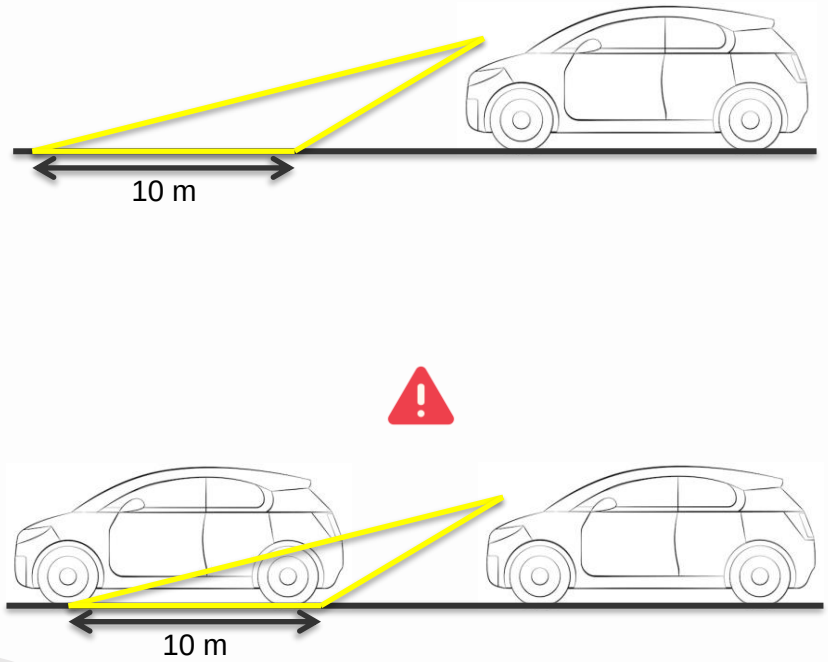
Approach

Approach

Our approach combines two powerful techniques: YOLOv8 (You Only Look Once) for vehicle detection and the SORT (Simple Online and Realtime Tracking) algorithm for tracking vehicles across video frames. YOLOv8 identifies vehicles in each video frame, providing bounding boxes around detected vehicles. The SORT algorithm maintains consistent tracks for each detected vehicle, ensuring smooth tracking even when vehicles change positions or occlude each other. We define a 10-meter safety zone in front of the host car. By knowing the speed of the host car and the distance to the detected vehicle within this zone, we calculate the time it would take for a collision (TTC). If the TTC is less than 0.7 seconds, a warning is issued. This timely alert enhances safety during driving, preventing potential collisions due to cut-ins. Our approach leverages state-of-the-art techniques, ensuring accurate detection and timely warnings for safer road experiences.



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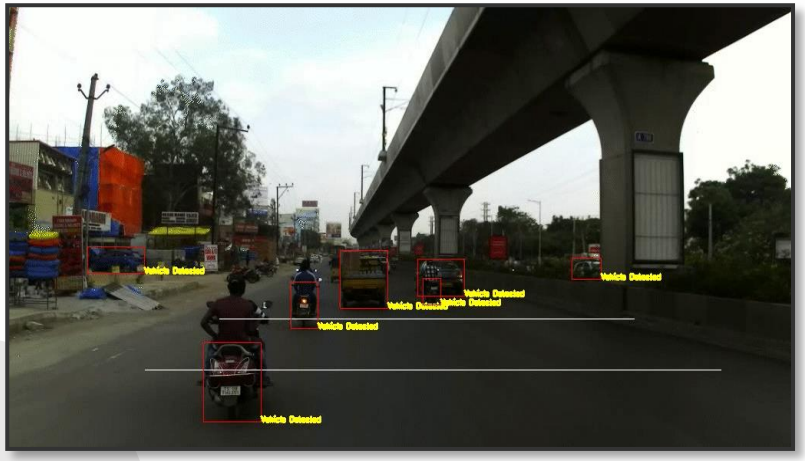
Sample Input
Output

Sample Input:

Sample Output:



04

Challenges Faced

Challenges

1. Multi-Class Vehicle Detection:
    - Accurately detecting various types of vehicles (bikes, scooters, autos, cars, trucks) in real-world scenarios posed a challenge.
    - Differentiating between small and large vehicles required fine-tuning the detection model.

2. Speed Estimation:
    - Obtaining accurate speed information for the host car was challenging.
    - Variability in road conditions, traffic, and camera angles affected speed estimation accuracy.

3. Cut-in Detection:
    - Identifying sudden cut-ins by other vehicles within a predetermined safety zone was crucial.
    - Ensuring timely alerts for potential collisions required precise detection and tracking.

4. Collision Prediction:
    - Calculating the time to collision (TTC) accurately based on relative speed and distance was essential.
    - Balancing false positives and false negatives in collision predictions was a trade-off.

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Code

Code

PhantomX256/Vehicle-Cut-In-Detection: This is a project created for the Intel Unnati Industrial Training Program 2024. (github.com)

THANK YOU