International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 13, Issue 2, pp: (1-5), Month: April - June 2025, Available at: www.researchpublish.com

VEHICLE DETECTION FROM VIDEO SEQUENCE USING DEEP LEARNING TECHNIQUE

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DOI: https://doi.org/10.5281/zenodo.15321741

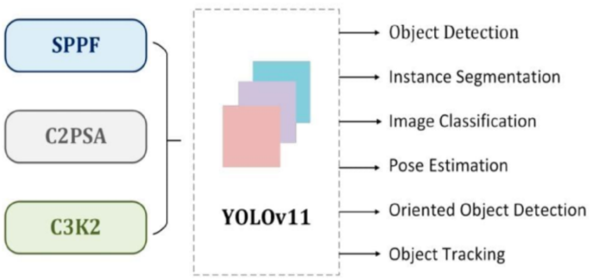
Published Date: 01-May-2025

Abstract: **This research focuses on moving object detection technique by using deep learning algorithm. The research is helps to identify the parameters of vehicle from video. Deep learning algorithm YOLO "You Only Look Once", it maintains high accuracy in detecting multiple objects within a single image. Thony python IDE is specially designed for vehicle detection, you can definitely use it to write and run python scripts for vehicle detection. This algorithm has been trained with Open Images image dataset of 170 images of vehicles and tested on 4 different videos. The primary goal and target of this paper is to rectify the challenges in the system should be able to detect the vehicles from videos**

Keywords: **Thony python, My SQL connector, Neural Networks, Deep Learning technique, vehicle detection, OpenCV, YoLo, python programming.**

I. INTRODUCTION

Vehicle detection using deep learning is a computer vision technique that leverages powerful neural networks to automatically identify and locate vehicles within an image or video frame, essentially allowing systems to see and recognize cars, trucks, and other vehicles in real-time, commonly used in applications like autonomous driving, traffic monitoring, and surveillance systems by accurately identifying the number plate and speed of vehicles on a road or scene.The research helps to identify accidents quickly. Deep learning algorithm YOLO "You Only Look Once" have been developed for the detection and tracking tasks. Python programming language have been utilized as the development language for the creation and training of the model.



YOLOv11 paper, Figure 1

2. LITEATURE REVIEW

Deep learning-based approaches have achieved state-of- the-art results in vehicle detection from video sequences Convolutional Neural Networks (CNNs) [1], Region- CNNs (R-CNNs) [2], Single-Shot Detectors (SSDs) [3], and You Only Look Once (YOLO) [4] have been widely used. Transfer learning and domain adaptation have also improved accuracy. However, handling complex scenarios and improving computational efficiency remain challenges.

Existing Method

Existing method for is to employ object detection algorithms like YOLO (You Only Look Once) which analyze each frame of the video to identify and locate vehicles within the image, with the ability to track vehicle across multiple frames through additional processing steps to maintain consistency in detection across the video sequence.

3. PROPOSED SYSTEM

Our proposed system for vehicle detection from a video sequence using deep learning would involve: capturing video frames, pre-processing the images, applying a convolutional neural network (CNN) based object detector like YOLO (Youn Only Look Once) to identify vehicles within each frame, and then post-processing the results to track vehicles across frames and generate relevant information like vehicle count, location, and speed; all while leveraging the power of deep learning for high accuracy and real-time detection capabilities

Methodology YOLO (you only look once)

We have used YOLO 11 version to detect and the moving vehicles in frame or image or video. YOLO stands for 'YOU ONLY LOOK ONCE'. YOLO11 is a Computer vision model architecture developed by Ultralytics. The architecture of YOLO11 is designed to optimise both speed and accuracy, building on the advancements introduced in earlier.

We have choosed YOLO 11 because in this bounding box are weighted by the predicted probabilities. YOLO provides high accuracy while also is run in real time.It provides fastest output then the others just like CNN,R-CNN,SSD etc. YOLO algorithm by dividing the image into number of frames, each frame having equal dimensional regions of size into size. YOLO 11 version is used in this project to identify parameters like date, time, number plate, speed, id of vehicles.

STEPS:

STEP 1:

YOLO11 software version is downloaded and extract the features go to thonny python installation and open tools and downloaded the opencvpython, ultralytics, paddlepaddle, paddleocr, mysql-connector.

STEP 2:

Open Thonny python IDE and go to files click on open it shows the saved document click main.py, then it is open the code on thonny IDE now save it and now xampaa has installed and apache, my sql should be in stop mode and run code.

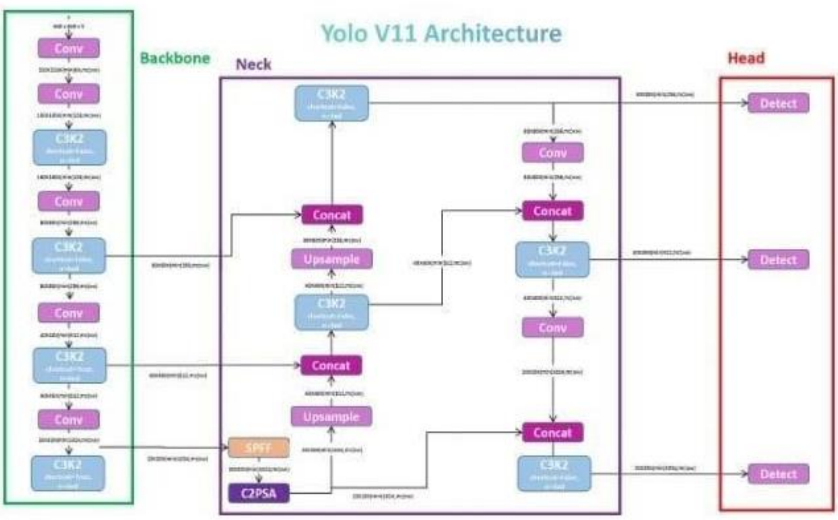
STEP 3:

Now we can observe the video without any movement and now open the 127.0.0.1/phpMyAdmin paste in browser then refresh it and double tap in the my data and run it again and observe the video movement and shell displays the value.

STEP 4:

Now go to back in browser and refresh it and observe the parameters like date, time, speed, id, number plate.

Architecture of Proposed System:



YOLOv11 Model Architecture

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STEPS INVOLVED IN ARCHITECTURE:

Backbone Network

1. Input image is passed through a backbone network (e.g. CSPDarknet53) to extract features.
2. The backbone network is a central infrastructure that connects network and allows data to be exchanged between them.

Feature Pyramid Network (FPN)

1 The features extracted by the backbone network are passed through an FPN to create a feature pyramid.

2 The FPN consists of multiple lateral connections and upsampling layers.

YOLO Head

1. The feature pyramid is passed through a YOLO head, which consists of multiple convolutional layers and detection layers.
2. YOLO head which helps to improve the accuracy of the bounding box predictions and it helps to improve the performance of the model by transferring knowledge from a teacher model to a student model.

Object Detection

1. The predictions from each detection layer are combined to form the final detections.
2. Object detection is crucial for autonomous vehicles to detect and respond to objects on the road.

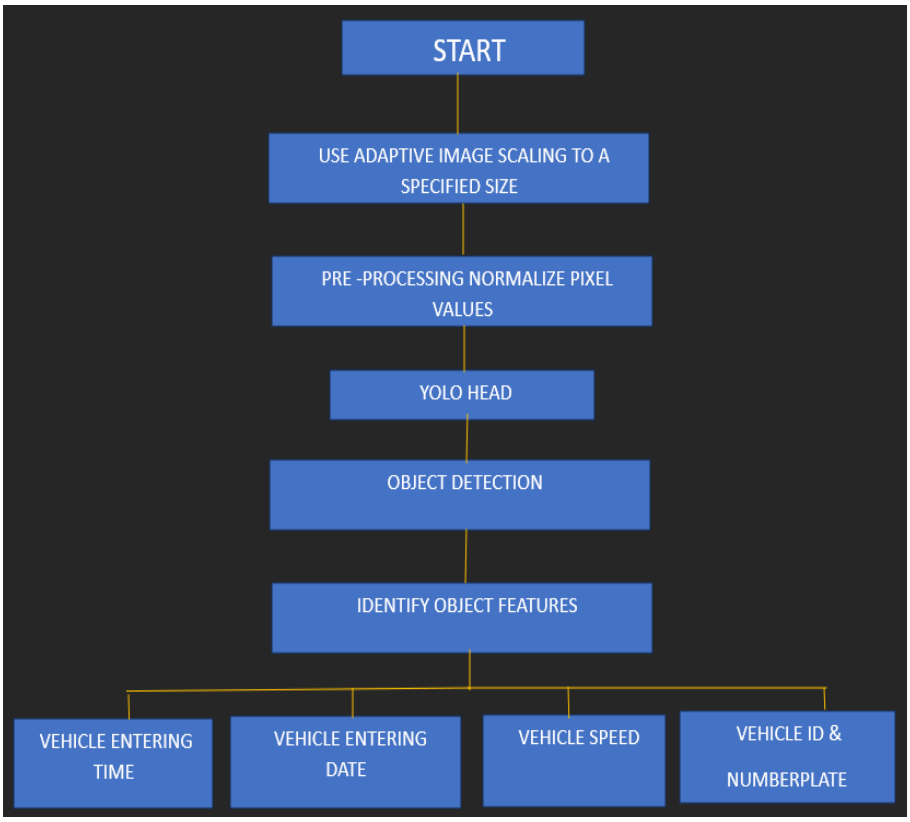
Post-processing

1. The final detections are filtered based on a confidence threshold.
2. The bounding box coordinates are adjusted to ensure they are within the image boundaries.

Output

1. The final detections are returned, including the bounding box coordinates, class probabilities, and confidence scores.

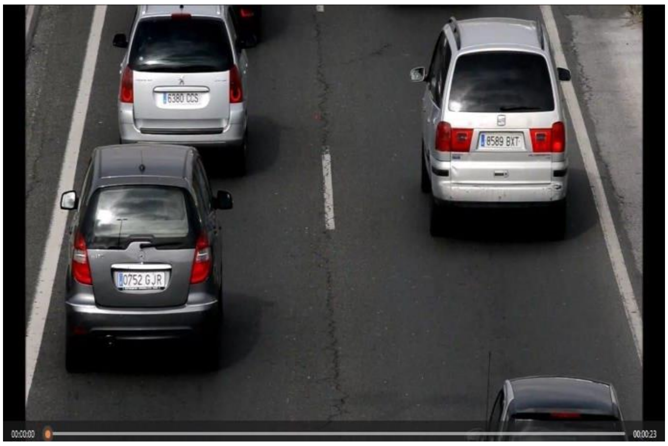
FLOW CHART



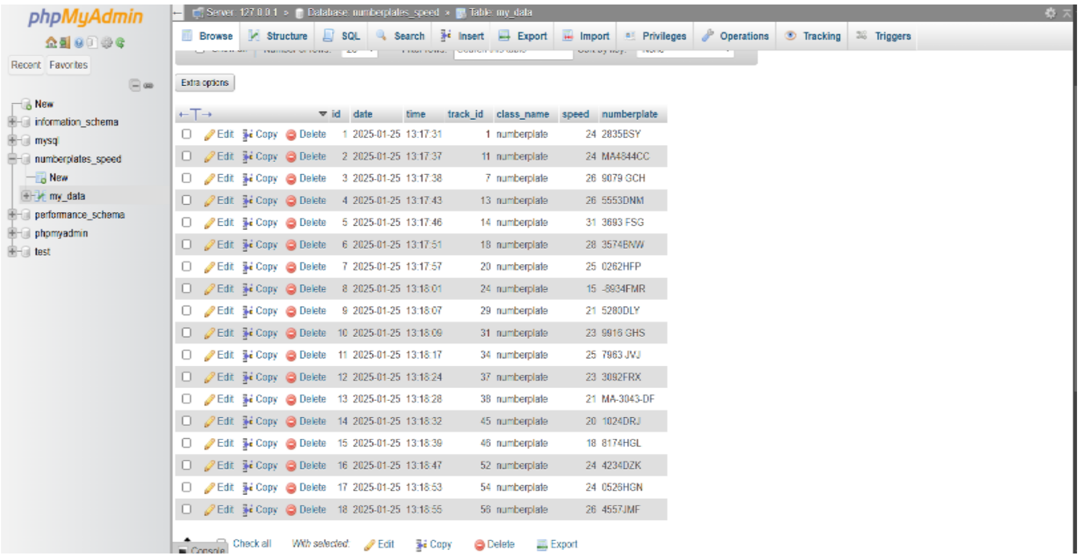
4. RESULT

When using deep learning for vehicle detection, the result is typically a highly accurate identification of vehicles within an image or video frame, pinpointing their location with bounding boxes, often achieving detection rates exceeding 90% depending on the model and dataset, allowing for precise vehicle tracking and analysis in applications speed, time, date, id and number plate.

Giving input (recoded video image):

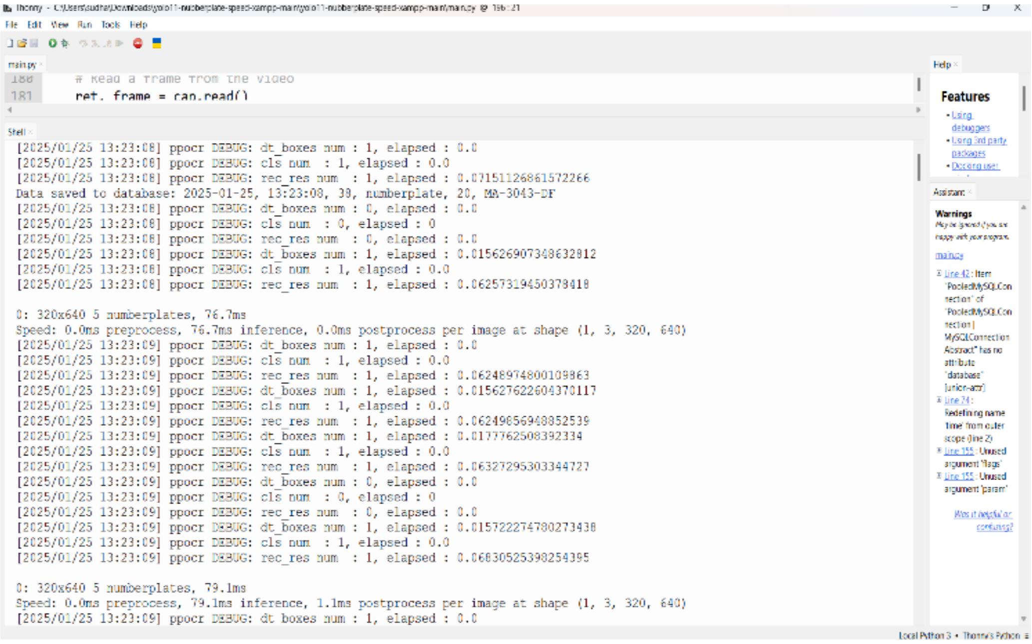


After giving parameters:



id	date	time	track_id	class_name	speed	numberplate
1	2025-01-25	13:17:31	1	numberplate	24	2835BSY
2	2025-01-25	13:17:37	11	numberplate	24	MA4844CC
3	2025-01-25	13:17:38	7	numberplate	26	9079 GCH
4	2025-01-25	13:17:43	13	numberplate	26	5553DNM
5	2025-01-25	13:17:46	14	numberplate	31	3693 FSG
6	2025-01-25	13:17:51	18	numberplate	28	3574BNW
7	2025-01-25	13:17:57	20	numberplate	25	0262HFP
8	2025-01-25	13:18:01	24	numberplate	15	-8934FMR
9	2025-01-25	13:18:07	29	numberplate	21	5280DLY
10	2025-01-25	13:18:09	31	numberplate	23	9916 GHS
11	2025-01-25	13:18:17	34	numberplate	25	7963 JVJ
12	2025-01-25	13:18:24	37	numberplate	23	3092FRX
13	2025-01-25	13:18:28	38	numberplate	21	MA-3043-DF
14	2025-01-25	13:18:32	45	numberplate	20	1024DRJ
15	2025-01-25	13:18:39	46	numberplate	18	8174HGL
16	2025-01-25	13:18:47	52	numberplate	24	4234DZK
17	2025-01-25	13:18:53	54	numberplate	24	0526HGN
18	2025-01-25	13:18:55	56	numberplate	26	4557JMF

OUTPUT IMAGES



5. CONCLUSION

In conclusion, Utilizing a deep learning algorithm like YOLO for vehicle detection demonstrates significant potential for accurate and robust vehicle identification in real -world scenarios particularly with convolution networks [CNNs] which effectively extract features from images allowing high accuracy even in complex traffic environments.

Future Scope

In order to development of gathering data on vehicle movements can provide insides into traffic patterns and help in urban planning and infrastructure with potential applications in areas like real-time traffic monitoring, vehicle speed, detecting number plate analysis, and improved safety features by accurately identifying and tracking vehicles in complex environments, even under challenging conditions like low light or heavy traffic.

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