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Car Over Speed Detection Using Computer Vision and Deep Learning

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Abstract
One of the most common traffic infractions is speeding. Every driver on the road is put in danger. In the USA, speeding caused 9717 fatalities. Loss of vehicle control, longer stopping distances, monetary losses, greater fuel consumption, and fatalities are a few effects of speeding. Airbags and seat belts may not be as effective at shielding the occupants from the accident when crash speeds increase. The country's economy suffers billion-dollar losses due to excessive speed. Multiple strategies are used in the current system, and performance enhancement is required. Many systems are expensive and less practical since they require a variety of different hardware and sensors. As the number of sensors increases, the operation's overall cost rises and its reliance on physical labor grows. There are numerous of image processing methods that employ edge detection to find objects and a straightforward formula to find the vehicle and determine its speed. The system relies on hard-coded rules, and these methods are exceedingly unreliable. To overcome this issue, this work aims to utilize computer vision and Deep Learning based Object Detection Yolov5 algorithm, aiming to detect over speeding of Cars and report the violation to the law enforcement officer. This system would provide an easy approach to monitor speeds of all cars. If excessive speed is noticed, photos of the specific vehicle will be taken and given to law enforcement. Implemented using Python platform. This work identifies over speeding in cars using computer vision and Deep Learning-based Object Detection YOLO algorithm and reporting the infraction to the law enforcement officer. If excessive speeding is noticed, photos of the specific vehicle will be captured. These systems can operate continuously and require essentially no manual work. Based on the available training data, this system identifies the vehicle and its type.

Key Words: Image Processing, Computer Vision, Deep Learning, YOLOv5 algorithm, Object Detection

Introduction

Car numbers and detection in highway monitoring video scenes are extremely important for effective traffic management and highway control. An enormous library of traffic video footage has been gathered for examination thanks to the widely used installation of traffic surveillance cameras. A higher viewing angle typically allows for consideration of a further away road surface. It is challenging to see a little thing far off the road from this vantage point since the car's object size varies greatly. It's essential to quickly fix the forementioned problems and then apply them to more intricate camera settings.

There are two main methods for object detection using vision: deep learning approaches and machine vision methods. Variance here is determined using the pixel values of minimum two successive video frames using the video frame difference method [1].

Driving at excessive speed

In the interest of the general public, the administration claims that harsher and greater fines have been applied. It is believed that heftier fines will make people more responsible and cautious drivers. People who are cautious and observant will be less likely to act negligently, cause fewer accidents on the road, and result in fewer fatalities. Drunk or reckless driving is a serious offence that occurs regularly in India. Accident probabilities are dramatically increased by negligent and inattentive road users. They end up seriously endangering other drivers and other road users as a result.[3] Speaking to the Parliament, Mr. Nitin Gadkari, the Minister of Road Transport and Highways, noted that over 54,000 individuals lost their lives in traffic accidents on the national highways in 2018. Additionally, it was noted that 5 percent of these fatalities were related to drunk driving, whereas the vast majority of these deaths were caused by speeding.

In India, going over the speed limit now carries a 2000 INR punishment because it falls under the category of risky driving. In the past, the fine for exceeding the speed limit varied from state to state and might be as low as 100 INR or as high as 3000 INR. In accordance with the modified Act, the fine may even be raised by 10% year.[4] Many motorists who are pulled over for speeding or reckless driving are discovered to be inebriated. According to the new rule, which strives to be fair, offenders will be fined according to the amount of alcohol they had in their system at the time of the offence.

Driving when impaired by drugs, alcohol, or other narcotics will result in penalties according to the categories outlined in the amendment. Instead of the previous meagre fine of 2,000 INR, the maximum fine that can be assessed for driving while drunk is now 10,000 INR.

The Indian government is attempting to make all administrative departments and agencies more open and freer of corruption with the aid of a significant makeover. Another organization that offers services to citizens connected to driving, vehicles, and the road is the RTO, or regional transport office, which is present in every state.

The RTO body has been automated, just like the majority of other government-approved programmers and services. The administration hopes to speed up the procedure, eliminate the need for cash transactions, reduce red tape, and do away with complicated procedures by computerizing these facilitations.[18]

Fig1.1: Highway roads.[5]

Fig1.2: Speed Limit Sign.

With regard to one-time registration, the issuance of no objection certificates, or NOCs, vehicle permits, and a variety of other information, the RTO or their online presence in the form of the Saratha website also provide assistance. Re- registering vehicles for use in states other than those they were initially registered in during purchase or by the previous owner are also included in some RTO services, as are the payment or refund of taxes.

Vehicle Detection

There are two main methods for object detection using vision: deep learning approaches and machine vision methods. Variance here is determined using the pixel values of minimum two successive video frames using the video frame difference method The threshold divides the foreground region from movement The stopping of the car can also be noticed by employing this technique and muzzling noise. Vehicle characteristics are used in two popular vehicle identification algorithms, Scale Invariant Feature Transform (SIFT) and Speeded Up Robust Features (SURF).

Deep Convolutional Network (CNN)

Deep Convolutional Network has had incredible success detecting objects in vehicles. CNNs can perform a wide range of related tasks, including classification and bounding box regression, and are skilled at learning image features. Two broad categories can be made for the detecting techniques. The two-stage method employs a convolutional neural network to categorize the object after creating a candidate box of it using a variety of procedure snu. Region-CNN (R-CNN) employs selective region search in the image during the two-stage process. [3] The convolutional network requires a fixed-size image input, and because of its deeper structure,

training takes a long time and uses up a lot of memory. SPP NET, which is based on the concept of spatial pyramid matching, enables the network to accept images of different sizes and produce fixed results. Convolutional networks' feature extraction processes, feature selection processes, and classification abilities have all been enhanced in various ways by R-FCN, FPN, and Mask RCNN. The Single Shot Multi box Detector (SSD) and You Only Look Once (YOLO) frameworks are the most significant one-stage techniques.

Problem Statement and Description

- Today, reckless driving puts both the driver and the broader public in grave danger. Although reckless driving is a severe issue, patrol officers' present methods for detecting it are insufficient.
- First of all, there are just not enough patrol officers to observe and study every driver's habit given the extensive mileage of driveways.
- Second, rash driving norms are merely descriptive, and visual observations cannot accurately capture the specifics of nighttime or inclement weather driving. In the current method, authorities must utilize a handheld radar gun to aim at

the car and record its speed in order to identify reckless driving. [6]

- If a car is travelling faster than the posted limit, the nearest police station is notified, and the car will be stopped.
- This is a time-consuming and inefficient process because one must inform the appropriate parties following detection.
- This system cannot be trusted with human life since the number of automobiles grows daily. An overspeeding vehicle detection model for highways is created after taking all of these factors into account The majority of fatal incidents are caused by over speeding. Humans have an inherent drive to succeed. However, we will always follow some other vehicle when using the road with other users. [4]
- As speed increases, so does the likelihood of an accident and the severity of any injuries sustain in one. Quicker vehicles are more likely to be involved in accidents than slower ones, and the severity of those accidents will also be greater with faster vehicles.[7]
- The risk is increased the faster you go. When travelling at a fast speed, the braking distance required to stop the car must be longer. When a crash occurs, a fast-moving car will have a bigger impact and hence cause more injuries.[8]
- Several ways have been used to address the major issue of excessive speeding, but the most of them are either manual or inefficient and rely on the user's alertness when in use. In order to inform drivers of the speed restriction, their own personal speed limit, and to warn them if they exceed the limit, an automatic speed alert and reporting system is required.
- Also, if any unwanted object like person, horse etc. is there, it is highlighting it in a big red box and giving alert sound.

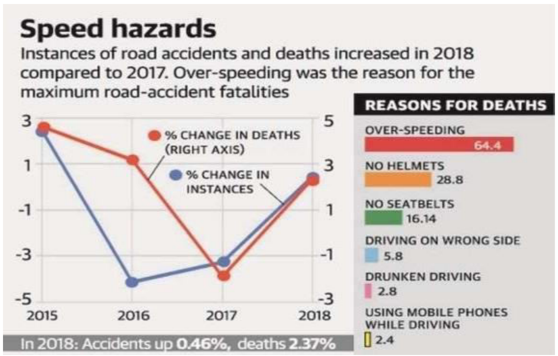

Fig1.3: Annual Publication on Accidents (Road Accidents in 2018).

Motivation behind this work

The need of this works the main factor in accidents today is excessive vehicle speed. Every year, excessive vehicle speed claims the lives of thousands of individuals.

It is crucial to keep an eye out for such excessively fast vehicles, especially on highways. Automated systems that keep track of such transgressions can be very beneficial and even save many lives.

A method for locating and detecting accidents on the road that is based on deep learning. The advantage of the suggested strategy is that anomalies are only picked up when typical traffic events are used to train the model.

The speed and complexity of the system serve as the primary drivers for adopting YOLO. YOLO simply glances at an image once to identify all the items it contains, as opposed to repeatedly gliding over it. YOLO employs characteristics from a complete image during training and categorizes the detection problem as a regression problem. When training and testing, it considers the complete image, unlike RCNN. YOLO thus concurrently predicts all the many item categories that are seen in an image. Now a days speeding cars hit and run case is becoming very common as we read in news articles: In Hyderabad's Jubilee Hills neighborhood, a speeding automobile struck street vendors, killing a two-month-old and injuring three others, according to police. Three female street vendors were hurt in the incident, which happened on Friday. A fast car with a temporary plate number struck the gathering of merchants.

In a horrifying hit-and-run event from Hyderabad, a woman was struck by a speeding automobile in the Rajendra Nagar neighborhood in broad daylight. The motorist left the scene right after the collision. However, the CCTV camera that was placed at the scene recorded the entire incident.

It is correct to say that, over speeding of cars has become a huge problem you get to know how tough time others goes through if innocent family members become victim and get into trouble. I realized and started reading about Traffic violations rules and had done a lot of research work. Got motivated to develop this work to report the infraction to the police and identify over speeding by mounting the gadget on the dashboard of the vehicle. Found &

investigated deep learning-based computer vision techniques for this aim. Yolo is the most appropriate model because it can add more categories.

In this work, speed is being detected for all the cars parallelly and over speeding is being checked. Also, if any unwanted object like person, horse etc. is there, it is highlighting it in a big red box and giving alert sound.

Aim and Scope

Aim: The purpose of this work is to create an automatic over speed detection system that would alert the authorities to a car that was going too fast. The driver may be charged with exceeding the speed limit once the information has been forwarded to the regulating body. This work primary goal is to eliminate the workforce required by the current systems. To assess the speed of the vehicles, the officer currently needs to wield the speeding gun. It should be mentioned that only 5% of those who violate the law receive speeding citations at the moment There are fewer than 10 cops per 10,000 people in certain places, including San Francisco, Stockton, Gilbert, etc. Any undesired objects, such as people, horses, or other animals, are highlighted in a large red box and an alert sound is produced.

Scope: The scope of this work is to identify excessive speeding and notify the infraction to a law enforcement official using computer vision and artificial intelligence. It has been shown that utilizing YoloV5 for predictions yields the best outcomes. Generating our own dataset and completely retraining the Yolov5 algorithm in accordance with the dataset and requirements.

Background and Basics

Machine learning: Computers can follow built and programmed algorithms thanks to the science of machine learning.

Machine learning, in the opinion of many experts, is the most effective technique to advance toward human-level AI. There are many different patterns included, including: It contains a variety of patterns, including the following:

- Supervised Learning Pattern
- Unsupervised Learning

Deep Learning: Artificial Neural Networks, a subfield of deep learning, use algorithms that are motivated by the structure and operation of the brain. Through supervised learning, often known as learning from labelled data and algorithms, deep learning has become increasingly important. Every deep learning algorithm follows the same procedure. It uses a hierarchy of nonlinear input transformations and produces a statistical model as its output. The following steps characterize the machine learning process.

- Locates pertinent data sets and gets them ready for analysis.
- Selects the kind of algorithm to employ.
- Based on the algorithm, builds an analytical model.
- Develops the model using test data sets and updates it as necessary.
- Executes the model to produce test results.

YOLO: Real Time Object Detection Algorithm:

A real-time object detection system called YOLO (You Only Look Once, Version 5) can recognize particular things in films, live streams, or still photos. To find an item, YOLO uses features that a deep convolutional neural network has learned. Joseph Redmon and Ali Farhadi are credited with creating YOLO versions 1-3. A Convolutional Neural Network (CNN) called YOLO is capable of quickly recognizing things. As ordered arrays of data, incoming images can be analyzed by classifier- based systems called CNNs, which can identify patterns in those patterns Convolutional neural network methods like YOLO "rank" regions according to how closely they resemble predetermined classes. Regions that score highly are reported as positive detections of the class that they most closely match. According on which regions of the video score highly in comparison to predetermined classes of cars, YOLO can be utilized, for instance, in a live traffic feed to identify various types of automobiles.

In terms of speed, accuracy, and class specificity, YOLO and earlier versions differ significantly. YOLOv2 was using Darknet-19 as its main feature extractor, whereas YOLO currently uses Darknet-53. The creators of Darknet-53, Joseph Redmon and Ali

Farhadi, also founded YOLO. Darknet-53 is more potent than Darknet-19 and more effective than rival backbones because it uses 53 convolutional layers as opposed to the preceding 19 layers ResNet-101.

Backbone	Top-1	Top-5	Ops	BFLOP/s	FPS
Darknet-19	74.1	91.8	7.29	1246	**171**
ResNet-101	77.1	93.7	19.7	1039	53
ResNet-152	**77.6**	**93.8**	29.4	1090	37
Darknet-53	77.2	**93.8**	18.7	**1457**	78

Table 1.1: Backbone Features

Observe that Darknet-52 is 1.5 times quicker than ResNet101 by referring to the chart Redmon and Farhadi presented in their YOLO study. Since it is still as accurate as ResNet-152 but two times faster, the accuracy shown does not require any trade-off between accuracy and speed between Darknet backbones. The moniker "You just look once" refers to the fact that it operates considerably faster than other detection techniques with comparable performance. Furthermore, without the necessity for model retraining, you can easily compromise between speed and accuracy by adjusting the model's size. Utilizing an M40/Titan X GPU, YOLO performs far better than other detection techniques with comparable performance.

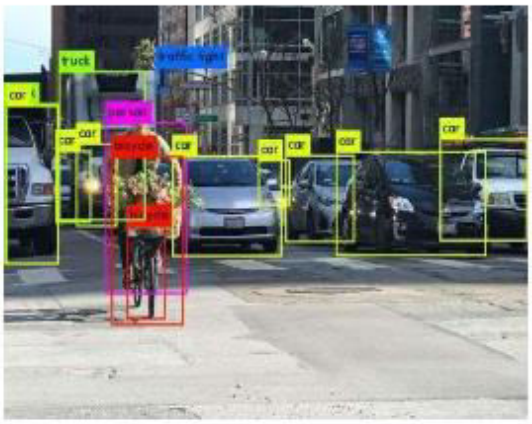

Fig 1.6: Objects Detected

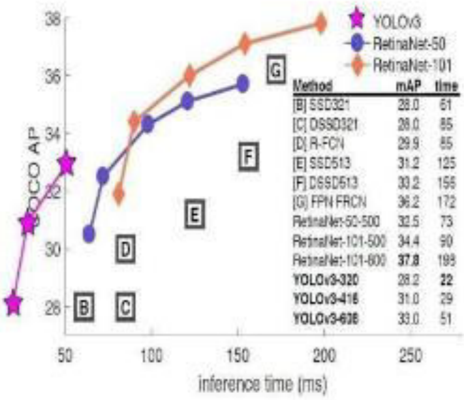

Fig1.8: YOLO Performance

YOLO Version 5, which Ultralights released in June 2020, is now the most sophisticated object detection algorithm on the market. It is a cutting-edge convolutional neural network (CNN) that accurately detects objects in real-time. This method processes the entire image using a single neural network, then divides it into parts and forecasts bounding boxes and probabilities for each component. The predicted

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probability weighs these bounding boxes. The approach "only looks once" at the image since it only performs one forward propagation cycle through the neural network before making predictions.

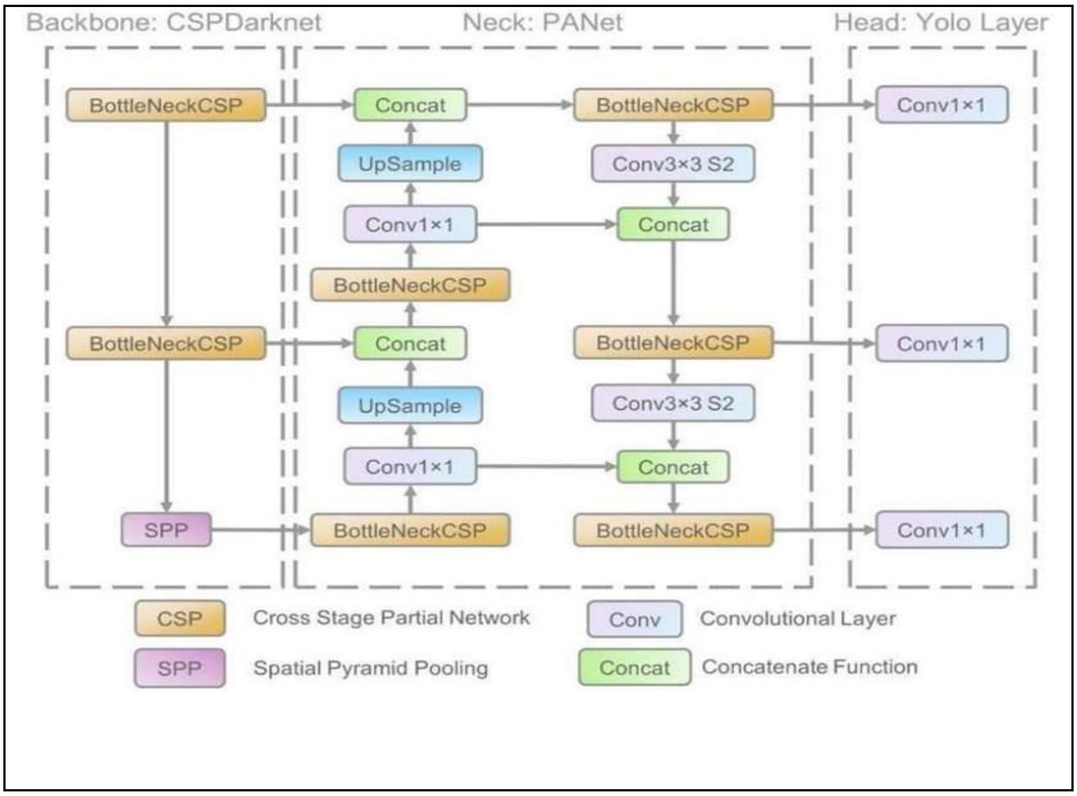

Fig 1.11: YOLO Architecture

YOLO and its Architecture:

The main purpose of Backbone is to extract important features from an input image, making it easy to recognize the same object with the variations of sizes and scale.

The remainder of the paper is structured as follows. Section 2 "Literature Survey" describingabout Detection of car using Image Processing and Machine learning approaches. Existing systems for Speed and Related Work is seen. Section 3 presents, "System Architecture" describing the proposed System Architecture and System Modules. Section 4 presents, "Implementation and Results". Section-5 Conclusion and future work.

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Literature Survey

In this section, detailed overview of the different research techniques is given with their working Procedure. David Fernández Llorca, Antonio Hernández Martínez, Iván García Daza et al [13] Vehicle Based Speed Estimation. Vehicle Speed Detection Problem using computer vision technique (vision-based speed detection approach based on input from video camera). Vision based speed detection including, camera settings and calibration, vehicle detection & tracking, distance &speed estimation. The challenge of making accurate estimations of distances & speed arises from the video sensors that projects 3D into a 2D plane.[13]

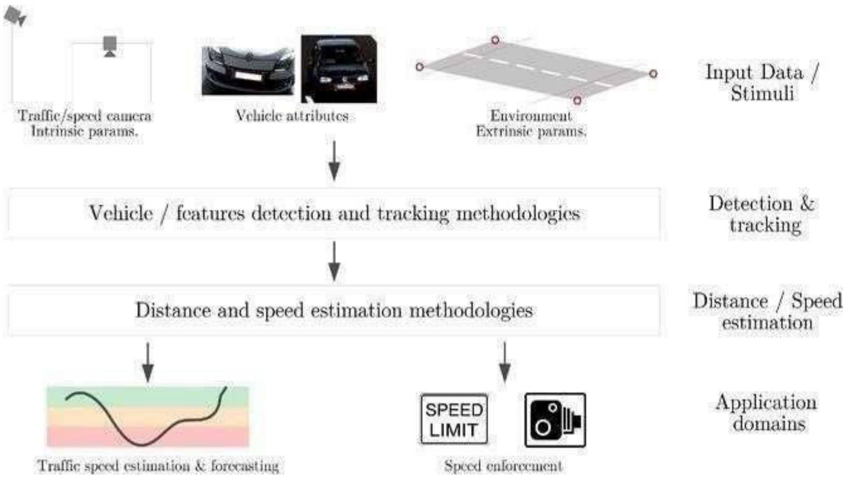

Fig2.1: Vision Based Speed Estimation

Omar Bourja, Abdelilah Maach, aYahya Zennayi, abFrançois Bourzeix, bTimothée Guerinb et al[14] Speed Estimation Using Simple Line. Calculating speed of vehicles in a real time by processing just a single pixel line. Allow reducing cost of products installed on road. License plate images cannot be captured with only single component, camera.

Cheng-Jian Lin, Shiou-Yun Jeng, and Hong-Wei Lioa et al[15] Detection Zone & YOLO.GMM. A real time traffic monitoring system based on virtual detection zone. Distance time travelled by vehicle to estimate speed. Limitation occur due to environment changes, different vehicle features and low detection speed.[15]

Jongsub Yu and Hyukdoo Choi et al [16] YOLO MDE: Object Detection with Monocular Depth Estimation. A new approach based on stereo pairs of images to perform regional detection was proposed two different architectures. Adapting different object detection architecture efficient DEE. Predicting complex output compositions leads a model to have generally low performances [16].

Yeonn Lee and Byungyog You et al [17]. Identifying obstacles around vehicles using sensor data FSD algorithm. Frass space studying is not only for autonomous vehicle but also driving & parking of an aircraft. It can be complex to conduct research in generating a path in real time for an autonomous vehicle driving.[17]

Seongu Kang, Jaei Hang and angsue Chung etal Computer vision and object detection using deep neural network (DNN) (001) object of interest groups that contain object with high frequency in specific domain. [18]

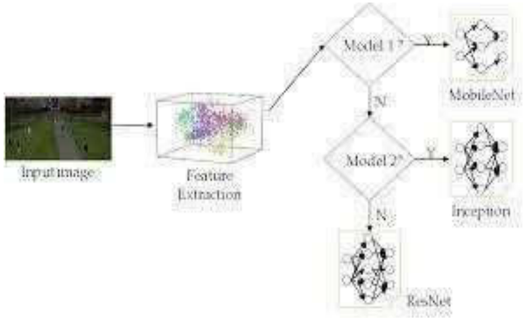

Fig 2.2: Example Of Model Selection.

Chaitanya Aher, Parth Jadhav, Dnyaneshwar Galphade, Ritesh Bansod4 More S.S et al

[19] Car Overspeed Detection Using Arduino UNO and IR sensor. Speed of the vehicle using IR sensor and display on LCD. System gives alert through buzzer if sensor detects over speed of vehicle. License plate cannot be detected for those who over speeding and violating traffic rules. [19]

Amir Khosravian, Abdollah Amirkhani, Masoud Masih-Tehrani Masoud Masih-Tehrani et al [20].State of the art architecture of faster RCNN Resnet 101 are trained by means of 100k database. Detection of traffic signs in chain & noise free images has been improved. Input images of convolutional neural network could be extremely noisy.[20]

Veronica Mattioli, Davide Alinovi, Riccardo Raheli et al [21]. Maximum

Likelihood speed estimation of moving object in video signals. Computer vision applications like ranging from human activities to object detection. Speed estimation algorithms. Maximum likelihood motion estimation algorithm. The proposed method shoes good & robust performance. Evaluated on set of real videos recordings & compared with block matching motion estimation algorithm.[21]

Ziqiang Qia Jianlin, Xin Songab, and Zhua Shuhua Li et al [22]. A cross frame post processing strategy for video object detection. Post-processing strategy CFPP & improve MAP of YOLOV4 on ImageNet video dataset. Designed framework can achieve better detection effect other strategies in case of high-speed moving object. Compare with still images video detection is more challenging due to occlusion, rare passes, high speed movements, frame loss etc. [22]

The literature review's conclusion is that by contrasting the various machine learning and deep learning algorithm datasets, improved classification may be ensured. Researchers have introduced numerous machine learning and deep learning algorithms, such as RCNN, RESNET101, YOLOv4, and Single shot detection, to address the issue. This survey includes a thorough breakdown of how various research approaches operate as well as their benefits and drawbacks. By comparing each method's qualities to the others in terms of particular performance criteria, the overall evaluation of the research effort is carried out. This study produced a superior research methodology that may be used to extract relevant information while taking context into consideration. Considering the great performance accuracy and is suitable detection of the car and over speeding is checked existing research methods.

Proposed System Architecture

This section describes the proposed system architecture for car overspeed detection using computer vision and deep learning.

Proposed System

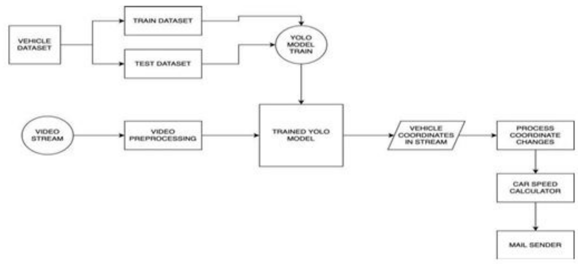

Fig 3.1 Proposed System Architecture

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The proposed system in this work, over speeding of Cars and report to the violation to the law enforcement official utilizing the Object Detection YOLO techniques based on Deep Learning and computer vision. If excessive speed is detected, photos of the specific carwill be taken travelling at speeds more than (80 km/h) and mailed to law enforcement. All of the automobiles speeds are being monitored in parallel, and over speeding is being looked into. Additionally, it highlights any unwelcome objects, such as people,horses, etc., in a large red box and makes an alert sound.

The proposed architecture has following modules:

Module 1: Datasets Collection

Module 2: Labeling/Annotation of the Dataset

Module 3: Training and Testing custom YOLO Model

Module 4: Speed Detection using Integration Model

Module 5: Mail Sender Module

Module1: Datasets Collection

Obtaining the correct data in the proper format is one of the most difficult machine learning challenges to address. Getting the proper data entails gathering or locating the information that is related to the results you want to forecast, i.e., information that includes a signal about important events. The data must be in line with the issue you're attempting to resolve. Images of kittens are not particularly helpful for creating a facial recognition system. A data scientist must confirm that the data is in line with the issue you are trying to solve. Your efforts to develop an AI solution must restart with data collecting if you lack the necessary information.

For machine learning to be effective, a solid training set is required. It takes time and domain-specific expertise on where and how to obtain pertinent data to gather the training set, which is a sizeable body of known data. Deep-learning nets are trained using the training set as a standard. Before they are let loose on data they have never seen before, they learn to rebuild that. At this point, skilled individuals must locate the appropriate raw data and convert it into a tensor—a numerical representation that the deep-learning system can comprehend. In a way, creating a training set is pre-pre-training. [20]

To accurately determine a car's speed, the system must first detect it from above. Pretrained Models are not trained to perform that task, hence a dataset that is appropriate for our goal of recognizing vehicles from a top perspective is required. "https://github.com/jwangjie/UAV-Vehicle-Detection-Dataset " is one of the datasets in use.There are hundreds of top-view pictures of vehicles in it. With the help of this dataset, we will train our Yolo model to recognize vehicles from above, and we'll then utilize it to determine each vehicle's speed separately.

Module2: Labeling/Annotation of Dataset

Data Annotation

Data annotation refers to the labelling of data. Although their applications can vary depending on the sector or use case, data annotation and data labelling are frequently used interchangeably. Labeled data emphasizes the qualities, attributes, or categories of the data that may be examined for trends that aid in target prediction. Frame-by-frame video labelling technologies, for instance, can be used to identify the locations of street signs, pedestrians, and other cars in computer vision for autonomous vehicles. Bounding boxes, semantic segmentation, landmarks, polygons, cuboids, and polylines are just a few examples of the various sorts of annotation approaches.

Labeling Process

The Open Labeling labelling tool, which is launched as a Python script from the location containing the input images directory and a text file with the names of all the necessary classes written in it, will be used to explain the image labelling process. This programmed can be used to annotate items in both movies and photos. The fundamentals of labelling any dataset are described in steps below.

Step1: Labeling images with Open Labeling tool.

Step2: Labeling videos with Open Labeling tool.

Step3: Using a pre-trained model's frozen inference network to automatically label images or videos.

Step 4: Additional dataset sources and tagging tools.

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Module3: Training and Testing custom YOLO Model

Training the Model: For training model, calculate gradients and alter the model's parameters value, but back propagation is not necessary during the testing or validation phases.

- Configure the Code
- Obtain the Data
- Create a YOLO v5 format version of the annotations.
- Annotation format for YOLO v5.
- Analyzing the annotations
- Options for Dataset Partitioning Training
- Data Hyper-parameter in the Config File Config File Unique Network Design
- Inference Model Training
- mAP calculation using test dataset.

Create a YOLO v5 format version of the annotations: Converting annotations into the YOLO v5-required format. Annotations for object detection datasets come in a wide range of formats. The dataset downloaded has annotations in the PASCAL VOC XML format, which is a pretty common format. Since this is a widely used format, conversion tools are available online. The annotation used by the PASCAL VOC format is stored in XML files where different attributes are denoted by tags. Examine a file that contains an annotation.

Define the locations of the train, val, and test as well as the names andnumber (nc) of the classes. To begin with the smallest of the pretrained models, yolo5s, in order to keep things straightforward and prevent overfitting because the dataset is small and there aren't many items per image. Continue to train for 100 epochs with a batch size of 32- and 640- pixels wide images. Having trouble remembering the model

- Reduce the batch size.
- Use a more compact network
- Use a more compact image size
- Of course, all of the aforementioned factors could affect the performance.
- Making the compromise is a design choice. Depending on the circumstances, you might also wish to choose a larger GPU instance.

Module 4: Speed Detection using Integration Model

Speed Detection: This work is intriguing, largely because of the camera. The frame flickers when using this camera. This means that cannot convert standard pixel distance travelled to Km/h mapping because the centroid of the bounding box likewise randomly flickers with each frame. Hence, this novel approach: SPEED INTERVALS OF 4 LINES.

This approach rests on the following presumptions

- Aware of the posted speed restriction for the road in the video.
- At least one car is moving at the posted limit of speed.

Determine the shortest amount of time for any car to cross these two lines while travelling in the same direction (This car will be moving at the speed limit). Once the minimal amount of time needed for an automobile to pass these two lines has been determined, the remaining cars' speeds can be determined using the straightforward formula speed=distance/time. [While not perfect, this would undoubtedly be far more accurate than the pixel mapping method].

Cars travelling in each lane will be detected with a bounding box named car. If any car over speeds (>80 km/hr) then an alert comes saying "!!! OVERSPEED VIOLATION DETECTED AT LANE1". **Speed is calculated using the formula:**

SPEED=DISTANCE/TIME km/hr

If any unwanted objects are seen like a person, horse then an alert will be raised with highlighted red box and giving a alert sound.

Module 5: Mail Sender Module

This module sends the mail about the car over speed to respective authority. The respective authority can take necessary measures to avoid accidents.

Implementation & Results

Section 4 presents, "Implementation" describing about Dataset Collection, Data Analysis and Data Preprocessing, Data Visualization and Feature Selection, Data Splitting, Model Building.

Collecting Our Training Images: In order to get your object detector off the ground, you need to first collect training images.

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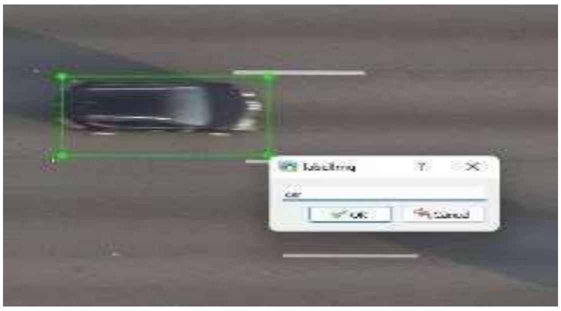
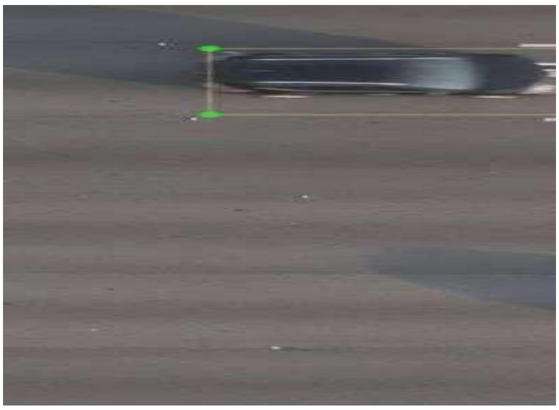
Fig : 4.1 : Collecting Training Images

Annotating Our Training Images

To train our object detector, need to supervise its learning with bounding box annotations. Draw a box around each object that we want the detector to see and label each box with the object class that we would like the detector to predict. This is shown in the figure below.





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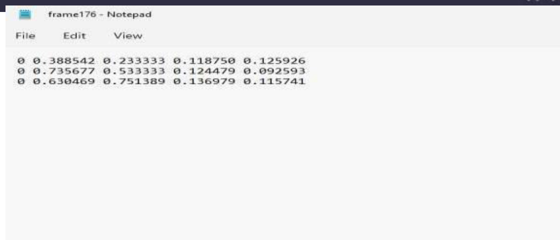
frame176 - Notepad
File Edit View
0 0.388542 0.233333 0.118750 0.125926
0 0.735677 0.533333 0.124479 0.092593
0 0.630469 0.751389 0.136979 0.115741

Fig 4.2 Annotating Our Training Images

To start off with YOLOv5 first clone the YOLOv5 repository and install dependencies. This will set up our programming environment to be ready to running object detection training and inference commands. Then, take a look at our training environment provided for free from Google Colab.

- Training Custom YOLOv5 Detector
- Evaluate Custom YOLOv5 Detector Performance
- Run YOLOv5 Inference on Test Images Export Saved YOLOv5 Weights for Future

Use simple speed=distance/time formula This OpenCV car speed estimation work assumes the camera is aimed perpendicular to the road. Timestamps of a vehicle are collected at waypoints ABCD or DCBA. From there, our speed = distance / time equation is put to use to calculate 3 speeds among the 4 waypoints. Speeds are averaged together and converted to km/hr and miles/hr.

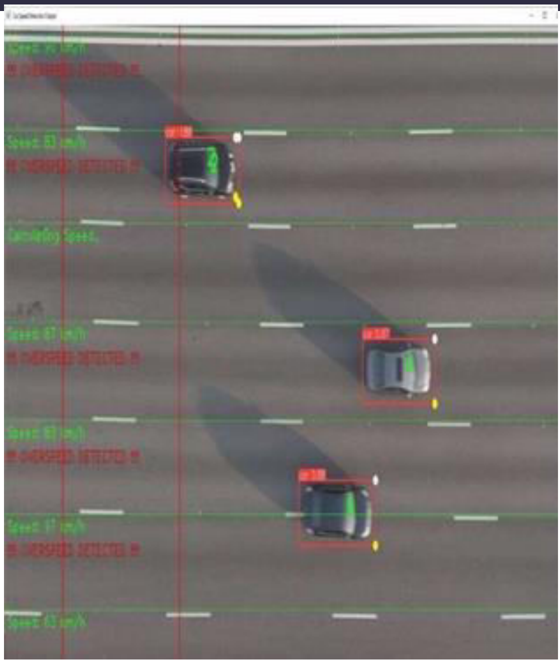

Fig 4.3: Screenshot of Output 1

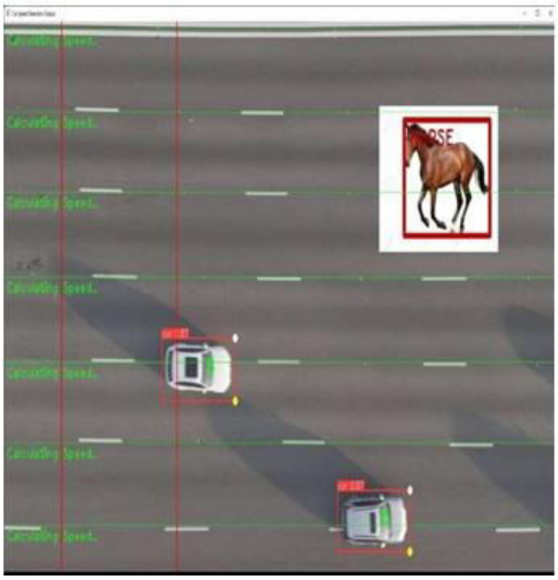

Fig 4.4: Screenshot of Output 2

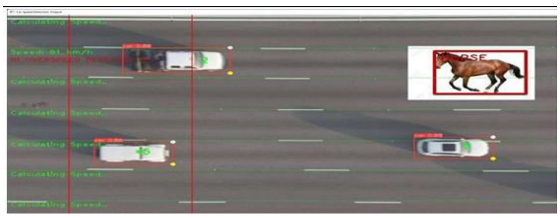

Fig 4.5: Screenshot of Output 3

The above figure 4.3,4.4,4.5 depict the experimental results of car overspeed. The figure indicates the over speed detection of the car.

Results and Accuracy: YOLO v5 is incredibly portable and simple to use. YOLO v5 performs well, infers swiftly, and trains quickly. The experimental results show that YOLOv5 achieves 99.3% accuracy.

Conclusion & Future Work

Through the use of computer vision and the Yolov5 object detection algorithm, this work seeks to identify over speeding in cars and report the infraction to a law enforcement official. This technology would offer a simple method to track the speeds of all vehicles. A snapshot of the exact car will be collected and sent to law police if excessive speed is observed. built on the Python platform. In this study, over speeding in cars is detected using computer vision and the YOLO method, which is based on deep learning, and the offence is reported to the police. If excessive speed is observed, pictures of the particular vehicle will be taken. These devices are capable of continuous operation and practically eliminate manual labour. Using the training data that is available, this system is able to identify vehicle and its type.

Yolo is the most appropriate model because it can add more categories. For photographs taken during the day, and able to attain an accuracy of about 90%, while accuracy drops throughout the night. This can be enhanced by increasing the number of night-time photographs in the training set. With the help of our system, it is feasible to apprehend speeders in places without police presence.

Future-work, can build another camera facing lower side of the road, which can detect license plate of corresponding over speeding cars. The captured licensed plate can be charged for violating traffic rules. To create a generalized model with an attention-based network topology that may be used across various areas.

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