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AN APPROACH FOR VEHICLE TARGET DETECTION USING YOLO V3

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Abstract : In recent years, autonomous driving has become the key development and transformation direction of the traditional automobile industry. In the complex driving environment, automatic driving requires extremely high accuracy and high speed of detection, otherwise, it is easy to lead to traffic accident tragedy.

Given the low accuracy of traditional car target detection methods in complex scenes, combined with the current hot development of deep learning, this project applies the YOLO V3 algorithm framework to achieve car target detection. In this project, we will detect cars moving on the road using deep learning techniques. Both detection and tracking vehicles such as cars, trucks, motorcycles, etc are challenging problems, especially in complex real-world scenes that commonly involve multiple vehicles, complicated occlusions, and cluttered or even moving backgrounds. This project mainly focuses on car detection can locate cars even in complex street scenes and it can apply to other vehicles by including other datasets and their class names, but false positives have remained frequent. The approximate articulation of each car is detected using YOLO V3 pretrained detector network and untrained network and their average precision and confidence scores are compared among them. The vehicle dataset having cars is used here.

Software Tools: MATLAB 2021a or Above

Keywords — Object Detection, Convolutional Neural Network, Deep Learning, YOLO V3

1.INTRODUCTION

During automatic driving, the composite background and mutual blockage between multiple targets obstruct the correct judgment of the detector and miss detection. When a closerange target is captured again, the vehicle may not be able to respond in time and cause an accident. Therefore, in the application of auxiliary systems, a model that can accurately identify partially obstructed targets in complex backgrounds and perform short-term tracking and early warning of completely obstructed objects is required. The method to improve detection accuracy while supporting real-time operations based on YOLO V3 and realizing real-time warnings for those objects that are completely blocked.

Object detection is a technique in computer vision that involves the detection of various objects in digital images or videos. Some of the objects detected include people, cars, chairs, stones, buildings, vans, trucks, persons, traffic lights and animals. YOLO is an algorithm technique that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect vehicles, traffic signals, people, parking meters, and animals.

This introduces the YOLO algorithm for object detection and explains how it works. It also highlights some of its reallife applications. In comparison to object recognition algorithms, a detection algorithm predicts class labels and detects object locations. So, It not only classifies the image into a category but can also detect multiple Objects within an Image. This algorithm applies a single neural network to the entire image. It means that this Network divides the image into regions and predicts bounding boxes and probabilities for each area. The predicted probabilities weights these bounding boxes.

2.LITERATURE SURVEY

1.Sipan Masoud Mustafa – In NEU 2019, Vehicle Detection And Tracking Using Machine Learning Techniques are developed. With rapid development in car and traffic industries, the same, the growth of population in the world brought the need for different tools and techniques especially technology solutions to manage traffic in cities and populated areas. Meanwhile, object detection can be used in various fields to help humans live easily with comfort and make the world a better place to live in. Object detection can be used in industries, digitized cities, government, research, academia, environment, etc. Vehicle detection and tracking are part of the object detection which is used in traffic, cities, etc. the importance of the topic is growing larger. That being said this research is intended to contribute to the improvement of the accuracy of these algorithms and models via available techniques and tools. This Thesis developed two classifier algorithms to detect and track vehicles. These two models are Support Vector Machine (SVM) and Decision Tree. The algorithm selection was based on various studies in the literature review. The most suggested models by other researchers were these two models. Therefore, the author decided to choose these models and compare them to specify the best model among these two. Many techniques have been deployed to increase the accuracy level and to make the best result possible. The models are trained with the same dataset and the evaluation result showed that SVM performs better than Decision Tree. The result of the models has presented both in image and video formats which the system detects the cars that are passing from the screen and tracks them as well.

2.Chaochao Meng, Hong Bao, and Yan Ma: In CISAT 2020, The vehicle detection system is compared based on different algorithms. Vehicle detection-based computer vision is the essential algorithm in autonomous driving, which aims at identifying which locate vehicles by digital images or videos. The basic idea of vehicle detection is detecting "blocks," which reflect the position of the vehicle in images or videos. Besides, this discusses 3D vehicle detection algorithms based on stereo perception, which originated from advanced planar vehicle detection perception. Finally, this paper summarizes the vehicle detection algorithms in recent years in terms of the difference between the feature extraction approach and the perceived results. It proposes hypotheses for further in-depth study of the vehicle detection algorithms. Here Faster R-CNN, HaBP, HoSVM, TD_HaBoost, SSD, Retina Net, and YOLO V3 Algorithms are compared to detect the vehicles.

3.EXISTING METHOD

Region-Based Tracking Methods

In these methods, the regions of the moving objects (blobs) are tracked and used for tracking the vehicles. These regions are segmented from the subtracting process between the input frame image and the prior stored background image.

A proposed research paper introduced a model-based automobile recognizing, tracking, and classification which is efficiently working under most conditions. The model provided position and speed knowledge for each vehicle as long as it is visible, in addition, this model worked on a series of traffic scenes recorded by a stable camera for automobile monocular images. The processing algorithms of this model are represented in three levels: raw images, region level, and vehicle level. A traffic criterion's assessment such as vehicle numbering and classification involving with a suggested traffic observation scheme. The proposed scheme demonstrated in its work the feature ratio and density to classify vehicles, also, it used the geometric traits to eliminate the false regions and for a more accurate segmentation process is used the shades elimination algorithm. Finally, this scheme was experimented with under three different lighting video streams is shown in below Figure 1.

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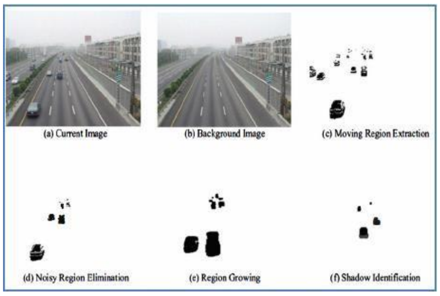

Figure 1 : Detection and tracking of moving regions

YOLO V2 Model

Aiming at the problem of a large number of model parameters and poor performance on the small-size object of the YOLOv2 object detection model, an improved YOLOv2 object detection model is proposed. Firstly, it improves the YOLOv2 by introducing depth-wise separable convolution to replace the standard convolution used in the YOLOv2. The number of parameters on the convolution layer is reduced by 78.83%. Secondly, the Feature Pyramid Network is introduced into the detection model to replace the YOLOv2's image feature fusion method and perform object detection tasks on multiscale image features. As a result, the ability of the improved YOLOv2 detection model to detect the small-size object is enhanced. Experimental results on PASCAL VOC 2007 datasets show that the improved YOLOv2 has a competitive accuracy to YOLOv2 and better performance on the small-size object.

4.PROPOSED METHOD

In our proposed method, we detect cars moving on roads using YOLO V3 Algorithm and the deep convolutional neural network used here is SqueezeNet. The vehicle dataset containing around 300 images is used in the pretrained network. In this dataset, 90 percent of images are used for training and 10 percent are used for testing.

In this Proposed system, we used SqueezeNet neural network as a backbone of the project. It contains 18 layers which is shown in below Figure 2.

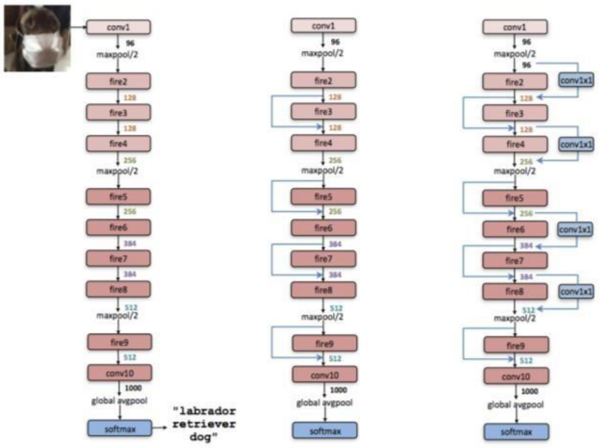

Figure 2 : Architectural view of SqueezeNet

5.NUMBER OF MODULES

Preprocessing: In this technique, the input image is preprocessed based on filtering and windowing techniques. The 1x1 and 3x3 convolutional filters are used.

Feature extraction: After preprocessing, the features are extracted from the given input image. Each class has different features so that the objects are identified precisely.

Image classification: In feature extraction, the features of the objects such as cars, bicycles, trucks, vans, people, traffic lights, etc. So that the detection of the objects is classified in this approach. The training data and testing data are compared to detect the objects and the average precision, confidence score, and mean IoU values.

6.RESULTS

The Simulation results of our proposed system are shown below figures. The Figure 3, Figure 4, Figure 5, Figure 6 are classified as data augmented image, annotated image, detected image, and the learning rate curve. For different Epochs values, we will display the above figures. Here in our project, we use both pre-trained networks and untrained networks to obtain the results and to compare the average precision and confidence score values.

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The results of our project are classified into 2 types:

1. Pre-Trained Network

2. Untrained Network

For an Untrained Network, we use different Epoch values to improve the Average Precision and Confidence score.

Pre-Trained Network :

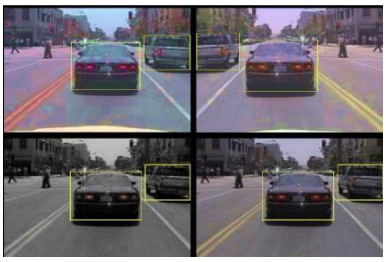

Figure 3 : Data Augmented Image

Figure 4 : Annotated Image

Figure 5 : Detected Image

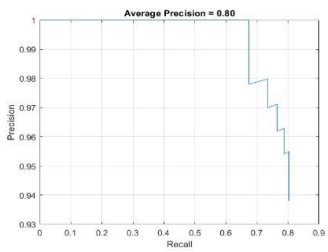

Figure 6 : Precision Curve

Untrained Network :

In training, we provide a number of epochs to 100 so that average precision, confidence score and mean IoU values are evaluated.

The Outputs for 100 Epochs are shown below in Figure 7, Figure 8, Figure 9 :

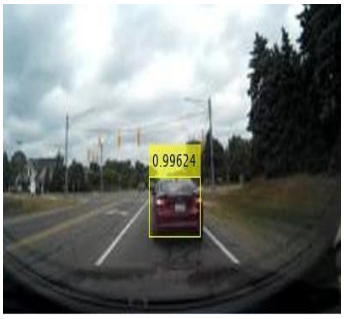

Figure 7 : Detected Image

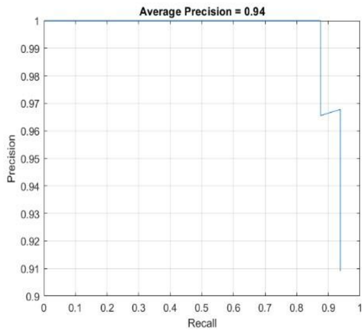

Figure 8 : Precision Curve

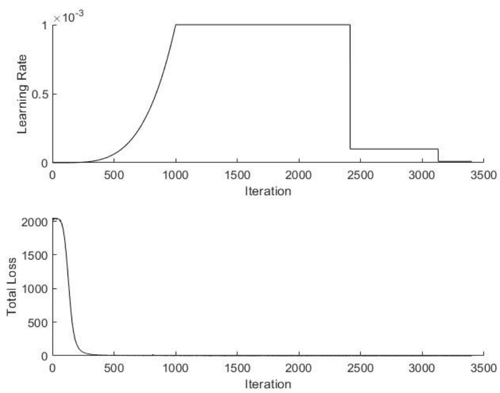

Figure 9 : Learning rate and Loss curve

NETWORK	PRECISION	CONFIDENCE SCORE	MEAN IOU
PRE-TRAINED	0.80	0.95191	0.8515
UN TRAINED	0.94	0.99624	0.8515

Table 1 : Result analysis of pretrained and trained networks

7.CONCLUSION

The traditional car detection method has low average precision values, confidence scores, and mean IoU values. Hence, target detection using YOLO V3 has been presented and evaluated. The performance of this system is gradually improved for the trained and untrained network.

The project "Vehicle Target Detection Using YOLO V3" has been verified by using MATLAB software. After verifying the results, we said that this approach is the best technique compared to previous traditional vehicle detection methods based on performance such as average precision, confidence score, and mean IoU values.

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