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Advancement of Driverless Cars and Heavy Vehicles using Artificial Intelligence (Object Detection)

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Abstract: ***Autonomous car or driverless car or Self driving car, if we put in a simpler language is a car which can drive without any human controlling it from inside. It is going to be a revolutionary change in the world of technology. Autonomous vehicle has many external sensors connected to it. By these external sensors it perceived or sense the environment and make decision accordingly. We refer these external sensors as Advance control Systems. Autonomous cars have various advantages over manual cars like fewer traffic accident, smart decision making just to name a few. So, the question is why driverless cars still not succeeded yet. The answer of the question lays on threats like cybercrime, or failure of the software and importantly how they are going to coup up with the manual cars running on roads because fully automation era is still a long road to go. Their main aim is to first overcome these barriers. We have some recent technologies like Anti braking system (ABS), cruise control that can be referred as early stage development for autonomous vehicle. IN this article we going to discuss about the detection codes which will make use of perceived environment given by sensors as input in return will give vehicle information about different type of objects present on the roads. We firmly believe that autonomous vehicle will be reality soon as soon as they overcome barriers of it.***

Index Terms: Object Detection, Autonomous car, Image Processing, YOLO

I. INTRODUCTION

Autonomous cars use various kinds of technologies to operate in an efficient manner. They are built with GPS sensing knowledge to help with navigation. Use of different types of sensors and other tools helps to avoid collisions. By use of technologies such as augmented reality, vehicle displays information to drivers in new and innovative ways.
Real-time video object detection plays a major role in autonomous cars for car detection, obstacles detection and many more applications that helps an Autonomous Vehicle to work in an efficient manner. Autonomous vehicles make use of different types of sensors together to decide on control of vehicle based on condition changes such as steering or applying thrust in case of emergency. However, detecting objects in a video stream frame-by-frame is difficult when delay of milliseconds can lead to collision

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In country like India more no of people are killed in road accidents than terror attacks Implementation of autonomation vehicles will also reduce number of accidents per year around the globe.
The basic requirements for an autonomous vehicle to work are cameras, sensory circuits like radar laser etc. The autonomous vehicles make use of these components to interpret the world around in technical term it's called creating DIGITAL MAP.
That's using computer vision, a filed of machine learning and artificial intelligence. Very first step toward implementing this is object detection. Object detection is basically divided into two steps. First one being, image classification and second one being image localization. Image classification determines the type of objects present in an image while localization of image provides the almost exact location of these objects in the images (in bounding boxes). Here we make us of convolutional neural networks(CNN), they provide operation of their own on an image in order to detect them. Here we will be using an algorithm or model names YOLO which stands for you look only once, as our CNN will run only once through an image.

II. RELATED WORKS

To stay updated with current technological researches and modern-day techniques in Object detection, a literature survey has been carried out exploring new techniques and approach. Towards AVs and their related Methods Early attempts at solving computer vision includes use of handcrafted. Features like Haar Wavelets [8][4]. As we mentioned in section [1] of this paper that Av(s) needs to make their own decision based on environment perceived by them so object tracking plays a crucial part[8]. They also needs some assistance in decision making, The new CS-A3C algorithm is a highly efficient path planning system [3]. Pedestrian detection which is a crucial part in running of AVs on road[4] . Contours in an image can be found as mentioned in[10] by using Open CV which helps in determining shape analysis, finding the size of the object of interest, and object detection. Collection of Data from virtual Environment [9] and Testing it in different Weather Conditions which is a key role in success of AVs on Road and a key component in development of our own model which is based on popular R-CNN algorithm .Jian-Gang Wang worked upon traffic light detection by there HDR and YOLOv2 [7] methods and resulted in the improvement in the precision rate.

III. PROPOSED SYSTEM

The main objective of this system is to train our own cnn model and testing hundreds of images of different objects in our object detection algorithms.The specific objectives are:

1. To basically feed hundreds of different images of different objects that mostly a self-driving car will see like traffic lights, people, footpaths, fellow vehicles and many more.
2. Testing images using YOLO algorithm.

IV. THE PROPOSED SYSTEM

A. Computer vision:

An autonomous vehicle must drive its way to its desired destination without any help of external means , it has to it safely by avoiding any obstacles. As discussed autonomous vechiles make use sensors like radar , lidars to perceives its surrounding to make a digital map of the surrounding to make a way on its own.

B. Object detection:

Object detection is technique that falls under computer vision that is used to detect or locate the instance of an object in images or videos . Object detection typically leverages Machine learning artificial intelligence.

Advanced driver assistance system(ADAS) uses object detection algorithms to perform operations such as detecting road lanes, pedestrian detection, detecting traffic signals and take decisions accordingly. Object detection technology can also be used in video surveillance and image processing.

C. Preprocessing data:

As discussed in section 2 we made our own convolutional neural network to work with. We will be using it with YOLO algorithm. For implementing computer vision in our model, we will be using IMAGEAI, a python computer visions library used for object detection and processing. We used Fig(1) as a sample image to demonstrate with

Fig (1) Sample image used

Fig (2): Gridded image

YOLO looks through the image only once, what the algorithm does it that it goes through the image and it divides it into an AXA grid. Fig(2) shows image grid of sample image (3X3)

Fig(3): Processed Image

After dividing yolo implements image classification and localization on each grid and predicts their bounding boxes and probabilities[Table 1]. Here Colourful square frames in fig (2) are bounding boxes while the written text above them is probability count of object appearing in each boxes

In order to train our model, we passed label data to our model. Model divide image into 3X3 grid fig (2), each grid is treated as class now there are three classes form which object is to be classified. Fig (3) is the processed image from model. From the image we can see classes are pedestrians, cars, footpath respectively for each grid it will make a vector

Table 1 Elements of the Grid

Pc	Probability count
Bx By Bz	Bounding boxes
c	Classes

In grid for each object there will be a label for each vector.

There is also a term called “CONFIDENCE”, we define it as Pc*IOU pred,truth). If there is no object in grid score will be zero otherwise it will equal Intersection over union score. The main thing YOLO do is to build a CNN network to predict a (7, 7, 30) tensor box. It uses a CNN network to reduce the dimension to 7×7.

D. Loss functions:

Classification loss

When an object is detected ,loss at each grid of class probabilities of each class

$$\sum_{i=0}^{s^2} \left(1_i^{obj}\right) \sum_{c \in classes}^{n} (p_i(c) - \hat{p}_i(c))^2$$

Localization loss

Measures the error at each predicted bounding box. (Only count the box responsible for detecting object)

$$\sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left(C_i - \hat{C}_i\right)^2$$

Confidence loss

Measures the degree of how much an object is present in the boundary box

$$\lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[(x_i - \hat{x}_i)^2 + (y_i - \hat{y}_i)^2 \right]$$

$$+ \lambda_{\text{coord}} \sum_{i=0}^{S^2} \sum_{j=0}^{B} \mathbb{1}_{ij}^{\text{obj}} \left[\left(\sqrt{w_i} - \sqrt{\hat{w}_i} \right)^2 + \left(\sqrt{h_i} - \sqrt{\hat{h}_i} \right)^2 \right]$$

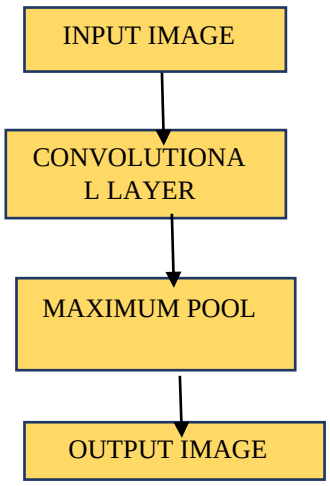
Loss

Final loss is calculated by summing up all the mentioned three types of looses :

{Confidence loss}+

{Localization loss}+{Classification loss}

Below is architecture of YOLO: -



Fig(4) Basic architecture of YOLO

A-1 IMAGEAI:

ImageAI is a very popular and widely used python library which helps us creating deep learning and object detection prograns in a very few steps and short period of time.

1. Install Imageai library in python 3.7.x
2. From Imageai sub directory “DETECTION” import ObjectDetection file
3. Import os into program
4. Get execution path from function getcwd () {current word directory}
5. Declare a variable named Detector which will be handling our object detection in this case
6. Set model type as YOLOv3
7. Set model path
8. Start the detection
9. Save the source code, object model, along with the image you want to analyse in same directory
10. After completion of detection, a new image will be store in the same directory as of your code with description of each object along with their probability.

V. RESULT AND DISCUSSION

After successful training of hundreds of images and objects more than satisfactory accuracy is done for the object detection using yolo algorithm. The loss functions cited above gives us idea about errors in detection of our input data set which involves images, objects and many more things. After processing the input image in algorithm we get output image which is divided into several grids with each grid representing a object. With processed image as output which corresponds to high accuracy object detection we can say that the proposed model is more efficient comparatively.

VI. CONCLUSION

As Artificial Intelligence is becoming the hot topic in today’s world, taking that into consideration that AI not only has high updation to come but it is also the future. Artificial Intelligence work and advancement is increasing day by day and the work rate will also increase. Object detection is a AI based algorithm which will help the system to understand the surrounding in a better way.

This algorithm will increase the rate as well as well as the working efficiency with the probability criteria gives it a upper hand on any other algorithm. As it’s a very primary level of detection we are showing in the paper we gather our processing data that is different images of different type of object you often find on road . In the primary stage , we trained our model using these images and in secondary stage we made an object detection code using our CNN model.

VII. FUTURE WORK

In future we can make smart roads for the upcoming driverless cars. These Smart roads must be built with using all concepts of Artificial intelligence and object detection algorithms. These smart roads not only increases security but safety of the passenger as well. With all advancement in autonoumous cars it is also necessary that a well planned environment must be created that will enhance the chances of autonomous vehicles to come up on Roads in upcoming years and giving a user a wonderful experience.

These roads must only used for AI based cars to get high level output and also to improve safety. These roads not only will increase work rate but also the connection between two cars and understanding between them also gets better and lowers the risk. We consider training our model in such a way it will become more effective like feeding them with more images so that it can be more comparable to real world scenarios

REFERENCES

1. Sibashis Parida,Matthias Franz,Sylvester Abanteriba,Sai Mallavarapu“Autonomous Driving Cars:Future Prospects,Obstacles,User Accepatance and Public Opinion(2019)”.
2. Gargi Desai ,Vishal Ambre,Sagar Jhakaria,Snehal Sherkhane “Smart Road Surviellance Using Image Processing(2019)”.
3. Sriram Subramanium,Jaspreet Singh Benyamin Ghojogh,Mark Crowley” Decision Assist for Self-Driving Cars(2018)”.
4. Zhilu Chen,Xinming Huang” Pedestrian Detection for Autonomus Vehicle Using Multi-spectral Cameras(2019).

5. Ruturaj Kulakarni,Shruti Dhavalikar Sonal Bangar" Traffic Light Detection and Recognition for Self Driving Cars using Deep Learning(2018)".
6. Wenhao Zong, Changzhu Zhang,Zhuping Wang,Jin Zhu,Qijun Chen" Architecture Design and Implementation of Autonomous Vehicle(2018).
7. Jian-Gang Wang,Lu-Bing zhou" Traffic Light Recognition With High Dynamic Range Imaging and Deep Learning(2018)".
8. Nakul Agarwal,Chang-Wei Chiang, Abhishek Sharma"A study on Computer Vision Techniques for Self driving Cars(2019)".
9. Juntae Kim,Geun Young Lim,Youngi Kim,Bokyeong Kim,Changseok Bae" Deep Learning Algorithm using Virtual Environment Data for Self Driving Cars(2019)".
10. Finding Contours in Your Image, OpenCV Tutorials. https://www.dezeen.com/tag/driverless-vehicles/
11. https://skymind.ai/wiki/autonomous-vehicle
12. J. Leonard, J. How, S. Teller, M. Berger, S. Campbell, G. Fiore, L. Fletcher, E. Frazzoli, A. Huang, S. Karaman et al., "A perceptiondriven autonomous urban vehicle," Journal of Field Robotics, vol. 25
13. J. Xin, C. Wang, Z. Zhang, and N. Zheng, "China future challenge: Beyond the intelligent vehicle," IEEE Intell. Transp. Syst. Soc. Newslett., vol. 16, no. 2, pp. 8–10, 2019.
14. X. Li, Z. Sun, D. Cao, Z. He, and Q. Zhu, "Real-time trajectory planning for autonomous urban driving: Framework, algorithms, and verifications," IEEE/ASME Transactions on Mechatronics, vol. 21, no. 2, pp. 740–753, 2018.
15. M. R. Endsley, "Autonomous driving systems: A preliminary naturalistic study of the tesla model s," Journal of Cognitive Engineering and Decision Making, vol. 11, no. 3, pp. 225–238, 2017.

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