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Autonomous Car and Lane Detection

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***Abstract*—*In This Paper, Simulation of autonomous car using Convolutional Neural Network(CNN) and Deep Neural Network(DNN's) is proposed. Real-time Lane is detected using various mathematical computation and advanced libraries of Python are used. Libraries like Numpy, Pandas, Keras and Computer Vision are used in this Project. As there are various stages of autonomy of cars, This project demonstrate the higher level of autonomous car. Which include self driving steering, along with Traffic Sign Detection, and acceleration of car with high accuracy. Open CV i.e Computer Vision Library is used to play with real-time images captured while driving a car.*

Key words: Convolutional Neural Network, Self Driving Car, Computer Vision.

I. INTRODUCTION

Automation in automobiles saves lot of human efforts and make more convenient. The Car which has ability to travel from one source to another destination can be referred as autonomous car or Self-driving car. In self Driving Car driver along with the travellers can sit back, relax and enjoy the ride. Artificial Intelligence can makes this possible by automating lot of manual work by taking input from human knowledge or skills. AI supports various advance libraries which are capable of detecting nearby activities using various advance sensors, cameras, GPS, Radar, LIDAR, etc. Through Various machine learning technique it is possible for us to train the cars in such a way that it can able to take decision of changing lanes, Traffic Sign Identification and Identification of various road symbol.

Literature Review

"SELF DRIVING CAR USING DEEP Q-LEARNING" Akhilesh Thete, Chinmay Toley, Shreyas Inamdar- In this research paper they had demonstrated the effectiveness of navigating autonomous vehicles using reinforcement learning methods. They also mention the model used and implementation planning. With deep Q learning they demonstate how to program AI devices.[1]

"Self-Driving Car based on Image Processing with Machine Learning" Prof. Shilpa Satre, Vinayak Bhat, Pranay Gadhave, Nikhil Jadhav – They used dummy car model to detect path and varios object around the environment. They used IOT tools to detect object. Lane detection is also performed using Image processing.[2]

"Self-Driving Cars: Automation Testing Using Udacity Simulator" Shahzeb Ali – This paper demonstrate the autonomous car using UDACITY simulator. They downloaded UDACITY Simulator where they use built in simulator to train Car. And data is collected in Excel sheet which is further use to train CNN model.[3]

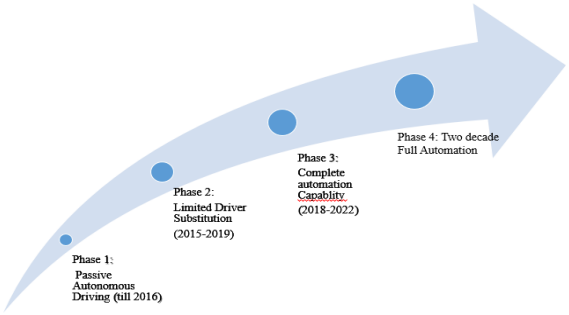
"Self Driving Car Using Machine Learning" Tej Kurani, Nidhip Kathiriya, Uday Mistry, Prof. Lukesh Kadu, Prof. Harish Motekar - The car was trained in various track combinations. That is a straight, curved, straight and curved combination, etc.[4]

"Open CV based autonomous RC Car", B,Sabith, K.Akila, S,Krishna Kumar, D.Mohan.– "The evidence from neuroscience suggest that a prioritization based on episodic return rather than expected learning progress may be useful.[5]

"A Study on Google Driverless Car" K Ismail Ashish , Assistant Prof. Kavitha S.N. – Gave over all review of google driverless car. Fully describe the use of sensors in driverless car Including Introduction, advantage Disadvantage.[6]

"Autonomous Vehicles: Levels, Technologies, Impacts and Concerns" Mohsin Raza – In this research paper they have demonstrated the Status, Level of automation and current research of autonomous Vehicles.[7]

Current Status and Research:



Problem Statement:

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It has been long era people are using non-autonomous cars and other transportation vehicles. Which prone to lot of accidents due to inaccuracy in driving. People are involving in other activities while driving the vehicles like attending phone calls, watching movies in infotenmaint system along with making Instagram reels etc. which causes distraction which majorly cause heavy accidents in which people loose life as well as wealth.

People with disabilities, like the handicap or blind unable to drive a car by their own, hence it will be a challenge for them to quickly move from one place to another, either they need to take help from others else they cant able to take initiative by their own.

As the technology is growing and with the help of AI i.e Artificial Intelligence and Machine learning it is possible for us to make automous car. Which is capable to move from one place to another without any human intraction. As this autonomous car can help to avoid the cost of maintenance of car after crashes as well as medical expenses. As we are discussing about all type of autonomous car, if we implement the same concept on public transport this will save lot of money as well as autonomous car can contribute a lot to save environment.

System Architecture :

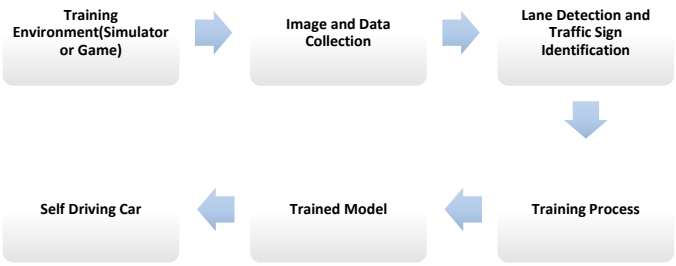

Fig: Block Diagram

System Operation:

The system starts with the selection of the environment. Either we can use real time environment or virtual environment. For this current research we used virtual environment i.e simulator. Udacity simulator supports the training and autonomous mode of driving the car. Initially as a part of training we need to drive a car in training mode in order to collect all images and data required for training the autonomous car. The same simulator allows us to collect the data like images from all angles as well as the variation of steering angles in the form of integer.

Lane detection can be done by applying various mathematical computation to the image as well as by doing image Augmentation technique. Image augmentation technique inclue image zooming, Image flipping, Image Panning, Image Brightness, Image Resize, Image Blur, etc. After that traffic sign Identification need to be done by adding sign board images in Convolutional Neural Network.

After Collection of data like images steering angles the model is to be trained using behavioral cloning. After training of model with higher epoch we can connect our model with the simulation by client server scripts.

Data Collection (Training Mode) :

To train the model data need to be collected. This data is extracted from various sources like Internet, Traffic sign websites, and simulators. We are using simulator which can able to collect data in training mode only. Udacity Simulator is open source tool which can be easily download from internet. In this Simulator we have two mode one is autonomous mode and another one in training mode. Maximum data is collected in training mode only, in which we need to drive car manually by using up, down, left and right keys of keyboard. The data is Collected in the form of integer in dedicated excel file which having column for left steering angle, right steering angle, acceleration and break. Data related to traffic signs and road signs are gathered from various internet web applications and road data is collected through car front angle camera.

Lane Detection:

The base thing of autonomous car is lane detection. When we look the real world through our own eye, we constantly performing some computation and calculation about the road in our brain. In self-driving car road detection, signs detection, and object detection need to train to the car just like we do. For lane detection we are constantly passing mp4 video to the system in order to get real feeling of high speed running car. Lot of computation and image augmentation are done to the specific frame of the video. Hence as a result we can able to get exact expected path using display line function as shown in the image below.

```
cap = cv2.VideoCapture("test2.mp4")
while(cap.isOpened()):
    _, frame = cap.read()
    canny_image = canny(frame)
    cropped_image = region_of_intrest(canny_image)
    lines = cv2.HoughLinesP(cropped_image, 2, np.pi/180, 100, np.array([]
    average_lines = average_slope_intercept(frame,lines)
    line_image = display_lines(frame, average_lines)
    combo_image = cv2.addWeighted(frame, 0.8, line_image, 1,1)
    cv2.imshow('result', combo_image)
    if cv2.waitKey(1) == ord('q'):
        break
cap.release()
cv2.destroyAllWindows()
```

Traffic Signs Identification:

Traffic Signs Identification are done by training Convolutional Neural Network by amending traffic signs images in CNN model. Different traffic signs images are classified into different groups. Each groups have four to five same images of same traffic sign with different angles and visibility. Input of model is the image capture while driving the car and output will the class name as per the input. Hence in this way Traffic sign Identification can be done in autonomous car

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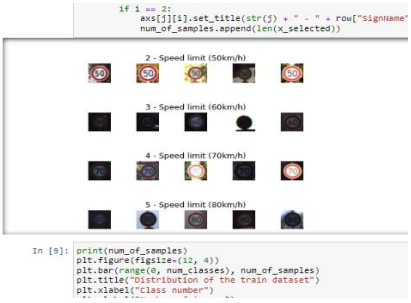

Trained Model:

The neural network i.e Convolutional Neural Network (CNN) will be trained to make steering angle prediction based on the lane detected by doing mathematical computation and Image augmentation. The data collected in .csv file and images collected through various web application are used to train the same model. Basically the behavior of trained model is copied to the car in order to get fully automated car. The vehicle is driven on the same track where the vehicle is trained.

Conclusion:

The approach of self-driving car and lane detection is discussed in this paper. A effective model was created to drive the car autonomously. The model for Image Identification i.e traffic sign Identification is also prepared with the help of neural network. And by cloning the existing trained model the autonomous car simulator has been successfully connected through client server script.

The model can be further improvised by implementing the same model in toy car or real cars. Few more advance sensors will be required to implement the same model with real-time vehicles.

References:

[1] “SELF DRIVING CAR USING DEEP Q-LEARNING” Akhilesh Thete, Chinmay Toley, Shreyas Inamdar

[2] “Self-Driving Car based on Image Processing with Machine Learning” Prof. Shilpa Satre, Vinayak Bhat, Pranay Gadhave, Nikhil Jadhav

[3] “Self-Driving Cars: Automation Testing Using Udacity Simulator” Shahzeb Ali

[4] “Self Driving Car Using Machine Learning” Tej Kurani, Nidhip Kathiriya, Uday Mistry, Prof. Lukesh Kadu, Prof. Harish Motekar]

[5] “Open CV based autonomous RC Car”, B,Sabith, K.Akila, S,Krishna Kumar, D.Mohan

[6] “A Study on Google Driverless Car” K Ismail Ashish , Assistant Prof. Kavitha S.N.

[7] “Autonomous Vehicles: Levels, Technologies, Impacts and Concerns” Mohsin Raza.