ISSN No. 0976-5697

Volume 11, Special Issue I, May 2020

International Journal of Advanced Research in Computer Science

CONFERENCE PAPER

Available Online at www.ijarcs.info

SELF-DRIVING CAR USING A SIMULATOR

Anmol Kumar
School of Computing and Information Technology
REVA University

B A Shivani
School of Computing and Information Technology
REVA University

Animesh Nath
School of Computing and Information Technology
REVA University

Arjun Singh
School of Computing and Information Technology
REVA University

Nikhil S Tengli
School of Computing and Information
Technology REVA University

Abstract : This paper focuses on the implementation, architecture and on-going design of a vehicle when it encounters with an object. The vehicle is driven, guided and controlled by utilizing an array of sensors and software. Many collision warning and avoidance systems were made known at the beginning of 21st century but automobiles won't necessarily be able to make judgment whether it is a child or an empty cardboard box which can be avoided. Collision can be avoided depending upon the interaction between the human and the car. Firstlyalgorithms were used to reach the destination. When a car encounters a collision, it naturally comes to a standstill or identifies the vehicle's next position or lets the vehicle go past it. There are two applications which are highlighted in this paper, one in which there is one route and the human driver takes control of the vehicle and the other one where the human does not interact with the vehicle. The results show that

Keywords: Training mode, Autonomous mode, ReLu activation function, CNN Algorithm

I. INTRODUCTION

A self-driving car, which is also known as an autonomous vehicle (AV), driverless car, robotic car, is a vehicle that has a capability ofsensing its environment and moving safely or navigate itself without any human input.[13]

The self-driving cars are able to detect or sense the environments with the help ofvarious techniques such as GPS, sensors, cameras, radar. Self-Driving cars have different control systems that are used for analysing sensored data to distinguish between different vehicles on the road, ability to detect various obstacles in the surrounding environments, ability to detect different type of sign boards, ability to analyze signals (traffic) on the roads. By applying these techniques play a major role in planning a desired path to a desired destination.[14]

Computer vision is one of the fields that has been increasing rapidly and advancing with the help of deep learning. Deep learning also helps autonomous vehicles (AV) to figure or to analyze their surroundings, going in depth what they see is the object classification and if they see an object (object detection). In our paper, we have implemented various technologies and algorithms and one such is a Convolution Neural Network (CNN) which itself carry out all the work of describing the features and extraction. CNN achieves unique and significant advantages [16]. Convolution neural network has a strong learning ability, with many desirable features, such as translational invariance and spatial local connectivity [17]. You will be able to see the implementation of different layers of CNN in this paper.

Programming languages like Python3 is been used because python is the key programming language when it comes to quickly developing and testing new automotive systems like intelligent parking system, lane detection, collision avoidance system, collision detection system.

Python is also commonly used to program the onboard computer on autonomous vehicle.

In the end, you will be able to see how successfully we can run the self-driving car with the help of a simulator.

II. LITERATURE SURVEY

The research and tests to develop driver-less cars started in the early 1920s, and the very first experiment was done in the year 1950. A Japanese Laboratory known as the Tsukuba Mechanical Engineering Laboratory, build the first semi-automated car in 1977 [8]. Self-Driving Cars are expected to be one of the next big innovations that the humankind is about to experience. The model built by the Laboratory could be operated only with streets that were specially marked and were guided by two cameras attached to the vehicle and an analogue computer. The success of these cars will also lead to environmental gain. The maximum speed the vehicle attained was 30 kilometres per hour [1].

The first fully autonomous cars hit the roads in the year 1980s [9]. Self-driving cars are already meeting the demands of understanding the human nature on the roads along with animals and their pattern of nature must be coded technically into driving algorithms. The superiorly trained systems of a driverless car should take into practice a larger amount of information including the present condition of the road and the car itself as compared to a human driver [11].

III. METHODOLOGY

Self driven car have same methodoly to that of traditional supervised learning. They receive input image and detect the feature of each of them. CNN itself carry out all the work of describing feature and extraction. CNN is designed to process images. Ther are four diferent layer in CNN: Convolutional layer, Pooling layer, Relu correction layer, and Fully connected layer.

Overview of the Car Simulator

There are two modes available, Training Mode or Autonomous Mode.

In the training mode, you drive the car manually on the track to record the driving behaviour. Data will be gathered many times per second. You can use the recorded images to train your model. It records from three angles, centre, left and right [7].

In the autonomous mode, you are testing your model to see how well your model can drive the car without deviating from the path.

Data Collection

A simulator was used to gather data. Data is recorded into two forms, image and text [4]. The image has three views from one position which is split into left side, right side and the center view. The speed and steering angle are recorded in the numeric value. This data is stored in an array form. We split the data into two segments, training and testing. The training is 80% and testing is 20%.

Figure 1 shows the camera view of the model. Firstly, we normalize our data into different batch. Sequential model is used to build a neural network by stacking it on top of another layer. When we go from one layer to another layer the output of the previous layer becomes the input of the next layer. A convolution neural network is used (Deep learning algorithm) which takes input images (of optimal size 32*32*3) and assigns learnable bias and weight to differentiate the images from one another. Weight decides how fast the activation function will trigger whereas bias is used to delay the triggering of the activation function.

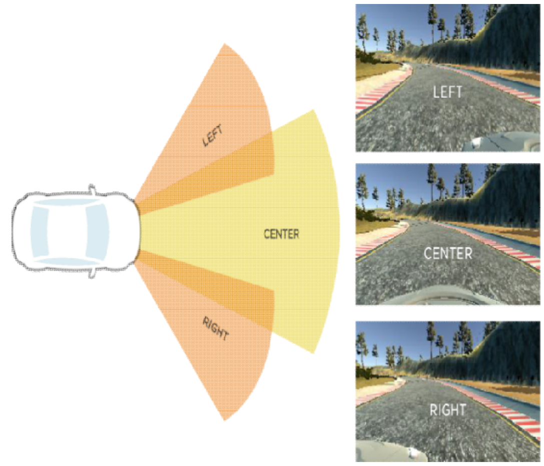

Fig. 1: Camera View.

Convolution Layer has an inbuilt number of filters which perform convolution operation [8]. When we apply the filters it will activate the output that represents high-level features. A kernel (3*3) slide over images and multiplying the values of image pixels and after summing up it generates a single value for that particular field. Figure 2 displays the image pixel multiplication.

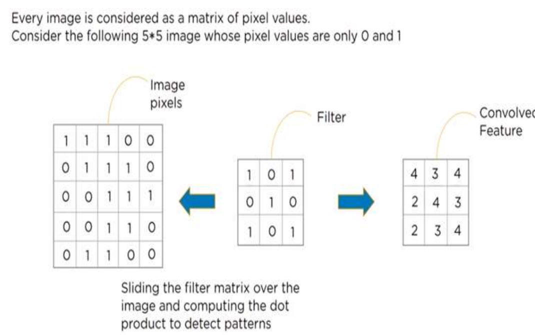

Fig. 2: Convolution Layer.

Pooling layer reduces the data by combining the output of neuron cluster into single neuron layer. Max pooling is generally performed on 2*2 matrixes. It pools the maximum value from cluster.

Figure 3 displays a pooling layer which is another building block of a CNN.Flattening the matrix is done through neural network to make values in an array form.

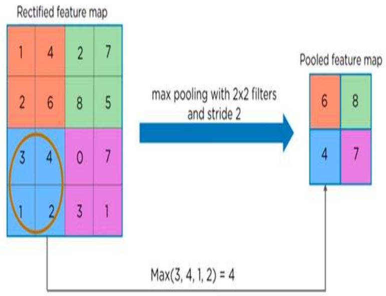

Fig. 3: Pooling Layer.

Activation function is used to determine whether the neuron should get fired or not. We have used rectified linear unit (ReLu) activation function.

ReLU is the most commonly used activation function in neural networkswhich is displayed inFigure 4. ReLU is linear for all the positive values and zero for all the negative values. Dropout technique is used to prevent model from over fitting.

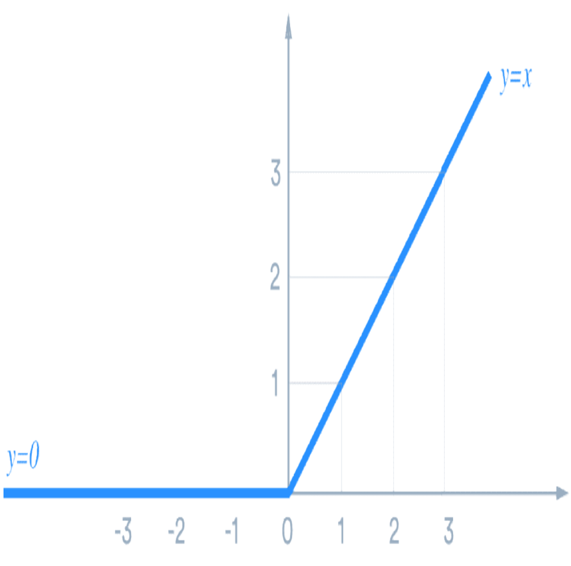

Fig. 4: ReLU Activation Function.

The fully connected layer receives input vector applies linear combination and activation function to input values to produces the output vector.it determine the position of feature and class in image.It learn the weight value in convolutional layer during training phase by backpropagation of gradient. Adam gradient descent is used to handle sparse gradients or noisy problems.

IV. Results

Lane marking detection, semantic abstraction, track planning are the methods which the CNN algorithm grasps. Atmospheric conditions vary from sunny, brisk wind, snowy to rainy. In these situations limited training data is adequate to train the car. This information can also be used to train the car to travel on highways, local and residential roads [5]. Sparse training is a method which is particularly used for steering, in this simulation and from which CNN algorithm learns essential road features.

V. Conclusion

The autonomous vehicle technology ought to beat social boundaries despite the substantial benefits. Accidents can be due to false estimation of nearby vehicle. The system learns to track the vehicle's route as well as help with vehicle stay on the right path no matter where they are driving.

The intention behind using different activation function is to make the model and CNN algorithm more efficient.

Within the next few years, autonomous cars will become more visible in our cities, as occasionally our ride may be driverless

VI. REFERENCES

1.H. Wu and Y. Feng, "A Pioneering Scalable Self-driving Car Simulation Platform," *2019 IEEE 2nd International Conference on Automation, Electronics and Electrical Engineering (AUTEEE)*, Shenyang, China, 2019, pp. 149-154.

2. N. Ali, M. R. Bonyadi, M. A. Raja, J. Akhtar, N. Javedand C. Ryan, "FUSCD - Future Smart Car Driver," *2019 22nd International Multitopic Conference (INMIC)*, Islamabad, Pakistan, 2019, pp. 1-7.

3. M. G. Li et al., "DBUS: Human Driving Behavior Understanding System," 2019 IEEE/CVF International Conference on Computer Vision Workshop (ICCVW), Seoul, Korea (South), 2019, pp. 2436-2444.

4. J. Kim, G. Lim, Y. Kim, B. Kim and C. Bae, "Deep Learning Algorithm using Virtual Environment Data for Self-driving Car," *2019 International Conference on Artificial Intelligence in Information and Communication (ICAIIC)*, Okinawa, Japan, 2019, pp. 444-448.

5. R. Sell, M. Leier, A. Rassõlkin and J. Ernits, "Self-driving car ISEAUTO for research and education," *2018 19th International Conference on Research and Education in Mechatronics (REM)*, Delft, 2018, pp. 111-116.

6. D. Dong, X. Li and X. Sun, "A Vision-Based Method for Improving the Safety of Self-Driving," *2018 12th International Conference on Reliability, Maintainability, and Safety (ICRMS)*, Shanghai, China, 2018, pp. 167-171.

7. M. V. Smolyakov, A. I. Frolov, V. N. Volkov and I. V. Stelmashchuk, "Self-Driving Car Steering Angle Prediction Based On Deep Neural Network An Example Of CarND Udacity Simulator," *2018 IEEE 12th International Conference on Application of Information and Communication Technologies (AICT)*, Almaty, Kazakhstan, 2018, pp. 1-5.

8. M. Bojarski *et al.*, "VisualBackProp: Efficient Visualization of CNNs for Autonomous Driving," *2018 IEEE International Conference on Robotics and Automation (ICRA)*, Brisbane, QLD, 2018, pp. 4701-4708.

9. Mrs Smita Desai, Miss. Shreya Desai "*Smart Vehicle Automation.*"2017 International Journal of Computer Science and Mobile Computing. IJCSMC, Vol. 6, Issue. 9, September 2017, pg.46 – 50

10. M. V. G. Aziz, H. Hindersah and A. S. Prihatmanto, "Implementation of vehicle detection algorithm for self-driving car on toll road cipularang using Python language," *2017 4th International Conference on Electric Vehicular Technology (ICEVT)*, Sanur, 2017, pp. 149-153.

11. Q. Memon, M. Ahmed, S. Ali, A. R. Memon and W. Shah, "Self-driving and driver relaxing vehicle," *2016 2nd International Conference on Robotics and Artificial Intelligence (ICRAI)*, Rawalpindi, 2016, pp. 170-174.

12. D. Jianmin, Z. Kaihua and S. Lixiao, "Road and obstacle detection based on multi-layer laser radar in driverless car," 2015 34th Chinese Control Conference

13. TaeihaghAraz, Lim, Hazel Si Min(2 Jan 2019)."*Governing autonomous vehicles: emerginresposibilty of safetyand risks".* Transport Reviews. 39

14. Maki, Sydney; Sage, Alexandria (19 March 2018). "*Self-driving Uber car kills Arizona woman crossing street*". Reuters. Retrieved 14 April 2019.

15.Mochamad Vicky Ghani Aziz''*Implementation of Vehicle Detection Algorithm for Self-Driving Car*" 2017 4th International Conference on Electric Vehicular Technology (ICEVT).

16. Chua L O, RoskaT.(1993). The CNN paradigm[J].Circuits&Systems I Fundamental Theory & Applications IEEE Transactions on, 40(3):147-156.

17. Razavian A S, Azizpour H, Sullivan J, et al. CNN Features Off-the-Shelf: An Astounding Baseline for Recognition[C] Computer Society, 2014:512-519.