AUTONOMOUS CAR USING TENSORFLOW

Navender Vats*, Md Abid Iqbal, Suraj Aggarwal
Maharaja Agrasen Institute Of Technology (MAIT), New Delhi, India
Email: navendervats@gmail.com, abidiqbal617@gmail.com, hiiamsurajaggarwal12@gmail.com

Abstract— Autonomous car, as the name suggests, a car that can drive on its own is the very concept that is being discussed in the major machine learning concepts. The basic approach for these types of projects is based upon the machine learning methods. Now is the time for the big advancement in this sector and is being in the process too in many of the developed and the developing countries. The goal of our project was to basically train a deep network to understand the steering behavior while driving, to make a fully autonomous car on the stimulator but being on a very realistic approach. For the purpose of the project, the deep network we are using is basically taking data from the front camera being mounted on the top of the car which basically predicts the steering direction at every moment. our system automatically learns about the traffic features and the traffic signals while driving for the almost perfect recognition of the markings and full autonomous driving.

Keywords - Autonomous, Machine Learning, Deep Network, Realistic Approach, Steering Direction, Front Camera

1. INTRODUCTION

Autonomous car or a self-driving vehicle or the driverless car , many names in which the same is called basically works on a single base which is machine learning or we can say artificial intelligence on which the entire system works.it is an environment which is capable of sensing its environment finally moving safe on the road with very less input by the human or even sometimes no human touch. If we talk about the combination of the functionalities present in the car and variations present in each and every type of this car includes inertial measurement units, radars, lidar, sonars and many more.

Advanced type of the car includes some of the best in the market techniques includes control systems which contain navigation paths, relevant obstacles, and the signage present on the road. Experiments on these types of vehicles have been done since the early 20th Experiments on these types of vehicles have been done since the early 20th century. Most of the credit can be given to the japanese on their work being progressed on the semi-automatic car which includes two cameras on the vehicle and an analog machine can be said to be a type of computer. Landmark of these type of vehicles were presented by the project done by Mellon University and funded by the United States in 1980. It was then in 2017 when a US based company Waymo started testing a fully autonomous car without a safety driver in the cabin and tried it for several million kms. From then these types of vehicles have grabbed a whole lot of consumers and these consumers have shown great interest in the development of these type of vehicles. We have used a simulator in the very concept of giving a briefing about the particular driver less car using nvidia model.

2. BACKGROUND

2.1 DAVE 2 SYSTEM

The simplest DAVE 2 system is basically a combination of three cameras mounted on the back of the windshield of the data acquisition car.[1] Video from the cameras are captured simultaneously which is a time-stamped video simultaneously with the steering angle applied with the help of a human driver. The CAN which is Controller Area Network is responsible for sending the steering command as it is received from the CAN by simply tapping on it. Purposely to make the system free from car geometry we show the steering command as 1/r where r shows the turning radius in meters.[2] This specific data is basically also used for the right and the left turns. Data related to the turning of the steering wheel have simple images taken from the video, combined with the steering command.

Figure 1 shows the simplest structure of the data collection from the DAVE 2 system.

For the off-center shifts the images can be gained from the right and left camera. Other shifts among the cameras and the rotations are performed by the viewpoint modification from the nearby camera. Adjustments of the weights are achieved using the back propagation as performed in the Torch ML package. [7] It is just for the training, when it is completely done ,it is easy to generate steering from the video images from a center camera only.

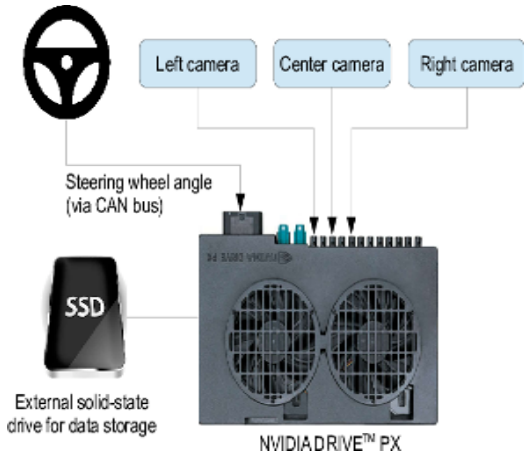

Figure 1. View of the data collection system in DAVE

2.2 DATA SET

The data set which we have used for this task has been gathered from the Udacity simulator itself. Firstly in the training period the car is steer by the human with the help of the keyboard with the storage of the frames and the steering directions in the disk. There are also off-the-shelf training set available for those who wants to skip the former process.[3] Near about 8036 samples were taken for this training set in which mostly the information like, three frames from the frontal, left and right camera; and the corresponding steering direction are being provided for the visualisation of the training data. Figure 2 shows the perfect example of the realisation of the data in the depth.

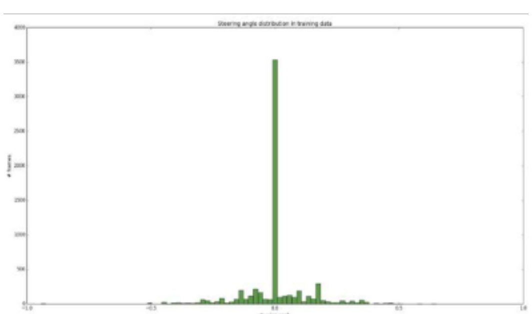

Figure 2. Realisation of the data in the depth.

3. NETWORK ARCHITECTURE

The network architecture which we are using here on this project is just a glimpse of NVIDIA paper in which the same problem is tackled of the steering angle prediction, just there was a more depraved environment.[4] Figure 3 shows a relatively shallow prediction of the network architecture in the project. The Lambda layer helped in the implementation of the normalized input, which established the foremost layer of the model.[6]

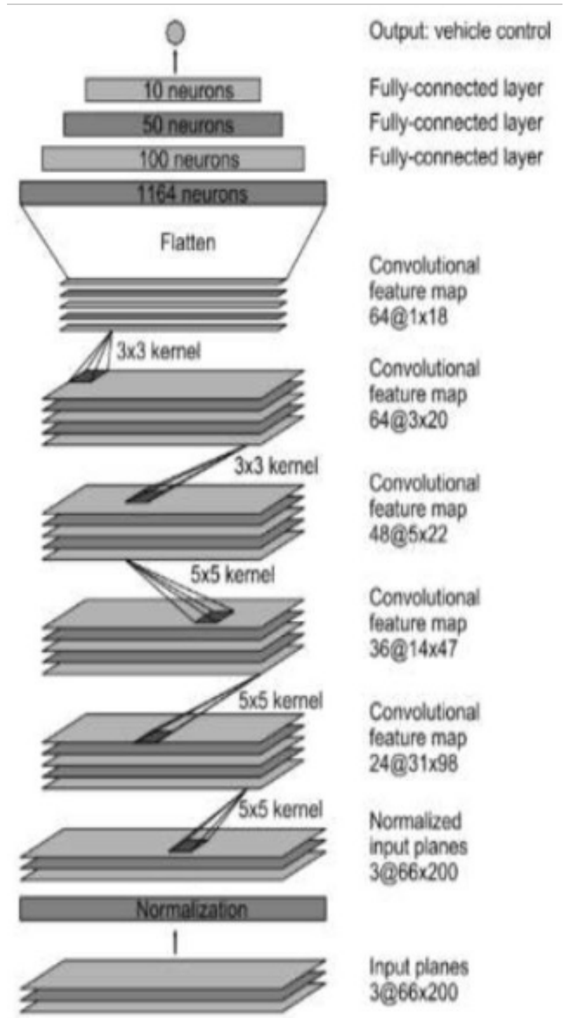

Figure 3. Network Architecture

This way the input is regulated such that it comes in the range[-1,1] ; this will work as long as the frame fed to the network in the range[0,255]. These convolution layers in the network architecture are in the 3 layer system ; [5] where finally , a last neutron efforts to right steering value from the features it receives from the last layers.

4. RESULTS

In my opinion, there were two main challenges in this project which are skew distribution of training data and the risk of overfitting. None of the problem remain unsolved, or at least weaken, using contentious data augmentation and drop out. With the minimal or we can say very minimal adjustments the network is able to steer safely and ride on both the tracks, never ever leaving the drivable section of the track area.

Accepted 20th April 2020

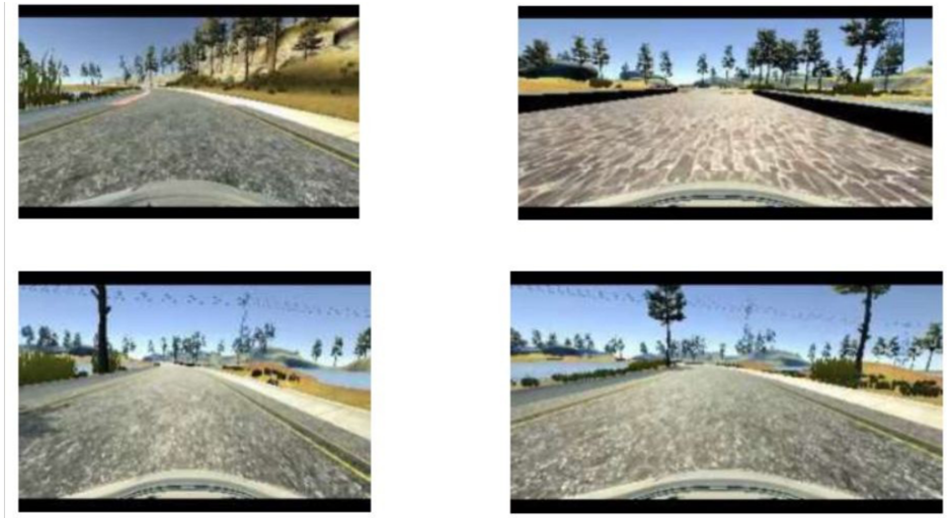

Figure 4. Pictures from the mounted camera from the

5. CONCLUSION

Through this project we are able to determine that CNNs and the DAVE 2 system are capable of learning the entire task of lane and road without any human intervented decomposition of the lane markings, road planning, and control. Not a big amount of the data was required for the training of the model , it is just with the less than hundred hours of riding was sufficient to make the car steer in the most adverse conditions, on locals and roads along the houses or the residential areas. Convolutional Neural Network was enough to train meaningful lane visages in the steering alone.

Moreover there is a whole lot of scope in the area for the total autonomous of the vehicle of any type riding in any area. Most GPS systems are also not so improved or efficient in this area and also the compatibility also depends with the working model but there is a whole lot of base in this area which is being progressed very carefully and correctly.

REFERENCES

[1] [https://images.nvidia.com/content/tegra/automotive/images/2016/solutions/pdf/e nd-to-end-dl-using-px.pdf]

[2] [https://www.researchgate.net/publication/285164623_An_Introduction_to_Convo lutional_Neural_Networks]

[3] Bojarski, Mariusz & Testa, Davide & Dworakowski, Daniel & Firner, Bernhard & Flepp, Beat & Goyal, Prasoon & Jackel, Larry & Monfort, Mathew & Muller, Urs & Zhang, Jiakai & Zhang, Xin & Zhao, Jake & Zieba, Karol. (2016). End to End Learning for Self-Driving Cars.

[4] Y. LeCun, B. Boser, J. S. Denker, D. Henderson, R. E. Howard, W. Hubbard, and L. D. Jackel. Backpropagation applied to handwritten zip code recognition. Neural Computation, 1(4):541–551, Winter 1989. URL: http://yann.lecun.org/exdb/publis/pdf/lecun-89e.pdf.

[5] L. D. Jackel, D. Sharman, Stenard C. E., Strom B. I., , and D Zuckert. Optical character recognition for self-service banking. AT&T Technical Journal, 74(1):16–24, 1995.

[6] Dean A. Pomerleau. ALVINN, an autonomous land vehicle in a neural network. Technical report, Carnegie Mellon University, 1989. URL: http://repository.cmu.edu/cgi/viewcontent.cgi?article=2874&context=compsci.