International Journal of Innovations in Engineering and Technology (IJIET)
http://dx.doi.org/10.21172/ijiet.222.01

Simulation of Self-driving Car using Deep Learning

Dr. P. Vijaya Bharati
Associate Professor
Department of Computer Science and Engineering
Vignan's Institute of Engineering for Women
Visakhapatnam, India

M. HemaLatha
Department of Computer Science and Engineering
Vignan's Institute of Engineering for Women
Visakhapatnam, India

M. Kavya
Department of Computer Science and Engineering
Vignan's Institute of Engineering for Women
Visakhapatnam, India

N. Deepika
Department of Computer Science and Engineering
Vignan's Institute of Engineering for Women
Visakhapatnam, India

Ch. Kavya Sai Durga
Department of Computer Science and Engineering
Vignan's Institute of Engineering for Women
Visakhapatnam, India

Abstract- The fast advancement of Artificial Intelligence has upset the area of autonomous vehicles by integrating complex models and algorithms. Self-driving vehicles are generally probably the greatest development in software engineering and automated insight. Profoundly vigorous algorithms that work with the functions of these vehicles will lessen numerous issues related with driving like the intoxicated driver issue. The point of the undertaking is to fabricate a Deep Learning model that can drive the vehicle independently which can adjust well to the constant tracks and requires no manual element extraction. This research work proposes a PC vision model that gains from video information. It includes image processing, image augmentation, behavioural cloning and convolutional neural network model.The neural network design is utilized to identify way in a video fragment, linings of streets, areas of obstructions, and behavioural cloning is utilized for the model to gain from human activities in the video.

Keywords-Deep learning, Autonomous automobiles, Autonomous, Mathematical model, cloning, Computational modelling, Vehicles.

I.INTRODUCTION

With the quick advancements in innovation, PCs are abandoning the old idea of 'PCs are moronic machines. Among every one of the accomplishments got in different fields of software engineering, an autonomous vehicle has been one of the greatest and most significant innovation.Assuming an individual wants to go crisis facility or to another spot yet the individual being referred to not prepared to drive or have no clue about how to drive, for this present circumstance the individual ought to enroll a driver. That particular situation might be unpleasant for the vehicle owner. To avoid such kind of bothersome conditions autonomous vehicle can accept an essential part and can be affordable for the person.

Our methodology is a profound learning model which depends on behavioural Cloning, an idea in which the specialist gains from human way of behaving and CNN model to choose well sophisticated model that captures and mimic the driving scenario of a driver in real life. Convolutional Neural Networks (CNNs) have been broadly utilized in pattern recognition works.Image pre-processing and image augmentation is also performed to provide more data to the model. A comparative analysis is also performed with the other deep learning models on the simulator provided by the Udacity.

The essential test is to encourage a learned model that is enough broad to drive on various tracks. The data made by the test framework is a flood of camera pictures (left, centre and right) and different telemetry information like speed and controlling point.

II.LITERATURE SURVEY

1. "CREATING AUTONOMOUS VEHICLE SYSTEMS" – Morgan Claypool Publishers

We are confident that any limitations of the current breed of autonomous vehicles will be successfully resolved to withstand the real-world test of time, through accurate training of models we shall be able to overcome the barriers.

2. "AUTONOMOUS DRIVING IN URBAN ENVIRONMENTS: BOSS AND THE URBAN CHALLENGE "– Journal of Field Robotics

A three-layer planning system combines mission, Situation, and motion planning to drive in urban environments, this paper presented an overview of the process of implementation of complete automation in vehicles.

3. "ROAD-BOUNDARY DETECTION AND TRACKING USING LIDAR SENSING"– IEEE Transactions on Robotics & Automation

This paper proposes a novel method based on extended filtering for fast detection and tracking of road curbs using successive range/bearing readings obtained from a scanning LiDAR measurement system.

4. "TRAFFIC FLOW PREDICTION WITH BIG DATA" – IEEE 2015

In this paper, a novel deep-learning-based traffic flow prediction method is proposed. A stacked autoencoder model is used to learn generic traffic flow features, and it is trained in a greedy layer-wise fashion. To the best of our knowledge, this is the first time that a deep architecture model is applied using autoencoders as building blocks to represent traffic flow features for prediction.

III.PROPOSED SYSTEM

We focused on a concept called ' Behavioural Cloning', which, basically, is a method of helping the machine to gain from a human subject. By Behavioural cloning human vehicle driving activities are caught and alongside the circumstance that brought about the activity. A log of these records is utilized as contribution to the machine learning.

The simulator Udacity is opensource and accessible with training mode or Autonomous Mode. In the training mode, manual vehicle drive is utilized to record the driving way of behaving. The recorded images and the way of behaving are utilized to train deep learning model. When trained the Autonomous Mode is utilized for testing the machine learnings models to perceive how the model can drive on new street. The simulator is utilized and first training information is create information utilizing behavioural cloning. The image information and activities are utilized to assemble and train the model.

IV.METHODS

A. Data gathering and simulator:We utilized Udacity simulator to produce the information. This Udacity simulator is work with the assistance of Unity and it is publicly released for everybody to utilize it. we can without much of a stretch create the information by utilizing simulator. The information is produced in type of csv log record containing condition of vehicle (steer point, brake, and name of the images(left, centre, right) caught by cameras (left, centre, right) at a case) and it additionally containing those images which are in CSV log file.

Figure 1. Left Figure 2.CentreFigure3. Right

B. Avoiding over fitting:To keep away from the over fitting of the model on any value during the preparation we want to eliminate a portion of the information on that data.
C. Lowering the resolution: As the generated images by the simulator are in high resolution, we need lower the resolution of the generated images .So, we have prevented the machine from training with noisy data present in the image that could affect the performance of the model.
D. Image Flip:The chosen random image is flipped horizontally in the process along with its steer angle by multiplying it by -1. After the image is chosen then it is decided with the constant probability to whether to flip the image or not. This assists with adding new information to the dataset if the picture is flipped so that model can be trained in each possible guided direction.

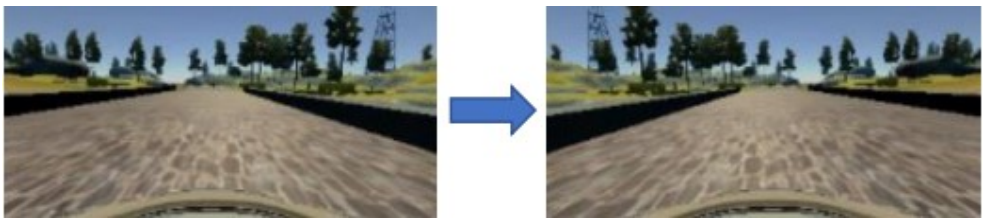

Figure 4. Flip image

E. Image processing: After the scaling down and trimming of the picture, it is changed over from RGB image to YUV image. YUV is a color coding framework that is generally utilized in variety image pipelining.In this way, the u and v goals can be brought down, they are compatible with CNNs, and CNNs can be prepared with similar accuracy commonly quicker than traditional RGB models.

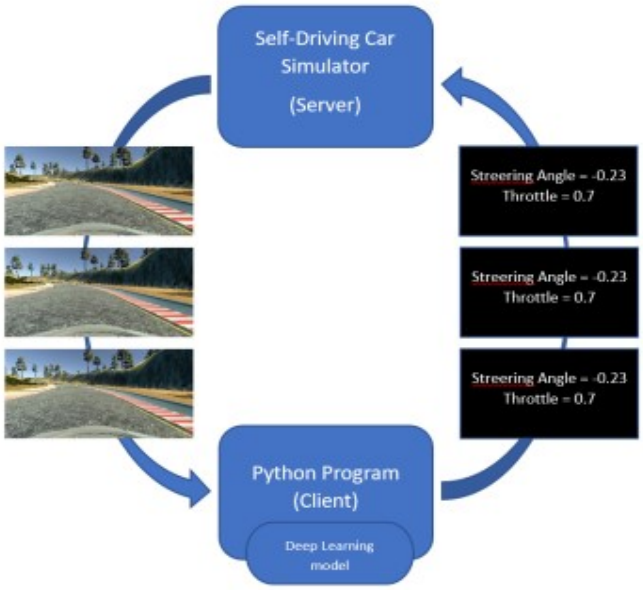

Figure 5. Implementation

V.MODEL ARCHITECTURE

We will be using the open-source Self-driving car simulator provided by Udacity that is used in their Self-driving car Nano degree program. Using this simulator we will first drive the car and collect data. Then we will train a CNN model to learn this behaviour and then test it back on the simulator. The model we will use was proposed by NVIDIA.

This model makes a difference in precise planning of the raw pixels from the pictures gathered to the guiding point kept in the driving log. The CNN helps in learning the information naturally founded on the pictures took care of into the Convolutional Neural Network and model is tuned by fluctuating the hyper boundaries values and adjusting the weights.

Below we can see the System Structure of NVIDIA's method, where they collected 3 sets of images from different cameras and recorded the steering angle for these images.

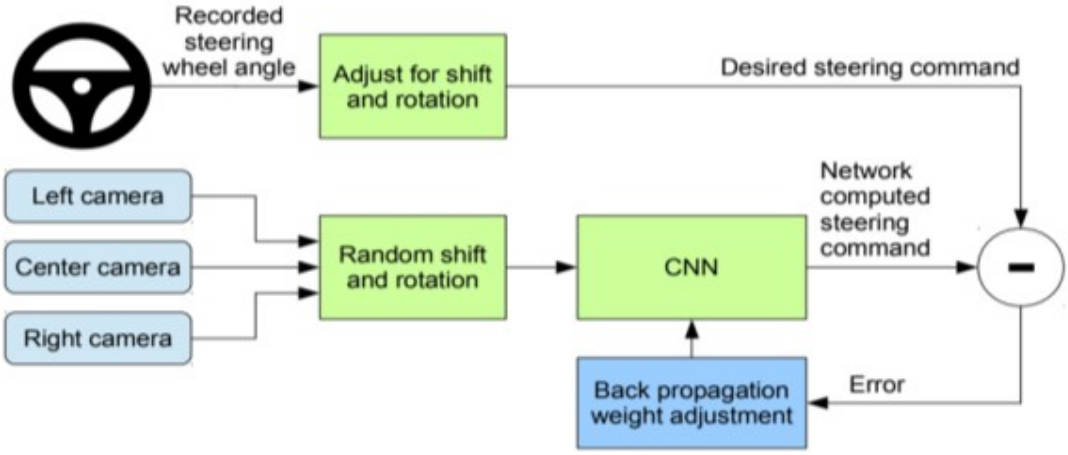

Figure 6. Model Architecture

VI.EXPERIMENT AND RESULT

The experimental results of proposed model are astonishing. The model is trained on the frames from the tracks and tested by driving autonomously on the tracks. Around 1500 images were passed to the generator function (for performing image augmentation during the training).

Figure 7. Training mode

Figure 8. Capturing the data

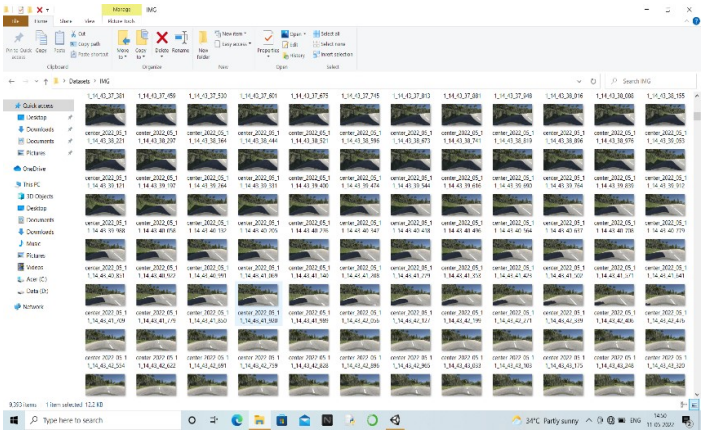

Figure 9. Datasets

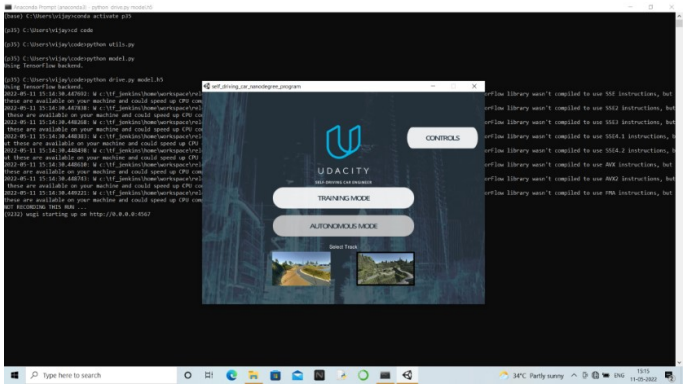

Figure 10. Autonomous mode

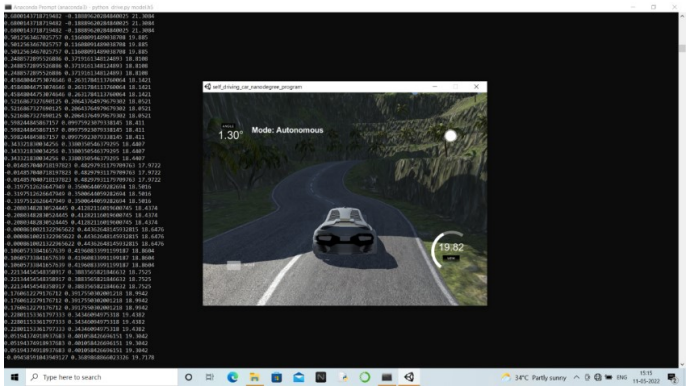

Figure 11. Output

VI.CONCLUSION

In this paper, we introduced a methodology for working of self-driving car. This approach depends on the idea of behavioural Cloning.This approach is end-to-end and doesn't require any separate manual work like feature extraction or connecting different modules for efficient working.The proposed model is Convolution based with five 2D-Convolutional Layers, one flatten layer and four dense Layers. Contrasted with other deep learning models the proposed model has outperformed. The work introduced in this paper can be acknowledged in real world to fabricate vehicles fit for driving autonomously.

REFERENCES

[1] https://ieeexplore.ieee.org/document/9396941
[2] https://www.irjet.net/archives/V8/i4/IRJET-V8I401.pdf
[3] https://developer.nvidia.com/blog/deep-learning-self-driving-cars
[4] https://github.com/udacity/self-driving-car-sim
[5] https://github.com/naokishibuya/car-behavioral-cloning
[6] https://bhargav265.github.io/Simulation_of_self_driving_car/ArtificialLifeReport.pdf
[7] https://www.kaggle.com/datasets/zaynena/selfdriving-car-simulator