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| **Steering angle of self-driven car & Self-braking using deep learning** |
| Interim Report |
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| A self-drive or autonomous car is a car that can guide itself without any human interaction. These cars use different technologies for navigation like GPS sensing and use different sensors to avoid collisions. In recent years, there is a rapid progress in the autonomous driving to improve the safety of the drivers. Autonomous driving becomes possible with the help of deep learning. |
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# Abstract

A driverless car or self-drive or autonomous car is a vehicle that can guide itself without any human conduction. These cars use different technologies for navigation like GPS sensing and use different sensors to avoid collisions. In recent years, rapid progress in the autonomous driving to improve the safety of the driver and the road users. Now a days transportation specially cars are part of human’s life. Cars now a days already include many semi-autonomous features, like it is able to assist in parking and also provides self-braking systems. And a complete autonomous vehicles are able to operate without human interaction and human control and it is becoming more of a reality.

# Introduction

The future is totally unknowable and unpredictable, but planning requires predictions for improvements. Many decision-makers wonder how autonomous (also called self-driving) vehicles will affect future travel, and planning for roads, parking and public transit systems, and whether public policies should encourage or restrict their use.

The motivation of the project is to eliminate the need for hand-coding rules and instead create a system that learns how to drive by observing. Predicting steering angle is one important part of the end-to-end approach to self-driving car.

## Benefits

### Reduced Stress, Improved Productivity and Mobility

Autonomous or self-driving vehicles can reduce the stress of a driver who gets stressed during driving.The advantages of autonomous cars are so many ‘Like the sensors in self-driving car are always observing and it does not affect the state of the human (driver) in a sleep or angry mood etc. and can also scan in multiple directions simultaneously’.

# Related Work

An autonomous navigation was suggested by Pomerleau (1989) using a neural network, he built a ‘Autonomous Land Vehicle in a Neural Network (ALVINN)’ system. The structure of that model was very simple comparatively a fully connected network. That network was built in order to predict the action from pixel inputs which was applied to a simple driving scenario. It really demonstrated the strength and the potential of neural network for autonomous navigation.

Last year, NVIDIA released a research paper related to self-driving idea that took advantages from ALVINN. In that paper the authors used a basic idea of CNN architecture to get or extract features from the driving frames.

# Project Requirements:

This project requires dataset as an input to find the steering angles, for this purposes the dataset which will be used in this project is provided by Udacity. By analyzing this dataset steering angles can be found after applying different parameters. On the other hand this project is also about to detect the self-brake phenomenon.

* Software (Which will be used for sensing input data to algorithmically generate instructions for driving)
  1. **CUDA**
     + Parallel computing platform
     + Gives access to any CUDA enabled GPU
  2. **Tensor Flow**
     + Computational library
  3. **Dataset**
     + For designing Neural Network
     + 40 GB in size
     + These data will contain different images which was collected by the car under different and challenging conditions like (weather, roads and illumination conditions)
  4. **Simulator**
     + Test our Neural Network
* Hardware(executing the instructions)
  1. **GPU** 
     + Used for parallel computation.
     + Real time computations
     + Optimize Neural Networks

# Experimental Setup

For experiment to get the results we are required to download the Dataset which is provided by the Udacity. As mentioned above the dataset is about 40GB in size and this dataset contains different images which is collected in different situations like weather, rough roads etc. It also contains asynchronous and synchronous events. We will use this dataset in our project to train our system.

## Building a Neural Network(GPU based)

* Using TensorFlow the implementation of NVIDIA’s System is available on github

## Training Neural Networks

* Constructing Steering Model
  + - Showing the computer a bunch of images
    - Assigning a numeric value to each image
    - Asking the computer to figure out how the pixels of the images relate to the numeric values
    - Using this relation to predict the numeric value assigned to other images.(steering angle)
* Building pedal system (for self-brake)
  + - Reassigning each image a numeric value i.e. braking amount
    - Determining relationship between pixel and numeric value

## Testing Neural Networks

* Calculate the difference between the true steering angle and the steering angle which will be calculated by the model.
* For self-brake the same scenario will be used.

**Desired steering command**



**Recorded Steering wheel angles**

Adjust for the shift & rotation

**Network computed steering command**

Left Camera

Random Shift & Rotation

CNN

Back Propagation weight adjustment

Center Camera

**Error**

Right Camera

# Result

As this project is continue, so with the passage of time the different and accurate results will be generated.