Self Driving Car.
using
Convolutional Neural Network

Prof. Amol Kalugade, Vinit Jain, Aditya Shetty, Karan Bawari, Atharva Muley

Abstract

The purpose of this project is to make a system that that learns how to drive in traffic on local roads with lane markings and on highways. The system is designed to automatically learn the internal representations of the necessary processing steps such as detecting useful road features with only human steering angle as the training images. This project introduces a new concept of Convolutional Neural Network (CNN), which is a class of deep neural network, most commonly applied to analyzing visual imagery. A Convolutional Neural Network was used to map raw pixels from a single front-facing camera directly to steering commands. Image compaction/augmentation methods were used to reduce the size of the images and improve the overall performance and accuracy of the system. We used Max-Pooling for Image Compaction which reduces the dimensionality of the Neural Network as we go deeper into it. The method selects only the maximum value of all and then passes it to the subsequent layer. Compared to explicit decomposition of the problem, such as lane marking, path planning, and control, our system optimizes all processing steps simultaneously. CNNs have been observed to perform well for feature extraction and classification. CNNs are particularly powerful in image recognition tasks because the convolutional operation captures the 2D nature of images. Also, the adoption of CNNs have increased over the last twenty-years, due to the advancement and support of graphics processing units (GPUs) which tremendously accelerate learning and inference. We used Keras to build our Neural Network model which runs on top of Tensorflow. Tensorflow is capable of running on both CPU and GPU.We trained our Neural Network model on Nvidia 1060 GPU which decreased the time required for training. There are two main steps involved in learning process of a CNN :- Training and Testing. A dataset was generated by capturing the images of the environment, and then splitting it into two components. One component is assigned to the training process. In training process, the parameters in the neural networks are tuned.The other component of the dataset is used for the testing/validating the learned parameters. The validating phase gives a representation of accuracy of the system. Once the desired accuracy is reached the system is ready for real world applications. A dataset with 3000-4000 images was found to be sufficient for learning process. Different models in CNN can be used to improve the robustness and improve the visualization of the internal processing steps in the network.

Keywords: Convolutional Neural Network, Max-Pooling