

Project Proposal

Proposal 3: Autonomous driving using end-to-end learning

Goal of the project

Achieve autonomous driving using end-to-end learning. The goal is for the vehicle to drive in the middle of the road, and correct itself if it gets too close to the edges. Ideally, the car manages to drive autonomously around any road/map indefinitely. Specifically, we will train the model on the hard track, and test it on both hard and simple track.

Relevant literature

We regard the recommended reading list to be the intermediate relevant literature. We expect to discover more as we work on our project.

About the Dave-2 Network:

[End to End Learning for Self-Driving Cars](#)

[End to end learning NVIDIA blog](#)

Image classification - how to design the network:

[ImageNet Classification with Deep Convolutional Neural Networks](#)

Implementing CNNs in Keras:

[Keras example for CNN](#)

Using the Udacity simulator for deep learning:

[Introduction to Udacity Self-Driving Car Simulator](#)

Model Architecture

We plan to base our model on the Nvidia Dave-2 network. This network begins with a normalization layer. This is followed by 3 convolutional layers with a stride of 2×2 and a 5×5 kernel, and then 2 non-strided convolutional layers with 3×3 kernels. This is followed by 3 fully connected layers which ultimately outputs the inverse turning radius $1/r$. To produce our network, we will experiment with using strided convolution versus pooling layers, try to add layers to the network and vary the kernel sizes. We also intend to try batch normalization in each layer. The input passed to the network will be passed through some data augmentation.

Dataset

We intend to use the provided simulator to drive the car manually, and record training data for our neural network to work on. The provided framework will allow us to capture video of the simulator camera view, along with the corresponding steering angle = $[-a, a]$. We intend to experiment with different ways to preprocess the images. We intend to experiment with cropping the image to capture the nearest part of the road, removing the car and sky from the images and whiting out all pixels that do not belong to the road.

Framework

We have been provided with some framework code to capture video of the autonomous driving. The simulator have built in features for generating a dataset from manual driving. Searches online has yielded comparable results, which we will use to verify that our code works, and compare results. Otherwise, we want to write much functionality ourselves, and experiment with model architectures.