Machine Learning Nanodegree
Capstone Project Proposal

Suresh Aswathnarayana

April 3, 2017

Classify Traffic Signs Using Deep learning

1. Domain Background

Autonomous vehicles have been gaining speed over the last couple of years. The Darpa Grand Challenge a prized competition for autonomous vehicles a decade ago sowed the seeds for developing autonomous vehicles. The aim of this competition was to bring out the research work that was happening in only the academia and big research labs into main stream implementation. Autonomous vehicles utilizes a combination of advanced hardware and software in order to perform the driving task.

It involves the usage of mechatronics a combination of mechanical and electronic components. Some of the mechatronics components are integrated cameras, laser sensors, radars, lidars, and feedback loop control systems for braking, acceleration and steering mechanisms. In order to integrate all these hardware, software techniques involving computer vision, Natural Language Processing, robotics and advanced Artificial Intelligence is required. Artificial intelligence involves Machine Learning, Deep Learning and Reinforcement learning where in the vehicle learns based on the existing data and also from the new data that the vehicle gathers in operation.

2. Problem Statement

A requirement for an autonomous vehicle is that the vehicle responds to traffic signs posted on the road so that it can adjust to speed, brake if needed, steer automatically or perform other necessary tasks that a human driver would perform. This involved the techniques of computer vision where the cameras of the vehicle detects the features of the images in the traffic sign and Machine Learning, Deep Learning in order to let the vehicle know what the traffic sign means and respond accordingly. Based on this requirement we can train a computer to detect the traffic signs and respond accordingly. This would help in reduction of accidents and improve the safety of driving.

3. Datasets and Inputs

I plan to use the German Traffic sign benchmark data set for my final capstone project. This data set is a benchmark for computer vision and machine learning. This data set is a large multi- category classification data set. The data set contains approximately 39000 training data, 12500 test data and 43 classes as labels.

4. Solution Statement

I plan to use deep learning methods in order to classify the multi –class problem of the traffic signs. Deep learning models are effective at determining the different and important features of a given image. I plan on using the convolutional neural network or short for CNN. CNN is an effective deep

learning algorithm for finding patters in images. My aim is to detect as many traffic signs as possible with my deep learning algorithm.

5. Benchmark Model

I will compare my results using CNN vs the results listed under the results section of the German benchmark. The url is listed below.

http://benchmark.ini.rub.de/index.php?section=gtsrb&subsection=results

6. Evaluation Metrics

The CNN trained on the data set will be compared for accuracy. The model will be trained to soft-max regression type multi class problem and the accuracy will be compared to the results given in the website listed above.

7. Project Design

- Collection of data here involves the already data set provided. I will try to utilize one or all the data sets regular RGB representations, HOG features, Haar-like features or the Hue histogram to see which one or the combination of the features would give me the best accuracy.
- Basic data exploration.
- Resize the images to one size (32x32) as the all the images in the data set might not be the same size.
- Convert to gray scale if needed.
- Scale the images between 0 and 1.
- Build the Convolutional Neural Network model. The choice of layers, sub sampling, pooling I would do based on the accuracy of my training.
- Calculate the accuracy of the models trained and compare it to the available benchmark.