Traffic Sign Classification

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While building a self-driving car, it is necessary to make sure it identifies the traffic signs with a high degree of accuracy, unless the results might be catastrophic. While travelling, you may have come across numerous traffic signs, like the speed limit signal, the left or right turn signal, the stop signal and so on. Classifying all these precisely can be a daunting task, which I attempted to solve in this project.

In the 2020 Honda Accord models, a front camera sensor is mounted to the interior of the windshield behind the rearview mirror.

That camera polls frames, looks for signs along the road, and then classifies them.

The recognized traffic sign is then shown on the LCD dashboard as a reminder to the driver.

What is Traffic Signs Classification?

Traffic sign classification is the process of automatically recognizing traffic signs along the road, including speed limit signs, yield signs, merge signs, etc. Being able to automatically recognize traffic signs enables us to build “smarter cars”. Self-driving cars need traffic sign recognition in order to properly parse and understand the roadway. Similarly, “driver alert” systems inside cars need to understand the roadway around them to help aid and protect drivers. Traffic sign recognition is just one of the problems that computer vision and deep learning can solve.

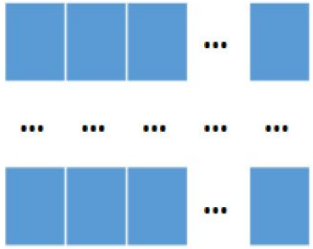
Purpose of this project

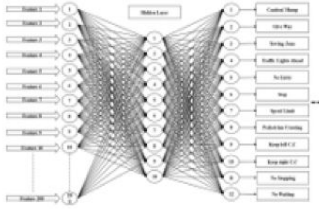
The purpose of this project is to classify traffic signs present in the image into one of the 43 different categories. With this model, we are able to read and understand traffic signs in real time which are a very important task for all autonomous vehicles.

Classifier

Camera → Input Frame → Sign Detection → Sign Registration → Feature Extraction → Recognition → Output

Classification or Recognition Phase





Road and Traffic Sign Database → Feature Extraction → Artificial Neural Network

Classifier Learning Phase

DATA SET

The dataset that I used to train my own custom traffic sign classifier is the **German Traffic Sign Recognition Benchmark (GTSRB)**.

The GTSRB dataset consists of 43 traffic sign classes and nearly 50,000 images.

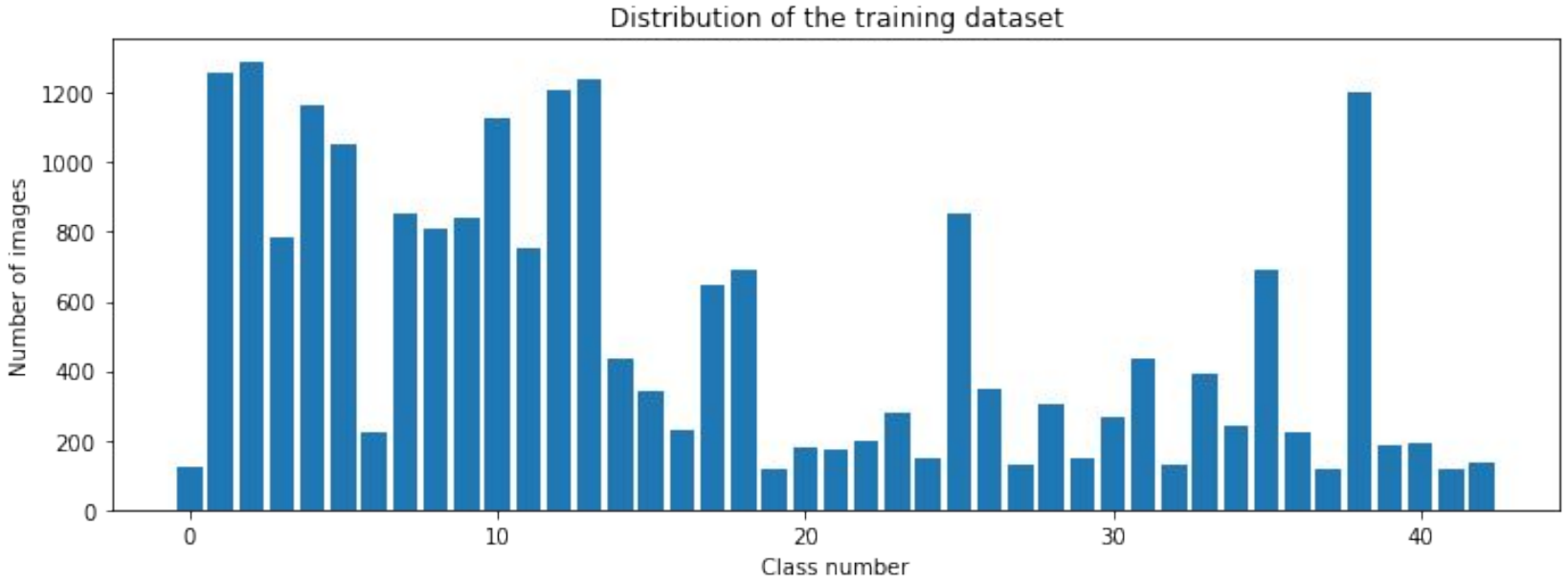
A sample of the dataset can be seen on the following picture — notice how the traffic signs have been *pre-cropped* for me, implying that the dataset annotators/creators have manually labeled the signs in the images *and* extracted the traffic sign Region of Interest (ROI) for me, thereby simplifying the project.

This DATA SET was used for a competition

Challenges with the GTSRB dataset

There are a number of challenges in the GTSRB dataset, the first being that images are low resolution, and worse, have poor contrast (as seen in the previous slide). These images are pixelated, and in some cases, it's extremely challenging, if not impossible, for the human eye and brain to recognize the sign.

The second challenge with the dataset is handling class skew.



The top class **(Speed limit 50km/h)** has over **2,000 examples** while the least represented class **(Speed limit 20km/h)** has under **200 examples** — that's an order of magnitude difference!

In order to successfully train an accurate traffic sign classifier, I had to devise an experiment that can:

- Preprocess my input images to improve contrast.
- Account for class label skew.