Image Classification of Street Signs

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Abstract—This study reports the classification problem of predicting a label, that describes the type of different street signs in a urban street environment. Two different neural networks are used for classification: AlexNet and GoogLeNet. After experimenting with different neural network setups, over accuracy on the validation and testing sets as well as accuracy on different image testing sets were archieved .

Index Terms—Robot, IEEEtran, Udacity, LaTeX, Reinforcement Learning, DQN, ROS.

1 Introduction

For autonomous vehicles, it is very important to be able to read all different street signs, which are around in an urban street environment. For a crossing section, sometimes there are more than 20 street signs. To be able to maneuver through these crossings and other urban driving situations, it is necessary to understand the different street signs to maneuver safely with the non-autonomous vehicles. Nowadays, this street sign detection is usually made with camera images from a mounted camera, that looks in front of the vehicle. Together with image classification algorithms and neural networks, the street sign detection already works well. The same approach is worked out in this study, with a decreased number of street signs.

2 Background

To classify the images of the street signs, two different types of standard neural network models were used. AlexNet and GoogLeNet. These networks were chosen, because they are commonly used to classify colored images and they have shown great results in accuracy and time. In both models, the base learning rate was st to 0.01, solver type was SGD(Stochastic Gradient Descent) and the model for the Udacity data set was trained for 4 epochs and the model for the street sign data set was trained for 30 epochs. The googLeNet reached a accuracy of 75 % for the Udacity data set.

3 Data Acquisition

The data for training the neural networks were taken from the German Traffic Sign Detection Benchmark http://benchmark.ini.rub.de/?section=gtsdb&subsection=dataset. This is a huge collection of German street signs. For simplification reasons only three different types of street signs were taken. These street signs are shown in figure 1 to 3.

4 Results

4.1 Udacity Dataset

Figure 4 and 5 show the training and the accuracy of the googLeNet applied to the Udacity dataset.

Fig. 1. Street Sign White Arrow

4.2 Street Sign Dataset

After using googLeNet and AlexNet for the street sign data set, AlexNet performed well better with the shown accuracy in figure 6. The training of the network could have been stopped after around 15 epochs, bevause the accuracy saturated at around $\approx 87\%$.

5 Conclusion / Future work

In the future, the network could be trained with more images as well as different street signs to cover every existing street signs, because at the end the autonomous vehicle has to cover every street sign that is around a urban road environment. Furthermore, the images could be pre-processed like turned and mirrored to get a higher number of different images and more training data..

References

Fig. 2. Street Sign Give Way

Fig. 3. Street Sign Your Turn

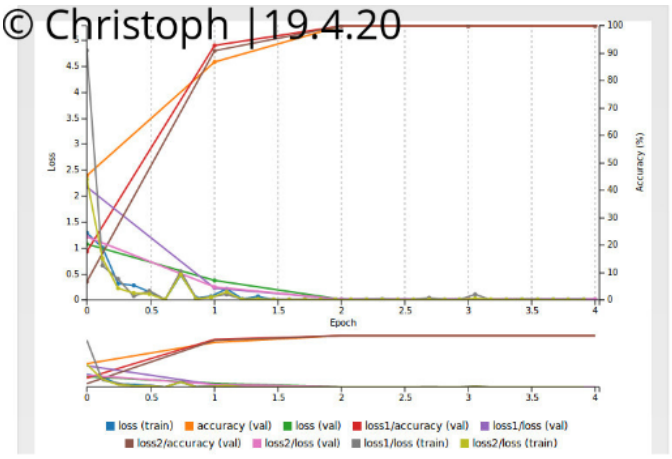

Fig. 4. Training of googLeNet for Udacity Dataset

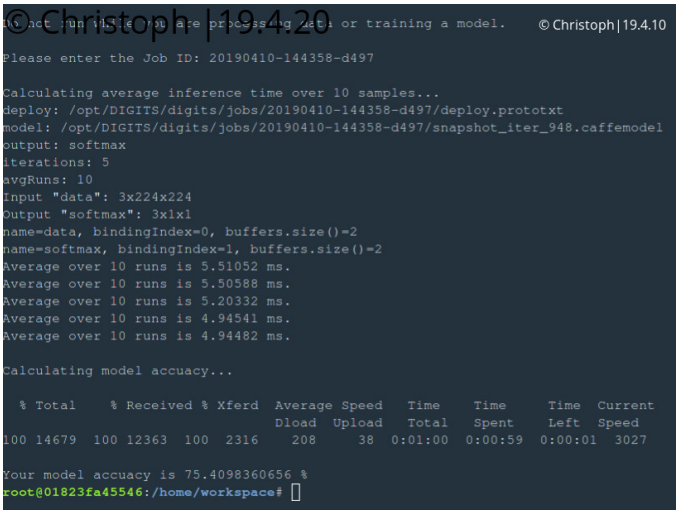

Fig. 5. Accuracy of googLeNet

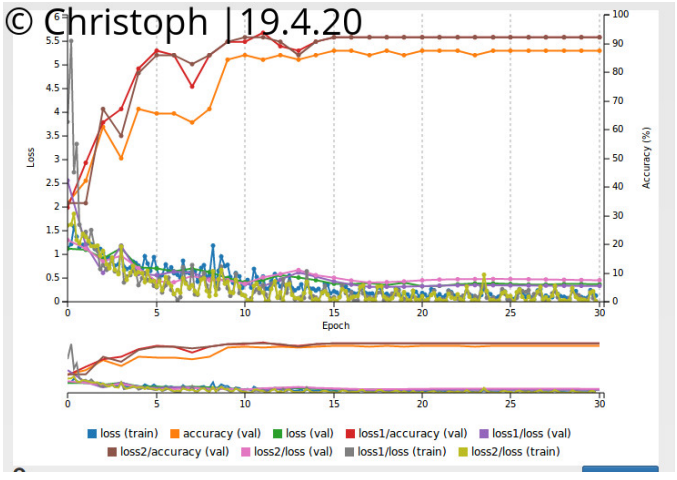

Fig. 6. Training of Street Sign Data Set with AlexNet