Detection and recognition of traffic signs

CMT307 Group 12 - Supervisor: Dev Kant

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Abstract

The present document is a coursework report for the module CMT307 Applied Machine Learning, academic year 2021-2022. This document describes the deployment and implementation of a Convolutional Neural Network used for Computer Vision, with the scope of classifying a set of traffic signs pictures from the German Traffic Sign Recognition Benchmark (GTSRB).

Contents

1. Introduction

Summary of the task and main goals/contributions/insights of the project.

The scope of this project is to develope a machine learning model capable of identify and classify traffic signs with the use of pictures, what is known in the industry as *Computer Vision.*

The data sources to train and test this model was obtained from the German Traffic Sign Recognition Benchmark (GTSRB)[1]. Links to this datasets are provided in Appendix 1. The project will consist of several python scripts that will decode pictures into numpy arrays to build the initial dataset, analyze and manipulate these pictures to finally be fed into a *Convolutional Neuronal Network* (CNN from now on) whose performance and implementation will be discussed, alongside different strategies and alternatives to improve performance. The choice of this machine learning method, as well as the CNN architechture and other computer vision alternatives, will be discussed in the later sections of this report.

2. Literature review / Related work

Overview of the related work most connected to the methods and tasks of the projects. Explain the differences and the connection between works in the literature with respect to the employed method (e.g. advantages/disadvantages, ideas you exploited, etc.). Tip: Google Scholar is a good resource to find relevant articles to any of the topics.

A CNN is a type of Artificial Neural Network where the neurons within any given layer will only connect to a small region of the layer preceding it. The biggest impact of the introduction of these types of networks is the significant reduction in computation workload, and this posed a notable benefit in the field of image processing. The reason why the Computer Vision technology has taken off during the recent years is due to reduce is hardware cost, increase on processors speed, and afordable better access for developers to big data storage pools.

In this section we will discuss the latest breakthroughs in the area of computer vision.

3. Description of the task/dataset

The German Traffic Sign Recognition Benchmark (GTSRB) contains 43 classes of traffic signs, split into 39,209 training images and 12,630 test images. The images have varying light conditions and rich backgrounds.

An exploratory data analysis was carried out after having decoded the ppm images into numpy arrays.

4. Methodology

Description of the machine learning methods used in the project.

[1] https://sid.erda.dk/public/archives/daaeac0d7ce1152aea9b61d9f1e19370/published-archive.html

5. Experimental setting

Description of the specific details of the evaluation (e.g. parameter tuning, usage of the development set).

6. Results

Final results of the experiments, including baselines and table/s with precision/recall/accuracy/f1, etc.

7. Analysis

Analysis of the results, error analysis (investigate the type of error the system makes, etc.).

8. Conclusion and future work

Summary of the main conclusions and takeaways from the experiments. Explain ways to investigate or improve the method in the future.

Appendix 1

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Appendix 2

Second appendix without listing item

Citations

See for example (Avendi 2020), (Chollet 2018) and (Géron 2019) .

Avendi, Michael. 2020. *PyTorch Computer Vision Cookbook*. First. Packt.

Chollet, Francois. 2018. *Deep Learning with Python*. First. Manning Publications Co.

Géron, Aurélien. 2019. *Hands on Machine Learning with Scikit Learn, Keras and Tensorflow*. Second. O'Relly.