Traffic Light Detection and Color Recognition

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1 Problem Definition

3-4 sentences

- Since the traffic lights are too small, it is currently hard to detect traffic lights for autonomous cars. For autonomous cars; this creates the problem of not stopping at the red light and possibly creates car accidents. So, there is an obvious need of a more improved system /framework which performs the traffic light recognition detection with more accurate results. In order to meet this need, we will develop the traffic light recognition & detection systems that we found as baselines. Thus, we can say that this problem has a clear connection with the autonomous driving, and also with our lecture COMP423.

2 Motivation

3-4 sentences

- We really like this problem because it is a big concern in today's life, especially what is going on in Nvidia, Tesla, Waymo, and in any other companies which are working on autonomous driving. Moreover, we consider that we can beat the SOTA approaches of this problem by using a more improved sensor/lidar including DL and ML algorithms which uses more input data and which are more trained.

3 Datasets

2 datasets at most, 3-4 items per dataset

- We plan to work on Bosch Small Traffic Light Dataset and LISA Traffic Light Dataset which are both mainly about traffic lights. Bosch Small Traffic Light Dataset contains 2 useful video data items which can be found here and here.

- The Bosch Small Traffic Light Dataset [1] has an online benchmark (HD1K benchmark) which we can submit our results. This online benchmark involves 4 primary topics which image classification, image processing, 3d object detection, and image segmentation.

- The SOTA on the dataset is "Evaluating State-of-the-art Object Detector on Challenging Traffic Light Data" [3]. In this article, the primary issue is to grasp and analyze the performance of a state-of-art CNN based object detection system (named as YOLO) on the LISA Dataset.

4 Baseline(s) (Optional)

3-4 items
-Introduction to the problem, basic summary of the papers -Methods for improving the traffic lights with ML and DL algorithms, what can also be improved by adding sensors. (Better vision at night) (Better percentage of detecting red light) -The difference between the improved version and old version

- [3], [2], and [4] state that the current traffic light recognition systems are not accurate enough about detecting the small traffic light area which is 50 x 50 pixels. In order to increase the accuracy of these systems, according to these articles, we should use publicly available datasets. Moreover, we should use more real-time traffic scene data as inputs to the machine learning and deep learning algorithms (especially convolutional neural networks (CNNs) and support vector machine (SVM) classifiers) to be utilized in traffic light recognitiondetection systems. We should also train the these ML & DL algorithms (the ones to be used in traffic light recognitiondetection systems) more by using the real-time traffic scene data as inputs, and by trying to avoid overfitting. In the [5], the main approach to improve traffic light recognition detection by using reward algorithms with higher number of trials and errors. As code baselines, we plan to use 1,2,and3.

5 The Proposed Approach (Optional)

3-4 sentences

- -The baseline can be improved with hardware support such as lidar and more sensors (getting the input from hardware and using it on software), but our main goal is to improve the baseline with reward optimization, and with higher number of trials & errors & related trained input data.

  We want to improve detection of traffic lights with the help of reinforcement learning which we learned in the lectures. We plan to do analyses on the baseline by training the baseline itself, then baseline with the improved algorithms and then look at the related rates, results, and statistics.

References

[1] Bosch small traffic lights dataset. 2017.

[2] Ali Harakeh Alex D. Pon, Oles Andrienko and Steven L. Waslander. A hierarchical deep architecture and mini-batch selection method for joint traffic sign and light detection. 2018.

[3] Kamal Nasrollahi Morten B. Jensen and Thomas B. Moeslund. Evaluating state-of-the-art object detector on challenging traffic light data, 2017.

[4] Songhai Zhang Yifan Lu, Jiaming Lu and Peter Hall. Traffic signal detection and classification in street views using an attention model, 2018.

[5] Dengxin Dai Fisher Yu Luc Van Gool Zhejun Zhang, Alexander Liniger. End-to-end urban driving by imitating a reinforcement learning coach. 2021.

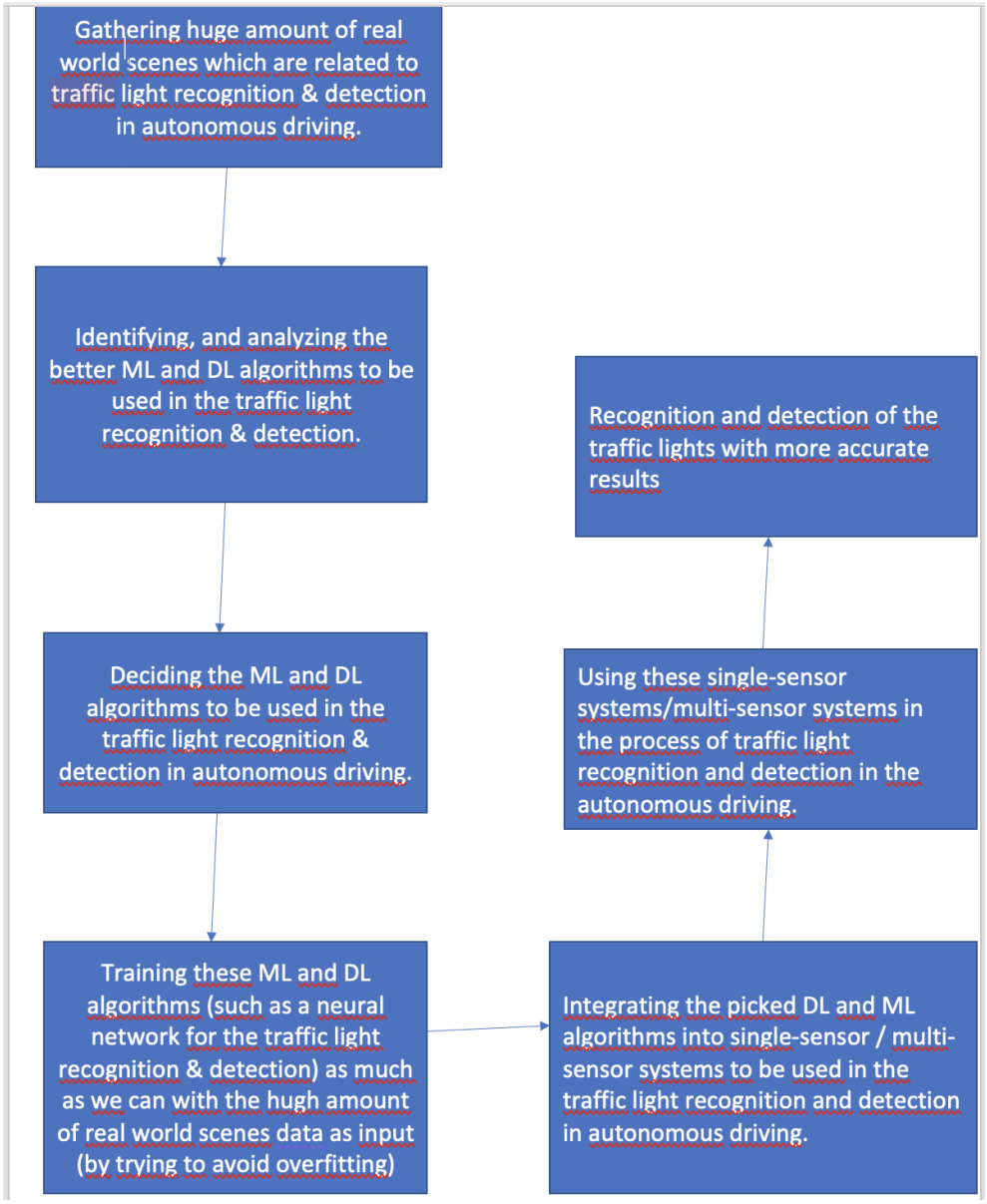

Figure 1: The figure showing our overall idea