Traffic Anomalies Detection with A Semi-supervised Approach

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1. Introduction

Based on sensor data from traffic, signaling systems and infrastructure, our transportation systems are becoming smarter. And some novel techniques are benefiting these realms from traffic control to public safety. With computer vision and deep learning, there are more opportunities to solve real-world problems using multi-cameras. As a member of public safety, traffic anomalies, where they can be lane violation, illegal U-turns, anti-direction driving, crashes, stalled vehicles and so on, are extremely dangerous, particularly in traffic highways and intersections. The potential solutions will get the humans in the loop to pay attention to meaningful visual information in situations where timely intervention can save lives.[1]

Unfortunately, progress has been limited for several reasons like missing data labels, and the lack of high-quality models that convert data to decent forms. In other words, it is hard to get data with labels from the real world. Due to the lack of labels, anomalies cannot be classified current algorithms. Thus, we plan to seek a semi-supervised approach the address this problem and focus on the research and development of techniques that rely more on transfer learning and semi-supervised learning.

With some pre-trained model like VGG 16 [2], we can leverage transfer learning to combine these models with our approach and detect the abnormal traffic behaviors from traffic camera video data which is provided by NVIDIA corporation.

2. General Plan

- Look for relevant videos from traffic cameras in the highway and intersection as training dataset and test dataset;
- Get object detection algorithms related to traffic environment;
- Divide the problem into different sub-tasks;
- Implement the algorithm on the training dataset, with some popular NN frameworks like Pytorch or TensorFlow;
- On the test dataset, compared to the benchmark, we could try to improve the accuracy and detection speed.
- Make all of ideas form a paper.

Find unsupervised learning paper Find paper on object detection Detect Static objects Take two images Get static image location (Reset all pixel values of selected images to be black if the surrounding pixels are similar, and white if they are different) Overlay that... Detect lanes Find paint in the road Connect two paints with a line Detect cars Find objects that move Use an existing algorithm to put boxes around them (so we can see it working) Judge different status of cars Origin - point that represents the object Direction Found by comparing origin in one frame to origin in another Compared to lane direction to see violations Speed Distance between origins in two frames Distance between objects Distance between two separate cars

References

[1] M. Naphade, D. C. Anastasiu, A. Sharma, V. Jagrlamudi, H. Jeon, K. Liu, M.-C. Chang, S. Lyu, and Z. Gao. The nvidia ai city challenge. *IEEE Smart-World, Ubiquitous Intelligence & Computing, Advanced & Trusted Computed, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, 2017.

[2] S. Ren, K. He, R. Girshick, and J. Sun. Faster r-cnn: Towards real-time object detection with region proposal networks. In *Advances in neural information processing systems*, pages 91–99, 2015.