Safety Concerns for Autonomous Vehicles

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I. Introduction

Self-driving cars have been a prediction and vision of the future for years to come. Imagine long road trips simplified with the autonomous vehicle driving through the night for you. This is just one of the many potential benefits of autonomous vehicles. Other benefits include safer roadways and better traffic flow. If the autonomous vehicle is perfected it could aid future generations in efficiency and safety. Autonomous cars are simply, cars with the ability to drive themselves. They're programmed with an Artificial Intelligence system that basically acts like a human driver and drives the vehicle without needing user input. Autonomous vehicles, as they are now, are insufficient for human roadways. There are a couple present issues in self-driving cars now. One of these issues is that autonomous vehicles are not able to safely navigate construction areas if signs are not fully recognized by the computer systems. Because so many people are working around construction areas, this is especially dangerous. Another critical issue with these vehicles is object detection. Autonomous object detection is one of the most critical components of autonomous vehicles, and although it's quite satisfactory, it's not good enough in its current state. Another issue with the autonomous car is how it calculates relative velocity to the objects moving in front of it.

Some methods are presented to help solve some of these critical issues. One method to making autonomous cars detect road signs better is to use computer vision algorithms. These algorithms are very accurate at detecting thousands of different work zone signs. Once the system has recognized what sign is present, it can perform the appropriate action. Maximizing object detection, on the other hand, cars are able to use temporal and stereo cues. Researchers were able to utilize these cues to recognize errors in object detection. To calculate the relative velocity of a moving object in front of autonomous vehicles you can calculate the TTC (Time to Contact). Calculating the TTC is vital in seeing how many seconds you have before a potential collision. Calculating the TTC quickly and accurately can lead to safer collision free roadways. For example, Seo et al. created mock work zones to test their computer vision algorithms. These mock courses were helpful to see how vehicles processed and analyzed different work signs and hazards. Ramanagopal et al. analyzed datasets and rendered images similarly. These researchers, on the other hand, simulated CNN object detectors. Wang et al. helped program an android phone camera on a self-driving robot car. This vehicle was able to detect and resolve issues by calculating the TTC by the help of a Java program [1][2][3].

However, although these solutions have assisted tremendously, work zone signs are not detected properly if signs are exposed to a unique light source. "Although we have demonstrated the effectiveness of utilizing color in detecting signs in perspective images, in practice, a color-based sign detector may not work in some cases (e.g., where a variation of the target color has not been observed during the training phase)." [1] When it comes to object detection in autonomous vehicles, using deep learning detects all negatives in the frame, but not all negatives need to be avoided. Using the TTC algorithm is very accurate, but this only provides an estimation so it must be combined with other sensors to be completely accurate. The present paper talks about some of these attempted solutions and strides at making the autonomous car perfect. Using different kinds of experiments, researchers were able to make lots of progress on issues that surround the autonomous vehicle.

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