



Deep Learning using Computer Vision in Self-Driving Cars

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Research Purpose

Self-Driving is one of the hottest topics in computer vision and deep learning is one of the most exciting topics in machine learning. There have been a lot of advances made in this field by Tesla, Google's Waymo, and Apple, to name a few. The major purpose of this research is to understand how deep learning is being used and the practical limitations faced with the current technology in self-driving vehicles.

The research aims to understand the intricacies and detail gone into the tools and techniques which enable deep learning for vision and image perception of self-driving cars.

Research Question:

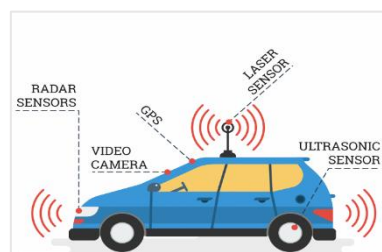
How does deep learning with computer vision help in self-driving technology?

Background

Japan, in the year 1977 introduced a camera system which could transfer data directly to a computer for image processing. As a result, this led to the first self-driving passenger vehicle, reaching a maximum speed going up to 20 miles per hour.

In the early '90s, Carnegie Mellon University started to build self-driving cars, incorporate neural networks into image processing and also included steering controls. In the mid-'90s, Carnegie researchers have taken their self-driving car to the road, traveling close to 2,800 miles from Pittsburgh, all the way to San Diego. They were able to control the speed/velocity and braking, but the car was otherwise autonomous.

Tesla with its self-driving software enables the autonomous hands-free operation for long highways and freeways. Tesla might be the closest company to come out with autonomous cars to the market, as of 2021. On the other hand, the cars are not autonomous in any way. (Source: Reference 1)

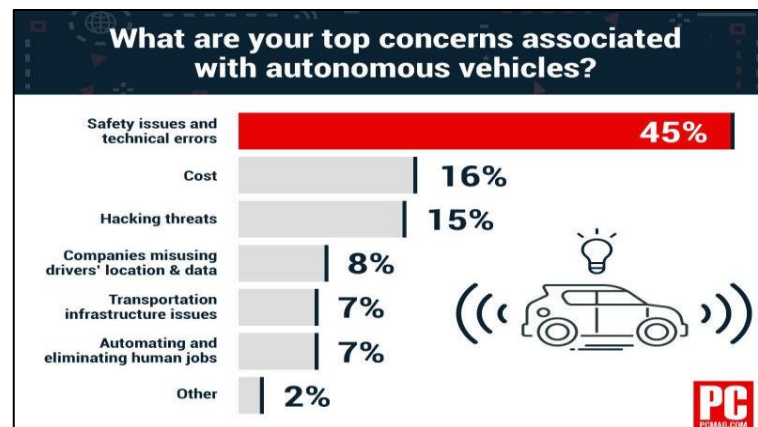


Self-Driving Cars: What the Engineers Think

Image source: Electronic engineering Journal (See Reference 2)

Research Methodology

- Qualitative Research:** Online survey, collecting and analysing years of video footage and images for computer vision and image semantic segmentation. This research will be primarily done based on the information gathered from literature reviewing of peer-reviewed journals taken as a reference.
- Quantitative Research:** A review of historical datasets can be done to improve the understanding of the machine learning algorithms.
- Data collection methods:** Out of the different data collection methods, the Secondary data collection method is used here.
- Data analysis:** Data science and analytic techniques are used to understand and interpret large sets of datasets.



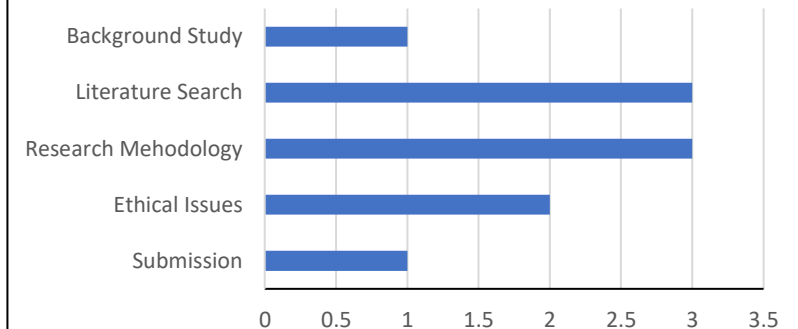
Source : PCMag (See Reference 3)

Evaluation Methodology

- Data Collection:** Starting with collecting historical datasets, images, and video files from analysis of previous years.
- Data Cleaning:** This method is used to clear out the noise and unnecessary data which is not relevant. This method can help us get accurate results and makes for better visualization for insights.
- Use of algorithms for classification:** Deep Learning (DL) is one of the prominent algorithms used in self-driving cars. The systems use CNN to interpret and classify the various sections of the road and to make appropriate decisions.

Schedule

Week Wise Schedule



Issues

- Some strong opinions for and against driverless cars may lead to a rise in political and some social conflicts. The reason is that a low tolerance is seen for accidents caused by autonomous vehicles which might delay the implementation of driverless systems and can considerably reduce those risks.
- Driver error is blamed for a majority of road traffic deaths. Hence, an improvement in safety would be an advantage. Therefore, to gain public trust and acceptance, the standards for safety would have to be stringent. This would classify as a legal issue.
- The critical event control systems which require automation needs strict virtual testing in a controlled environment before releasing to public roadways. To trial test, this system on the roads could have potential risks associated with the public. This would come under legal issues.

References

- History of autonomous cars, Available at : <https://www.tomorrowstoday.com/2021/08/09/history-of-autonomous-cars/> (Accessed: 02 May, 2022).
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- What's the Scariest Thing About Driverless Cars? Hint: It's Not the Price. Available at : <https://www.entrepreneur.com/article/336118> (Accessed: 02 May, 2022)