

RBE 500 Homework #7

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Discussion Essay

Please write a two-page essay (excluding references) discussing the existing and potential ethical issues in the application domain(s) of robotics you are interested in exploring in your graduate study and future career.

In this essay, I will be exploring the ethical concerns surrounding the advent of autonomous vehicles. Specifically, I will focus on self-driving vehicles in the civilian space, such as cars, buses, and trucks. As for a geographical and cultural focus, this essay will mostly take on a perspective encapsulated by transportation and traffic sensibilities within the United States of America.

The V. Müller report states that a problem qualifies as a problem for AI/robot ethics if we do *not* readily know what the right thing to do is, further causing us to not readily know the answers to certain questions. ^[3] There are several such unanswered questions with regard to level 5, full driving automation cars, as defined by the Society of Automotive Engineers. ^[2] Such vehicles will not even have steering wheels or acceleration/breaking pedals! ^[6] Let us ponder on that for a moment. I ask the reader to imagine themselves in a car that just moves, without the ability to override any controls. Personally, I am a big fan of cruise-control and steering assistance in my own car, but I am not sure I would feel comfortable sitting in a car without the ability to override its controls. While this feels like a small thought experiment, it is in fact a question of ethics. Acceptance of level 5 autonomous cars requires humans to ‘trust’ a machine, and just how averse will human society be towards this? Level 5 autonomy might become technologically possible, but will humans actually want to use it?

A survey conducted by Policygenius found that 76% of Americans feel less safe driving or riding in cars with self-driving features. ^[5] This seems like an astonishingly high number, but is perhaps understandable. Before any major technological advancement, humans have usually felt skeptical of the technology in question. Most humans likely felt unsafe traveling in commercial aircraft when it first came into existence. Yet, if we glance at all the ten debate topics outlined in the V. Müller report, only a few could explain this general insecurity around AVs (autonomous vehicles). After, besides a few corner-cases of morality (for example, the famous trolley problem), AVs are supposed to be designed to follow traffic rules, which intrinsically have very few ‘grey areas’. One of these ten debate topics, however, appears as a general logical explanation — the opacity of AI systems. ^[3] Here, it is explained that the AI systems behind AVs are generally invisible to both the user and the programmer. It is therefore difficult to trust a ‘black-box’ system to take charge of moving heavy machinery that could endanger human life.

The antidote to this distrust seems to be multifaceted, however two major facets are widely available statistics on the safety of AVs, and technical education of the public. A well-cited,

comprehensive article from the AI Ethics journal lists among its many conclusions that AVs have the potential to increase traffic safety, and that people with high education levels are more positive towards AVs than people with lower education levels. ^[4] Therefore, as society begins to see more widespread studies and data on the safety of AVs, people might begin to trust AVs more. Furthermore, as education systems begin to focus more on STEM, the general understanding of AI will begin to increase.

An additional perspective is that the opacity of AI systems could eventually decrease its scope from being opaque to both programmer and user to just the user. For example, currently, most programmers view neural networks (NNs) as a black box. We understand that NNs have input, output, and middle layers, but the fact that the middle layers re-adjust their weights via backpropagation makes it extremely difficult to know why a fully-trained NN makes a prediction in a certain way. However a recent manuscript by Caglar Aytekin has shown that any neural network with any activation function can be represented as a decision tree. ^[1] Studies like this will give humans a deeper understanding of AI, and can eventually help users of autonomous vehicles battle against the ‘fear of the unknown’.

Now, assume that the problem of the negative public perception of AVs is solved. There would still be many difficult ethical questions that either the manufacturer or the user would have to answer. Take for a moment one of the corner-cases of morality we mentioned earlier — the trolley problem. Any well-designed AV would have to account for the situation where, due to unpredictable environmental factors on the road, there would be rare situations where the AV would not be able to avoid a calamity. As an example, say there is suddenly a human in the path of the AV, but the vehicle does not have enough time to steer away while keeping both the passenger and pedestrian safe. In this event, should the AV prefer the life of the passenger, or the pedestrian?

As humans, we always prefer saving our own life first. But an autonomous entity that prefers its ‘owner’ or passenger could quickly turn into a slippery slope. What would be the legal ramifications if the pedestrian was killed? Who would be responsible? Although the question was probably asked far differently, the Policygenius survey found that Americans are divided 50/50 on who should be held responsible if a car crashes while self-driving features are in control — the driver or the car manufacturer. ^[5]

The moral question of the trolley problem begins to enter the realm of artificial moral agents, as mentioned in the V. Müller article. ^[3]

References

- [1] Caglar Aytekin. Neural networks are decision trees, 2022.
- [2] On-Road Automated Driving (ORAD) Committee. *Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles*, April 2021.
- [3] Vincent C. Müller. Ethics of Artificial Intelligence and Robotics. In Edward N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, Summer 2021 edition, 2021.
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- [5] Policygenius. Self-driving cars make 76% of americans feel less safe on the road. <https://www.policygenius.com/auto-insurance/self-driving-cars-survey-2022/>, September 2022. Accessed: 2022-11-18.
- [6] Synopsys. Autonomous driving levels. <https://www.synopsys.com/automotive/autonomous-driving-levels.html>. Accessed: 2022-11-18.