Rob Stanford
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Autonomous Driving Systems

As technology advances, humans continually seek to leverage new advances in the hopes of improving our lives, making processes more efficient, tasks safer, or enabling new abilities. The automotive industry is one such area where recent technological advancements have enabled autonomous driving systems to potentially transform the way we travel as well as reshape the space we share with automobiles. As manufacturers and consumers adopt this new technology, it is essential to pause and consider whether some of the unintended consequences of autonomous driving systems may outweigh the benefits, causing more harm than good.

The appeal of autonomous driving systems is easy to see. They can reduce the number of automobile accidents caused by human error, enable more efficient use of time while inside a vehicle, and help to increase mobility for those who cannot drive (Wallace, 2017). More and more vehicles are being offered with, or come standard with, some level of autonomous driving. Some vehicle manufacturers, such as Tesla, make their main selling point their ability to be fully autonomous. Yet for all this progress, it is important to critically examine the other side of what happens with enabling autonomous driving systems. Technological advancements aside, there are a host of ethical, legal, and societal issues raised by autonomous driving systems. These issues must not become secondary to purely technological advancement, or there exists the risk of causing more harm than good.

The automobile has always been a prime example of human technological progress. Since the very first automobile was constructed in 1886, it has never slowed down in adopting new technologies. Key to the multitude of new technologies are automobile safety systems, of which the automobile has roughly five eras of vehicle safety. The first era, the safety and

convenience era, occurred roughly from 1950 through 2000. Developments such as cruise control, seat belts, and anti-lock brakes were developed during this time. The next era, from 2000 to 2010, is the advanced safety era. Where advancements such as electronic stability, blind spot monitoring, forward collision warning, and lane departure warning came about. From 2010 to 2016, the era of advanced driver assistance occurred. Systems like rearview cameras, automatic emergency braking, automatic pedestrian braking, rear cross-traffic alert, and lane-centering assistance became more prevalent. We are currently in the fourth era, starting in 2016 and estimated roughly through 2025, the era of partially automated safety. Developments such as lane keeping assist, adaptive cruise control, and traffic assist are deployed during this era. Finally, the fifth era, known as fully automated safety, is estimated to arrive sometime around 2025. With it, fully autonomous driving capabilities will be brought to automobiles (Miller, 2023). The safety of cars has evolved at a breathtaking pace since the early 2000s. In a span of about 20 years, we have gone from systems that are fully under the control of the driver to the driver being assisted by the automobile to now having the automobile fully control some systems. During this time, the potential ethical, legal, and societal issues have all taken a back seat to technological development and deployment.

Stakeholder Analysis

While the debate around autonomous driving systems can be complex and multifaceted, generally speaking, the advocates and detractors can be grouped into two main groups. In favor of the adoption of autonomous driving systems are automobile manufacturers. They're largely the group responsible for the development of autonomous driving systems and have much to gain from their wider adoption. In opposition to autonomous driving systems adoption is the general

public. The general public is the end consumer and user of autonomous driving systems, and as such, they have concerns over their development and usage.

Stakeholder 1: Automobile manufacturers

Values. Automobile manufacturers are a business, first and foremost. Their company is designed around the production and sale of automobiles, automobile services, and automobile accessories. Anything that either enables them to sell more automobiles or sell automobiles more efficiently is something they want to take advantage of, as it allows them to become more profitable.

Position. By selling automobiles that include autonomous driving systems, it allows automobile manufacturers to market the automobile in new ways. They can appeal to customers on the grounds of increased safety by means of reducing human error or market to customers based on the ability to reclaim time that otherwise would have been previously spent driving. Manufacturers can also market on reduced emissions and reduced traffic congestion due to autonomous vehicles. All these put the vehicle in a more favorable position to market, either by increasing the price of the vehicle or by helping the vehicle stand out in a crowded marketplace.

Claims. Many of the positions of automobile manufacturers on why to sell autonomous vehicles are claims of fact. They rely on facts about how "self-driving cars [...] are dramatically safer than human drivers" (Lee, 2023). Somewhat ironically, according to autonomous vehicle developer Waymo, over 1 million miles 55% of all incidents that occurred during testing on public roads were the result of a human driver hitting a stationary Waymo vehicle. In every vehicle-to-vehicle event, human drivers had violated the road rules or behaved dangerously. (Waymo Team, 2023). Given that autonomous driving systems have been shown to have a reduced number of accidents as compared to a human driver, the claim of value is also

applicable. There is an inherent goodness in reducing the number of people injured in automobile accidents.

Stakeholder 2: General Public

Values. While many in the general public can understand the general upside of autonomous driving systems, many also understand that the technology is still fraught with ethical, legal, and societal issues (Hundt et al., 2022). The general public wants to understand and be assured that what goes into making an autonomous vehicle is not ethically unsound or that using it will have dubious legal consequences. The general public also values their hard-earned money, and they do not want to feel forced to spend it on features they might not need or want. The general public also wants to feel safe and in control of the vehicle they are in. However, autonomous vehicles can expose a much larger target surface for hackers to penetrate. That can end up yielding valuable data to attackers, as well as render physical control of the vehicle over to the attacker.

Position. At the heart of most autonomous driving systems is an artificial intelligence that has been trained from large data sets; its purpose is to know how to react when presented with a similar challenge. However, it has been shown that large data sets used to train A.I. can be tainted and have a bias, be it racist, sexist, ableist, or ageist (Hundt et al., 2022). The bias A.I. could have an unfair, real-world effect given the decisions an autonomous driving system will face every day. The current state of laws covering the operation of autonomous vehicles is also a concern for many people. At the moment, in the United States, each state has its own laws regarding the operation of autonomous vehicles. Some manufacturers choose to enable autonomous driving functionality which allows a driver to not obey the current driving laws and

creates confusion about who is legally at fault (Thadani et al., 2023). Many consumers also do not want to be forced into buying a vehicle with an autonomous driving system before they feel the technology is fully ready (Smith, 2019) or do not desire the autonomous driving system at all, but it is a forced, standard option.

Claims. The general public can also make a claim of fact in their argument against autonomous vehicles. The fact that bias in A.I. training can exist means it can have a direct effect on the way an autonomous driving system would potentially operate and respond. Dealing with the ambiguous legal uncertainties of operating an autonomous vehicle, the claim of policy is relevant to the argument; there needs to be a policy enacted at a federal level to cover the development and use of an autonomous driving system.

Argument Question

Should vehicles come with autonomous driving systems while the technology is still at a developmental stage?

Arguments

Stakeholder 1: Automobile manufacturers

Automobile manufacturers utilize the Utilitarianism ethical framework to help answer the question of whether they should utilize autonomous driving systems at this stage of development. Modern Utilitarianism was developed by Jeremey Bentham in the 18th century. The major principle of utilitarianism is that a choice is right or wrong by focusing on the outcome of said choice; that the most ethical choice is one that produces the greatest good for the most number of people.

Automobile manufacturers argue that the use and development of autonomous driving systems is ethical because, as more autonomous driving takes place, the end outcome will be that

fewer accidents occur from human error, thus saving lives. Automobile manufacturers also argue that, as a result of the adoption of autonomous driving systems, they will significantly improve traffic flow and reduce emissions, making transportation more sustainable and environmentally friendly.

The statistics from limited autonomous driving pilots show that the majority of issues encountered during testing were caused by human error (Waymo Team, 2023; Zhang & Cruise, 2023). The more autonomous driving systems are adopted and put into use, the safer the roads will become for all.

By adopting autonomous driving systems into vehicles, auto manufacturers will be able to claim they are helping to reduce accidents and make driving safer. Yet, at the same time, they will also be able to increase the cost of automobiles, increasing their profit margin.

Stakeholder 2: General Public

The general public sees the argument as not purely based on the outcome of the decision but instead wants to understand the process behind the development of autonomous driving systems. The desire to know if the systems themselves are applied ethically across all of the general public. This viewpoint aligns well with the Kantian ethical framework. Developed by Immanuel Kant, Kantian ethics places importance on rationality, autonomy, and treating individuals as ends in themselves rather than a means to an end. One of the major principles of Kantian ethics is that an action is morally right if it can be willed as a universal law; that is, if an action is morally right for one person, it must be morally right for everyone in similar circumstances. Another major principle is that of autonomy: that individuals have the capacity for self-determination and moral agency and should be treated as such.

Autonomous driving systems have a difficult time doing things they are not trained or programmed to do, and while they are trained and programmed to follow the laws and obey traffic regulations, they cannot make moral decisions. For example, the moral decision of whether to hit a bicyclist who has swerved into the vehicle's lane or to swerve into oncoming traffic. By enabling autonomous driving systems, there is a removal of the very human autonomy that is fundamental to Kantian ethics.

The current state of autonomous driving systems is vastly underregulated; there is little or variable oversight to help drive the technology in a fair and just manner. The general public cannot yet completely depend on an autonomous driving system; many situations demand a human driver take control of the vehicle. According to Kantian ethics, it would be better to limit or remove autonomous driving systems until they can respect everyone equally.

Given the current state of fully autonomous driving systems, with more widespread adoption of autonomous driving systems, the general public will be the one to suffer from their incomplete development. In a non-autonomous vehicle, an individual can depend on another moral individual being responsible for their vehicle's actions. Autonomous driving strips the general public of that right. By including autonomous driving, a feature not everyone might want, it increases the cost of the vehicle and increases the attack surface of the vehicle, making it more vulnerable to exploitation.

Student Position

The last 20 years have seen a tremendous increase in the capabilities of automobile safety systems, and autonomous driving systems look to eventually be one of the biggest increases in automobile safety. However, autonomous driving systems are still in the very early stages of development, and for that reason, I cannot yet support their wide-scale adoption. My personal

belief is that autonomous driving systems should be allowed in the future, but at the current time, the ultimate responsibility of vehicle operation still needs to fall to the human operator behind the wheel.

Eventually, the time will be right for the widespread adoption of autonomous driving systems. But in line with the general public's argument, there are a lot of questions about how the A.I. for the autonomous driving system was trained and how that will equally or unequally affect individuals from different races, sexes, ages, etc. Another area that I believe needs more resolution before the mass adoption of autonomous driving systems is the lack of governmental oversight. There needs to be better, clearer rules in place, to the benefit of both the general public and automobile manufacturers. If clear rules for how an autonomous driving system would be established and declared at the federal level, it would be easier for auto manufacturers to ensure their autonomous driving systems were meeting the required baseline.

The best way forward to resolve this argument is to keep iterating on autonomous driving systems and do so in a way that is safe and fair to everyone in the general public. Ensure that A.I. training is free from bias and continue to develop the A.I. models to handle more road situations. Pursue improvements to autonomous vehicles' sensors and other hardware capabilities. Outside of the vehicle, it would also be beneficial to study and improve current road design. If we know we are moving towards a world where autonomous vehicles are commonplace, we should be designing roads that are meant to be used by autonomous vehicles. That might mean removing certain aspects of roads today that easily confuse autonomous vehicles, or that might mean designing specific areas dedicated to human traffic (walking, bicycles, etc.). These are challenges that will require both the government and automobile

manufacturers to work in tandem to resolve them and help spur the widespread adoption of autonomous driving systems.

Summary

Autonomous driving systems have the potential to revolutionize the world of transportation. Eventually, we will arrive at that destination, but we have to do everything in our ability today to ensure that we arrive there in a fair and equitable manner for all of the general public, not just because automobile manufacturers want to become more profitable.

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