

The Better Backseat Driver: Increased Safety Through Autonomy

OSU CS391 Final Writing Assignment

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OVERVIEW

The United States Department of Transportation's National Highway Traffic Safety Administration reports that there were 37,113 fatalities caused by motor vehicle traffic accidents in the United States, in 2017, and there have been at least 30,000 every year since 1975 [1]. For every 100,000 Americans, over 10 die in a motor vehicle accident each year. Motor vehicle traffic deaths are among the leading causes of accidental injury deaths in the United States [2]. The widespread use of motor vehicles has other unintended consequences as well, such as contributing to massive commute times [3], and having a negative impact on the health of the environment [4]. Because of the impact on the environment, every living organism on the planet has a stake in this problem. Citizens of modern societies are especially impacted because they often need to use motor vehicles and thus put themselves at risk of death or injury and subject themselves to potentially long commutes. The companies who play a part in the manufacturing and distributing of vehicles are heavily financially invested in this problem.

Artificial Intelligence (AI) can be applied to these problems by creating autonomous vehicles to solve the issues introduced by motor vehicles while still retaining their benefits. The ethics of introducing self driving cars to society can be analyzed through the lens of utilitarianism. Autonomous vehicles do not suffer from the same attention problems that human drivers do, meaning that they will cause less accidents and therefore less injuries and deaths. Additionally, their driving behaviors can be optimized to improve the flow of traffic and prevent traffic jams [5]. They also allow for the introduction

of more efficient and environmentally friendly infrastructure in modern cities. Some societal and logistical issues must be addressed as they are introduced into society, but their overall benefits will outweigh the negative consequences. Motor vehicles have multiple side effects that harm all members of society, but these problems can be resolved by applying AI to autonomous vehicles.

PROBLEM DESCRIPTION

Cars are crucial to most societies. They are used and manufactured around the world, and are used to commute at all times of the day. From the simple commute to work, to getting groceries, to visiting family, cars are essential to many parts of our daily lives. Despite this, these tools inevitably take lives - quite frequently in fact. This danger is shown in [1] and [2]. Accidents are not the only way cars damage our world or society - traffic is an extreme time sink [3], as well as pollution creator [4]. Speaking of pollution, cars themselves are responsible for a significant amount of pollution, which can cause damage to the environment [4]. These things obviously negatively impact the utility functions of the members of society - slowly but truly, these members of society are wasting their time in traffic, being the victims of pollution, and risking life and limb to get somewhere in a manner not much more expedient than the alternatives.

STAKEHOLDERS

Stakeholders in the use of cars include nearly everyone in society. Firstly car owners and users are obviously implicated by decisions in this field, as they are owners. Also, those that are driving cars are

also stakeholders - the everyday pedestrian crossing the street who risks being hit by a distracted driver is certainly impacted by the decision to move to autonomous cars. On the other end of the spectrum are the large companies that manufacture cars - these companies (Ford, Chevrolet, GMC, Volkswagen, ...) are heavily invested in this issue - they derive the entirety of their revenue from selling these cars to people. Changing up what cars can or should be used on the road has the ability to significantly impact their income streams. Further expanding the scope of those that hold stake in this issue, all living creatures that depend on their environment to survive must be considered stakeholders - these creatures will all be impacted in some way by the pollution released by cars.

APPLICATIONS OF AI

Before we go about explaining how AI would be applied to the transport industry, we must define what an Autonomous Vehicle (AV) is. An AV is a vehicle that can perform all the computation and adjustments required to drive itself - it can map routes to destinations, drive and react as needed to external events. Autonomous vehicles are not the stuff of science fiction any longer - there are already many companies working on such vehicles. Waymo, for example, is invested in making safe AV for the masses, and has started work on both integrating with existing platforms (both cars and trucks) as well as testing their own proprietary car [6, 19]. Tesla are also experimenting with AV capability and this functionality is included in all of their new cars [20], as well as trucks that have AV capability. BMW is working on AV tech too, with what they refer to as "levels" of autonomy, with "level 5" being complete computer control and automotive autonomy [7]. Lastly in terms of examples (but definitely not the last company doing AV work) is Embark, a company focused on developing autonomous trucks [8]. How does this all relate to AI, though? AI is a fundamental component in the functioning of these systems: AI allows programmers to create intelligent computer systems that can react like humans. Here, it is important to note that while they may react 'like' humans, unlike humans, they react consistently, educatedly and reliably. This trustable reaction as

well as the ability to process many orders of magnitude more data than a human, in an exact manner, makes AI a great fit for applications in AV systems. In fact, AI is able to overcome the shortfalls that make humans such dangerous, unpredictable drivers [10, 11, 12]. The process of making AI is difficult and costly, though. This requires that the creation of such technology be spearheaded by companies with a significant amount of capital to invest. This, however, does not exclude smaller, startup-like companies from engaging in the process of creating AV systems, as they can create smaller sub-assemblies (physical and code-wise). There are plenty of examples of small and passionate groups of individuals coming together to create startups that advance specific aspects of the technology and drive progress forward significantly [9]. The passion of these groups allows society to progress towards a significant change and solve the issues that come along with motor vehicles.

BENEFITS OF AI

Autonomous vehicles will crash less than human drivers and thus have a positive impact on society. Human drivers often make errors that lead to accidents and fatalities. In 2018, the National Highway Traffic Safety Administration reported that between 92 and 96 percent of automotive accidents are caused by human error [10]. Drivers are unable to react to potential accidents in time, and this is often their fault. In 2015, nearly 400,000 people in America were injured by distracted drivers [11]. An FBI report shows that in 2014 there were over 1 million arrests for driving under the influence [12]. Humans are emotional, irrational, and slow to react. Letting a human operate a motor vehicle puts the lives of others in danger. Autonomous vehicles do not suffer from the same issues as humans. They constantly analyze their environment, and execute consistent and safe instructions based on their observations. As a result, less crashes will occur from allowing AI to make driving decisions instead of humans.

To analyze the ethics of using autonomous vehicles with utilitarianism, a utility function must be defined that encompasses all stakeholders. The utility

function used in this analysis will include the health of all organisms on the planet, and the happiness and freedom of members of society, and the financial outlook of both companies and individuals. Having less motor vehicle accidents will improve the health and safety of all members of societies that rely on driving for transportation. In addition to reducing the likelihood of injuries and deaths for individuals, the likelihood of an individual's friends or family being injured decreases as well, leading to a positive increase in mental health. Reducing the number of crashes will relieve many families from unexpected crash related expenses, and increase the financial outlook of car manufacturing companies by improving their reputations. The improved safety provided by autonomous vehicles will have a very positive impact on society, and dramatically increase the overall utility function.

In addition to reducing crashes, autonomous vehicles can speed up transportation and save people time. Travel times in many modern areas are very large. For example, the US Census Bureau reported that the mean commute time to work in the United States between 2014 and 2018 was over 26 minutes each way [3]. Autonomous vehicles have potential to give much of that time wasted on traveling back to individuals. Human drivers have imperfect reactions, coordination, and driving strategies. On the other hand, autonomous vehicles can be programmed with optimal driving patterns and coordination in mind, greatly reducing traffic congestion. An experiment done by many American universities showed that autonomous vehicles can be programmed to drive using behaviors that dampen traffic waves [5]. Researchers from Nagoya University showed in a simulation that the increasing the number of the vehicles on the road that are autonomous improves the traffic flow [13]. When humans are completely removed from the equation, the possibilities are even greater. A network of autonomous vehicles coordinating together could remove the need for stopping, and increase the speed at which vehicles can safely travel at. If commuters and travelers spend less time traveling, they will have more time and freedom to do the things they want to do, leading to an increase in utility. Additionally, they will be able to use their traveling time more effectively because

they no longer have to operate the vehicle, saving them even more time. Individuals who use vehicles for travel will see increased happiness, freedom, and health. They also may be able to financially benefit from having more time. This will result in a large net gain of utility for society.

The introduction of autonomous vehicles allows for a reimagining of modern infrastructure. If a fleet business model is used like the one being explored by Waymo [6], the fleet could be parked far outside of the city during low usage hours. Parking cars outside of the city allows the large amounts of space dedicated to parking to be freed up for other uses. The potential benefits of this are numerous, including more sustainable city design to increase the health of the environment, and more affordable housing within the city to help individuals financially. These benefits would be felt by all those living in and around the city, leading to a great increase in net utility. The fleet would also likely be very profitable for the companies who operate them, as well as reduce the barrier to entry for transportation that currently exists due to the large cost of motor vehicles. Additionally, there is the opportunity to create a fleet of autonomous vehicles that are fully electric. Gas powered vehicles have a negative impact on the health of the environment [4]. Electric vehicles do not suffer from this problem, but currently the manufacturing process of electric vehicles is significantly worse for the environment than that of traditional vehicles. However, it is believed that the emissions produced by this process could be cut down to the same level as traditional vehicles by adopting new manufacturing processes [14, 21]. A fleet of autonomous cars would encourage the widespread use of electric vehicles, greatly decreasing the negative impact of cars on the environment, and increasing the utility of all organisms on the planet. Autonomous vehicles have the potential to improve many aspects of society. They can increase the health and happiness of all individuals in society and have positive impacts on the environment without negatively impacting the finances of the companies that create them. Overall, the net utility for society is greatly increased by autonomous vehicles. Therefore, their introduction is morally justified under utilitarianism.

ADDRESSING POTENTIAL ISSUES

It is no surprise that there are many potential fears when it comes to the appearance of fully autonomous vehicles. However, most of those fears can be attributed to an incomplete understanding of the implications of AVs to our everyday lives, and human's natural resilience to change. A common argument against autonomous vehicles is the fear of providing third-party entities an easy way to monitor and track vehicle users, which is a major breach of privacy. While this is a valid concern, it is important to note that rapid data collection is an already common phenomenon and not really related to AVs. More specifically, it wouldn't be any more difficult to implement tracking mechanisms on a regular vehicle, as nothing about the nature of automatic driving directly enables tracking. Another important point is while this tracking sounds dangerous in nature, it has many benefits: for example, it would be possible to greatly improve the infrastructure and optimize our time spent on the road with all the data collected from individual AVs, and this would improve the utility of all commuters [3, 15]. Furthermore, such a system could help people who got stranded on the road, suffered a component failure, or otherwise took part in an automotive accident by automatically informing parties who can deliver aid. It seems as the benefits would outweigh the costs, since tracking could only be exploited by an already malicious party, which would be capable of installing tracking devices on cars regardless. Another obvious problem that also stems from tracking is the problem of security compromise, or "Hacking". Though it is true that as systems become more complex they become more susceptible to exploitation by adversaries, security has always been and will continue to be an arms race between people attempting to exploit systems and defend them. This does not mean that we should stop advancement in fear of security, but rather that we need to continue advancing our understanding and practices in security to make sure the defenders can always stay ahead of the attackers. Many items that are constantly used by a majority of individuals, such as smartphones, pose an obvious security threat if exploited. However, as a

society, we have recognized that these phones undergo constant scrutiny from the security community, and the probability of malicious compromise is vastly overshadowed by the benefits of those phones. Another problem that might arise with the appearance of AVs is the loss of income for a majority of driving professions, such as public transit operators, taxi drivers, and truck drivers. While this is likely the case due to the much greater efficiency promised by AVs, these jobs are less likely to disappear, and more likely to simply shift to different types of jobs [3]. It is important to consider that there are many tasks that humans are not optimized for doing, which is why computers were invented in the first place. Driving as a profession is one of those tasks, as it requires long hours of constant attention, and any mistake or slight mishap during a long night of driving can cause a catastrophe [1, 2, 11]. On the other hand, jobs as developers tasks with optimizing AVs, mechanics that would fix and debug those machines, and similar professions (which are based around the cognitive ability of humans: something we excel in as a species), are likely to see a significant rise. Though it is true that AVs will trigger a difficult period of transition as the job market makes this transition, it seems that the long term benefits even for the working class will outweigh the costs: thus justifying this transition under utilitarianism.

CONCLUSION

The advent of autonomous vehicles that will replace the need for manual driving is soon upon us, and as such it raises many questions in regards to the ethical implications of such a system. In this paper, we have looked at the issue through the lens of utilitarianism, and presented evidence that the benefits provided by autonomous vehicles in such domains as environmental friendliness, human safety, and travel efficiency, will outweigh the potential problems that arise from this change. Though with every significant advancement in human history there comes a period of uncertainty and gradual adjustment, in the long term AVs will greatly benefit the human population as a whole, and optimize out the many issues involved with manual transportation.

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