Autonomous Vehicle Case Study

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Introduction

Self-driving cars (Autonomous Vehicles (AVs)) have many associated benefits such as reducing accidents by removing human error, providing a smoother riding experience, "eased road congestion, decreased harmful emissions, and minimized unproductive and stressful driving time." (Lin, 2015). Although AVs are predicted to reduce the amount of accidents due to human error, accidents won't cease to exist. The case video brings up the critical distinction between an accident involving human drivers and an accident involving AVs. The distinction at hand is that humans react in an accident scenario whereas AVs can make informed decisions of what to do. Humans cannot be blamed for their in the moment reaction, so if a person has to swerve into another lane possibly endangering others for the sake of their own safety, they will not be in the ethical wrong for doing so in most peoples' opinions. Since AVs are designed with software and data, programmers have the ability to specify how an AV should react in any given situation. So if the AV is put into the situation of having to swerve into another lane possibly endangering others for the sake of its own passengers' safety, it has the ability to make a decision based on any set of guidelines. The decision making process creates a number of ethical and policy issues. AVs can be designed on a number of principles such as keeping its passengers safe at all costs or minimizing harm to others. AVs also have the potential to analyze who the individual passengers involved in the accident are before the accident even happens. With these capabilities, AV companies could create a list of individuals who are to be protected at all costs and sell spots on the list to guarantee vehicle safety. This could be abused by powerful and wealthy individuals to create a situation where AV accidents discriminate against people based on their socioeconomic status. As AVs can be based on any set of principles, any factor such as age, gender, socioeconomic status, etc can be used to discriminate against. Without policy intervention, AVs allow for a new form of discrimination that previously was not possible.

The 'Obvious' Solution

At first glance, the solution seems obvious and simple: a policy that declares AVs must minimize harm while protecting its passengers. Unfortunately, this solution has problems of its own, as the whole situation of creating policy for AVs is more complex than it seems. The Case brings up the situation of an AV having to swerve into another lane to protect its passengers. In the situation of having a motorcyclist with a helmet in the right lane and a motorcyclist without a helmet in the left lane, the minimize harm principle dictates that AVs ought to swerve into the motorcyclist wearing the helmet because the helmet would give them a higher chance of survival when hit. This decision would be to punish the motorcyclist who is acting in a responsible manner by wearing a helmet and save the irresponsible, unlawful motorcyclist who is not wearing a helmet. Since encouraging unsafe behavior like not wearing a helmet would not promote safe transportation, this system seems to have some drawbacks. The point is that AV systems will always have some sort of bias. The bias can be deliberately chosen, and what the biases are has massive potential to impact individuals involved in AV accidents. Policy must be discussed and formed in order to protect individuals from discrimination by ensuring the bias of AVs are favoring the individual. Policymakers must also consider the niche ethical situations like the one described above and how the policy would impact individuals involved in those situations.

Article : New Paper Examines the Promise and Policy of Driverless Cars

This article describes many more benefits of AVs while also addressing some of the potential hurdles. AVs are predicted to generate, “an additional $67 billion in auto industry revenue while providing $3.1 trillion in societal benefits.“ (Karsten, 2016). The revenue within the auto industry represents the vehicle sales generated while the societal benefits represents other services enabled by AVs. AVs have the ability to provide extremely low cost transportation due to the lack of labor cost. AVs also have the ability to provide accessible transportation to people who currently do not have accessible transportation available to them. People who cannot drive due to lack of licensing or health reasons can be driven by an AV. “AVs would enhance mobility in older populations that can no longer drive. “ (Karsten, 2016). Another revolutionary benefit of AVs is the ability for the car to find and park itself or continue to drive around which eliminates the inconvenient issue of finding a parking spot. “Traffic is said to be reduced 30% through the lowering need of finding parking because AVs can park themselves.” (Karsten, 2016). Although there are many benefits noted above, there are also many regulatory hurdles for AVs. Two vital steps for creating AVs include collecting data from the cars, including sensor data as well as map creation data, and testing cars on the road. “(China) still bans road testing and the collection of high-resolution data for maps. Similarly, data protection and privacy rules in the EU would make it difficult for companies to use data collected by driverless cars.”(Karsten, 2016). Strict policies in China and the EU make collecting this data difficult if not impossible. In the U.S, this data is able to be collected, but the current, “State laws in the U.S. mandate a steering wheel, brakes, and a licensed driver behind the wheel, contradicting some vehicle designs that forgo all these features.” With the end goal of AVs being to remove the need for a human driver, the U.S. laws currently do not support this vision.

Article : Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation

Another hurdle for AVs is liability. Considering “Motor vehicle accidents claimed over 33,000 lives in the United States in 2012”, the decision of who is legally responsible for the damages associated with these accidents is important (Villasenor, 2014). The current situation of liability is that the human driver is liable for damages caused by the vehicle in the case of an accident. With AVs, the driver would be a part of the car, so the manufacturer of the vehicle would be liable for damages. According to the article, liability issues show growing attention that “Liability concerns will slow or even completely prevent consumer access to autonomous vehicle technology.”(Villasenor, 2014). Due to manufacturers not wanting to be held legally responsible for motor vehicle accidents, there is a concern that AVs will not become available to the consumer. With autonomous vehicles having the ability to dramatically improve driver safety by reducing the number and severity of accidents, preventing consumer access to autonomous vehicle technology would be a mistake (Villasenor, 2014). One positive externality of liability law is that, “The legal precedents established over the last half a century of products liability litigation will provide manufacturers of autonomous vehicle technology with a very strong set of incentives to make their products as safe as possible.” (Villasenor, 2014). When AVs become available to consumers, they will have to work extremely well and demonstrate their ability to improve driver safety, in order for manufacturers to not get sued. Even with this in mind, there will be accidents due to faults in autonomous vehicles. This will provoke a response from the law, but, “there is no reason that the legal system will be unable to resolve them.”(Villasenor, 2014).

Article : Semi-autonomous vehicles must watch the road and the driver

Tesla's "Autopilot" system is a semi-autonomous vehicle system that does not replace the human driver despite its name implying so. The first ever fatal car crash in a semi-autonomous vehicle occurred in May 2016 in a Tesla (Karsten & West, 2017). The driver initiated the "Autopilot" cruise control at 73 mph on a clear day 2 minutes before crashing into a tractor trailer and dying (Karsten & West, 2017). This report from the National Highway Traffic Safety Administration concludes there were no failures on the part of the semi-autonomous driving system. The failure was attributed to driver negligence and inattention. The most likely scenario is that the driver initiated the "Autopilot" believing the car would be able to drive itself. When the tractor trailer turned to cross the road, the tesla did not recognize there was a vehicle in front of it, so it did not initiate any sort of braking system. The tesla then proceeded to maintain a high speed until it collided with the tractor trailer. This situation emphasized the importance of driver awareness of how their semi-autonomous vehicle works. This awareness must include knowing the limitations of the vehicle as well as the proper situation to use certain features. The lack of knowledge exhibited by the driver demonstrates the potential dangers of ignorance, marketing, and new technology. Although the danger is present, a study conducted by MIT showed, "most salesmen were themselves unfamiliar with how new safety features worked." (Karsten & West, 2017). This indicates there is an educational void when buying new cars, as the salesman's job is to persuade an individual to buy the car not to educate them on the features of the car.

Article : When It Comes to Safety, Autonomous Cars Are Still "Teen Drivers"

AVs are often discussed in the industry as if they are professionally safe drivers, but the reality is more like, “putting a teenage driver on the road.” (Hsu, 2017). AVs are still in their youth in adoption and development. AVs are currently at level 2 on a scale of 0-5 which describes different levels of automated driving. This scale will be covered in more detail in the paragraph titled, “Article : National Highway Traffic Safety Administration Overview”. AVs have the potential to learn quickly and improve their driving skills by comparing data from real human drivers as is the case with Tesla’s Autopilot system, but after many years of incremental improvement, how safe is safe enough? Since “No single test can determine the safety of self-driving cars.”, it seems difficult to answer that question without having a massive number of AVs actually driving on real roads with a less frequent accident and fatality rate than the average human driver. More research into the testing of AVs should be conducted, but until then, companies like Uber and Tesla will continue to test AVs in the real environment such as when Uber conducted a pilot test of AVs in Pittsburg and briefly tested some in San Francisco before California’s regulators protested them to a halt (Hsu, 2017).

Article : California Gives the Green Light to Self-Driving Cars Companies could be allowed to operate and sell autonomous vehicles by the end of the year

California made a legal process for manufacturers to certify and register their autonomous vehicles, “as safe and effective without a detailed inspection, or even having to test on the state beforehand.” (Harris, 2017). California changed their cautious approach to whenever manufacturers feel like the vehicles are ready to go. This may seem like a hazardous approach, but due to the liability issues discussed previously, manufacturers are not keen to release AVs until their ability to produce a safer driving experience has been demonstrated. The California DMV has relaxed its stance in the past years even allowing testing of level 4 and 5 AVs by companies such as Uber as long as they are not providing a ride in exchange for payment. The DMV opted to take a relaxed stance on AVs allowing pretty much any manufacturer that complies with Federal motor vehicle safety standards to produce AVs. This essentially pushes back the policy issue from a state government level to the federal government level. Since some of the federal safety standards inherently prohibit AVs without brake pad or other traditional car safety features, “This could be a time-consuming process for cutting-edge driverless cars that lack traditional steering wheels, accelerator and brake pedals, such as those being developed by Google spin-out Waymo and start-up Zoox.” (Harris, 2017). With all of this in mind, there may need to be changes made to the standards themselves or exemptions may be required for AVs to be allowed on the road.

Article : Self-Driving Cars Have a Bicycle Problem Bikes are hard to spot and hard to predict

Bikes are more difficult to recognize for AI systems that control AVs due to the high mobility and large variance to color, shape, and size of the bikes and bikers. A leading algorithm trained to identify and orient objects within 3D space named Deep3DBox identifies and orients cars up to 88% accuracy while having 59% accuracy for bikes (Fairley, 2017). While AVs mainly deal with other cars on the highway, AVs will have to recognize and avoid pedestrians, bicyclists, as well as motorcyclists frequently. Especially when in a city environment, AVs will commonly come across pedestrians, bicyclists, skateboarders, etc. AVs must promote the safety of drivers as well as people outside of cars. The importance of the ability of non-car recognition in AV systems is brought to light by this article.

Article : National Highway Traffic Safety Administration Overview

“The continuing evolution of automotive technology aims to deliver even greater safety benefits than earlier technologies. One day, automated driving systems, which some refer to as automated vehicles, may be able to handle the whole task of driving when we don’t want to or can’t do it ourselves. “ The hope of AVs is displayed as improving safety while removing work. This article describes 6 levels of autonomous driving (0-5). Level 0 consists of many common safety features found in vehicles such as automatic emergency braking, forward collision warning, and lane departure warning. Level 2 consists of automated acceleration, braking, and steering for highway assistance as long as the driver is engaged. Level 3 is the first level where the driver does not need to maintain control constantly but still needs to be ready to retake control. Level 4 is the first level removing the need for a driver, while level 5 can autonomously drive without a location restriction ("Automated vehicles for safety," n.d.). Currently there are only level 2 AVs available for purchase, but as higher level AVs come to market, policy guiding manufacturers and consumers becomes increasingly relevant.

Article : USACM Issues Statement on Algorithmic Transparency and Accountability

Algorithms are a set of instructions used by computers to carry out operations. Algorithm use for institutional decision making has become ubiquitous in society in many areas from job applications, college applications, loan approval, etc. Automated decision making at an institutional level has some potential drawbacks as, “The use of algorithms for automated decision-making about individuals can result in harmful discrimination.” ("ACM US public policy council releases statement and principles on algorithmic bias," 2017). AVs rely heavily on algorithm use to make decisions which is not of much concern on the surface, but when looked into further, a new form of discrimination becomes possible. In addition to the ability for AVs to discriminate on any factor in an accident scenario, there is also the concern that complex models such as the ones used in AVs may make decisions in an opaque manner. This means people may not be able to understand why a decision was made the way it was by the AV due to a number of factors such as: the algorithm may not technically be able to be observed, the cost of providing transparency may be excessive, or the compromise of trade secrets ("ACM US public policy council releases statement and principles on algorithmic bias," 2017).

Article : TedEd Beware online "filter bubbles"

Filter bubbles are the result of algorithms promoting similar, relevant content. Personalization has led to filter bubbles by recommending content the algorithm believes will promote the best retention. Within the business model of social media companies is the desire to keep users online, which is best achieved through highly personalized content. Content may be personalized according to many different factors, and content may be personalized even without a person being logged into their account. According to the video, Google takes into account 57 variables when personalizing a search (Pariser, 2011). Personalization has also led to a personalized web with nobody having the same experience when searching Google or browsing social media.

The newspaper industry used to hold the power of filtering information to the public. Now, the torch has been passed to algorithms created by companies. Filter bubbles demonstrate the potential for algorithmic bias. AVs rely on algorithms and may run into algorithmic bias with its training data such as the failure to detect bicyclists and pedestrians compared to cars.

Conclusion

Autonomous Vehicles (AVs) are a heavily invested technology being developed by large technology companies such as Google, Tesla, and Uber. The hope of AVs is to one day replace the need for a human driver, allowing for more passengers to make more efficient use of their time. Another hope of the AV is to drastically reduce car accidents and fatalities due to removing the human error within the equation. These hopes are on their way, but many things stand in the way of the promise of AVs such as liability law and safety concerns. One safety concern identified is AVs lacking the ability to consistently identify pedestrians and bikers. Although there are many positives associated with AVs, the policy guiding manufacturers and AV producers is of the utmost importance. The policy will not prevent accidents from still occuring, but it may prevent a new form of discrimination from AVs as well as ensuring a reasonable expected safety.

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