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Driver Distraction and the Ethics of Artificial Intelligence in Autonomous Vehicles.

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Abstract

Autonomous vehicles (AVs) have an increasing presence on our roads every day. These vehicles are equipped with Artificial Intelligence (AI) and a range of sensors to assist the driver in automated driving but do not yet possess the capability to function completely independently of driver input. This paper will review research into driver distraction during automated driving and the ethical decisions AI must make in the event of a collision.

2 Introduction

Driver Distraction in Automated Vehicles is an upcoming issue of emerging technology. While driver distraction has always been of concern when driving motorized vehicles, the arrival of AVs brings new issues into the realm of driver distraction. While AVs are quickly achieving higher levels of automation, they are not yet at levels that allow driving to be free of supervision by an attentive driver. AI will be responsible for choosing the most correct option in the event of an accident but what constitutes a correct option when human life is concerned? What role does ethics play in the programming of AI in AVs?

3 Levels of Automation

The Levels of automation as defined by SAE (2018) will be used in this text to refer to the capabilities of AVs and are summarised here.

- Level 0 – No automated assistance - Driver performs all driving functions.
- Level 1 – Driving Assistance - Specific automation systems can assist with longitudinal or lateral vehicle control but not both at the same time and driver must perform all other driving tasks.
- Level 2 – Partial Driving Automation - Partial automation can control both longitudinal and lateral movement of vehicle while a driver controls the remaining driving tasks with expectation of driver to immediately take control of all driving tasks when required.
- Level 3 – Conditional Driving Automation - Vehicle automation achieved under limited driving environments and driver must take control in the event of a system failure or when requested by AVs.
- Level 4 – High Driving Automation - full driving automation under limited driving environments. When engaged driver then becomes a passenger and is not expected to take control of vehicle.
- Level 5 – Full Driving Automation - complete vehicle automation with no restrictions on driving environment.

4 Driver Distraction

Driving a vehicle on today's roads comes with great risks. The World Health Organisation estimates 1.35 million people die globally each year on roads and current trends indicate that by 2030 road traffic injuries will be the 5th leading cause of death globally (World Health Organization, 2018).

Regan (2007) summarises driver distraction as engaging in secondary activities which inhibit a driver's ability to perform their primary task of driving. He then defines four types of driver

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distraction. Visual e.g., looking at a GPS; attentional e.g., talking to passengers; physical e.g., drinking a coffee; auditory e.g. loud music. With these criteria defined, it becomes apparent that distractions are a prevalent and almost constant factor of driving a vehicle.

So why is driver distraction such a problem with AVs? It would seem the benefit of purchasing an AV would be to reduce the work of a driver as much as possible.

While this is the final goal of AVs the highest level of automation available in commercial vehicles would correspond to SAE level 2. This means drivers will have to continue being alert and involved in driving until at least level 4 has been achieved, and even so it will not be until level 5 that an AV will be capable of driving with no conditions or defined driving environment. This raises concern over the ability of drivers to regain control of an AV when required.

A study by Eriksson and Stanton (2017) found a significant increase in time it took drivers to take control of a vehicle while being engaged in a secondary task (participants drove a simulated AV and were asked to read a newspaper and retake control of the vehicle when prompted). This shows that AVs below level 4 will not afford drivers the luxury of performing secondary tasks while in the driver's seat.

Another potential issue that has the potential to lead misuse or misunderstanding of these systems is the inconsistency in the naming of advanced driver assistance systems and automation systems by manufacturers. A survey performed by Abraham et al. (2017) found that the lack of conventional naming between manufacturers in advanced driver assistance systems and automation systems caused confusion
in the level of assistance these systems offered. This confusion could indicate a potential for consumers to be unsure of what their vehicle is capable of and result in over confidence or underutilisation of advanced driver assistance systems and automation systems available in consumer vehicles. Abraham et al. (2017) suggest that an increase in driver education and a more common standard from manufacturers could be a crucial step to take in the adoption of higher levels of automation.

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5 Ethics of AI in AVs

Since AI will be in control of AVs it is important to question the ethical decisions an AI will have to make not only in the event of an accident but also in daily driving.

In his chapter "Why Ethics Matter for Automated Cars" Lin (2016) brings up variations of the trolley problem (Foot, 1967, Judith Jarvis, 1976) as an example of possible ethical dilemmas that an AV could encounter while driving. These trolley style problems present scenarios where a crash is impossible for an AV to avoid, whatever decision the AI makes it is going to cause harm to either a person or property. While these thought problems are a good starting point for the discussion of ethical decision making, they do not represent the majority of minor decisions that an AI will have to make on a daily basis that still carry ethical concerns.

Goodall (2019) argues that while trolley problems can be useful to help find the different values placed on objects and lives in the event of an accident, they do not capture the complexity and scope of ethical decision making an AV will have to undertake on a daily basis. Goodall in turn offers four scenarios that AVs are far more likely to encounter during daily operation but still carry ethical concerns.

- Following distance involves the moral implications of placing value in either efficiency or safety in the allowable following distances of AVs.

- Braking strategies involves the ethical decisions behind an action as simple as the level of brake pressure applied by an AV when coming to a stop in traffic to more dangerous scenarios such as braking to avoid an animal when being followed by a heavy vehicle that may not be capable of stopping as quickly.

- Lateral positioning within a lane involves the frequent inputs that must be made to keep within a driving lane and the manoeuvres an AV must make when traffic potentially enters its lane unexpectedly.

- Permitting violations of the law it is possible that to an AV must make decisions that violate road laws to prioritise safety in a given situation.

These four scenarios only scratch the surface of possible decisions and scenarios an AV could face daily and as AVs reach higher levels of automation they will have to deal with increasingly difficult and abstract decisions as well as the frequency of these decisions. Covering all possible decisions and scenarios would be a task too large for this paper, but the ethical implications of even the smallest decisions must be carefully considered alongside the broader questions and ethical dilemmas of scenarios such as the trolley problem.

6 Conclusion

AVs still have a long way to come until we are going to be able to rely on them for fully automated driving. It suffices to say drivers will have to continue to be vigilant participants in AVs until we have reached level 4 automation in consumer vehicles. Until that point is reached it will be paramount to educate drivers about the exact capabilities of the systems in their vehicles and ambiguity must be left behind if we are to see a safe and wide adoption of AV technology.

The ethical considerations for AI in AVs have been shown to be a both numerous and nuanced. The amount and difficulty of decisions made by AI are intrinsically linked to levels of automation we achieve, and as higher levels are strived for it is critical that the ethical and moral considerations for decision making and not pushed aside or forgotten in the pursuit of technology.

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(Abraham et al., 2017, Eriksson and Stanton, 2017, Foot, 1967, Judith Jarvis, 1976, Lin, 2016, Maurer et al., 2016, Noah, 2019, Rajaei and Aldhalaan, 2011, Regan, 2007, SAE, 2018, World Health Organization, 2011, World Health Organization, 2018)

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