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MANAGING NEGATIVE EMOTIONS CAUSED BY SELF-DRIVING

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ABSTRACT

Reducing the negative emotions experienced in Self-Driving cars is key to increasing the number of users. To reduce anxiety, AI-based systems that measure the physiological response of passengers, mainly using biometric data, are used. In the future, the vehicle must be sufficiently emptical to reduce people's distrust. The potential for hacking is still one of the main sources of anxiety about Self-Driving cars. To live with this difficulty, users need to be confronted with what machine learning means and accept that, contrary to expectations, Self-Driving cars cannot yet be 4 or 5 times safer than manual driving. To achieve the greater good – energy savings and lower emissions, efficient transport networks, greater use of digital infrastructure, safer and more usable public spaces, etc. – we need to be patient with Self-Driving vehicles.

KEY WORDS

self-driving cars, acceptance, trust, hacking

CLASSIFICATION

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NEGATIVE EMOTIONS AND BELIEFS ABOUT SELF-DIRECTION

Studies have investigated the negative feelings of Self-Driving users, as their market uptake and acceptance also depends on reducing users' doubts. Of the many negative emotions, the most commonly identified in previous research are 'anxiety', 'ungrounded fear', 'hesitation' and 'overload'. People fear that AI could take control and drive the vehicle without human intervention, and they also fear that Self-Driving cars' systems could be hacked, which explains the 'fear' [1].

Users are 'sceptical' about whether they should try the vehicle, and this is most common among older people, car addicts and those living in less populated areas. And the feeling of being 'overwhelmed' is related to the lack of information for many about how the car will get the user from point A to point B [2].

The fear of technology taking control of our lives – and the possibility that it may not always do so benignly – is deep-rooted and has been present in popular culture long before the first Self-Driving experimental vehicle was on the market [3].

A sense of 'safety' also helps predict the likelihood of technology adoption, but people feel much safer and more protected when they drive their own car. This sense of insecurity influences high levels of anxiety about AVs. The perception of 'efficiency', or 'productivity' is also problematic for the AV industry. People expect distracting technologies to make them feel more efficient and productive, but if they do not really feel that way when using the technology, they are unlikely to change their existing habits.

AI-BASED SYSTEMS TO REDUCE NEGATIVE EMOTIONS

Negative emotions such as anxiety and stress reactions resulting from the mental processes of human functioning can be experienced when using Self-Driving cars. To reduce the unwanted feelings experienced in this way, systems are used that infer emotions based on pulse and blood pressure. Depending on the user's emotional state, the vehicle recommends colours and music to stabilise the emotional state. In a future study, emotions will be classified based on situational and environmental factors and biometric information of the user AI devices [4].

The acceptance of a human-like AI device is higher if it can show empathy towards the human consumer. Therefore, if the auto is able to continuously monitor human emotional states in a situation-dependent manner, strong intelligence and empathic behaviour will help the user to adopt AI devices [5].

Fear of hacker attacks is a combination of emotional and cognitive reactions to possible stimuli from the external environment. Machine Learning, Deep Learning, can be associated with learning from data, which is a characteristic of the way AI systems operate.

In so-called Input attacks or Input attacks, attackers alter the input data provided to the AI system to manipulate the output desired by the attackers. Another way of interfering is the so-called 'poison attack', where attackers either alter the data used to train the system or manipulate the data training. These types of attacks mainly occur during the development and training of the system, i.e. during the initial process of AI system development. The third most well-known mode is so-called offline learning, where attackers learn offline to discover information for future attacks.

In the case of a Self-Driving car, this can be done by the attacker slightly modifying or partially obscuring a stop sign on the road to trick the AI system. This type of attack is called an 'input attack' in the AI system. These attacks can be defended against by combining input data from multiple sources, using data aggregation and algorithms [6].

One method to protect Self-Driving vehicles is to have connected Self-Driving vehicles (CAVs) train ML (machine learning) models locally and upload them to the blockchain network, thus using the ‘collective intelligence’ of the CAVs while avoiding large amounts of data transfer. The blockchain is then used to protect the distributed learning models. The performance of the presented framework is evaluated by simulations [7].

Another method is to generate adversarial datasets by a conventional attack engine, which are easily detected by ML models for CAV behaviour detection. Supervised learning algorithms are developed over time-series data from the attacker dataset, then translated into the neural network and recurrent long short-term memory by deep learning (DL) models [8].

REDUCING NEGATIVE EMOTIONS THROUGH TOLERANCE OF TRAFFIC RISKS

A study with participants in South Korea and China shows that Self-Driving cars should be safer than human-driven vehicles, and that since Self-Driving is seen as a new, less controllable activity than human driving, people would demand higher safety standards for Self-Driving.

Like the Chinese participants, the South Korean participants wanted Self-Driving to be 4-5 times safer than human driving. The number of fatal accidents caused by Self-Driving cars in both countries would have to be 5-8 times lower to be acceptable to the public. To ensure the benefits and usefulness of vehicles, people must tolerate traffic risks that are higher than their expected risk [9].

Like all new technologies, autonomous driving technology will be fully operational and reliable, but will need more time for testing and regulatory approval. Self-Driving cars will face higher external costs, higher accident risk rates and higher delays for other road users, i.e. higher testing and regulatory requirements compared to other technological innovations.

It is essential to recognise that the frequent interactions, unexpected interactions and weather conditions with other unpredictable objects – non Self-Driving vehicles, pedestrians, cyclists, animals, to name but a few – and the frequent interactions with the vehicle’s control, mean that Self-Driving vehicles require even more complex software than aircraft, which ‘only’ need to follow a route without constantly monitoring the environment and avoiding sudden obstacles [10].

INCREASING TRUST IN TECHNOLOGY

The interest in using Self-Driving cars is based on a lower perception of risk, which can be reduced by increasing the perception of the usefulness of Self-Driving and the confidence in the technology. People’s perceptions of advanced vehicle technologies are mainly associated with individual experience and knowledge. Their acceptance is largely influenced by the fact that many people have simply never encountered the technology and know little about it [11].

In terms of adopting Self-Driving and reducing negative feelings, it may be useful to link Self-Driving to the integration of technological developments in smart cities. Through the development of smart cities across digital platforms, on-demand and Self-Driving transport is enabled for the user:

- the best and most cost-effective choice of possible routes and modes of transport,
- tools for safer urban mobility through connected and autonomous vehicles, because Self-Driving vehicles can communicate with other Self-Driving vehicles and ITS,
- more efficient use of travel time,
- energy savings and lower emissions, efficient transport networks, greater use of digital infrastructures, safer and more usable public spaces (parking, charging networks, cycle

lanes, electric cars, car sharing, traffic reduction, smart flows),
- the expectation that by 2050 half of all vehicles sold and 40 % of journeys will be autonomous,
- car-sharing and ride-sharing, reducing car ownership, car dependency and parking demand,
- and increasing accessibility to cars [12],
- increased safety in transport and thus a reduction in the number of accidents,
- easier transport for elderly and disabled people,
- reduce stress levels for drivers [13-19].

CONCLUSIONS

In order for negative feelings and cognitions about the zone to be resolved, more information needs to be provided to the user. On a cognitive level, it is necessary to prepare what machine learning means and what algorithms are currently used to train the memory of Self-Driving cars in order to make them safer.

On an emotional level, users need to be influenced, which can be monitored by the car by measuring biometric data, or by using its own tools – temperature control, music, lights, radio stations, IoT coordination – to intervene in ways that reduce the amount of stress, anxiety and other negative emotions during the journey.

Finally, understanding and accepting that Self-Driving, one of the many AI-based services that will help future life, is essential to humanity's ability to better use the Earth's carrying capacity. This requires asking for people's patience and giving them accurate information about what Self-Driving can do at this stage, where the legal and ethical regulations stand and what the limits are for its application.

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