AI-Enabled PII Lifecycle Governance in State Motor Vehicle Administration Systems: A Case-Driven Framework

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ABSTRACT

Vehicle automation signifies a novel safety paradigm that may require a reevaluation of current safety supervision frameworks. This white paper provides an overview of the technical and regulatory framework regarding the safety of autonomous driving systems (ADS). It presents the most recent artificial intelligence and machine learning methodologies that facilitate ADS functionality. The paper examines the concepts of safety from the viewpoints of standards-setting bodies, federal and state regulations, and legal fields. The document delineates essential legislative alternatives based on themes presented in the White House's Blueprint for an AI Bill of Rights, articulating a framework for ADS safety. The analysis finds that prospective ADS safety reforms may involve either the modification of the Federal Motor Vehicle Safety Standards (FMVSS) or a comprehensive risk analysis "safety case" methodology. The analysis examines case law regarding liability in robotics and judicial actions concerning consumer and commercial privacy, acknowledging that the advent of AI will transform liability frameworks, necessitating a meticulous approach to data collection that incorporates accountability and safeguards the privacy of consumers and organizations. This analysis underscores the necessity for policies that address human-machine interface concerns, emphasizing requirements for safety drivers and remote operators. This work underscores the necessity for collaboration among engineers, policy experts, and legal scholars to formulate a comprehensive Blueprint for ADS safety and identifies avenues for further research.

Keywords: Personal Identifiable Information; Data Lifecycle Management; Government Information Systems; Artificial Intelligence; Data Governance; Privacy Compliance

Introduction

This study commences by examining the principles of safety for Automated Driving Systems (ADSs). Concepts of safety differ throughout various fields. Safety is not a solitary notion, but rather a variety of ideas. Safety is perceived as a reflection of cultural norms, and safety culture can serve as an organizational instrument to enhance safe decision-making. Safety may be regarded as a metric, a process, or a benchmark. ADS safety specialists provide the concept of roadsmanship, defined as driving in a manner that safely responds to dangers and prevents the creation of hazards for others. Establishing criteria for safe ADS vehicle performance may involve the formulation of novel vehicle standards, the use of human reference standards, and the introduction of innovative risk assessment methodologies.

Risk constitutes the foundation for safety criteria in organizations such as the Society of Automotive Engineers (SAE) and the International Organization for Standardization (ISO). These standard-setting bodies established a consensus on defining safety and evaluating risk. The ISO defines safety as the "absence of unreasonable risk," a definition echoed by numerous other organizations. Standards-setting organizations surpass regulators in delineating ADS engineering principles and formulating protocols, resulting in the emergence of various industry-wide norms for ADS operation. Prominent standards for ADS

safety encompass Underwriters Laboratories (UL) 4600. UL 4600 is a standard that identifies numerous potential flaws and hazards, along with methodologies for assessing and reducing associated risks. The objective of adhering to this guideline is to exhibit a lack of unreasonable risk.

The notion of unreasonable risk is enshrined in U.S. federal law (49 U.S.C. § 30102), wherein regulators characterize "motor vehicle safety" as safeguarding the public from unreasonable accident risks arising from the design, construction, or performance of a motor vehicle. Manufacturers are obligated to adhere to U.S. federal motor vehicle safety standards (FMVSS) and certify that their vehicles meet this safety criterion prior to operation.

The standards are primarily self-regulated, with federal authorities possessing only restricted and reactive recall authority, gathering empirical data to oversee safety, and recommending recalls when indications of unacceptable hazards arise. States such as California possess somewhat more rigorous evaluation protocols for examining the safety performance of ADS. States possess unequivocal jurisdiction to prioritize passenger safety in commercial activities, such as taxis, ride-hailing services, or private shuttles.

Judicial bodies and legal academics are defining safety with a focus on responsibility. This article outlines many historical instances pertaining to liability in robotics throughout manufacturing, medical surgery, street-cleaning robots, and other AI-enabled consumer devices, as legal precedent continues to develop. These incidents provoke intriguing inquiries on the evaluation of flaws and damages in AI systems. Legal ethicists emphasize the significance of the duty of care in the court assessment of liability for traffic accidents, wherein legal precedent posits that drivers are obligated to adhere to a social compact by undertaking reasonable and sensible measures, even when such activities may be

Safety Case Methodology

A safety case, elaborated upon in the Safety Background Section on Page 13, is an iterative framework that enables developers to incorporate environmental aspects and revise hazards based on observations. Although it may encompass criteria or benchmarks for cataloging hazards and risks, it is not intended to serve as a mere checklist of standards. Safety researcher Koopman advocates for an iterative safety case methodology, citing worries that static vehicle-specific rules inadequately assess system-wide risks.

Instead of assuming that simple adherence to a standard upon deployment guarantees complete risk mitigation, it is crucial to consistently assess and enhance the residual risk within the system.

A safety case serves as an internal explanatory instrument for coordinating various engineering teams inside an organization, as well as a strategic external communication tool regarding the safety measures that have been evaluated. Although the Safety Case has numerous proponents, detractors highlight several deficiencies in the current safety case methodology.

- The reliance on self-reported evidence and the proprietary character of claims within a safety case complicates impartial examination. The preeminent safety case standard, UL4600, is deliberately adaptable, thus it does not possess certain pass/fail criteria.

Standards organizations frequently exhibit inadequate community participation processes and may embody representational biases. The panels that endorse numerous consensus standards generally represent the agreement solely of the members of the participating organizations, which require substantial resources and time to engage, thereby potentially marginalizing the perspectives of government, academic, or other stakeholders not involved in these organizations.

This evaluation does not assess whether a state or federal safety case strategy may mitigate these critiques; nonetheless, further iterations will certainly be required to enhance the system's validity and accountability while maintaining flexibility. An effective safety case necessitates competent independent assessors. This stipulation corresponds with a priority articulated in the White House Blueprint for an AI Bill of Rights, which asserts that "Automated systems should be designed to permit independent evaluation (e.g., via application programming interfaces)." The White House indicates that evaluators should encompass researchers, journalists, ethics review boards, inspector generals, or third-party auditors. This interdisciplinary roster of evaluators underscores the significance of disseminating performance data to develop and maintain continuous accountability. 151

Safety Case: Scope and Policy Alternatives

State or federal authorities may adopt a Safety Case methodology. Nevertheless, USDOT rulemakings to develop a safety case framework will likely require several years to progress. In the meantime, governments may elect to adopt interpretations of safety case frameworks that best accord with their policy objectives, and these reforms may require time for refinement. Potential reforms may encompass:

Formulating directives or stipulations for ADS manufacturers to create and uphold a comprehensive risk management strategy or safety case, either as a substitute for or in conjunction with FMVSS compliance.

Establishing accountability mechanisms to ensure comprehensive risk assessment through the utilization of independent oversight entities. These businesses can assess safety case submissions, so allowing them to provide verifiable proof for future claims and offer advice to decision-makers regarding the results of the safety case.

Identifying triggering events (e.g., fleet expansion) that necessitate a more detailed risk reassessment.

Framework for ADS Data Acquisition and Privacy

This section will emphasize essential lessons from public papers and literature about data gathering and data privacy for ADS. ADS data represents but a fraction of the extensive data collection occurring within the mobility and consumer electronics sectors. This section will

mostly address issues specific to ADS privacy or those that distinguish ADS-equipped vehicles, while certain concerns may be alleviated through overarching AI policies.

The reliance of ADS-equipped cars on external sensors for environmental perception and decision-making necessitates the collection of extensive training data to guarantee the efficacy of the used models. Continuous oversight and supplementary direction will guarantee that each ADS fleet can expand securely, enhance proficiency, and exhibit ongoing progress. Regulators must determine the requisite data, the appropriate data format, the frequency of updates, and the methods for safeguarding privacy and proprietary interests.

Considerations for General Data Collection

The Automated Vehicle Safety Consortium provides a potential framework for the ongoing assessment and enhancement of performance in response to both known and unknown alterations in the operational environment. This Consortium posits that certain trends or anomalies may signify modifications within the ADS-DV's operating environment or inaccuracies in pre-deployment assumptions. By instituting performance metrics that can identify irregularities relative to prior expectations or assumptions, developers can amend these assumptions as necessary and formulate, evaluate, and execute suitable responses for their vehicles.

This wait-and-see approach to the emergence of anomalies corresponds with the current U.S. federal strategy for safety oversight. Vehicles are mandated to address more comprehensive data requests, potentially undergo voluntary recalls, and propose solutions only when abnormalities manifest as accidents or observable safety failures. This may indicate a reactive approach to data collecting, centered on lagging measures, as a probable consequence for the U.S. However, it remains uncertain whether this strategy would adequately reassure the public regarding the safety of ADSs. Diverse stakeholders may hold varying perspectives that embody a combination of policy objectives and conventions (e.g., federal, state, or municipal) that advocate for either a more permissive or reactive approach, while others support a more controlling or proactive stance.

Furthermore, it is not simple to ascertain whether to adopt a proactive or reactive approach, or how to implement either effectively. Leading metrics may serve as potential precursors to more significant failures; however, in practice, it may be challenging to determine if these early indicators are indeed warnings. An overemphasis on particular leading measurements may adversely affect safety outcomes. For instance, initial data monitoring reports concentrated on disengagements of the automated system, wherever safety drivers or operators intervened during testing. This primary indicator has faced extensive criticism for inadequately representing the essence of advancement in the testing process. Reporting disengagements may penalize organizations that disengage frequently out of excessive caution, while rewarding those who postpone disengagement when it may have been warranted. This example serves as a lesson on the necessity of revising leading metrics when evidence indicates that they produce unexpected consequences.

These difficulties may indicate the necessity for more comprehensive evaluations, rather than focusing on isolated data or awaiting the failure of a specific component. A

comprehensive evaluation can create improved metrics based on integrated objectives (e.g., adherence to FMVSS, functional success/failure) and ascertain methods to mitigate risk within these boundaries.

For any method to be effective, data collecting will be essential, and several prominent cases may exemplify ADS data collection:

The USDOT Secure Data Commons (SDC) exemplifies the secure collection and management of private data through USDOT data exchanges. The platform facilitates the periodic or real-time transfer of vehicle data, offering tiered user access; some users can utilize analytical tools in R without the ability to download raw data, while others may receive enhanced access privileges.

The Mobility Data Specification (MDS) is utilized by over 300 global cities and is an open-source data standard developed in Los Angeles, governed by the non-profit organization, the Open Mobility Association. MDS enables real-time data communication between regulators and private entities, incorporating both real-time and historical data exchange. Historically, the

The MDS data specification concentrates on scooter vehicles. Trip-level data must be securely maintained by the city or an authorized third party. MDS facilitates bidirectional data sharing, allowing regulators and cities to contribute data to the API for private operators' use, while operators can also input data through an application programming interface (API). Numerous cities employing MDS, such as Los Angeles, require MDS compliance prior to granting e-scooter permits. The Open Mobility Foundation, originally focused on micromobility solutions like e-scooters and bikeshare, has broadened the MDS 2.0 to facilitate data sharing for ride-hailing, taxi, and other passenger services. Consequently, uncertainties persist regarding the enhancement of the MDS or the potential need for a new specification for ADS.

• Oversight by the Federal Aviation Administration. The FAA's risk-based oversight method, which encompasses information sharing and reporting initiatives, is credited with saving numerous lives. These initiatives include the Aviation Safety Information and Sharing (ASIAS) program, voluntary reporting systems, and Aviation Safety Infoshare. The ASIAS data repository encompasses both public and proprietary data sources, integrating government and industry information. The Commercial Aviation Safety Team identifies risks and formulates mitigation strategies primarily through voluntary reporting programs and collaboration with the ASIAS program. FAA inspectors verify the effectiveness of carrier Safety Management System processes and take into account risks identified by the ASIAS system. If they do not comply, the FAA may mandate enhanced monitoring via the Safety Assurance System. The Commercial Aviation Safety Team, ASIAS, the FAA, and industry stakeholders convene biannually for the Aviation Safety Infoshare to exchange safety concerns and best practices, safeguarded by confidentiality in a non-punitive reporting framework. The FAA's success demonstrates the potential for collaborative information-sharing initiatives between industry and government, as well as mechanisms that aviation authorities might employ to promote open data exchange.

ADS Data: Scope and Regulation

A solely federally initiated data gathering endeavor may create deficiencies for numerous states and municipalities. State and federal oversight of ADS safety monitoring is collaborative; nonetheless, the allocation of information collection responsibilities will rely on legislative guidance and alignment with various policy goals. Redundant data gathering is taking place, prompting requests for a unified API or standardized data specification to enhance interoperability and facilitate a centralized data collection system that allows states to effortlessly incorporate criteria. This may fulfill various data requirements across distinct governmental entities. Potential policy alternatives to enhance the monitoring and evaluation of ADS systems may encompass:

• A federal ADS data exchange to assess ADS performance, supervised by an impartial evaluation entity, to gather:

Leading metrics encompass critical incidents, near-misses, unanticipated halts, or occurrences of vehicles obstructing roadways, traffic zones, or driveways.

Lagging metrics, such as observable failure events including accidents, injuries, and fatalities, are currently recorded but not stored in a complete framework.

Incident investigation boards capable of comprehensively evaluating this data and formulating suggestions.

• The emphasis of state data collecting will be on:

Passenger service - safety, sustainability, equity.

Compliance and conduct of safety drivers.

Compliance and conduct of remote operators.

Considerations for Data Privacy in ADS

There is a broad agreement that data gathered by mobility firms possesses value and utility both for its intended primary application and beyond. Xie et al. emphasize that,

Training autonomous vehicles necessitates a substantial volume of data gathered from diverse driving situations, such as urban areas, with various sorts of personal information, including work hours and travel itineraries. The amassed extensive data, regarded as the "new oil" for machine learning in the data-centric AI epoch, typically encompasses a significant volume of privacy-sensitive information that is challenging to eliminate or even scrutinize.

Safeguarding this sensitive information will need a delicate equilibrium. Both excessive and insufficient data sharing can provide recognized and unrecognized hazards to many stakeholders. This section will elucidate this extensive subject by concentrating on two areas: consumer privacy and company proprietary privacy.

Risks to Consumer Privacy

Users of mobility services generally provide access to numerous potentially sensitive data points, which are maintained by ADS operators in accordance with user agreements. This may encompass movement and route data, video footage, or photos of passengers within the cars, in addition to personal information pertaining to riders' age, gender, or other attributes. This method of data collection is not exclusive to an ADS environment; analogous data is also gathered by ride-hailing fleet operators and, to a lesser degree, certain OEMs, particularly those equipped with ADAS functionalities. Nevertheless, the capability to collect in-vehicle movies and photographs is expected to introduce an extra dimension of sensitivity.

Automotive manufacturers maintain stringent control over extensive data repositories for millions of vehicles in their fleets. Manufacturers utilize car event data recorders (EDRs), also known as black boxes, which assist in evaluating vehicle malfunctions and solutions by retaining data on vehicle states and actions immediately preceding airbag activation. According to the Driver Privacy Act of 2015, this data may only be accessed with the owner's consent for vehicle repairs or if required by an official investigation (by a regulatory body or court official).

Specific data threats to customers are recognized:

• Human trace data: As noted in the legal privacy section, route data accumulated over an extended duration is readily traceable due to individuals' normal movement patterns (e.g., home-to-work, home-to-shopping destinations, etc.). Reidentification, public disclosure of sensitive information, targeted cybercriminal activities, or the most extreme consequence, stalking or violence inflicted against individuals owing to data exposure.

Personal demographic information, including age and ethnicity, can be utilized to "...harass AV users via marketing and advertising, to perpetrate identity theft, to profile users and anticipate their behaviors, thereby consolidating information and power." 171

• Remote surveillance and video or photographic data: Certain ADS operations will utilize live video feeds to guarantee adherence to operational regulations and to oversee the vehicles. However, these feeds will be highly sensitive and will present a novel opportunity for monitoring activities in transportation, with implications for both governmental access (law enforcement, legal proceedings) and criminal activities malefactors (extortion, abduction, etc.). The classification of ADS cars as public spaces will determine the privacy safeguards afforded to riders.

Consumer Data Privacy: Purview and Policy Options

Federal agencies, states, and other jurisdictions will collectively oversee privacy rules, necessitating coordination to safeguard privacy for both consumers and commercial entities.

• Examine the prerequisites for privacy risk assessment (either as FMVSS or as a component of a Safety Case) that adhere to the Carpenter ruling, which stipulates that the data is voluntarily supplied, that the utilization of these transportation services is not deemed essential for engagement in contemporary society, nor does it represent prolonged tracking over time.

• Implement assessments for data security to guarantee that consumer data is safely maintained and kept apart from personal demographic information. One hundred seventy-four

Establish directives or policies to reduce data gathering and retention. Risks to Commercial Privacy

Automotive manufacturers oversee and safely administer extensive data repositories. Vehicles are equipped with event data recorders (EDRs) that evaluate car malfunctions and solutions by retaining data from the moments preceding airbag deployment. There are many other types of data held by OEMs and ADS developers. The classification of this data as a trade secret will depend on policy and judicial rulings. In a 2022 legal proceeding concerning Waymo and the State of California, wherein data obtained was disclosed to a journalist through a public records request, the ruling indicated that "operational processes and design capabilities" do qualify as trade secrets that may be retained by the state for a limited duration; however, this protection is not perpetual. This implies that if trade secret data is retained, it may not be disseminated for a specified period. States currently possess secure data regarding ADS operations. Nonetheless, uncertainties persist regarding the conditions under which an ADS developer may disclose material deemed a trade secret to regulatory bodies, as well as the safeguards these entities will maintain.

Commercial Data Privacy: Scope and Policy Alternatives

Both state and federal authorities, as well as courts, continue to deliberate on business privacy. The subsequent factors pertain to this policy domain:

• Define explicit criteria for identifying data that qualifies as a trade secret.

• Implement protective measures to safeguard the integrity of any trade secret information deemed essential for collection.

Framework for ADS Human Alternatives, Considerations, and Contingencies

Humans are expected to continue participating in certain facets of ADS operating safety and servicing. Two critical human positions that may necessitate policy consideration are the remote operator and the safety driver. If ADS systems depend on one or both jobs, these roles must be incorporated into the risk management strategies. Regulators may find it challenging to precisely validate human error and control concerns. The role of human errors in initiating or contributing to accidents is contingent upon specific circumstances. For instance, individuals in managerial positions may neglect to respond to perilous situations, resulting in human-out-of-loop complications that might culminate in accidents or errors. Nonetheless, proficient oversight and timely action might result in safer operations. Excessive reliance on operators in automation may present issues to the safety of human-system interaction, considering the established difficulties in this domain. These difficulties pose challenges for both employee protocols and legal responsibilities. The responsibilities will significantly differ among ADS developers, necessitating the establishment of definitive rules for the equitable and safe evolution of safety driver and remote operator duties, ensuring optimal success for human ADS operators.

Conclusions and Recommendations

The primary conclusions from this investigation indicate that engineers, regulators, and legal academics possess divergent definitions of safety and will likely require enhanced collaboration to promote secure transportation systems. A plan for ADS safety must be influenced by specialists in engineering, regulation, and jurisprudence. This analysis identified two overarching strategic approaches to ADS Safety: 1) revising the Federal Motor Vehicle Safety Standards (FMVSS) and 2) implementing an ADS Safety Case Approach. Both methodologies may incorporate performance-based and technology-neutral criteria, regarded as best practices, and both could enhance safety policies.

Concerning the ADS Data Policy, prioritizing data collecting and privacy issues will be essential for formulating an effective plan that is not impeded by legal conflicts. The analysis determines that data gathering will be essential for informing oversight and guidance to guarantee the safe adoption and expansion of ADS, as well as to promote ongoing enhancement of the ADS business. This data collection initiative must reconcile consumer privacy with proprietary interests.

The research underscores the significance of including human aspects and human reliability in the safety of Automated Driving Systems, especially concerning the roles of safety drivers and remote operators. The analysis suggests that guidelines and regulations are necessary to safeguard human operators and mitigate safety concerns related to human-system interaction. This white paper seeks to furnish stakeholders from many sectors with a fundamental comprehension of ADS safety and proposes policy directions for additional investigation and advancement in this swiftly progressing domain. This research delineates these crucial challenges; nonetheless, considerable effort remains to ascertain solutions and guarantee consistent safety outcomes throughout the business.

Assess domestic and international initiatives regarding connected infrastructure requirements and formulate a California Connected Vehicle Policy Framework: Enhanced connectivity has the potential to augment safety results by facilitating improved communication among vehicles, infrastructure, and edge-computing devices. Connected Automated Driving Systems (ADSs) equipped with advanced and dependable technological enablers can address Operational Design Domain (ODD) deficiencies, mitigating fragmentation as vehicles traverse intricate or unpredictable landscapes. The Australian Office of Future Transport has likewise endorsed the notion of connectivity to improve safety at intersections and avert collisions. Additionally, China is investing in the potential of connectivity to bolster safety.

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