![ACEA logo] European Automobile Manufacturers Association

Artificial Intelligence in the automobile industry

KEY MESSAGES

1. **The European Artificial Intelligence (AI) policy landscape must ensure legal certainty while providing a sufficiently dynamic and flexible ecosystem capable of adapting to the constant evolution of technology.**

   A balanced ecosystem is one that supports technical development while safeguarding its use, one that unlocks private investments and keeps capital flowing, and one that enables the EU automotive industry and its supply chain to remain competitive against global players.

   The European Automobile Manufacturers' Association (ACEA) believes that a sectoral and light-touch approach to AI would be the only viable option for addressing both the automotive sector's specificities and the way in which automotive products are developed, tested, produced and put on the market.

2. **As a first step, before introducing horizontal requirements, EU policymakers should consider where existing certification requirements and regulatory frameworks in force in the automotive sector could be used in a way that promotes technological innovation while safeguarding society.**

   At EU level, there are already strict ex-ante conformity assessment procedures in force for passenger cars and commercial vehicles (Type Approval Regulation 2018/858, applicable from 1 September 2020), and other sectorial regulation for two- and three-wheelers. There are also a range of strict ex-post surveillance mechanisms in place (eg conformity of production, in-service compliance, market surveillance and recalls, etc). At international level (UN-ECE), legislation has been recently adopted and more is currently being drafted to address various issues surrounding automated driving.

   These existing frameworks should be first completed with practical guidelines. This will provide benchmarks in the form of codes of conducts, best practices, standards that can assist manufacturers with conformity in their research, development, and deployment of such technical innovation.

   Legislative gaps can only be determined afterwards. Where – based on demonstrable evidence – legal gaps exist, new potential AI requirements should be included within the existing frameworks. Coordination / synchronisation between different workstreams (the European Commission's DG CNECT and DG GROW, UN-ECE WP29/1) is key to avoid overlapping and conflicting regulatory frameworks / certifications and compliance requirements.

3. **ACEA reiterates, however, that in assisted and automated driving a technology-neutral approach to regulation is essential. Here, regulation should take into account the degree of automation and vehicle behaviour (ie functional requirements and methods for validating the function), rather than the technology used.**

Where gaps in relation to AI are found, mandatory requirements should be reserved exclusively for high-risk, safety-critical AI applications related to automated driving – level 3 and above as defined by the Society of Automotive Engineers (SAE) – as long as they are incorporated into the type approval system. Unrelated, non-safety-critical AI applications (eg traditional driver assistance systems, comfort functions, infotainment, etc) should be deemed as 'low-risk', and not be subject to stringent mandatory requirements.

'Narrow' AI applications, as well as traditional software systems, products or services based on software engineering methods, should also fall outside the scope of any potential regulation / requirement for 'high-risk' applications.

4. **Many of the potential AI legal requirements advanced in the European Commission's AI White Paper have already been adopted effectively into established processes governing the automotive sector, or are partly addressed by current and future applicable legislation.**

A short analysis of existing applicable requirements and requirements currently being drafted, and one of potential gaps in the current legislation, is presented. However, further investigation will be required.

5. **Prior to the introduction of any new AI-specific requirements, a thorough assessment of existing AI use cases – and of their risk-level – is urgently required.**

The risk assessment of AI systems should be based on a set of criteria that considers the safety relevancy (severity, probability and controllability of malfunctions), autonomy of learning, autonomy of decision making, type of algorithmic model used and the potential impact of the AI system on a (larger) group of people. This assessment should be irrespective of the sector.

Following this, the classification of what is high-risk or low-risk should be valid solely for the individual AI applications; it should not apply to the sector as a whole. Indeed, the classification or categorisation of an entire sector is rejected by the industry. In order to avoid moderate-risk AI use cases being wrongly classified, an accurate and narrow definition of high risk is needed. A simple binomial / two-levels categorisation (ie high-risk or low-risk) might not be sufficiently flexible to reflect the variety of AI use cases; it requires a more nuanced, differential approach.

As for the entities in charge of risk assessment and compliance, the remits of the existing type-approval authorities and bodies should be expanded to cover in-vehicle high-risk AI applications, so that the necessary sectoral expertise and operational relationships with relevant stakeholders are further enhanced.

6. **Differentiating and defining AI is a significant challenge. The definitions for AI advanced in the EC White Paper on AI, and also by the High Level Expert Group on Artificial Intelligence (AI HLEG), would benefit from clarification.**

   In fact, the White Paper falls back on a phenomenological description, which remains too vague and too broad. It risks introducing regulations for traditional software systems and narrow AI applications that are also able receive data from their surroundings, process this data and use it to take a decision or perform a certain action.

   The debate between an all-encompassing definition of AI, one which covers all situations and applications versus a more precise, subset-specific approach is a challenging one. This will remain controversial and subject to the rapid evolution of technology.

7. **Europe's automobile manufacturers understand all the potential concerns relating to AI use in the automotive sector, and they are working on ways to mitigate the impact / address the reality of these concerns. It is an absolute priority for them to put vehicles on the market that meet the maximum safety and ethical standards.**

   Currently, safety validation is ensured by provisions dictated in the Vehicle Type Approval Regulation and the General Safety Regulation. In parallel (in order to accelerate the adoption of practical tools nurturing the objectives of the AI HLEG Ethical Guidelines for Trustworthy AI) vehicle makers support the further development of industry-driven initiatives. These should be standards and / or codes of conduct that promote the deployment of AI in ways that secure greater trust in – and public acceptance of – new technologies and, ultimately, transport automation.

   Principles such as human centricity, responsibility, transparency and explainability, safety, reliability and technical robustness, protection of privacy, quality of data and sharing of data are all supported and should be enshrined into these initiatives in ACEA's view.

8. **In the automobile industry, AI has enormous potential both when embedded within the industry's products, in production and manufacturing processes, as well as in value-added chains. A more widespread deployment of AI will contribute hugely to a safer, cleaner, more efficient and more reliable mobility ecosystem in Europe.**

   For instance, AI applications for connected and automated vehicles can improve driver safety, monitoring and comfort, situational awareness and trajectory prediction. This can

lead to significative gains in performance and efficiency (eg enhanced traffic fluidity and logistical flows, reduced fuel or power consumption, etc).

When applied throughout the automotive value chain, AI will help improve productivity (streamlining of manufacturing processes, for example), product safety (more effective quality checks and monitoring, predictive maintenance) and objectivity (mitigation of human bias).

9. **One of the major areas of AI application is in-vehicle use – functionalities in cars, vans and heavy-duty vehicles (HDVs) such as trucks and buses – and for automotive technologies.**

Examples of 'narrow AI' applications deployed in vehicles today and in the future are recommender systems such as lane recognition, vehicle recognition or traffic sign recognition. These are based on machine-learning algorithms trained offline and tested rigorously before being deployed as fixed software in vehicles, similar to any other vehicle-based software component. Other AI-powered applications include the processing of video feeds from cameras for ADAS, natural language processing, face and voice recognition, etc.

In the future, AI-based applications and their techniques can be deployed for map building, image analysis and data fusion for detecting objects and surroundings, thereby driving new policies and strategies for automated driving as well as the human-machine interface.

10. **Currently, the in-vehicle deployment of AI technology has limitations.**

The technology for implementing so-called 'general AI' capable of common-sense reasoning, self-awareness and the ability of the machine to define its own purpose is currently not technically feasible, nor will it be in the near future.

For in-vehicle safety critical functions and services, learning rational systems in certificated AI systems are not involved at the current state of development. The software deployed, including AI-modules, is developed according to state-of-the-art standards and practices for functional safety and software development. It is both analysed and rigorously tested before deployment. Online-retrained parameters for both safety and non-safety critical functions cannot be applied in operation unless correct functioning / correctness is guaranteed / proven. It is always necessary to validate the correctness of algorithms. This can be done directly through human oversight, or indirectly by, for example, mathematical correctness proofs.

INTRODUCTION

The European Automobile Manufacturers' Association (ACEA) welcomes the opportunities given by the European Commission to stakeholders to provide feedback on the recently-published policy papers[1] on Artificial Intelligence (AI). This position paper builds on the previously submitted ACEA contributions in response to Commission's consultations.

In view of the Commission's announcement of its plan to present a proposal on AI in the first quarter of 2021 and to potentially revise existing EU legislation on a number of AI-related matters, this new ACEA position paper attempts to provide policymakers at EU, national and international level with recommendations that can help shape the upcoming AI regulatory and policy framework in a way that is balanced and proportionate.

Section A of this paper (starting on the next page) presents ACEA's policy recommendations. Spread over five sections, it addresses the following main issues: sectoral frameworks and existing legislation to cover AI specificities; AI legal requirements; a risk-based approach; the definition of AI; as well as recommendations on how to tackle safety and ethical challenges relating to AI and, more specifically, automated driving.

Section B (as from page 23) consists of a technical annex divided into three sections. These sections underline the importance of AI technology in the automotive industry; present the relevant taxonomy surrounding AI; and provide a non-exhaustive overview of the various AI applications in the automotive industry. Special attention is paid to in-vehicle AI applications for Cooperative, Connected and Automated Mobility (CCAM), where AI technology can play a major role in taking automated and autonomous driving to the next level. Moreover, other major AI use cases covering the entire automotive value chain are also explored and presented in this annex. Finally, the main benefits of AI in relation to the automotive industry are outlined: AI technology can deliver greater product and road safety, better performance and objectivity as well as higher productivity for example.

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[1] European Commission, White Paper on Artificial Intelligence – A European approach to excellence and trust, COM(2020) 65 final, 19 February 2020. European Commission, Inception Impact Assessment on a Proposal for a legal act of the European Parliament and the Council laying down requirements for Artificial Intelligence, Ref. Ares(2020)3896535, 23 July 2020.

SECTION A: ACEA POLICY RECOMMENDATIONS

Vehicle manufacturers are leading the transition towards safer, greener, more efficient and smarter mobility in Europe. To that end, digitalisation and the use of new technologies are of paramount importance. AI represents a key technological area for the entire automotive value chain, as well as the EU's industrial base as a whole. Since day one, automobile manufacturers have pledged to implement and deploy this technology throughout the various segments of the industry in an innovative, trustworthy and human-centric way.

At the core of this are the needs and benefits of humans, end-users and society as a whole. Numerous initiatives pushing for standards and legislation – as presented throughout this paper – are proof of manufacturers' ongoing commitment. Yet ACEA recognises that, in order to harness the full potential of AI in a way that takes both opportunities and risks into account, the right EU framework and conditions need to be enhanced.

This paper presents the recommendations to policymakers for due consideration when developing the European approach to AI, as formulated by Europe's 16 major automobile manufacturers.

1. TAKE A BALANCED AND SECTOR-BASED EUROPEAN APPROACH TO AI

The European Union's AI policy landscape must ensure legal certainty while providing for a sufficiently dynamic and flexible ecosystem that can adapt to the constant evolution of technology. A balanced ecosystem is one that supports technical development while safeguarding its use; one that unlocks private investments and capital flows; one that ensures that the EU automotive industry and its supply chain – as well as the wider EU industry – is well placed in the global race for competitiveness and is able to preserve its innovation power.

To achieve this a light-touch sectoral approach to regulation is advisable. Preventing the fragmentation of the Digital Single Market into potentially divergent frameworks, which could restrain the free circulation of AI goods and services, is a priority in this respect. An adequate European approach to AI is one that considers AI as a sector-specific technology. It is not viable to use a cross-sectoral horizontal AI initiative to address the way in which automotive products are developed, tested, produced and put on the market. Hence, ACEA recommends that European policymakers should refrain from adopting a 'one-size-fits-all' approach to tackling the challenges posed by AI.

2. CONSIDER THE EXISTING SECTORAL FRAMEWORK AND ADDRESS POTENTIAL GAPS IN CURRENT LEGISLATION

The automotive sector is already subject to strict ex-ante conformity controls (eg type approval)[2] and ex-post – eg Conformity of Production (CoP), market surveillance and in-service compliance. Although extensive, directly-applicable regulations already exist for vehicle homologation and product safety, a need has been identified for additional regulation that goes beyond previous rules, based on the assumption that automated / autonomous vehicles (AVs) would be comparable to a mere AI device.

Before introducing any new horizontal requirements, legislators must consider whether certification requirements and regulatory frameworks already in force in the automotive sector (eg type approval framework, market surveillance provisions and recalls, UN-ECE legislation)[3] can be used in a way that promotes technological innovation whilst safeguarding society, as well as where these can be completed with practical guidelines. These should provide benchmarks in the form of codes of conducts, best practices, etc to assist manufacturers in conforming during their research, development, and deployment of such innovation. Only later should gaps be determined.

If legal gaps exist based on demonstrable evidence, potential new AI requirements should be included into the existing frameworks. This is an essential step in preventing the duplication or invalidation of certification testing and market surveillance for the European AI Framework and the European Union Whole Vehicle Type Approval. Any AI-specific certification requirements and / or industry standards should also be set out in such a way that it retains flexibility for this relatively new technology.

In the specific case of assisted and automated driving, any regulation must consider the level of automation and vehicle behaviour (functional requirements and methods for validating the function), rather than the technology used. This would allow for a technology-neutral approach to regulation. The work carried out at UN level on automated driving, where the European Commission's DG GROW is involved, is pursuing this direction; the recently adopted UN regulation on Automated Lane Keeping Systems is an example of how safety-relevant aspects can be covered. This is also the case for the concept of future automated driving systems, which will incorporate all safety aspects, including those related to the specificities of using AI algorithms for driving functions. Here, close coordination and alignment between the Commission's DG CNECT and DG

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[2] It is crucial to remember that road vehicles fall under the New Legislative Framework and are regulated at the EU-level. There is legislation for specific conformity assessment as part of EU Regulation 2018/858 (applicable from 1 September 2020) for passenger cars and commercial vehicles, and other sectorial Regulation for two- and three-wheelers. These procedures, called 'Type Approval', are rather strict (See DigitalEurope response to EC White Paper on AI, p 29). New General Safety Regulation (EU) 2019/2144, Article 11 setting out "Specific requirements relating to automated vehicles and fully automated vehicles", and implementing and delegated acts (DG GROW) applicable from 2022.

[3] Legislation developed/adopted within the framework of the Working Party on Automated/Autonomous and Connected Vehicles – GRVA (WP29/WP1).

GROW as well as UN-ECE WP29/WP1 will be essential.

It must be noted that many of the potential AI legal requirements put forward in the Commission's White Paper on AI are already well adapted to the established processes governing the automotive sector or partially addressed by current and future-applicable legislation. The following chapter presents a short analysis of the already applicable requirements, or those currently being drafted, as well as possible gaps in the current legislation. This analysis is not intended to be exhaustive; further investigation is required.

2.1 Analysis of already-applicable legal requirements[4] and potential gaps (in-vehicle use cases)

Before looking at the requirements it is key to stress that, if legal gaps are found, mandatory requirements are conceivable exclusively for safety-critical ('high-risk') AI applications related to automated driving – level 3 and above as defined by the Society of Automotive Engineers (SAE) – as long as they are incorporated into the type approval system. Applications that are not safety-related (eg driver assistance systems, comfort functions, infotainment, etc) should be deemed as 'low-risk' and not be subject to stringent mandatory requirements.

- **Training data**

As with specifications or software, data is fundamentally a development artifact[5], particularly when it comes to data used to train algorithms or test functions, services, or other products. Their use is subject to the same requirements as product liability, safety and reliability and therefore should always be considered in connection with their real-world use.

However, these rules on data and algorithms created (trained) by this data must be applied consistently. They may require clarification, particularly on quality and verification mechanisms, but without leading to additional requirements and any considerable increase in complexity.

- **Keeping of records and data**

Within the safety validation framework for AVs, which is being developed at UN level (WP29 GRVA, FRAV and VMAD), auditing processes will help demonstrate that functional and operational safety have been robustly implemented during the design and development processes of the automated driving system and that this will continue during the vehicle life cycle. Evidence must be provided by the manufacturer (test reports, documentation, inspections) to cover: hazard and risk analyses

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[4] The listed requirements refer to those put forward in the European Commission's White Paper on Artificial Intelligence – A European approach to excellence and trust, COM (2020) 65 final, 19 February 2020.

[5] 'Artifact' is a term used in the software development process to indicate a physical piece of information. Training data can be considered as such; it is part of the software but equally subject to the same requirements (liability, safety, etc) that apply to the software.

and mitigation strategies, robust design validation process (virtual testing, track tests, real-driving tests), safety management system, etc.

However, clarifications on the documentation and retention obligation for development documentation including – in legitimate cases – the training data sets and training methods, would be welcomed. This might be very helpful for product monitoring for example. However, any requirement concerning data storage must be set up in line with the General Data Protection Regulation (GDPR).

- **Information provision**

This is being addressed at UN level by WP29, in relation to customer information and the capabilities and limitations of an automated driving system's Operational Design Domain (ODD). WP1 will address new driver training requirements in the future. Both WP29 and WP1 will be addressing this information provision with the following aim: communication with other road users shall provide sufficient information – when required – about the vehicle's status and intention.

Any potential new legislation should consider including exceptions to the obligation to provide information under Article 13 GDPR when processing personal data by means of AI, similar to those already provided for under Article 14 (5) b GDPR (for example if, and to the extent that, providing the information proves impossible or would require disproportionate effort). Furthermore, it would also be useful to establish certain standards or guidelines as to how the information obligation would look like within AI systems.

- **Robustness and accuracy**

Robustness and accuracy requirements are already included in the automotive regulatory framework, in the form of operational performance requirements that the system needs to fulfil to be approved. Introducing such requirements for AI alone, eg applied to an Automated Driving System (ADS), may create incompatibilities with the performance required for the entire ADS. Overall, forms of in-use monitoring for ADS are being discussed at GRVA (WP29). Examples can be already seen in the newly adopted UN Regulation on ALKS.

- **Resilience**

In this context, we are talking about resilience against both overt attacks and more subtle attempts to manipulate data or algorithms. This requirement is already covered by the SOTIF-CEL Annex and the UN Regulation on Cyber Security Management Systems, which will be transposed into the EU General Safety Regulation 2019/2144.

- **Human oversight**

Already now, the Automated Driving Systems of vehicles provide for mechanisms that allow the user to intervene and deactivate / override the ADS in a simple manner (as laid down in the UN Regulation on ALKS for SAE level 3 vehicles), these existing mechanisms should be considered as a

form of human oversight.

- **Specific requirements for remote biometric identification**

As referenced in the Commission's White Paper, biometric identification systems are already covered by the GDPR. The processing of biometric data uniquely for identification purposes is forbidden pursuant to Article 9(1) of GDPR. Facial recognition is only permitted if it falls under the scope of one of the exemptions listed in such Article.

- ○ The use of biometric data with machine learning is relatively new from a technical perspective and application-wise has only marginally been explored. Therefore, careful hand-in-hand regulatory and technical development is required. Using an ethical principle framework could act as a preparatory approach for regulation.
- ○ It would also be useful for this legal framework to clarify that not only research in the public interest is covered by the research privileges when processing personal data – cf Article 5 (1) b (2nd half sentence) GDPR, Article 9 (2) j GDPR, Article 89 (2) GDPR – during research involving AI. Recital 159 GDPR already stipulates that privately-funded research also has recourse to these privileges. However, such privileges for research interests in the private sector are sometimes denied when it comes to discussions on data protection law. For example, it is sometimes stated that privileges arising from Article 9 (1) j of the GDPR only apply to research in the public interest (Schiff, in: Ehrmann / Selmayr, General Data Protection Regulation, 2nd ed. 2018, Article 9, Recital 63). However, this is not how the standard has been grammatically drafted.

- **Product liability**

From the perspective of the automobile industry, the EU Liability regime governing producers' liability based on the Product Liability Directive (PLD) is currently effective and should in principle be retained. The PLD provides legal certainty for consumers and allows for their effective compensation where required. It also respects development processes and innovation, and thus constitutes a generally well-balanced liability system. With regard to the next generation of automated vehicles, the automotive industry considers the current liability regime also as generally sufficient and balanced.

Vehicle manufacturers therefore stress that any need for revisions to the current EU legislative framework for liability to cover the risks engendered by certain AI applications, as proposed in the White Paper, as well as why the current application EU legislative framework would be insufficient, must be clearly demonstrated. Furthermore, as the PLD is a horizontal regulation covering many sectors, any assessment of the need for revision must meet certain criteria. It must be cross-sectorial, as it cannot be undertaken in a way that tackles a single aspect of one specific sector; it must be conducted in an open form so as to involve the overall stakeholder community; and it must take into consideration interdependencies with other legal areas, including data protection law.

The various applications of AI, their grade of autonomy and their risk potential should be assessed for each group / category of AI. Only when after a thorough review the current liability system in relation to AI does not seem sufficient for certain AI applications to balance consumer protection and innovations, should any adaptation to the current liability regime be considered. Non-mandatory guidelines could be introduced in order to add specifications, eg in regard to the definition of 'product', 'software', and 'services'.

- **Product safety**

In addition to the liability regime, other existing regulations on product safety, copyright liability, etc should not be changed radically for AI. The principles of these legal areas have worked well for a long time for many different technologies. The highest possible degree of technology neutrality should be respected within the legal standards.

As for product safety, existing laws are functional and effective. It is unclear which specific characteristics of AI software would require new legislation when compared to traditional software. At most, the General Product Safety Directive (GPSD) could benefit from a targeted revision in order to update some of the definitions, with a view to clarifying their applicability:

- ○ Where AI software has been embedded, or has been updated, after the product has been placed on the market, this is intended to be part of that 'product', insofar as this software is certified by the original producer.
- ○ By way of contrast, vehicle manufacturers believe that the original producer should not be held liable for any safety risk posed by the subsequent incorporation of standalone software over which it has no control. This standalone software should be considered / understood as a 'product' in its own right. Its producers / developers should be primarily liable for any safety risk created.
- ○ Where a software update causes an important change to the product, or modifies its original performance and has a significant impact on its functioning, we think this could be deemed a new product. Where applicable, this could be addressed in technical product legislation.

For example, the changing functionality of existing software in the automotive sector is already regulated and controlled. At UN-ECE level, a new Regulation has been adopted by WP29 on software updates and software updates management systems, which covers requirements and industry best practices for the safe and secure implementation of software updates[6]. As AI systems are also approved under the same standards, the need for further regulation is unclear.

For motor vehicles, updating software relating to a part, system or component that is an element

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[6] New UN Regulation on Software Update and Software Updates Management System, adopted 24 June 2020, WP29.

of the vehicle's type approval and that modifies its functioning or behaviour, will likely require a new type approval or an extension of the existing type approval under Regulation 2018/858 on the approval and market surveillance of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles. With respect to market surveillance and recalls, we would like to point out that the above-mentioned Regulation 2018/858 contains new, detailed rules for motor vehicles that apply from 1 September 2020, and should remain unaffected by the revision of the GPSD.

In general, new functions already need to be approved, homologated, monitored, and observed in operation. If updates become more frequent, a product – whether AI-based or not – may evolve during its life cycle in such a way that it no longer resembles its originally approved form. It is true that certain uses of AI accelerate such updates or allow them to be carried out autonomously, which may entail – at least – a need to clarify existing regulations. For safety-critical functions in the automotive sector, far-reaching approval regulations – the GPSD and the GSR – define the procedure for determining the approved status of a product and any potential deviations, apply in all these cases. There is no identifiable need for new regulation, particularly relating to AI.

3. USE A RISK-BASED APPROACH FOR AI APPLICATIONS

Before the introduction of any new AI-specific requirements, vehicle manufactures call for a risk-based approach, based on a set of criteria, which wisely assesses and classifies AI applications' risk level on a case-by-case basis.

Yet at the same time, it is important to prevent entire sectors from being placed under general suspicion, as each sector involves applications, products, and services with different risk requirements.[7] Therefore, classifying whole sectors according their risk level is inadequate for several reasons.

First, a list of 'high-risk sectors' implies continuous updates of the sectors and the assessment of their risk-level. This seems impractical, and could significantly hamper AI development and impair its use for non-critical functions and services in the sectors listed. This is most likely to happen in the transport sector, where the majority of AI applications would be low-risk.

Second, problems over the differentiation of sectors may arise. Indeed, as digitisation increases, sectors increasingly overlap and are no longer discrete. This would trigger many questions over

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[7] The Commission's White Paper seeks to introduce a two-factor, risk-based approach for classifying high-risk AI applications. The first factor is the sector where the AI application is employed, and whether – given the characteristics of the activities typically undertaken – significant risks can be expected. The second is the intended use of the application and whether – in the sector in question – it is used in a way that significant risks are likely to arise.

whether, and why, AI applications in functions such as production, marketing or finance ('non-high-risk sectors') should be treated differently from the same functions serving, for example, the transport industry (a 'high-risk' sector).

Third, such an approach seems to ignore the fact that in many sectors certain products already undergo validation processes to ensure – among other elements – their safety before being put on the market. For example, activities are ongoing to integrate new technologies such as autonomous driving within the existing framework (UN-ECE level) that governs the automotive sector.

Overall, it is unclear why a risk classification based solely on the particular AI application would be insufficient. Each AI system must be considered separately, otherwise general suspicion would increase the training outlay unnecessarily for the vast majority of uses that pose no risk / are low-risk. This would further complicate and impede the use of AI and significantly harm the competitiveness and employment situation in Europe.

The focus should be on the AI applications and on differentiating the criticality of their function. In other words, the risk assessment and classification should be based solely on the AI application and its intended use.[8] To that end, we recommend the following approach:

- An accurate and narrow definition of high-risk is required, in order to avoid moderate-risk or 'narrow' AI use cases being classified as high-risk and thus being overregulated. Introducing a level of moderate risk might offer a reasonable solution.

- It is currently unclear which body can evaluate whether a specific application is high-risk and what criteria they will use. For the former, ACEA recommends that the remits of the existing type-approval authorities / bodies be expanded to cover in-vehicle high-risk AI applications. This way, the necessary sectoral expertise, operational relationships and track-record with relevant stakeholders are further enhanced. For the latter, criteria for assessing and classifying 'high-risk' applications should be spelled out further. We call on the Commission to consider following criteria and factors: safety relevancy (severity, probability and controllability of malfunctions), learning autonomy, decision-making autonomy, type of algorithmic model, and the potential impact of the AI system on a (larger) group of people.

- Finally, ACEA recalls that the existing ISO26262 reference guidelines (and more generally the IEC 61508 for other transport systems) already provide an automotive-specific, risk-based approach for determining risk classes and can provide a basis.

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[8] We refer to the 'critical use' criterion as proposed in the European Commission's White Paper.

4. RECOGNISE THAT DEFINING AI POSES MAJOR CHALLENGES

As well as the risk-based approach, the definition(s) of AI will have absolute relevance inasmuch as it / they will determine the scope of the potential AI regulatory framework. However, differentiating and defining AI poses significant challenges.

This has been the subject of debate since the 1950s, with its relationship to technologies (such as machine learning and symbolic reasoning) being heavily influenced by societal inputs such as funding agencies and commercial interests. This debate (over an all-encompassing definition of AI for all situations and application realms or rather a precise, subset specific one) remains difficult and controversial. Yet, if an AI system is not clearly defined, the risk arises that existing functions, services, and products will be subsumed under the umbrella term of AI.

Here, the White Paper falls back on a phenomenological description, which remains too vague and overly broad, and thus would benefit from clarification. Referring to COM(2018) 237 and the AI HLEG[9] definition of AI, the White Paper describes the perception of the environment through data acquisition, the interpretation of these data, conclusions drawn based on knowledge or information gleaned from the data, and decision-making in relation to a complex objective as key elements of an AI system. This depiction carries the risk of introducing regulations for traditional software systems and 'narrow AI' applications that are also able to input data from their surroundings, process this data and make some type of decision / perform an action that produces an output.

5. TACKLE SAFETY AND ETHICAL CHALLENGES

Advances in AI, autonomous technologies, as well as the emergence of the Internet of Things (IoT) and robotics, are associated with a set of challenges and risks that have to be thoroughly addressed to establish a trustworthy technology. The Commission's White Paper on AI identifies a range of risks in terms of fundamental rights, including personal data and privacy protection as well as non-discrimination, but also safety risks stemming from AI applications (such as connectivity, autonomy,

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[9] "Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions.", High Level Expert Group on Artificial Intelligence, *A definition of AI: Main capabilities and scientific disciplines*, p 6, 8 April 2019, https://ec.europa.eu/digital-single-market/en/news/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines.

data dependency, opacity, complexity of products and systems, software updates and more complex safety management and value chains). In addition, these technologies have triggered a range of ethical questions over their impact on people and society and their decision-making capabilities.

Manufacturers recognise all the potential concerns relating to the use of AI in the automotive sector, and are working on ways to mitigate the impact / address the reality of these concerns. Their priority is to put vehicles on the market (and thus on our roads) that comply with the maximum safety and ethical standards. This will be instrumental in building trust among the general public in, and acceptance of, technologies such as AI and ultimately of transport automation. This chapter provides an overview of the safety frameworks currently in place in the automotive sector for tackling safety challenges stemming from AD. It also looks at the ethical discussion around CCAM and the achievements to date, as well as the principles that could be further developed as industry-driven initiatives for an ethical approach to AI.

5.1 Safety frameworks for Automated Driving (AD)

In the specific case of assisted and automated driving, safety is ensured by provisions dictated in the Vehicle Type Approval Regulation and the General Safety Regulation. As part of the latter's recent revision, new safety measures were also introduced, some of which may rely on AI. The delegated and implementing acts that will set out the technical requirements for these measures are currently being drafted and will apply from July 2022. As previously set out, the safety framework is complemented by tailored provisions on liability – here specifically through the Motor Insurance Directive – and product safety.

At UN-ECE level, strict safety requirements[10] have been developed / adopted for Automated Lane Keeping Systems (ALKS) for passenger cars – SAE level 3 at low speed (below 60 km/h) – which, once activated, are in primary control of the vehicle.

In addition, a new safety validation framework for AVs is being developed at UN-ECE level. This aims to set up a scenario database to ideally cover foreseen traffic situations that an ADS can encounter during the life-time cycle. These scenarios serve as the input for 'black-box' testing, together with information from sensors (cameras, lidars, etc), whereas actuation (eg steering, braking, path control) is the output. Such a scenario would include strict KPIs, derived from functional requirements and skilled and attentive driver performance. Designated entities will test

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[10] Requirements include: emergency manoeuvres, in case of an imminent collision; transition demand, when the system asks the driver to take back control; minimum risk manoeuvres, when the driver does not respond to a transition demand. In all situations the system shall minimise risks to safety of the vehicle occupants and other road users. However, the driver can override such systems and can be requested by the system to intervene at any moment.

the ADS ability to meet these KPIs.

ACEA therefore reiterates that, instead of introducing a further regulatory layer, the potential EU legislative framework on AI should be consistently aligned with the UN-ECE requirements for Automated Driving Systems. Future UN-ECE requirements should be considered as valid AI-safety related requirements.

Finally, the automotive industry relies widely on design and performance standards overseen by major standardisation bodies that define the state-of the-art in engineering. One relevant standard deserving particular attention in this context is the Safety of the Intended Functionality (SOTIF) 21448[11]; this standard applies to functionality that requires proper situational awareness in order to be safe. It is concerned with guaranteeing the safety of the intended functionality in the absence of a fault, in contrast with traditional functional safety, which is concerned with mitigating risk due to system failure.

5.2 Ethical framework for AI: the role of industry-led initiatives

Alongside safety concerns, vehicle manufacturers are addressing ethical considerations, particularly those on the protection of human life and integrity, freedom of choice or the right to privacy in the development and operation of CCAM; this in order to secure public and societal acceptance and trust of AI technologies and transport automation.

The Task Force on Ethical Aspects of Connected and Automated Driving (Ethics Task Force) comprising of Germany, Austria, Luxembourg, United Kingdom, the European Commission[12], ACEA and CLEPA, emphasised the need for further action to increase public acceptance and participation; including societal aspects and ethical considerations. These should be addressed via a harmonised European and international approach, looking at responsibility, cybersecurity and data protection.

Following these recommendations, the Commission's Expert Group that advises on specific ethical

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[11] ISO/PAS 21448 provides guidance on the design, verification, and validation measures that developers of autonomous driving technology can apply in order to achieve SOTIF in their autonomous mobility products. It helps developers attain safety requirement completeness even when the system is used in unknown or unsafe conditions, including the reasonably foreseeable misuse of autonomous vehicles. For developers of autonomous driving technologies, this new standard means a new approach to systematic failure analysis. Rather than focusing solely on malfunctions, ISO/PAS 21448 takes the complexity approach, requiring developers to account for any potential hazards resulting from the sheer complexity of the technologies covered by the standard.

[12] See Report of the Task Force on Ethical Aspects of Connected and Automated Driving (Ethics Task Force), https://www.bmvi.de/SharedDocs/EN/publications/report-ethics-task-force-automated-driving.pdf?__blob=publicationFile

issues raised by driverless mobility has produced a report,[13] which provides twenty recommendations to support researchers, policymakers and manufactures of connected and automated vehicles (CAVs), as well as deployers, in dealing with relevant ethical issues raised by connected and automated mobility. The recommendations include ethical, societal, and legal considerations for the safe and responsible development of CAVs and cover the following areas: road safety, risk, dilemmas, data and algorithm ethics (privacy, fairness, explainability), and responsibility / accountability.

In parallel, vehicle manufacturers endorse the Ethics Guidelines of the High Level Expert Group[14] on Artificial Intelligence, which set out basic requirements for trustworthy AI: human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, societal and environmental well-being, and accountability.[15] These seven key requirements for trustworthy AI are reasonable and should be supported.

In order to accelerate adoption of practical tools nurturing the objectives of the Ethical Guidelines for Trustworthy AI, vehicle manufacturers support the further development of industry-led initiatives, in the form of standards or codes of conduct for implementing automation and promoting the deployment of AI in such a way that it builds greater trust in, and public acceptance of, new technologies.[16]

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[13] Set up in 2019. European Commission, DG RTD, Independent Expert Report, Ethics of Connected and Automated Vehicles. Recommendations on road safety, privacy, fairness, explainability and responsibility, September 2020, https://ec.europa.eu/info/news/new-recommendations-for-a-safe-and-ethical-transition-towards-driverless-mobility-2020-sep-18_en.

[14] Ethics Guidelines for Trustworthy AI, https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai . As well as these, there are a growing number of reports and guidelines on AI and ethics – such as those by the G20, the UNESCO, the Council of Europe (COE), the Institute of Electrical and Electronics Engineers (IEEE), the Organisation for Economic Co-operation and Development (OECD), the International Telecommunications Union, the World Health Organization (WHO), and the UN Secretary General's High Level Panel on Digital Cooperation.

[15] Notions of adherence to ethical principles (respect for human autonomy, prevention of harm, fairness, explicability), and values (respect for human dignity, freedom of the individual, respect for democracy, justice and the rule of law, equality, non-discrimination and solidarity, citizens' rights) are also advocated by AI HLEG and supported here.

[16] For example, the AI4People project is translating the seven key requirements for trustworthy AI into practical steps for AV industry and policy makers to make the automated vehicles comply with them (the report is expected by December of 2020). Also, the Focus Group on AI for autonomous and assisted driving (FG-AI4AD) supports standardisation activities for services and applications enabled by AI systems. The FG-AI4AD will focus upon the behavioural evaluation of AI responsible for the dynamic driving task in accordance with the 1949 and 1968 Convention on Road Traffic of the UN-ECE Global Forum for Road Safety: https://www.itu.int/en/ITU-T/focusgroups/ai4ad/Pages/default.aspx.

On this basis, an ethical approach could focus on shaping AI responsibly by balancing its benefits with a common set of values and principles and increasing transparency through a standardised assessment process. This could potentially be described in industry standards or codes of conduct, which build upon the ethical principles set out in the existing EU and international initiatives.[17] The following aspects[18] must be taken into consideration when drafting industry ethical standards for trustworthy AI technology:

- Human-centricity: the deployment of AI technologies should have, at its core, the well-being of human individuals and society at large. A human-centric approach requires that, when developing and deploying AI, internationally agreed human rights will be respected and fostered.[19]

- Responsibility: AI use should be preceded by a transparent assessment process, carried out within the third-party type approval framework and certification requirements currently in force in the automotive sector. Here, collaboration with type approval authorities could enable practical handling. Moreover, AI use should be based on a high-quality and representative database, one founded on core principles such as diversity, non-discrimination and fairness. There should be general collaboration to promote the creation of, and access to, representative data sets, and standards of fairness / representativeness should be developed via dialogue process involving a diverse range of stakeholders.

    - Ethical questions have been raised concerning the fact that AI algorithms and the underlying data are attributed with a potentially discriminatory bias for example. In this context, although the data on which an algorithm is based still plays a significant role, potential discrimination only occurs when the trained algorithm is applied. Any potential standards should take this into account and not create major additional obstacles for the recording and quality of training data in itself, but should word the requirements in such a way that any pre-processing of data and its use in training algorithms is sufficiently considered.

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[17] ISO/TC 241 WG6: Road Traffic Safety (RTS) – "Guidance on safety ethical considerations for autonomous vehicles. ISO/IEC AWI TR 24368, "Information technology — Artificial intelligence — Overview of ethical and societal concerns", https://www.iso.org/standard/78507.html. IEC SEG 10 "Ethics in Autonomous and Artificial Intelligence Applications, Identify ethical and societal concerns relevant to IEC technical activities", https://www.iec.ch/dyn/www/f?p=103:186:7652619617184::::FSP_ORG_ID:22827.

[18] See Daimler, https://media.daimler.com/marsMediaSite/en/instance/ko/Using-new-opportunities-responsibly-Daimler-AG-adopts-principles-for-dealing-with-artificial-intelligence.xhtml?oid=44351958

[19] See Ministerial Conclusions from the fourth High Level Meeting on CAD, drafted by Member States and Industry stakeholders (ie ACEA), 7 October 2020, https://citainsp.org/wp-content/uploads/2020/10/HLM-CAD-Helsinki-Conclusions.pdf

○ Furthermore, the extent to which earmarking, and provenance of training data can in itself be problematic with regard to a possible bias should also be examined. As a minimum, international exchange and clearly regulated acceptance of data must make it possible to select representative training data sets that cannot be generated per se in a self-contained economic area such as the EU, because the groups in question are not sufficiently represented in the average population.. For example, individuals' clothing, skin colour, ethnic background or culturally-determined individual behaviour in road traffic should not lead to a higher risk of harm for that specific individual because they are underrepresented in the training data.

Responsibility is also linked to the notions of accountability and auditability. This requires an appropriate balance between the latter and the principles of cybersecurity, data protection, and intellectual property.

- Transparency and explainability: the required degrees of transparency and adequate explainability[20] should be supported to allow end users to trust new technologies. These are also relevant for improving reconstruction of malfunctions or inefficient (automated) decisions, although arguably it will not be possible to achieve this for all applications. Transparency should focus on traceability and auditability and the need of proportionality on transparency requirements on algorithmic decision making. Explainability indicates the behaviour cq input–output relationship of which can exhaustively or sufficiently be explained ex post.[21]

- Protection of privacy: privacy protection should be ensured from the design phase of AI onwards, and privacy-enhancing technologies must be supported. Automobile manufacturers fully comply with GDPR provisions and principles for data protection (eg principle of choice, informed consent, etc).

- Safety, reliability and technical robustness: the basis for this is conscientious training of the learning systems, the use of scientifically-validated algorithms and up-to-date technologies in order to provide high quality standards for AI application. As identified in the AI HLEG Ethical Guidelines for Trustworthy AI, technical robust AI systems are "developed with a preventative approach to risks and in a manner such that they reliably behave as intended while minimising unintentional and unexpected harm, and preventing unacceptable harm."

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[20] The level of explainability should vary depending on the type of addressee (authority, end-user, etc).

[21] For example, when a piece of software analyses huge quantities of data in order to make predictions about future market developments, it should be obvious what parameters it considered while performing the analysis. That way, we can explain any possible unintended bias – and eliminate it.

- Quality and sharing of data: data is fundamental and a prerequisite for many AI applications. Therefore, incentives to exchange non-differentiating company data should be promoted. The broadest possible participation in existing data, for example in open data initiatives, is to be welcomed.

  - If a company is to operate globally, then training data must be collected globally. This is an important condition that will determine – among other things – whether European industry can play a world-leading role or not. As differences in the environment produce different results, the development processes used by European vehicle manufacturers must take account of all relevant cases / traffic scenarios that the vehicle may encounter. Hence, it is important to stress the use of global data and the implementation of clear guidelines and processes for sharing data between countries, both inside and outside the European Union. Otherwise, the value of the data will be lost.

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[22] Ibid footnote 13, p 16

CONCLUSIONS

In order to fully capture the impact and benefits of AI in the automotive industry for all stakeholders (from developers to deployers of AI, automobile manufacturers, and end users) policies need to remain flexible and follow the evolution of technological development. This will leave the necessary room for innovation.

As highlighted throughout this position paper, automotive industry products and vehicles are subject to strict regulatory frameworks already in force and fall under the New Legislative Framework, which lays down new stringent requirements for automated vehicles. Therefore, enforcement of applicable legislation and, where necessary, the provision of practical guidelines on how to enhance these frameworks, would be a good first step before new laws are drafted. Second, an in-depth assessment of existing laws and a thorough gap analysis are required before amending current legislation.

If new requirements are deemed necessary, there should be a risk-based approach to their scope, and they should be limited to high-risk AI applications (ie safety-critical functions). Later, guidance on how to fulfil the requirements will be needed. This stepwise approach is essential for promoting innovation and competitiveness while providing developers, deployers and other stakeholders with legal certainty.

Public trust and confidence will stimulate adoption and use of AI and automation across the entire mobility ecosystem. This trust will be determined by considerations such as the safety of AI-based products, their transparency and the explainability of their purpose, use, benefits, and the limitations of AI systems. The safety of automotive products and vehicles is already ensured by the provisions dictated in the existing safety frameworks for automated driving. In addition, vehicle manufacturers have also been deploying AI in a trustworthy fashion and are actively supporting an ethical approach to AI, one based on a recognised set of values and principles to be enshrined into industry-led initiatives.

With these views, ACEA wishes to contribute to the development of a European ecosystem of trust and excellence for AI. It stands ready to work further with the European Commission and all other stakeholders involved.

LIST OF ABBREVIATIONS

AI – Artificial Intelligence

AD – Automated driving

ADAS – Advanced Driver Assistance System

ADS – Automated Driving System

AI HLEG – High Level Expert Group on Artificial Intelligence

ALKS – Automated Lane Keeping System

ANN – Artificial neural network

AV – Automated vehicle

CAD – Connected and automated driving

CAV – Connected and automated vehicle

CCAM – Cooperative, Connected and Automated Mobility

CoP – Conformity of Production

FRAV – Functional Requirements for Automated and Autonomous Vehicles (GRVA, WP29 UN-ECE)

GDPR – General Data Protection Regulation

GPSD – General Product Safety Directive

GRVA – Working Party on Automated / Autonomous and Connected Vehicles (WP29 UN-ECE)

GSR – General Safety Regulation

HDV – Heavy-duty vehicle

ML – Machine learning

OEM – Original equipment manufacturer

ODD – Operational design domain

PLD – Product Liability Directive

SAE – Society of Automotive Engineers

UN-ECE – United Nations Economic Commission for Europe

VMAD – Validation Methods for Automated Driving (GRVA, WP29 UN-ECE)

WP1 – Global Forum for Road Traffic Safety (UN-ECE)

WP29 – World Forum for Harmonisation of Vehicle Regulations (UN-ECE)

SECTION B: TECHNICAL ANNEX

1. ARTIFICIAL INTELLIGENCE: KEY TECHNOLOGY FOR THE AUTOMOBILE INDUSTRY

Increasingly, the generation, collection and processing of data is opening up possibilities for the use of technologies such as AI and automated blockchain, which are disrupting the transport sector on a global scale. In the automobile industry, vehicle manufacturers acknowledge that AI has enormous potential both when embedded within the industry's products and in its production processes and throughout value-added chains. The auto industry believes that AI is going to be a central technology both in the near future and in the longer term. It will make transport safer, cleaner, more efficient and more reliable, while also delivering increased productivity, product safety, performance and objectivity.

AI and human-machine interaction, in combination with other digitisation technologies, are profoundly changing production and logistics as well as the analysis of markets, customer behaviour, and sales.[23] AI is finding applications throughout the whole automotive value chain and, to a certain extent, is already reshaping the way that people and goods move across Europe, from scanning traffic patterns to reducing road casualties and optimising routes to reduce emissions. Currently, AI is being implemented in automotive manufacturing, including design, supply chain, production, and post-production.

Most importantly, AI is increasingly being applied in automobiles: automated driving is the best-known example, but AI also finds a role in a wide variety of other applications, such as safety features for vehicles, comfort functions, Advanced Driver Assistance Systems, warning and 'driver risk assessment' systems, connectivity systems, infotainment systems, etc. Aftermarket services such as predictive maintenance and insurance are also being transformed through AI use.

Before focusing on specific AI applications in the automobile industry, an overview of generally understood AI terms and the taxonomy surrounding AI is provided, in order to clarify the technical scope of 'Artificial Intelligence' covered by this ACEA position paper. Currently, and in the near future, automobile manufacturers rely on the following classifications of AI:

- ### AI techniques and subsets

In this respect, the automobile sector makes use of various AI techniques and subsets. ACEA

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[23] See VDA, https://www.vda.de/en/press/press-releases/20181201-Mattes--Artificial-intelligence-creates-enhanced-road-safety.html, https://www.vda.de/en/press/press-releases/210321-Damasky-Artificial-intelligence-is-deciding-factor-for-connected-and-automated-driving.html

supports the definition proposed by the High Level Expert Group on Artificial Intelligence in the paper 'A definition of AI: Main capabilities and scientific disciplines': "As a scientific discipline, AI includes several approaches and techniques, such as machine learning (of which deep learning and reinforcement learning are specific examples), machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search, and optimisation), and robotics (which includes control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems)."[24]

The dominant advanced application of AI in the automotive industry, within the near future, is machine learning of software and systems. Therefore, we would like to complement the definition of machine learning by adding that this technique is based on computing systems with methodologies that include artificial neural networks (ANNs aka 'deep learning'), linear regression and classification, Bayesian methods, kernel methods, reinforcement learning, etc.

The development processes needed for machine learning do not differ significantly from today's processes: vehicle manufacturers will continue to develop and release new features, systems and vehicles that are type approved when placed on the market. When new or updated functionality is available, it is released in new vehicles or vehicles in the field, which will have to comply with the Software Updates Regulations.

- **Narrow AI**

Narrow AI systems are those that "can perform one or few / domain-specific tasks".[25] As described in the following paragraphs, narrow AI applications are the most-commonly used and currently deployed in vehicles as well as in the near future.

These narrow applications must be distinguished from the concept of 'general AI'. As defined by the AI HLEG a general AI system is: "intended to be a system that can perform most activities that humans can do [...]. There are still many open ethical, scientific and technological challenges to build the capabilities that would be needed to achieve general AI, such as common sense reasoning, self-awareness, and the ability of the machine to define its own purpose."[26]

As pointed out, this technology is currently not technically available (nor will it be in the near future). Moreover, it is vital to recall that certain key features of highly automated vehicles already available on the market are not implemented with the use of trained AI algorithms. Instead they display a certain degree of environmental perception, autonomy and adaptivity, which risks being wrongly

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[24] Ibid footnote 8, p 6

[25] Ibid, p 5

[26] Ibid, p 5

associated with 'high-risk' AI.

Traditional driving dynamics control and **Advanced Driver Assistance Systems (ADAS)**[27] are already capable of:

- Assessing the vehicle's surroundings via distinctive sensor technology.

- Using this information to regulate the driving and braking forces acting on individual wheels to ensure superior driving stability and to prevent the vehicle from swerving.

- Employing radar to maintain distance from the vehicle in front.

- Warning the drivers if they are deviating from the road lane or help them stay in lane in certain traffic situations.

- Activating traditional airbag systems.

Other applications include heating, ventilation and air conditioning (HVAC) for example.

These traditional software systems, products and services, based on software engineering methods, are able to input data from their surroundings, process this data and take some sort of decision or perform an action that produces an output. However, these should clearly fall outside the scope of any potential regulation and / or requirement for high-risk AI applications.

2. THE APPLICATION OF AI IN THE AUTOMOTIVE SECTOR

AI is relevant to the automobile industry in the major areas listed below. This list of the use cases is non-exhaustive and is intended to be representative.

2.1 In-vehicle AI applications

One of the major areas of AI application is in the vehicle itself (functionalities in cars, vans, trucks and buses) and in wider automotive technology. AI is an important technology for autonomous driving[28], for environmental detection and for control of the vehicle, as well as for many other in-vehicle applications.

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[27] For instance, Advanced Driver Assistance Systems (ADAS) can already take over safety-critical functions (such as steering and braking) from the driver under certain circumstances. Autonomous Emergency Braking (AEB) and Lane Keeping Assistance (LKA) are examples of partially automated technologies in-use today that can help prevent accidents.

[28] It is important to recall that AI is a tool for AD, but not a necessity. In addition, AI can be used for other applications than AD.

Examples of current AI use for CCAM purposes

Narrow AI applications and other features: machine learning algorithms used and currently deployed in vehicles and in the future can be considered as 'narrow AI'. Examples of narrow AI systems currently deployed in vehicles include recommender systems, such as lane recognition, vehicle recognition or traffic sign recognition. Narrow AI algorithms are trained offline and tested rigorously before being deployed as fixed software in vehicles, just as with any other software component in a vehicle.

ADAS are increasingly using AI to, for example, process the video feeds coming from cameras mounted on the vehicle, although this is currently limited to SAE level 2 applications. Another application is Natural Language Processing (NLP), which is advanced, intelligent voice control that can be used for navigation and comfort functions. AI is also conceivable for use in facial or voice recognition applications to unlock or start the vehicle.

Current limitations to the use of AI for CCAM

The full potential of autonomous vehicles remains untapped, as the application of AI systems and learning rationale systems[29], for this specific purpose is still limited. While automobile manufacturers are keen to use AI to increase the levels of vehicle automation, in the short term they cannot rely on AI-induced automated decision processes when it comes to mass deployment.

In fact, currently, the technology for implementing so-called 'general' AI (capable of common-sense reasoning, self-awareness and having the ability to define its own purpose) is not available, nor will it be in the near future.

At their current state of development, learning rational systems in homologated / certificated AI systems are not involved in vehicles for safety critical functions or services. The software that will be deployed (including AI modules) is being developed according to state-of-the-art standards and practices for functional safety and software development. It will be rigorously analysed and tested before deployment. The software is then fixed; no changes can be made unless the manufacturer deploys an update that will also have undergone the same process to ensure its quality and conformance with the intended functionality.

This means that, at the current state of development of AI, online re-training for safety-critical

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[29] High Level Expert Group on Artificial Intelligence, A definition of AI: Main capabilities and scientific disciplines: "Rational AI systems are a very basic version of AI systems. They modify the environment, but they do not adapt their behaviour over time to better achieve their goal. A learning rational system is a rational system that, after taking an action, evaluates the new state of the environment (through perception) to determine how successful its action was, and then adapts its reasoning rules and decision making methods.", p 3, 8 April 2019, https://ec.europa.eu/digital-single-market/en/news/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines.

functions cannot be applied if the correct functioning cannot be guaranteed.[30] It is always necessary to validate that algorithms are correct. This can be done directly – via human oversight – or indirectly, using mathematical correctness proofs for example. Once proved correct, the online-retrained parameters for both safety and non-safety critical functions can also be used operationally.

Examples of potential future AI applications for CCAM

ACEA endorses the earlier UN-ECE working document on Artificial Intelligence and vehicle regulations,[31] which offers the following examples of AI and machine learning in-vehicle applications:

- **Map building**

Online map building is typically carried out using methods called SLAM (Simultaneous Localisation and Mapping). However, offline production of high-definition (HD) maps through AI has already started. This is done by exploiting the proliferation of camera-based ADAS. The map-relevant information collected by cameras is then analysed (potentially using AI) in real-time in the vehicles, compressed and sent to the cloud. Through the use of AI, these elements can be processed and integrated into HD maps.

- **Image analysis and data fusion for object and surrounding detection: deep learning for image processing will be one of the key applications for autonomous driving**

Also as described in the UN-ECE working document, automated / autonomous vehicles will rely on sensing technologies in order to detect road signs, their environment and other road users. The information acquired through sensors will be then analysed, eg through machine learning combined with deep learning technologies, and will be used by the vehicle to interpret its surroundings.

- **Driving policies / strategies for automated driving**

As the document explains, driving policies may be developed using AI and machine learning (eg reinforcement learning), allowing the vehicle to make decisions. Driving policies will be based on the representation of the vehicle surroundings and the predictions of the software.

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[30] For these, in the automotive sector, the approval requirements continue to apply, such as those stipulated in the General Product Safety Directive, as well as the product monitoring obligations and technical monitoring requirements.

[31] UN-ECE, WP29-175-21 175th WP29, 19-22 June 2018, Artificial Intelligence and vehicle regulations, https://www.unece.org/fileadmin/DAM/trans/doc/2018/wp29/WP29-175-21e.pdf.

- **Human-Machine Interface (HMI)**

Through the use of AI and machine learning, it is possible to achieve an efficient human-machine interaction. This interaction could use, for example, speech recognition and a personalised driving experience enhanced with intelligent assistance through voice command. Another relevant application that falls under this category is driver behaviour monitoring, such as attention or drowsiness detection.

2.2 Other AI use cases in the automotive industry

Cognitive ergonomics is the term used to describe the use of learning rational systems that relieve employees of small, repetitive administrative tasks, for example in business processes and applications and prepare the tasks for a final decision (form releases, entries, etc).[32] This is currently at an early development stage.

Manufacturing is another important area for AI application. This encompasses, for example, anomaly detection, planning optimisation, and intelligent robotics (artificial intelligence that enables robots to work together with human-skilled workers).[33] It is also covers algorithms for optimising manufacturing and logistics processes. Other relevant use cases in the automotive manufacturing process are[34]:

- Predictive maintenance in the body shop;
- Dust particle analysis in the paint shop through measuring sensors;
- AI-based image recognition in assembly;
- Radio Frequency Identification (RFID) to identify components automatically and without contact throughout the value chain;
- Function validation with the comfort access robot;
- App to track vehicle location in the production system.

In this respect, AI is useful for information processing; algorithms can search and organise highly complex data sets quickly, efficiently and continuously. This enables, for example, precise market forecasts containing myriad variables. AI can thus prepare and present a substantial database for the human decision maker.[35]

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[32] VW, https://www.volkswagenag.com/en/news/stories/2018/11/learning-to-learn.html#

[33] Futurebridge, https://www.futurebridge.com/industry/perspectives-mobility/artificial-intelligence-reshaping-the-automotive-industry/

[34] BMW Group, https://www.press.bmwgroup.com/global/article/detail/T0306012EN/from-press-shop-to-validation:-bmw-group-plant-munich-builds-on-artificial-intelligence-and-smart-use-of-data

[35] Ibid, footnote 31

AI can also play a significant role in the provision of services. Think, for example, of so-called predictive maintenance: tools and machines will be able to learn their own optimum maintenance intervals using rational learning systems, sending a timely reminder to the maintenance staff at the facility. Currently, many AI applications are predicting problems relating to engine or battery performance that may occur in the future. In addition, there are many insurance providers that offer quick AI-powered services right now, eg assisting in insurance and claim settlements.[36]

Finally, AI can support freight transport operators by optimising logistic flows as well as optimising the need for transport at a given time and with a given load, by choosing the most effective route at a given time and with a given priority.

3. UNDERSTANDING AI BENEFITS AND OPPORTUNITIES IN THE AUTOMOBILE INDUSTRY

On a broader scale, we believe that AI can be used to tackle a variety of road transport-related problems, while streamlining processes along the entire automotive value chain. For example, Artificial Intelligence can help in achieving greater product safety, performance, objectivity and productivity. When applied to vehicles, AI is expected to help improve situation understanding, driver safety and monitoring, and trajectory prediction.

- AI technology can contribute to increasing the level of safety for vehicles, drivers, and roads; fully in line with road safety targets such as the 'Vision Zero' ambitions of the European Commission.
  - As acknowledged by the Commission,[37] connected and automated vehicles can improve road safety by reducing fatality rates in traffic accidents. Partially automated vehicles are currently available on the market and are equipped with safety systems, from basic ones that give drivers additional sensorial perception (such as blind spot detection) to advanced active safety systems that intervene automatically, faster, and more reliably than a human being.
  - Driver monitoring will also enhance road safety: driver recognition / identification, detection of distraction or drowsiness of the driver, systems to alert the driver, etc can all be based on, or improved by, AI technology. Moreover, air bags could be deployed in such a way that AI will reduce injury based on how the driver is sitting.

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[36] Ibid, footnote 32

[37] See Commission (EU), Report on the safety and liability implications of Artificial Intelligence, the Internet of Things and robotics (COM(2020) 64 final); See also Commission (EU) Report on Saving Lives: Boosting Car Safety in the EU (COM(2016) 0787 final).

- Performance / efficiency gains: AI technology applications, in the case of CCAM, can further optimise movements or decisions, maximising efficiency in terms of time and fuel or power consumption.
  - AI technology can enhance traffic fluidity by optimising routes and detecting parking spots. The number of inefficient road trips will be reduced by optimisation of the journey, as will power and fuel consumption, triggering positive environmental effects.
  - Gains in terms of driving comfort can also be expected. Thanks to data processed through sensors and fed into algorithms, both speed and manoeuvring can be adapted to provide smoother navigation in different types of driving situations.
  - Starting with deployment on closed sites, such as large logistics terminals, ports and mines, AI technology in autonomous, heavy-duty commercial vehicles will increase safety and make logistical flows more efficient. Some of these commercial applications are already being deployed by European heavy-duty vehicle manufacturers.
- Increased accessibility, affordability, and greater offer:
  - For people with reduced mobility, such as the elderly and disabled, using AI in autonomous mobility solutions represents a game changer, allowing them to make more effective use of individual road transport;
  - AI can improve integrated Mobility-as-a-Service solutions.
- Predictive maintenance and diagnostics: preventive maintenance through continuous data analysis will reduce unanticipated failures and help achieve a closer relationship with customers.
- Cost reduction: AI can reduce in-vehicle cost as well as the cost of ownership through predictive maintenance.
- Objectivity and effectivity of processes: a potential AI benefit relates to the mitigation of human bias, allowing for greater objectivity. For example, in manufacturing-production processes AI allows for more effective quality checks / monitoring.
- Individualised marketing: infotainment system can offer products and services to the driver, based on the raw data.
- User experience and customer satisfaction: AI applications will ultimately lead to safer journeys, more efficient traveling and more relaxing and satisfying driving.
- Reduced time to market: AI can help accelerate the development of new products, for example by avoiding the need for 1:1 scale prototypes to be built, making verification tests digital and learning better and faster from data. AI allows for capturing the key features of new products in the design process, hence reducing the time to market.

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ABOUT THE EU AUTOMOBILE INDUSTRY

- 14.6 million Europeans work in the auto industry (directly and indirectly), accounting for 6.7% of all EU jobs.

- 11.5% of EU manufacturing jobs – some 3.7 million – are in the automotive sector.

- Motor vehicles account for €440.4 billion in taxes in major European markets.

- The automobile industry generates a trade surplus of €74 billion for the EU.

- The turnover generated by the auto industry represents over 7% of EU GDP.

- Investing €60.9 billion in R&D annually, the automotive sector is Europe's largest private contributor to innovation, accounting for 29% of total EU spending.

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