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BALANCING SECURITY AND PERSONAL FREEDOM IN THE AGE OF AI: CIVIL LAW PERSPECTIVES

L´articolo analizza l´impatto dell´IA sull´ordinamento giuridico, evidenziando il conflitto tra esigenze di sicurezza pubblica e tutela delle libertà individuali. Esamina le criticità dell´uso dell´IA nella sorveglianza rispetto al GDPR, con particolare attenzione a bias algoritmici, proprietà dei dati e responsabilità contrattuale ed extracontrattuale. Approfondisce il problema della "black box" dell´IA e le sue ricadute su responsabilità e prova in ambito giudiziario. Vengono proposti, infine, modelli alternativi di responsabilità e adattamenti normativi per conciliare innovazione tecnologica e diritti fondamentali.

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IUS/01 - DIRITTO PRIVATO
Articolo divulgativo - ISSN 2421-7123

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Pubblicato, Lunedì 27 Aprile 2026

CamminoDiritto.it
ISSN 2421-7123

Abstract ENG

The article analyses the impact of AI on the legal system, highlighting the tension between public security requirements and the protection of individual freedoms. It examines the challenge posed by the use of AI in surveillance in relation to the GDPR, with particular attention to algorithmic bias, data ownership, and contractual and extra-contractual liability. It further explores the "black box" problem of AI and its implications for accountability and evidentiary standards in legal proceedings. The article, finally, assesses alternative liability models and proposes legal adaptations aimed at reconciling technological innovation with the safeguarding of fundamental rights.

Introduction

The accelerated development of artificial intelligence (AI) has profoundly transformed contemporary society[1], particularly in the realm of public security[2] and data governance [3].

AI systems are increasingly integrated into surveillance mechanisms[4], predictive analytics[5], and public administration[6], providing unprecedented capabilities for monitoring[7], data processing[8], and decision-making[9]. These technological advancements have the potential to enhance public safety, prevent crime, and improve governmental efficiency[10]. However, they simultaneously raise profound concerns regarding the protection of fundamental rights, especially privacy and individual freedom.

The legal debate on AI centres on the tension between enhancing public security through technology and protecting individual autonomy from state and corporate overreach[11].

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This tension is not new—throughout legal history, lawmakers have grappled with the need to balance collective safety with the protection of individual liberties. Yet, the scale and complexity of AI introduce novel legal and ethical challenges that require a reconsideration of existing regulatory frameworks[12].

From a civil law perspective, AI governance engages critical legal questions regarding the regulation of personal data[13], algorithmic transparency[14], and the attribution of liability for harms caused by automated decision-making[15]. In this regard, it is essential to emphasise the peculiar features of AI systems, which distinguish them from traditional technologies. AI is characterised by a significant degree of autonomy, the capacity for adaptive learning, and a structural opacity often described as the "black box" problem. These elements reduce predictability and challenge the reconstruction of causal chains, thereby complicating the application of traditional liability models grounded in human conduct and foreseeability.

The General Data Protection Regulation (GDPR) and national civil codes provide foundational legal mechanisms to address these issues[16], but the rapid evolution of AI technology reveals gaps and ambiguities that challenge traditional legal paradigms. For instance, the principles of proportionality and necessity embedded in the GDPR aim to prevent excessive data processing, but struggle to address the opacity of AI algorithms and their potential discriminatory effects[17].

The legal implications of AI in surveillance extend beyond data protection to encompass the fundamental principles of civil liability. Civil law traditionally assigns responsibility based on human agency and fault[18]; however, the autonomous and probabilistic nature of AI systems complicates the attribution of liability. Whether responsibility should rest with the developers, deployers, or manufacturers of AI remains a contentious issue. This ambiguity calls for a systematic legal framework capable of addressing the unique risks posed by AI while preserving core principles of justice and fairness.

This paper aims to provide a comprehensive analysis of the legal challenges posed by AI-driven surveillance from a civil law perspective[19]. It will examine the adequacy of existing legal frameworks in regulating AI technologies and safeguarding personal freedoms. Special attention will be given to the principles of algorithmic accountability, data protection, and the evolving concept of civil liability in the context of automated decision-making.

By adopting a rigorous, multidisciplinary approach, this study seeks to advance the legal discourse on AI regulation and propose doctrinal solutions to ensure a balanced coexistence of technological innovation and the protection of fundamental rights[20].

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1. The legal framework of AI surveillance: Civil Law approaches

The regulation of artificial intelligence in the context of surveillance raises intricate legal questions under civil law, particularly regarding the interaction between technological innovation and the protection of individual rights[21]. AI-driven surveillance systems, encompassing facial recognition[22], behavioural analysis[23] and predictive policing[24], present unprecedented challenges to existing legal frameworks. While these technologies promise to enhance public security, they simultaneously threaten fundamental rights to privacy and personal autonomy, necessitating a nuanced legal response.

At the European level, the General Data Protection Regulation stands as the primary legislative instrument governing the collection and processing of personal data. Under Article 5, the GDPR enshrines core principles such as data minimisation, purpose limitation, and transparency, which seek to constrain the invasive potential of AI-driven surveillance. In particular, Article 22 provides individuals with the right not to be subject to decisions based solely on automated processing, including profiling, which significantly affects their rights and freedoms.

This provision reflects the broader objective of preventing the erosion of human autonomy by automated systems[25].

1.1 The Limits of Traditional Liability Frameworks

Civil law further imposes specific duties of care on entities deploying AI in surveillance. National legal frameworks grounded in the Civil Code extend liability to actors responsible for wrongful or negligent conduct that results in harm. For instance, Article 2043 of the Italian Civil Code imposes an obligation to compensate for damages caused by illicit acts. This general principle of extra-contractual liability (delictual liability) could be applied to the use of AI technologies that infringe upon privacy rights or cause other forms of legally recognisable harm[26].

However, applying these traditional concepts to AI surveillance is fraught with practical difficulties. This opacity complicates liability attribution in practice[27]. The difficulty is further exacerbated by the adaptive nature of AI systems, whose behaviour may evolve after deployment, making it problematic to identify a single moment of defect or fault. As a result, traditional liability models—typically based on foreseeability and human control—struggle to accommodate systems whose risk profile is dynamic and partially uncontrollable. When harm arises from automated decision-making, it may be unclear whether responsibility lies with the software developer, the public authority deploying the

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technology, or third-party service providers[28].

To address these gaps, legal scholars advocate for the introduction of a distinct liability regime tailored to the peculiarities of AI systems[29]. Such a framework would need to balance the promotion of innovation with the imperative to protect fundamental rights.

One proposed solution involves adopting a strict liability standard for entities that control or deploy AI surveillance technologies[30], thus eliminating the need to prove fault or negligence.

This approach aligns with existing legal doctrines applicable to inherently hazardous activities, where the potential for significant harm justifies the imposition of heightened responsibilities[31].

1.2 Proposals for Adapted Liability Models

Moreover, civil law must grapple with the intersection of public and private interests in AI surveillance. While public authorities may invoke national security imperatives to justify invasive surveillance measures, these objectives must be reconciled with the individual's right to privacy[32]. The principle of proportionality, a cornerstone of European legal systems, mandates that surveillance measures must be necessary and proportionate to the legitimate aim pursued[33]. Judicial oversight mechanisms and independent auditing procedures are essential to ensuring compliance with these standards and preventing abuses[34].

In this context, the emergence of a risk-based regulatory approach provides a crucial conceptual framework for rethinking civil liability. By classifying AI systems according to the level of risk they pose—particularly in sensitive domains such as surveillance—this model enables a differentiated allocation of legal responsibilities. High-risk systems may justify the adoption of stricter liability standards or enhanced duties of care, while lower-risk applications may remain subject to traditional negligence-based regimes.

The legal framework governing AI surveillance under civil law reveals both strengths and limitations. Existing doctrines of liability and data protection offer foundational safeguards, but the distinctive characteristics of AI necessitate an evolution of legal principles. Future regulatory developments must prioritise algorithmic transparency, the fair allocation of liability, and robust mechanisms for safeguarding personal freedoms in the face of technological advancement.

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This alignment between ex ante risk classification and ex post liability allocation enhances systemic coherence, ensuring that those who design or deploy high-risk AI systems internalise the corresponding legal risks.

2. Algorithmic bias and civil liability

The integration of artificial intelligence into decision-making processes has amplified concerns regarding algorithmic bias[35] and its implications for civil liability. Algorithmic bias refers to systematic errors in AI outputs that disproportionately affect certain social groups, often resulting from the data used to train these systems. Such biases can produce discriminatory outcomes[36] that infringe on legally protected rights and raise fundamental questions about the allocation of legal responsibility.

Traditional legal doctrines require a direct causal link between a wrongful act and the harm caused[37]. However, AI operates through complex statistical models and machine-learning processes[38]. This ambiguity complicates the application of classic fault-based liability under Article 2043 of the Italian Civil Code or equivalent provisions in other civil law jurisdictions.

One of the core legal issues is whether algorithmic bias should be treated as a defect in the product[39] or as a failure of due diligence by the developer or deployer[40]. The EU Product Liability Directive provides a potential framework, classifying AI systems as products subject to strict liability for defects[41]. Under this regime, injured parties do not need to prove negligence but only that the AI system was defective and caused harm.

An alternative perspective advocates for the application of vicarious liability principles, holding entities that deploy AI responsible for the harms their systems cause, regardless of whether they directly created the algorithm. This would align with established doctrines of employer liability[42], which impose responsibility on principals for the actions of their agents. In the context of AI, such a framework would ensure that those who benefit from automated systems bear the corresponding legal risks.

Beyond the challenges posed by algorithmic bias in tort-based frameworks, a broader perspective on liability also requires re-evaluating the contractual and extra-contractual dimensions of AI governance.

3. Contractual and extra-contractual responsibility in AI governance

The rapid proliferation of artificial intelligence (AI) systems has given rise to complex

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legal issues surrounding both contractual and extra-contractual liability. Given the autonomous and self-learning nature of these technologies, it becomes increasingly difficult to determine responsibility when harm arises[43]. In AI governance, this difficulty is particularly pronounced in the context of surveillance applications[44], where the deployment of advanced monitoring tools can infringe on privacy rights and cause other legally significant damages. Civil law frameworks must therefore adapt to allocate liability in a manner that balances technological innovation with the protection of fundamental rights.

A systematic allocation of liability in AI governance requires distinguishing between the different actors involved in the AI lifecycle, notably producers (or manufacturers), developers, and deployers or end-users. Each of these actors exercises a different degree of control over the system and contributes differently to the generation and management of risk. In line with a risk-based approach, liability should be allocated primarily to the actor best positioned to prevent harm or mitigate its consequences. Producers and developers may bear responsibility for design defects and training data biases, while deployers and users may be liable for improper implementation, lack of oversight, or misuse of the system in concrete operational contexts.

A systematic understanding of liability in AI governance requires distinguishing between the different actors involved in the AI lifecycle, namely: - producers/manufacturers, who design and place AI systems on the market; - developers, who contribute to the training and technical configuration of the system; - deployers or users, who implement the AI in a specific operational context.

The allocation of liability among these actors should reflect their respective degree of control over the risk and their capacity to prevent harm. In line with the risk-based approach, responsibility tends to concentrate on those actors who are best positioned to manage systemic risks, particularly in high-risk AI applications such as surveillance systems.

Contractual liability arises from the breach of obligations agreed upon between parties. In the realm of AI, these obligations typically derive from contracts governing the development, deployment, and use of AI systems[45]. Such contracts may include specific terms regarding performance standards[46], data protection compliance[47], and the allocation of liability in the event of malfunction or misuse[48].

A key issue in AI governance is the enforceability of contractual clauses when harm results from autonomous decision-making[49]. Traditional contract law presumes human agency and intent, but AI systems operate through automated processes that may not be

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foreseeable by either party. This raises the question of whether liability should be allocated strictly based on the contractual relationship[50] or extended to third parties who may suffer harm from AI-related actions[51].

For example, in cases where AI surveillance systems misidentify individuals or generate biased outcomes[52], the injured party may seek redress under the contractual agreement between the AI provider and the public authority[53]. However, if the contract does not explicitly address liability for algorithmic errors, general principles of contract interpretation and implied terms may be invoked[54]. Civil codes in European jurisdictions, such as Article 1218 of the French Civil Code on non-performance, provide a basis for contractual liability when an autonomous system causes harm attributable to a breach of agreed obligations[55].

Furthermore, the concept of "force majeure" may complicate contractual liability in AI governance[56]. If an AI system's malfunction is deemed unforeseeable or beyond the control of the contracting parties, liability may be excluded. However, courts have increasingly scrutinized such exclusions, especially when the harm arises from negligent design, insufficient oversight, or the absence of adequate safety mechanisms.

Extra-contractual liability (also known as delictual or tort liability) addresses harm caused outside the scope of a contractual relationship[57]. This form of liability is particularly relevant in AI governance, where third parties—such as consumers or private individuals—may suffer harm from AI applications without being a party to the underlying contract.

In the context of AI surveillance, this includes privacy violations, reputational harm, and discriminatory practices resulting from biased algorithms. Extra-contractual liability applies not only to the direct user of the AI system but also to developers and manufacturers under the principle of "culpa in vigilando" which holds entities accountable for failing to prevent foreseeable harm[58].

As previously discussed, the opaque nature of AI complicates the identification of causal responsibility[59]. This problem raises questions about how liability should be apportioned among the various stakeholders involved in the design, deployment, and maintenance of AI systems.

Building on the rationale of strict liability explored above, some legal scholars extend this to encompass AI harms in general, irrespective of contractual or product-based frameworks[60]. Under a strict liability regime, the injured party is not required to prove fault but only to demonstrate that the AI system caused harm. This approach is consistent

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with existing legal frameworks for hazardous activities where the potential for significant harm justifies the imposition of heightened liability standards. For instance, the European Product Liability Directive already provides a model for holding producers strictly liable for defective products, which could be extended to AI systems[61].

In line with the previously discussed vicarious liability model, a broader interpretation may apply to public or private organisations that integrate AI into surveillance infrastructure[62]. In the AI context, vicarious liability could apply to organisations that deploy AI systems for surveillance, even if the harm results from autonomous decision-making.

National legal systems often impose vicarious liability on employers for wrongful acts committed by their employees in the course of employment[63]. By analogy, entities that use AI systems as functional equivalents of human agents may bear responsibility for the consequences of the AI's operation. This interpretation aligns with the notion that legal responsibility should track the economic benefits derived from the use of advanced technologies.

However, applying vicarious liability to AI raises doctrinal challenges. Unlike human agents, AI systems lack legal personhood and independent volition. To address this gap, some scholars propose recognising AI as a distinct legal entity with its own liability framework[64].

Others advocate for imposing joint and several liability on all entities involved in the AI supply chain[65], from developers to end-users. The fragmentation of legal responsibility in AI governance underscores the need for a unified liability framework.

4. Privacy protection and the limits of AI regulation

As artificial intelligence continues to penetrate various aspects of public and private life, it significantly challenges traditional paradigms of privacy protection[66]. The ability of AI systems to collect, analyse, and interpret vast amounts of personal data—often without the explicit knowledge or consent of the individuals concerned—raises profound questions about the adequacy of existing privacy laws[67]. In particular, the balance between protecting individuals' right to privacy and the necessity for AI-driven surveillance to enhance public security presents an ongoing legal conundrum.

At the European level, the General Data Protection Regulation (GDPR) represents the primary instrument designed to safeguard personal data and privacy in the context of

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digital technologies[68]. Under the GDPR, the processing of personal data is subject to strict limitations, ensuring that it is carried out in a manner that respects individuals' privacy rights[69]. Specifically, the principles of data minimisation, purpose limitation, and transparency are designed to ensure that personal data is processed in a way that is both necessary and proportionate to the intended purpose[70]. However, the GDPR's application in the context of AI-driven surveillance technologies presents several challenges.

4.1 Consent and Transparency in AI Surveillance

The 'black box' nature of AI systems complicates GDPR compliance, particularly the requirement for transparency, by preventing individuals from understanding how their data is processed. Moreover, the right to explanation, enshrined in Article 22 of the GDPR, provides individuals with the right not to be subject to automated decisions that produce legal effects or similarly significant effects, yet its practical application in the context of AI remains highly debated[71].

Furthermore, AI surveillance systems - such as facial recognition and behavioural analysis -present particular challenges with regard to consent and data subject rights. In many instances, individuals may be unaware that their data is being processed, let alone that it is being used to monitor their activities in real-time. This lack of informed consent is in direct conflict with the core principles of data protection law. While the GDPR attempts to address these issues, its application to AI is often ambiguous[72], especially when it comes to the deployment of AI surveillance technologies by public authorities.

4.2 The Regulatory Gap and the Role of the GDPR

The limits of AI regulation are further compounded by the speed at which AI technologies are evolving. Regulatory bodies struggle to keep pace with technological advancements, and existing laws—such as the GDPR—are frequently criticised for being too general or slow to adapt. While GDPR sets a strong foundation for data protection[73], it is clear that a more specialised, flexible regulatory framework may be necessary to address the unique risks posed by AI in the surveillance context.

In this light, privacy protection in the age of AI must be reimagined through a multifaceted approach. While existing data protection laws, such as the GDPR, offer vital safeguards, there is a growing need for supplementary measures that account for the dynamic nature of AI technologies. Specifically, regulators should consider introducing tailored standards for AI systems, focusing on algorithmic transparency, the prevention of bias, and the development of frameworks for ongoing oversight and accountability.

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The regulation of AI-driven surveillance raises crucial questions about the future of privacy protection. While the GDPR provides a valuable foundation, it must be complemented by more adaptive, targeted regulatory approaches that address the specific challenges presented by AI technologies[74]. Only through a more nuanced and proactive regulatory framework can the delicate balance between security and privacy be maintained in the face of rapid technological change.

5. Data ownership in the context of AI surveillance

The increasing deployment of artificial intelligence systems in surveillance activities has raised complex legal questions concerning data ownership within the framework of private law[75].

While data itself is not traditionally recognised as a tangible object susceptible to property rights in many legal systems, the commodification and pervasive collection of personal data have prompted a reevaluation of its legal status[76]. The core issue revolves around identifying who holds the right to control[77], use[78], and derive economic benefit from the data generated by or through AI surveillance mechanisms[79]. In the context of private law, these inquiries are closely linked to the principles of contractual autonomy, property law doctrines, and the evolving landscape of digital assets.

5.1 Ownership vs Control: A Conceptual Tension

From a contractual perspective, ownership claims over data are frequently governed by the terms established between parties involved in data collection, processing, and utilisation[80]. Contracts play a pivotal role in defining the scope of data access and delineating proprietary claims. However, standard contractual frameworks often exhibit significant power imbalances[81], especially when individuals are required to consent to extensive data collection practices without meaningful negotiation. This asymmetry raises concerns regarding the voluntariness and informed nature of such agreements, challenging the traditional foundations of consent under private law. Furthermore, the unilateral imposition of data ownership clauses may conflict with established legal doctrines on unfair contract terms, particularly where individuals are deprived of control over their personal information.

In jurisdictions with robust data protection regimes, such as those under the General Data Protection Regulation (GDPR), data subjects retain specific rights over their personal data [82]. While these rights do not equate to full ownership in the proprietary sense, they afford individuals a degree of control analogous to possessory entitlements in tangible property.

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5.2 Private Law and Data Subject Rights

The right to access, rectify, and erase data, for instance, reflects private law's enduring concern with protecting individual autonomy against the disproportionate exercise of control by data controllers. However, the intersection between data protection law and private law is not without tension. Private law principles traditionally focus on the allocation of ownership through contractual and property frameworks[83], whereas data protection laws emphasize the preservation of fundamental rights and personal autonomy [84].

Some scholars suggest viewing personal data as quasi-property, though privacy-based regulation remains dominant[85]. Moreover, AI surveillance often involves the collection of non-personal or anonymised data[86], further complicating ownership claims. In these instances, proprietary entitlements may be asserted by the entities that aggregate and process the data rather than the individuals from whom it originates. This dynamic challenges conventional notions of ownership and raises the possibility of recognising sui generis rights over data sets.

5.3 A Case for a Sui Generis Legal Category

Comparative legal approaches reveal a lack of uniformity in addressing these issues: while some legal systems lean towards recognising data as a proprietary asset subject to exclusive control[87], others emphasise a more relational model, focusing on the legal obligations arising from data processing rather than proprietary claims per se[88].

The proliferation of AI surveillance thus necessitates a re-examination of private law frameworks to determine whether they adequately capture the complex and multifaceted nature of data ownership[89]. Traditional property doctrines, which emphasise exclusivity and transferability, may prove ill-suited to address the relational and dynamic character of digital data[90]. Consequently, there is growing scholarly debate regarding the need to develop a distinct legal category for data ownership[91], one that balances proprietary interests with the protection of individual rights. Within this evolving landscape, private law remains a crucial arena for negotiating the competing claims of individuals, corporations, and public authorities in the age of AI-driven surveillance.

6. Liability in AI-driven consumer transactions: challenges and legal responses

The integration of AI systems into contractual relationships, ranging from automated

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decision-making processes to AI-driven product recommendations, has introduced complexities in determining responsibility for harm or breach of obligations.

Traditional liability frameworks, primarily rooted in contractual and tortious principles, face increasing strain in addressing the unique characteristics of AI-driven transactions.

In such contexts, issues arise concerning the identification of liable parties, the attribution of fault, and the assessment of damages. In consumer contracts involving AI, the primary challenge lies in defining the contractual obligations and determining whether the performance of an AI system constitutes a breach[92]. Under conventional contract law, liability is typically attributed to the contracting parties based on fault or strict liability doctrines[93].

However, the autonomous nature of AI systems disrupts the straightforward application of these principles, as decisions made by AI may not directly reflect the intent or actions of either party[94]. Consequently, questions emerge regarding whether liability should rest with the AI's developer, the service provider deploying the system, or the end-user.

The European legal framework, particularly through the lens of the Consumer Rights Directive and the proposed AI Liability Directive[95], attempts to address these ambiguities by extending liability to the parties that design, deploy, or control AI systems. Notably, under the Product Liability Directive, producers remain strictly liable for defects in AI-integrated products, thereby safeguarding consumer protection while allowing room for technological innovation[96]. Nevertheless, the classification of AI outputs as "defects" remains contentious, particularly when the AI operates in unpredictable or adaptive ways beyond the initial design parameters.

Moreover, the principle of foreseeability underpins much of contractual and tortious liability[97]. Yet, the self-learning capacity of advanced AI systems complicates the determination of foreseeable harm. Courts may struggle to evaluate whether AI-driven outcomes were reasonably predictable or within the scope of intended use.

In response, some legal scholars advocate for a risk-based approach, wherein liability attaches to those who are best positioned to prevent or mitigate harm, thus shifting the focus from traditional fault to a broader assessment of control and accountability[98]. This approach mirrors the broader evolution of European AI regulation, where risk classification plays a central role in determining the intensity of legal obligations. Transposed into private law, this logic supports a differentiated allocation of liability among producers, developers, and users, based on their respective capacity to control the risks inherent in AI systems.

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AI-driven consumer transactions also raise concerns regarding informational asymmetry and consumer autonomy[99]. Consumers often lack the technical expertise to fully understand how AI systems operate, increasing their vulnerability to non-trasparent decision-making processes.

This asymmetry challenges the principle of informed consent, a foundational concept in contract law. In light of this, regulatory initiatives advocate for heightened transparency obligations, requiring service providers to disclose the AI's role and its potential limitations[100].

In addressing these challenges, private law is evolving to incorporate new liability paradigms while preserving established doctrines of fairness and accountability.

Hybrid models of liability, which combine elements of strict liability with fault-based considerations, are gaining traction as a means of balancing technological innovation with consumer protection[101]. Additionally, contractual clauses explicitly addressing AI-related risks are becoming increasingly prevalent, offering parties a mechanism to allocate liability in advance. Overall, the regulation of liability in AI-driven consumer transactions reflects a dynamic interplay between legal tradition and technological innovation.

As AI continues to permeate commercial activities, legal frameworks must adapt to ensure equitable outcomes, protect consumer interests, and maintain the coherence of private law principles.

7. Tort liability and AI-driven decision-making

The increasing reliance on artificial intelligence in decision-making processes raises complex questions regarding tort liability, particularly when algorithmic determinations result in harm to individuals[102]. In private law systems, as mentioned above, tort liability is traditionally rooted in the principles of fault, causation, and damage. However, the autonomous and non accessible nature of AI systems challenges the application of these classic parameters.

One of the primary concerns is the attribution of fault in cases where AI-driven decisions cause harm. Given that AI systems operate with a degree of autonomy, it becomes difficult to establish a direct causal link between human intervention and the resulting damage[103].

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From a theoretical perspective, the debate revolves around whether the responsibility should rest with the developer, the deployer, or the user of the AI system. Jurisdictions rooted in civil law have adopted diverse approaches to these questions. In some systems, liability is tied to the concept of culpa in eligendo[104] or culpa in vigilando[105], which focuses on the duty of care in the selection and supervision of AI tools. In these cases, the entity responsible for deploying the AI may be held liable for the harm caused if it failed to exercise reasonable care in its oversight. Conversely, some legal frameworks advocate for strict liability, where the responsible party is held liable irrespective of fault due to the inherent risks associated with AI technologies. This approach mirrors traditional regimes governing inherently dangerous activities, recognizing that the complexity and unpredictability of AI systems make fault-based models insufficient to safeguard injured parties.

A critical issue in assigning tort liability for AI-driven decision-making is the challenge of establishing proximate causation[106]. AI systems, particularly those using machine learning, often function as "black boxes," rendering their decision-making processes inscrutable[107].

This opacity complicates the evidentiary burden placed on plaintiffs, who must demonstrate a causal link between the algorithm’s output and the harm suffered[108].

Some legal scholars advocate for a presumption of causation in favour of claimants, thereby shifting the burden of proof to the AI deployer to demonstrate the absence of a causal connection[109]. This shift aligns with broader doctrinal trends in product liability and medical malpractice, where evidentiary asymmetries justify procedural adjustments to protect injured parties. Moreover, the standard of care applicable to AI-driven decision-making is evolving. Courts may assess the reasonableness of the AI system's design, the adequacy of testing and monitoring protocols, and the foreseeability of the harm caused.

In this context, the emergence of "ex ante" regulatory standards plays a crucial role in defining the expectations of AI governance[110]. Compliance with these standards may serve as a defence against tort claims, while deviation could constitute prima facie evidence of negligence.

The intersection of AI and tort liability requires a recalibration of traditional doctrines to account for the distinctive characteristics of autonomous decision-making systems.

The legal responses vary across jurisdictions, reflecting divergent policy choices between

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protecting injured parties and fostering technological innovation. Nevertheless, a coherent framework must balance these interests while ensuring that victims of AI-driven harm retain effective avenues for redress.

The allocation of tort liability in AI-related harm must therefore be understood as part of a broader risk governance framework. Rather than focusing exclusively on fault, contemporary approaches increasingly emphasise risk control and risk distribution.

From this perspective, liability should not be assigned solely on the basis of causal attribution, but also considering which actor—among producer, developer, or deployer—was in the best position to anticipate, monitor, and mitigate the risks associated with the AI system. This functional approach to liability aligns with the logic of the risk-based regulatory model and promotes a more equitable distribution of losses.

8. Product liability in the age of AI systems

The advent of artificial intelligence in consumer and industrial applications necessitates a reassessment of conventional product liability frameworks[111]. In private law, product liability typically imposes responsibility on manufacturers[112], distributors[113], and sellers [114] for harm caused by defective products. However, the unique characteristics of AI systems—such as their capacity for autonomous decision-making and continuous learning—challenge the adequacy of existing legal doctrines grounded in static, human-designed products.

The legal question thus arises: to what extent can AI systems be treated as "products" within the meaning of product liability regimes, and how should liability be apportioned when harm results from their operation[115]?

In civil law jurisdictions, product liability is generally governed by statutory regimes that impose strict liability on manufacturers for defective products. This model, which obviates the need to prove negligence, is based on the principle that those who profit from placing products on the market should bear the risks associated with their defects[116].

However, AI systems complicate the traditional tripartite classification of defects[117] —design defects, manufacturing defects, and warning defects—due to their capacity for autonomous adaptation. For instance, an AI system may function as intended at the point of sale but evolve in a manner that subsequently causes harm. This raises the question of whether liability attaches to the original developer, the entity responsible for system updates, or the user overseeing the AI's deployment.

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One of the principal challenges lies in defining the point at which an AI system becomes "defective"[118]. Traditional product liability regimes focus on defects existing at the time the product enters the market[119]. However, in the case of machine-learning algorithms, harm may arise from post-market evolution, making it difficult to identify a singular moment of defectiveness[120]. Some legal scholars advocate for a dynamic interpretation of product defect, extending liability to encompass foreseeable harms resulting from the system's adaptive processes[121]. Others suggest the adoption of a sui generis liability regime tailored specifically to AI technologies[122], recognising their departure from traditional product paradigms.

Another contentious issue is the allocation of liability among the various actors involved in the AI lifecycle. In the context of AI-driven products, multiple parties contribute to the system's functionality, including developers, software engineers, data providers, and end-users[123].

This complex supply chain dilutes the attribution of responsibility, challenging the application of conventional product liability rules. Some legal systems respond by adopting joint and several liability, enabling injured parties to seek redress from any liable entity[124].

However, concerns arise regarding the fairness of imposing liability on downstream actors, such as distributors, who may lack the technical capacity to foresee or mitigate algorithmic risks. Furthermore, the evidentiary burden of proving defect and causation is heightened in the case of AI systems[125]. The opacity of algorithmic processes—the so-called "black box" problem—complicates a claimant's ability to demonstrate the causal nexus between the AI's functioning and the resultant harm. To address this, certain scholars propose reversing the burden of proof, requiring the AI producer to disprove defectiveness once a claimant establishes prima facie evidence of harm[126]. This evidentiary shift aligns with broader trends in consumer protection law, which prioritise access to remedies over rigid fault-based principles.

Product liability in the age of AI demands a recalibration of existing legal frameworks to accommodate the distinctive risks posed by autonomous and adaptive technologies. Whether through the reinterpretation of existing doctrines or the creation of bespoke liability regimes, legal systems must ensure that injured parties maintain access to effective redress while fostering an environment conducive to technological innovation. This balancing act is essential to uphold the foundational principles of private law while responding to the novel challenges posed by AI-driven products.

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9. Causal uncertainty and proof of damage in AI-driven systems

The integration of artificial intelligence into everyday processes has intensified the complexity of establishing causal links and proving damage under private law[127].

Traditional liability regimes are predicated upon the claimant's ability to demonstrate a clear causal connection between the wrongful conduct and the resulting harm[128]. However, AI systems—particularly those employing machine-learning models—operate through opaque and dynamic mechanisms that obfuscate causal relationships. This "black box" effect poses significant challenges to the evidentiary framework underpinning private law, especially in cases where the harm is the product of algorithmic decision-making.

In civil law systems, the principle of causation typically follows a bifurcated analysis[129], distinguishing between factual causation (causa efficiens)[130] and legal causation (causa juridica)[131]. Factual causation is assessed through the conditio sine qua non test[132], which asks whether the harm would have occurred "but for" the defendant's conduct. Legal causation, on the other hand, limits liability to consequences that are foreseeable and sufficiently proximate. Yet, in the context of AI, these well-established tests falter due to the system’s capacity for autonomous learning and unpredictable outcomes. For instance, an AI-powered medical diagnostic tool may evolve beyond its initial programming, producing erroneous outputs without any identifiable human error[133]. This raises the question of how to allocate liability when the causal chain is obscured by algorithmic complexity.

A core difficulty lies in proving the existence of a direct causal link when AI systems act as independent intermediaries between human input and tangible harm[134]. Traditional legal frameworks rely on human agency as the locus of responsibility[135]; yet AI disrupts this model by performing actions without direct human oversight. As a result, legal scholars have proposed various adaptations to the causation standard. One emerging approach is the adoption of a "probabilistic causation" model[136], whereby courts accept statistical evidence to infer causation where direct proof is unattainable. This approach, while facilitating claims involving complex technologies, raises concerns about eroding the presumption of innocence and diluting the burden of proof in civil litigation.

Another proposed solution involves reversing the burden of proof in cases where algorithmic opacity prevents the claimant from establishing causation. Under this model, once the claimant demonstrates prima facie evidence of harm, the burden shifts to the defendant—typically the AI producer or operator—to disprove a causal link[137]. Such an approach aligns with broader principles of consumer protection and recognises the

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informational asymmetry inherent in AI litigation.

Moreover, the concept of collective liability has emerged as a response to causal indeterminacy in AI-related harm. This model reflects a "risk-based" approach whereby liability is distributed across all entities involved in the AI's design, development, and deployment. Such a framework ensures compensation for injured parties without requiring precise identification of the causal agent. However, collective liability risks overburdening peripheral actors who may lack meaningful control over the AI's behaviour, raising concerns about fairness and the equitable distribution of legal responsibility.

The issue of damage quantification also becomes more intricate in the context of AI-driven harm[138]. In private law, compensation is generally tied to the principle of full reparation, which aims to restore the injured party to the position they would have occupied but for the wrongful act[139]. However, AI-generated harm may manifest in novel forms - such as algorithmic discrimination[140] or reputational damage[141] - that defy conventional categories of pecuniary and non-pecuniary loss.

The intersection of causal uncertainty and AI-driven harm necessitates a reconfiguration of the evidentiary and liability paradigms in private law. Whether through probabilistic models, burden-shifting doctrines, or collective liability frameworks, legal systems must adapt to ensure effective redress for claimants while preserving fundamental principles of fairness and legal certainty. As AI technology continues to evolve, so too must the legal mechanisms that govern its societal impact, striking a balance between fostering innovation and upholding the core tenets of private law.

Conclusion

The advent of artificial intelligence in public surveillance has posed unique and complex challenges to the traditional frameworks of civil law[142]. AI can improve public security but raises serious concerns over fundamental rights, especially privacy and freedom.

This tension between technological innovation and the safeguarding of individual freedoms is at the heart of the legal debate surrounding AI regulation[143].

From a civil law perspective, existing legal mechanisms, such as the General Data Protection Regulation (GDPR) and national civil codes, provide important protections for personal data and privacy. However, these legal instruments face significant challenges in adapting to the rapid evolution of AI technologies[144]. The opacity of AI algorithms, the

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risk of algorithmic bias, and the complexities of assigning responsibility for harm caused by automated decision-making highlight the inadequacies of current legal frameworks in fully addressing the risks posed by AI-driven surveillance[145].

In particular, the principle of transparency—central to both the GDPR and civil liability regimes—remains a critical issue in the regulation of AI surveillance systems. The "black box" problem, wherein the decision-making processes of AI systems are not fully understood by either the individuals affected or the entities deploying the technology, underscores the need for clearer regulatory standards. The current inability to guarantee algorithmic accountability[146], especially when it comes to discriminatory outcomes or violations of privacy, poses significant risks to the legal protection of individuals.

Furthermore, while contractual and extra-contractual liability frameworks provide some recourse for harm caused by AI systems[147], the complexity of attributing fault in the context of autonomous decision-making necessitates the development of a more tailored liability regime[148]. The application of strict liability, vicarious liability, and more transparent standards for determining responsibility in AI governance are essential to ensure that those who deploy AI systems are held accountable for the harm they cause.

Looking forward, it is evident that a comprehensive, multi-dimensional regulatory approach is required to address the challenges of AI surveillance[149]. While existing legal frameworks provide a foundation, they must be adapted and extended to meet the specific needs posed by AI technologies. Proposals for more robust regulation should focus on enhancing algorithmic transparency, ensuring stronger safeguards against discriminatory biases, and establishing clearer liability regimes for AI-related harm.

To this end, regulators must take proactive steps to develop new legal standards that are flexible and adaptable to the rapid pace of technological change. This includes exploring innovative regulatory tools, such as real-time oversight mechanisms, mandatory impact assessments, and the establishment of independent auditing bodies to ensure compliance with privacy protections and human rights standards[150]. Furthermore, the adoption of international standards for AI regulation is critical in ensuring that legal protections are consistent across jurisdictions and that global cooperation can address the cross-border challenges posed by AI technologies.

Balancing the advancement of AI technologies with the protection of fundamental rights requires a nuanced and proactive legal approach[151]. While AI surveillance has the potential to contribute significantly to public safety, it must not come at the expense of individual freedoms. The future of AI regulation must centre on ensuring that technology serves the public good while respecting the core principles of justice, fairness, and human

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dignity.

A coherent legal framework for AI requires the integration of the risk-based regulatory approach with civil liability rules, ensuring that the allocation of responsibility among producers, developers, and users reflects their respective roles in the generation and management of technological risk.

In this respect, the integration of a risk-based approach into civil liability frameworks appears essential. Such an approach allows for a more coherent allocation of responsibility among producers, developers, and users, reflecting their respective roles in the creation, deployment, and control of AI systems.

Ultimately, the integration of AI into critical decision-making processes demands not only sector-specific adaptations, but a coordinated legislative strategy that places legal clarity, human rights protection, and technological accountability at the heart of future regulatory frameworks.

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