

How Does the Growing Field of AI Technology Affect Ethics and Data Privacy?

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science
University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science, School of Engineering

Kiki Wong

Spring, 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Bryn E. Seabrook, Department of Engineering and Society

INTRODUCTION

Artificial Intelligence (AI) has ushered in transformative changes across various facets of our lives, exerting a profound influence on both individuals and businesses. The ability of AI to efficiently collect, process, and analyze vast amounts of data has revolutionized various industries, leading to enhanced technologies, streamlined business processes, and increased efficiency. In the realm of media, AI-powered technologies like natural language processing, image and audio recognition, and computer vision have reshaped how we interact with and consume information across different mediums, from text to video and 3D (Salokannel). As technological advancements continue to unfold, it brings to the forefront critical inquiries regarding privacy, security, and the ethical dimensions inherent in the application of AI.

One of the central ethical dilemmas surrounding AI pertains to data privacy. AI systems often rely on vast amounts of personal data to train their algorithms and make informed decisions. However, the indiscriminate collection and utilization of such data raise profound concerns about individuals' privacy rights and the potential for misuse or unauthorized access. Striking a balance between leveraging data for innovation while safeguarding individual privacy represents a complex ethical challenge that requires careful consideration and robust regulatory frameworks.

The inherent biases present in AI algorithms pose another significant ethical concern. AI systems learn from historical data, which may reflect societal biases and inequalities. Consequently, these biases can be perpetuated and even amplified by AI algorithms, leading to discriminatory outcomes in various domains, including employment, criminal justice, and healthcare. Addressing algorithmic bias requires proactive measures to diversify datasets,

incorporate fairness metrics into AI models, and ensure transparent and accountable decision-making processes to mitigate the impact of biases.

Central to this exploration is the research question: How do the advancements in AI impact individuals and corporations concerning data privacy and security surveillance? To address this query, the study adopts a Science and Technology Studies (STS) framework, with a particular emphasis on scrutinizing the Social Construction of Technology (SCOT). This approach is instrumental in unraveling the intricate dynamics that influence the discourse surrounding AI, privacy, and security.

BACKGROUND

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think and learn like humans. The goal of AI is to develop systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI encompasses a broad range of technologies and applications, ranging from simple rule-based systems to complex machine learning algorithms. AI enables the automation of repetitive and mundane tasks, freeing up human resources to focus on more complex and creative endeavors (Laskowski, 2023). This automation leads to increased efficiency and productivity in various fields, from customer service to manufacturing. Companies leverage AI for tasks ranging from customer service chatbots to data analysis for strategic decision-making. “The beauty of AI is that it analyzes vast quantities of data and spots patterns that might not be obvious to the human eye or brain” (Morel, 2023).

However, this integration has not been without consequences. Data privacy laws have evolved to address the challenges posed by the increasing collection and utilization of personal information. Data privacy laws are legal frameworks that govern the collection, use, processing, storage, and sharing of personal information of individuals. Data protection laws give individuals more control over how businesses collect and use their personal information and ensures that personal data is not misused without consent (Cussol, 2023). These laws aim to protect the privacy and confidentiality of individuals' data and ensure that organizations handling such data adhere to specific standards and principles.

Ethical considerations surrounding AI have become increasingly prominent as its integration into various sectors raises complex questions about fairness, accountability, and transparency. The reliance of AI systems on vast datasets for training and decision-making has sparked concerns about data privacy, especially regarding the collection, storage, and utilization of personal information (Alrefaei et al., 2022). Furthermore, AI algorithms can inadvertently perpetuate biases present in the data they are trained on, leading to discriminatory outcomes in domains such as employment, criminal justice, and finance (Kazim & Koshiyama, 2020). Addressing these ethical challenges requires careful attention to diversity in datasets, the incorporation of fairness metrics into AI models, and the establishment of transparent and accountable decision-making processes (Zhou et al., 2020). Transparency and accountability are fundamental principles that must be integrated into AI systems to mitigate biases and uphold ethical standards (Naik et al., 2022). As AI continues to advance, ongoing efforts to align its development and deployment with ethical considerations will be essential to ensure its responsible integration into society.

SOCIAL CONSTRUCTION OF TECHNOLOGY

Drawing upon the Social Construction of Technology (SCOT) framework, this research situates the study within the broader field of Science, Technology, and Society (STS). SCOT emphasizes the social factors influencing technological development, emphasizing the importance of interpretations, meanings, and controversies surrounding technology. Pinch and Bijker provide insights into how technologies become socially accepted and embedded in society such as how the stabilization of technology occurs when a dominant interpretation emerges, a result of negotiations among different groups. Social acceptance hinges on the framing of technologies, where different groups associate them with values and interests (Bijker, 2017).

Concurrently, the analysis incorporates elements of the privacy, security, and risk perspectives within STS, exploring how these concepts interact with AI advancements. The complexity of algorithms in AI systems poses a significant privacy challenge for both individuals and organizations as it gains the ability to make decisions by identifying subtle patterns in data that may be challenging for humans to detect (Van Rijmenam, 2023). Consequently, individuals might be unaware that their personal data is being utilized in decision-making processes that impact them directly. Understanding the social construction of AI and its implications on privacy and security is crucial in contributing to the discourse on how technology shapes societal norms (Mohamed et al., 2020).

RESEARCH QUESTION AND METHODS

Artificial Intelligence (AI) technology has led to significant advancements across various sectors, such as healthcare, education, and marketing. However, these advancements bring along ethical and legal implications that necessitate careful consideration. The impact of AI on ethics

and data privacy laws is a multifaceted issue that requires a comprehensive understanding of the implications involved. AI's ability to process vast amounts of data and derive insights poses significant challenges to traditional notions of privacy, raising concerns about the protection of personal information and the erosion of individual autonomy. Understanding the intricate interplay between AI and data privacy laws is essential for navigating the ethical complexities inherent in this rapidly evolving landscape. This research paper seeks to explore the multifaceted relationship between AI and data privacy, examining its impact on legal frameworks, ethical principles, and societal norms. Through an analysis of current practices, emerging trends, and potential solutions, this paper aims to elucidate the evolving dynamics of data privacy in the age of AI, drawing upon a diverse array of research cases, historiography, and scholarly papers to provide a comprehensive understanding of the subject matter.

RESULTS AND DISCUSSIONS

Artificial Intelligence (AI) technology has a significant impact on ethics and data privacy laws by introducing complex challenges that need to be addressed. AI's reliance on data for its algorithms makes it closely intertwined with data privacy concerns (Alrefaei et al., 2022). The ethical considerations surrounding AI technology involve ensuring the integrity of data, maintaining the safety and security of systems, and upholding confidentiality to avoid biases and ensure trust in algorithms (Köbis & Mehner, 2021). Furthermore, the ethical challenges in AI marketing specifically highlight data privacy as one of the most pressing concerns (Kumar, 2024).

Ethics in Artificial Intelligence

The rapid growth of the AI field significantly impacts ethics, particularly concerning the collection, storage, and usage of extensive data upon which AI systems heavily rely. The reliance of AI systems on vast datasets raises concerns about data privacy, emphasizing the need to safeguard individuals' privacy rights in the face of increasing data collection and processing activities (Murphy et al., 2021). This is particularly pertinent in sectors such as healthcare, marketing, and education, where AI technologies are increasingly utilized to derive insights and make informed decisions. Compliance with existing data protection laws and regulations is essential to ensure the privacy and security of individuals' information (Elendu, 2023). Regarding data privacy laws, current frameworks may not be fully equipped to handle the novel privacy threats posed by AI technologies. There is a growing recognition that existing data protection regimes may need updates to effectively address the privacy implications of AI applications (Stahl et al., 2022). As AI continues to advance and permeate various sectors of society, it becomes imperative to reassess and adapt regulatory frameworks to adequately safeguard individuals' privacy rights in the face of evolving technological capabilities and ethical considerations.

AI algorithms can unintentionally perpetuate biases present in the data they are trained on, potentially leading to discriminatory outcomes (Kazim & Koshiyama, 2020). AI algorithms learn from historical data, which may reflect existing societal biases and inequalities. Without careful attention and mitigation strategies, AI systems can perpetuate and even exacerbate biases in decision-making processes, leading to unfair outcomes in various domains, including employment, criminal justice, and finance. Addressing algorithmic bias requires a concerted effort to diversify datasets, incorporate fairness metrics into AI models, and implement transparent and accountable decision-making processes. Ensuring fairness and accountability in

AI decision-making processes is crucial to mitigate these biases and uphold ethical standards (Zhou et al., 2020). Transparency and accountability are fundamental principles that must be integrated into AI systems to address ethical considerations. The opacity of AI decision-making processes presents challenges in understanding how decisions are reached, which can impact trust in these systems (Sanderson et al., 2022). Establishing clear accountability mechanisms and ensuring transparency in AI algorithms are essential steps in addressing ethical concerns related to AI technology (Naik et al., 2022).

Artificial Intelligence in Autonomous Vehicles

Moreover, the increasing autonomy and decision-making capabilities of AI systems raise ethical questions about accountability and liability. As AI technologies become more sophisticated and autonomous, it becomes challenging to attribute responsibility when errors or adverse outcomes occur. The lack of clear accountability mechanisms poses challenges in determining who should be held liable for AI-related incidents, especially in contexts where human oversight is minimal or absent (Bryson, 2016). Establishing frameworks for AI accountability and liability is crucial to ensure transparency, fairness, and accountability in AI-driven decision-making processes. This becomes highly evident in the ethics landscape of AI in autonomous vehicles.

As the integration of Artificial Intelligence (AI) technology in autonomous vehicles continues to advance, one of the most pressing challenges is ensuring that these vehicles make ethically sound decisions in complex and dynamic environments. Despite significant progress in developing learning-based methods for decision-making in autonomous vehicles, AI systems still struggle to navigate ethical dilemmas effectively. These dilemmas often arise in situations where autonomous vehicles must make split-second decisions that involve trade-offs between different

ethical considerations, such as prioritizing the safety of passengers, pedestrians, and other road users (Brown, 2021). For instance, an autonomous vehicle may face the ethical dilemma of choosing between swerving to avoid colliding with pedestrians at the expense of endangering its occupants or maintaining its course and risking harm to pedestrians. The difficulty lies in programming AI systems to align their decision-making processes with ethical principles and societal values, which may vary across different cultural and legal contexts (Yuan et al., 2023). The lack of universally accepted ethical standards for autonomous vehicles exacerbates the challenge of ensuring that AI systems make ethically responsible decisions. As a result, researchers and policymakers must grapple with the complex task of developing robust ethical frameworks and regulatory guidelines to guide the behavior of autonomous vehicles and promote safety, accountability, and societal trust in AI-driven transportation systems.

Data Privacy

The growing field of Artificial Intelligence (AI) also significantly impacted privacy laws, necessitating adjustments and enhancements to existing regulatory frameworks to address emerging challenges. As AI technologies increasingly rely on vast amounts of data for training and operation, concerns about privacy infringement and data protection become more pronounced. The pervasive collection, analysis, and utilization of personal data by AI systems raise questions about individual privacy rights and the adequacy of current privacy laws to safeguard against potential abuses (van Rijmenam, 2023). The intricate nature of AI algorithms complicates traditional notions of data privacy, as AI systems can uncover insights and patterns from data that were previously unseen or unrecognized. This ability to extract nuanced information from large datasets raises concerns about the re-identification of individuals and the potential for unauthorized access or misuse of personal information. Additionally, the

deployment of AI in various sectors, such as healthcare, finance, and marketing, introduces new privacy risks associated with the sharing and processing of sensitive data.

The global nature of AI development and deployment necessitates harmonization and standardization of privacy laws across jurisdictions to ensure consistent protection of individuals' privacy rights. Variations in privacy regulations across regions can create compliance challenges for organizations operating in multiple jurisdictions and may lead to inconsistencies in privacy protection for individuals. To address these challenges, policymakers and regulators are increasingly focusing on updating and strengthening privacy laws to account for the unique risks posed by AI technologies (Mylrea, 2023). This includes enhancing transparency and accountability requirements for AI systems, implementing data minimization and purpose limitation principles to reduce unnecessary data collection and processing, and empowering individuals with greater control over their personal data through mechanisms such as data portability and consent management.

Ethical approaches play a pivotal role in enhancing AI systems by guiding their development, deployment, and usage in a manner consistent with ethical principles and conducive to positive societal outcomes. One fundamental aspect is ensuring fairness and mitigating bias within AI systems. Ethical AI frameworks emphasize the identification and reduction of biases in training data and algorithms to prevent discriminatory outcomes, employing techniques like algorithmic auditing and fairness-aware machine learning. Transparency and explainability are vital, with efforts focused on making AI decisions comprehensible to stakeholders and affected parties through interpretable machine learning methods and transparency frameworks. Human-centered design principles and user empowerment are integral, ensuring that AI systems are intuitive and accessible, with users

retaining transparency and control over their interactions. Societal impact assessments and ethical risk management play a crucial role in evaluating the broader implications and risks associated with AI deployment, enabling stakeholders to mitigate ethical risks and promote responsible AI development and use. Through the adoption of these ethical approaches, developers, organizations, policymakers, and other stakeholders can contribute to the ethical advancement of AI technology, fostering trust, fairness, and societal well-being.

The field of AI is undoubtedly advancing rapidly, but it is not without its limitations. One of the primary constraints is the relatively nascent stage of AI development, which means that many AI algorithms and systems have not undergone extensive experimentation or refinement. As a result, there may be inherent biases, inaccuracies, or limitations in AI technologies that have yet to be fully understood or addressed (Chowdhury, 2012). Looking ahead, future research in AI ethics will play a crucial role in further elucidating the complexities of ethical considerations in AI. Scientists and researchers will have the opportunity to conduct more comprehensive experiments, analyze real-world data, and develop sophisticated frameworks for assessing and mitigating ethical challenges in AI systems. By continuing to investigate and innovate in this field, we can better understand the implications of AI technologies and work towards the responsible and ethical deployment of AI in society.

CONCLUSION

The ethical considerations surrounding AI technology encompass a wide range of concerns, including data integrity, system safety and security, confidentiality, and privacy protection. Addressing these challenges requires a comprehensive approach that integrates ethical principles into all stages of AI development, from data collection and model training to

deployment and evaluation. The impact of AI on ethics and data privacy laws underscores the need for robust regulatory frameworks and ethical guidelines to safeguard individuals' privacy rights, mitigate algorithmic biases, and promote transparency and accountability in AI decision-making processes. While AI holds immense potential to drive innovation and improve societal well-being, it is essential to acknowledge its limitations and uncertainties, particularly in areas such as bias mitigation and ethical decision-making. Moving forward, continued research in AI ethics will be critical in advancing our understanding of the ethical complexities inherent in AI technologies and guiding the development of ethical AI systems that align with societal values and norms. By fostering interdisciplinary collaboration and engagement with stakeholders, we can collectively navigate the ethical challenges of AI and harness its benefits for the betterment of society.

Works Cited

- Alrefaei, A. F., Hawsawi, Y. M., Almaleki, D., Alafif, T., Alzahrani, F. A., & Bakhrebah, M. A. (2022). Genetic data sharing and artificial intelligence in the era of personalized medicine based on a cross-sectional analysis of the Saudi Human Genome Program. *Scientific Reports*, 12(1). <https://doi.org/10.1038/s41598-022-05296-7>
- Amedior, N. (2023). Ethical implications of artificial intelligence in the healthcare sector. *Advances in Multidisciplinary & Scientific Research Journal Publication*, 36, 1-12. <https://doi.org/10.22624/aims-/accrabespoke2023p1>
- Bijker, W. (2017). Constructing worlds: Reflections on science, technology and democracy (and a plea for bold modesty). *Engaging Science, Technology, and Society*, 3, 315. <https://doi.org/10.17351/ests2017.170>
- Brown, D. (2021). How should autonomous cars make life-or-death decisions? In the best of worlds, they won't. Retrieved from <https://www.washingtonpost.com/technology/2021/08/06/self-driving-ai-death-decisions/>
- Bryson, J. J. (2018). Patience is not a virtue: The design of Intelligent Systems and systems of Ethics. *Ethics and Information Technology*, 20(1), 15–26. doi:10.1007/s10676-018-9448-6
- Chowdhury, M., & Sadek, A. W. (2012). Advantages and limitations of artificial intelligence. *Artificial intelligence applications to critical transportation issues*, 6(3), 360-375.
- Cussol, E. (2024, January 11). 6 Reasons Why Data Privacy Is Important For Businesses. Termly. <https://termly.io/resources/articles/why-is-data-privacy-important/#:~:text=Most%20data%20protection%20laws%20give,to%20respond%20to%20customer%20requests>

- Elendu, C. (2023). Ethical implications of ai and robotics in healthcare: a review. *Medicine*, 102(50), e36671. <https://doi.org/10.1097/md.00000000000036671>
- Gupta, B. (2023, July 5). The Future of Smart Home Security. *Times of India Blog*.
<https://timesofindia.indiatimes.com/blogs/voices/the-future-of-smart-home-security/>
- Hughes, Thomas P. 1987. The evolution of large technological systems. In *The social construction of technological systems. New directions in the sociology and history of technology*, edited by W. E. Bijker, T. P. Hughes and T. Pinch. Cambridge, Massachusetts & London, England: MIT Press, 51-82
- Kazim, E. and Koshiyama, A. (2020). A high-level overview of ai ethics. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3609292>
- Köbis, L. and Mehner, C. (2021). Ethical questions raised by ai-supported mentoring in higher education. *Frontiers in Artificial Intelligence*, 4. <https://doi.org/10.3389/frai.2021.624050>
- Laskowski, N., & Tucci, L. (2023, November 13). What is artificial intelligence and how does ai work?: Definition from TechTarget. *Enterprise AI*.
<https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence>
- Morel, D. (2023, October 5). The Future of Work: How Will AI Change Business?. *Forbes*.
<https://www.forbes.com/sites/davidmorel/2023/08/31/the-future-of-work-how-will-ai-change-business/?sh=3abc5b2778e7>
- Mylrea, M., & Robinson, N. (2023). Artificial Intelligence (AI) Trust Framework and Maturity Model: Applying an Entropy Lens to Improve Security, Privacy, and Ethical AI. *Entropy*, 25(10), 1429. doi:10.3390/e25101429

- Naik, N., Hameed, B., Shetty, D., Swain, D., Shah, M., Paul, R., ... & Somani, B. (2022). Legal and ethical consideration in artificial intelligence in healthcare: who takes responsibility?. *Frontiers in Surgery*, 9. <https://doi.org/10.3389/fsurg.2022.862322>
- Salokannel, P., & User, S. H. (n.d.). *The Impact of AI: How Artificial Intelligence is Transforming Society*. 3DBear.
<https://www.3dbear.io/blog/the-impact-of-ai-how-artificial-intelligence-is-transforming-society#:~:text=AI%20has%20played%20a%20major,greater%20efficiency%20in%20many%20industries>.
- Sanderson, C., Lu, Q., Douglas, D., Xu, X., Zhu, L., & Whittle, J. (2022). Towards implementing responsible ai.. <https://doi.org/10.1109/bigdata55660.2022.10021121>
- Stahl, B., Schroeder, D., & Rodrigues, R. (2022). *Privacy.*, 25-37.
https://doi.org/10.1007/978-3-031-17040-9_3
- Van Rijmenam, M. (2023, December 10). *Privacy in the age of AI: Risks, challenges and solutions*. The Digital Speaker.
<https://www.thedigitalspeaker.com/privacy-age-ai-risks-challenges-solutions/>
- Yuan, K., Huang, Y., Yang, S., Zhou, Z., Wang, Y., Cao, D., & Chen, H. (2023). Evolutionary decision-making and planning for autonomous driving based on safe and rational exploration and Exploitation. *ScienceDirect*. doi:10.1016/j.eng.2023.03.018
- Zhou, J., Chen, F., Berry, A., Reed, M., Zhang, S., & Savage, S. (2020). A survey on ethical principles of ai and implementations.. <https://doi.org/10.1109/ssci47803.2020.9308437>