



(REVIEW ARTICLE)



## Towards a conceptual framework for ethical AI development in IT systems

Oluwaseun Augustine Lottu <sup>1,\*</sup>, Boma Sonimiteim Jacks <sup>2</sup>, Olakunle Abayomi Ajala <sup>3</sup> and Enyinaya Stefano Okafor <sup>4</sup>

<sup>1</sup> *Independent Researcher, UK.*

<sup>2</sup> *Independent Researcher, Nigeria.*

<sup>3</sup> *Indiana Wesleyan University, USA.*

<sup>4</sup> *Independent Researcher, Phoenix, Arizona, USA.*

World Journal of Advanced Research and Reviews, 2024, 21(03), 408–415

Publication history: Received on 25 January 2024; revised on 02 March 2024; accepted on 04 March 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.21.3.0735>

### Abstract

The rapid advancement of artificial intelligence (AI) technologies has prompted significant societal, ethical, and legal concerns regarding their deployment in information technology (IT) systems. Addressing these concerns necessitates the establishment of a robust ethical framework to guide AI development and integration into IT systems. This paper presents a comprehensive conceptual framework aimed at fostering ethical AI development within IT systems. The proposed framework incorporates multidisciplinary perspectives, drawing upon principles from ethics, computer science, law, and philosophy. It emphasizes the integration of ethical considerations at every stage of the AI development lifecycle, including design, implementation, deployment, and maintenance. Central to this framework is the recognition of AI systems as socio-technical artifacts with profound impacts on individuals, communities, and societies at large. Key components of the framework include transparency, accountability, fairness, privacy, and security. Transparency entails ensuring that AI algorithms and decision-making processes are comprehensible and explainable to stakeholders, thereby fostering trust and enabling scrutiny. Accountability mechanisms are essential for attributing responsibility for AI-driven outcomes and facilitating recourse in cases of harm or injustice. Moreover, the framework emphasizes the importance of fairness in AI systems, advocating for the mitigation of biases and discrimination across diverse demographic groups. Privacy protection measures are deemed crucial to safeguarding individuals' personal data from unauthorized access or misuse, while robust security protocols are essential for defending against malicious exploitation and adversarial attacks. By delineating ethical guidelines and best practices, this conceptual framework aims to empower developers, policymakers, and organizations to navigate the complex ethical landscape of AI development in IT systems. Ultimately, the adoption of such a framework is imperative for harnessing the transformative potential of AI technologies while upholding fundamental ethical principles and societal values.

**Keyword:** Ethical; AI; IT; System; Framework; Development; Review

### 1. Introduction

The exponential growth and rapid advancement of artificial intelligence (AI) technologies in recent years have revolutionized the landscape of information technology (IT) systems, offering unprecedented opportunities for innovation and optimization (Allioui and Mourdi, 2023). AI, encompassing machine learning algorithms and data analytics, has demonstrated remarkable capabilities in automating tasks, predicting outcomes, and personalizing experiences across various domains (Sarker, 2022). However, this proliferation of AI within IT systems has also raised profound societal, ethical, and legal concerns that demand urgent attention and mitigation strategies (Du and Xie, 2021). Firstly, the widespread deployment of AI in IT systems has engendered apprehension regarding its societal implications.

\* Corresponding author: Oluwaseun Augustine Lottu

From concerns about job displacement due to automation to fears of exacerbating existing inequalities through biased decision-making algorithms, the societal impact of AI adoption is multifaceted and far-reaching. Ethical considerations are paramount, as AI systems wield significant influence over individuals' lives, ranging from employment opportunities to access to essential services (Díaz-Rodríguez *et al.*, 2023). Secondly, the ethical dimensions of AI deployment in IT systems are increasingly under scrutiny. Instances of algorithmic bias, data privacy violations, and AI-driven discrimination have underscored the need for ethical guidelines and standards to govern AI development and usage (Patel, 2024). Without adequate safeguards, AI technologies risk perpetuating societal injustices and undermining trust in automated systems. Furthermore, the legal landscape surrounding AI deployment in IT systems is evolving rapidly, presenting complex challenges and ambiguities (Cheng *et al.*, 2021). Questions of liability, accountability, and regulatory oversight loom large as policymakers grapple with balancing innovation with the protection of individual rights and societal welfare. In light of these pressing concerns, there is an urgent need for the development of a robust ethical framework to guide AI development in IT systems (Mclarney *et al.*, 2021). Such a framework must encompass principles of transparency, fairness, accountability, privacy, and security to ensure that AI technologies are designed, deployed, and governed in a manner that upholds ethical standards and aligns with societal values (Mylrea and Robinson, 2023). This paper endeavors to contribute to this imperative by proposing a conceptual framework aimed at fostering ethical AI development within IT systems, thereby navigating the complex ethical landscape and ensuring the responsible and beneficial deployment of AI technologies for the betterment of society.

---

## 2. Overview of the Proposed Conceptual Framework

The proposed conceptual framework for ethical AI development in IT systems draws upon a range of multidisciplinary perspectives, synthesizing insights from ethics, computer science, law, philosophy, and other relevant fields (Benefo *et al.*, 2022). This multidisciplinary approach is essential for addressing the multifaceted challenges and considerations inherent in AI development and deployment. Ethical principles serve as the foundation of the framework, guiding the ethical design, implementation, and usage of AI technologies. Ethicists contribute expertise in moral philosophy, ethical theories, and ethical decision-making frameworks to ensure that AI systems align with fundamental ethical values such as fairness, justice, autonomy, and beneficence (Keles, 2023; Prem, 2023). Computer scientists play a crucial role in the technical aspects of AI development, including algorithm design, data processing, and system architecture. Their expertise is instrumental in implementing ethical principles into AI algorithms and ensuring the integrity, reliability, and performance of AI systems. Legal scholars provide insights into the regulatory landscape surrounding AI deployment, including laws, regulations, and legal precedents governing data privacy, intellectual property, liability, and accountability (Babikian, 2023). Their contributions help navigate the legal complexities and ensure compliance with applicable laws and regulations. Philosophers contribute critical perspectives on the ethical and conceptual foundations of AI, addressing questions about the nature of intelligence, consciousness, agency, and moral responsibility. Their insights help contextualize ethical dilemmas and guide ethical decision-making in AI development. Additional disciplines such as psychology, sociology, anthropology, and economics offer valuable perspectives on the societal, cultural, and economic implications of AI deployment (Joyce *et al.*, 2021). These insights inform considerations related to human behavior, social dynamics, cultural diversity, and economic equity, enriching the framework with a holistic understanding of AI's impact on society.

The integration of ethical considerations throughout the AI development lifecycle is paramount for ensuring the responsible and ethical deployment of AI technologies within IT systems (Konda, 2022). Ethical considerations must be addressed at every stage of the AI development process, from design and implementation to deployment and maintenance. Ethical considerations should be incorporated into the design of AI systems from the outset. This involves identifying potential ethical risks and biases, defining ethical design principles, and integrating mechanisms for transparency, fairness, accountability, privacy, and security into the AI system architecture. By embedding ethical principles into the design phase, developers can proactively mitigate ethical concerns and promote ethical behavior in AI systems (Burr and Leslie, 2023). During the implementation phase, developers translate ethical principles into actionable strategies and technical solutions. This includes adopting ethical coding practices, conducting ethical impact assessments, and incorporating ethical guidelines and standards into the development process. Developers must ensure that AI algorithms are designed and implemented in a manner that upholds ethical values and respects human rights (Fukuda-Parr and Gibbons, 2021). Ethical considerations remain relevant during the deployment of AI systems, as they interact with users and stakeholders in real-world contexts. Developers must monitor AI systems for ethical compliance, evaluate their impact on individuals and society, and address any ethical challenges or issues that arise during deployment (Amugongo *et al.*, 2024). This may involve implementing safeguards against misuse, providing mechanisms for user consent and control, and establishing protocols for handling ethical dilemmas and unforeseen consequences. Ethical considerations continue to be important throughout the lifecycle of AI systems, including during maintenance and updates (Marabelli *et al.*, 2021). Developers must regularly assess AI systems for ethical performance, address emerging ethical issues and concerns, and adapt their strategies and practices to evolving ethical norms and standards.

This requires a commitment to ongoing ethical reflection, dialogue, and improvement to ensure that AI technologies continue to serve the public good and uphold ethical values over time.

In summary, integrating ethical considerations throughout the AI development lifecycle is essential for promoting the responsible and ethical deployment of AI technologies within IT systems (McLennan *et al.*, 2022). By incorporating multidisciplinary perspectives and addressing ethical concerns at every stage of development, the proposed conceptual framework aims to guide developers, policymakers, and organizations in navigating the complex ethical landscape of AI development and ensuring that AI technologies contribute positively to society while upholding fundamental ethical principles and values.

## 2.1. Core Principles of the Framework

Transparency is a foundational principle of the ethical AI development framework, emphasizing the importance of making AI algorithms and decision-making processes comprehensible and explainable to stakeholders (Ehsan *et al.*, 2021). This involves providing insights into how AI systems operate, the data they use, and the reasoning behind their decisions. Transparency fosters trust among users and stakeholders by enabling them to understand and scrutinize AI systems, thereby promoting accountability and responsible usage.

AI developers must strive to make AI algorithms and decision-making processes transparent and understandable to non-experts (Felzmann *et al.*, 2020). This may involve using interpretable machine learning models, providing documentation on algorithmic behavior, and offering user-friendly interfaces that facilitate transparency. Transparency builds trust by allowing users and stakeholders to verify the accuracy, fairness, and ethical soundness of AI systems. By enabling scrutiny, transparency encourages accountability and helps identify and address potential biases, errors, or unintended consequences in AI-driven decision-making.

Accountability is essential for ensuring that individuals and organizations are held responsible for the outcomes of AI-driven decisions and actions (de Laat, 2021). It involves attributing accountability for both positive and negative consequences, facilitating recourse for individuals harmed by AI systems, and promoting a culture of responsibility and integrity in AI development and usage.

Developers, organizations, and individuals involved in AI development and deployment must be accountable for the ethical and societal impacts of AI systems. This requires clear lines of accountability and mechanisms for identifying and addressing ethical lapses, errors, or misconduct in AI-driven decision-making. Ethical AI development frameworks should include mechanisms for individuals to seek recourse and redress in cases where they have been harmed or unjustly treated by AI systems (Smuha, 2021). This may involve establishing grievance procedures, providing avenues for legal or regulatory oversight, and implementing remedies for addressing harm or discrimination caused by AI-driven decisions.

Fairness is a fundamental principle of the ethical AI development framework, emphasizing the importance of mitigating biases and discrimination in AI systems across diverse demographic groups (Varona and Suárez, 2022.). Fairness requires ensuring equitable treatment and outcomes for all individuals, regardless of race, gender, ethnicity, or other protected characteristics. AI developers must proactively identify and mitigate biases in AI algorithms and datasets that may lead to unfair or discriminatory outcomes. This involves implementing fairness-aware machine learning techniques, auditing AI systems for bias, and incorporating diversity and inclusion considerations into the design and training of AI models. Ethical AI development frameworks should prioritize fairness by promoting equitable access to AI technologies and ensuring that AI-driven decisions do not perpetuate or exacerbate existing inequalities (Nassar and Kamal, 2021). This requires ongoing monitoring and evaluation of AI systems for fairness and the implementation of corrective measures to address disparities or inequities in AI-driven outcomes.

Privacy is a critical consideration in AI development, emphasizing the need to safeguard individuals' personal data from unauthorized access or misuse. Privacy principles ensure compliance with data protection regulations and standards, protect individuals' rights to control their personal information, and build trust in AI systems (Timan and Mann, 2021.). AI developers must implement robust privacy protections to safeguard individuals' personal data throughout the AI lifecycle. This includes data anonymization, encryption, access controls, and data minimization techniques to reduce the risk of unauthorized access, data breaches, or privacy violations (Ezeigweneme *et al.*, 2024). Ethical AI development frameworks should adhere to relevant data protection regulations and standards, such as the General Data Protection Regulation (GDPR) in the European Union or the Health Insurance Portability and Accountability Act (HIPAA) in the United States (Oakley, 2023). Compliance ensures that AI systems respect individuals' privacy rights and legal obligations regarding the collection, use, and sharing of personal data.

Security is paramount in AI development, ensuring the integrity, confidentiality, and availability of AI systems and data. Security principles involve implementing robust protocols to defend against malicious exploitation and adversarial attacks, as well as ensuring the reliability and resilience of AI systems in the face of security threats (Chivukula *et al.*, 2023). AI developers must prioritize security by implementing robust protocols to protect AI systems and data from cyber threats, such as hacking, malware, and unauthorized access. This includes employing encryption, authentication, and access controls, as well as conducting regular security audits and vulnerability assessments to identify and mitigate security risks. Ethical AI development frameworks should prioritize the integrity and reliability of AI systems, ensuring that they operate as intended and produce accurate and trustworthy results (Uzougbo *et al.*, 2023). This requires implementing measures to detect and mitigate errors, biases, or adversarial attacks that may compromise the reliability or integrity of AI-driven decision-making.

In summary, the core principles of transparency, accountability, fairness, privacy, and security are essential for guiding ethical AI development in IT systems. By incorporating these principles into the design, implementation, deployment, and maintenance of AI systems, developers can ensure that AI technologies are developed and used in a manner that upholds ethical standards, respects individual rights, and promotes societal welfare (Njemanze *et al.*, 2008; Brey and Dainow, 2023).

## 2.2. Application of the Framework

During the design phase, ethical considerations are integrated into the architecture and specifications of AI systems to ensure that ethical principles are embedded from the outset (Burr and Leslie, 2023.). Ethical considerations, such as fairness, transparency, and privacy, are incorporated into the design of AI system architecture and specifications. This involves assessing potential ethical risks and impacts associated with the use of AI technologies and implementing design features to mitigate these risks. For example, designers may incorporate mechanisms for bias detection and mitigation, data anonymization, and user consent into the architecture to promote fairness and privacy. Design principles for ethical AI development are established to guide designers in making ethical decisions throughout the design process (Benke *et al.*, 2020). These principles may include requirements for transparency, accountability, fairness, privacy, and security. By establishing clear design principles, designers can ensure that ethical considerations are prioritized and integrated into the development of AI systems, leading to the creation of more responsible and ethical AI technologies.

During the implementation phase, developers adhere to ethical coding practices and standards while integrating mechanisms for transparency and accountability into AI deployment. Developers follow ethical coding practices and standards to ensure that AI systems are developed in accordance with ethical principles (Hagendorff, 2020). This involves adhering to coding standards that prioritize transparency, accountability, fairness, privacy, and security. Developers also conduct ethical reviews of code to identify and address any ethical concerns or issues that may arise during the development process.

Mechanisms for transparency and accountability are integrated into AI deployment to ensure that stakeholders can understand and scrutinize the behavior of AI systems (Felzmann *et al.*, 2020). This may involve implementing features such as explainability tools, audit trails, and user interfaces that provide insights into how AI systems make decisions. By integrating transparency and accountability mechanisms, developers empower users to hold AI systems accountable for their actions and promote trust in their use (Akagha and Epie, 2022).

During the deployment phase, AI systems are monitored for ethical compliance and performance, and ethical challenges and issues are addressed as they arise. AI systems are monitored for ethical compliance and performance to ensure that they operate in accordance with ethical principles (Eitel-Porter, 2021). This involves conducting regular audits and assessments of AI systems to identify any ethical concerns or issues. Monitoring also involves tracking performance metrics related to transparency, fairness, privacy, and security to ensure that AI systems meet ethical standards.

Ethical challenges and issues that arise during deployment are promptly addressed to mitigate potential harms and ensure that AI systems operate ethically. This may involve implementing corrective measures to address biases, improving transparency and accountability mechanisms, and updating privacy and security protocols (Akagha *et al.*, 2023). By addressing ethical challenges in real-time, developers demonstrate their commitment to responsible AI deployment and safeguard against potential ethical risks.

During the maintenance phase, AI systems are updated to reflect evolving ethical norms and standards, and continuous evaluation and improvement of ethical practices are conducted. AI systems are updated to reflect evolving ethical norms and standards to ensure that they remain aligned with ethical principles (Vakkuri *et al.*, 2021). This may involve

incorporating updates to privacy regulations, addressing emerging ethical concerns, and adapting to changes in societal expectations. By updating AI systems, developers demonstrate their commitment to ethical responsibility and ensure that AI technologies continue to meet ethical standards over time (Uzougbo *et al.*, 2023). Continuous evaluation and improvement of ethical practices are conducted to ensure that AI systems remain ethical and responsible throughout their lifecycle. This involves conducting regular assessments of AI systems' ethical performance, soliciting feedback from stakeholders, and implementing improvements based on lessons learned. By continuously evaluating and improving ethical practices, developers demonstrate their commitment to ethical responsibility and contribute to the ongoing advancement of ethical AI development practices (Babawurun *et al.*, 2023; Agbese *et al.*, 2023).

### 2.3. Future Outlook

The future of ethical AI development in IT systems holds both promise and challenges. As technology continues to advance rapidly, it is imperative to anticipate emerging trends and prepare for the evolving landscape of AI deployment (Adebukola *et al.*, 2022). Several key areas warrant attention in shaping the future of ethical AI development; Future advancements in AI technology will bring about new capabilities and applications, ranging from autonomous vehicles and virtual assistants to personalized medicine and predictive analytics. As AI systems become more sophisticated and pervasive, ethical considerations must evolve accordingly to address emerging ethical challenges and risks (Borenstein and Howard, 2021). The development of effective governance mechanisms and regulatory frameworks is essential for ensuring the responsible and ethical deployment of AI technologies. Policymakers and regulatory bodies must collaborate with industry stakeholders to establish clear guidelines and standards for ethical AI development, covering aspects such as transparency, accountability, fairness, privacy, and security (Chidolue and Iqbal, 2023; Fabian *et al.*, 2023). Education and awareness initiatives are crucial for fostering a culture of ethical responsibility among AI developers, policymakers, and the general public. Training programs, workshops, and educational resources can help raise awareness about ethical issues in AI development and equip stakeholders with the knowledge and skills needed to address them effectively (Enebe *et al.*, 2019). Continued research and innovation in the field of ethical AI development are essential for advancing the state-of-the-art and addressing complex ethical challenges. Interdisciplinary collaboration among researchers from diverse fields, including ethics, computer science, law, philosophy, and social sciences, can facilitate the development of innovative solutions to ethical dilemmas in AI deployment. Ethical AI development is a global endeavor that requires collaboration and cooperation across borders and sectors (Uchechukwu *et al.*, 2023). International collaboration platforms and initiatives can facilitate knowledge sharing, best practice exchange, and joint efforts to address common ethical challenges in AI deployment. By fostering global cooperation, stakeholders can work together to promote ethical AI development and mitigate potential risks and harms. Ensuring diversity and inclusion in AI development teams and decision-making processes is essential for promoting ethical AI development. By incorporating diverse perspectives and experiences, developers can better identify and address biases, mitigate risks, and ensure that AI technologies are designed and deployed in a manner that is equitable and inclusive. Enhancing accountability and transparency in AI development and deployment is critical for building trust and confidence in AI technologies. Developers should adopt practices that enable stakeholders to understand how AI systems work, assess their performance, and hold responsible parties accountable for their actions (Rakova *et al.*, 2021). Transparency measures such as explainability tools, audit trails, and impact assessments can help promote accountability and trustworthiness in AI deployment. Conducting comprehensive societal impact assessments of AI technologies is essential for understanding their broader implications on individuals, communities, and society at large. These assessments should consider the social, economic, cultural, and ethical dimensions of AI deployment, as well as potential risks and benefits. By proactively assessing societal impacts, stakeholders can identify and address ethical concerns and ensure that AI technologies contribute positively to societal well-being (Havrda and Rakova, 2020).

---

### 3. Recommendation and Conclusion

The adoption of a conceptual framework for ethical AI development is crucial for guiding the responsible and ethical deployment of AI technologies in IT systems. Such a framework provides developers, policymakers, and organizations with clear guidelines and principles for addressing ethical considerations throughout the AI development lifecycle. By prioritizing transparency, accountability, fairness, privacy, and security, the framework helps mitigate ethical risks and ensure that AI technologies align with societal values and norms.

For developers, the adoption of a conceptual framework for ethical AI development entails integrating ethical considerations into their design, implementation, deployment, and maintenance practices. This requires a commitment to ethical coding standards, transparency mechanisms, and accountability measures to ensure that AI systems operate in a manner that upholds ethical principles and respects individual rights. For policymakers, the adoption of a conceptual framework for ethical AI development involves establishing regulatory frameworks and governance

mechanisms to promote ethical AI deployment. Policymakers must collaborate with industry stakeholders to develop clear guidelines and standards for ethical AI development and ensure compliance with relevant laws and regulations.

For organizations, the adoption of a conceptual framework for ethical AI development requires a commitment to ethical responsibility and corporate citizenship. Organizations must prioritize ethical considerations in their AI strategies and decision-making processes, invest in ethical training and education for their employees, and actively engage with stakeholders to address ethical concerns and promote transparency and accountability in AI deployment.

Looking ahead, advancing ethical AI development in IT systems will require ongoing collaboration, innovation, and commitment from all stakeholders. Key challenges and opportunities include; Addressing emerging ethical challenges and risks associated with advancements in AI technology. Strengthening governance mechanisms and regulatory frameworks to ensure the responsible and ethical deployment of AI technologies. Promoting diversity and inclusion in AI development to mitigate biases and ensure equitable outcomes. Enhancing accountability, transparency, and societal impact assessment practices to build trust and confidence in AI technologies. Fostering global collaboration and knowledge sharing to address common ethical challenges and promote best practices in AI development.

In conclusion, the adoption of a conceptual framework for ethical AI development is essential for guiding the responsible and ethical deployment of AI technologies in IT systems. By prioritizing transparency, accountability, fairness, privacy, and security, stakeholders can ensure that AI technologies are developed and deployed in a manner that upholds ethical principles and contributes positively to societal well-being. Despite the challenges ahead, the future of ethical AI development holds great promise for advancing innovation, promoting social progress, and addressing complex ethical dilemmas in the digital age.

---

## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

---

## Reference

- [1] Adebukola, A. A., Navya, A. N., Jordan, F. J., Jenifer, N. J., & Begley, R. D. (2022). Cyber Security as a Threat to Health Care. *Journal of Technology and Systems*, 4(1), 32-64.
- [2] Agbese, M., Mohanani, R., Khan, A. and Abrahamsson, P., 2023, June. Implementing ai ethics: Making sense of the ethical requirements. In *Proceedings of the 27th International Conference on Evaluation and Assessment in Software Engineering* (pp. 62-71).
- [3] Akagha, O. and Epie, C., 2022. Responsible People Management and Fairness During COVID-19 (Law and Ethics–The Case of Pan-Atlantic University). In *Responsible Management of Shifts in Work Modes–Values for a Post Pandemic Future, Volume 1* (pp. 95-111). Emerald Publishing Limited.
- [4] Akagha, O.V., Coker, J.O., Uzougbo, N.S. and Bakare, S.S., 2023. Company Secretarial and Administrative Services In Modern Irish Corporations: A Review Of The Strategies And Best Practices Adopted In Company Secretarial And Administrative Services. *International Journal of Management & Entrepreneurship Research*, 5(10), pp.793-813.
- [5] Alliou, H. and Mourdi, Y., 2023. Unleashing the potential of AI: Investigating cutting-edge technologies that are transforming businesses. *International Journal of Computer Engineering and Data Science (IJCEDS)*, 3(2), pp.1-12.
- [6] Amugongo, L.M., Kriebitz, A., Boch, A. and Lütge, C., 2023. Operationalising AI ethics through the agile software development lifecycle: a case study of AI-enabled mobile health applications. *AI and Ethics*, pp.1-18.
- [7] Babawurun, T., Ewim, D.R.E., Scott, T.O. and Neye-Akogo, C., 2023. A Comprehensive Review of Wind Turbine Modeling for Addressing Energy Challenges in Nigeria and South Africa in the 4IR Context. *The Journal of Engineering and Exact Sciences*, 9(2), pp.15479-01e.
- [8] Babikian, J., 2023. Navigating Legal Frontiers: Exploring Emerging Issues in Cyber Law. *Revista Espanola de Documentacion Cientifica*, 17(2), pp.95-109.

- [9] Benefo, E.O., Tingler, A., White, M., Cover, J., Torres, L., Broussard, C., Shirmohammadi, A., Pradhan, A.K. and Patra, D., 2022. Ethical, legal, social, and economic (ELSE) implications of artificial intelligence at a global level: a scientometrics approach. *AI and Ethics*, 2(4), pp.667-682.
- [10] Benke, I., Feine, J., Venable, J.R. and Maedche, A., 2020. On implementing ethical principles in design science research. *AIS Transactions on Human-Computer Interaction*, 12(4), pp.206-227.
- [11] Borenstein, J. and Howard, A., 2021. Emerging challenges in AI and the need for AI ethics education. *AI and Ethics*, 1, pp.61-65.
- [12] Brey, P. and Dainow, B., 2023. Ethics by design for artificial intelligence. *AI and Ethics*, pp.1-13.
- [13] Burr, C. and Leslie, D., 2023. Ethical assurance: a practical approach to the responsible design, development, and deployment of data-driven technologies. *AI and Ethics*, 3(1), pp.73-98.
- [14] Cheng, J.Y., Abel, J.T., Balis, U.G., McClintock, D.S. and Pantanowitz, L., 2021. Challenges in the development, deployment, and regulation of artificial intelligence in anatomic pathology. *The American Journal of Pathology*, 191(10), pp.1684-1692.
- [15] Chidolue, O. and Iqbal, T., 2023, March. System Monitoring and Data logging using PLX-DAQ for Solar-Powered Oil Well Pumping. In *2023 IEEE 13th Annual Computing and Communication Workshop and Conference (CCWC)* (pp. 0690-0694). IEEE.
- [16] Chivukula, A.S., Yang, X., Liu, B., Liu, W. and Zhou, W., 2023. *Adversarial Machine Learning: Attack Surfaces, Defence Mechanisms, Learning Theories in Artificial Intelligence*. Springer Nature.
- [17] de Laat, P.B., 2021. Companies committed to responsible AI: From principles towards implementation and regulation?. *Philosophy & technology*, 34, pp.1135-1193.
- [18] Díaz-Rodríguez, N., Del Ser, J., Coeckelbergh, M., de Prado, M.L., Herrera-Viedma, E. and Herrera, F., 2023. Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. *Information Fusion*, p.101896.
- [19] Du, S. and Xie, C., 2021. Paradoxes of artificial intelligence in consumer markets: Ethical challenges and opportunities. *Journal of Business Research*, 129, pp.961-974.
- [20] Ehsan, U., Liao, Q.V., Muller, M., Riedl, M.O. and Weisz, J.D., 2021, May. Expanding explainability: Towards social transparency in ai systems. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (pp. 1-19).
- [21] Eitel-Porter, R., 2021. Beyond the promise: implementing ethical AI. *AI and Ethics*, 1, pp.73-80.
- [22] Enebe, G.C., Ukoba, K. and Jen, T.C., 2019. Numerical modeling of effect of annealing on nanostructured CuO/TiO<sub>2</sub> pn heterojunction solar cells using SCAPS.
- [23] Ezeigweneme, C.A., Umoh, A.A., Ilojiana, V.I. and Adegbite, A.O., 2024. Review Of Telecommunication Regulation And Policy: Comparative Analysis USA AND AFRICA. *Computer Science & IT Research Journal*, 5(1), pp.81-99.
- [24] Fabian, A.A., Uchechukwu, E.S., Okoye, C.C. and Okeke, N.M., (2023). Corporate Outsourcing and Organizational Performance in Nigerian Investment Banks. *Sch J Econ Bus Manag*, 2023Apr, 10(3), pp.46-57.
- [25] Felzmann, H., Fosch-Villaronga, E., Lutz, C. and Tamò-Larrieux, A., 2020. Towards transparency by design for artificial intelligence. *Science and Engineering Ethics*, 26(6), pp.3333-3361.
- [26] Felzmann, H., Fosch-Villaronga, E., Lutz, C. and Tamò-Larrieux, A., 2020. Towards transparency by design for artificial intelligence. *Science and Engineering Ethics*, 26(6), pp.3333-3361.
- [27] Fukuda-Parr, S. and Gibbons, E., 2021. Emerging consensus on ‘ethical AI’: Human rights critique of stakeholder guidelines. *Global Policy*, 12, pp.32-44.
- [28] Hagendorff, T., 2020. The ethics of AI ethics: An evaluation of guidelines. *Minds and machines*, 30(1), pp.99-120.
- [29] Havrda, M. and Rakova, B., 2020, October. Enhanced well-being assessment as basis for the practical implementation of ethical and rights-based normative principles for AI. In *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC)* (pp. 2754-2761). IEEE.
- [30] Joyce, K., Smith-Doerr, L., Alegria, S., Bell, S., Cruz, T., Hoffman, S.G., Noble, S.U. and Shestakofsky, B., 2021. Toward a sociology of artificial intelligence: A call for research on inequalities and structural change. *Socius*, 7, p.2378023121999581.

- [31] Keles, S., 2023. Navigating in the moral landscape: analysing bias and discrimination in AI through philosophical inquiry. *AI and Ethics*, pp.1-11.
- [32] Konda, S.R., 2022. Ethical Considerations in the Development and Deployment of AI-Driven Software Systems. *International Journal Of Computer Science And Technology*, 6(3), pp.86-101.
- [33] Marabelli, M., Newell, S. and Handunge, V., 2021. The lifecycle of algorithmic decision-making systems: Organizational choices and ethical challenges. *The Journal of Strategic Information Systems*, 30(3), p.101683.
- [34] Mclarney, E., Gawdiak, Y., Oza, N., Mattmann, C., Garcia, M., Maskey, M., Tashakkor, S., Meza, D., Sprague, J., Hestnes, P. and Wolfe, P., 2021. NASA framework for the ethical use of artificial intelligence (AI).
- [35] McLennan, S., Fiske, A., Tigard, D., Müller, R., Haddadin, S. and Buyx, A., 2022. Embedded ethics: a proposal for integrating ethics into the development of medical AI. *BMC Medical Ethics*, 23(1), p.6.
- [36] Metcalf, J., Moss, E., Watkins, E.A., Singh, R. and Elish, M.C., 2021, March. Algorithmic impact assessments and accountability: The co-construction of impacts. In *Proceedings of the 2021 ACM conference on fairness, accountability, and transparency* (pp. 735-746).
- [37] Mylrea, M. and 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), p.1429.
- [38] Nassar, A. and Kamal, M., 2021. Ethical dilemmas in AI-powered decision-making: a deep dive into big data-driven ethical considerations. *International Journal of Responsible Artificial Intelligence*, 11(8), pp.1-11.
- [39] Njemanze, P.C., Njemanze, J., Skelton, A., Akudo, A., Akagha, O., Chukwu, A.A., Peters, C. and Maduka, O., 2008. High-frequency ultrasound imaging of the duodenum and colon in patients with symptomatic giardiasis in comparison to amebiasis and healthy subjects. *Journal of Gastroenterology and Hepatology*, 23(7pt2), pp.e34-e42.
- [40] Oakley, A., 2023. HIPAA, HIPPA, or HIPPO: What Really Is the Health Insurance Portability and Accountability Act?. *Biotechnology Law Report*, 42(6), pp.306-318.
- [41] Patel, K., 2024. Ethical reflections on data-centric AI: balancing benefits and risks. *International Journal of Artificial Intelligence Research and Development*, 2(1), pp.1-17.
- [42] Prem, E., 2023. From ethical AI frameworks to tools: a review of approaches. *AI and Ethics*, pp.1-18.
- [43] Rakova, B., Yang, J., Cramer, H. and Chowdhury, R., 2021. Where responsible AI meets reality: Practitioner perspectives on enablers for shifting organizational practices. *Proceedings of the ACM on Human-Computer Interaction*, 5(CSCW1), pp.1-23.
- [44] Sarker, I.H., 2022. Ai-based modeling: Techniques, applications and research issues towards automation, intelligent and smart systems. *SN Computer Science*, 3(2), p.158.
- [45] Smuha, N.A., 2021. Beyond the individual: governing AI's societal harm. *Internet Policy Review*, 10(3).
- [46] Timan, T. and Mann, Z., 2021. Data protection in the era of artificial intelligence: trends, existing solutions and recommendations for privacy-preserving technologies. In *The Elements of Big Data Value: Foundations of the Research and Innovation Ecosystem* (pp. 153-175). Cham: Springer International Publishing.
- [47] Uchechukwu, E.S., Amechi, A.F., Okoye, C.C. and Okeke, N.M., 2023. Youth Unemployment and Security Challenges in Anambra State, Nigeria. *Sch J Arts Humanit Soc Sci*, 4, pp.81-91.
- [48] Uzougbo, N.S., Akagha, O.V., Coker, J.O., Bakare, S.S. and Ijiga, A.C., 2023. Effective strategies for resolving labour disputes in the corporate sector: Lessons from Nigeria and the United States.
- [49] Vakkuri, V., Kemell, K.K., Jantunen, M., Halme, E. and Abrahamsson, P., 2021. ECCOLA—A method for implementing ethically aligned AI systems. *Journal of Systems and Software*, 182, p.111067.
- [50] Varona, D. and Suárez, J.L., 2022. Discrimination, bias, fairness, and trustworthy AI. *Applied Sciences*, 12(12), p.5826.