

Exploring Distinct Ethical Challenges Deriving from AI-RPA Technical Characteristics

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Abstract

Addressing the existing gap in ethical research surrounding distinct technical characteristics of Robotic Process Automation enhanced with Artificial Intelligence (AI-RPA), this analysis examines the unique ethical dimensions by positioning AI-RPA as a distinct technological subdivision. From an analytical perspective, this study highlights key characteristics such as minimal reliance on programming, rapid development cycles, and restricted algorithmic control, which differentiate AI-RPA from traditional AI systems. These characteristics underscore the need for tailored ethical considerations, to identify ethical perils within AI-RPA's technological origins. By positioning AI-RPA as a distinct subdivision and examining its unique characteristics alongside their emerging ethical challenges, this paper enriches the evolving discourse on AI ethics, providing valuable insights for researchers, policymakers, and organizations implementing AI-RPA technologies.

Keywords

Robotic Process Automation, Artificial Intelligence, AI-RPA, Digital Ethics, Distinct Characteristics

1. Introduction

This Robotic Process Automation (RPA) is a technology that employs software bots to automate repetitive, rule-based tasks, to streamline business processes, and to boost efficiency across industries. RPA can be considered a subset of Artificial Intelligence (AI) by itself, as well as being empowered by AI, automating tasks traditionally performed by humans [1]. This method of automation follows a mimicking approach of manual human functionality, by automating these tasks through User Interface (UI) interactions. Unlike traditional software development, which involves building complex algorithmic logic and detailed workflows from scratch,

RPA uses pre-fabricated functions to replicate advanced algorithmic commands. This approach of minimized coding requirements, efficiently streamlines operations, and speeds up development time [1]. AI technology integrated into RPA (AI-RPA) underscores a critical role in enhancing RPA capabilities [2]; enabling it to handle more complex and more advanced business processes. Example processes of AI-RPA are: enterprise resource planning, customer service, document understanding and processing, and automated testing. This addition of AI technology achieves more sophisticated automation, making informed data-driven decisions that improve efficiency and decision-making capabilities [2]. The concept of strengthening RPA processes with AI technology is represented by various terminologies, including cognitive RPA, cognitive automation, AI-augmented RPA, AI-RPA, and intelligent automation. This paper tends to hold to the term AI-RPA.

While much research has been done on the overall potential of RPA, as well as to RPA's vast impact on various industries, the ethical implications distinctive for AI-RPA processes and its unique practice, remain underexplored. Alongside various other scholars, Beerbaum [3] and Marchiori [4] do focus on the ethical side of AI-RPA processes, however, they mainly highlight the familiar AI ethical concerns, like: transparency, accountability, and risks associated with irrational decision-making [4]. Ethical concerns unique to AI-RPA solutions require more extensive exploration in current academic research and discourse. It is largely concerned to see ethical analyses chasing the rapid expansion of RPA systems across many fields and industries, rather than to be ready for future developments. Khankhoje [5] reinforces the importance of further exploring ethical perils originating from AI-RPA solutions, due to the accumulation of AI-RPA specific characteristics bringing about more ethically charged issues, especially from its technical level [5]. This paper delves beyond the earlier mentioned familiar ethical concerns, and aims to explore uncharted ethical perils distinct and unique to AI-RPA processes.

To fulfill the outlined objective, firstly, a comprehensive literature review aims to contextualize this research within its broader narrative, providing a foundational understanding of the historical and theoretical developments shaping the current landscape. A thorough engagement with existing literature not only situates the study within established scholarly discussions but also enhances its relevance by linking its objectives to ongoing debates and unresolved questions in the field. Secondly, a comprehensive analysis from the perspective of AI-RPA as a distinct subdivided AI technology, will be conducted to analyze its operational mechanics, and to uncover potential ethical perils, inherent within its design and function. The third step involves synthesizing the findings to construct a compelling argument in line with the insights gathered from the in-depth examination of AI-RPA specific technological characteristics, aiming to articulate a well-rounded perspective on unique AI-RPA specific ethical risks. This study contributes to the ongoing discourse on AI and AI-RPA ethics, providing actionable insights for policymakers, AI strategies, and ethical frameworks, to ultimately promote responsible

and ethical use of AI technologies.

2. Ethical Foundations and Evolving Standards in AI

AI ethics traces back to Alan Turing's prediction and concerns that computers would one day imitate human behavior [6], and to John McCarthy's groundbreaking theory on the non-monotonic reasoning capabilities of machines [7]. Modern-day AI ethical research strongly follows the concepts of Latour [8] and Verbeek [9]. Latour [8] redefined how we perceive the social dynamics of technological systems, arguing that technology mediates relationships between actors—challenging the notion of technology as equally important within interactive relationships [8]. Verbeek [9] expanded on these ideas with the concept of “technological mediation”, offering a framework to analyze the roles technologies play in human existence and society [9]. As digital technology rapidly developed; scholars, companies, and organizations increasingly focus on the ethical implications of various impactful digital technological applications, such as Artificial Intelligence (AI). Despite common ground regarding the overall ethical risks posed by AI; scholars, governments, and tech companies still often advocate for distinctive approaches utilizing AI technologies. Firstly, from a scholarly point of view, Floridi *et al.* [10] express concerns about AI bias, privacy, autonomy, and accountability [10]. In line with this, Tsamados *et al.* [11] advocate for greater transparency in algorithms and emphasize the importance of ensuring its reversibility [11]. Second, commercial corporations under which: IBM, present semi-contradictory yet similar views on the ethical approach toward AI—striving to mitigate risks while fostering, or even pushing innovation and leveraging the beneficial potential of AI technology [12]. Principles, policies, guidelines, and frameworks for ethical AI have been published by numerous sources varying from private firms to universities and public organizations. Drawing from these sources, government institutions navigate a complex landscape of regulations, policies, and frameworks. This has led to foundational protocols and agreements such as the EU AI Pact, the EU Ethics Guidelines for Trustworthy AI, and the Fundamental Rights and Algorithm Impact Assessment. Despite various strong and successful initiatives, ongoing discussions persist about ethical standards and best practices required for responsibly implementing AI technology [13].

Ethical Regulatory Challenges in AI

The continuing rapid evolution of AI technologies and applications has shown significant advancements within many fields and industries, including developments such as facial recognition [14], healthcare diagnostics [15], and autonomous vehicles [16]. These technologies offer substantial potential for enhancing economic growth [17], societal progress, and overall human welfare [18]. Challenges like limited transparency in decision-making, data biases, data security concerns, privacy issues, and a range of other ethical dilemmas pose increasingly significant risks to society [19]. To address these growing concerns, AI systems

must prioritize transparency over their opaque nature [20]. This opaqueness, often referred to as the “black box” problem—a concept first coined by Cauer [21]; presents significant technical challenges in understanding and interpreting how AI systems make decisions. This lack of clarity can lead to e.g. unwanted biases embedded in AI outputs, reduced reliability due to undetected errors in the algorithms, and accountability gaps where responsibility for error is unclear [22]. Aligned with these plausible issues; as it becomes difficult to determine the reasoning behind specific outcomes generated by AI solutions—significant ethical challenges arise.

Understanding AI systems within their unique context, goals, and operational environment is essential for effectively interpreting and explaining AI models [23]. This approach helps clarify the often opaque, black-box nature of AI algorithms. Following this approach; Montgomery’s [24] “precision regulation”, referring to a more targeted and risk-based approach to creating and enforcing policies and guidelines for AI systems—emphasizes focus on specific use cases rather than imposing broad, generalized strategies, policies, and regulations on the technology as a whole [24]. Besides the often generalized approach in AI regulations, policies, and frameworks—the term “AI” itself is frequently ambiguous [25], often applied so broadly that it risks misinterpretation and overextension, being too readily assigned to any form of algorithmic intelligence across disciplines, which leads to confusion around its meaning and applications. Compounding this mistreatment of terminology, the rapid expansion of unique AI subsets, each with distinct functions and algorithmic solutions, presents challenges for effective policy making and ethical standards. In response to earlier comparable challenges in the Information and Communication Technologies (ICTs), Stahl *et al.* [26] emphasize the importance of addressing ethical issues in emerging ICTs based on their unique characteristics [26]—in the same manner, AI technological subdivisions like AI-RPA, should be regulated individually; targeting their specific technical and operational features distinctively within the broader AI landscape. This paper seeks to position AI-RPA as a distinct branch within the broader field of AI, highlighting its unique ethical challenges and implications.

3. AI-RPA’s Technical Characteristics

Building on Montgomery’s [24] concept of precision regulation, and Stahl *et al.* [26] stating the importance of uniquely addressing technologies—to highlight technical characteristics specific for AI-RPA is crucial to illuminate critical underlying ethical perils. Individual AI-based technologies demand customized regulatory frameworks to manage risks effectively—enabling responsible innovation and adaptation within the distinct technological landscape [27]. As a specific branch of AI technology; AI-RPA introduces new layers of ethical complexities—encountering numerous potentially novel ethical challenges that diverge from those typically associated with general AI [3].

Where AI methods tend to replicate human-like cognitive abilities—RPA

focuses on the automation of repetitive, rule-based digital tasks typically performed by humans [28]. At the intersection of human and digital interactions, RPA proves particularly valuable in automating routine administrative tasks across various industries, streamlining repetitive and time-intensive processes such as scheduling, and transaction processing, which often draw essential human resources away from high-value activities [29]. At a technical level, RPA excels in bridging legacy software with modern systems, facilitating seamless data transfers, and coordinating interactions between otherwise unconnected applications [30]. Especially when dealing with process fragmentation [31], RPA offers the capability to link essential business processes that may otherwise operate without a cohesive workflow.

AI-RPA systems appear in various uses integrating traditional RPA processes with the cognitive capabilities of AI—creating a powerful synergy that has led to numerous innovative applications. For example, a solution enhancing job vacancy management demonstrates how RPA and Intelligent Document Processing (IDP) effectively complement each other to streamline operations [32]. As a second example, integrating RPA with Application Programming Interfaces (APIs) highlights how RPA can dynamically connect to backend databases through external interfaces, using real-time API-driven data as input for subsequent RPA workflows. Thirdly, integrating Optical Character Recognition (OCR) within RPA processes enables full automation of tasks previously requiring human visual interpretation [33]. In this workflow, paper document information is extracted and directly entered into registration systems. Another example involves leveraging Regular Expressions (Regex) in RPA processes to efficiently extract specific data patterns from large volumes of text [34], such as identifying and isolating customer IDs from unstructured data in email messages. The fifth example demonstrates a powerful integration where RPA acts as the foundational layer. Natural Language Processing (NLP) on top of RPA technology, enables the interpretation and analysis of human language in financial communications, identifying linguistic cues that may indicate fraud. Enhanced by Machine Learning (ML), the system continuously improves as it learns from its historical data [35]. Traditional Process Mining through RPA, monitoring digital processes—requires users to manually group and label activities, and to select connectors. Large Language Models (LLMs) enhance this workflow by automating these tasks—efficiently grouping recorded activities, assigning meaningful labels, and recommending optimal connectors for seamless automation and process optimization [36].

This integration of advanced AI technology into RPA workflows can be achieved through several technical approaches. Many RPA platforms, such as Blue Prism [37], Automation Anywhere [38], and UiPath [39] offer built-in AI capabilities [3], often as simplified activities that encapsulate underlying AI models and code [40]. A basic integration approach involves simulating human action to initiate AI tools, using keystrokes and mouse clicks to interact with AI tools directly via their web interfaces. For example, using ChatGPT's browser based web portal [41]

by entering prompts and copy-pasting the output. More advanced options include direct API connections to ChatGPT's backend, allowing for prompt-driven responses without the need of a visual interface. Alternatively, RPA workflows can invoke external scripts, such as Python [42] or C# [43], to perform more complex AI-powered tasks seamlessly within the automation framework. Finally, the earlier mentioned integrated activities within RPA tools, allow for quick use of AI technology. While these methods of accessing and integrating AI technology into RPA workflows may appear similar, they are fundamentally different from stand-alone AI technologies, software, and tools. These differences are what makes AI-RPA solutions to introduce new, unique and potentially more ethically complex challenges [5]. Uncovering these distinct ethical challenges requires a deeper understanding of the specific characteristics that contribute to such potential risks. The following sections explore how each characteristic of AI-RPA is distinct from conventional AI, and potentially shapes ethical challenges unique to AI-RPA.

3.1. Mimic Human Interactions

RPA solutions efficiently interact with applications and systems similarly to how humans do, by mimicking human input like mouse clicks and the typing words. Different from manual processes, RPA workflows offer significant advantages by executing tasks 24/7, at low operational costs, [3] at higher speed, and with increased precision. This scraping method is built upon the system's UI, making RPA solutions highly adaptable and easy to deploy without significant technical infrastructure changes [44]. Given that RPA methods merely mimic human interactions, equating its technical and ethical positioning to that of a manual user is misleading and risky [45], this will overlook distinct safety protocols and ethical strategies that RPA technology should rightly undergo. Just as AI in its fullest terminology raises questions about whether it should be classified as a natural person, a legal entity, an object, or an entirely new category [3]—RPA behooves a similar examination. The critical question remains: despite its near-perfect replication of human behavior—should RPA be equated with manual processes, or rather be recognized as a distinct, artificial process with unique technical and ethical implications?

To contextualize these issues in real-world applications, RPA processes, by mimicking human interactions, may circumvent privacy and security assessments by being misclassified as analogous to human labor or a mere replacement for human effort rather than being recognized as a distinct technological system. For instance, RPA workflows may bypass critical security evaluations, such as logging in with standard user credentials without additional scrutiny, or processing sensitive personal data without triggering the same compliance protocols that would apply to automated systems. The fundamental and concerning question thus arises: if RPA systems are designed to emulate human behavior and perform tasks indistinguishably from human operators, should they not be subjected to distinct ethical and technical considerations that reflect their unique capabilities and

limitations?

3.2. Minimal Reliance on Advanced Programming

Penn's [46] concept of "Algorithmic Silence", the deliberate omission of highly abstract algorithmic techniques, highlights, or perhaps more accurately, exposes how automated tasks become increasingly relying on digital systems. This especially counts for AI-RPA technologies, where RPA professionals lack the technical algorithmic expertise to deeply navigate such systems—paradoxically leading to a deeper dependency on its technology, restricting users' autonomy over their systems. RPA technology, tools, and software, follow visual programming principles and a model-driven development design structure [47], showing minimal reliance on advanced programming [48]. Rather than relying on IT specialists; consultants and business professionals with only limited programming experience, can fully implement and design RPA solutions [13] [49]. The software being used has been simplified to the point where its modeling tools allow everyday business users to build, design, and deploy simple workflows and desktop automation [3]. AI-powered techniques, like "Text to Workflow" technology and "the recording option" [40], enables users of all skill levels to create fully functional workflows, significantly simplifying RPA deployment. Consequently, this ease of use can inadvertently amplify ethically sensitive issues by limiting control through visual programming functionalities, rather than to use highly customizable scripts. Because of this, technical oversight diminishes due to reduced understanding of algorithmic risks from lower skilled programming professionals [5].

In practice, RPA software leverages a low-code programming style, converting complex underlying code into simplified visual activities that only require basic input parameters. This approach effectively obscures the intricate processes behind these visual representations, rendering even the simplest functions into black-box operations for users. As functions grow in complexity, users increasingly depend on predefined activities without a clear understanding of the underlying algorithms driving their operation.

3.3. Short Development Cycles and Competitive Playgrounds

IT plays a crucial role in helping organizations enhance operational efficiency through the redesign and management of business processes [50]. The need to remain competitive in fast-evolving markets often drives companies to adopt IT solutions that offer transformative benefits [51]. RPA's swift implementation capabilities offer substantial potential to strengthen a company's competitive edge in the market. However, in such highly competitive playgrounds, prioritizing outpacing rivals through rapidly deployed RPA solutions; sidelines ethical considerations. These RPA solutions, along with AI-RPA processes, are designed for swift deployment and typically expect a short development period [52]. This design for rapid development and quick deployment cycles [13], reduces the emphasis on comprehensive ethical considerations, rigorous testing, and high algorithmic

quality standards.

3.4. From Temporary to Long-Term Solutions

Although RPA processes are frequently introduced as temporary solutions, their well demonstrated successes [53] often lead to long-term adoption. This unprepared shift towards long-standing employment on unanticipated IT architecture could lead to an overloaded, uncontrollable complexity of organizations' IT environments [54]. If left unchecked, this homegrown technical debt can hinder an organization's level of agility [54], and its ability to remain transparent and explainable, ultimately creating vulnerabilities of obscured potential ethical risks. Manual processes, carried out by human intelligence, although not guaranteed... maintain a certain awareness of potential ethical risks. In contrast; AI-RPA processes lack the self-awareness [55] necessary to recognize or signal ethical concerns. When long-standing automated processes cause erosion of professional knowledge about its untouched process [56], or when multiple iterations distance from the original format—cautious towards plain ethical perils disappear.

Contrary to the ideal theoretical scenario where RPA serves as a temporary bridge until software applications fully assume its functionalities, it is not uncommon for successful RPA implementations to remain in production far longer than initially intended. In practice, RPA occupies a middle ground between manual human labor and fully integrated software solutions. However, unlike fully developed software applications, RPA often bypasses the rigorous ethical, privacy, and security assessments typically applied to its more comprehensive counterparts. This further reinforces the tendency to rely on RPA solutions for extended periods rather than integrating their functionalities into a broader, more robust software architecture.

3.5. Limited Algorithmic Control

Although AI remains subject to the well-known obscure “black box” problem [21], stand-alone AI systems do offer decent, if not, great control over the configurations of a model, its customization possibilities, and its specific application of the model. However, when AI solutions are integrated within RPA software and tools, they often limit configuration options compared to the extensive customization possible in standalone models, here, access to the underlying code allows for greater flexibility [57]. This lack of extensive customizability, and its limited algorithmic control, inherently reduces the capacity to restrain ethical perils. Unlike traditional software development, AI-RPA technological solutions typically offer limited flexibility in adjusting algorithmic parameters, which can impede users' ability to tailor solutions to meet nuanced ethical requirements. This aligns with an over-reliance on default settings and standardized workflows, which may not fully account for the unique ethical demands of specific use cases.

4. Conclusion

By examining AI-RPA as a distinct technological subdivision, this research

highlights the critical ethical implications of its defining characteristics, under which, have minimal reliance on advanced programming, rapid development cycles, and restricted algorithmic control. Such features offer significant operational advantages, however, simultaneously introduce vulnerabilities like diminished technical oversight, constrained customization and adeptability, and decreased cautiousness towards plain ethical perils. To address such ethical challenges, it is critical to distinguish AI-RPA as a subdivision within the broader field of AI, focusing on AI-RPA's unique technological characteristics introducing specific ethical risks. Rather than adopting a generalized approach to address ethical challenges inherent to AI as an umbrella term, a subdivided approach allows for a sharper focus on ethical risks that might otherwise go unnoticed.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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