

Artificial Intelligence as Author of Scientific Publications

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Ascribing authorship of scientific publications to artificial intelligence is a complex and controversial issue. However, it is a challenging and uncertain problem that, given the growing development of artificial intelligence-based technologies that go beyond the performance of purely technical tasks and even contribute to the development of aspects such as the incorporation of scientific research information published in languages other than English, also contributing to potential insights in research, is becoming unavoidable when considering scientific publishing. This paper aims to add to this discussion by arguing that, although this is a challenging and even controversial position, it is inevitable and even ethically desirable to accept artificial intelligence, if it subsidizes sufficiently, as a (co-)author of any scientific publication. It is a matter of starting to think about how this attribution can be controlled and achieved with increasing respect for the ethics of scientific publication.

Keywords: Artificial Intelligence; Authorship; Chatbot; Copyright; Publication Ethics; Research Ethics; Scientific Publication; Transparency

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Introduction

SCIENTIFIC publication is crucial in several dimensions: for the development of science itself, but also for the status of the scientist, the teaching and/or research institutions, not to mention the journals themselves and their publishers (1-3). Underlying scientific publication is a constant

drive to improve the rigor and quality of what is published (4). This is happening in a context of uncertainty, but one in which artificial intelligence is already an increasingly present reality and is rapidly improving, given the growing development of artificial intelligence (AI) based technologies that go beyond the execution of mere technical tasks commanded by humans (5-8).

This raises the question of the (im)possibility of AI being the authorship of scientific publications. Attributing authorship of scientific publications to AI is a complex and controversial issue that is increasingly debated (7, 9-11). This is a challenging and uncertain problem, but one that needs to be addressed, inasmuch that it is increasingly unavoidable when considering scientific publication. We seek to contribute to this discussion while respecting the ethics of scientific publication.

Artificial Intelligence Authorship

Artificial Intelligence and Chatbots

The presence of AI in the most varied dimensions of human existence is increasingly visible. AI has no self-awareness and is based on algorithms that are never fully neutral (12). It is shaped by contextual influences that transcend technical aspects and result in profound implications beyond the virtual world (13, 14) and can ultimately materialize into a conversational interface (13), such as an AI Chatbot (like Bard or ChatGPT), as an “[...] advanced research assistant in that it provides its own answers to users’ questions based on the related literature that it has learned” (15). For example, within the scope of the problem focused in this paper, we asked Bard: “Can artificial intelligence be considered an author of scientific papers?” The response of the AI tool is as follows:

Currently, AI cannot be considered an author of scientific papers. This is because AI does not meet the criteria for authorship established by most academic publishers. These criteria typically require that authors have made a significant contribution to the conception and design of the study, the acquisition, analysis, or interpretation of data, and the drafting or revising of the manuscript. AI does not have the ability to do any of these things on its own. Instead, AI is a tool that can be used by humans to help with these tasks.

However, there is some debate about whether AI should ever be considered an author of scientific papers. Some people argue that AI is becoming increasingly sophisticated and that it may eventually be able to meet the criteria for authorship. Others argue that AI is simply a tool and that it should not be given the same credit as humans for their work.

Ultimately, the question of whether AI can be considered an author of scientific papers is a complex one that will likely need to be decided on a case-by-case basis. For now, AI cannot be considered an author in the same way that humans can (16).

Given that any scientific publication must express problematization, conceptualization, and argumentation (17), to what extent is the use of IA in scientific publications not worthy of recognition as authorship?

Scientific publications authorship

Regarding the relationship between IA and authorship in scientific publications, COPE (Committee on Publication Ethics), an

important organization that provides guidance on issues related to integrity in scientific publishing, presents the following position statement:

[...] AI tools cannot be listed as an author of a paper.

AI tools cannot meet the requirements for authorship as they cannot take responsibility for the submitted work. As non-legal entities, they cannot assert the presence or absence of conflicts of interest nor manage copyright and license agreements.

Authors who use AI tools in the writing of a manuscript, production of images or graphical elements of the paper, or in the collection and analysis of data, must be transparent in disclosing in the Materials and Methods (or similar section) of the paper how the AI tool was used, and which tool was used [...] (18).

Polonsky and Rotman problematize the roles of AI for different levels of contribution by relating the role of AI to the respective expectations in a very pertinent way (7) (**Table 1**).

In this respect, too, radicalism may not be a good advisor, either for the future or for the present. In the words of Hosseini et al. (10),

There are three reasons for opposing journal policies that ban the use of LLMs [large language models] in writing or editing scholarly manuscripts. First, bans are unenforceable. Even if prominent research institutions and journals were to adopt such measures, these efforts would likely be in vain, since detecting text that has been generated with LLMs is extremely difficult, partly because LLM-generated text can be altered by human beings to mask it. [...] Second, bans may encourage undisclosed use of LLMs, which would undermine transparency and integrity in research and discourage training and education in responsible use of LLMs. Third, LLMs can play an important role in helping researchers who are not highly proficient in English (the lingua franca for most top journals) to write and edit their papers or review others’ manuscripts (p. 3).

Table 2 depicts the different options in academic publishing and their rationale and problems.

Some potential uses of IA in scientific publications include the following:

- Contributes to the legitimacy and quality of scientific publications by selecting peer reviewers (11) and even conducting reviews (19);
- Contributes to the quality of scientific writing (20);
- Identifies gaps in current knowledge (20);
- Combats plagiarism (1, 11) and verifies the authenticity of images (11);
- Promotes interdisciplinarity as a mutual contribution of different scientific fields (20);
- Increases international collaboration (1, 20);
- Makes science more inclusive by reducing the monopoly of

Table 1. AI Roles for Different Levels of Contribution.

AI's Role	Expectations
Co-Author	Substantial writing (or significantly informed by AI and edited by co-authors); synthesis and analysis of information which provide novel insights.
Acknowledgement	AI is utilized for editing, improving clarity of the writing, or identifying errors.
Quoted	Directly quoted (including the date and specific input/question asked included in a footnote).
Cited	Statement in methodology that the tool was used to analyze data or develop a specified model.
<i>Source: Polonsky and Rotman (7)</i>	

Table 2. Evaluation of Different Policy Options Concerning the Use AI in Writing or Editing Scholarly Publications.

Policy Option	Rationale	Problems
Ban the use of AI in generating texts for scholarly manuscripts	- Avoids difficult issues related to fair allocation of authorship credit, accountability, and transparency	- Not enforceable - Leads to clandestine use of AI - Discourages equity in science and prevents helping researchers who are not adept at writing in languages other than their first language
Allow AI to be listed as authors	- Avoids giving human authors undue credit for work done by AI - Promotes transparency	- AI cannot be morally or legally responsible or accountable
Allow AI to be listed in the acknowledgements section	- Promotes transparency	- AI cannot be morally or legally responsible or accountable
Disclose use of AI in the body of the texts and among references	- Promotes transparency - Consistent with disclosing	- Consistency of disclosure
<i>Source: Hosseini et al. (10).</i>		

- English as the lingua franca of science (10, 20);
- Reduces the loss of potentially relevant scientific information (1, 12, 20);
- Contributes to open data in the context of open science (1, 12, 20).

However, there are also several challenges to ascribing AI a central role in scientific publishing, namely:

- Situations where human experience is critical, such as the internship report (22);
- The limited ability to mobilize reasoned personal argumentation with reflexivity and capacity (2, 12);
- Plagiarism, invention of unscientifically validated arguments, and misattribution of sources (13, 15);
- Respect for the ethics of the research product (12);
- AI and its tools, such as chatbots, have no free will or conscience and are not morally, socially, or legally responsible for the content of articles (7, 10, 15, 20);
- In general, AI tools, such as chatbots, are not legally subject to copyright (8, 15).

In summary, it is not an easy decision whether to ascribe

AI the possibility of authorship. However, we live in a time when AI is developing “[...] autonomous A.I. systems self-learn and can produce creative and intelligent output without human intervention” (8), which may help to shape new ways of looking at scientific authorship in AI. As Polonsky and Rotman aptly point out (7),

[...] if one utilises AI to generate novel insights, subsequently refining, sharpening, and integrating those insights within their academic paper; and if the final conclusions are an amalgamation of all co-authors (including the AI), then one cannot directly state which ideas or paragraphs were developed by the AI. However, one should also not omit its significant contribution either. It is unclear whether an acknowledgement would suffice, given that if this ‘value adding’ activity was undertaken by a human, co-author status would likely be attributed (p. 94).

Limitations of AI in Authorship

AI faces several challenges in authorship (1, 5, 7-15, 20). While

AI systems may excel at language generation, one of their key limitations is understanding context. Human writers have a deep understanding of the world, emotions, and cultural nuances that significantly impact the quality and depth of their writing. While current AI systems are adept at recognizing patterns, they struggle to interpret contextual cues and produce content that resonates on an intellectual and emotional level. Despite these limitations, AI can serve as a complementary writer. By providing data-driven insights, organizing information, and even generating preliminary drafts, AI systems can assist human writers in the writing process. AI can provide significant support by automating time-consuming tasks, freeing human authors to focus on creativity, analysis, and critical thinking. The prospect of AI authorship raises ethical concerns. Attribution of authorship carries significant weight, and readers have an expectation of authenticity that may be undermined by AI-generated content. Transparency in acknowledging AI contributions is critical to maintaining trust with readers, avoiding plagiarism, and preserving the integrity of academic and journalistic writing.

Another challenge is the potential for bias in AI systems. AI models learn from human-generated data, making them vulnerable to replicating existing biases embedded in such data. This raises an important question: Can AI truly be unbiased if it is fed biased information? Addressing this concern requires careful consideration and rigorous efforts to mitigate bias in AI-generated content.

The attainment and mastery of domain-specific knowledge is essential for authors. While AI can efficiently analyze, process, and summarize large amounts of information, it currently lacks the ability to possess true domain expertise. Subject matter experts are still essential for providing nuanced

insights and authoritative knowledge. Despite its current limitations, continued advances in AI will undoubtedly enhance its capabilities as a complement to authors. The synergistic integration of AI and human authors holds great potential, with AI providing efficient research, basic drafting, and content suggestions, while human authors contribute with creativity, critical thinking, and the ability to connect emotionally with readers.

Conclusion

As discussed above, the growing development of AI-based technology can, among other benefits, accelerate and enrich scientific knowledge in aspects such as the incorporation of scientific research information published in languages other than English, the promotion of interdisciplinarity, and the collaboration in the emergence of potential insights in scientific research.

The possibility of attributing AI authorship of scientific publications is a complex and controversial issue that needs to be discussed and addressed. This paper has attempted to contribute to this discussion by arguing that, although this is a challenging and even controversial position, it is inevitable and even ethically desirable to accept AI as (co-)author of a given scientific publication if it complies. "From the perspective of research ethics, if an AI chatbot makes a significant contribution to research and can explain and prove the research results, it would be reasonable to recognize its authorship" (15). In this context, aspects such as critical thinking, academic freedom, and digital literacy on the part of the (human) researcher are essential to always be present and guide this process (23). We need to start thinking about how this attribution of authorship can be done, while respecting the ethics of scientific publication. ■

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