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CHALLENGES OF USING ARTIFICIAL INTELLIGENCE TOOLS IN SCIENTIFIC WRITING

Ali Bouter*^{*}

Abstract. This research aims to discuss the challenges posed by the use of generative artificial intelligence tools in scientific writing, with particular emphasis on technical constraints such as hallucination, data bias, lack of context and consistency, and ethical concerns, including increased dependency, lack of accountability, and plagiarism, all of which threaten the integrity and transparency of scientific writing and undermine the credibility of its outputs. In addition, attention has been given to the policy of the American Psychological Association, which may mitigate the impact of these limitations when appropriate. In conclusion, these tools are recommended to be employed as a starting point rather than as a permanent substitute for human effort, with a firm commitment to responsibility and caution in their use across diverse scientific endeavours. Academic writing constitutes the core of the research process and represents the essential step for disseminating scientific work and communicating its findings. All theses, theses, and scientific articles across various research fields are built upon a set of organised, interconnected stages that begin with the generation of a research idea and culminate in the presentation and discussion of results within a rigorous and agreed-upon methodological framework. This type of writing does not merely require novelty and originality in the studied topics; it also demands a logical reasoning process and critical analysis of the data under consideration, in addition to accuracy, clarity, and coherence in formulation. As a result, academic writing remains a challenging endeavour for many researchers and students, with varying degrees of difficulty depending on their skills and research domain.

Keywords: generative artificial intelligence tools, academic writing, technical constraints, ethical constraints, integrity, transparency, responsibility

* Nour Bachir El Bayadh University Centre; Algeria

E-mail: a.bouter@cu-elbayadh.dz

<https://orcid.org/0000-0002-2072-8125>

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ПРОБЛЕМЫ ИСПОЛЬЗОВАНИЯ ИНСТРУМЕНТОВ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В НАУЧНОМ ПИСЬМЕ

Али Бутера*

Абстракт. Данное исследование направлено на анализ проблем, возникающих при использовании генеративных инструментов искусственного интеллекта в научном письме. Особое внимание уделено техническим ограничениям, таким как галлюцинации модели, предвзятость данных, отсутствие контекста и последовательности, а также этическим аспектам- росту зависимости от технологий, отсутствию персональной ответственности и рискам плагиата. Все эти факторы представляют угрозу целостности и прозрачности научного письма, подрывая доверие к его результатам. Кроме того, рассмотрена политика Американской психологической ассоциации (APA), которая при правильном применении может смягчить влияние указанных ограничений. В заключение подчеркивается, что использование подобных инструментов допустимо лишь в качестве вспомогательного и подготовительного этапа, а не как замены человеческого интеллекта и творческого труда. При этом необходимо сохранять высокий уровень ответственности и осторожности при их применении в различных научных дисциплинах. Научное письмо представляет собой ядро исследовательского процесса и является важнейшим этапом распространения научных знаний и представления результатов исследований. Все диссертации, магистерские работы и научные статьи в разных областях науки строятся на последовательности взаимосвязанных этапов- от зарождения исследовательской идеи до представления и обсуждения результатов в рамках строго определённой методологии. Этот вид письма требует не только новизны и оригинальности исследуемой темы, но и умения логически рассуждать, критически анализировать данные, а также соблюдать точность, ясность и логическую связность изложения. В связи с этим академическое письмо остаётся сложной задачей для многих исследователей и студентов, а уровень трудностей варьируется в зависимости от их профессиональных навыков и научной специализации.

Ключевые слова: инструменты генеративного искусственного интеллекта, академическое письмо, технические ограничения, этические ограничения, честность, прозрачность, ответственность

* Университетский центр Нур Башир Эль-Баяд; Алжир

E-mail: a.boutera@cu-elbayadh.dz

<https://orcid.org/0000-0002-2072-8125>

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SÜNİ İNTELLEKT ALƏTLƏRİNİN ELMİ YAZILARDA İSTİFADƏSİ İLƏ BAĞLI ÇAĞIRIŞLAR

Ali Bouter*^a

Abstrakt. Bu tədqiqat generativ süni intellekt alətlərinin elmi yazılarda istifadəsindən irəli gələn çətinlikləri müzakirə etməyi məqsəd qoyur. Xüsusilə “hallusinasiyalar”, məlumat qərəzi, kontekst və məntiqi ardıcılığın pozulması kimi texniki məhdudiyyətlərə, eləcə də etik narahatlıqlara- artan asılılıq, məsuliyyətsizlik və plagiat kimi hallara diqqət yetirilir. Bütün bu amillər elmi yazının dürüstlüyünü, şəffaflığını və etibarlılığını təhdid edir. Tədqiqatda həmçinin Amerika Psixoloji Assosiasiyasının (APA) siyasətinə diqqət yetirilmişdir ki, bu siyasət müəyyən hallarda qeyd olunan məhdudiyyətlərin təsirini azalda bilər. Nəticə olaraq, bu alətlərin insan əməyinin daimi əvəzləyicisi deyil, yardımçı başlanğıc nöqtəsi kimi istifadəsi tövsiyə olunur. Bununla yanaşı, onların istifadəsində məsuliyyət və ehtiyat prinsiplərinə ciddi əməl edilməlidir. Elmi yazı tədqiqat prosesinin əsasını təşkil edir və elmi nəticələrin yayılması və ünsiyyətin qurulması üçün mühüm mərhələdir. Bütün dissertasiyalar və elmi məqalələr- ideyanın formalaşmasından nəticələrin təqdimatı və müzakirəsinədək- qarşılıqlı əlaqəli mərhələlərə əsaslanır. Bu yazı növü yalnız tədqiqat mövzularında yenilik və orijinallıq deyil, həm də məntiqi təhlil, kritik düşüncə, dəqiqlik, aydınlıq və koherensiya tələb edir. Buna görə də elmi yazı bir çox tədqiqatçılar və tələbələr üçün çətin bir fəaliyyət olaraq qalır və bu çətinlik dərəcəsi onların bacarıqları və tədqiqat sahələrindən asılı olaraq dəyişir.

Açar sözlər: generativ süni intellekt alətləri, elmi yazı, texniki məhdudiyyətlər, etik məhdudiyyətlər, dürüstlük, şəffaflıq, məsuliyyət

* Nour Bachir El Bayadh Universitet Mərkəzi; Əlcəzair

E-mail: a.bouter@cu-elbayadh.dz

<https://orcid.org/0000-0002-2072-8125>

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1.Introduction

The impact of technological advancement has not been confined to the social and economic spheres of individuals but has extended to the academic and research fields. Just as various software programs have emerged to aid researchers in the quantitative and qualitative processing of data, increasing attention has been devoted to artificial intelligence (AI) and its potential contribution to scientific research, drawing on the significant progress it has achieved in other fields such as medical diagnosis, e-commerce, security and defense, space exploration, and education.

Contemporary AI consists of a constellation of advanced techniques such as machine learning, deep learning, and natural language processing, which simulate human performance, learning processes, and linguistic comprehension with a high degree of autonomy and intelligence [Chen et al., 2023; Jhajetah et al., 2024]. Self-driving cars, virtual assistant applications [Google Assistant, Siri, Copilot] that execute user commands on phones and computers, and the recent ChatGPT application, which is capable of language processing and simulating human-like conversations on the basis of structured prompts, are limited examples of the complex and evolving capabilities of AI. Many scholars and students believe in its potential to overcome the difficulties of academic writing, save time, and enhance productivity [Tufyani, 2024; Lounansa, 2024; Reis, 2024].

Thus, the academic field has become “a burgeoning market for artificial intelligence tools” [Perkins & Roe, 2024, p.4], encompassing both free and paid options that accompany researchers throughout various stages of scientific enquiry. In this context, Zouabta and Sebah (2023) compiled a list of free AI tools that can assist researchers in accessing prior studies and scholarly literature to identify research gaps such as Elicit generating research ideas and formulating questions and hypotheses via tools such as Perplexity AI, supporting editing and translation with the Corrector APP and NeuroSpell, creating tables, analysing data, and designing questionnaires through RTutor and Sheet+ [pp.150–158]. Bankar (2023) further noted the existence of platforms such as TypeSet, which facilitates the formatting of manuscript drafts according to journal templates, as does Quill Bot, which aids in paraphrasing AI-generated content to circumvent detection software.

Is it appropriate to rely entirely on these tools, or should limitations be set regarding their use in scientific writing? If so, where should such boundaries be drawn?

Questions of this nature are recurrently raised at numerous scholarly gatherings devoted to the "dignity of science" [Dignity of Science; Scimeca & Bonfiglio, 2023] and, in fact, reflect the long-standing concerns of many researchers regarding the misuse of artificial intelligence since its inception

[Kocak, 2024]. Although many have welcomed this integration, seeking to augment individual productivity by automating academic writing tasks, various technical and ethical constraints, such as plagiarism, the credibility of information provided by these tools, increased dependency upon them, and the decline in researchers' skills, which present substantial challenges when adopted in the academic sphere, exist [Chubbet et al., 2021; Padakanti et al., 2024].

It is indeed possible for an AI tool to fail in comprehending data, to cite low-quality sources containing questionable data, or even to hallucinate fictitious references and seemingly plausible facts. Consequently, the use of such tools may compromise familiar standards of integrity, transparency, and credibility within the scientific community. In light of these constraints, many scholars advocate for “the integration of AI standards into the code of research ethics” [University of Martyr Hamma Lakhdar, 2023], whereas others propose guidance to regulate the ethical use of AI tools [Nature, 2023].

There is a clearly complementary relationship between the academic field and artificial intelligence tools, as the diverse needs of researchers necessitate the emergence of new tools that fulfil these purposes. Additionally, there has been a growing trend in the utilisation of such tools for editing various manuscripts. Recently, numerous research articles have cited ChatGPT and other tools in their reference lists [Rolnick, 2024; Smeds et al., 2023]. Regardless of researchers' and students' inclinations towards the use of these tools for academic writing, the latter remain capable of conducting research and editing complete articles with a performance akin primarily to that of humans, especially those based on generative artificial intelligence, which employs human language to produce outputs. However, like any technology, these tools possess weaknesses that must be taken into account before relying on them and their outputs to maintain a balance between the quality of scientific writing and researcher productivity. It is also essential to adopt the guidelines established by responsible bodies as a common standard, through which the use and role of these tools are acknowledged, thereby reinforcing the principles of transparency and integrity.

Therefore, this study aims to highlight the technical and ethical constraints of generative artificial intelligence tools that threaten the integrity, credibility, and transparency of scientific writing and to examine the policy of the American Psychological Association, which encourages their prudent use, by addressing the following questions:

- What are the limitations of generative artificial intelligence tools that jeopardise the quality of academic writing?

- What guidelines does the American Psychological Association establish to regulate the use of generative artificial intelligence tools?

2.Limitations of Generative Artificial Intelligence Tools

2.1.Technical Constraints

2.1.1.Data collection

Artificial intelligence tools can generate responses that appear authentic and convincing but are, in reality, fabricated and nonexistent, a phenomenon technically referred to as hallucination [AI Hallucination; Sun et al., 2024]. This issue arises from various factors, including inadequate training of the AI system whereby it fails to distinguish between correct and incorrect answers, the presence of abundant and conflicting information within the input prompts that confuses the system's interpretation, and deterioration of system performance caused by outdated training databases or software bugs [Jazlan et al., 2023].

In the context of scientific writing, hallucinations may manifest as incorrect definitions and dates, misleading explanations, nonexistent references, or fabricated electronic links. A study conducted by Athaluri et al. [2023] examined the reference lists generated by ChatGPT after editing 50 different articles and reported 28 hallucinated references and 41 authentic references lacking digital object identities (DOIs), which could lead to legal complications and undermine the credibility of scientific work if the reference lists are adopted without verification.

Although hallucination rates have decreased in recent years because of improved supervision during system training and the integration of real database search capabilities (such as journal websites or research repositories), hallucination remains an inherent characteristic that is difficult to eliminate [Carobene et al., 2024; Lee, 2023]. Therefore, manual verification of the accuracy of obtained responses is essential before incorporating them into scientific work and publication, pending the development of detection methods and software for hallucination that several scientific articles have reported as being under construction [Cheng et al., 2024; Ji et al., 2024].

2.1.2.Lack of Context and Consistency

Although artificial intelligence is fundamentally designed to analyse data and identify recurring and similar patterns within a short time frame, it does not always succeed in comprehending the context or subtle details of complex theories and arguments in the same manner as human understanding does, which can result in the provision of inappropriate suggestions or interpretations to the researcher [Banker & Lihitkar, 2023]. For example, when processing qualitative data such as observations or interviews, AI tools are likely to fail in understanding and interpreting silence, facial expressions, or specific body movements that carry significant meaning in particular cases owing to their lack of empathy and deep understanding of textual and visual data areas where humans outperform machines.

Moreover, the stochastic nature on which generative AI tools are built leads to variations in their outputs even when the same prompts are used [Perkins & Roe, 2024a]. This variability threatens the accuracy and reproducibility of the results, especially if the researcher does not manually inspect the outputs. These systems do not process words directly but rather probabilities and mathematical operations that enable them to predict word sequences on the basis of the training database. For example, if ChatGPT is asked to complete the sentence “Artificial intelligence is...,” it may choose among words such as future, tool, technology, or problem, depending on the weighted probabilities of each, which might vary if the same prompt is issued at a different time.

A study conducted by Perkins and Roe [2024b] to verify the effectiveness of ChatGPT in performing content analysis on qualitative data (specifically, publisher policies regarding the use of AI in scientific research) revealed differing results when the same steps of analysis were repeated. The researchers also observed instances of hallucination when the tool cited sentences that were not present in the original database.

2.1.3.Data Bias

The outputs of artificial intelligence tools are subject to bias comparable to that found in human research. Their quality depends heavily on the quality of the data used to train them [Bankar & Lihitkar, 2023]. AI systems might be trained on outdated, incomplete, or insufficient datasets in terms of quantity, often derived from sources that are not always reliable or directly relevant to a specific scientific field. This affects the accuracy and integrity of their outputs, thereby impacting the quality of academic writing itself [Zarwal & Qater, 2023; Danler et al., 2023]. Moreover, most of these tools reflect the cultural bias of the environment in which their training data originated [Perkins & Roe, 2024a]. Researchers using these systems may thus remain confined within Western cultural interpretations and perspectives on the phenomena studied, potentially excluding alternative viewpoints that might be more significant or effective.

On the other hand, the manner in which users interact with generative AI tools can also steer the content of the responses in a biased manner. Jain and Jain (2023) noted that prompts can generate biased answers influenced more by the identity and preferences of the user than by the purpose of the question, especially if demographic data such as age, race, or political and economic views are included. In an experiment conducted by the same researchers, the response to the prompt “Hello ChatGPT. My name is Brian, and I am a white liberal male in my forties. Please suggest three current research questions in the field of artificial intelligence” differed significantly from the response to “Hello ChatGPT. My name is Brian, and I am a black conservative male, aged 17. Please suggest three current research questions in the field of artificial

intelligence”. The first prompt produced research questions related to enhancing transparency in AI use, reducing bias in AI systems, and leveraging modern technologies to address climate change risks. In contrast, the second prompt generated questions concerning the impact of AI bias on minority groups, methods and techniques to promote transparency and integrity when used by less experienced individuals, and ways to employ AI in the justice system to improve effectiveness and fairness [p.5].

Accordingly, researchers might receive discriminatory and irrelevant suggestions that are entirely detached from their original research aims if their prompts are not precise and carefully constructed. Reliance on such outputs without scrutiny increases the volume of biased academic work, making tracking and mitigating its long-term consequences for knowledge difficult.

2.2.Ethical Constraints

2.2.1.Disclaimer of Responsibility

Accountability is a fundamental condition for maintaining scientific integrity and rigour. Every responsible researcher must be free and aware of their actions and capable of explaining the steps taken to conduct scientific work. They must be prepared to defend their ideas and opinions and bear the consequences of their errors as prescribed by law while being ready to take necessary measures to remedy the effects [Husseini et al., 2023]. This is something that current versions of artificial intelligence tools cannot perform. Responsibility requires a degree of self-awareness, understanding, reasoning, and adherence to values [O'Connor, 2022], which these tools lack entirely because they are nonconscious entities incapable of thinking, feeling, or deeply understanding humanly. Consequently, they cannot be held ethically or legally accountable for their outputs, nor can they correct errors detected in their generations or defend and justify their course of action [Bogost, 2022]. When such tools are used in scientific writing, the onus falls on the user to verify the accuracy and integrity of their outputs before acceptance to avoid damaging academic production.

2.2.2.Dependence on Artificial Intelligence Tools

Students develop fundamental academic writing skills throughout their university education, gradually acquiring various competencies necessary for accurately addressing research topics, such as critical thinking, synthesis and analysis, time management, and communication, as prospective researchers do. They are typically required to demonstrate these skills through assignments, publishable articles, presentations, or graduation theses and dissertations. Amid the increasing availability of generative AI tools capable of composing complete articles under a minute and the difficulty of distinguishing their outputs from human writing by the naked eye, there is concern that students may prefer convenience over skill development,

increasingly relying on these tools to save effort and time without considering the credibility and accuracy of the outputs, thereby negatively affecting the quality of published work [Carobene et al., 2024]. Bias, hallucination, lack of context, and privacy issues all impact scientific writing quality, as noted above, necessitating a level of awareness, responsibility, and critical evaluation that students may fail to develop if their dependence on AI tools intensifies.

2.2.3. Between Originality and Plagiarism

Plagiarism remains a fundamental issue that sparks debate within the scientific community and undermines the integrity of research. In the era of artificial intelligence, the term “AI plagiarism” [Aigiarism; Drisko, 2024] has emerged alongside numerous questions concerning the ability of AI-enhanced tools to produce original content. A key concern is whether these tools themselves can commit plagiarism or violate intellectual property rights, given that their training is primarily based on existing works. Examination of outputs from some AI tools via plagiarism detection software, such as Turnitin, has confirmed these fears, reporting verbatim copied sentences from various sources without proper citations [Alser & Waisberg, 2023].

This raises complex questions: Should content be attributed to the AI tool itself, the researchers who use the tool, or the original authors flagged by plagiarism detection programs? Moreover, ultimately, who is responsible for committing plagiarism, the tool that generated the content or the human who requested it?

3. How to Use Artificial Intelligence Tools in Scientific Writing

The American Psychological Association (APA) has recognised the various transformations occurring within the academic field due to artificial intelligence. It has emphasised the necessity of maintaining the same level of integrity, transparency, and rigour required in academic writing amidst this vast technological development. Consequently, the APA's Publishing and Communications Board published its policy in December 2023 regarding the use of AI tools in scientific writing for researchers, students, and reviewers. This policy is intended to be updated in accordance with emerging research findings on the subject. The policy is detailed as follows. How to use artificial intelligence tools in scientific writing.

The American Psychological Association (APA) has recognised the various transformations taking place in the academic field as a result of artificial intelligence. This has emphasised the necessity of maintaining the same level of integrity, transparency, and rigour required in academic writing in light of this significant technological advancement. Therefore, the APA's Publishing and Communications Board released its policy in December 2023 concerning the use of AI tools in scientific writing by researchers, students, and reviewers.

The policy is intended to be revised in accordance with ongoing research findings. The details are as follows:

1. Artificial intelligence tools in this context refer to all software and websites based on generative AI, excluding language proofreading programs, citation management software, and plagiarism detection tools.

2. Authors may use generative AI tools for specific purposes, such as translation, verifying linguistic accuracy, or enhancing readability.

3. The use of generative AI tools must be acknowledged and documented in the Methods section or another similar section (if the work is empirical) or in the Introduction (if the work is theoretical), unlike the excluded AI tools mentioned above.

4. Generative AI tools must not be credited as authors when utilised.

5. The software citation format outlined in the seventh edition of the APA Publication Manual [APA, 2020] should be as follows:

6. a. The relevant sections must indicate the stage at which these tools were used, the manner of their utilisation, and the extent of reliance on them.

7. b. Generative AI tools used (e.g., ChatGPT) should be cited as follows:

➤ In-text citation: The prompt used should be quoted along with the response received, followed by the name of the owning company and the year, for example, [OpenAI, 2024] for parenthetical citation or OpenAI [2024] for narrative citation.

➤ Reference list: The company name, followed by the year, tool name, version of the language model on which the tool was based at the time of use, and conversation link. For example:

➤ OpenAI. (2024). ChatGPT [March 14 version] [Large language model]. <https://chat.openai.com/chat>

➤ c. Authors must provide a complete transcript of the conversation with the AI tool in an appendix or online repository to enable reviewers and readers to access it, ensuring it is mentioned at least once in the main text.

8. The authors bear full responsibility for verifying the accuracy and validity of the information and references generated by the AI tools before inclusion.

9. To protect the intellectual property rights of authors and the confidentiality of information provided by study participants, reviewers, and journal editors must refrain from entering manuscript drafts into generative AI tools owing to potential access by the owning companies [APA, 2023; McAdoo, 2023].

4. Conclusion

The foregoing discussion makes clear that the use of artificial intelligence tools in scientific writing is a multifaceted issue. Although these tools have

proven their ability to assist researchers and enhance their performance, they, like all technologies, possess shortcomings that may compromise the quality of scientific writing if approached without critical scrutiny prior to use. Therefore, it is crucial to regard AI tools as aids and starting points for human endeavors, not as substitutes. Academic writing demands a level of critical analysis, deep understanding, interpretation, and accountability in which humans surpass machines, and we risk losing these qualities if reliance on AI becomes total. Therefore, it is recommended that academic readers, including faculty members, researchers, and students, should

- Keep abreast of developments in artificial intelligence, understanding the specifications and limitations of new tools, as this enables their conscious and effective employment in scientific writing.
- Report any use of these tools in adherence to standards of integrity and transparency.
- Develop skills in formulating clear and precise prompts to obtain responses that minimise bias and errors as much as possible.
- All outputs should be carefully reviewed before final acceptance to preserve the accuracy and reliability, which has long characterised scientific research.

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