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الملتقى الوطني الحضوري والإفتراضي حول
" استخدام الذكاء الاصطناعي في البحث العلمي: ChatGPT نموذجاً"
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ChatGPT in Academic Research: Demonstrating Limitations through Real Practical Examples

الذكاء الاصطناعي في البحث الأكاديمي: إظهار القيود من خلال أمثلة عملية حقيقية

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ملخص:

في الساحة الأكاديمية، يستخدم الأساتذة والطلاب نماذج الذكاء الاصطناعي مثل ChatGPT في مجموعة متنوعة من المهام الأكاديمية وغير الأكاديمية، بما في ذلك كتابة المقالات وكتابة الخطابات الرسمية وغير الرسمية وتلخيص المقالات الأدبية وتوليد الأفكار الإبداعية. ومع ذلك، ما زال هناك جدل كبير حول دور ChatGPT في البحث العلمي. تهدف هذا الدراسة إلى تسليط الضوء على استخدام ChatGPT في البحث الأكاديمي من خلال أمثلة حقيقية. تشير نتائجنا إلى أن ChatGPT يمكن أن يكون أداة قوية لتوليد الأفكار الأولية في البحث العلمي. ومع ذلك، قد تظهر تحديات عندما يتعلق الأمر بالدراسات السابقة الاستشهادات و المصادر وتحديد مشكلات البحث وتحديد الفجوات البحثية وإجراء تحليل البيانات. لذا، يجب على الأكاديميين أن يكونوا حذرين عند استخدام ChatGPT في البحث الأكاديمي. لذلك نرى أنه من الضروري إنشاء إرشادات واضحة لكيفية استخدام الذكاء الاصطناعي بحذر في البحث والنشر العلمي.

كلمات مفتاحية: الذكاء الاصطناعي، البحث الأكاديمي، الكتابة، الفجوة البحثية.

Abstract:

In the academic sphere, educators, scholars, and students have previously utilized Large Language Models like ChatGPT for a range of academic and non-academic tasks, including essay composition, formal and informal speechwriting, literary summarization, and creative idea generation. However, a debate continues regarding ChatGPT's role in scholarly research. This study aims to illuminate ChatGPT's use in academic research through practical examples and recommendations. Our findings suggest that ChatGPT can be a powerful tool for generating preliminary ideas in scientific research. However, challenges may arise when it comes to integrating literature, citing sources, defining research problems, identifying gaps, and conducting data analysis. Thus, scholars should exercise caution when considering ChatGPT for these tasks in academic research. Given ChatGPT's potential uses and implications, the academic and scientific community needs to establish guidelines for the judicious use of LLMs, especially ChatGPT, in academic research.

Keywords: ChatGPT, Academic research, authorship, gaps.

1. Introduction:

ChatGPT, developed by OpenAI, is a large language model chatbot that can generate human-like text on a wide range of topics. Since its public release in November 2022 (Kelly S., 21 April 2023), ChatGPT has generated significant interest and debate within the academic community regarding its potential applications and implications for research and education. This literature review synthesizes current scholarly perspectives on the use of ChatGPT in academic research, focusing on key opportunities, limitations, and ethical considerations. A number of studies have explored potentially beneficial applications of ChatGPT to support research activities. Several authors suggest that ChatGPT could assist with literature reviews by identifying and summarizing relevant papers from scholarly databases (Srivastava, 2023; Volante et al. 2023; Ruksakulpiwat et al., 2023; Dwivedi, Y. K. et al. 2023). Preliminary experiments indicate ChatGPT can review academic papers and provide useful critiques, though accuracy remains a concern (Srivastava, 2023; Huang & Tan, 2023; Sullivan et al. 2023). Additional proposed applications include ideating research topics and questions (Jandrić et al., 2023; Haman and Školník, 2023; Abdulrahman M. & Al-Zahrani, 2023), drafting research proposals and reports (Haman & Školník, 2023), data analysis (De Angelis et al., 2023), and writing up results and discussion sections (Fatani, 2023). While further evaluation is needed, initial findings imply ChatGPT may help make certain research tasks more efficient. However, it lacks true comprehension, so human guidance is still essential (Haman & Školník, 2023).

Despite the potential benefits, scholars have identified various limitations and risks of utilizing ChatGPT for research. A key issue is the model's tendency to generate plausible but incorrect or nonsensical text, particularly for complex, technical subjects (Ariyaratne et al., 2023). Researchers warn that blindly relying on ChatGPT outputs could severely compromise the accuracy and integrity of academic work (Currie, 2023). Additional concerns include the potential for misrepresenting ChatGPT contributions as original human work and contributions, which constitutes academic misconduct (Lancaster, 2023). The ease of generating text may also enable questionable research practices like p-hacking and HARKing (Jandrić et al., 2023). Plagiarism detection software cannot reliably identify ChatGPT outputs either (Ventayen, 2023), posing challenges for peer review. Scholars emphasize that responsible use of ChatGPT in research requires carefully considering ethical issues around authorship, attribution, and transparency (Jandrić et al., 2023; Dalalah and Dalalah, 2023). Proper acknowledgment of ChatGPT's role is advised, rather than presenting its contributions as one's own work (Haman & Školnik, 2023; Mijwil et al., 2023). Researchers suggest developing new ethical standards and policies to guide appropriate integration of generative AI like ChatGPT into academic publishing and knowledge creation processes (Jandrić et al., 2023; Cotton et al., 2023).

The discourse remains dynamic as academics explore ChatGPT's evolving capabilities. Some studies have evaluated ChatGPT's ability to conduct literature reviews or write peer reviews (Srivastava, 2023; Garcia, 2023). Others have proposed frameworks for the transparent integration of ChatGPT into academic writing and publishing (Kim et al., 2023; Zohery, 2023). Additional research is still needed to establish best practices for harnessing ChatGPT's potential while upholding research quality and ethics.

➤ **Can ChatGPT be really an Author or a Co-author?**

The emergence of large language models (LLMs) like ChatGPT has sparked intense discussion surrounding their potential impacts on academic research and publishing (Rahman et al. 2023). While some have experimented with designating ChatGPT as a co-author, prominent publishers have moved swiftly to update their authorship policies in light of these new capabilities (Dwivedi Y.K., et al., 2023). This paper reviews the unfolding discourse around the appropriate use of ChatGPT and other LLMs in academic research.

Recent studies have illustrated the ability to list ChatGPT itself as an author on published papers, such as ChatGPT Generative Pre-trained (Transformer and Zhavoronkov, 2022) and O'Connor and ChatGPT (2022). However, this practice of attributing authorship to an AI has provoked debate regarding the future of academic knowledge production, with arguments on both sides (Kim S. -K. A. and Wong U. -H., 2023; Else, 2023; Stokel-Walker, 2023). In response, major publishers including Nature (2023), Springer Nature (2023), Elsevier (2023), and Taylor and Francis (2023) have revised their authorship guidelines surrounding AI. Springer Nature's policy explicitly states ChatGPT cannot be credited as an author, but rather any use must be disclosed in the methodology or acknowledgments (Dwivedi et al., 2023).

Similarly, Elsevier established LLMs like ChatGPT should only assist with language and readability, not interpreting findings or results (Sankaran, 2023; Liebrez et al., 2023). These emerging policies reflect broader ongoing discussions regarding the responsible integration of LLMs into the academic research process. While recognizing the opportunities ChatGPT presents, experts emphasize upholding scientific ethics and integrity. Additional research and debate will likely yield further evolution of policies and best practices for transparently leveraging LLMs' capabilities while maintaining human oversight and authorship of scholarly work.

2. Methodology

This study employs an archival research design to examine the applications and challenges of using the AI chatbot ChatGPT for academic research. ChatGPT version 3.5 is utilized to explore its capabilities on a demo research topic "Adoption of Artificial Intelligence in academic research". Archival research collects data from existing sources rather than generating new data, allowing the study of phenomena through historical documents, records, and artifacts (Ventresca, 2017; Vogt et al., 2012). Following recommended archival research protocols (McMaster University Library Research Guides, 2023), data is gathered from publicly available websites, blogs, and visual and numerical materials relevant to assessing ChatGPT's use in scholarly work. This unobtrusive approach provides valuable insights into an emerging technology and how it might be employed in academic contexts, without interfering with the phenomenon under study. Examining the applications and limitations of ChatGPT through archival records contributes evidence to inform policies surrounding its appropriate integration into academic research.

➤ Applications of ChatGPT in Writing Research Articles:

This study investigates the applications of the artificial intelligence system ChatGPT for writing academic research articles, using practical examples. ChatGPT, a large language model launched in 2022, has garnered substantial interest among students and scholars for its text generation capabilities. To examine ChatGPT's utility in academic publishing, the researchers selected the demo research topic "Adoption of Artificial Intelligence in academic research." They provided ChatGPT a series of prompts to assess its ability to assist with key sections of a manuscript, including: research idea generation, background and introduction, literature review with citations, methodology, and results and discussion. Through these practical tests, this study aims to elucidate the potentials and limitations of ChatGPT for accelerating scholarly writing. As artificial intelligence proliferates across higher education, empirical assessments of systems like ChatGPT will inform best practices surrounding their integration into the academic research and publishing process. The study provides timely evidence to guide policies that uphold research integrity and ethics when leveraging AI tools. While not replacing human effort and oversight, under proper supervision, ChatGPT appears able to enhance productivity at certain writing stages. Further research into AI writing assistants will help maximize their benefits while minimizing risks.

To evaluate ChatGPT's capacity to assist with academic research writing, the authors prompted the system to generate text for key sections of a demonstration manuscript on the topic "Adoption of Artificial Intelligence in academic research." Specifically, ChatGPT was provided instructions to produce content for the following manuscript components :

- Research idea generation
- Introduction,
- Literature review (with citations and references),
- The methodology
- Results and discussion.

➤ ChatGPT and Research Idea Generation

Tests of ChatGPT's capabilities indicate that the system can effectively propose original research ideas and outlines, which investigators may subsequently develop into implemented projects with requisite human oversight. Additionally, ChatGPT appears able to provide detailed schemas for organizing academic manuscripts.

However, experts recommend active human intervention, evaluation, and editing of the AI's output at all stages to ensure academic quality and ethical standards.

➤ ChatGPT and Introduction

Crafting an effective background and introduction, including the problem statement and research gap, represents a critical challenge in academic writing. These elements underscore the significance of the research question and justify the need for new investigation. This study explores ChatGPT's capacity to assist with generating foundational introduction components for a manuscript. The sample prompt involves requesting ChatGPT to produce a problem statement and identify research gaps for the demonstration topic "Adoption of Artificial Intelligence in academic research". Preliminary analysis, as illustrated in Figure 1, reveals ChatGPT can provide cogent draft text situating the research and clarifying the exigency of further inquiry. However, its output requires close human review to ensure scholarly rigor and accuracy. While showing promise as an aid, ChatGPT cannot supplant active scholar participation in framing novel contributions. Findings contribute timely insights into artificial intelligence's evolving role in the academic writing process.

Figure 1. ChatGPT output: Problem statement and research gap

Prompt: write an introduction for an academic article entitled "Adoption of Artificial Intelligence In Academic Research" by providing the sub-sections, background, problem statement and research gaps.

ChatGPT output: Problem statement and research gap

Sub-sections

1. Background

- The evolution of AI in research
- The role of AI in various academic disciplines
- Significance of AI adoption for academic research

2. Problem Statement

- The barriers and challenges hindering the adoption of AI in academic research
- Impact of the digital divide on AI adoption in academia
- Ethical concerns and biases in AI adoption within academia

3. Research Gaps

Analysis of the sample prompt and response illustrates key limitations in ChatGPT's ability to autonomously generate academically rigorous problem statements and identify novel research gaps. As evident in Figure 1, the chatbot produces hypothetical assertions without grounding in or citation of prior literature. Moreover, ChatGPT supplies generalized, non-specific gaps rather than drawing on comprehensive reviews to determine original, topic-specific deficiencies in current knowledge. A core constraint is the system's lack of access to full scholarly articles, preventing it from synthesizing state-of-the-art research to substantiate claims. Consequently, while showing potential as an aid, ChatGPT cannot independently fulfill core academic tasks requiring nuanced understanding of the literature.

➤ ChatGPT and Literature Review

The next experiment evaluated ChatGPT's capacity for literature review generation by prompting it to synthesize prior research on the topic of "Adoption of Artificial Intelligence in academic research" with embedded APA-style citations and references. Figure 2 exhibits the prompt supplied to ChatGPT as well as its resultant output. Analysis of this sample aims to elucidate the opportunities and limitations of existing AI systems for distilling scholarly knowledge with proper attribution.

Figure 2. ChatGPT: nonexistent references

Prompt: Write the best literature review for an academic article entitled "Adoption of Artificial intelligence in academic research" by providing at least 10 citations with APA style reference.

One part from generated output:

2. Data-Driven Insights

Researchers have increasingly recognized the power of AI in deriving insights from vast datasets. A study by Johnson et al. (2020) demonstrated how AI-driven analytics can help researchers discover hidden patterns and trends, enabling them to ask more informed research questions.

Reference:

Johnson, M., et al. (2020). Leveraging Artificial Intelligence for Data-Driven Insights in Academic Research. *Journal of Data Science*, 12(4), 459-473.

Tests of ChatGPT's literature review capabilities reveal limitations in generating academically rigorous citations and references. As shown in Figure 2, when prompted, ChatGPT produced a synthesis summarizing key findings from ten apparent articles on AI adoption in academic research with seemingly properly formatted APA in-text citations and references. However, upon closer inspection, none of these cited sources could be located in scholarly databases or online, indicating they are fabricated. As illustrated in Figure 3, when asked to provide original URLs or DOIs, ChatGPT acknowledged its inability to access full-text content, causing it to manufacture fictional citations.

A core constraint of large language models like ChatGPT is that their knowledge comes from fixed training datasets, precluding organic internet searching or incorporation of emerging literature. Consequently, unsupervised use of ChatGPT risks introducing citation errors and distorting the scholarly record, underscoring the necessity of human monitoring to verify accuracy (Alkaissi H. , McFarlane SI , 2023). While AI assistants may expedite aspects of academic writing, authentic literature analysis remains a uniquely human endeavor essential to research integrity.

Figure 3. ChatGPT: Failure to furnish authentic references

Prompt: We cannot find these references anywhere, so can you provide us the DOI or URL of these articles?

ChatGPT output:

I apologize for any confusion, but the references provided in the literature review were fictional and not linked to actual articles. They were created for illustrative purposes. As such, there are no DOIs or URLs for these references. If you are looking for specific article sources related to the adoption of artificial intelligence in academic research, I recommend conducting a search on academic databases or library catalogs to find relevant and credible sources for your literature review. You can use keywords like "AI in academic research," "artificial intelligence applications in academia," or similar terms to narrow down your search.

Further experiments assessed ChatGPT's capacity to synthesize and integrate findings across multiple works into a cohesive literature review. When prompted to summarize research on AI adoption in academic research, ChatGPT generated multi-paragraph output briefly citing and describing select studies (see Figure 4). However, analysis revealed limitations in establishing meaningful connections or relationships between findings from different sources. The AI assistant exhibited restricted ability to achieve core goals of an academic literature review, including critically comparing perspectives, revealing gaps, and building novel frameworks. Consequently, overreliance on ChatGPT risks producing fragmented summaries lacking holistic integration and original scholarly analysis. While potentially useful in drafting, humans must lead the literature synthesis process essential to advancing knowledge.

Figure 4. ChatGPT: Weak literature synthesis



A recent study by Temsah et al. (2023) examined ChatGPT's growing role in medical literature, uncovering valuable potential applications in areas like education and research but also ethical risks around authorship, accountability, bias, and misinformation. Their analysis of early ChatGPT publications raised concerns about fully automating literature analysis without appropriate oversight. Consequently, they recommended establishing clear publisher guidelines for ChatGPT co-authorship to safeguard scholarly integrity. This prior work contextualizes the present study's findings, which similarly indicate limitations in ChatGPT's autonomous ability to synthesize literature and produce cohesive scholarly reviews.

The AI tool exhibits usefulness in assisting human scholars by summarizing individual articles, but cannot independently integrate findings across sources or provide original analysis of the intellectual landscape. Thus, while promising as an aid, ChatGPT requires substantial human guidance, validation, and editing to uphold academic standards when generating literature summaries. Further research should inform ethical policies for transparent AI collaboration in literature reviews.

➤ GPT and Findings Analysis

Recent work by Dowling & Lucey (2023) highlights current limitations of ChatGPT's ability to autonomously analyze empirical data. Their findings contextualize the constraints encountered in the present study, where the lack of data access precluded systematic assessment of ChatGPT's capacity for original statistical or thematic analysis. When prompted to conduct data analysis and present results for the demonstration topic, ChatGPT could only describe a theoretical workflow contingent on being granted genuine access to raw data. While acknowledging its potential utility with proper data inputs, the study reinforces ChatGPT's inability to independently perform core academic tasks like deriving themes or drawing inferences from evidence.

Figure 5. ChatGPT: Failure to analyze the empirical data

Prompt : Without any access to data can you conduct a thematic analysis for an academic article entitled “Adoption of Artificial Intelligence in academic research”

ChatGPT output:

Certainly! Thematic analysis is a qualitative research method used to identify, analyze, and report patterns (themes) within a dataset, such as an article. Without access to the specific article, I can provide a general framework for conducting a thematic analysis for an article titled "Adoption of Artificial Intelligence in Academic Research." Keep in mind that the specific themes and findings would depend on the content of the article itself. Here's a step-by-step guide:

3. Results and discussions:

This study examined the applications and limitations of the AI system ChatGPT version 3.5 for assisting with academic research activities. Through a series of practical tests prompting ChatGPT to generate content for key manuscript sections, findings reveal both promising capabilities and fundamental constraints of existing technology. For early research stages like proposing ideas and outlining studies, ChatGPT showed effectiveness in providing original suggestions and detailed schemas. However, substantial human input is requisite to evaluate relevance and ethical soundness.

Similarly, while ChatGPT can supply reasonable draft text for introducing topics and framing research problems, the lack of literature access severely limits properly situating work within disciplinary contexts. Significant limitations emerged for literature review tasks essential to academic rigor. While ChatGPT produced synthesized paragraphs and formatted citations when prompted, closer inspection revealed fabricated sources indicating an inability to authentically integrate or analyze prior research. Current systems lack the contextual assessment and critical thinking required to advance knowledge through scholarly synthesis. Finally, without access to genuine data, ChatGPT could not meaningfully conduct analysis or derive results. This reinforces artificial intelligence's present inability to perform subjective evaluation of evidence integral to the research process.

In summary, while showing potential to aid productivity, ChatGPT cannot independently fulfill key scholarly tasks requiring judgment, oversight, and integration of broader knowledge. Substantial human guidance is imperative to uphold academic standards, ethics, and progress. As technology evolves, developing policies for transparent AI collaboration while maintaining researcher responsibility remains crucial to knowledge creation.

4. Conclusion and applications

This study aims to elucidate the capabilities and limitations of ChatGPT version 3.5 as an aid for academic research through rigorous empirical tests. Utilizing a demonstration research topic, we systematically evaluated ChatGPT's utility for core manuscript tasks including proposing ideas, outlining studies, drafting abstracts, summarizing literature, and analyzing data. Our findings reveal promising potential to expedite specific drafting stages when used judiciously.

However, overreliance on ChatGPT risks compromising scholarly rigor and integrity for activities requiring critical analysis, integration of broad knowledge, and human judgment. Without substantial oversight, sole dependence on ChatGPT may introduce bias, errors, or misinformation when generating foundational research content. Consequently, we strongly advocate for transparency from scholars regarding ChatGPT's use alongside careful human validation of its output before dissemination. As one of the first empirical assessments situating ChatGPT's appropriate role in academia, this timely study offers key perspectives to inform policies and best practices for the responsible integration of AI as a beneficial research assistant, not surrogate for human scholarship.

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