

# Applying artificial intelligence to enhance the composition of scientific papers for non-native English-speaking researchers

Aplicando a inteligência artificial para aprimorar a composição de artigos científicos para pesquisadores não nativos de língua inglesa

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Most scientific papers in world literature are written in English<sup>[1]</sup> by non-native English speakers.<sup>[2]</sup> Non-native English-speaking scientists face difficulties in writing clearly, succinctly, and without grammatical errors.<sup>[3,4]</sup> Nevertheless, despite the use of word processors and spell checkers, the final text still does not compare favorably with that created by native English speakers, thus contributing to the lower chances of acceptance of these papers in prestigious scientific journals.<sup>[5,6]</sup> In fact, as Editors of the Brazilian Journal of Oncology, one of the most difficult barriers to overcome when analyzing submitted papers is poor English usage.

Artificial intelligence (AI) involves the development of algorithms and computer programs that can learn from and make predictions or decisions based on real-world data, mimicking human intelligence. Natural language processing (NLP) is a type of AI that enables machines to understand, interpret, and generate human language in a manner natural to humans.<sup>[7,8]</sup> For example, ChatGPT (Generative Pre-Trained Transformer) (<https://chat.openai.com/>) is a language model developed by OpenAI that was designed to generate natural language responses to text prompts input by the user. Additionally, ChatGPT's underlying AI systems (GPT-3 and GPT-4)

are pre-trained on vast amounts of text data from the Internet, enabling it to learn language patterns and structures.

With these capabilities, AI programs can assist scientists in the search for pertinent scientific papers on the Internet, summarize them, and help with the writing of abstracts, titles, and parts of the introduction, methods, results, and discussion.<sup>[9-12]</sup>

Elicit (<https://elicit.org/>) is a collaborative software tool for requirements gathering and documentation, whereas ResearchRabbit (<https://www.researchrabbit.ai/>) is an online platform offering a wide range of research tools. Elicit and ResearchRabbit will suggest references many times not yet known by the scientist because it can go "beyond the horizon" by a self-learning approach based on several retrieved papers using its contents, keywords, and citations<sup>[13]</sup> to retrieve other papers.

There are several software programs that now also use AI to correct grammatical and spelling errors as well as improve the text with suggestions, such as Grammarly (<https://www.grammarly.com/>) and Paperpal ([www.paperpal.com](http://www.paperpal.com)). Furthermore, GPT-3 and GPT-4, can correct spelling, punctuation, and grammatical errors. In addition, it can also

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summarize the text, paraphrase it, and even create a section of a paper based on another, for example, creating an abstract or even an introduction based on the results of the paper. Most interesting to us is the possibility of a non-native English speaker loading his text into GPT-3 or GPT-4 and asking the AI program to improve it so that it will no longer be perceived as a paper written by a foreigner.

Regarding AI-assisted writing, both authors and editors must be concerned about plagiarism. A recent study described that a text generated by GPT-3 underwent a plagiarism check using Turnitin (<https://www.turnitin.com/>) and received a satisfactory evaluation. The similarity index was as low as 19%, primarily detected in the paper's methods section, as anticipated.<sup>[10]</sup> It seems then that texts generated by GPT-3 or GPT-4 may circumvent usual plagiarism checking by available software.

There are several limitations to the use of AI in improving scientific writing. As we can see, AI can be an accessory or a facilitator, but should never be expected to write accurately by itself any of the sections of a scientific paper. Even as AI-generated output can be rapidly produced in a grammatically correct way and sometimes even insightful in terms of its content, several errors can occur that require human correction and editing.<sup>[10]</sup>

Nevertheless, the authors believe that the editorial help provided by AI-powered software programs, such as GPT 3 or GPT-4, can be useful, especially for non-native English-speaking scientists to improve their writing. Authors can, however, disclose in the paper in which of the article's sections AI-powered software programs were used and for what reasons. In fact, International Committee of Medical Editors (ICMJE) in its Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals recommends this type of disclosure. Authors who use AI technology should describe how they used it in both the cover letter and submitted work.<sup>[14]</sup> In addition, it is important to note that the authors duly checked the AI-generated output. Acknowledgment regarding the responsibility for all paper content also needs to be explicitly recognized by all authors. We believe that if all of these precautions are taken, non-native English-speaking researchers can safely and productively use AI to improve their scientific writing.<sup>[15,16]</sup>

## AUTHORS' CONTRIBUTIONS

AG	Collection and assembly of data, Conception and design, Data analysis and interpretation, Manuscript writing, Final approval of the manuscript.
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