International Journal of Research in Medical Sciences
Sharma A et al. Int J Res Med Sci. 2025 Jan;13(1):532-542
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20244167

Review Article

Artificial intelligence in scientific writing: opportunities and ethical considerations

Anil Sharma*, Praveen Rao, Mohammad Zubair Ahmed, Krishnakant Chaturvedi

NeoCrest Life Sciences Consulting Private Limited, New Delhi, India

Received: 10 November 2024
Revised: 03 December 2024
Accepted: 06 December 2024

***Correspondence:**
Anil Sharma,
E-mail: anil.sharma@neocrest.in

ABSTRACT

Scientific writing is a major consideration when writing a research paper, as it encompasses all aspects of the research. With the rise of digitalization, new opportunities have emerged for the development of Artificial intelligence (AI)-driven tools and algorithms designed to analyze the vast amounts of data being uploaded. It has allowed researchers and practitioners to more efficiently access and evaluate a vast array of scientific papers. This capability facilitates the connection of related studies from the past, identifies research gaps, and speeds up the processes of literature review, evidence generation, and knowledge discovery. Despite these advancements, AI tools are subject to ethical considerations, regulatory approval, compliance with data protection regulations, journal guidelines, transparency, and public perception. Some text prompts are used to instruct AI tools to generate effective information. Fostering trust and transparency with AI tools in scientific writing includes operationalizing frameworks, addressing discrepancies, reducing plagiarism, and generating new innovative ideas. Future trends suggest that AI capabilities will keep advancing and developing, underscoring the need for ethical considerations and the need to balance AI automation with human expertise. However, it cannot replace the creativity and critical thinking skills that are crucial for scientific writing and research. The key objective of this review is to discuss and assess various AI-based tools and algorithms, focusing on their key features and how they can support researchers and authors in enhancing their writing skills.

Keywords: Artificial intelligence, Scientific writing, Plagiarism, ChatGPT, ICMJE

INTRODUCTION

Artificial Intelligence (AI) has become a sophisticated tool for identifying and resolving discrepancies in scientific research. It operates through programmed algorithms to generate inputs and responses during human interaction. Medical researchers can use AI for writing articles, conducting literature reviews, summarizing data, organizing content, refining readability, and even drafting complete papers.[1] AI tools have significantly impacted key areas such as writing, grammar corrections, plagiarism detection, paraphrasing, referencing, statistical analysis, and ensuring regulatory compliance. Editors and publishers use AI for tasks like literature searches, plagiarism checks, detecting image alterations, addressing ethical concerns, prioritizing submissions, editing content, verifying references, adapting formats, and enhancing the visibility of published work.[2] Scientific research communities and universities worldwide have raised concerns about the impact of AI bots like ChatGPT on scientific communication, citing the potential to mislead readers by generating human-like text that appears to be authored by humans.[3]

However, it is becoming increasingly clear that AI-generated text can be riddled with errors, superficial, and may include irrelevant and wrong journal references and inferences. The increasing use of AI tools in research writing offers significant benefits but also presents challenges. These tools lack the ability to understand new

information, generate insights, or perform deep analysis, which are essential for meaningful scientific discourse. While effective at reiterating established knowledge, they struggle to identify or produce novel outcomes.

However, with careful utilization, these technologies can be crucial for researchers, especially those who are non-native English speakers. Furthermore, despite their sophistication, AI tools cannot completely reproduce the refined comprehension and experiential knowledge that human researchers contribute.[4] Various AI tools, including large language models (LLMs) like ChatGPT, Google Bard, Bing AI, Scite Assistant, Consensus, RapidMiner, SciSpace Copilot, and Meta's Galactica, are increasingly utilized in research publications.

The development of machine learning algorithms, such as neural networks, has led to significant advancements in computational speed and capacity.[5] The lack of training in statistical tools poses a significant challenge for researchers. Advanced AI tools help analyse data efficiently, avoid biases, recommend suitable statistical methods, and generate visual representations for presentations and publications.

AI enhances precision, effectiveness, and the credibility of research outcomes. However, it cannot replace human intelligence, creativity, or critical thinking, which remain essential in scientific writing and research. The current paper highlights the applications, benefits, and limitations of AI tools in scientific research, emphasizing their role in enhancing efficiency while acknowledging the irreplaceable value of human expertise.

POPULAR LARGE LANGUAGE MODELS (LLMS) AND THEIR FUNCTIONALITIES

LLMs are advanced systems with numerous parameters and high processing power, designed to generate natural language text in response to user input. They create algorithms, understand language, and generate coherent text by capturing word probability distributions. In addition to improved generalization and domain adaptation, LLMs seem to exhibit emergent abilities like reasoning, planning, decision-making, in-context learning, and zero-shot answering.[6] LLMs are effective across a broad spectrum of natural language processing tasks, including language translation, text summarization, question answering, and content creation.

AI models can offer advance data analytics, automated table and figure creation, language translation and localization, grammar and style editing. Additionally, the growth of subscription-based models signals a move towards making high-quality education more accessible to a wider audience, although there are concerns about the potential long-term impact on the quality of education. These paid AI models offer a vast range of options for creating and drafting manuscripts while addressing privacy concerns. Here we have discussed the most popular AI tools used in scientific writing.

ChatGPT

Generative pre-training (GPT) is among the initial autoregressive generative models built on the transformer architecture.[7] ChatGPT (https://openai.com/index/chat) by OpenAI is a member of GPT family and a LLM model that could revolutionize scientific writings. The model utilizes a deep neural network structure known as the transformer model, which employs self-attention to selectively emphasize important elements within the input data.[8] ChatGPT can transform researchers commands in advanced format, preparing the draft according to scientific guidelines, paraphrasing the sentence, editing and translating the content.

The latest version ChatGPT-4 exceeds ChatGPT-3 in terms of logical structure, language complexity, vocabulary depth, and coherence of text. The potential application of ChatGPT includes content generation, research findings, and grammatical corrections. Writing styles differ notably between humans and generative AI models GPT models use complex sentences and nominalizations, favouring sophisticated language, while human writers prefer simpler constructions and more epistemic expressions to convey attitude.

Its application implements notable paraphrasing and summarizing the context. A study found that the average plagiarism rate in texts generated by ChatGPT was 45%, indicating that nearly half of the content closely resembles the original source, raising concerns about the authenticity and originality of the paraphrased text.[9] These applications have downsides such as plagiarism, bias, copyright infringement, difficulty distinguishing reliable information, and ethical concerns. ChatGPT in healthcare systems is limited by issues like accuracy, efficiency, precision, lack of real-time fact-checking, insufficient contextual awareness, inability to create useful visual content, infringement of copyright laws, ethical issues and limited expertise in specialized domains.[10]

Scite.ai

Scite.ai (https://scite.ai/) utilizes AI advancements to generate "Smart Citations," offering detailed insights into how a scientific paper is referenced. These citations provide context, classify whether they support, contradict, or merely mention the cited claim, enhancing the understanding of the citation's significance.

This improves the easy accessibility of citations to the target journals in scientific writing.[11] The applications of scite.ai include contextual insights, literature review, research evaluation, identifying citation trends and patterns, and enhancing the discoverability of relevant categories related to journals. While Scite.ai provides innovative capabilities for analysing citations and

conducting literature reviews, researchers should recognize its limitations and consider integrating it alongside other tools in their research.

Gemini

Gemini (https://gemini.google.com/), previously known as Google Bard, is a versatile language AI that utilizes Bidirectional Encoder Representations from Transformers (BERT). This advanced model enables researchers to generate text, visualize content, receive writing assistance, translate materials, and provide accurate and comprehensive responses to queries. The advanced AI using the latest Ultra 1.0 model can manage intricate tasks such as coding, logical reasoning, and collaborative creative projects effectively.[12]

Gemini has three additional advanced prototypes Gemini pro (GPro), Gemini nano (GNano), and Gemini ultra (GUltra). Among them GPro is a sophisticated AI model created to comprehend and produce human language, facilitating interaction through both short exchanges and extended conversations, with capabilities extending to understanding and generating code, text summarization, content creation, formatting and editing.[13]

While focusing on advantages, it has limited exposure to real-world data, potentially affecting its ability to identify biases and improve interactions. Gemini provides extensive support for manuscript writing, aiming to revolutionize research. In evaluating capabilities through queries on tasks like literature review and journal suggestions, Gemini scored 100%, outperforming ChatGPT-3.5, which scored 70%. ChatGPT-3.5 underperformed in areas such as explaining scientific papers, searching bibliographic databases, and formatting references.[14]

SciSpace copilot

SciSpace (https://typeset.io/) provides instant answers and simplifies concepts, making it easier for users to navigate and understand research papers. The tool summarizes research publications and provides academics and researchers with relevant links to save time and effort. Users can also upload their own papers to extract data.[15] The tool can describe the content of documents, explain specific paragraphs, entire pieces, or sections through a chat interface. Additionally, it translates jargon, acronyms, and complex paragraphs into clear, understandable terms.[15] Although the model is free for limited access but requires a subscription with paid charges to get an access for the paid and updated version.

Trinka AI

Trinka AI (https://www.trinka.ai/), developed by Enago in New Jersey, USA, is an advanced tool designed for academic and technical writing. It offers sophisticated paraphrasing, grammar checking, and language enhancement features to improve writing tone, delivery, and phrasing in line with academic standards. With the highly accurate iThenticate text similarity detection algorithm and access to an extensive paid publication database across all scientific fields, Trinka ensures top-notch plagiarism detection.[16]

It can proofread and edit MS Word documents, evaluating manuscripts against over 20 editorial checkpoints. The citation checker tool helps users find reliable sources for citations, and the tool can match paper ideas with a vast array of publications and trends to suggest suitable journals. Trinka also allows users to create personalized dictionaries to tailor the writing experience. Table 1 enlists the additional AI tools used in scientific writing.[16,17]

ADVANCED DATA ANALYSIS: UTILIZING AI FOR COMPLEX STATISTICAL ANALYSIS, EXTRACTING INSIGHTS FROM LARGE DATASETS

Harnessing AI for sophisticated statistical analysis and insight extraction from vast datasets can greatly enhance scientific writing by providing advanced analytical capabilities, improving accuracy, and revealing hidden patterns. Here are several effective applications of AI:

Statistical models and machine learning

AI can deploy and manage intricate statistical models like Bayesian networks, neural networks, and decision trees. For instance, neural networks can model complex non-linear relationships in biological data, while Bayesian networks can elucidate probabilistic relationships in epidemiological studies. Furthermore, AI tools can automate data cleaning, preprocessing, and analysis, saving time and minimizing human error. Platforms such as IBM Watson and Google Cloud AutoML offer robust solutions for automated data analysis.[18]

Natural language processing and data mining

Natural language processing (NLP) techniques can extract relevant information from extensive text bodies, like literature reviews or research articles.[19]

Data visualization and predictive analytics

AI generates sophisticated visualizations that simplify interpreting complex data. Tools like Tableau and Power BI provide powerful data visualization capabilities, highlighting key insights and trends.[20] These tools can create dynamic dashboards to visualize the spread of infectious diseases, aiding researchers, and policymakers in informed decision-making.

Predictive analytics powered by AI forecast future trends based on historical data. In public health, they can predict the spread of diseases using current and historical data.[21]

Scientific writing and literature reviews

AI significantly enhances literature reviews by analyzing existing research to identify gaps, trends, and seminal works efficiently. Tools like Zotero and Mendeley now integrate AI features to help researchers quickly find relevant papers.[16]

AI-driven data analysis supports the conclusions in scientific papers, adding credibility and depth. Automated summarization tools, like those provided by IBM Watson, condense complex information into concise, readable summaries, facilitating the writing process.[22]

Programming and statistical tools

Programming languages like R and Python offer robust libraries for statistical analysis and machine learning, such as Scikit-Learn, Pandas, Numpy, and TensorFlow.[23] Traditional statistical tools like SPSS and SAS also have integrated AI capabilities. In summary, AI's advanced statistical models, automated data analysis, machine learning algorithms, real-time analysis, NLP, data mining, sophisticated visualizations, and predictive analytics significantly enhance the scientific writing process.

LLMs and data analytics

Using AI, particularly LLMs, to analyze large datasets offers a promising approach to data analytics. These techniques leverage reasoning and code generation to automate insight discovery, enhancing data-driven decision-making. AI helps researchers organize ideas and extract knowledge from complex datasets. Recent advancements have enabled structured dataset creation from scientific literature, addressing issues of data quality, scalability, and human bias.[24]

Clinical informatics and AI

Incorporating scientific research through clinical informatics, including genomics, proteomics, bioinformatics, and biostatistics, into clinical practice unlocks innovative patient care approaches. AI technologies can handle the enormous data generated during patient care to improve diagnosis, classification, prediction, and prognostication of diseases.[12] For example, The Camelyon Grand Challenge 2016 (CAMELYON16), a global machine learning initiative, evaluates algorithms for automated cancer detection in H&E-stained whole-slide imaging (WSI). It achieved promising results with a 92.4% tumor detection sensitivity.[25]

Additionally, neuroscience-inspired AI can enhance machine learning efficiency, especially at the edge, using large neuroimaging datasets. Tools like PACESS enable spatial analysis of biological datasets, revealing complex multi-cellular interactions in tissues like bone marrow.[26]

ETHICAL CONSIDERATIONS

Adhering to ethical norms in research and writing is essential for advancing science. Organizations like the International Committee of Medical Journal Editors (ICMJE) and the Committee on Publication Ethics (COPE) have established policies to address these issues. Most medical journals follow ICMJE's uniform guidelines, because of their ethical standards in biomedical publishing.

Common rules across guidelines

Accuracy and reliability of AI-generated content

GPT models may produce inaccurate or illogical content, known as hallucinations, due to reliance on training data patterns without understanding facts. This unverified content risks spreading misinformation. Furthermore, AI tools often rely on outdated sources, complicating the publication of current articles and raising ethical concerns in research and healthcare.[27]

Issues of plagiarism and authorship

AI tools, using advanced algorithms, excel at detecting plagiarism by comparing content against a vast range of published materials, ensuring even subtly rephrased text retains the original essence. With the rise of AI-generated content, traditional plagiarism detection tools struggle to distinguish between human-written and machine-generated text, challenging academic integrity. This has increased the need for tools tailored to detect AI-generated content.[28] Additionally, Jenkins and Lin argue that when LLMs contribute at a human-like level, they deserve appropriate credit, as failing to do so unfairly attributes all credit to human authors.[29]

Potential for misinformation and fabricated data

In a study investigating the capabilities of AI language models in generating scientific abstracts, researchers found that the generated abstracts were often indistinguishable from real abstracts and could even fool human reviewers.[30] AI models rely on extensive datasets for training, and the effectiveness of these models can be influenced by the quality and representativeness of the data. In the field of research, access to detailed and high-quality datasets may be restricted, which can result in biases or a partial understanding of specific elements. This can result in data limitations, lack of contextual understanding, knowledge gap, and limited data extraction.[31]

Impact on the integrity of scientific research, bias, and transparency

The use of AI technology in scientific research frequently suffers from a lack of transparency. For example, when AI algorithms are employed for data processing or generating

results, researchers may not fully grasp how these algorithms operate or make decisions. This lack of clarity can result in misunderstanding and misuse of the findings.[32]

COPE, along with the Journal of the American Medical Association (JAMA) and the World Association of Medical Editors (WAME), has determined that authors who use AI tools for manuscript writing, image or graphic creation, or data collection and analysis must be transparent, unbiased and clearly disclose the use of these tools and specify the particular AI tools employed in the materials and methods section of their manuscripts to ensure the ethics of research are maintained. Individual guidelines are listed in the next section.

Guidelines for disclosing AI assistance in manuscript authorship

Key regulatory bodies emphasize the necessity of transparency, accountability, and ethical use and that AI cannot fulfill authorship criteria due to its inability to declare conflicts of interest, manage publication rights, or handle licensing agreements.

Authors must fully account for AI's contributions to their manuscripts and ensure adherence to ethical standards. Below is the outline of guidelines laid down by various bodies concerning AI use in scientific writing.

International committee of medical journal editors

The International committee of medical journal editors (ICMJE) advises authors to disclose the use of AI and other tools in manuscript preparation and content development, with this information appearing in the acknowledgments or methods section. AI cannot be listed as an author since it cannot be accountable for the work.

Journals should require authors to disclose AI-assisted technologies (e.g., LLMs, chatbots) upon submission, specifying the AI's role in writing assistance, data collection, analysis, or figure generation.[33] Use of disclosure statements like “The authors acknowledge the use of ‘GPT name’ for assisting in the drafting of the manuscript. The final content was reviewed and edited by the authors" is encouraged.[33]

Committee of publications ethics

Authors must disclose the use of AI tools in manuscript preparation, detailing the extent and nature of the assistance. They are responsible for the content's integrity, ensuring AI-generated text is accurate and free of bias or errors.

AI tools, such as ChatGPT or LLMs, cannot be authors because they cannot take responsibility for the work. Authors using AI for writing, image production, or data analysis must be transparent about its use and fully accountable for the manuscript's content, liable for any ethical breaches.[34]

Nature research journals

Nature mandates that authors disclose any AI tools used for data analysis, writing, or figure generation. Authors are accountable for the accuracy of content produced with AI tools. LLMs do not meet authorship criteria, as authorship implies accountability for the work. The use of LLMs should be documented in the methods section or another suitable part of the manuscript.[35]

American psychological association

The American psychological association (APA) stresses transparency and ethical use of AI. Any AI assistance in writing or data analysis must be disclosed. Authors must ensure AI tools do not introduce bias or errors into their work.[36]

Elsevier

Elsevier's policy permits the use of generative AI and AI-assisted technologies to improve language and readability before submission, provided this is disclosed. AI cannot be listed as an author. Authors are responsible for the work's originality, ensuring that all authors qualify for authorship and that the work does not infringe third-party rights.[37]

World association of medical editors

World association of medical editors (WAME) offers guidelines for using chatbots and generative AI in academic publishing. Chatbots like ChatGPT cannot be listed as authors as they do not meet legal and ethical standards. Authors must be transparent about chatbot use, detailing their involvement in research. They are responsible for the accuracy and originality of chatbot-generated content, ensuring it is plagiarism-free and correctly attributed. Editors and reviewers should disclose any chatbot use in the manuscript review process to maintain confidentiality.[38]

Journal of the American medical association

Journal of the American medical association (JAMA) and the JAMA Network journals have set guidelines for AI use in scholarly publishing. AI tools cannot be authors, and their use must be transparently disclosed in manuscripts. AI-generated clinical images are discouraged unless part of formal research. Authors are accountable for AI-generated content, and peer reviewers must not input manuscripts into AI tools, with any assistance disclosed. These policies stress accountability, confidentiality, and human oversight, aligning with ICMJE and COPE guidelines to ensure ethical AI use in publishing.[39]

Balancing AI assistance with human oversight

Humans must consider the privacy risks and personal data implications of AI tools. Increasing reliance on AI raises concerns about younger generations losing critical assessment skills, potentially affecting scientific integrity. Regulatory challenges highlighted by Nature include intellectual property rights, quality control, standardization, informed consent, and data ownership, emphasizing the need for AI and human oversight to meet regulatory requirements.[40] Balancing AI with human oversight is crucial, with the EU Commission identifying human agency and oversight as essential for trustworthy AI. Human oversight addresses risks such as threats to autonomy, lack of transparency, unclear algorithms, privacy concerns, and potential discrimination.[41]

Real world ethical use of an AI model for writing manuscript

AI-driven tools are being explored for their ability to assist researchers, scholars, and professionals in manuscript writing, data summarization, and content creation. These models provide various services, from streamlining the writing process to enhancing text quality and clarity. Here are the examples of studies where effective text prompts were used to command ChatGPT. In one study, a medical student was tasked with writing a case study using ChatGPT. The student conducted a simple two-step experiment to assess the impact of providing ChatGPT with relevant patient information. In the first step, the student evaluated ChatGPT's response to a medical question without the patient's medical history, and in the second step, medical history was included in the prompt. The results showed that ChatGPT effectively summarized complex surgical case study data into a clear and readable medical context.[42]

In another study, ChatGPT was asked to generate mathematical expressions and formulas, such as with the prompt: "Explain how the Du Bois and Du Bois formula was developed." In response, ChatGPT provided a detailed summary and a broad range of information on the topic.[43] ChatGPT typically provides generic responses by default. Incremental prompting involves guiding it step by step to deliver answers tailored to specific interests and levels of understanding. In one experiment, ChatGPT was tasked with finding academic papers, summarizing their conclusions, providing references, and identifying areas of uncertainty. It successfully generated a draft summary, presenting the information clearly and concisely.[1]

A study investigating the levels of plagiarism in paraphrased text generated by ChatGPT found that the average plagiarism rate was 45%. The results showed a significant reduction in plagiarism in the provided texts (mean difference −0.51, 95% CI −0.54 to −0.48; $p<0.001$). Additionally, a notable decrease in plagiarism was observed when comparing the second attempt to the initial one (mean difference −0.06, 95% CI −0.08 to −0.03; $p<0.001$).[9] In a blinded, randomized, non-inferiority-controlled study comparing GPT-4's introduction sections with human-written ones in a medical journal, there were no significant differences in content quality. Most assessors (59%) preferred GPT-4's introductions over human-written ones (33%). The results indicated that GPT-4 could be a valuable tool for writing introduction sections, with future research needed to explore its effectiveness in other parts of scientific papers.[44]

Table 1: Overview of additional AI tools to assist in scientific writing.

S. no.	Tool	Applications	Web address/URL
1.	Consensus.ai	Used for searching relevant references and understanding the content of research	https://consensus.app/
2.	Word tune	Used for teaching paraphrasing skills	https://www.wordtune.com/
3.	Microsoft editor	Spelling and grammar checking, plagiarism detection, vocabulary enhancement	https://www.microsoft.com/en-in/microsoft-365/microsoft-editor
4.	DeepL translator	Accurate translation, privacy, and security	https://www.deepl.com/en/translator
5.	Reverso translation	Contextual translation, conjugation and grammar, collaborative translation	https://www.reverso.net/text-translation
6.	Ludwig.guru	Text generation, text summarization	https://ludwig.guru/
7.	Hyperwrite	Streamline Writing and content creation	https://www.hyperwriteai.com/
9.	RapidMiner	Visualization and reporting, data mining, and text mining	https://altair.com/altair-rapidminer
10.	Bing AI	Writing assistance, translation, and grammatical correction	https://www.bing.com/chat
11.	Bio render	Scientific image and illustrations	https://www.biorender.com/
12.	Scinapse	Finding R&D trends, aggregating and analyzing academic papers	https://www.scinapse.io/
13.	Sourcely	Finding, summarizing, and formatting sources for academic paper	https://www.sourcely.net/
14.	Lit Maps	Filter results by date range, author, and keyword and allows access to second-order citations from a discovery graph	https://www.litmaps.com/

DATA PRIVACY AND SECURITY: RISKS ASSOCIATED WITH DATA PRIVACY WHEN USING AI

While AI offers remarkable assistance for manuscript writing, the use of such tools raises serious data privacy and security concerns, particularly when dealing with sensitive information governed by regulations like GDPR (General Data Protection Regulation) and HIPAA (Health Insurance Portability and Accountability Act).

While AI-powered code understanding systems like OpenAI Codex and GitHub Copilot offer significant benefits, they also pose a risk of inadvertently generating code containing sensitive information. This can lead to unauthorized access and misuse.[45] AI cannot assume responsibility for content, requiring human authors to ensure accuracy, ethics, and ownership while using it as a collaborative tool with caution.

Using AI in medical writing requires prioritizing health data protection. HIPAA's Privacy Rule sets standards for safeguarding personal health information (PHI), focusing on consent, data minimization, and security.

Additional state laws often enhance these protections, addressing local issues and ensuring compliance with federal and state regulations. Adhering to these guidelines allows organizations to leverage AI while maintaining patient privacy and confidentiality.[46]

Compliance with data protection regulations

To effectively navigate the complexities of GDPR and HIPAA compliance when utilizing AI systems, organizations can adopt the following strategies.

Data minimization

Limit the data collected to only what is essential for AI operations. Evaluate and implement algorithms that require minimal user information to function effectively, thereby reducing the risk of data misuse.[47]

Consent and transparency

Develop user-friendly consent mechanisms that not only obtain explicit permission for data usage but also provide clear, concise information about how AI will process and utilize their data. This can be achieved through easily accessible privacy notices and user agreements.[48]

Right to be forgotten

Integrate robust data management systems that allow users to request the deletion of their personal data effortlessly. Ensure that AI systems are equipped with features to permanently remove data upon request, maintaining user trust.[49]

Conducting data protection impact assessments (DPIAs)

Implement a proactive approach by continually assessing potential data privacy risks associated with AI processing. Establish a framework for regular DPIAs that lead to the timely identification of risks and the adoption of necessary mitigation strategies.[50]

Securing protected health information (PHI)

Employ advanced encryption methods and strict access controls to safeguard PHI processed by AI. Regularly update security protocols to counter emerging threats and ensure compliance with HIPAA standards.[51]

De-identification practices

Create a systematic approach for de-identifying health data prior to AI processing, ensuring that identifiable information is either removed or adequately disguised/ redacted unless explicit consent is secured from individuals.

Implementing audit trails

Integrate comprehensive audit trail functionalities within AI systems to monitor and log into all access to PHI. This not only enhances accountability but also equips organizations to respond promptly to compliance inquiries or potential breaches.[51]

By adhering to these strategies, organizations can effectively leverage AI technologies in their publication work involving personal information, while also maintaining compliance with GDPR and HIPAA, ultimately fostering trust and safeguarding user privacy.

PUBLIC PERCEPTION AND TRUST: IMPACT OF AI ON PUBLIC PERCEPTION OF SCIENTIFIC RESEARCH AND WRITING

Given that AI has the capability to enhance grammatical accuracy and provide relevant data, authors, editors, and readers need to be more vigilant about ensuring the trustworthiness and reliability of the information presented. A study suggests that enhancing public awareness of AI and robotic autonomous systems, along with their potential applications and usage contexts, will help manage expectations and address our inherent resistance to change. Additionally, the significant time-saving benefits of AI usage contribute greatly to its positive impact.[52]

Organizations like the European Commission's High-level Expert Group on AI (HLEG) have taken the stance that AI is a technology we can, and should, place our trust in.[53] However, few studies suggests that LLMs do not possess extensive problem-solving capabilities and have difficulty managing uncertain inputs, which leads to inaccuracies.[54] Due to the uncertainty and lack of updated data, trusting

AI tools and their information remains an open question. Public trust in technology is greatly affected by the privacy aspects of its implementation.

Strategies for fostering trust and transparency in AI-assisted manuscript writing

Kullback–Leibler Divergence (KLD) measures the disparity between two probability distributions. It is commonly used to assess the accuracy of statistical models or to determine the amount of information lost when approximating one distribution with another.[55] In November 2021, UNESCO introduced a recommendation on the Ethics of AI in Paris, emphasizing principles such as proportionality and non-harm, safety and security, fairness and non-discrimination, sustainability, privacy and data protection, responsibility and accountability, awareness and literacy, and multi-stakeholder governance.

These guidelines are designed to enhance trust and transparency in AI systems.[56] Although these models have some limitations, they are capable of understanding intricate academic concepts and improving text quality. Any modifications to the manuscript are monitored with a version control system, providing clear differentiation between human-written and machine-generated content.[57]

The use of AI image generation methods, like Generative Adversarial Networks (GANs), in medical manuscript writing is growing rapidly. These techniques can produce high-quality images customized for the manuscript's needs without direct human input. Advanced AI tools, such as IBM Watson Discovery, can streamline and accelerate the literature review process. They efficiently identify pertinent references, aiding in the generation of research ideas and the exploration of potential new treatments.[58] Figure 1 demonstrates several strategies to foster trust and transparency in AI.[59]

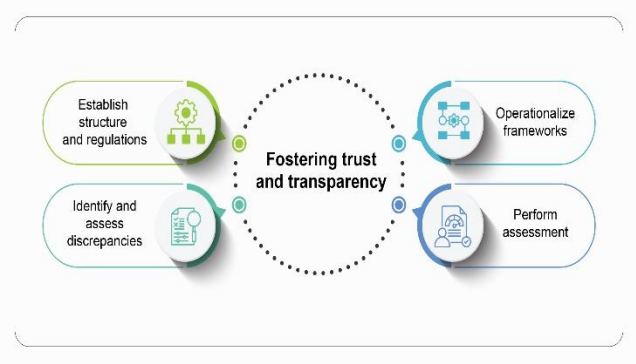

Figure 1: Strategies to ensure trust and transparency in AI.

Future trends and potential challenges

It's essential to inform researchers and academics about both the strengths and limitations of LLMs, as well as the possible risks linked to their usage. This could include offering training on effective methods for utilizing LLMs in research and highlighting the need to uphold academic integrity. There are two key approaches for advancing AI, first, enhancing the quality of content produced and published in the future; and second, implementing reviews of existing public content to uncover and address any overlooked issues, ensuring improvements for more effective use.[60] The accuracy and consistency of an AI system are frequently constrained by the quality of its training data and the hardware on which it runs.

Currently, there are no established regulations or guidelines to determine legal responsibility when AI fails or causes harm while delivering a service. For AI models to function effectively and accurately, a vast amount of data is required. Future outlooks indicate that AI capabilities will continue to expand and evolve, highlighting the importance of ethical considerations and balancing AI automation with human expertise.

The potential for AI to increasingly integrate into daily tasks and professional roles, and its impact on publishers by boosting efficiency and creativity, presents an exciting prospect for future advancements in AI technology. AI faces challenges beyond future trends, including outdated information, privacy concerns, algorithmic bias, transparency, computing demands, trust deficits, unreliable results, data scarcity, misconduct, tone misinterpretation, and socio-economic impacts like job losses.

CONCLUSION

AI tools provide a robust platform for researchers to enhance writing skills. Our review highlights their advantages and pitfalls in scientific and manuscript writing. Starting a research project requires reviewing existing literature, a time-consuming process prone to missed insights without experience or clear guidelines. AI tools streamline this by organizing data efficiently, aiding adaptation to technological advancements and fostering effective human-AI collaboration. Over-reliance on AI can lead to insufficient understanding of the material, which in turn can result in being under prepared for future assignments.

Moreover, AI can enable plagiarism, undermining the integrity of the learning environment. This study highlights guidelines on AI tools' ownership and authorship as discussed in scientific journals. AI contributions must be acknowledged, but AI tools cannot qualify for authorship as they lack responsibility, cannot declare conflicts of interest, or handle copyright agreements. AI should assist in writing, not research, with all content verified by authors.

To mitigate risks of errors and biases, human researchers must thoroughly validate work generated by LLMs. AI tools offer rapid context and data insights, addressing gaps in research and writing within limited timeframes.

While they streamline the research process and manuscript preparation, their limitations-such as lack of context, originality, accuracy, ethics, coherence, and critical analysis must be recognized. These tools complement but cannot replace human expertise and oversight. Further research is essential to better understand their capabilities and limitations, ensuring their ethical and effective use in science.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Salvagno M, Taccone FS, Gerli AG. Can artificial intelligence help for scientific writing? Critical care. 2023;27(1):75.
2. 2. Bahammam AS, Trabelsi K, Pandi-Perumal SR, Jahrami H. Adapting to the impact of artificial intelligence in scientific writing: balancing benefits and drawbacks while developing policies and regulations. J Nat Sci Med. 2023;6(3):152-8.
3. Else H. By Chatgpt fool scientists. Nature. 2023;613:423.
4. Yasin YM, AL-Hamad A. Harnessing AI for enhancing scientific writing in nursing research: Prospects, pitfalls, and solutions. Wiley Online Library. 2023: 379-80.
5. Hosseini M, Rasmussen LM, Resnik DB. Using AI to write scholarly publications. Taylor & Francis. 2023: 1-9.
6. Naveed H, Khan AU, Qiu S, Saqib M, Anwar S, Usman M, et al. A comprehensive overview of large language model:230706435. 2023. Available at: https://arxiv.org/abs/2307.06435. Accessed on 05 May 2024.
7. Kocoń J, Cichecki I, Kaszyca O, Kochanek M, Szydło D, Baran J, et al. ChatGPT: Jack of all trades, master of none. Information Fusion. 2023;99:101861.
8. Huang J, Tan M. The role of ChatGPT in scientific communication: writing better scientific review articles. American J Canc Res. 2023;13(4):1148.
9. Hassanipour S, Nayak S, Bozorgi A, Keivanlou MH, Dave T, Alotaibi A, et al. The Ability of ChatGPT in Paraphrasing Texts and Reducing Plagiarism: A Descriptive Analysis. JMIR Med Educ. 2024;10:53308.
10. Dave T, Athaluri SA, Singh S. ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations. Frontiers in Artif Intellig. 2023;6:1169595.
11. Nicholson JM, Mordaunt M, Lopez P, Uppala A, Rosati D, Rodrigues NP, et al. scite: A smart citation index that displays the context of citations and classifies their intent using deep learning. Quantitative Science Studies. 2021;2(3):882-98.
12. Alhur A. Redefining healthcare with artificial intelligence (AI): the contributions of ChatGPT, Gemini, and Co-pilot. Cureus. 2024;16:4.
13. Islam R, Ahmed I. Gemini-the most powerful LLM: Myth or Truth. In2024 5th Information Communication Technologies Conference (ICTC). 2024;303-308. Available at: https://ieeexplore.ieee.org/abstract/document/10602253. Accessed on 17 May 2024
14. AlSagri HS, Farhat F, Sohail SS, Saudagar AKJ. ChatGPT or Gemini: Who Makes the Better Scientific Writing Assistant? Journal of Academic Ethics. 2024:1-5.
15. Jain SJ, Sibbu K, Kuri R. Conducting Effective Research using SciSpace: A Practical Approach. Authorea Preprints. 2023. Available at: https://www.techrxiv.org/doi/full/10.22541/au.170111059.99508682. Accessed on 05 May 2024
16. Jhajj KS, Jindal P, Kaur K. Use of Artificial Intelligence Tools for Research by Medical Students: A Narrative Review. Cureus. 2024;16(3):55367.
17. Chen TJ. ChatGPT and other artificial intelligence applications speed up scientific writing. Journal of the Chinese Medical Association. 2023;86(4).
18. Abdullah AA, Hassan MM, Mustafa YT. A review on bayesian deep learning in healthcare: Applications and challenges. IEEE Access. 2022;10:36538-62.
19. 1Younis HA, Ruhaiyem NIR, Ghaban W, Gazem NA, Nasser M. A systematic literature review on the applications of robots and natural language processing in education. Electronics. 2023;12(13):2864.
20. Suganthalakshmi T, Saravanakumar M. DATA VISUALIZATION IN THE DIGITAL AGE. PRERANA: Journal of Management Thought & Practice. 2024;16(1).
21. Saad R, Ali H, Ayesha S, Ahmad Yousaf G, Hafiz Khawar H. Harnessing Predictive Power: Exploring the Crucial Role of Machine Learning in Early Disease Detection. JURIHUM. 2023;1(2):302-15.
22. Khan B, Shah ZA, Usman M, Khan I, Niazi B. Exploring the landscape of automatic text summarization: a comprehensive survey. IEEE Access. 2023. Available at: https://ieeexplore.ieee.org/abstract/document/10272614. Accessed on 05 May 2024.
23. Khandare A, Agarwal N, Bodhankar A, Kulkarni A, Mane I, editors. Analysis of Python Libraries for Artificial Intelligence. Intelligent Computing and Networking; 2023 2023//; Singapore: Springer Nature Singapore. Available at: https://link.springer.com/chapter/10.1007/978-981-99-0071-8_13#citeas. Accessed on 05 April 2024.
24. Gandomi AH, Chen F, Abualigah L. Big Data Analytics Using Artificial Intelligence. Electronics. 2023;12(4):957.
25. Liu Y, Gadepalli K, Norouzi M, Dahl GE, Kohlberger T, Boyko A, et al. Detecting cancer metastases on gigapixel pathology images. arXiv preprint arXiv:170302442. 2017. Available at:

https://arxiv.org/abs/1703.02442. Accessed on 05 April 2024.
26. Adams G, Tissot F, Liu C, Brunsdon C, Duffy K. PACESS: Practical AI-based Cell Extraction and Spatial Statistics for large 3D biological images. 2022.
27. Carobene A, Padoan A, Cabitza F, Banfi G, Plebani M. Rising adoption of artificial intelligence in scientific publishing: evaluating the role, risks, and ethical implications in paper drafting and review process. Clin Chem Labor Med (CCLM). 2024;62(5):835-43.
28. Neysani M, Elhambakhsh SE, Nikbakht A. AI-English Language Generated Content: Navigating the Fine Line Between Originality and Plagiarism. Research in English Language Pedagogy. 2024. Available at: https://sanad.iau.ir/Journal/relp/Article/897181. Accessed on 05 April 2024.
29. Hosseini M, Resnik DB, Holmes K. The ethics of disclosing the use of artificial intelligence tools in writing scholarly manuscripts. Research Ethics. 2023;19(4):449-65.
30. Dathathri S, Madotto A, Lan J, Hung J, Frank E, Molino P, et al. Plug and play language models: A simple approach to controlled text generation. arXiv preprint arXiv:191202164. 2019.
31. Sharma H, Ruikar M. Artificial intelligence at the pen's edge: Exploring the ethical quagmires in using artificial intelligence models like ChatGPT for assisted writing in biomedical research. Perspectives in Clinical Research. 2024;15(3):108-15.
32. Chen Z, Chen C, Yang G, He X, Chi X, Zeng Z, et al. Research integrity in the era of artificial intelligence: Challenges and responses. Medicine. 2024;103(27):38811.
33. Editors ICoMJ. Defining the Role of Authors and Contributors: International Committee of Medical Journal Editors 2024 Available at: https://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html. Accessed on 05 April 2024.
34. COPE. Authorship and AI tools - COPE position statement 2023. Available at: https://publicationethics.org. Accessed on 21 August 2024.
35. Nature. Nature Portfolio - Artificial Intelligence (AI) 2024. Available at: https://www.nature.com. Accessed on 21 Augus 2024.
36. Association AP. APA Journals policy on generative AI: Additional guidance 2023. Available at: https://www.apa.org. Accessed on 22 August 2024.
37. Elsevier. Elsevier Policies - Publishing ethics 2024. Available at: https://www.elsevier.com. Accessed on 24 Augiust 2024.
38. Zielinski C, Winker MA, Aggarwal R, Ferris LE, Heinemann M, Lapeña Jr JF, et al. Chatbots, generative AI, and scholarly manuscripts: WAME recommendations on chatbots and generative artificial intelligence in relation to scholarly publications. Colombia Médica. 2023;54(3).
39. Flanagin A, Kendall-Taylor J, Bibbins-Domingo K. Guidance for Authors, Peer Reviewers, and Editors on Use of AI, Language Models, and Chatbots. JAMA. 2023;330(8):702-3.
40. Meskó B, Topol EJ. The imperative for regulatory oversight of large language models (or generative AI) in healthcare. Digital Medicine. 2023;6(1):120.
41. Koulu R. Proceduralizing control and discretion: Human oversight in artificial intelligence policy. Maastricht Journal of European and Comparative Law. 2020;27(6):720-35.
42. Ho WLJ, Koussayer B, Sujka J. ChatGPT: Friend or foe in medical writing? An example of how ChatGPT can be utilized in writing case reports. Surg Pract Sci. 2023;14:100185.
43. Zheng H, Zhan H. ChatGPT in scientific writing: a cautionary tale. American J Med. 2023;136(8):725-6.
44. Sikander B, Baker JJ, Deveci CD, Lund L, Rosenberg J. ChatGPT-4 and human researchers are equal in writing scientific introduction sections: a blinded, Randomized, Non-inferiority Controlled Study. Cureus. 2023;15(11):49019.
45. Adhyapak S, Nair S, Mogare H. Data Privacy and Security Risks in AI-Based Code Understanding. Int J Res App Sci Engin Technol. 2024;12(6):1913-21.
46. Humphrey BA. Data privacy vs. innovation: A quantitative analysis of artificial intelligence in healthcare and its impact on HIPAA regarding the privacy and security of protected health information: Robert Morris University; 2021.
47. Ganesh P, Tran C, Shokri R, Fioretto F. The Data Minimization Principle in Machine Learning. arXiv preprint arXiv:240519471. 2024.
48. Wulf AJ, Seizov O. "Please understand we cannot provide further information": evaluating content and transparency of GDPR-mandated AI disclosures. AI & Society. 2024;39(1):235-56.
49. Hutt S, Das S, Baker RS. The Right to Be Forgotten and Educational Data Mining: Challenges and Paths Forward. International Educational Data Mining Society. 2023.
50. Georgiadis G, Poels G. Establishing a Comprehensive Privacy Impact Assessment Methodology for Big Data Analytics in Compliance with the General Data Protection Regulation. Available at SSRN 4757166.
51. Amin MA, Tummala H, Shah R, Ray I. Balancing Patient Privacy and Health Data Security: The Role of Compliance in Protected Health Information (PHI) Sharing. arXiv preprint arXiv:240702766. 2024.
52. Artificial Intelligence: Public Perception, Attitude and Trust. 2023. Available at: https://www.bristows.com/app/uploads. Accessed on 18 August 2024.
53. Ryan M. In AI we trust: ethics, artificial intelligence, and reliability. Science and Engineering Ethics. 2020;26(5):2749-67.
54. Thorne S. Understanding the Interplay between Trust, Reliability, and Human Factors in the Age of Generative AI. International Journal of Simulation: Systems, Science & Technology. 2024;25:(1):1.

55. Lovric M. International encyclopedia of statistical science. (No Title). 2011.
56. Díaz-Rodríguez N, Del Ser J, Coeckelbergh M, López de Prado M, Herrera-Viedma E, et al. Connecting the dots in trustworthy Artificial Intelligence: From AI principles, ethics, and key requirements to responsible AI systems and regulation. Information Fusion. 2023;99:101896.
57. Pividori M, Greene CS. A publishing infrastructure for Artificial Intelligence (AI)-assisted academic authoring. J Am Med Informat Asso. 2024;31(9):2103-13.
58. Hajji R. Artificial intelligence–assisted technology medical manuscript writing: new challenges for reviewers and editors. Telehealth and Medicine Today. 2024;9(1):1.
59. Mylrea M, Robinson N. Artificial Intelligence (AI) Trust Framework and Maturity Model: Applying an Entropy Lens to Improve Security, Privacy, and Ethical AI. Entropy (Basel). 2023;25(10):1.
60. Razack HIA, Mathew ST, Saad FFA, Alqahtani SA. Artificial intelligence-assisted tools for redefining the communication landscape of the scholarly world. Science Editing. 2021;8(2):134-44.

Cite this article as: Sharma A, Rao P, Ahmed MZ, Chaturvedi K. Artificial intelligence in scientific writing: opportunities and ethical considerations. Int J Res Med Sci 2025;13:532-42.