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Artificial Intelligence As A Tool For Scientific Writing

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Abstract: The advent of Artificial Intelligence (AI) has significantly transformed the landscape of scientific writing, offering tools that enhance efficiency, accuracy, and accessibility. AI-powered platforms such as ChatGPT, Grammarly, and Quillbot provide researchers with capabilities ranging from grammar refinement to content generation, citation management, and even plagiarism detection. These tools streamline the writing process, enabling scientists to focus more on data interpretation and innovative thinking. However, the integration of AI in scientific writing also poses challenges. Over-reliance on AI may result in a lack of originality, ethical concerns over authorship, and potential propagation of misinformation if outputs are not critically evaluated. This paper explores the multifaceted role of AI in scientific writing, examining its benefits, limitations, and ethical implications. By analyzing the functionalities of various AI-based tools, this study aims to provide a balanced perspective on how AI can be optimally utilized to complement human expertise in producing high-quality scientific literature.

Keywords: Artificial intelligence, scientific writing, pros, cons

I. INTRODUCTION:

Scientific research plays a crucial role in modern society, driving innovation, informing policy decisions, and shaping public opinion. However, communicating scientific findings to the general population can be challenging, as scientific research is often highly technical and complex, requiring a deep understanding of specialized terminology and concepts. Artificial intelligence (AI) is a branch of computer science that allows machines to work efficiently, can analyse complex data. The research focused on AI has increased tremendously, and its role in healthcare service and research is emerging at a greater pace. This review elaborates on the opportunities and challenges of AI in healthcare and pharmaceutical research.(1)

Artificial intelligence (AI) is an emerging tool in multiple research areas including healthcare and has been suggested to assist communication also with patients. Using AI language models to create lay abstracts for scientific articles has the potential to improve uniformity and accuracy in the language used to communicate scientific concepts while also reducing the possibility of misinterpretation or bias. This can be done by the researchers themselves when producing a scientific report, but also by any interested reader after publication in almost any selected language. Furthermore, AI language models may be trained on massive volumes of data, allowing them to provide lay abstracts tailored to certain audiences or fields of research, hence increasing accessibility and engagement. Also, the application of AI will have a significant impact on healthcare education, with the ability to develop summaries tailored to the knowledge level of student groups, allowing them to access complex scientific content.(2)

Artificial intelligence (AI) is the replication of human intelligence by a system or machine. The goal of artificial intelligence (AI) is to create a machine that can think like a human and emulate human activities such as perception, reasoning, learning, planning, and prediction. Intelligence is one of the primary attributes that distinguish humans from animals. With the persistent occurrence of industrial revolutions, a rising number of machine types continue to replace human labor in all sectors of life, and the approaching replacement of human resources by machine intelligence is the upcoming major challenge to be met. Many scientists are focused on the topic of AI, making the research rich and diversified. AI study areas include search algorithms, knowledge graphs, natural language processing, expert systems, evolution algorithms, machine learning (ML), deep learning (DL), and others.(1)

AI development involves perceptual, cognitive, and decision-making intelligence. Perceptual intelligence refers to a machine's core human-like abilities such as vision, hearing, and touch. Cognitive intelligence refers to the higher-level ability to reason, infer, and acquire knowledge. It is motivated by cognitive science, brain science, and brain-like intelligence to provide machines with thinking logic and cognitive abilities comparable to humans. Once a machine has perception and cognition abilities, it is frequently expected to make optimal decisions as humans do in order to improve people's lives, industrial manufacturing, and other areas. To make optimal decisions, applied data science, social science, decision theory, and managerial science must be used in conjunction with data science. To attain perceptual intelligence, cognitive intelligence, and decision-making intelligence, an AI infrastructure layer supported by data, storage and computing capacity, ML algorithms, and AI frameworks is necessary. Then, using training models, it may learn the internal laws of data to support and implement AI applications.(1)

II.COMMON SOFTWARE USED FOR SCIENTIFIC WRITING:

1. ChatGPT:

ChatGPT is a chatbot developed by OpenAI and launched on November 30, 2022. Based on large language models, it enables users to refine and steer a conversation towards a desired length, format, style, level of detail, and language. At each level of the interaction, context is provided by subsequent user prompts and responses. Although a chatbot's primary goal is to simulate a human conversationalist, ChatGPT is adaptable. (3)Among numerous instances, it can design and debug computer programs; produce music, teleplays, fairy tales, and student essays; answer test questions (sometimes at a level higher than the typical human test-taker), Create business ideas, write poetry and song lyrics, translate and summarize text, replicate a Linux system, simulate full chat rooms, play games like tic-tac-toe, and simulate an ATM.(4)

2. Perplexity:

Perplexity AI is an AI-chatbot-powered research and conversational search engine that answers queries using natural language predictive text. Launched in 2022, Perplexity generates answers using sources from the web and cites links within the text response. Perplexity's main product is its search engine, which relies on natural language processing. It interprets the context of the user queries to provide a personalized search result. Perplexity summarizes the search results and gives a text with inline citations. It prioritizes newer sources to avoid outdated information and allows users to ask follow-up questions that are interpreted in the same context.

3. Copy.ai:

Copy AI is an artificial intelligence writing tool that uses machine learning to generate various types of content, including blog headlines, emails, social media content, web copy, and more. Built on top of OpenAI's GPT-3 large language model (LLM), Copy AI is designed to help users with the copywriting process. It provides various tools and writing frameworks to help get you started, is available in more than 25 languages, and is a great tool for beginners to get familiar with generative AI. Copy AI is one of the easiest generative AI programs to use. You can easily generate content for anything you like with a simple interface and excellent tools.

4. Consensus:

Consensus, based on artificial intelligence, quickly collects and organizes scientific research data. This tool allows efficient navigation of relevant scientific and research findings. It will take a question and search of established research literature to find the most relevant articles, including highlighting those with systematic reviews, high citation counts, and RCTs. It provides one-line summaries of each article and where it has enough good-quality sources will also give an overall summary.

5. DALL·E 3:

DALL·E 3 is an image generator by OpenAI, the creator of ChatGPT. It's very simple to use—it runs in ChatGPT—and it produces interesting results, no matter if you've just started writing image prompts or are

already a master. A great choice to begin exploring the realm of AI image generation. DALL-E, an image generation AI model developed by OpenAI. It has enhancements in image generation capabilities, improved understanding of context, or expanded creativity in generating images from textual descriptions.

6. Synthesia:

Synthesia is an AI company that specializes in synthetic media production, particularly focused on AI-generated video production. They offer a platform that allows users to create high-quality videos using AI-generated avatars that can speak in multiple languages and convey various emotions. It is an AI company at the forefront of synthetic media production, offering a platform that enables users to create high-quality videos using AI-generated avatars. These avatars, customizable in appearance and capable of expressing various emotions, serve as virtual speakers delivering content in multiple languages. With a user-friendly interface, it empowers users to effortlessly produce professional-looking videos without the need for advanced technical skills. Beyond its multilingual support and emotional expressiveness, it emphasizes customization and personalization, allowing users to tailor videos to their branding requirements. Its applications span diverse industries, including corporate communications, e-learning, marketing, and entertainment, reflecting its versatility and potential for engaging global audiences. As it continues to innovate and refine its technology, advancements in avatar realism, language support, and feature expansion are anticipated, further enhancing its position as a leader in AI-driven video production.

7. QuillBot:

QuillBot is a writing assistant powered by artificial intelligence (AI) that helps individuals generate high-quality articles. It employs NLP algorithms to improve grammar and style, rewrite and paraphrase sentences, and raise overall work coherence. Its ability to paraphrase and rephrase language is one of its key capabilities. This could be especially handy if you want to maintain your study work original and free of plagiarism while incorporating material from earlier sources. It may also summarize a research paper and suggest alternative language and phrase structures to help you put your ideas into your own words. It might help you add diversity to your writing by suggesting various sentence structures. This feature can improve the readability and flow of your research articles, hence increasing reader engagement.

8. Gradescope:

Widely used in educational institutions, Gradescope is an AI-powered grading and feedback tool. The time and effort needed for instructors to grade assignments, exams, and coding projects are greatly reduced by automating the process. Its machine-learning algorithms can decipher code, recognize handwriting, and provide students with in-depth feedback.

9. Elicit:

Elicit is an AI-driven research platform that makes it simpler to gather and analyze data. It uses NLP approaches to glean insightful information from unstructured data, including polls, interviews, and social media posts. Researchers can quickly analyze huge amounts of text with Elicit to find trends, patterns, and sentiment. Using the user-friendly Elicit interface, researchers can simply design personalized surveys and distribute them to specific participants. To ensure correct and pertinent data collection, the tool includes sophisticated features, including branching, answer validation and skip logic.

10. Semantic Scholar:

Semantic Scholar is an AI-powered academic search engine that prioritizes scientific content. It analyses research papers, extracts crucial information, and generates recommendations that are pertinent to the context using machine learning and NLP techniques. Researchers can use Semantic Scholar to research related works, spot new research trends, and keep up with the most recent advancements in their fields.

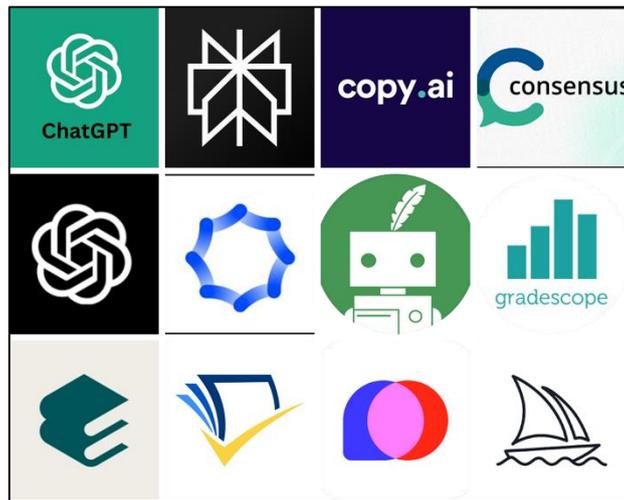


Fig 1. Common AI tools

III.PROS OF AI:

1. MORE POWERFUL REFERENCING:

In contemporary research endeavors, the advent of AI has ushered in an era of unparalleled efficiency and depth in literature review processes through the concept of power referencing. By harnessing the capabilities of artificial intelligence, researchers can now navigate vast repositories of academic papers, patents, and other scholarly sources with unprecedented speed and precision. This transformative capability not only expedites the discovery of relevant literature but also enables the identification of emerging trends, patterns, and gaps in knowledge across diverse fields. Moreover, AI-driven search engines equipped with advanced natural language processing algorithms offer researchers enhanced search capabilities, ensuring more accurate and contextually relevant results. Through automated citation and referencing, AI further streamlines the scholarly writing process, promoting consistency and accuracy while freeing researchers to focus on critical analysis and interpretation tasks. Ultimately, power referencing with AI empowers researchers to synthesize cross-disciplinary insights, stay abreast of real-time developments, and propel the frontier of human knowledge forward with unprecedented efficiency and efficacy.(5)

2. BETTER UNDERSTANDING OF PROBLEMS:

AI offers a significant advantage in research by facilitating a better understanding of complex problems. Through advanced data analysis techniques, machine learning algorithms, and predictive modeling, AI can uncover hidden patterns, correlations, and insights within large and heterogeneous datasets that may be challenging for human researchers to discern. By processing vast amounts of data, AI can identify nuisances and interdependencies that contribute to a more comprehensive understanding of the underlying problem. Additionally, AI systems can simulate scenarios and predict outcomes, allowing researchers to explore potential solutions and their impacts before implementation. This capability not only accelerates the research process but also enables researchers to make more informed decisions based on evidence-driven insights. Overall, AI empowers researchers to delve deeper into the intricacies of complex problems, leading to more effective strategies and innovative solutions across various domains.(5)

3. ASKING BETTER RESEARCH QUESTIONS:

AI presents a remarkable advantage in research by facilitating the formulation of better research questions. Through its ability to analyze vast amounts of data, identify patterns, and generate insights, AI systems can uncover latent relationships and trends that may elude human researchers. By leveraging machine learning algorithms, natural language processing, and data mining techniques, AI can assist researchers in refining their inquiries, leading to more precise and focused research questions. Additionally, AI-driven tools can analyze existing literature, identify gaps in knowledge, and suggest areas for further exploration, thereby guiding researchers toward more impactful research inquiries. This iterative process of question refinement and exploration not only enhances the relevance and significance of research endeavors but also accelerates the pace of discovery and innovation across diverse fields. Overall, AI empowers researchers to ask more incisive and relevant questions, driving forward the frontiers of knowledge and understanding.(5)

4. IMPROVING RESEARCH DESIGN:

AI offers a significant advantage in research by improving research design through its advanced analytical capabilities and predictive modeling techniques. By analyzing vast amounts of data from various sources, AI can identify relevant variables, detect patterns, and uncover insights that inform the development of robust research methodologies. Machine learning algorithms can assist researchers in optimizing experimental designs, sample sizes, and data collection strategies to ensure statistical validity and reliability.(5) Moreover, AI-driven simulations enable researchers to explore different scenarios and evaluate the potential outcomes of experimental interventions before implementation, thereby enhancing the efficiency and effectiveness of research protocols. Overall, AI empowers researchers to design more rigorous and insightful studies, leading to more reliable findings and a deeper understanding of complex phenomena across diverse fields of inquiry.

5. GENERATING STUB DATA:

AI offers a valuable advantage in research by automating the generation of stub data, which serves as placeholder or simulated data for testing and validation purposes. Through techniques such as generative adversarial networks (GANs) and probabilistic modeling, AI systems can create synthetic datasets that closely mimic the characteristics of real-world data while safeguarding privacy and confidentiality. This capability is particularly beneficial in fields where access to large, diverse datasets is limited or where sensitive information must be protected. By generating stub data, researchers can conduct preliminary analyses, develop and refine algorithms, and validate research methodologies without relying solely on actual data, thus accelerating the research process and mitigating risks associated with data scarcity or privacy concerns. Overall, AI enables researchers to overcome data limitations and expedite research progress by providing high-quality simulated data for experimentation and validation purposes.

6. TRANSFORMING DATA:

Qualitative research, in particular, can benefit a lot from this feature of AI tools, because this type of research takes as possible input data much richer and more complex content that not always can be processed straight away, such as pictures, documents, and either video or audio recorded interviews. Transforming those rich data into data that can be more systematically analyzed is indeed a very time and effort-consuming task. For quantitative researchers, AI tools can contribute to improving the visual representation of research findings. By analyzing data patterns and trends, for example, these tools can generate interactive visualizations, infographics, or charts that effectively convey complex information. This assists researchers in presenting their results in a visually compelling and understandable manner, facilitating comprehension and reader engagement.

7. ANALYSING DATA:

AI presents a significant advantage in research through its unparalleled ability to analyze data. By leveraging advanced machine learning algorithms, statistical techniques, and computational methods, AI systems can process vast and complex datasets with remarkable speed and accuracy. These systems can identify patterns, correlations, and trends within the data that may not be readily apparent to human researchers, thus uncovering valuable insights and driving discovery. Moreover, AI can perform sophisticated data mining tasks, extract actionable information, and generate predictive models to anticipate future trends or outcomes. Additionally, AI-powered analytics tools can handle diverse types of data, including structured and unstructured data, enabling researchers to gain comprehensive insights from a wide range of sources. Ultimately, AI enhances the research process by enabling researchers to extract meaningful knowledge from data more efficiently and effectively, leading to informed decision-making and breakthrough discoveries across various fields.

8. REPORTING:

AI offers a significant advantage in research through its ability to streamline and enhance the reporting process. By automating various aspects of report generation, AI systems can significantly reduce the time and effort required for researchers to compile and present their findings. Natural language processing (NLP) algorithms enable these systems to analyze and summarize large volumes of data, academic papers, and other sources, extracting key insights and generating coherent and informative reports. Additionally, AI-powered tools can assist researchers in organizing data visualizations, creating interactive dashboards, and formatting reports according to specific guidelines or standards. This not only improves the readability and accessibility of research findings but also ensures consistency and accuracy in reporting. Moreover, AI can facilitate real-time updates and revisions to reports, keeping them current and relevant. (5)Grammarly is an online writing assistance tool that is already very popular among researchers. Its features include grammar and spelling checks, style suggestions, and even plagiarism detection. This is analogous to a copilot tool for general writing. This tool became so popular that there are already several empirical investigations that agree on the positive impact of its use on the quality of general academic writing.

9. GETTING FEEDBACK:

AI provides a valuable advantage in research by facilitating the process of obtaining feedback. Through the integration of natural language processing (NLP) algorithms and sentiment analysis techniques, AI systems can analyze feedback from various sources, including surveys, social media, and academic publications. (5)By automatically aggregating and synthesizing this feedback, researchers can gain valuable insights into the reception and impact of their work, as well as identify areas for improvement or further exploration. Moreover, AI-driven tools can generate actionable recommendations based on feedback, and enable researchers to refine their methodologies, adjust their research questions, or adapt their approaches accordingly. This iterative feedback loop not only enhances the quality and relevance of research but also fosters collaboration and engagement within the academic community. Overall, AI empowers researchers to harness feedback effectively, driving continuous improvement and innovation in their research endeavors.

10. UNCOVERING NEW CHALLENGES THAT WE STILL DON'T KNOW HOW TO TACKLE:

AI offers a distinctive advantage in research by uncovering new challenges that we may not have previously identified or fully understood how to tackle. Through its ability to analyze vast amounts of data and detect subtle patterns and anomalies, AI systems can reveal emergent phenomena or complexities within various domains that may have been overlooked by traditional methods. Additionally, machine learning algorithms can generate novel hypotheses or predictions based on the data, prompting researchers to explore uncharted territories and address previously unrecognized issues. Furthermore, AI-powered simulations and modeling techniques can simulate scenarios and explore potential outcomes, shedding light on unforeseen challenges and informing the development of innovative solutions. By surfacing these previously unrecognized challenges, AI not only expands the scope of research but also catalyzes scientific inquiry and drives progress toward overcoming complex problems in diverse fields.

IV. CONS OF AI:

1. LIMITED CONTEXT UNDERSTANDING:

One significant disadvantage of AI in research is its limited context understanding. While AI systems excel at processing and analyzing large volumes of data, they often struggle to comprehend the nuanced context surrounding that data. This limitation can lead to inaccuracies or misinterpretations in research findings, especially in complex or ambiguous situations where contextual understanding is crucial. Additionally, AI may overlook subtle contextual cues or implicit information that human researchers would easily recognize, potentially leading to biased or incomplete conclusions. Furthermore, AI's inability to grasp the broader context of a research problem may hinder its ability to generate innovative insights or propose novel research directions. As a result, human oversight and interpretation are still necessary to ensure the validity and relevance of research findings generated by AI systems, highlighting the importance of collaboration between AI and human researchers to mitigate this limitation.

2. OVER-RELIANCE ON AI

A notable disadvantage of AI in research is the risk of over-reliance on AI systems, which can lead to complacency and undermine critical thinking skills. While AI offers powerful tools for data analysis, automation, and decision-making, relying too heavily on these systems without human oversight can pose significant risks. Over-reliance on AI may result in researchers becoming disconnected from the underlying data and methodologies, potentially leading to blind spots, biases, or errors in research findings. (6)Moreover, AI systems are not infallible and can produce inaccurate results or misinterpretations, particularly when applied to complex or novel research problems. Additionally, over-reliance on AI may stifle creativity and innovation, as researchers may become reliant on pre-programmed algorithms rather than exploring alternative approaches or hypotheses. Therefore, researchers need to maintain a balanced approach, leveraging AI as a tool to enhance research capabilities while retaining critical thinking skills and human judgment to ensure the integrity and validity of research outcomes.

3. LOSS OF CREATIVITY AND ORIGINALITY

One significant disadvantage of AI in research is the potential loss of creativity and originality. While AI excels at processing vast amounts of data and identifying patterns, it lacks the inherent human ability to think creatively and generate truly innovative ideas. Relying too heavily on AI for research tasks may limit researchers' exploration of unconventional or out-of-the-box approaches, as AI tends to prioritize solutions based on existing patterns and data. This could result in a narrowing of research perspectives and a reluctance to explore uncharted territories or pursue novel hypotheses. Furthermore, the automated nature of AI-driven processes may lead to a homogenization of research methodologies and findings, diminishing the diversity of thought and approaches within the research community. Therefore, researchers must maintain a balance

between leveraging AI for its analytical capabilities and preserving the human capacity for creativity and originality in research endeavors.(7)

4. ETHICAL ISSUES:

An inherent disadvantage of AI in research lies in the ethical issues it raises. AI-driven research methodologies, particularly in fields like healthcare and social sciences, pose significant ethical concerns regarding privacy, bias, and accountability. For instance, AI algorithms trained on biased datasets may perpetuate or exacerbate existing biases, leading to unfair outcomes or discriminatory practices. Moreover, the collection and analysis of large-scale data by AI systems raise questions about individual privacy and data security, especially when sensitive personal information is involved. Additionally, the opaque nature of some AI algorithms can make it challenging to understand how decisions are made, raising concerns about transparency and accountability. Furthermore, the potential for AI to automate tasks traditionally performed by humans raises questions about job displacement and the ethical implications of AI-driven decision-making in critical domains such as healthcare and criminal justice. Addressing these ethical issues requires careful consideration, transparency, and regulation to ensure that AI research is conducted ethically and responsibly, with due regard for the rights and welfare of individuals and society as a whole.(8)

5. AI GENERATED BIASES:

AI systems learn from the data they are trained on, and if the training data contains biases or inaccuracies, those biases can be perpetuated or even amplified in the AI's outputs. This can lead to skewed or unfair results, particularly in fields where decisions have significant social or ethical implications, such as healthcare, criminal justice, or hiring practices. For example, if historical data used to train an AI model contains gender or racial biases, the model may inadvertently perpetuate these biases in its decision-making process, resulting in discriminatory outcomes. Moreover, the complex and often opaque nature of AI algorithms can make it challenging to identify and mitigate biases effectively. (6)Addressing AI-generated biases requires careful attention to data selection, preprocessing, and algorithm design, as well as ongoing monitoring and evaluation to ensure fairness and equity in AI-driven research and decision-making processes.

6. POTENTIAL FOR ABUSE:

A notable disadvantage of AI in research is its potential for abuse, stemming from the powerful capabilities of AI systems and their widespread accessibility. AI can be used to manipulate and generate misinformation, deceive individuals, and amplify harmful content, posing significant risks to the integrity of research outcomes and the public trust in scientific advancements. For instance, AI algorithms can be employed to fabricate research data or manipulate experimental results, undermining the credibility of scientific research and eroding public confidence in the scientific community. Moreover, AI-driven technologies, such as deepfakes and text-generating models, can create convincing but false narratives or misleading information, leading to misinformation campaigns and societal unrest. Additionally, the proliferation of AI-powered surveillance technologies raises concerns about privacy violations and the erosion of civil liberties. To mitigate the potential for abuse, researchers and policymakers need to implement robust ethical guidelines, transparency measures, and regulatory frameworks to govern the responsible development and use of AI in research.

5. CONCLUSION:

AI has revolutionized scientific research, offering numerous benefits and some challenges. On the positive side, AI accelerates data analysis, aiding in pattern recognition and hypothesis generation. It enables the discovery of new insights from vast datasets, leading to breakthroughs in various fields. Moreover, AI-driven simulations facilitate complex modeling and prediction tasks, enhancing our understanding of intricate phenomena. However, concerns arise regarding AI's interpretability and potential biases in data handling. Additionally, there are ethical considerations surrounding AI's role in research, including issues of privacy, security, and job displacement. Despite these challenges, the overall impact of AI on scientific research remains overwhelmingly positive, with its potential to reshape how we approach and solve complex scientific problems. AI has significantly transformed scientific research by expediting data analysis, hypothesis generation, and complex modeling. Its ability to process vast datasets and identify patterns has accelerated discovery across various disciplines. However, challenges persist, including the interpretability of AI models, biases in data and algorithms, ethical considerations surrounding data privacy and security, potential job displacement, and concerns about reproducibility and robustness. Despite these challenges, the benefits of AI in scientific research outweigh the drawbacks, offering unprecedented opportunities to expand our understanding of the natural world and address complex societal challenges. Efforts to address these challenges through transparent practices, ethical guidelines, and ongoing research will be crucial in maximizing the positive impact of AI on scientific advancement.

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