

THE USE OF ARTIFICIAL INTELLIGENCE APPLICATIONS FOR EDUCATION AND SCIENTIFIC RESEARCH

EL USO DE APLICACIONES DE INTELIGENCIA ARTIFICIAL PARA LA EDUCACIÓN E INVESTIGACIÓN CIENTÍFICA

José Segovia Juárez ¹  Robert Baumgartner ² 

¹Universidad Tecnológica de los Andes, Abancay, Perú

²Language Center, Universidad Peruana Cayetano Heredia, Lima, Perú

Correspondencia:

PhD. José Segovia Juárez
jsegoviaj@utea.edu.pe

Como citar este artículo: Segovia, J., & Baumgartner, R. (2024).

The use of artificial intelligence applications for education and scientific research. *Hatun Yachay Wasi*, 3(1), 98 -111. <https://doi.org/10.57107/hyw.v3i1.61>

ABSTRACT

Artificial Intelligence (AI), particularly Generative Artificial Intelligence (GAI), is increasingly being used in education and scientific research. This article explores the use of AI applications, such as ChatGPT, Scite, and Litmaps in education and scientific research. This kind of application offers several advantages but should be used with certain caution. Any inference must be verified made by AI tools to ensure their validity. While current AI technologies can quickly analyze vast amounts of data or represent networks of citations, their results may be influenced by the quality and comprehensiveness of databases. Thus, human experts must review and verify the results carefully to ensure their accuracy and originality. Additionally, academic institutions should educate students and researchers about the risks of utilizing GAI models while providing comprehensive guidelines to prevent plagiarism.

Keywords: artificial intelligence apps, ChatGPT, Scite, Litmaps, research

RESUMEN

La Inteligencia Artificial (IA), particularmente las herramientas de Inteligencia Artificial Generativa (IAG), se están utilizando cada vez más en el campo de la educación y la investigación. Este artículo explora el uso de aplicaciones de IA, como ChatGPT, Scite y Litmaps, en la educación y la investigación científica, los cuales ofrecen varias ventajas; sin embargo, su uso debe realizarse con precaución. Se debe verificar cualquier inferencia realizada por las herramientas de IA existentes, para garantizar su validez. Aunque las tecnologías actuales de IA pueden proporcionar análisis y representación de redes de citas, sus resultados pueden estar influenciados por la calidad y exhaustividad de las bases de datos en diversos campos. Es importante que expertos humanos revisen y verifiquen con cuidado las referencias. Además, las instituciones académicas deben educar a estudiantes e investigadores sobre los riesgos éticos asociados con el uso de modelos de IAG, al tiempo que proporcionan pautas para prevenir el plagio.

Palabras clave: Aplicaciones de Inteligencia Artificial, ChatGPT, Scite, Litmaps, investigación



INTRODUCTION

Computational tools are crucial in enhancing the research process in almost every discipline. The internet and computer software, such as data mining, are used to extract and discover patterns in large data sets; statistical packages to analyze data; editing software and grammar checkers to improve writing; and modeling and simulation software to study relationships and make predictions; among other applications. On the other hand, the integration of computational tools has extended to educational fields such as mathematics, biology, chemistry, and digital media art, where they have been utilized to enhance learning, analyze natural phenomena, and analyze scientific data (L. Chen et al., 2020). The use of computational tools has also been associated with positive impacts on various processes within institutions, including research projects, quality management, and teaching (Mabic et al., 2022). Recently, Artificial Intelligence (AI), particularly Generative AI (GAI), has been used in education and research.

Artificial Intelligence

Artificial Intelligence is the science and technology of manufacturing intelligent systems using algorithms and datasets, particularly intelligent computer programs (McCarthy, 2007). Study subfields of Artificial intelligence are Machine Learning, Data Mining, Information Retrieval and Semantic Web, Speech Recognition and Natural Language Processing, Image Processing and Computer Vision, Robotics, Knowledge Representation and Knowledge Database, Logic Reasoning and Probabilistic Reasoning, Expert Systems, and Generative Artificial Intelligence, among others.

In its 2023 Future of Jobs report, the World Economic Forum (2023) stated that AI is expected to create 58 million new jobs by 2025, most of which will require some expertise in AI and machine learning. According to this report, by 2030, AI is expected to contribute US\$ 15.7 trillion to the global GDP, a

26% increase from the current figure. Approximately 40 % of this growth is attributed to enhanced productivity boosted by AI. The key takeaway is that for formal education to fulfill its commitment to actively empowering students to engage in society and contribute to its ongoing development, students must acquire knowledge, competence, and confidence in building and utilizing AI within the framework of their formal education. Thus, regardless of whether we see AI as an opportunity or, instead, as a threat, the education system will need to make AI a prominent element of our curricula.

Large Language Models (LLM) and Generative Artificial Intelligence (GAI)

New developments in natural language processing (NLP) have resulted in the creation of robust language models, including large language models (LLM), trained with massive amounts of data, that allow to generate human-quality text, translation of languages, writing different kinds of creative content, and answer your questions in an informative way. LLMs are still under development but have already been used to create various applications, including chatbots, virtual assistants, and content-creation tools (Liu et al., 2023). GPT-3/GPT-4, as an illustration, exhibits the ability to generate text with human-like qualities based on the input it is provided, thereby serving as a potent tool for diverse natural language processing tasks.

In Generative AI (GAI), “generative” refers to these systems’ ability to produce unique and diverse outputs beyond simply recognizing or categorizing preexisting data. This area of Artificial Intelligence is concerned with creating new content, frequently by identifying patterns and structures in already-existing data. It entails developing algorithms and models to generate new, realistic data across various media formats, including text, images, audio, and other types. The Generative Pre-Trained Transformer (GPT) (Radford et al., 2018), which

comprises models like GPT-3/GPT-4, is a prime example of GAI.

Another example of LLM is Bard (Bard, Google AI, 2023). Bard has a range of capabilities, such as generating types of content like poems, code, scripts, musical pieces, emails, and letters. Additionally, Bard can translate text between several languages. It can also summarize texts such as articles or books and offer factual topic summaries. Moreover, Bard can convert text to speech for individuals with impairments or reading difficulties and translate speech into text for those who are deaf or have hearing challenges.

This paper reviews the use of some GAI applications for scientific research and discusses its benefits and pitfalls, including ethical aspects that need to be addressed by the community.

MATERIALS AND METHODS

We used Google Scholar, ChatGPT, Scite, and Litmaps as the primary sources of references and data to write this paper.

The paper is structured in the following manner: In the following sections, we review ChatGPT as a powerful GAI system, Scite to explore trends in bibliographic references, and Litmaps for citation relationship networks. In the discussion, we will present their main strengths and threats in the research process, finally establishing the study's conclusions.

ChatGPT

ChatGPT (Chat Generative Pre-Trained Transformer) is an artificial intelligence-based conversational large language model (LLM) developed by OpenAI (Radford et al., 2018; OpenAI, 2023). It is a chatbot with a conversational artificial intelligence interface that has gained prominence in various domains, including medical education and healthcare literature (Sallam, 2023a). ChatGPT can generate text responses from its knowledge acquired via machine learning in engagement with data from large databases and the internet (Pavlik, 2023). As an example, Figure 1 shows a ChatGPT answer to a question regarding photosynthesis.

FIGURE 1

A ChatGPT answer to a question regarding photosynthesis



ChatGPT

Photosynthesis is a fundamental biological process that occurs in plants, algae, and some bacteria, and it plays a crucial role in the ecosystem by producing organic compounds and oxygen. The process involves the conversion of light energy into chemical energy in the form of glucose. Let's break down the process of photosynthesis into its main stages:

1. Light Absorption:

Photosynthesis begins with the absorption of light by pigments, primarily chlorophyll, located in the chloroplasts of plant cells. Chlorophyll absorbs light most efficiently in the blue and red regions of the electromagnetic spectrum. The energy from light is used to excite electrons in chlorophyll molecules, initiating the process.

2. Light Reactions:

These reactions take place in the thylakoid membrane of the chloroplasts and involve two main processes:

a. **Photophosphorylation:** Light energy is used to convert ADP (adenosine diphosphate) and inorganic phosphate (Pi) into ATP (adenosine triphosphate). This process is driven by the flow of electrons through the electron transport chain.

ChatGPT in health

In healthcare practice, ChatGPT has been identified as a valuable tool for streamlining workflow and refining personalized medicine (Sallam, 2023a).

ChatGPT can provide information from updated evidence-based guidelines, making it a valuable tool to augment a physician's clinical judgment (Ghafoor & Yahya, 2023). Furthermore, the utility of ChatGPT in specific domains such as cancer treatment information, infectious disease research, and pharmacy has been explored, indicating the growing popularity of large language models for medical question-answering and information retrieval (Chen et al., 2023; Cheng et al., 2023).

The performance of ChatGPT in clinical reasoning exams and its implications for medical curricula and practice have also been examined, suggesting the need to revise assessments and incorporate AI-related topics into medical education (Strong et al., 2023).

However, there are concerns about the accuracy of the information it provides in the healthcare domain, particularly in generating patient education materials and answering specific medical queries (Sütcüoğlu & Güler, 2023). Despite these concerns, ChatGPT can be used in medical, dental, pharmacy, and public health education to improve personalized learning and clinical reasoning (Sallam et al., 2023).

ChatGPT in Science and Education

Several studies have explored the potential applications, benefits, and concerns of integrating ChatGPT into various scientific research and academic writing aspects (Cheng et al., 2023; Deng & Lin, 2023; Sallam, 2023a, 2023b). The potential benefits of ChatGPT in assisting non-native English users and its impact on productivity in higher education have also been highlighted by Lin, (2023), Firaina & Sulisworo, (2023) and, Rahman &

Watanobe (2023) suggested it could help students improve their programming skills.

In the context of academic writing, ChatGPT speeds up scientific writing. It is an efficient language bot that generates text by linguistic connections (Buriak et al., 2023), which is helpful for second language writing (Chen, 2023). Moreover, Seth et al. (2023) highlighted it as a tool that could revolutionize academia and increase research writing.

Issues and limitations of ChatGPT

The scientific community raised concerns about using ChatGPT and other AI applications in education, particularly regarding the breakdown of academic integrity and the lack of ethics involved in copying and plagiarism (Khalil & Er, 2023; Mohammadzadeh et al., 2023). On the other hand, there are concerns regarding the impact of ChatGPT on the quality, authenticity, and critical thinking in scientific research and academic writing (Arif et al., 2023; Rahman et al., 2023; Sallam et al., 2023; Seth et al., 2023).

The ChatGPT-4 fails to generate accurate scientific references in various domains, including Mechanical and Electrical Engineering (Barrot, 2023; Chen, 2023), and some health domains (Sütcüoğlu & Güler, 2023). ChatGPT may produce false or incorrect references when queried on a scientific topic. As a result, text generation could be biased or inaccurate. For this reason, we advise against using the current versions of this application to generate high-level or in-depth scientific texts.

To overcome issues with generating proper citations of ChatGPT, other applications, such as Scite, are shown in the next section.

Scite

Scite is a platform designed to assist researchers in assessing the credibility of papers and their references. Scite, utilizing AI, classifies citations

into three categories: supporting, contradicting, or simply mentioning the referenced research. This tool enables users to efficiently evaluate the context and significance of papers (Brody, 2021; Nicholson et al., 2021). The current implementation of Scite (Scite.ai) offers several tools for researchers, among them:

- Scite Assistant, using a proprietary LLM and an extensive database of citations, gives researcher text generated based on references related to the user query, as shown in Figure 2.

- Search for scientific references in large databases and use the data to find references supporting or contradicting citations.
- Verify the references' reliability of a paper to check if they have been retracted or supported by other studies.
- Provide the researcher with a publication's dashboard with several valuable metrics, such as journals and authors citing the most from their work.

FIGURE 2

A ChatGPT answer to a question regarding photosynthesis

The screenshot shows the Scite Assistant interface. At the top, there is a navigation bar with 'assistant by scite Beta', 'Install extension!', 'Product', 'Discover', 'Pricing', 'Blog', and a user profile icon. The main chat area contains a user query: 'What are some arguments against COVID-19 vaccine in children?, give references'. The assistant's response is a detailed paragraph discussing parental hesitancy and its various factors, citing several studies. To the right, a 'References' sidebar is visible, showing 'Reference #9' with a snippet of text and a link to the full context. Below it, the title of the reference is displayed: 'COVID-19 Vaccination Intentions, Concerns, and Facilitators Among US Parents of Children Ages 6 Months Through 4 Years', along with the authors' names and a link to the full text.

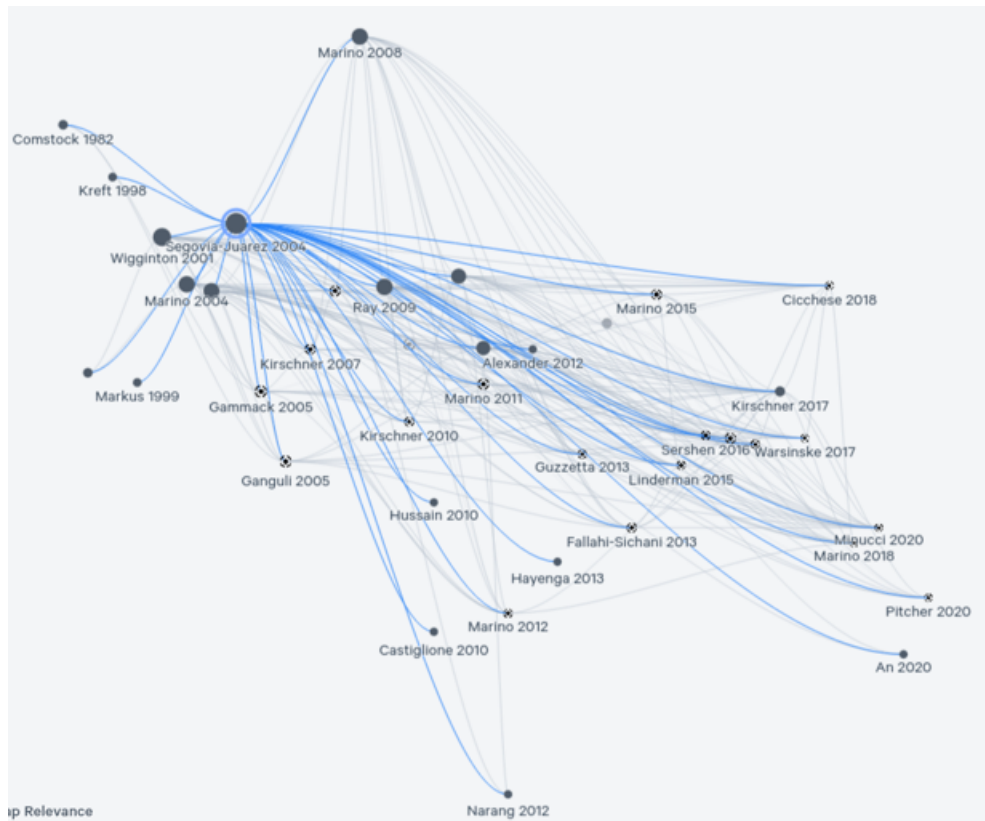
Note: There are two main windows: on the left, text generated, and on the right, a list with references used.

There are other features to find networks of references. However, Litmaps are the best option, as described in the following section.

Litmaps

Litmaps (derived from 'Literature map') is an Artificial Intelligence-based application that enables the visualization of concept relationships in scientific literature. It employs AI techniques to analyze texts and represent their relationships in citation relationship networks. For instance, in

Figure 3, the relationships network of a research article are depicted with time (x-axis) and the relevance map of the article.

FIGURE 3*Relevance map of an article***DISCUSSION**

This section summarizes the advantages and disadvantages of using ChatGPT in education and research and using Scite and Litmaps in scientific research. Finally, we reference the ethical considerations for using GAI in education and research.

ChatGPT in Education

ChatGPT offers advantages in the field of education:

- **Interactive learning.** With its interface, ChatGPT allows students to engage in natural language conversations, making the learning process more engaging and enjoyable.
- **Personalized support.** ChatGPT can assist students by answering questions, explaining concepts, and offering tailored explanations based on needs.
- **Availability.** One of the benefits of ChatGPT is its round-the-clock availability, ensuring that students can access information and assistance at any time. This flexibility is particularly beneficial for learning and students residing in different countries.
- **Language practice.** For those learning a language, ChatGPT serves as a tool for practicing and improving language skills through interactive conversations. It can assist with grammar, vocabulary, and overall comprehension.
- **Research aid.** Students can rely on ChatGPT to quickly gather information on topics, helping them with their research endeavors. It provides summaries, explanations, and references to sources that accelerate the research process.
- **Coding support.** In computer science and programming courses, ChatGPT proves helpful by offering code examples that explain programming concepts clearly and provide

debugging assistance—all aimed at facilitating the acquisition of coding skills.

While ChatGPT has numerous educational advantages, it is important to consider its drawbacks.

- Lack of critical thinking. While ChatGPT can provide information, it relies on learned patterns rather than possessing thinking skills. It may need to evaluate the quality or reliability of the information it generates.
- Potential for inaccuracies. ChatGPT responses are based on its training data. The researcher may need access to up-to-date information. This problem can sometimes lead to inaccurate responses in fast-paced fields.
- It has limited context understanding. It needs more context and understanding. ChatGPT processes text sequentially and may not fully grasp the context of a conversation. Despite being able to provide accurate responses, the AI-powered assistant has a limited understanding of the subject matter.
- Bias and fairness issues. The training data used for ChatGPT could contain biases, which may inadvertently result in unfair responses from the model that can perpetuate stereotypes.
- Potential for misleading information. Without oversight, ChatGPT might generate correct but easily misinterpreted responses for users that could lead to the spread of misleading information.
- Security concerns. ChatGPT can be susceptible to misuse, such as generating content or responding to requests. It requires monitoring and filtering to ensure a safe and secure learning environment.
- Lack of understanding of emotions. ChatGPT is a software system that lacks intelligence. May not comprehend or respond appropriately to a student's emotional state. In context, human emotional support and understanding play a vital role.
- Dependency on technology. Reliance on ChatGPT

for education might hinder students' critical thinking abilities and their capacity to research and analyze information independently.

- Privacy concerns. Utilizing ChatGPT in education may involve sharing information. Privacy concerns emerge regarding the storage and utilization of data generated during interactions with the model.
- Unintentional encouragement of mistakes. If students consistently receive information from ChatGPT without any correction, there is a risk of reinforcing errors and misconceptions.

ChatGPT in Research

ChatGPT provides various benefits in the field of research.

- Idea generation. Researchers can employ ChatGPT to brainstorm and generate ideas for their research projects. The model can provide insights, propose hypotheses, and offer perspectives to stimulate thinking.
- Support for data analysis. In fields involving data analysis, ChatGPT can assist researchers in grasping statistical concepts, guiding them through data interpretation and even aiding in creating code for statistical analyses.
- Language translation. For collaborations, ChatGPT can help with language translation tasks, facilitating communication between researchers who speak other languages and enhancing the accessibility of research findings.
- Drafting and editing support. Researchers can utilize ChatGPT to draft and edit sections of their manuscripts. The model can offer suggestions for improvement in writing style, grammar usage, and overall structure, which saves time during the writing process.
- A quick guide to methodologies. ChatGPT offers researchers a reference for selecting research methodologies, experimental designs, and statistical methods for their studies.
- Automated notetaking. Researchers can utilize ChatGPT to take notes during meetings or while

studying papers. The model can effectively summarize points. Generate concise notes for later review.

- Access to specialized knowledge. ChatGPT provides researchers access to a range of knowledge across various scientific disciplines, allowing them to explore connections and incorporate perspectives into their work.
- Time efficiency. ChatGPT assists researchers in saving time by answering questions, thereby reducing the need to search through extensive literature or perform repetitive tasks manually.

While ChatGPT offers these advantages, researchers need to use it as a tool rather than a replacement for critical thinking and domain expertise. Researchers should also remain aware of biases and limitations in the training data that could impact the model's responses.

Despite its advantages, ChatGPT has some drawbacks when applied to research:

- As a general-purpose language model, ChatGPT may not have extensive knowledge in specific fields. Therefore, it may not fully comprehend the intricacies and complexities of certain disciplines, which could result in inaccurate or overly simplified responses.
- The responses generated by ChatGPT rely on patterns learned from a range of data sources, which may not include the up-to-date research developments. Consequently, researchers might need more accurate information while using this model.
- ChatGPT generates responses without providing citations or sources, which makes it difficult to verify the accuracy and reliability of information provided. This lack of transparency raises concerns for researchers.
- If biases exist within the training data used for ChatGPT, it may unintentionally produce skewed information. Given that objectivity and

neutrality are paramount in research, this poses an issue.

- Due to its limitations, ChatGPT may struggle to understand the designs, protocols, or methodologies used in scientific research, leading to responses that lack the necessary depth of understanding for research processes.
- While ChatGPT can assist in summarizing existing research findings, it cannot conduct experiments or contribute novel discoveries.
- When using ChatGPT in a research setting, researchers should be mindful of security and privacy concerns. Sharing proprietary information may pose risks.

To make the most of ChatGPT in research, researchers must approach its use with caution. Recognizing its limitations and considering it as a tool rather than a replacement for human expertise and critical thinking are essential factors. Human oversight and verification play roles in ensuring rigorous scientific inquiry.

Scite in research

Scite.ai provides benefits in the context of research:

- Scite.ai specializes in analyzing citations, allowing researchers to evaluate the impact and credibility of a scientific paper by examining its citation context. This feature assists researchers in understanding how a specific work has been received and referenced within the community.
- Researchers can rely on Scite.ai to identify studies that have been successfully replicated, offering insights into the reliability and reproducibility of their findings.
- Scite.ai streamlines the process of conducting literature reviews by summarizing citation patterns and key discoveries related to a research topic. This process saves researchers time and effort during their literature review stages.
- Using Scite.ai, researchers can detect citation biases by determining if a paper has been cited

in support, contrast, or merely mentioned. This information contributes to understanding how papers fit into the scientific discourse.

- Researchers can integrate Scite.ai into their workflows. Benefit from a tool that keeps them updated on citations and discussions within their areas of interest.
- Scite.ai offers representations of citation networks, enabling researchers to explore the connections between papers and gain a deeper understanding of the context in which research is conducted.
- With Scite.ai, researchers can make decisions by gaining insights into the citation landscape, helping them prioritize which papers to delve into further or include in their research projects.
- By utilizing Scite.ai, researchers can quickly identify papers within their specific field, providing invaluable information in comprehending the works that have contributed to an area of research.
- Scite.ai promotes evidence-based research by offering qualitative assessments of how research findings have been received and incorporated into the scholarly literature.

It is important for researchers using Scite.ai that while it provides features, they should also consult sources of information and apply critical thinking when evaluating research papers. Additionally, users should be mindful of any biases in the data and algorithms used by Scite.ai.

Although Scite.ai provides useful features, its usage in scientific research is limited by drawbacks.

- The accuracy and dependability of Scite.ai analyses hinge on the quality of the underlying data, including the precision of citation information. Any inaccuracies or missing data might impact the reliability of the results.
- The Scite.ai database may not uniformly cover all journals or fields. Researchers involved in

niche or emerging areas might find that the platform has restricted coverage, potentially overlooking studies.

- Similar to any data-driven tool, biases present in the training data can influence Scite.ai algorithms, leading to analyses or recommendations in areas where research from underrepresented or marginalized communities is scarce.
- Although Scite.ai can offer insights into citation patterns, it does not directly assess the quality or validity of content within a paper. Researchers should still exercise their evaluation of papers.
- Citation patterns evolve over time, and a paper's impact may change accordingly. Scite.ai analysis represents a snapshot of citation patterns so researchers should consider the aspect when interpreting results.

It is important to be cautious about how citation categories (support, contrast, or mention) are understood. Misunderstanding them could lead to conclusions about the context in which a paper is cited. Scite.ai primarily focuses on analyzing citation patterns. It may not capture the context of a research field or the reasons behind citing a specific paper.

Despite these drawbacks, Scite.ai can provide valuable insights when used thoughtfully alongside research methods. Researchers should be aware of its limitations. Complement its findings with literature examination and critical thinking.

Litmaps

Litmaps provide benefits in the field of research, particularly when it comes to analyzing literature:

- By utilizing artificial intelligence, Litmaps visually represents how different ideas, topics, and research areas are interconnected, helping researchers gain an understanding of the relationships between concepts.
- Litmaps intelligently analyzes texts using

AI techniques, assisting researchers in extracting insights, identifying concepts, and understanding the semantic relationships within a body of literature.

- Litmaps generates maps that illustrate citation relationships between publications, helping researchers explore the influence and impact of articles, identify works, and comprehend the evolution of ideas over time.
- Researchers can employ Litmaps to analyze the aspects of literature. For example, they can examine how the importance or relevance of a research topic has evolved over time, providing historical context.
- Litmaps streamlines the literature review process by offering representations of citation networks. This helps researchers identify papers, understand the structure of existing literature, and identify areas that require exploration or gaps in knowledge.
- The integration of AI techniques enables Litmaps to surpass traditional bibliometric analyses. Litmaps provides researchers with a tool that offers detailed insights into the connections between concepts. It features a user interface, making it easy for researchers to interact with and explore the generated maps.
- One of the benefits of Litmaps is its ability to identify emerging trends and hot topics within a field. By analyzing citation patterns and clustering concepts, researchers can stay updated with the developments in their study area.

The visual nature of Litmaps also makes it a powerful tool for communicating research findings. Researchers can use the generated maps to present the landscape of their research area, making complex relationships easier for a broader audience to understand.

Researchers need to be aware of the limitations of Litmaps and ensure that the generated

visualizations align with their research goals and context. While Litmaps can offer insights, it also has certain drawbacks and limitations:

- The effectiveness of Litmaps heavily relies on the quality and accuracy of the underlying data. If there are inaccuracies or incomplete information in the literature, it may affect the reliability of the generated maps.
- Litmaps may not encompass all journals or fields equally. Researchers working in emerging areas might find the platform has limited coverage, potentially missing out on studies.
- The quality and clarity of input texts can impact the quality of visualizations. If the original texts are unclear or poorly written, it may hinder the accuracy of identifying concept relationships in Litmaps.
- While Litmaps can highlight relationships between concepts, it does not directly determine the contents' quality or validity within a paper. Therefore, researchers should conduct their paper evaluations.
- Similar to AI-driven tools, biases present in training data can influence Litmaps algorithms. This results in skewed analyses, especially in areas lacking research from underrepresented or marginalized communities.
- Careful interpretation is required for understanding visualizations provided by Litmaps. For researchers to grasp the mapping methodology accurately and avoid misinterpretation of concept relationships, it is crucial to understand the context.
- It is important to note that research trends are constantly evolving. Although Litmaps provides a snapshot, it may not capture the most recent shifts in the scientific landscape. Therefore, researchers should consider this aspect when interpreting results.

It is recommended that researchers view Litmaps as a tool rather than relying solely on its capabilities. Additionally, they should augment insights gained

from Litmaps with research methods and evaluate relevant literature to understand the research landscape comprehensively.

Ethical aspects of the use of GAI

Responsible utilization, user awareness, and institutional guidelines play a role in mitigating the risks associated with plagiarism with AI-generated content. Users are required to adequately provide citations and attributions when incorporating information from GAI models into their work.

The text produced by GAI models may unintentionally generate content that looks much like previously published work, which could result in plagiarism claims. Although GAI models aid in text generation, users must guarantee their work's originality. Users must check ChatGPT's output and make any necessary modifications to ensure that it adheres to standards and upholds academic integrity.

In research environments, peer review and human oversight are still fundamental. While GAI models can assist in generating content, human experts need to review and verify the generated materials' accuracy, originality, and appropriateness.

Organizations and users should adhere to comprehensive ethical use policies to ensure the use of GAI models. These policies should prioritize integrity, discourage plagiarism, and provide guidelines for responsibly utilizing AI-generated content.

Academic institutions must inform researchers and students about the potential hazards of using GAI models while highlighting the importance of producing work. Guidelines for citation styles and techniques to prevent inadvertent plagiarism must be provided. Authors should share research data for result reproduction; it is essential for ensuring transparency and facilitating the verification of scientific findings.

We have primarily used AI to prepare class materials, summarize and simplify texts, and brainstorm ideas. In our institutions, guidelines are in preparation. However, other universities have already defined their guiding principles (Moorhouse et al., 2023; Russell Group, 2023).

CONCLUSIONS

GAI applications such as ChatGPT or Scite in education and research have several advantages. However, they should be used with caution. The text generated may contain biases and inaccuracies from incomplete or biased data sources and references. Authors should only use currently available AI tools for knowledge inference and only assume conclusions to be valid after proper verification.

Current AI technologies, such as Scite and Litmaps, offer analysis and network representation of citations. However, results in several fields may be limited by the quality and completeness of databases.

Academic institutions should inform students and researchers about the hazards of using GAI models. Scientists should be provided with clear and proper ethical guidelines to follow.

REFERENCES

- Arif, T., Munaf, U., & Ul-Haque, I. (2023). The future of medical education and research: Is ChatGPT a blessing or blight in disguise? *Medical Education Online*, 28. <https://doi.org/10.1080/10872981.2023.2181052>
- Bard, Google AI. (2023). Bard. <https://bard.google.com/>
- Barrot, J. (2023). Using ChatGPT for second language writing: Pitfalls and potentials. *Assessing Writing*, 57, 100745. <https://doi.org/https://doi.org/10.1016/j.asw.2023.1007>

- Brody, S. (2021). Scite. *Journal of the Medical Library Association*, 109(4), 707–710. <https://doi.org/https://doi.org/10.5195/jmla.2021.1331>
- Buriak, J., Akinwande, D., Artzi, N., Brinker, C., Burrows, C., Chan, W., Chen, C., Chen, X., Chhowalla, M., Chi, L., Chueh, W., Crudden, C., Carlo, D., Glotzer, S., Hersam, M., Ho, D., Hu, T., Huang, J., Javey, A., Kamat PV, Kim ID, Kotov NA, Lee TR, Lee YH, Li Y, Liz-Marzán LM, Mulvaney P, Narang P, Nordlander P, Oklu R, Parak WJ, Rogach AL, Salanne M, Samorì P, Schaak RE, Schanze KS, Sekitani T, Skrabalak S, Sood AK, Voets IK, Wang S, Wang S, Wee ATS, Ye J. (2023). Best Practices for Using AI When Writing Scientific Manuscripts. *American Chemical Society*, 17(5):4091-4093. <https://doi.org/10.1021/acsnano.3c01544>
- Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *Institute of Electrical and Electronics*, 8, 75264–75278. <https://doi.org/10.1109/ACCESS.2020.2988510>
- Chen, S., Kann, B., Foote, M., Aerts, H., Savova, G., Mak, R., & Bitterman, D. (2023). The utility of ChatGPT for cancer treatment information. *Journal of Medical Internet Research*, 25, e48568. <https://doi.org/10.1101/2023.03.16.23287316>
- Chen, T. (2023). ChatGPT and other artificial intelligence applications speed up scientific writing. *Journal of the Chinese Medical Association*, 86(4), 351–353. <https://doi.org/10.1097/jcma.0000000000000900>
- Cheng, K., Li, Z., He, Y., Guo, Q., Lu, Y., Gu, S., & Wu, H. (2023). Potential use of artificial intelligence in infectious disease: Take ChatGPT as an example. *Annals of Biomedical Engineering*, 51, 1130–1135. <https://doi.org/10.1007/s10439-023-03203-3>
- Deng, J., & Lin, Y. (2023). The benefits and challenges of chatgpt: An overview. *Frontiers in Computing and Intelligent Systems*, 2, 81–83. <https://doi.org/10.54097/fcis.v2i2.4465>
- Firaina, R., & Sulisworo, D. (2023). Exploring the usage of ChatGPT in higher education: Frequency and impact on productivity. *Buletin Edukasi Indonesia*, 2, 39–46. <https://doi.org/10.56741/bei.v2i01.310>
- Ghafoor, S., & Yahya, A. (2023). Assessing ChatGPT's Performance in Answering Cervical Cancer Screening Questions to ChatGPT-generated Clinical Vignettes: A Pilot Study. *Research Square* <https://doi.org/10.21203/rs.3.rs-3152561/v1>
- Khalil, M., & Er, E. (2023). Will ChatGPT get you caught? rethinking of plagiarism detection. <https://doi.org/10.35542/osf.io/fnh48>
- Lin, Z. (2023). Why and how to embrace ai such as ChatGPT in your academic life. *Royal Society Open Science*, 10(8), 230658. <https://doi.org/10.31234/osf.io/sdx3j>
- Liu, Y., Han, T., Ma, S., Zhang, J., Yang, Y., Tian, J., He, H., Li, A., He, M., Liu, Z., Wu, Z., Zhao, L., Zhu, D., Li, X., Qiang, N., Shen, D., Liu, T., & Ge, B. (2023). Summary of ChatGPT-Related research and perspective towards the future of large language models. *Meta-Radiology*, 1(2), 100017. <https://doi.org/https://doi.org/10.1016/j.metrad.2023.100017>
- Mabić, M., Gašpar, D., & Praničević, D. (2022). Does information technology influence processes at universities? – teacher's perspective. *ENTRENOVA – ENTERPRISE RESEARCH INNOVATION*, 8, 146–153. <https://doi.org/10.54820/entrenova-2022-0014>
- McCarthy, J. (2007). What is artificial intelligence?

- <https://www-formal.stanford.edu/jmc/whatisai.pdf>
- Mohammadzadeh, Z., Ausloos, M., & Saeidnia, H. (2023). ChatGPT: High-tech plagiarism awaits academic publishing green light. Non-Fungible Token (NFT) can be a way out. *Library Hi Tech News*. <https://doi.org/10.1108/lhtn-04-2023-0067>
- Moorhouse, B., Yeo, M., & Wan, Y. (2023). Generative AI tools and assessment: Guidelines of the world's top-ranking universities. *Computers and Education Open*, 5, 100151. <https://doi.org/https://doi.org/10.1016/j.caeo.2023.100151>
- Nicholson, J., Mordaunt, M., Lopez, P., Uppala, A., Rosati, D., Rodrigues, N., Grabitz, P., & Rife, S. (2021). Scite: A smart citation index that displays the context of citations and classifies their intent using deep learning. *Quantitative Science Studies*, 2(3), 882–898. https://doi.org/10.1162/qss_a_00146
- OpenAI. (2023). ChatGPT-3.5: *Language Model by OpenAI*. <https://platform.openai.com/docs/models>
- Pavlik, J. (2023). Collaborating with ChatGPT: Considering the implications of generative artificial intelligence for journalism and media education. *Journalism & Mass Communication Educator*. 78(1), 84-93. <https://doi.org/10.1177/10776958221149577>
- Radford, A., Narasimhan, K., Salimans, T., & Sutskever, I. (2018). *Improving language understanding by generative pretraining*. OpenAI. <https://openai.com/research/language-unsupervised>
- Rahman, M., Terano, H., Rahman, N., Salamzadeh, A., & Rahaman, M. (2023). ChatGPT and academic research: A review and recommendations based on practical examples. *Journal of Education Management and Development Studies*, 3, 1-12. <https://doi.org/10.52631/jemds.v3i1.175>
- Rahman, M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences*, 13(9). <https://doi.org/10.3390/app13095783>
- Russell Group. (2023). *Russell group principles on the use of Generative AI tools in education*. https://russellgroup.ac.uk/media/6137/rg_ai_principles-final.pdf
- Sallam, M. (2023a). ChatGPT utility in healthcare education, research, and practice: Systematic review on the promising perspectives and valid concerns. *Healthcare*, 11, 887. <https://doi.org/10.3390/healthcare11060887>
- Sallam, M. (2023b). The utility of ChatGPT as an example of large language models in healthcare education, research, and practice: Systematic review on the future perspectives and potential limitations. *MedRxiv*. <https://doi.org/10.1101/2023.02.19.23286155>
- Sallam, M., Salim, N., Barakat, M., & Al-Tammemi, A. (2023). ChatGPT Applications in Medical, Dental, Pharmacy, and Public Health Education: A Descriptive Study Highlighting the Advantages and Limitations. *Narra J*, 3 (1), e103. <https://doi.org/10.52225/narra.v3i1.103>
- Seth, I., Kenney, P., Bulloch, G., Hunter-Smith, D., Thomsen, J., & Rozen, W. (2023). Artificial or Augmented Authorship? A Conversation with a Chatbot on Base of Thumb Arthritis. *Plastic and Reconstructive Surgery Global Open*. 11(5), e4999 <https://doi.org/10.1097/gox.0000000000004999>
- Strong, E., DiGiammarino, A., Weng, Y., Basaviah,

P., Hosamani, P., Kumar, A., Nevins, A., Kugler, J., Hom, J., & Chen, J. (2023). Performance of ChatGPT on free-response, clinical reasoning exams. *JAMA Internal Medicine*. <https://doi.org/10.1101/2023.03.24.23287731>

Sütcüoğlu, B., & Güler, M. (2023). Appropriateness of premature ovarian insufficiency recommendations provided by ChatGPT. *Menopause*, *30*(10), 1033–1037. <https://doi.org/10.1097/GME.0000000000002246>

World Economic Forum. (2023). *The Future of Jobs report 2023, insight report may 2023*. https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf