Bibliometric analysis of ChatGPT based on Scopus data: Global research trends (2022–2024)

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Abstract: *The emergence of ChatGPT has reshaped academia and research, generating both enthusiasm and concerns. While ethical challenges persist, a growing movement advocates for its integration and the adoption of best practices.* ***Objective:*** *This study conducts a bibliometric analysis of scientific publications on ChatGPT indexed in Scopus (2022–2024) to map trends and characterize the academic output related to this technology.* ***Methods:*** *A systematic bibliometric analysis was performed following the PRISMA protocol. Data were extracted from Scopus, identifying 437 relevant publications. A statistical analysis using VOSviewer enabled the identification of 13 clusters and 32 nodes. Results: The analysis revealed that the majority of publications originated from the United States (24.80%), India (11.17%), and China (11.17%). The predominant publication types were journal articles (45.3%) and conference papers (36.8%). The most active research fields include Computer Science (27.7%), Medicine (14.5%), and Social Sciences (13.2%).* ***Conclusions:*** *Findings underscore the increasing prominence of ChatGPT as an interdisciplinary research topic. Key areas of focus include: the evolution of language models, response accuracy, impact on education and healthcare, and challenges and opportunities that AI presents in academic research.*

Keywords: ChatGPT, Bibliometric Analysis, Scientific Production, Scopus.

1. Introduction

In recent years, advances in artificial intelligence (AI) have shaped the way multiple tasks are performed (Makridakis, 2017; Burgos et al., 2023). In this context, significant changes are also occurring within the scientific community regarding traditional research methods (Aguilar et al., 2023; Dwivedi et al., 2023).

The emergence of ChatGPT has not only provided a supportive tool for tasks related to research work but has also become a subject of study. On the one hand, the ethical implications of its use are being analyzed (González Arencibia & Martínez Cordero, 2020), and on the other, the advantages and challenges of its incorporation into research activities are being evaluated (Yu, 2023).

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Despite the debate surrounding the use of ChatGPT in scientific writing (González Arencibia & Martínez Cardero, 2020; Salvagno et al., 2023), there is a growing movement advocating for its implementation across various fields (Agudo-Peregrina, 2019; Lopezosa, 2023; Goyanes & Lopezosa, 2024). This movement comprises researchers, academics, and professionals who recognize the potential of ChatGPT to transform research and education (Deng & Lin, 2022; Burgos et al., 2023; Mejía Rivera & Rivera García, 2023).

In terms of its application, ChatGPT is being utilized in various ways within the scientific community (Castillo-González et al., 2022; Chen, 2023; Dergaa et al., 2023). Researchers use this model to generate drafts of academic papers, analyze large sets of qualitative data, and assist in creating summaries and literature reviews (Chen, 2023; Rahman et al., 2023). Additionally, its use as a pedagogical tool is being explored, helping students understand complex concepts and improving their writing skills (Mejía Rivera & Rivera García, 2023).

ChatGPT is also employed in the peer-review process (Mehta et al., 2024), where it can help identify errors and suggest improvements to manuscripts. Collectively, these applications demonstrate how ChatGPT is being integrated into research activities, providing new capabilities, and boosting scientific productivity (Castillo-González et al., 2022). Building on these ideas, it is crucial to understand how ChatGPT is being utilized in scientific production (Reyes Flores & Mejía Rivera, 2024), particularly in indexed publications. This understanding is essential for the scientific community to progress more rapidly and effectively, maximizing the capabilities of ChatGPT while simultaneously addressing the challenges its use may pose, including required regulations. The research question that guided this study was: What are the publication trends and disciplinary distributions of ChatGPT research in Scopus from 2022 to 2024?

2. Methodology

The applied methodology was the PRISMA protocol (Moher et al., 2009) which ensures a series of guidelines for reporting systematic reviews (Espinal et al., 2024; Torres et al., 2024). As shown in Figure 1, a search was conducted for titles, abstracts, and keywords of publications available in the Scopus database through the ChatGPT search command [TITLE-ABS-KEY(ChatGPT)]. The results were then cleaned to verify their relevance and remove duplicates. Finally, a statistical analysis was performed using VOS Viewer software to visualize relationships, identify associations, and clustering the analyzed publications.

The selection of Scopus as the sole source for this analysis is justified by its extensive coverage and high-quality data, ensuring the inclusion of top-tier publications. Scopus provides consistent and normalized data, facilitating comparisons and its advanced tools enable detailed analyses and visualization of trends, collaborations, and impact.

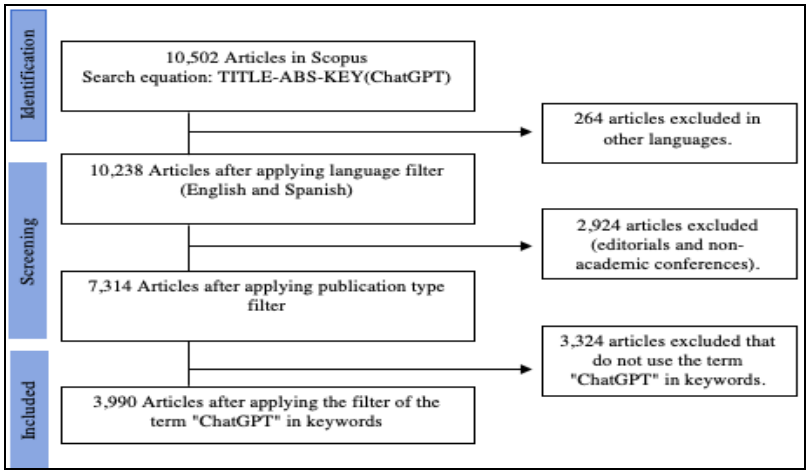

Figure 1. PRISMA flow diagram for the systematic literature review

2.1 Inclusion and exclusion criteria

Table 1 presents the inclusion and exclusion criteria defined for the selection process of the articles included in this bibliometric analysis.

Table 1. Selection criteria for publications

Element	Inclusion Criteria	Exclusion Criteria
Language	English and Spanish	Languages other than English and Spanish
Article Type	Academic journals or conferences	Conference abstracts
		Duplicate articles
Topic	ChatGPT	Unrelated to ChatGPT

Based on the criteria outlined, an initial search was conducted in the Scopus database in September 2024, yielding 10,502 articles. This initial search required the application of filters that considered the exclusion criteria. Consequently, the search excluded publications written in languages other than Spanish and English, publications in press at the time of the search, as well as publications such as letters to the editor, conference reviews, notes, and short surveys. This process resulted in the selection of documents that met the inclusion criteria and served as the basis for the bibliometric analysis conducted in this study.

3. Findings

The results indicate that Scopus contains 3,900 publications related to ChatGPT. The majority of these publications are affiliated with institutions located in the United States (24.80%), India (11.17%) and China (11.17%), as shown in Figure 2.

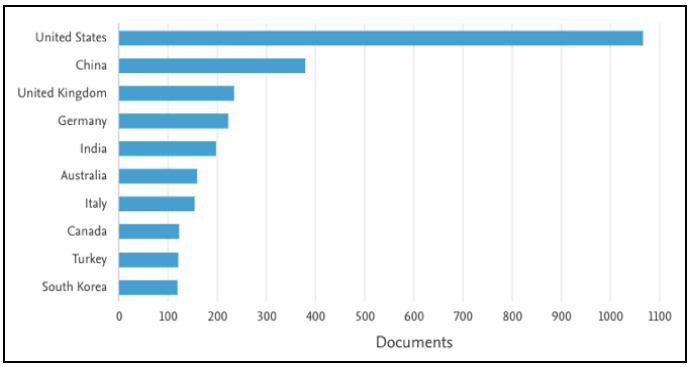

Figure 2. Publications by country. Source: Scopus

Among the indexed publications, 45.3% consist of journal articles, while 36.8% correspond to conference papers, as show in Fig 3. The academic fields with the highest number of publications are Computer Science (27.7%), Medicine (14.5%), and Social Sciences (13.2%).

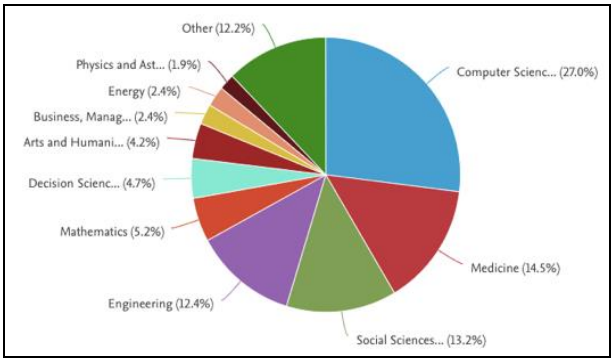

Figure 3. Publications by country. Source: Scopus

The mapping also identified leading affiliations (Fig. 4) and the most prominent authors based on number of publications. These include Ishith Seth and Warren Matthew Rozen, Wisit Cheungpasitporn, Charat Thongprayoon, Jing Miao, Jérôme Rene Lechien, Luigi Vaira, Zohar Elyoseph, and Carlos Chiesa-Estomba.

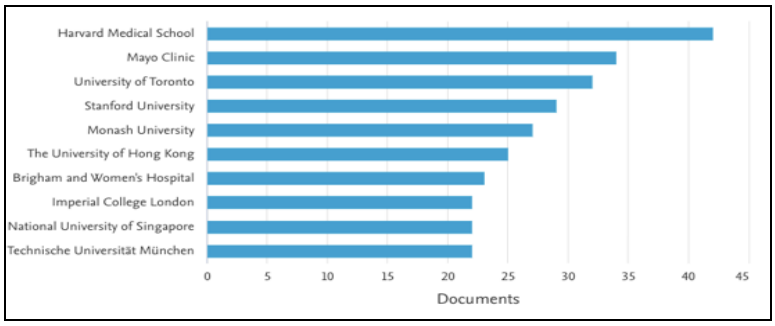

Figure 4. Leading institutional affiliations. Source: Scopus

The analysis of sponsoring institutions which have funded the largest number of ChatGPT-related publications over the past two years, reveals a notable presence of organizations from the United States and Asia.

Figure 5 illustrates the network of relationships by clusters revealed through the bibliometric analysis using VOSviewer. This network highlights a significant concentration of co-occurrences centered around the "ChatGPT" node, which is linked to 13 clusters comprising a total of 32 nodes. Key nodes such as performance, question, challenge, and higher education indicate major areas of study within the academic community. Peripheral nodes, such as case study, comparative study, perception, and generative AI, also demonstrate relevance, suggesting that research on ChatGPT encompasses both experimental studies and user perceptions, particularly in educational contexts.

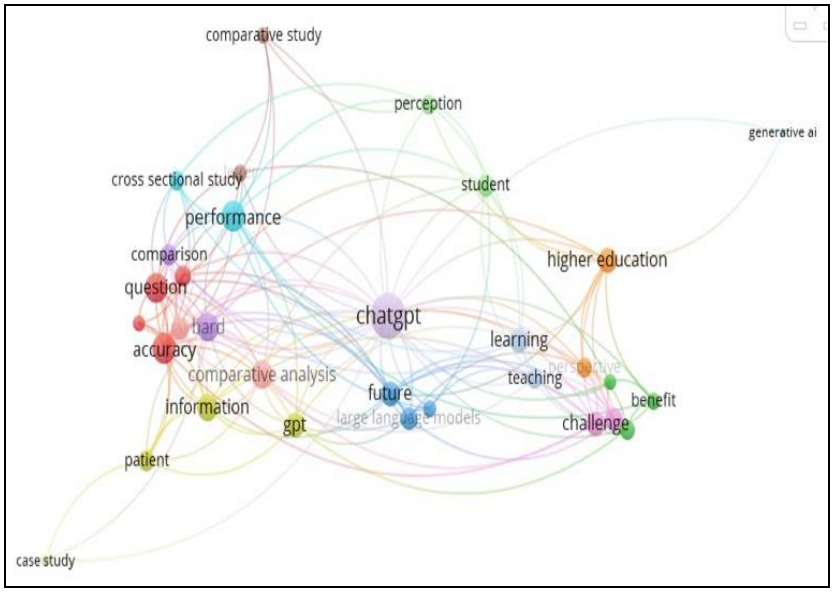

Figure 5. Clusters relationships identified. Source: VOS Viewer

The breakdown of data by clusters indicates that "ChatGPT" node has the highest number of co-occurrences (1,039) and link strength (646), underscoring its centrality in the research. Other key terms, such as performance (76), accuracy (32), and higher education (29), highlight the diversity of topics being investigated, as shown in Figure 6. Overall, this analysis reveals a growing interest in ChatGPT across various academic disciplines, with a tendency to explore its accuracy, applications, benefits, and challenges.

The cluster 1 includes concepts such as “future”, and “large-scale language model”. This reflects the academic community's focus on the future implications and utilization of large-scale language models. This highlights a strong interest in communication and language, particularly in how advanced language models can evolve and revolutionize various fields of knowledge. The inclusion of "future"

suggests optimism within the research community regarding the transformative potential of these technologies, anticipating significant advancements that could reshape the way people interact.

The second cluster, with terms such as “question”, highlights the importance of accuracy and utility of ChatGPT's responses, determining the effectiveness of these technologies in daily life. This cluster reflects the need for language models to understand and appropriately respond to human queries, which is essential for their acceptance and success in practical applications. Respectively, the third cluster addresses the “benefits” and “risks” of AI technologies. The potential benefits are substantial, including increased efficiency, access to information, and new opportunities across various industries. However, it is also vital to consider risks such as privacy, security, and ethical implications.

Cluster	keywords	Link	link strength	Co-occurrences
1	Comment	6	21	17
	Future	11	38	27
	Large language models	9	21	15
2	ChatGPT responses	5	8	12
	Correspondence	8	27	13
	Question	14	81	43
3	Benefit	6	20	12
	Risk	5	22	13
4	Information	12	49	28
	Patient	8	36	22
5	Learning	11	36	27
	Teaching	8	29	21
6	Challenge	11	65	39
	Opportunity	10	63	38
7	Higher education	11	44	29
	Perspective	7	29	22
8	Comparative analysis	13	35	16
	Quality	10	24	13
9	Perception	7	39	28
	Student	9	62	43
10	Accuracy	15	55	32
11	Bard	13	53	24
12	Case study	3	20	20
13	Chat GPT	30	646	1,039
14	Comparative study	5	25	19
15	Comparison	8	34	18
16	Letter	6	35	18
17	Cross sectional study	7	22	12
18	Generative IA	2	13	12
19	Gpt	11	36	20
20	Limitation	7	23	15
21	Performance	16	123	76

Figure 6. Clusters relations identified. Source: VOS Viewer

The fourth cluster, with terms such as "information" and "patient," focuses on the healthcare sector. This cluster reflects the critical intersection between technology and medicine, where AI innovations can lead to significant improvements in health outcomes and the efficiency of medical care. In contrast, the fifth cluster emphasizes the impact of language models on education, with terms such as "learning" and "teaching". AI technologies have the potential to transform education by offering new pedagogical methodologies and personalizing learning to better meet individual students' needs.

Encompassing terms like “challenge” and “opportunity”, the sixth cluster reflects the balance between the challenges and opportunities presented by new AI technologies. While significant obstacles exist, such as overcoming technical and ethical barriers, there are also numerous opportunities for innovation and advancement across various fields. Simultaneously, the seventh cluster focuses on higher education and future perspectives, with words such as "higher education" and "perspective." This emphasizes the importance of academic perspectives in integrating and applying emerging technologies in higher education settings.

The eighth cluster, which includes "comparative analysis" and "quality," underscores the importance of benchmarking and quality in research on language models. Rigorous evaluation and systematic comparison are essential for understanding the strengths and limitations of these technologies, ensuring their effective and responsible implementation. Meanwhile, the ninth cluster reveals an interest in students' perceptions and experiences with AI technologies in education, with terms such as "perception" and "student". This indicates that student perception is crucial to the adoption and effectiveness of new educational tools. The acceptance and success of these technologies depend largely on how they are perceived and used by students.

Regarding the tenth cluster focuses on the accuracy and performance of language models, with terms such as "accuracy" and "performance." The high frequency of these terms underscores the importance of ensuring these technologies are effective and reliable. Accuracy and performance are critical factors that determine the practical utility of language models in various applications, from natural language processing to automated decision-making. In parallel, in the eleventh cluster, the mention of "bard" suggests a specific reference to a study or application, while "case study" indicates a focus on detailed analyses of specific cases. This cluster reflects an interest in better understanding the impact of these technologies through specific and detailed studies, providing valuable insights that can inform future research and developments.

The twelfth cluster shows a strong concentration on ChatGPT, with a very high frequency of "ChatGPT," outlining its central relevance in current research. This suggests considerable interest in exploring the capabilities and limitations of ChatGPT, as well as comparing it with similar technologies. Finally, the thirteenth cluster, with terms such as "limitation" indentifies limitations and performance, suggesting a critical focus on identifying areas for improvement in language models.

4. Discussion

The bibliometric analysis developed confirm that ChatGPT research is expanding in academic literature, adopting a multidisciplinary approach that spans education (Goyanes & Lopezosa, 2024), medicine (Burgos et al., 2023), and computational linguistics (Biswas, 2023). Findings underscore ChatGPT’s prominence as an interdisciplinary research topic with diverse applications (Kalla et al., 2023; Singh

& Singh, 2023). The key nodes identified through VOSviewer reveal major research axes in the analyzed publications: performance, question, challenge, and higher education.

The node "performance" highlights the importance of accuracy and efficiency in generative AI models, as emphasized by researchers (Kasneci et al., 2023). These factors are crucial for AI applicability across disciplines, ranging from computational linguistics (Liu et al., 2023) to automated decision-making in healthcare (Coskun et al., 2023; Lim et al., 2023). This suggests that the scientific community increasingly acknowledges the long-term implications of ChatGPT's usage and its reliance on large-scale language models trained on extensive textual data (Hassani & Silva, 2023).

The "question" node reflects concerns about the precision and utility of ChatGPT-generated responses (Kuşcu et al., 2023). This highlights two key issues: first, the need to enhance models' ability to comprehend and adequately respond to human queries (Deng & Lin, 2022; Elkhatat, 2023); and second, the necessity of proper training to create effective prompts (White et al., 2023) and ensure digital literacy, which is essential for maximizing ChatGPT's potential while upholding ethical usage practices (Dave et al., 2023).

The "challenge" node captures the dichotomy between the opportunities and challenges posed by AI technologies (Gill & Kaur, 2023). While innovation, increased efficiency, and cost reduction are among its primary benefits (Deng & Lin, 2022), major concerns persist, including security and privacy risks, reliability and accuracy issues, quality control, environmental impact, and cultural implications (Ray, 2023).

Finally, the "higher education" node emphasizes that ChatGPT's emergence has sparked a significant debate within academia, yet no clear consensus has been reached. Nevertheless, its growing integration into teaching and learning processes is undeniable. This necessitates the involvement of governments, industry, and higher education institutions in regulating and overseeing its use, establishing protocols, and fostering the training of future professionals. Ensuring ethical and effective utilization of AI tools in academia remains a critical priority.

The co-occurrence bibliometric analysis suggests that discussions on ChatGPT's impact are still in their early stages. The distribution of document types reveals that the majority are articles (2,582), followed by conference papers (1,318), suggesting a solid combination of established research and emerging discussions in academic spaces such as international conferences. Additionally, content analysis demonstrates a wide variety of terms and thematic approaches, with 8,633 keywords provided by authors. These data underscore the depth and breadth of research on ChatGPT, characterized by high collaboration, both in the number of co-authors per document (3.98) and in the diversity of keywords used, which could be linked—based on cluster analysis—to its implications across different spheres of scientific research.

5. Conclusions

Research trends on ChatGPT literature include its evolution in language models, permorfance and response accuracy, benefits and risks, impact on health and education, challenges and opportunities of AI and perspectives on higher education.

The bibliometric analysis reveals a significant concentration of co-occurrences around the "ChatGPT" node, connected through 13 clusters comprising 32 nodes. Key nodes such as performance, question, challenge, and higher education indicate major areas of interest and study within the academic community. Peripheral nodes, such as case study, comparative study, perception, and generative AI, also demonstrate relevance, suggesting that research on ChatGPT encompasses both experimental studies and user perceptions, particularly in educational settings.

The analysis reveals a growing interest in ChatGPT across various academic disciplines, with a tendency to explore its applications, benefits, and challenges in higher education, task performance, and precision. Results shows that international collaboration is significant, with 23.59% of co-authorships involving researchers from different countries, indicating a global and multidisciplinary approach to ChatGPT research, even within such a short time frame.

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