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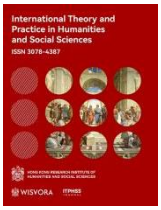

What Ethical Issues do ChatGPT Face: A Bibliometrics Based Study

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Abstract

ChatGPT represents a groundbreaking AI application that has garnered significant attention since its inception. However, despite its promising potential, its ethical implications have sparked considerable debate. This study aims to examine the key concerns surrounding the ethical governance of ChatGPT by conducting a bibliometric analysis and cluster-based content analysis of relevant scientific literature. The bibliometric analysis identifies influential authors, countries, and pivotal publications, revealing three primary categories of ethical issues associated with ChatGPT: human-related ethics, academic integrity and technical literacy, and artificial intelligence (AI) technology ethics and derived ethical concerns. Additionally, content analysis further refines these categories by synthesizing frequently occurring keywords. Building on this framework, the study provides a comprehensive discussion of the major ethical challenges faced by ChatGPT, as well as outlining future research priorities. Furthermore, this research investigates the knowledge base underlying ChatGPT's ethical governance, exploring key high-citation and high-link-strength literature through co-citation analysis, thereby mapping the research landscape and highlighting areas of growing scholarly interest. This study offers valuable insights for policymakers, researchers, and technology practitioners, emphasizing the need for more stringent policies, comprehensive guidelines, and robust ethical design in the development of ChatGPT and similar AI technologies.

1. INTRODUCTION

ChatGPT, also known as Chat Generative Pre-Trained Transformer, is an advanced natural language processing tool powered by generative artificial intelligence technology. It is based on the pre-trained GPT-4 model and transformer architecture, developed by the American artificial intelligence research company OpenAI, and was released on November 30, 2022. Since its debut, ChatGPT has gained global popularity due to its impressive capabilities and application potential across various sectors, including education, healthcare, business, and scientific research(Sedaghat, 2023; Tzelves et al., 2024). However, as its use becomes more widespread, the ethical implications of ChatGPT and similar technologies have attracted increasing scrutiny. Key concerns have emerged regarding academic integrity, privacy protection, information security, and the broader social impact of these technologies. These issues have garnered considerable attention from academia, technology developers, and the public, and they represent critical

challenges to the future development of artificial intelligence(Khowaja et al., 2024; Madden et al., 2023; Niloy et al., 2024). One of the foremost ethical challenges is the need to ensure the authenticity and accuracy of the content generated by ChatGPT, particularly as its intelligence enables it to produce rich and varied text. This raises concerns about the potential generation of harmful or misleading information.Another pressing issue revolves around user privacy—specifically, how ChatGPT processes personal data while safeguarding privacy, as well as determining the appropriate division of responsibility between AI systems and human users. Additionally, the increasing deployment of ChatGPT in academic and research settings has raised concerns about the potential for involuntary plagiarism and academic misconduct, which warrants further investigation. Therefore, systematic theoretical research into the ethical challenges posed by ChatGPT and similar technologies is crucial. Developing a robust ethical framework and regulatory mechanisms is essential to ensuring the sustainable development of artificial intelligence technologies. This study employs a bibliometric approach to identify and examine the primary ethical issues associated with ChatGPT's application, offering recommendations for the ethical governance of ChatGPT and similar AI technologies.

2.Materials and Methodology

2.1 Materials

For this study, we conducted a comprehensive search of the SCOPUS database for relevant literature up to December 5, 2024, with no restriction on the start date. The search focused on two sets of keywords: "ChatGPT" and "ethic OR ethics", applied to the title, abstract, or keywords sections of the papers. Only English-language publications, including both articles and reviews, were included. This search yielded 316 documents.

To ensure the validity of the included literature, we employed a two-person manual screening process. This step was essential, as some abstracts contained references to ethical approval, such as phrases like "research approved by the ethics committee," which were irrelevant to the research topic and could lead to confusion. Such cases were addressed through manual review. Following a double-blind screening process, the two reviewers discussed and finalized the list of papers for inclusion. The Kappa value, which measures the agreement between the reviewers, was used to assess the accuracy of the screening. This value represents the percentage of agreement between the two reviewers, with a score of 1 indicating perfect agreement on whether an article should be included, and 0 indicating complete disagreement. The Kappa value for this process was 0.939, indicating a high level of consistency in the inclusion and exclusion criteria. Ultimately, 278 articles were included in the analysis.

2.2 Methodology

This study employed a bibliometric analysis of the literature concerning the ethical challenges encountered by ChatGPT in its application, accompanied by a cluster-based content analysis. Bibliometrics is a methodological approach used to study scientific activities, knowledge dissemination, and academic influence through quantitative analysis of literature and its associated characteristics. Numerous scholars across various disciplines, such as ethics, pedagogy, and medicine, have applied bibliometric techniques to delineate the knowledge structure of a field, thereby identifying the most significant and impactful elements of research within those domains(Prado et al., 2024; Saheb et al., 2021; Yang Chuang & Qi Xiu, 2023) .

For the bibliometric analysis in this study, we utilized VOSviewer software to perform quantitative analyses, including keyword co-occurrence and citation coupling(Van Eck &

Waltman, 2010). In terms of network visualization, the network consists of nodes and edges. Nodes can represent entities such as countries, authors, or keywords, illustrating the relationships between these entities. The distance between nodes signifies the strength of their connections; shorter distances indicate stronger associations(Boyack & Klavans, 2010). In this study, we focused on a network based on total link strength (TLS). Both link and TLS properties reveal the number of connections an item has with others and the total strength of these connections. To supplement the quantitative analysis, we conducted a content analysis of the three clusters identified in the co-occurrence keyword analysis. This approach allows for a deeper understanding and comprehensive exploration of the ethical issues highlighted by the bibliometric results.

3. Results and Discussion

This section began with co-authorship analysis to explore the time, authors, countries and other relevant features of the research on ChatGPT ethical governance. Then we clustered the keywords through co-occurrence, and analyzed and extracted the key framework of the research according to the clustering characteristics and literature research.

3.1 Study the main distribution characteristics

3.1.1 Research time distribution characteristics

Since the release of ChatGPT at the end of November 2022, relevant studies on the ethical governance of ChatGPT have been published in relevant academic journals from 2023. Among them, 94 research results on ChatGPT and ethical issues were published in 2023 and 184 in 2024 (Contains two web debut articles), indicating that with the widespread application of ChatGPT, researchers have begun to pay more attention to its ethical governance issues.

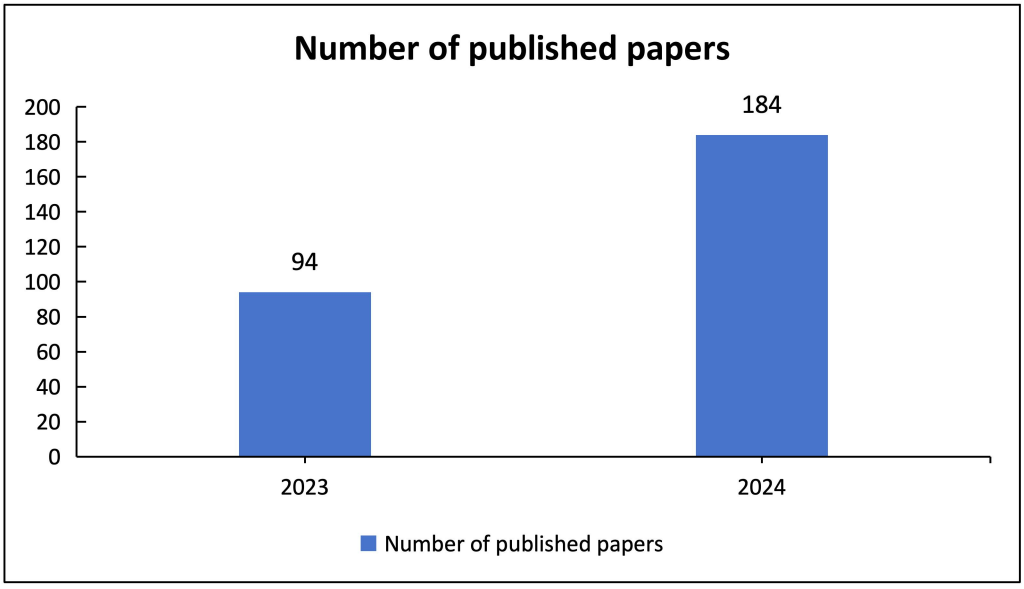

Figure 1: Number of published papers in 2023-2024

3.1.2 Distribution characteristics of authors

Since the type of this research is still rising, as we could see from the Density Visualization of co-authorship-Authors (Figure 2), authors with 2 or more publications were included, with a minimum cluster size of 5 by default. A total of 22 authors were included, with only one cluster and a total link strength of 26, and the published literature was far from forming an author cluster

effect. Of all the researchers, only 22 published two or more articles, and only six published three or more articles. Raman Raghu (Amrita School of Business, Amrita Vishwa Vidyapeetham), Teixeira da Silva J.A. (Independent Researcher, Japan), Bukar Umar Ali Sayeed, Md Shohel, Razak Siti Fatimah Abdul and Yogarayan Sumendra (Faculty of Information Science and Technology, Multimedia University Malyasia), in which the last four researchers are collaborators from the same unit. The above six authors published 10 articles in total, accounting for only 3.60% of the total results. Moreover, density visualization of co-authorship showed that the core degree of researchers in this field is low at present, indicating that this research field is far from forming a core group of authors, and there is still a lot of research space.

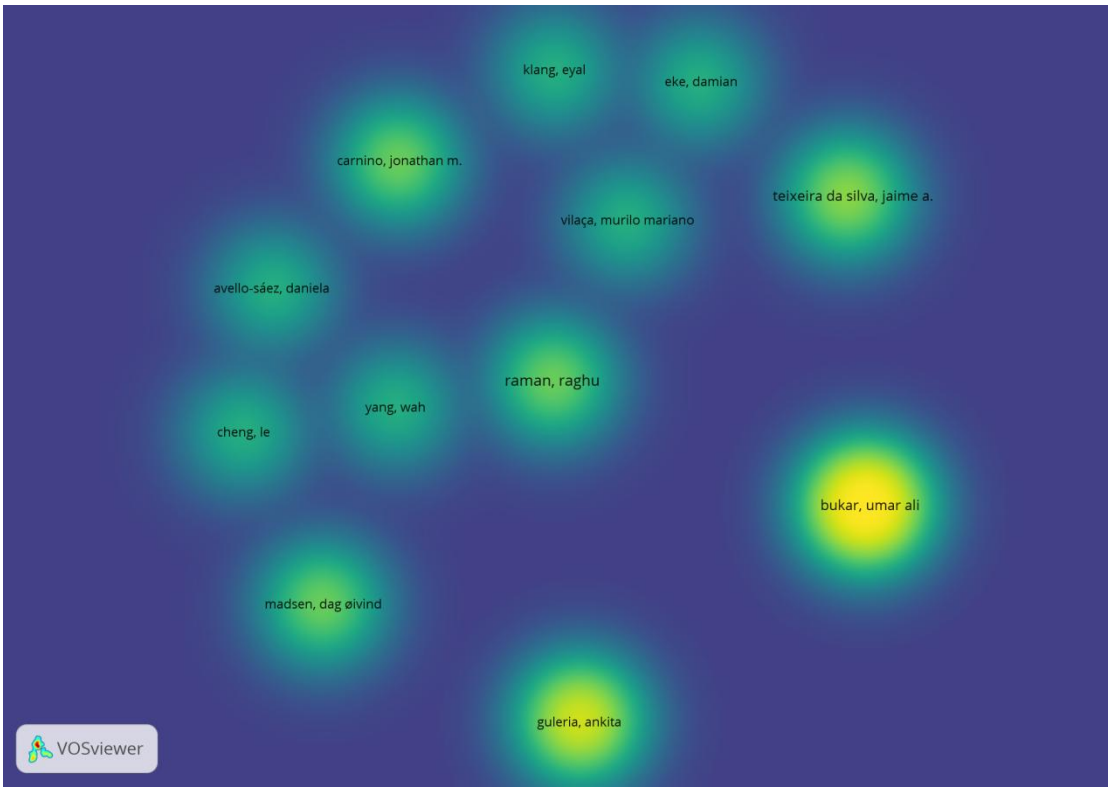

Figure 2:The Density Visualization of Co-authorship Authors

3.1.3 Study the distribution characteristics of countries and regions

In this part of the analysis, countries or regions with three or more publications are included, with a minimum cluster size of 5 by default. A total of 46 countries or regions were included, forming six clusters with a total link strength of 458. Through the content analysis, we found that only 9 countries or regions have published more than 10 articles, including the United States (94), the United Kingdom (28), India (25), Australia (24), China(Mainland, 22), Germany (16), Spain (14), Italy (13), Saudi Arabia (11). Early researches on the ethical governance of ChatGPT came from Canada (February 2023), Ireland (February 2023), Norway (March 2023), France (April 2023), the Netherlands (April 2023), New Zealand (April 2023) and other countries begin.

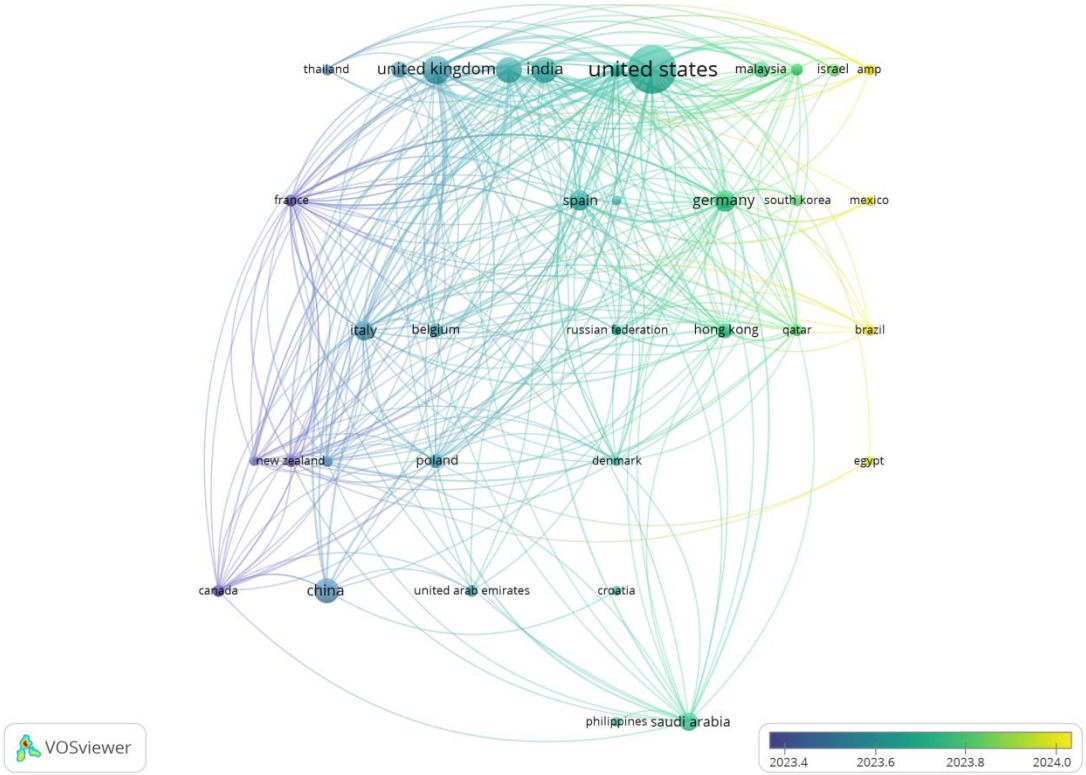

Figure3: The Overlay Visualization of Co-authorship Countries

3.2 Keyword co-occurrence analysis and cluster-based content analysis

3.2.1 Keyword co-occurrence analysis

The study analyzed 899 author keywords extracted from the collected papers, focusing on keywords with a frequency of occurrence greater than three. To enhance the clarity of clustering and emphasize the dominant research themes, a minimum cluster size of 10 was applied. This process resulted in the inclusion of 49 keywords, forming three distinct clusters with a total link strength of 1,179. The content analysis revealed that among these keywords, 49 appeared more than three times (Figure 4), 24 appeared more than five times, and only 15 appeared more than ten times. These findings suggest that, while the research landscape on ChatGPT ethical governance remains relatively fragmented, certain core thematic communities have begun to emerge.

Specifically, the ten most frequently occurring keywords were: ChatGPT (157 occurrences), AI (156 occurrences), ethics (85 occurrences), generative AI (45 occurrences), LLM (large language model, 40 occurrences), chatbot (34 occurrences), education (22 occurrences), higher education (21 occurrences), AI ethics (16 occurrences), and machine learning (15 occurrences).

These results highlight two key insights: 1) Focused Research Themes: The findings indicate a high degree of thematic concentration in certain areas. For instance, keywords such as "AI," "Generative AI," and "LLM" exhibit high co-occurrence frequencies and strong link strengths, underscoring the centrality of AI-related frameworks in studies of ChatGPT ethical governance. This suggests that much of the current research situates ChatGPT within the broader scope of artificial intelligence as a field, 2) Narrow Research Perspectives: Conversely, the relatively small number of high-frequency keywords also reveals the limited scope of existing research on ChatGPT ethical governance. While foundational topics like "ChatGPT" and "ethics" dominate, the narrower thematic diversity indicates that broader ethical considerations, such as social and cultural implications, are comparatively under explored.

This dual perspective underscores the need for expanding the scope of research to address a

wider range of ethical dimensions associated with ChatGPT and similar AI technologies.

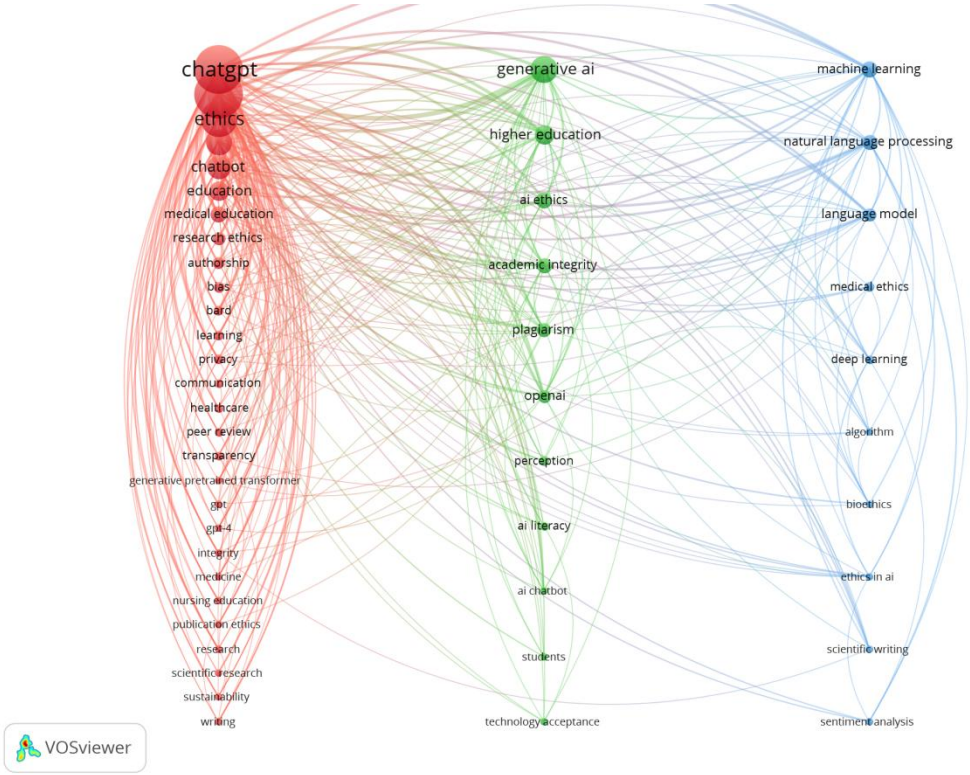

Figure4: The Network Visualization of Co-occurrence-Author keywords

3.2.2 Keyword cluster-based content analysis

According to the clustering results (FIG.4) and the content analysis method, it can be summarized and found that the following three core research themes existed in ChatGPT ethical governance research (Table 1).

3.2.2.1 Ethics relating to humans

The first cluster centers on the application of ChatGPT and the ethical considerations directly related to humans. Based on the results of keyword clustering, a secondary analysis and thematic categorization of the keywords within this cluster were conducted. This analysis identified five primary sections within the cluster, which are as follows:

(1) Similar research subjects (Generative language model): chatgpt, llm, ai, chatbot, bard, gpt-4, generative pretrained transformer, gpt

(2) Basic ethical element: ethics, privacy, bias, sustainability, communication

(3) Education and learning: education, medical education, authorship, learning, nursing education

(4) Practical ethics of scientific research: transparency, peer review, integrity, research, research ethics, publication ethics, writing, scientific research

(5) Medical care: medicine, healthcare

Cluster 1 examines the application of ChatGPT and its ethical implications, focusing on issues that directly pertain to human users. Within this cluster, classification (1) identifies the objects of study, emphasizing ChatGPT and other technologies with comparable functions or characteristics, such as chatbots and Bard. These studies explore the intricate relationships between large language model (LLM)-based AI technologies and human interactions. This foundation informs further categorizations, namely classifications (2)–(4), which address specific application

scenarios and ethical considerations. The areas of focus of these studies include basic ethical elements (ethics, privacy, bias, etc.), Education and learning, The role and challenges of Scientific research and Medical care in fields that have a profound impact on the development of human society (Naeem et al., 2024; Ugras et al., 2024; Weidener & Fischer, 2024). This cluster aims to uncover the societal impact of LLM-based AI technologies, assess their potential to promote human well-being and sustainable development, and identify ethical challenges. Researchers in this area seek to propose governance strategies that ensure the alignment of AI applications with societal values and ethical norms, safeguarding their responsible deployment in diverse human-centered domains.

3.2.2.2 Technical literacy and academic integrity

In the second cluster, researchers investigate how generative language models, while offering significant convenience to users, simultaneously raise ethical concerns regarding issues such as academic misconduct and plagiarism. Building upon the results of keyword clustering, we conducted a secondary analysis and thematic categorization of the keywords within this cluster. This analysis identified three key sections, which are as follows:

(1) Generalized research subjects (AI): generative ai, openai, ai chatbot

(2)Technical literacy and academic integrity: plagiarism, academic integrity, ai ethics, perception, ai literacy, technology acceptance

(3) Education: higher education, students

In Cluster 2, classification (1) identifies the research focus as the generative language models represented by ChatGPT. Researchers in this cluster primarily address concerns surrounding academic integrity, emphasizing the ethical challenges that arise from the integration of ChatGPT and similar generative AI technologies in academic contexts. Specifically, studies explore the ways in which the widespread use of these tools in educational settings impacts academic norms and ethical practices. For instance, scholars such as McIntire and Uludag have investigated issues like plagiarism and cheating facilitated by generative AI, highlighting the potential disruptions to academic integrity posed by these technologies(McIntire et al., 2024; Uludag, 2023).

Notably, the concept of "education" reappears in this cluster but carries a distinct connotation compared to Cluster 1. In Cluster 1, "education and learning" primarily pertains to educational activities and learning processes related to human behavior. However, in Cluster 2, "education" is closely tied to academic integrity issues and focuses on entities such as "higher education" and "students," reflecting the scope of ethical concerns surrounding academic misconduct in the literature. This differentiation underscores the broader thematic diversity within ethical discussions on ChatGPT, with Cluster 2 offering insights into how generative AI tools intersect with academic environments to challenge traditional norms and governance frameworks. Additionally, the theme of "(4) Practical ethics of scientific research" in Cluster 1 bears a vague similarity to "(2) Technical literacy and academic integrity" in Cluster 2. Through content analysis, we find that Cluster 1's "(4) Practical ethics of scientific research" focuses on the ethics and transparency within traditional academic research practices. It emphasizes improving research quality and regulating research behavior through institutional practices such as transparency, peer review, and research integrity. In other words, Cluster 1 is concerned with the ethical practices in traditional research, where technology serves as an auxiliary tool for "human agency." On the other hand, Cluster 2 primarily addresses the ethics of technology itself, focusing mainly on the ethical issues arising from the application of artificial intelligence in education, with a slight extension into discussions of academic integrity. Cluster 2 explores the profound impact of emerging technologies, represented by ChatGPT, on technical literacy, plagiarism, and

ethical concepts. It centers on the novel ethical challenges triggered by AI, with technology itself as the core issue.

3.2.2.3 Artificial intelligence technology ethics and derived ethics

The third cluster predominantly focuses on the field of artificial intelligence (AI) ethics and the derived ethical considerations exemplified by ChatGPT. Building on the results of keyword clustering, a secondary analysis and thematic categorization of the keywords within this cluster was conducted. This analysis identified two principal sections, which are as follows:

(1) Pan-artificial intelligence technology: machine learning, natural language processing, language model, deep learning, algorithm, scientific writing, sentiment analysis

(2) Derived ethics: ethics in ai, bioethics, medical ethics

In Cluster 3, classification (1) identifies the research focus, encompassing a wide range of artificial intelligence technologies represented by ChatGPT, including but not limited to machine learning, deep learning, and algorithmic frameworks. ChatGPT stands as a significant milestone and a transformative application of advancements in AI, symbolizing the evolution of natural language processing (NLP) and generative AI. Consequently, many researchers use ChatGPT as a representative case to explore the broader domain of AI ethics and its derived ethical implications. These studies systematically examine the ethical challenges and regulatory requirements emerging from the technological evolution of AI(Haupt et al., 2024; Roberts et al., 2024).

Moreover, as emerging AI technologies increasingly integrate with other scientific and technological domains, researchers have expanded their investigations to consider the derivative ethical issues specific to these interdisciplinary applications. For instance, in fields such as biotechnology and medicine, the embedded application of AI has prompted new ethical debates in areas like bioethics and medical ethics. Examples include discussions on AI-driven diagnostic tools and personalized medicine, which raise concerns about patient autonomy, data privacy, and the equitable distribution of healthcare resources(Chen, Jamie et al., 2024; Zhong Mingrui, 2024).

These studies extend beyond the ethical frameworks governing AI technology itself, delving into the broader social implications and ethical constructs shaped by the integration of AI with cutting-edge technologies in various fields. The ultimate goal is to offer both theoretical foundations and practical guidance for the responsible innovation and deployment of AI technologies, ensuring their alignment with societal values and ethical standards.

Table 1: Keywords Content analysis based on clustering

Cluster	Classify	Keyword	Weight<Links>
Ethics relating to humans	Similar research subjects(Generative language model)	chatgpt	48
		llm	31
		ai	45
		chatbot	31
		bard	14
		gpt-4	9
		generative pretrained transformer	8
		gpt	7
	Basic ethical element	ethics	38
		privacy	14
		bias	7

		sustainability	8
		communication	7
	Education and learning	education	21
		medical education	18
		authorship	13
		learning	12
		nursing education	6
	Scientific research	transparency	9
		peer review	9
		integrity	9
		research	9
		research ethics	8
		publication ethics	8
		writing	8
		scientific research	4
	Medical care	medicine	9
		healthcare	8
Academic integrity and technical literacy	Generalized research subjects(AI)	generative ai	30
		openai	22
		ai chatbot	11
	Academic integrity and technical literacy	plagiarism	22
		academic integrity	18
		ai ethics	16
		perception	9
		ai literacy	7
		technology acceptance	7
	Education	higher education	21
		students	5
Artificial intelligence technology ethics and derived ethics	Pan-artificial intelligence technology	machine learning	23
		natural language processing	22
		language model	17
		deep learning	12
		algorithm	9
		scientific writing	8
		sentiment analysis	6
	derived ethics	ethics in ai	12
		bioethics	10
		medical ethics	7

3.3 Knowledge base of ChatGPT ethical governance research

The co-citation analysis of all 278 papers was carried out, and literatures that were cited more than 5 times were included, with a total of 51 literatures. Among them, only 29 articles were cited more than 10 times, and only 7 articles were cited more than 20 times. We analyzed the three most frequently cited papers and the three with the highest total link strength (TLS) to determine the knowledge base in this area of research.

3.3.1 Highly cited literature

The most frequently cited document is "*ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns*", published in *Healthcare* 2023 by Sallam M(Moreno et al., 2023). Systematic review on the promising perspectives and valid concerns, the researchers further highlight the problems faced by the use of ChatGPT, including the generation of inaccurate information, ethical and privacy risks, and the negative impact that excessive reliance on technology can have on professional judgment.

The second most frequently cited paper was "*ChatGPT is fun, but not an author*" by Thorp H.H. published in *Science* two months after ChatGPT was published (Thorp, 2023). This paper explores the role of ChatGPT in academic writing and its controversy as the author of academic results. The authors argue that although generative AI tools such as ChatGPT can assist with text generation tasks and show some practicality and interest in academic writing, it is essentially an algorithm-based tool rather than a subject capable of independently assuming academic responsibility. The authors do not agree that ChatGPT should be considered an "author" with attribution credentials, and call on the academic community to strengthen ethics and policy development when facing generative AI technologies, clarify the boundaries of tool use, while maintaining the basic principles of academic integrity and accountability.

The third most cited document is Stokel-Walker C's article published in *Nature* in 2023. "*Chatgpt listed as author on research papers: many scientists disapprove*" (Stokel-Walker, 2023). Similar to the previous paper, the authors are also concerned about the controversial issue of ChatGPT's listing as an author of an academic paper, and note that the majority of scientists are opposed to this, believing that AI tools lack independent intent, responsibility, and the ability to contribute academically, and do not meet the basic requirements of collaborator status. The article also puts forward the call to formulate relevant policies to regulate the use of AI tools in academic publishing, to ensure the rationality of academic attribution and the maintenance of academic integrity.

3.3.2 High link strength literature

Literature with high total link strength (TLS) is usually the classic literature, authoritative review or basic theory in the research field. By analyzing the literature with high TLS, we can quickly understand the key achievements or research hotspots in the research field.

The article with the highest total link strength is "*ChatGPT Utility in Healthcare Education, Research, and Practice: Systematic Review on the Promising Perspectives and Valid Concerns*", which was published in *Healthcare* by Sallam M in 2023. Followed by Thorp H.H. "*ChatGPT is fun, but not an author*," was published in *Science* two months after the release of ChatGPT. The cited frequency of these two literatures is also the top two in the field, indicating that these two literatures are in a pivotal position in the academic network. The high link strength indicates that these two papers play a key role in connecting different research topics or subfields, and are the core bridge for cross-domain knowledge dissemination. The high citation frequency further indicates that the academic content and views of the literature are widely recognized and cited, which is an important theoretical basis or practical basis for research in this field.

The third paper is an article by Dowling M and Lucey B published in 2023 in the journal Finance Research Letters "*ChatGPT for (finance) research: The Bananarama conjecture*". The article focused on the hypothesis that the output power of large language models such as ChatGPT is limited by the quality of the input data (called the "Bananarama conjecture" - meaning "only as good as the data"). They explore the practical effects of LLMs in academic

research in finance, including its ability to generate, analyze, and summarize data, while examining challenges such as technological misuse, ethical issues, and academic integrity. Through theoretical analysis and case studies, the article illustrates ChatGPT's potential in dealing with complex financial issues, while calling on researchers and educators to use the technology prudently to ensure research quality and reliability(Dowling & Lucey, n.d.).

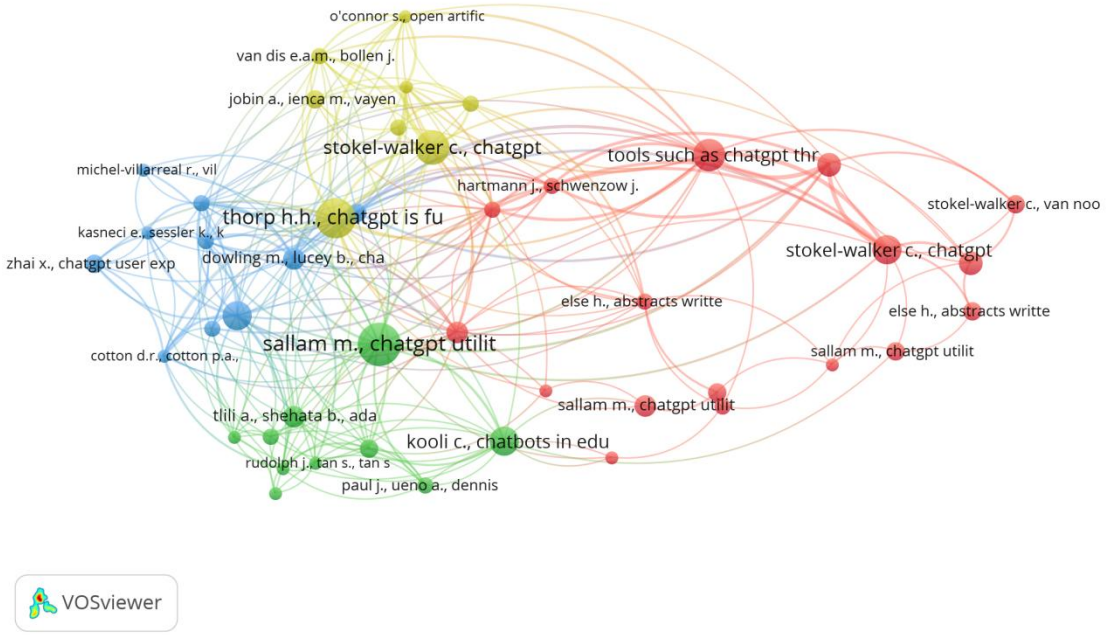

Figure5: The Network Visualization of Co-citation Cited References

3.4 Discussion

Since its release slightly over two years ago, ChatGPT, as a leading representative of generative artificial intelligence, has demonstrated remarkable capabilities in text generation, driving practical innovations across various fields, including education, healthcare, and business. Despite these advancements, academic attention to the ethical challenges and controversies associated with ChatGPT has not progressed at a comparable pace. This study provides a systematic evaluation and synthesis of the literature in this domain, aiming to capture researchers' attitudes toward the ethical dilemmas posed by ChatGPT. Current research predominantly addresses issues such as academic integrity, focusing on concerns like plagiarism and misuse resulting from ChatGPT's sophisticated generative abilities. Moreover, there is increasing exploration of its applications in critical sectors like education, medical care, and scientific research, where its potential benefits are intertwined with significant ethical concerns, including privacy violations, bias, and accountability gaps. By mapping the evolving academic landscape, this analysis underscores the need for deeper and more comprehensive ethical inquiry to guide the responsible integration of ChatGPT into society.

3.4.1 Academic integrity

Most researchers concur that ChatGPT demonstrates considerable potential as a generative AI tool in academic writing. Text generated by ChatGPT and similar applications exhibits notable fluency, coherence, and logical structure, enabling its use in drafting paper abstracts, literature

reviews, and other academic texts(Lund et al., 2023). However, its application has sparked profound discussions regarding academic integrity. A central concern involves the "originality" of ChatGPT-generated content. By design, ChatGPT reorganizes and synthesizes information based on patterns observed in large-scale datasets during training, rather than offering genuinely novel or creative contributions. This characteristic raises ethical questions about attributing authorship or citing content generated by ChatGPT as part of original research findings. The reliance on such tools without proper acknowledgment has prompted debates on their role in scholarly practices and the potential erosion of academic standards (Stokel-Walker, 2023). Secondly, the authenticity of text generated by ChatGPT remains a critical concern, as it can inadvertently produce inaccurate information or even fabricate references. This undermines both the quality of academic texts and the integrity of the research process, potentially misleading the direction of scholarly inquiry and diminishing the credibility of academic results(Alkaissi & McFarlane, 2023). Additionally, the use of ChatGPT raises concerns regarding the transparency of academic writing. Traditional academic writing requires researchers to meticulously document their research processes, methodologies, and data sources. In contrast, the content generated by ChatGPT lacks traceability to specific sources or logical development paths, which undermines the verifiability of academic work and makes it challenging to substantiate claims made in research(Lund et al., 2023). These issues highlight the need for greater scrutiny and clear ethical guidelines when integrating generative AI into academic practices.

In this context, the establishment of clear guidelines for the use of ChatGPT in academic writing is of paramount importance. On one hand, academic institutions and publishers must create explicit frameworks to ensure the proper definition of AI tools' roles, preventing both their overuse and misuse. These guidelines should clarify the boundary between AI as a tool for enhancing research and its potential role in authorship. On the other hand, researchers need to foster a strong ethical awareness, recognizing AI as a tool rather than a substitute for human creativity. Adherence to academic integrity is crucial, with an emphasis on ensuring the authenticity, originality, and transparency of academic outcomes(Lund et al., 2023; McIntire et al., 2024). In conclusion, while ChatGPT offers significant convenience to researchers, its application also raises serious concerns regarding academic integrity. To address these challenges, future efforts should aim to balance technological innovation with established academic norms. This balance can be achieved through the refinement of both technological capabilities and institutional regulations, fostering the sustainable and ethical development of academic practice(Alkaissi & McFarlane, 2023).

3.4.2 Privacy

As a representative of generative AI technology, ChatGPT's wide application in key fields such as education, healthcare and scientific research not only promotes the improvement of service efficiency and quality, but also brings profound ethical challenges. Privacy protection is an essential ethical issue in the application of ChatGPT, with its complexity manifesting in multiple dimensions (Cartwright et al., 2024; Lalar et al., 2024). In the field of education, the use of student data for automated assessments may influence their academic progression (Sana’a & Mohammad, 2024). In healthcare, patient data, including medical histories and diagnoses, are highly sensitive; if exposed, such data could have severe consequences for both the privacy and psychological well-being of patients (AlSamhori et al., 2023). Furthermore, risks such as unauthorized access, data breaches, and secondary use of data persist, especially in contexts involving cloud storage and multi-party collaboration. While data anonymization is a common protective measure, the risk of data de-anonymization remains significant, particularly when data

is cross-referenced with external information. These challenges not only jeopardize user privacy but also erode trust in AI systems, which in turn impedes the widespread acceptance and use of such technologies (Yu Shasha, 2024).

To effectively address these privacy concerns, a comprehensive approach involving technical, policy, and user engagement measures is necessary. On the technical side, multi-layer encryption and distributed storage should be employed to ensure the security of data processing and storage. From a policy perspective, clear data usage regulations should be established, mandating privacy impact assessments (PIA) and introducing dynamic consent mechanisms that allow users to manage data permissions flexibly. Additionally, the transparency of data usage, the establishment of privacy compliance certifications, and the enhancement of user privacy education are crucial for building trust in AI systems. Moreover, cross-industry privacy protection alliances and third-party privacy audits will provide long-term support for safeguarding privacy in AI applications. The integration of these measures will not only improve privacy protection but also promote the responsible and sustainable development of generative AI technologies, such as ChatGPT.

3.4.3 Attribution of responsibility

The issue of "attribution of responsibility" is particularly prominent in ChatGPT applications (Yang Chuang & Qi Xiu, 2023; Zhou Jianlong et al., 2023). First, the content generated by ChatGPT is based on vast amounts of training data and model inference, rather than human logical reasoning. As a result, when the system provides biased, inaccurate, or erroneous advice or information, it becomes difficult to pinpoint who is responsible (Urman & Makhortykh, 2023). In the field of education, erroneous learning recommendations may mislead students and negatively affect their academic development (Cetin et al., 2024). In healthcare, inaccurate medical advice can directly influence clinical decisions, potentially jeopardizing patient safety (Guo Yan, & Wang Chengzhen, 2024). This ambiguity in responsibility exacerbates the crisis of trust between users and developers, while also posing challenges to existing legal and regulatory frameworks. Although current legal structures have outlined basic requirements for the application of artificial intelligence, the rapid pace of technological development means that many nuances and specific application scenarios have not been adequately addressed by the law. Thus, determining how to clearly allocate responsibility among the various levels and roles involved in AI applications is an urgent issue that needs resolution.

Government bodies should establish clear standards for responsibility attribution in AI applications based on specific industry contexts (such as education, healthcare, etc.). For example, in healthcare, the distribution of responsibility among AI system designers, developers, users, and regulators should be explicitly defined. In the case of incorrect or inaccurate recommendations, it should be clearly determined whether the developer, healthcare institutions, or medical professionals bear responsibility. This standardized framework for responsibility will help reduce ambiguity and improve transparency. Additionally, it is essential to foster collaboration between governments, technology developers, industry experts, and the public to establish a cross-disciplinary regulatory mechanism that collectively addresses responsibility issues. This approach ensures transparency and fairness in the application of AI technologies, while also establishing a robust accountability system. Given the automated nature of artificial intelligence, real-time review and feedback mechanisms should be incorporated into applications. For example, in healthcare settings, automated systems can be developed to validate the advice provided by ChatGPT, ensuring its accuracy and safety. Furthermore, users should be able to provide feedback when errors are detected, helping to adjust the system’s recommendations. Such

real-time monitoring and feedback mechanisms will contribute to reducing errors and strengthening oversight of AI systems.

3.4.4 Interpretability and transparency

"Interpretability and transparency" is also a significant ethical challenge faced by ChatGPT. The complexity of its deep learning model makes it difficult to explain and verify the outputs, which is particularly critical in high-risk fields such as healthcare (Heston & Lewis, 2024). In these situations, if users are unable to understand the underlying rationale for the recommendations generated by ChatGPT, they may over-rely on the system or completely exclude their own judgment. This could lead to an improper realization of the system's value, as users may fail to critically engage with the content provided, thereby diminishing the overall accountability and ethical use of the technology.

To address this challenge, several measures can be implemented to enhance the explainability and transparency of ChatGPT applications. First, incorporating mechanisms that allow users to trace how the model arrives at specific outputs would increase trust and usability. For instance, in healthcare applications, it would be beneficial to provide a clear explanation of the model's reasoning, such as highlighting relevant patient data or medical guidelines that contributed to a recommendation (Liu Yang et al., 2024). This would help healthcare professionals maintain a sense of control over the decision-making process while still benefiting from AI-driven suggestions. Additionally, developing user-friendly interfaces that simplify the presentation of model outputs could improve transparency without overwhelming users with technical details.Furthermore, integrating explainability into the training and validation processes of AI models is essential. By ensuring that models are not only accurate but also interpretable, developers can reduce the risk of misapplication in sensitive fields. In healthcare, for example, explainable AI models could help clinicians understand why a particular recommendation was made, allowing them to assess its validity and relevance (Sun Pengfei et al., 2024). Moreover, clear guidelines and regulations regarding the transparency of AI tools should be established, particularly in sectors where errors can have severe consequences, such as healthcare. These regulatory frameworks could mandate transparency in the data and models used by AI systems, ensuring that users thoroughly understand how decisions are made. By implementing these strategies, the ethical application of ChatGPT and similar AI technologies can be better ensured, promoting informed decision-making while maintaining accountability.

3.4.5 Fairness

In addition to the more widely discussed ethical challenges, ChatGPT also faces the relatively under-explored issue of "fairness" in its applications. Generative AI, such as ChatGPT, relies on existing datasets for training, which may carry inherent biases or imbalances. Consequently, the results generated by the model may unintentionally exacerbate or replicate societal inequalities, particularly in fields like education and healthcare. In the education sector, ChatGPT's algorithms are often trained on historical educational data that predominantly reflects the needs and performance of students from high-resource regions. As a result, the model may favor addressing the needs of these students when providing learning recommendations, while neglecting the specific requirements of students from low-resource groups. These students often face challenges related to infrastructure, educational resources, and support. If the model fails to consider these factors, its recommendations may provide limited assistance to these groups, thereby reinforcing educational inequality (Li Juntao, 2024). In the healthcare sector, the training data used by ChatGPT may lack diversity, particularly in terms of race, gender, age, and other socio-economic

backgrounds. Due to the absence of representative, diverse data, the model's predictive capabilities may be biased against certain groups (e.g., minority populations or low-income patients), leading to inaccurate disease risk assessments for these populations. This bias can result in inaccurate healthcare recommendations, which in turn may lead to inequitable distribution of medical resources. Not only does this impact patient health management, but it may also widen health disparities, particularly in areas where precision medicine is crucial (Hanna et al., 2023).

To address this fairness issue, it is essential to use more diverse and representative databases for training and apply debiasing techniques to eliminate potential biases in the data. Furthermore, increasing the transparency of the model, establishing fairness evaluation and monitoring mechanisms, implementing relevant regulatory policies, and encouraging user feedback are effective measures to ensure the fairness of AI applications. Implementing these strategies can help mitigate fairness issues in AI technologies like ChatGPT, promote their just and inclusive use, and reduce the exacerbation of social inequalities.

4.Conclusion and Suggestion

In conclusion, the widespread application of ChatGPT across fields such as scientific research, education, and healthcare presents significant opportunities for the innovative development of services and systems. However, it also introduces pressing ethical challenges, including concerns about privacy protection, responsibility attribution, fairness, and transparency. These challenges require careful consideration, as the ethical risks associated with AI technologies like ChatGPT can undermine public trust and equity. Moving forward, it is essential to foster the responsible use of ChatGPT by advancing data governance, optimizing AI models, and strengthening ethical frameworks. This approach will not only protect societal values but also ensure the long-term promotion of social welfare and justice in AI applications.

Limitation

This study acknowledges several limitations that should be considered in future research. First, a significant limitation stems from the fact that the study was conducted by researchers with backgrounds in management and ethics. To address the complex ethical dilemmas posed by ChatGPT, future research would benefit from a more diverse team of professionals across disciplines. This approach would allow for a broader and more nuanced understanding of the ethical challenges and potential scientific inquiries involved.

Secondly, the focus of the study was restricted to ChatGPT, excluding other AI technologies such as robotics, machine learning, algorithms, and generative adversarial networks (GANs), which represent broader AI applications. Extending the research to encompass a wider range of AI products could provide a more comprehensive overview of the ethical issues faced by different AI systems.

Additionally, this study limited its scope to English-language articles from the Scopus database, which may affect the universality of the findings. Future research could expand its scope to include other databases, such as Web of Science or PubMed, to incorporate a broader range of scholarly perspectives from diverse backgrounds.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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