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The Impact of Chatgpt in Medical Sciences in View of Bibliometrics

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1. Abstract

In the era of big data, medical science could not but incorporate new techniques and protocols. Computational linguistics and large language models have already been applied to various aspects of medicine. Recently, the application of Chat Generative Pre-Trained Transformer -ChatGPT has attracted the scientific community's interest in the changes it can initiate in the science of medicine, scientific literature, diagnostic techniques and the management of medical data and health records. From rave reviews to skepticism and transparency issues, the ChatGPT seems to be charting a new path in medical sciences and the effects of its implementation, positive or negative, will be visible and significant shortly. This study spotlights an early bibliometric approach highlighting the impacts of ChatGPT in Medical Sciences.

2. Introduction

Chat Generative Pre-Trained Transformer [ChatGPT] belongs to large language models, which started its operation publicly in November 2022 by the company OpenAI based in San Francisco, California. In principle, large language models use neural networks to perform tasks based on billions of natural speech patterns produced by humans. In addition to extensive writing, reporting, and text generation capabilities, it also has limited code generation capabilities [1]. Based on the GPT-3 model, ChatGPT can rapidly and highly accurately produce automated conversations due to being trained on such input data. It can also significantly reduce the costs of businesses in the area of customer support [2]. Some additional benefits of using ChatGPT in academia are assisting in literature research, summarization and review in numerous topics and scientific areas, generating text providing significant aid in the draft creation of an abstract or a manuscript, and analyzing text data. ChatGPT also provides language translation options in several popular languages and gives answers to various scientific answers in several disciplines [3].

The emergence of such large language models also affects other aspects of social and economic life, which must be transparent. Cyber security, health misinformation, and social issues such as social stereotypes and gender equality are issues in which technical intelligence and computational linguistics can play a positive and negative role. Further-more, they may also affect the professional orientation of young people or other professionals since in companies, e.g. of the media and the electronic press; many newsletters can be reproduced through them. Finally, an important objection is raised, in matters of intellectual rights, since if ChatGPT can create a poem or a story from the vast amount of data it can manage, the intellectual rights of this project it needs to be clarified to whom they will belong [4].

Despite this, their launch and the enthusiasm for their use are also accompanied by reservations and skepticism, mainly from the scientific world. As easy as it is for a user to learn, for example, disease symptoms, it is just as easy to simplify and popularize data with severe scientific impact, if anything, in complex medical topics or lead the researcher to false and inaccurate information and interpretation

of scientific studies. Also, issues of transparency of the algorithms trained and used by the companies that implement large language models should be regulated at an institutional level and by government bodies [5-8].

Already the European Union is working systematically to map and record all the systemic risks arising from artificial intelligence tools such as ChatGPT and to precisely identify the relationships between providers, professional users, and end users, as well as the risks at a social and economic level. Finally, the legal jurisprudence of various issues related to issues of content, data, and the extent of their use by tools such as ChatGPT will be evaluated [9].

Can ChatGPT and similar language models make a significant impact in Medical Science? Here are some ways ChatGPT can contribute when we addressed the following question to ChatGPT and reflect on its perception of such a tool in scientific research: "What is the social impact of ChatGPT in Medical Science?" ChatGPT generated the sub-sequent answer:

1. "Improved accessibility to medical information: ChatGPT can help bridge the knowledge gap between medical professionals and patients by providing accessible and understandable information about various medical conditions, treatments, and preventive measures. Patients can ask questions in plain language and receive reliable and relevant answers, empowering them to make informed decisions about their health.

2. Enhancing medical education and training: ChatGPT can be valuable in medical education and training programs. It can assist medical students in understanding complex medical concepts, reviewing case studies, and practicing diagnostic reasoning. This technology can augment traditional learning methods and provide personalized learning experiences.

3. Decision support for healthcare professionals: ChatGPT can act as a decision support system for healthcare professionals. Analyzing patient data and medical literature can assist doctors in diagnosing diseases, recommending treatment options, and staying up to date with the latest research and guidelines. This can help improve the accuracy and efficiency of medical decision-making.

4. Remote healthcare and telemedicine: ChatGPT can play a crucial role in providing remote healthcare services in situations where access to healthcare is limited. Patients in underserved areas can interact with the system to receive preliminary medical advice, triage, and determine whether immediate medical attention is required. It can help extend medical expertise to areas with a shortage of healthcare professionals.

5. Ethical considerations: While ChatGPT offers significant potential, there are also ethical considerations to address. Ensuring patient privacy and data security is paramount. It is crucial to maintain transparency regarding the limitations of ChatGPT and avoid overreliance on AI systems. Additionally, efforts should be made to ensure that the technology does not exacerbate existing healthcare disparities and is accessible to individuals with diverse backgrounds and levels of digital literacy.

Overall, the social impact of ChatGPT in Medical Science lies in its ability to democratize access to medical information, support healthcare professionals, and improve patient outcomes. However, deploying this technology responsibly and in conjunction with human expertise is essential to maximize its benefits while minimizing potential risks "[10].

Artificial intelligence has revolutionized the generation and management of data in all sciences. The data's importance and gravity are vital when patients generate it, so data management in medicine and public health authorities automatically becomes critical for the individual and society. Computational linguistics and large language models applied in medical sciences have brought optimism about their usage and, concurrently, skepticism [11].

The present study spotlights the research frontiers of ChatGPT at the beginning of its era in medical sciences through the dynamics of bibliometrics.

3. Materials and Methods

The current bibliometric approach utilizes the Scopus database, VOS viewer and R-bibliometrix. Scopus is a comprehensive scholarly database containing 1.7 billion cited references. Scopus includes approximately 2500 serial titles from around 7000 publishers. Scopus is a comprehensive scholarly database that covers a wide range of subjects and includes many cited references. Researchers can leverage its user-friendly interface and navigation menu to explore relevant literature effectively. The database's flexibility in re-search fields allows users to focus their searches on specific subject areas, ensuring more targeted and refined results. Boolean Syntax further enhances the search capabilities, enabling researchers to construct complex queries by combining keywords using Boolean operators. The indexing operations in Scopus are crucial in organizing and categorizing the documents within the database. This indexing process helps researchers locate and access relevant publications more efficiently, contributing to the overall effectiveness of the bibliometric analysis. The Scopus database provides researchers with valuable resources and tools for conducting bibliometric analysis, making it a popular choice in the academic community [12-16]. After application of various combinations, the phrase "ChatGPT" was used, without time limitation, and the following search details: TITLE-ABS-KEY [chatgpt] AND [LIMIT-TO [SUBJAREA , "MEDI"] OR LIMIT-TO [SUBJAREA , "NURS"] OR LIMIT-TO [SUBJAREA , "BIOC"] OR LIMIT-TO [SUBJAREA , "HEAL"] OR LIMIT-TO [SUBJAREA , "IMMU"] OR LIMIT-TO [SUBJAREA , "PSYC"] OR LIMIT-TO [SUBJAREA , "NEUR"] OR LIMIT-TO [SUBJAREA , "CHEM"] OR LIMIT-TO [SUBJAREA , "PHAR"]] AND [LIMIT-TO [LANGUAGE , "English"]]. The research was performed at 19/06/2023.

4. Results and Discussion

The following figure represents the word clouds of the 50 most frequent keywords in Abstract, Title and Keywords manuscript fields (Figure 1). The above word clouds show that the most frequent keywords occurred in Titles, Abstracts, and Keywords. There was a high level of similarity among the most frequent words: ChatGPT dominates the clouds. "artificial intelligence", "intelligence", "chatbot", "large language models", "ai", "medical", "research", "models" and "education" were also words that appeared in the collected documents. As expected, the search keyword ChatGPT prevailed in word clouds. Moreover, the stemming terms of various keywords in the fields, Title, Abstract, Keywords, or its derivatives, occurred in (Figure 1). The visualization map in (Figure 2) displays the co-occurrence network of keywords. This representation is derived from 1102 terms extracted from the selected manuscripts' titles, keywords, and abstracts. Only terms with a minimum occurrence of 6 were included to ensure relevance, resulting in 49 terms meeting the threshold. The map classifies these terms into six distinct clusters, each with a different color. The color assigned to an item in the visualization map corresponds to its cluster affiliation. Additionally, the proximity of two items on the map indicates a more substantial level of relatedness between them. In (Figure 2), the representation highlights the six clusters with the highest occurrence scores. Among these clusters, the blue cluster features the term "chatgpt" as its key item, emphasizing its importance as a search term. Similarly, the green, light blue, purple, red, and yellow clusters are associated with the terms "artificial intelligence", "medical education", "adult", "human" and "language," respectively, all of which have notable occurrences: 155, 11, 11, 150 and 32, as indicated in (Figure 2).

Interestingly, the following paradox appears. While in a bibliometric analysis, the search term has the highest frequency of occurrence, in the present research, this term does not have the highest frequency but the third highest. The search term "chatgtp" comes third, after the term "artificial intelligence" with 155 and "human" with 150 occurrences in the red and green groups, respectively. This discrepancy could be attributed to various factors. One possibility is that the term "chatgpt" may be relatively new or less commonly used in the literature compared to the terms "artificial intelligence" and "human," which are more established and widely discussed concepts. The popularity and usage of specific terms can vary depending on the research field, time, and the emergence of new technologies or concepts. Additionally, the frequency of occurrence of a term in a bibliometric analysis can also be influenced by the selection criteria, data sources, and search strategies used. Different databases or search engines may yield different results, and the specific search parameters employed can impact the frequency rankings.

In (Table 1), an analytical description of the correspondence terms is presented as follows:

The red cluster comprises 15 terms primarily related to health care, clinical practice, training, and medical research. It includes terms associated with natural language processing and deep learning.

- The green cluster focuses on artificial intelligence and machine learning. Key terms in this cluster include scientific literature, plagiarism, practice guideline, openai and decision making.
- The blue cluster highlights the significance of chatgpt. Terms such as chatbot, authorships, publishing, writing, and ethics represent this cluster.
- The presence of terms like a human experiment, language, radiology, and interpersonal communication in the yellow cluster indicates a focus on various aspects of ChatGPT and the impact of language models in human communication.
- The purple cluster contains keywords like adult, physician, control study and re-search.
- The light blue cluster illustrates the emergence of chatgpt in the COVID-19 crisis and includes the terms nonhuman, education, and medical education.

Emphasis is also placed on issues such as decision-making and data analysis where they are manifested in the bibliometric analysis in various terms and reflects the im-portance that ChatGPT can have in the management of medical information and knowledge so that the doctor can offer an accurate and correct diagnosis or treatment. Concerns also focus on the production of research in the medical sciences and the production of scientific medical texts. This finding is manifested by the presence of keywords such as 'medical literature, medical research, medical writing'.

An additional topic that stems from the bibliometric analysis is the ethical side of text production in the medical sciences, from a natural language processing model, the derivations, the accuracy of the information, plagiarism, and its reliability at the medical level. The production and dissemination of scientific knowledge should be reviewed for accuracy and moral impact on human life [17,18].

Several concerns have already been expressed about the production of scientific summaries by ChatGPT, which are plausible. They are produced in scientific language and in a formal manner, which in some cases are challenging to be recognized as such by established scientists. So, questions arise about the value of research on a moral level and to what extent citizens and the political system can trust its results. In the scientific world, abstracts and texts produced by artificial intelligence tools lead to stricter use in several journals and conferences to preserve the value and verification of scientific research [19, 20].

Also, the boundaries between a cognitive and educational tool and a tool that can faithfully reproduce high-precision medical text that may help a 3rd-year medical student to pass the tests, which can be used for fraudulent purposes, are blurred, and depends on the end user and their ethical point of view. The same assumption applies to all natural language processing models, some of which use and rely

on hundreds of billions of parameterized words and natural speech elements, such as the Chat Generative Pre-Trained Transformer [ChatGPT] [21,22].

In clinical practice, the personal contact between patient and doctor is of the utmost importance and is a sensitive part of medical science. The patient's opinion on the use of artificial intelligence in the production of automated texts in the recording of medical data and practices may lead to the obsolescence of medicine and clinical practice due to the reduction of the contribution of the human factor in the production of medical text and writing [23].

Either ChatGPT is going to prove to be an essential tool in the production of scientific knowledge, even as a search engine, as can be seen in the bibliometric map with the presence of the specific term, or a new revolution is starting that will bring rearrangements and restructurings even at the review process of manuscripts in scientific journals. A new path in the scientific landscape is inevitably starting. Reviewing the rest of the terms of the bibliometric analysis, the fear of plagiarism that can arise from utilizing ChatGPT is visible. Besides, the human factor should always have the final word and perspective, especially in public health matters. The balance of deploying such artificial intelligence tools should be done with the correct dose so that no substitution or human replacement by such tools in daily medical practice is established [24,25].

Table 1: An analytical description of the correspondence terms is presented as follows.

Cluster	Terms
red	clinical practice, deep learning, health care, health care delivery, health care personnel, human, internet, language processing, medical literature, medical research, medical writing, natural language processing, patient care, software, training
green	algorithm, artificial intelligence, chatbots, data analysis, decision making, knowledge, machine learning, openai, plagiarism, practice guideline, scientific literature
blue	ai, authorship, chatbot, chatgpt, ethics, large language models, publishing, writing
yellow	communication, human experiment, interpersonal communication, language, language model, radiology
purple	adult, controlled study, physician, research, search engine
light blue	covid-19, education, medical education, nonhuman

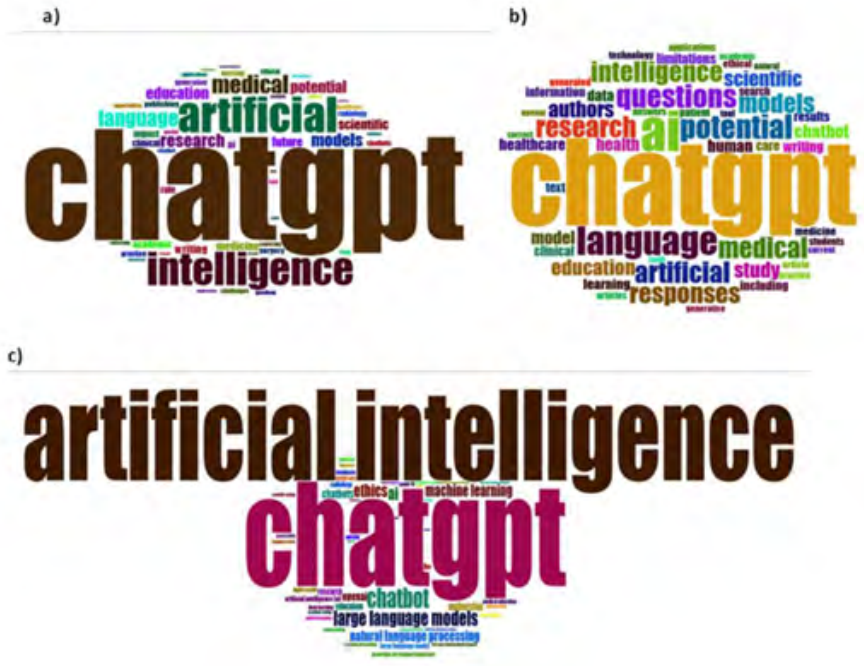

Figure 1: Frequency words clouds of (a) titles; (b) Abstract; (c) Keywords (50 Words).

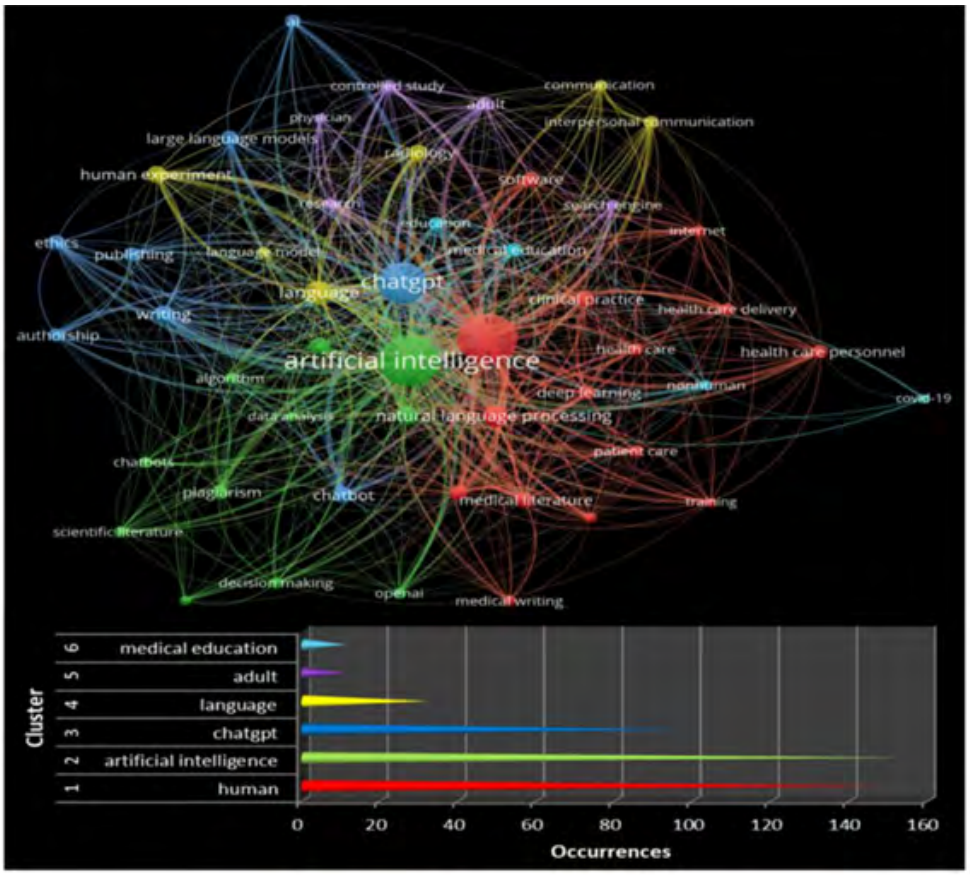

Figure 2: Keyword Analysis and number of occurrences of the keywords in each cluster

5. Conclusion

The impact of large language models of artificial intelligence and similar tools will be multidimensional in the medical sciences as well, from the level of diagnosis, research, and interpretation of results as well as the management of electronic health records and data in public health authorities. In the coming years, there will be significant interest and discussion around issues arising from using tools such as transparency, cost, reliability and validation of data, and research applications. Bioethics issues will be a rather big challenge for the medical scientific community. The development of ChatGPT will reshape many regulations and compliances in producing medical documents and enriching scientific literature. As large language models such as ChatGPT evolve, a more de-tailed assessment of the risks and benefits of its applications from scientific and institutional bodies will be required.

6. Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

7. Author Contribution

All authors have read and agreed to the published version of the manuscript.

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