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Research Article

Chatbot and ChatGPT Publication Trends: A Bibliometric Analysis

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ABSTRACT

Artificial Intelligence tools like ChatGPT and chatbots are designed to replicate intelligent human-to-human conversation. At the end of 2022, ChatGPT was a trending topic and discussed across the sectors, it was discussed in the media. Journalists and experts exchanged numerous thoughts and suggestions. ChatGPT also created worries among academics as students may utilize ChatGPT to write essays and projects. This study's primary goal is to identify trends in publication and to realize the visualisation network of co-authorship of countries, co-occurrence of keywords, co-citation and citation of authors, countries and bibliographic linkage or coupling examination in ChatGPT and Chatbot research. The study employed a bibliometric approach. Data was extracted using the Clarivate Web of Science (WoS) database. The terms "OpenAI", "ChatGPT", "Chatbot, "Generative Model", and "Generative Pre-Trained Transformer (GPT)" were used to search the publications and we found 6391 documents that were published between 1990 and 2023. The bibliometric networks of publications are visualized using the VOSviewer. Results revealed that the highest (2288) number of research published in 2023 and publications increased rapidly yearly. Most of the publications are contributed by the USA, China, the UK, Germany and Canada. Elsevier, Springer Nature, IEEE, MDPI and Wiley are the top publishers that contributed more research. This analysis provides a thorough understanding of ChatGPT and Chatbot. It will be helpful for both those studying and applying AI in their professional and academic endeavours.

Keywords: Artificial Intelligence, Bibliometrics, Chatbot, ChatGPT, Education, Network Analysis, OpenAI.

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INTRODUCTION

Artificial Intelligence (AI) applications are rapidly developing and becoming more noticeable in various facets of everyday life. ChatGPT, a chatbot with a conversational AI platform developed by OpenAI, is one recent phenomenon (Tlili *et al.*, 2023). Chatbots are intelligent computer programmes that reproduce intelligent person-to-person discussions, these are categorised into; AI-based chatbots, rule-based chatbots, conversation flow chatbots and voice chatbots, each with its function (Rathore, 2023). Integration of chatbots is valuable to support and toll for professionals (Alshurafat, 2023). OpenAI has an opportunity to significantly enhance numerous facets of our lives, among them the use of chatbots. Many procedures and processes can be automated by chatbots, which streamlines communication, increases efficiency, and provides an easier user interface (Rathore, 2023).

In November 2022, the artificial intelligence language model ChatGPT was introduced, it offers generated conversational answers to query prompts (Dowling and Lucey, 2023), based on Open Artificial Intelligence's (OpenAI) language model (Haleem *et al.*, 2023), it was developed and launched by OpenAI (https://openai.com/) (Tong and Zhang, 2023), immediately went viral (Cox and Tzoc, 2023), it has got 100 million of subscribers within the two months after the launch (Leiter *et al.*, 2023), journalists and experts exchanged numerous thoughts and suggestions (Taecharungroj, 2023), and the launch of ChatGPT attracted all scholars attention, regardless of their field of study (Dwivedi *et al.*, 2023). The mainstream press also has debated the ChatGPT implications and, more generally on generative AI, stressing the various possible merits and drawbacks of such technologies (Dwivedi *et al.*, 2023). ChatGPT generates text in replies to queries submitted to it using deep learning techniques. ChatGPT is an innovative alternative to search engines such as Google, which responds to inquiries with a collection of links to assist you in discovering more about a topic (Cox and Tzoc, 2023). The

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models in OpenAI ChatGPT are based on Google's transformer models, Google Labs made these models open to the public; however, the firm did not integrate them into their products. As OpenAI ChatGPT is free to use, its success is dependent on its widespread use (Aydin and Karaarslan, 2023).

REVIEW OF LITERATURE

Artificial intelligence has had a tremendous effect on societies, organizations, and individuals. It provides systematic reasoning capabilities according to inputs (Dwivedi *et al.*, 2023). AI is a combination of disciplines based on the fields of computer science and linguistics that aims to construct computers capable of doing activities that would generally require human intellect (Sarker, 2022). These activities include the capability to learn, adapt, rationalise, recognise, and comprehend abstract concepts, and the ability to respond to complex human characteristics such as interest, emotions, imaginative thinking, and so on (Korteling *et al.*, 2021). It may be utilized for text completion, language translation, and chatbots (Mijwil *et al.*, 2023). The adoption of AI in academia is a trendy area in the education sector. ChatGPT is an application of AI that provides a variety of advantages covering, enhanced learner involvement, accessibility, and collaboration. However, it creates uncertainty about plagiarism and academic integrity (Cotton *et al.*, 2024). Scholars are worried about the usage of chatbots, specifically ChatGPT, in schools and colleges to generate academic essays (Khalil and Er, 2023).

ChatGPT is excellent and yields interesting results while writing stories, poems, lyrics, and essays, users can ask any queries, and it will respond with relevant, convincing topics and responses. ChatGPT is presently at the top of many educational priorities. To respond to the tools, administrators form task forces and convene institution-wide discussions, with the majority of the suggestions being to implement these tools (Haleem *et al.*, 2023; McGee, 2023). Even in its simplest form, ChatGPT may produce plausible-appearing research studies for respected journals (Dowling and Lucey, 2023). ChatGPT is more beneficial in academic and scientific writing and scientific research (Sallam, 2023). ChatGPT might engage in conversation with us the same way that a real human specialist can; the same query will never yield identical results, but the basic information will just be similar (Tong and Zhang, 2023).

ChatGPT has slowly and steadily made inroads into clinical patient management and medical education (Khan *et al.*, 2023). ChatGPT achieves outstanding accuracy in making clinical choices, with specific strengths appearing when more clinical data is available (Rao *et al.*, 2023). A query with ChatGPT about a disease, along with its definition and risk factors of disease, ChatGPT provided complete details of the disease, and other diseases with related symptoms, also a list of therapy choices and exercises was provided. It can help patients who are unfamiliar with a certain disease by providing valuable information and medication options (James *et al.*, 2023; Kim, 2022). As a new technology, ChatGPT has advantages, but it must be used with extreme caution (Khan *et al.*, 2023).

ChatGPT is widely regarded as of top quality, with a pleasant attitude and happy sentiments leading social media. ChatGPT is regarded as a wonderful opportunity in a variety of sectors (Leiter *et al.*, 2023). A study conducted by Taecharungroj (2023) found that ChatGPT can have both beneficial and bad effects on technology and humans. ChatGPT allows text generation on any topic and in any terminology from any prompt. Its flexible architecture permits it to do a variety of tasks such as answering questions, language modelling, machine translation, and more (Aydin and Karaarslan, 2023). ChatGPT is a system based on machine learning that learns from data independently and can generate sophisticated and presumably intelligent writing after training on a vast text data set (Van *et al.*, 2023).

In research, ChatGPT can be utilized to generate new ideas or to ease the process of research aspects and it can help in writing summaries and generating keywords. If ChatGPT is linked to library discovery tools, it may be able to provide a bibliography of related resources. The simplicity with which ChatGPT can respond to study inquiries has the capability to revolutionise the teaching styles. It also can generate syllabi, model lesson plans, and lesson content in seconds (Cox and Tzoc, 2023). According to Ali and Djalilian (2023), chatbots are trained to utilise large libraries and then generate and process textual or spoken conversations between humans. Siri, Alexa, and Google Assistant are a few of the examples of voice chatbots (Ali and Djalilian, 2023).

A variety of problems must also be considered for the successful adoption of ChatGPT in accounting, such as integrating with current systems and procedures, security and confidentiality of data concerns, assuring consistency and accuracy in responses, and handling client expectations and confidence (Alshurafat, 2023). Although ChatGPT may be a beneficial tool for researchers, it poses a risk to scientific journals because ChatGPT-generated papers may contain erroneous or plagiarised content (Zielinski *et al.*, 2023). Adesso (2023) demonstrated how ChatGPT can simulate and analyse physical principles and phenomena using its built-in statistical and mathematical capabilities. ChatGPT also includes functions like emotion detection, subject detection and sentiment analysis to assist users in better understanding their discussion partner. ChatGPT can assist businesses in making customer service more effective and efficient (Shaji George *et al.*, 2023). AI chatbots like ChatGPT are significantly more advanced than web search engines in that computers generate original content, however, computers are still limited in that they are unable to take responsibility for their work (Lee, 2023).

ChatGPT's potential advantages and possibilities for various industries, including education, writing for academic purposes, and client service. ChatGPT can encourage collaborative learning,

streamline interactions between students and teachers, and provide a more effective approach for preserving and retrieving course information in the academic context (Rathore, 2023). ChatGPT and its successors will serve as valuable online assistants for patients as well as healthcare practitioners (Hopkins *et al.*, 2023). ChatGPT holds great promise, but its implementation in clinical practice will face numerous challenges (Patel and Lam, 2023). Some of the authors had a conversation with ChatGPT about AI's potential future in medicine and higher learning (King, 2023; Tlili *et al.*, 2023) and the editor asked ChatGPT to prepare an editorial on incorporating chatbots in medical research (D'Amico *et al.*, 2023).

Most of the research studies suggested that ChatGPT can create original articles on a wide range of subjects and be utilised in several disciplines, and it is difficult to separate ChatGPT from human-like writing (Uludag, 2023). It is used in philosophy(Generative Pre-trained Transformer and Zhavoronkov, 2022), accounting (Alshurafat, 2023), biology (Cahan and Treutlein, 2023; Tong and Zhang, 2023), and in the medical education field (Khan *et al.*, 2023), used by libraries (Cox and Tzoc, 2023), and people use it to seek medical information (Mijwil *et al.*, 2023). It is useful for doing routine tasks like calculations and data entry, improves efficiency and accuracy, enhances collaboration and communication with customers, streamlines access to information resources, reduces workload with productivity, and is also helpful in data analysis (Alshurafat, 2023).

ChatGPT exemplifies the capabilities of the future generation of chatbots powered by big language models (Patel and Lam, 2023). There is no problem utilising ChatGPT to produce scientific publications if it is just utilised for language editing. Any new concepts produced by ChatGPT, on the other hand, must be evaluated through real experiments, with the results verified by humans (Kim, 2023). Salvagno *et al.* (2023) address the usage of a chatbot powered by artificial intelligence in scientific writing. Adopting such applications raises various ethical concerns, including the possibility of plagiarism and inaccuracy, and there is also a potential disparity in accessibility among nations with varying levels of income if the application becomes paid. An AI chatbot with exceptional writing abilities generated sensation in academia (Lee, 2023). Crawford *et al.* suggested that instructors can use AI, such as ChatGPT to create helpful learning experiences for students who have developed good character (2023).

OBJECTIVES OF THE STUDY

- To know the growth of research publications in ChatGPT and Chatbot.
- To identify the top ChatGPT and Chatbot research influential authors, journal research outputs and their citation data
- To understand the visualisation network of co-authorship of countries, co-occurrence of keywords, co-citation and citation of authors, countries and bibliographic linkage or coupling examination in ChatGPT and Chatbot research.

METHODOLOGY

Present study employed the methods of bibliometric analysis as it will be useful for exploring huge data. Web of Science (Wos) was used to retrieve data about publications. The "OpenAI", "ChatGPT", "Chatbot, "Generative Model", and "Generative Pre-Trained Transformer (GPT)" words are used to search the publications. The publication data were collected on 10th November 2023. We obtained 6391 paper results produced between the years 1990 and 2023 as the period selected because the publications on chosen terms covered between these years only. and the publication's statistics, including title, abstract, keywords, bibliographic data, and citation details, were downloaded in the form of text. Scimago Journal Rank (SJR) is used to obtain H-Index statistics. Journal Citation Indicator (JCR) 2022 is used to gather the journal's Impact Factor (IF) details. Additionally, the Microsoft Excel application is used to create graphs and Tables. Further, downloaded data is analysed by utilising the VOSviewer application to visualize the publications networks.

Analysis of the Study

In 1990, only one document related to the chosen area was published and indexed in the Clarivate Web of Science, Figure 1 illustrates the increasing number of publications and indicates that the highest volume of documents (2288) was produced in 2023.

Thirteen different types of documents were published, with a total of 6391 documents. Among them, 82.99% were articles, 9.09% were Early Access, 5.46% were editorial materials, 5.27% were letters, 4.25% were review articles, 3.19% were proceeding papers, 1.5% were meeting abstracts, and 0.60% were in other forms. These other forms include book chapters, news items, book reviews, corrections, data papers, and retracted publications (Figure 2).

According to Figure 3, out of 6391 research publications, the United States of America (USA) produced 30.34% of publications which is the highest in number of publications. China follows closely with 23.58% of the publications, while the United Kingdom has 10.01%, and Germany has 6.44%. Canada published 4.78% of the documents, India published 4.66%, Japan published 4.45%, France published 4.03%, and Australia published 3.92%. These are the top ten countries which published the highest number of research documents.

According to the data, 279 publishers have produced research in the chosen area. Out of 6,391 publications, 20.96% have been

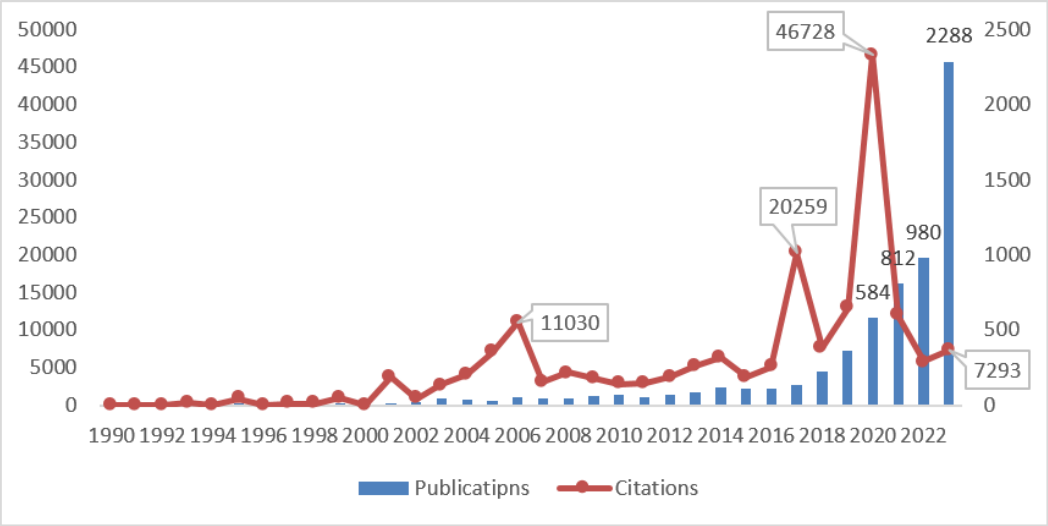

Figure 1: Year-wise Publications with citations.

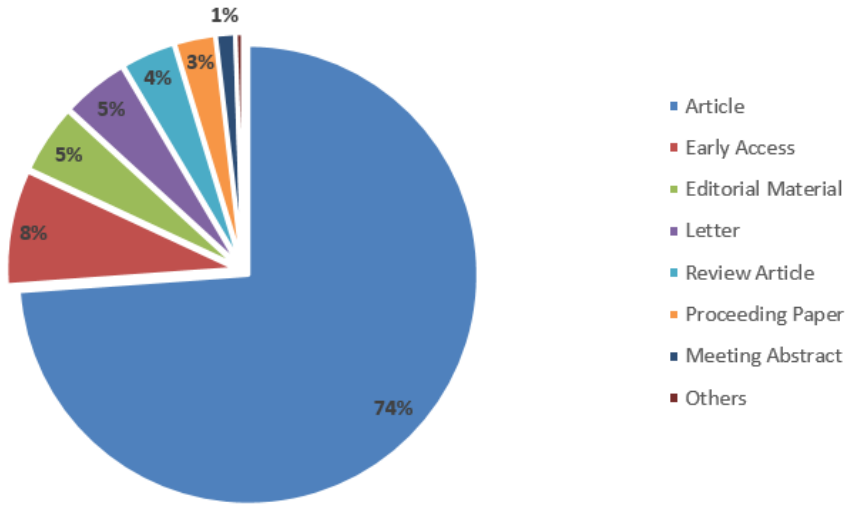

Figure 2: Publication as Type.

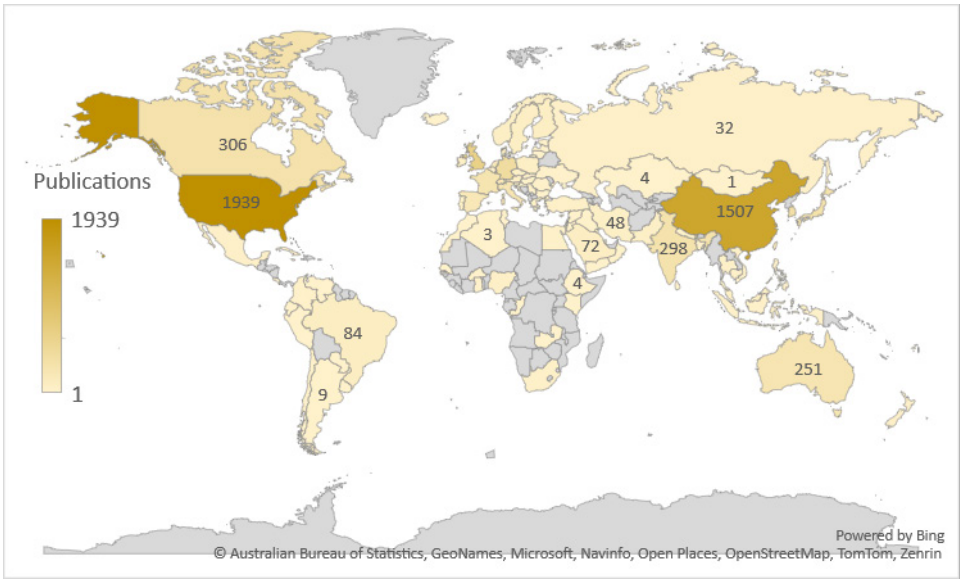

Figure 3: Publications by Country.

published by Elsevier, followed by Springer Nature with 14.36%, Institute of Electrical and Electronics Engineers (IEEE) with 14.22%, Multidisciplinary Digital Publishing Institute (MDPI) with 6.33%, and Wiley with 5.13%. Figure 4 shows the top ten publishers.

Table 1 displays the top ten sources or journals that have produced the most number of publications in the chosen field. According to the Web of Science, IEEE Access is the top-ranked journal that has published 158 publications. The top ten productive journals have produced 808 documents, which is 12.64% of all documents. One of them, "Lecture Notes in Computer Science," is part of the Springer Publications Book series, which has the highest h-Index (470) according to the SJR, it also produced 58 documents. The "Neuroimage" journal by Elsevier, USA has a 418 h-Index and a 1.57 impact factor according to Journal Citation Reports 2022 by Clarivate. With 76 publications, the journal "IEEE Transactions on Pattern Analysis and Machine Intelligence" published by IEEE, USA, has the second-highest h-Index (417), and the highest impact factor (6.82) when compared to the other 279 journals in the list. The USA published five of the top ten journals, two are from Switzerland, and one each from Canada, the Netherlands, Germany, and Canada.

The top 10 impactful articles are displayed in Table 2 and are ranked by the total number of citations received. "Generative Adversarial Networks" by Goodfellow *et al.* and "ImageNet Classification with Deep Convolutional Neural Networks" by Krizhevsky *et al.* are two of the articles that have received the most citations, with 23927 and 15206 respectively, and were published by the Association for Computing Machinery (ACM) in the Communications of the ACM journal in 2020 and 2017. Two articles were published by Academic Press Inc. Elsevier Science and IEEE also published 2 articles. "A fast learning algorithm for deep belief nets" by Hinton *et al.* published by MIT Press in

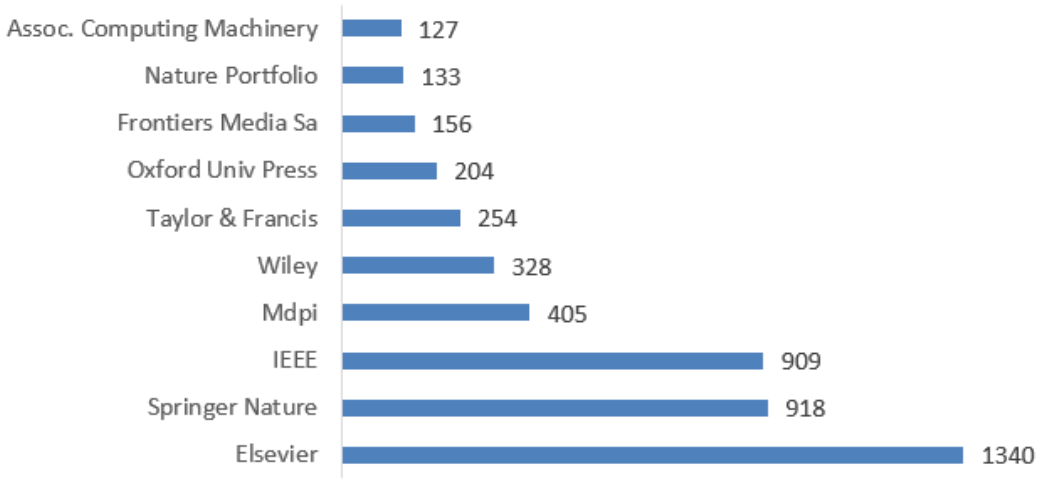

Figure 4: Top 10 Publishers.

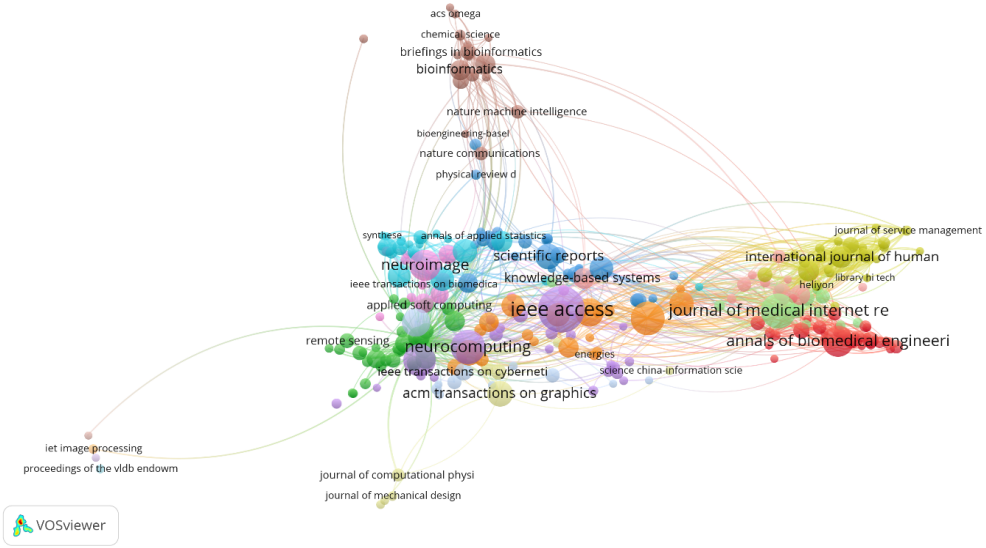

Figure 5: Citation-wise Sources.

Neural Computation journal received 10951 citations which is the third most influential paper in the field.

Figure 5 shows citation-based sources network visualisation. According to Figure 5, 277 of the 1876 sources have at least 5 publications. The top five published titles are IEEE Access (158) 2.472%, "Journal of Medical Internet Research" (90) 1.408%, neurocomputing (85) 1.330%, Applied Sciences (83) 1.299%, and "IEEE Transactions on Pattern Analysis and Machine Intelligence" (76) 1.189%.

According to Figure 6, 73 of the 105 nations have a minimum of 5 publications. The largest cluster of connected countries includes 73 countries organised into seven clusters. Figure 6 depicts the network of nations' associations on co-authorship. Nodes symbolise the various nations. Node size reflects the number of publications generated by the nation. Total link strength is greatest in the USA (1346), the UK (818), the People's Republic of China (773), Germany (436), and Switzerland (337), and authorship collaboration is greatest in these countries. Mongolia, Paraguay, Syria, and Trinidad and Tobago, on the other hand, reported a total link strength of zero, indicating that these countries had the lowest level of author collaborations.

Figure 7 depicts a cooperative network between affiliated institutions. The nodes indicate institutions and each node size is proportional to the number of articles produced by the organisation. According to the analysis, 619 out of 5270 organisations have at least 5 publications. During the research,

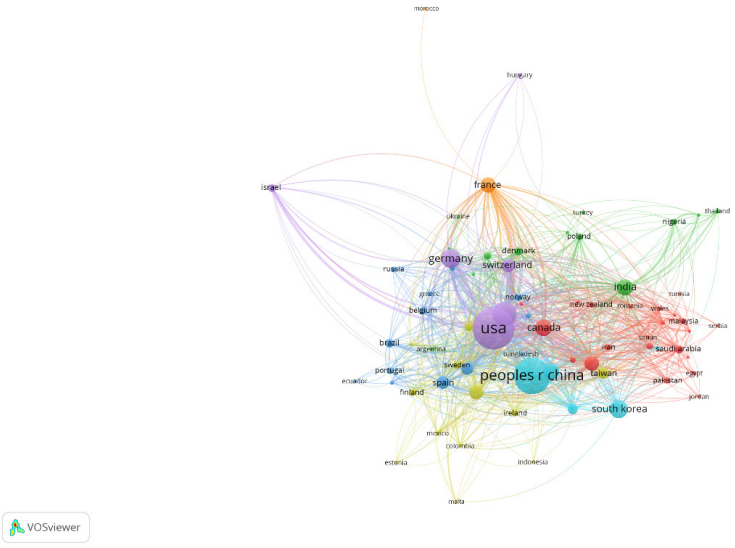

Figure 6: Network of Nations Based on Co-authored Research.

Table 1: Top 10 Productive Journals/Publications.

Rank	Journal	TP	h-Index	JCR-IF	Country	Publisher
1	IEEE Access	158	242	0.89	USA	IEEE
2	Journal of Medical Internet Research	90	197	1.73	Canada	JMIR Publications Inc.
3	Neurocomputing	85	196	1.02	Netherlands	Elsevier
4	Applied Sciences Basel	83	130	0.57	Switzerland	MDPI
5	"IEEE Transactions on Pattern Analysis and Machine Intelligence"	76	417	6.82	USA	IEEE
6	Annals of Biomedical Engineering	71	156	0.77	USA	Springer
7	Neuroimage	71	418	1.57	USA	Elsevier
8	"IEEE Transactions on Neural Networks and Learning Systems"	59	251	2.63	USA	IEEE
9	"Lecture Notes in Computer Science"	58	470	-	Germany	Springer
10	Sensors	57	245	0.89	Switzerland	MDPI
	Total Publications	808				

Note: TP=Total Publications; IF=Impact Factor.

Table 2: Top 10 Impactful Research Papers.

Rank	Title	Author	Source Title	Total Citation	Publisher
1	"Generative Adversarial Networks"	Goodfellow, Ian; Pouget-Abadie, Jean; Mirza, Mehdi; Xu, Bing; Warde-Farley, David; Ozair, Sherjil; Courville, Aaron; Bengio, Yoshua (2020)	"Communications of the ACM"	23927	ACM
2	"ImageNet Classification with Deep Convolutional Neural Networks"	Krizhevsky, Alex; Sutskever, Ilya; Hinton, Geoffrey E. (2017)	"Communications of the ACM"	15206	ACM
3	"A fast learning algorithm for deep belief nets"	Hinton, Geoffrey E.; Osindero, Simon; Teh, Yee-Whye (2006)	Neural Computation	10951	MIT Press
4	"Unified segmentation"	Ashburner, J; Friston, KJ (2005)	Neuroimage	5990	"Academic Press Inc Elsevier Science"
5	"From few to many: Illumination cone models for face recognition under variable lighting and pose"	Georghiades, AS; Belhumeur, PN; Kriegman, DJ (2001)	"IEEE Transactions on Pattern Analysis and Machine Intelligence"	3638	IEEE Computer Soc
6	"Finding scientific topics"	Griffiths, TL; Steyvers, M (2004)	"Proceedings of the National Academy of Sciences of the United States of America"	3423	National Academy of Sciences
7	"Whatever next? Predictive brains, situated agents, and the future of cognitive science"	Clark, Andy (2013)	"Behavioral and Brain Sciences"	2597	Cambridge University Press
8	"Learning generative visual models from few training examples: An incremental Bayesian approach tested on 101 object categories"	Li Fei-Fei; Fergus, Rob; Perona, Pietro (2007)	Computer Vision and Image Understanding	1628	"Academic Press Inc Elsevier Science"
9	"Acoustic Modeling Using Deep Belief Networks"	Mohamed, Abdel-rahman; Dahl, George E.; Hinton, Geoffrey (2012)	"IEEE Transactions on Audio Speech and Language Processing"	1233	IEEE
10	"FAB-MAP: Probabilistic localization and mapping in the space of appearance"	Cummins, Mark; Newman, Paul (2008)	International Journal of Robotics Research	1019	Sage Publications Ltd.,

17 clusters with 4566 network links and 6231 link strengths were found. With 246 and 202 total link strengths, respectively, the "Chinese Academy of Sciences, China" and the "University College London, UK" claimed the highest total link strength collaboration.

For this study, the major research hotspots in this field were identified through a keyword co-occurrence map. Individual node in Figure 8 represents a keyword. The presence of more lines and a bigger node indicates a higher keyword co-occurrence frequency. During the research, 7 clusters and 32875 links were discovered. The overall keyword co-occurrence strength link was 56024. The keyword "Chatbot" has the highest occurrence with 3154 total link strength, followed by "Artificial Intelligence" (2622), "Generative Model" (1868), "Deep Learning" (1471), and "ChatGPT" (1357).

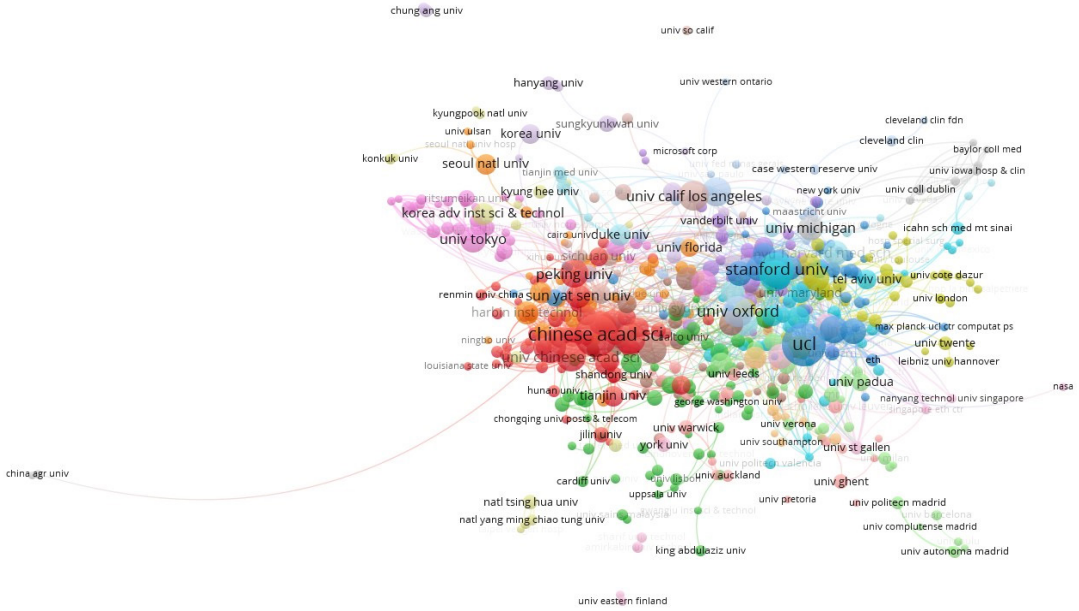

Figure 7: Co-authorship analysis of Institutions.

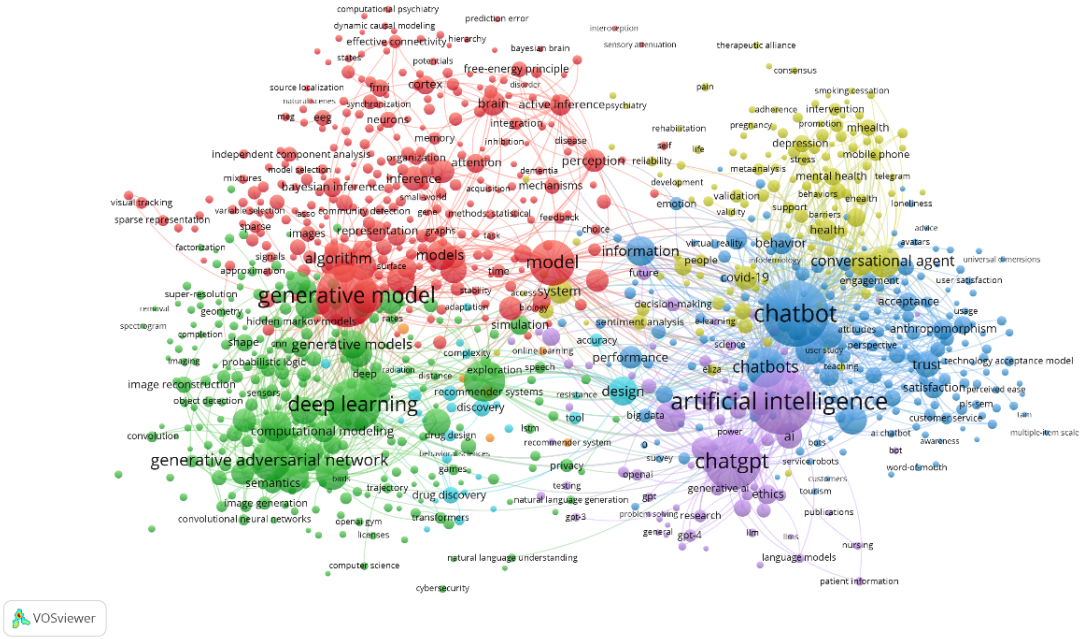

Figure 8: Keyword Co-occurrence Network Visualization.

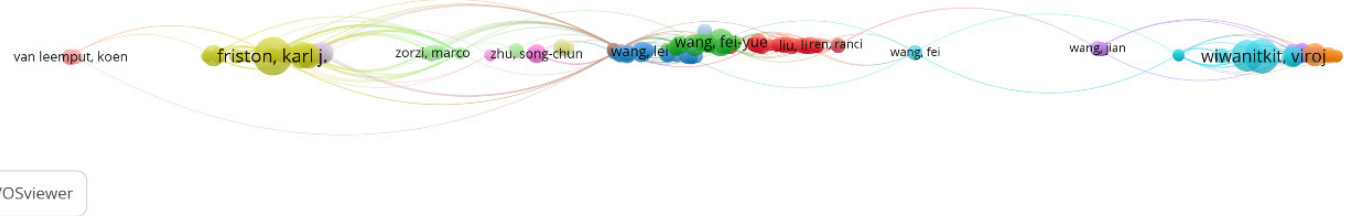

Figure 9: Author Citation Analysis.

Figure 9 depicts the network of author citations. According to the analysis, 193 of the 21215 authors had at least 5 publications published. During the analysis, 15 clusters with 599 links were discovered. For the authors' citation analysis, overall 2525 link strengths were recorded. The authors Friston, Karl J., and Parr, Thomas, found a high correlation between citations.

Figure 10 depicts a country-wise citation analysis. According to the analysis, 73 countries out of 105 have minimum 5 publications. Five clusters exist, connected by 1143 links and a total link strength of 11687, highlighting the importance of citation analysis across countries. The top five rankings in terms of total link strength are the USA (9489), China (5615), the UK (4568), Canada (2383), and Germany (2168).

Figure 11 depicts an organization's association network with the highest citations. Nodes represent organisations, and the size of a node reflects the volume of research conducted by the organisation. There are 16 clusters, 14202 links, and 24310 overall link strengths, according to VOSviewer analysis. The "University College London", UK and the "University of Montreal", Canada have found the strongest link strength.

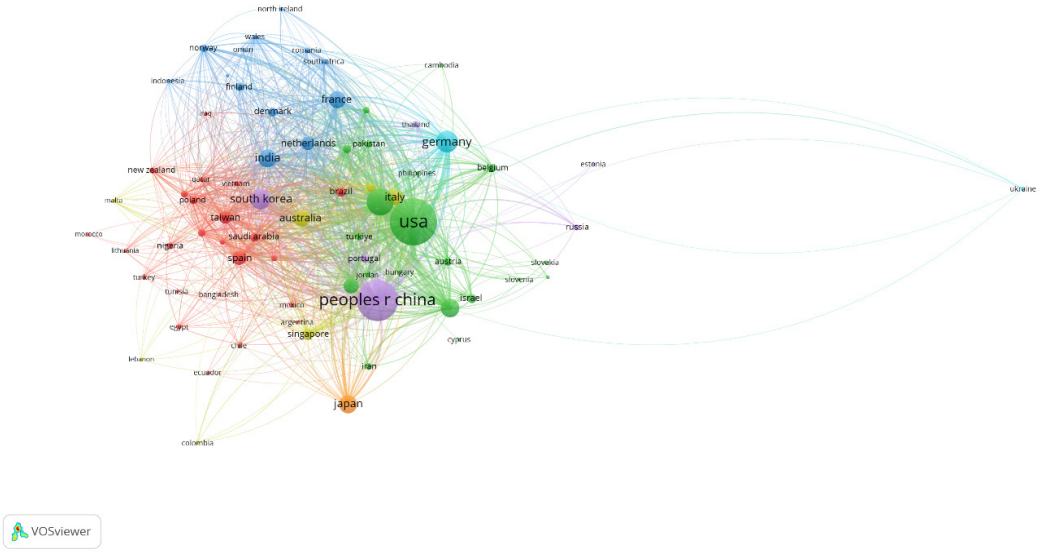

Figure 10: Citation Analysis by Country.

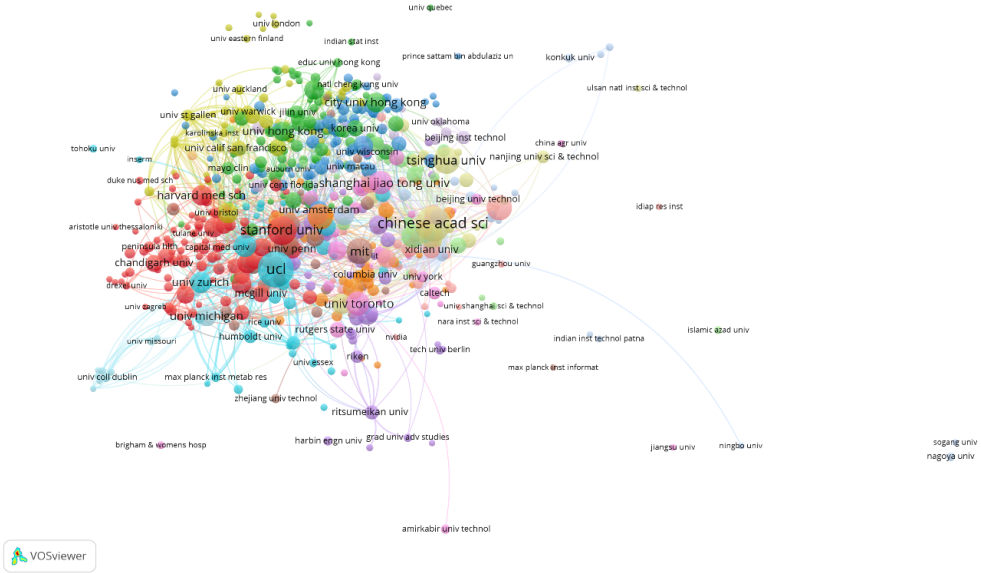

Figure 11: Citation Analysis by Institution.

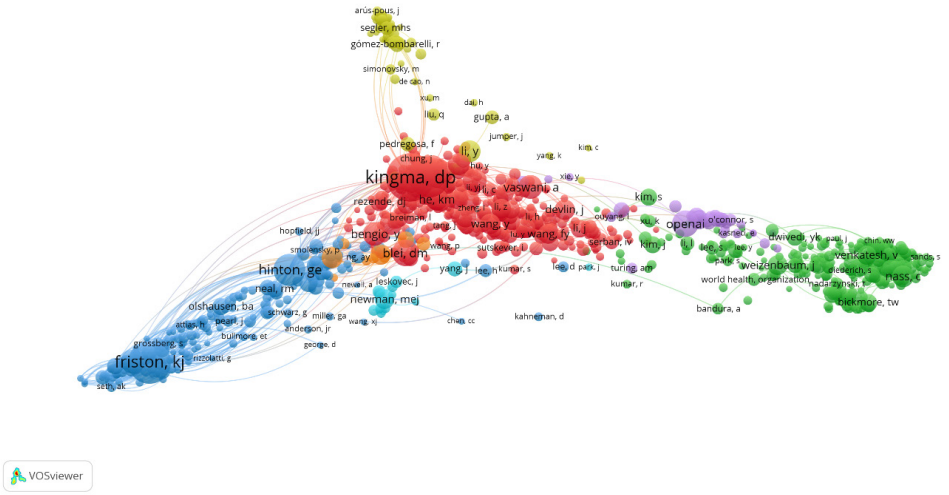

Figure 12: Cited Author Co-citation Analysis.

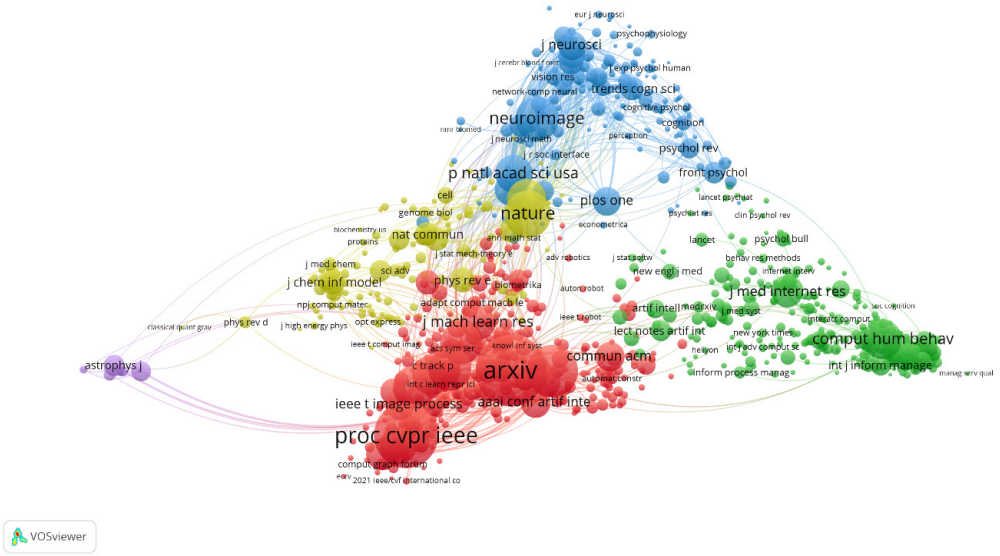

Figure 13: Visualisation of Source Title and Co-citation Analysis.

Figure 12 shows that cited author co-citation analysis suggests a greater correlation, with a total of 7 clusters, 135119 links, and 539304 overall link strength. In the top three positions, Friston, Karl J. (20697), Kindma, D.P. (17187), and Goodfellow, I. (12584) had the highest link strength.

Figure 13 displays the visualisation of the source title and co-citation analysis. According to the findings, the complete 5 clusters contain 191602 links and 3796900 overall link strength, highlighting the significance of source citations in the network analysis. As per the analysis, the arXiv (e-Print archive) has the strongest association with other sources (247534 total link strengths and 6639 citations).

According to the network visualisation map in Figure 14, 73 countries are linked together in 6 clusters and 2599 links. The analysis discovered 2793338 link strengths in total. The People's Republic of China, the USA, the UK, South Korea, and Germany are at the top countries of the bibliographic coupling in the chosen field, with total link strengths of 922692, 899075, 415337, 286184, and 266383, respectively.

FINDINGS

The literature on "OpenAI", "ChatGPT", "Chatbot", "Generative Model", and "Generative Pre-Trained Transformer (GPT)" published and indexed in Web of Science between 1989 and

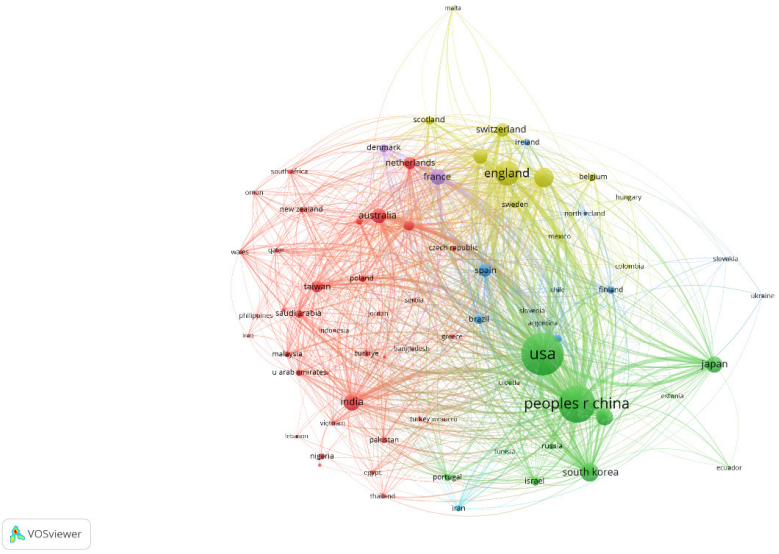

Figure 14: Bibliographic Coupling Network of Countries.

2023 was analyzed, and a total of 6391 publications were found during the period. The highest number of papers (2288) was published in 2023, the main reason is that in November 2022, the artificial intelligence language model ChatGPT was introduced by OpenAI, which offers generated conversational answers to queries quickly (Dowling and Lucey, 2023; Tong and Zhang, 2023) and ChatGPT has 100 million subscribers within two months of its launch (Leiter *et al.*, 2023), it attracted all the scholars in all the fields (Dwivedi *et al.*, 2023), and also experts and journalists exchanged their thoughts (Taecharungroj, 2023). The quantity of publications increased rapidly over the years (Figure 1). According to the study, 82.99% of the publications were articles, and 9.09% of them were Early Access, indicating that journals are producing a greater proportion of publications (Figure 2). The USA made the largest contribution to the chosen field (1939), followed by China (1507), the United Kingdom (640), Germany (412), South Korea (359), and 100 other nations (Figure 3). Top publishers that have produced a significant amount of publications in the chosen field include Elsevier, Springer, IEEE, MDPI, and Wiley (Figure 4).

The top three journals with the highest publication output are "IEEE Access" (158), from IEEE, USA; "Journal of Medical Internet Research" (90), from JMIR Publications Inc., Canada; and "Neurocomputing" (85), from Elsevier, Netherlands. The book series "Lecture Notes in Computer Science" by Springer, Germany has the highest h-Index, followed by the "Neuroimage" journal by Elsevier, USA and the "IEEE Transactions on Pattern Analysis and Machine Intelligence" journal by IEEE, USA (Table 1). In the chosen field, the article "Generative Adversarial Networks" by Goodfellow *et al.* which was published in Communications of the ACM journal in 2020, is a highly impactful publication. Table 2 lists the top 10 highly impactful publications. Network visualization keywords for in-depth analyses of "OpenAI", "ChatGPT", "Chatbot", "Generative Model", and "Generative Pre-Trained Transformer (GPT)" research will be beneficial to academics, researchers, authors, and other individuals who use AI assistance tools in their writing. The VOSviewer results show that more research has been done using the keywords "Chatbot" and "Artificial Intelligence", "Generative Model", "Deep Learning", and "ChatGPT". As per the data, fewer research studies have been done using other keywords (Figure 8).

CONCLUSION

This study uses WoS data and VOSviewer to provide a detailed visualisation of the chosen field. It focuses on bibliometric analysis to assess the trends and growth of publications on "ChatGPT" and "Chatbot". The research on "OpenAI," "ChatGPT," "Chatbot," "Generative Model," and "Generative Pre-Trained Transformer (GPT)" has a wider scope based on the findings of bibliometric studies. When it comes to generating the most cited papers in the field, the USA holds an impressive position. Most publications were published in the journal "IEEE Access". In 2023, more research publications were produced. The technology, academic, and publishing industries will all benefit from this study. This analysis offers academics a thorough viewpoint that will be helpful for both those studying and applying AI in their professional and academic endeavours. Publishers, educators, software engineers, and educational institutions can all benefit from it. The study provides a summary of the current status and the trends of research in the fields of "ChatGPT" and "Chatbot," The study has a limitation, as it only covers the list of published documents that includes the terms "OpenAI," "ChatGPT," "Chatbot," "Generative Model," and "Generative Pre-Trained Transformer (GPT)"; the content of the publications is not covered. Only Web of Science data is used in the bibliometric analysis; publications from other databases are not included.

ABBREVIATIONS

ACM: Association for Computing Machinery; **AI:** Artificial Intelligence; **GPT:** Generative Pre-Trained Transformer; **IEEE:** Institute of Electrical and Electronics Engineers; **IF:** Impact Factor; **JCR:** Journal Citation Reports / Journal Citation Indicator; **MDPI:** Multidisciplinary Digital Publishing Institute; **SJR:** Scimago Journal Rank; **UK:** United Kingdom; **USA:** United States of America; **WoS:** Web of Science.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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