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# Global Research Trends in Artificial Intelligence, New Technologies, Law, and Social Sciences: A Bibliometric and Science Mapping Analysis

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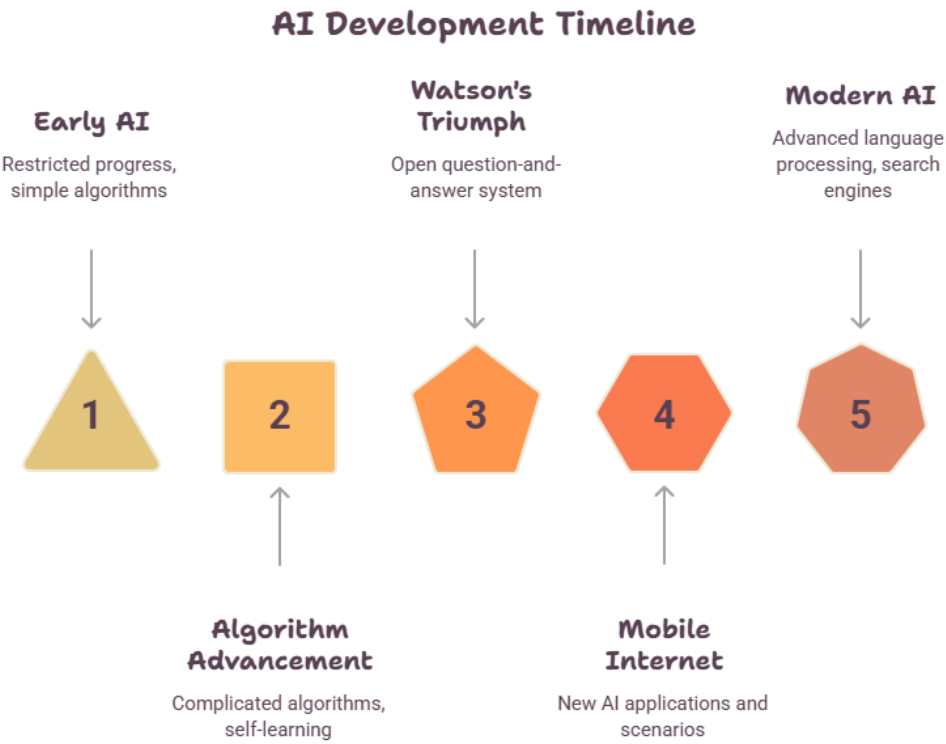
**Abstract**

Artificial Intelligence (AI) is reshaping how the world operates. The application of digital information, information systems, computer technology, and machine learning will continue to drive the spread of AI tools throughout society. The application of digital information, information systems, computer technology, and machine-learning is making it possible for AI tools to permeate all aspects of society. This bibliometric analysis revealed that in social sciences, there has been a significant increase in publications on AI-related topics over the last decade (2013-2022), with the number of publications rising by over 85% annually. From diverse research fields or subjects related to the social sciences, there are smaller groups that can be grouped: legal, logical reasoning with legal issues, education, economics, and ethics. The United States is the top country for print publications with 20%, followed by China with 13%. AI is a reality and will impact in numerous ways. As it develops, it can lead to new ideas and jobs, but it's important to manage them well. We need to establish guidelines for what it could do and the good and bad aspects.

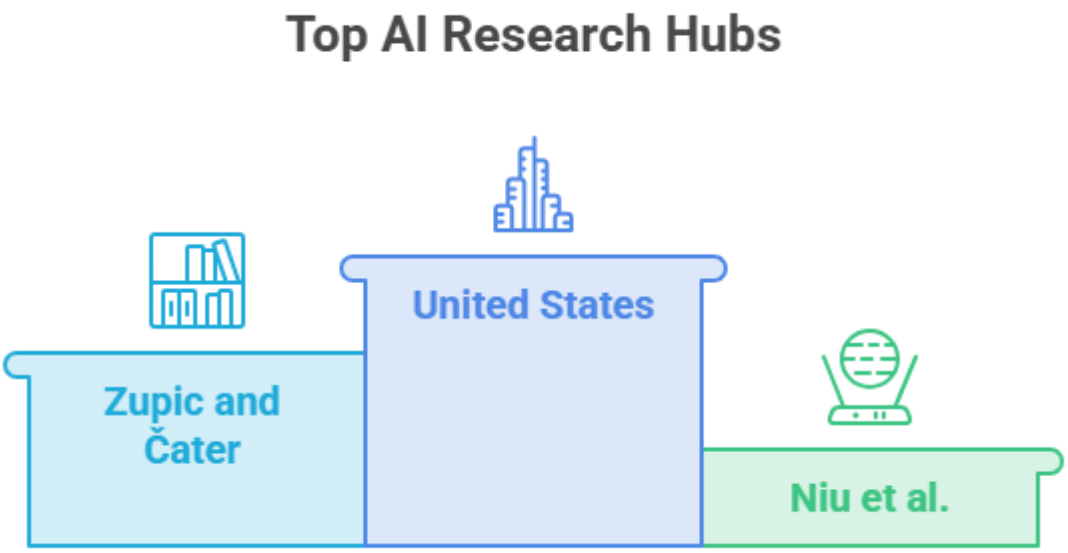
**Keywords:** Artificial intelligence, bibliometric analysis, social sciences, machine learning, Scopus.

# INTRODUCTION

Today, the use of the word "artificial intelligence" means the study of some behaviors that are labelled intelligent, and the creation of things that exhibit these behaviors (Shapiro 1992). Its roots can be traced back to 1843, when Ada Lovelace wrote an algorithm for a machine (Aiello, 2016), thus becoming the first programmer. This predates Charles Babbage's Analytical Engine by many years (Babbage, 1973). The works of many authors, such as Homer, René Descartes, Ramon Lühn and Jules Verne, featured robots, mechanical animals and artificial beings, and many people studying robots and artificial intelligence were inspired by them. Turing's studies kicked off computer science and automatic decoding in 1950, paving the way for the development of Artificial Intelligence. He discussed his ideas and a simple computing machine, using Turing machines or the Turing test, to consider the extent and the capabilities of computation (Turing, 1950). So, it's determined that the best way to get that dream of creating intelligence that cannot be produced naturally is by computers, and some new ideas have surfaced in various fields of engineering, particularly the military. Cohen's work of 2000 states that it was only during World War II that Prof. Aiken developed the first mechanical, digital computer with the aid of IBM at Harvard University. They were also involved in the development of the first large automatic universal and operational digital computer in the U.S. (Aiken, 1964) that previously had to be operated by hand. They were employed by big businesses in the early 1960s, including General Motors, and one is the Robot Surg from 2007. Stanford University began a new line of research in the upcoming years by releasing the first robot that was able to follow instructions (Nilsson, 1984). The first use of 'artificial intelligence' in reference to an undertaking involving several American institutions was around 1936. The study began with the premise that in theory, all types of smart learning can be described very clearly and exactly, so that the machine can be created that reproduces the way it works. It is still alive today as noted by McCorduck et al, in 1977. The field of AI was dubbed the "winter of artificial intelligence" in the 1970s, when funding and interest in the field tapered off (Floridi, 2020). During the subsequent decades, there are additional "winters" to keep track of (Hendler, J.). The main improvements in artificial intelligence, which happened just in the last few decades, especially during the 2000s, couldn't have happened before that. Towards the end of 2000, however, many of the restrictions that hindered progress were lifted and more and more AI systems started to employ complicated algorithms, and the use of self-learning became more prevalent (Havenstein, 2005). In 2007, IBM made an open question-and-answer system named Watson that defeated the human players on the TV game show Jeopardy. I won in 2011, as mentioned in Kaul et al., 2020. This technology was called DeepQA, and relied on language processing, together with several search engines, to manage unstructured data, and generate plausible answers (Ferrucci et al., 2013). The development of the mobile Internet has certainly ushered in new applications and scenarios of artificial intelligence (AI) (Zhang & Chen, 2020).

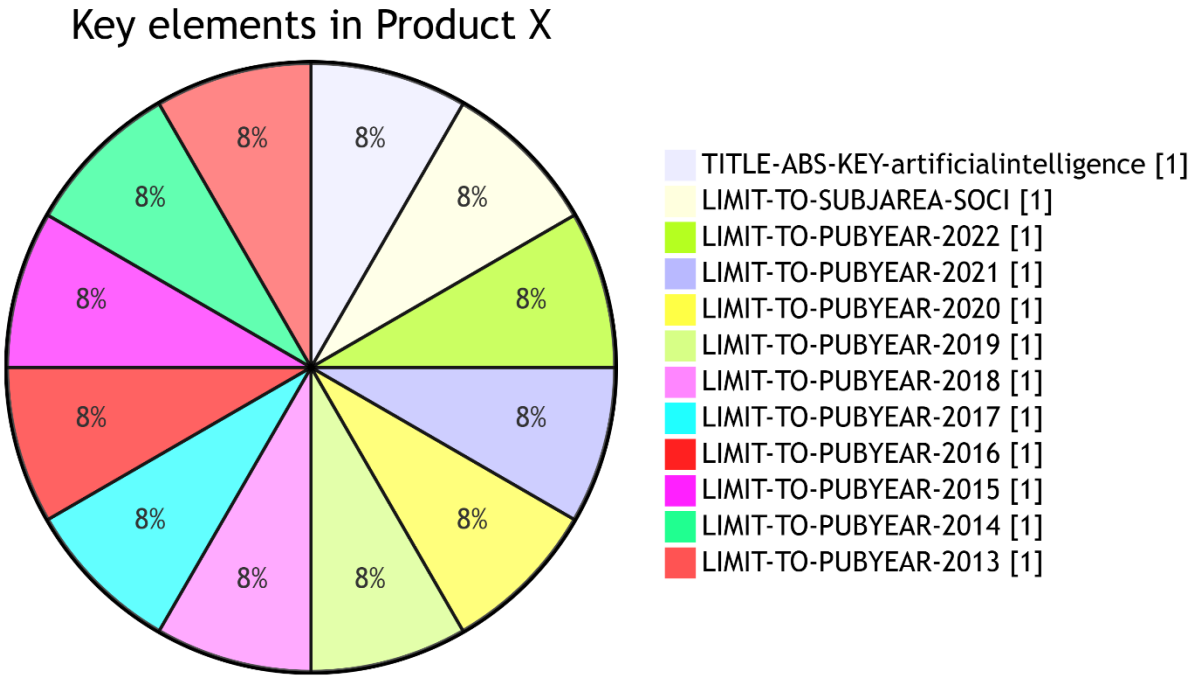



In today's world, AI has many applications in all fields of work and everyday life.Self-driving cars are widespread in the car industry.They apply machine learning and big data in finance to inform decisions.Smart payment systems are based on facial and voice recognition for convenient payments.AI is applied in healthcare to diagnose diseases, create medicines, and manage patient care.Also, in smart homes, automation and sensors can help regulate the light, temperature, and security. While studying the literature on the history of the application of artificial intelligence in bibliometrics, it is possible to have a clear idea of the topics addressed, but some main fields such as STEM, biological sciences, A&H, and social sciences are poorly represented. Using bibliometrics to evaluate is a means to make meaningful quantitative and statistical studies (Álvarez-Betancourt and García-Silvante, 2014).It evaluates scientific work in various ways, examines journals and journal authors, and considers what countries, organisations, and even how countries and organisations are working together. There are some variations in conducting EA analyses in the health and medicine domain. From 2014 to 2019, the number of scientific articles increased by 45.15%, according to Guo et al.in 2020. While the healthcare sector has been the most prominent area of application, AI has also found use in other sectors, albeit to a lesser degree. These areas include engineering (Shukla et al., 2019), e-commerce (Bawack et al., 2022), education (Song & Wang, 2020), university administration (Prieto-Gutierrez, 2023), maritime (Munim et al., 2020), agri-food chains (Monteiro and Barata, 2021), and finance (Goodell et al., 2021). Some of the few global studies that have looked into this topic say that one particular study isn't very important. According to this research, which was retrieved from the Science Citation Index (SCI) database, the production of science has risen since the 1990s.It also reports that computer science and engineering are the most dynamic fields to generate scientific and engineering research on AI. Moreover, Niu et al. (2016) found that the United States is the number one country in the world in terms of the number of AI-related scientific publications. In this sense, this work aims to offer a summary of the history of AI research in the social sciences in the past decade and to evaluate the concepts, content, composition, and evolution of the social science research area, as in the work by Zupic and Čater (2015). It is definitely a read that all those who care about AI should read.




## MATERIALS AND METHODS

The main collection from the Scopus database (Elsevier, 2018) is used to find all the existing publications about AI for bibliometric analysis. This database was selected rather than others such as Web of Science, as it is one of the largest sources of academic literature on a wide range of subjects and has greater coverage and superior search functionality. This search was performed on May 25 after installing the application, in accordance with the TITLE, KEYWORD, and SUMMARY included in the application. The next search was carried out using Boolean operators. Type in the word "text" followed by "of the question":



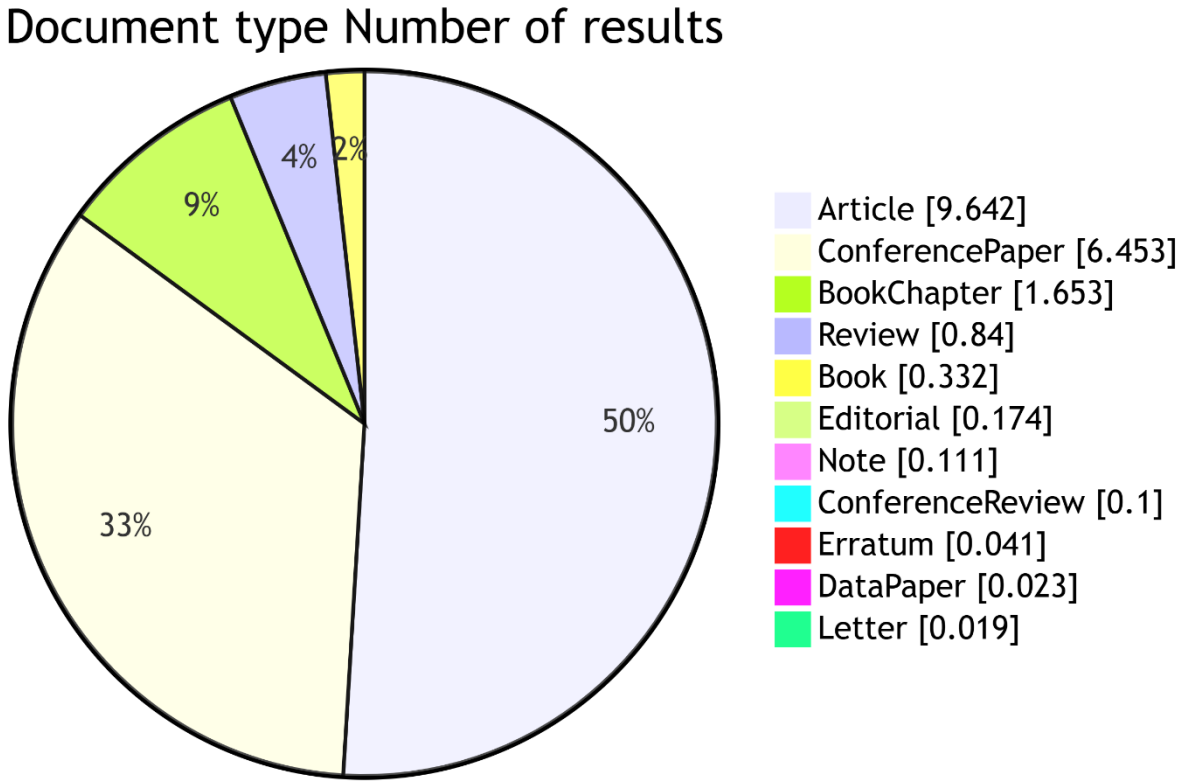

A total of 19,408 scientific articles from predefined bibliometric analysis were used. We did not exclude any kinds of articles, languages, or native speakers, and only included those articles published in the last 10 years, except for 2023 (we will not include all articles as this year is not fully complete yet). Thus, conference papers or book chapters can be included in bibliometric

studies. Articles in all languages are available (except English). The data returned for analysis focuses on the characteristics of publications, their content, and the role they play in the research topic. They consider various activity indicators such as the year when the article was published, the number of articles published, the journal where the articles appeared, the countries involved in the activity, the authors involved, universities involved, and other factors that indicate the impact of the research on scientific output, including H-indices of journals. The download limit is a few blocks of 2000 documents each, as bibliographic information is processed from a large number of documents, with a focus on the keywords of the documents and the relations between the authors. The structure of these networks and their performance were analysed using special Pajek software developed by Batagelj & Mrvar (1998). The data were designed to be analysed with the information contained within Microsoft Excel, and statistical analysis of the identified metadata was conducted and examined to view the annual growth pattern.

# FINDINGS

As you can see from Table 1, there are 19,408 publications in the Scopus database from the original study that are related to IA research in the social sciences. For the analysis between 2013 and 2022, they are divided into 11 different types of documents, as shown in Figure 1. The second most frequent type of publication was conference reports (33.24%).About 83% of the publications were either papers or conference reports.

**Table 1.** Number and type of documents in AI publications.




## Annual publication of published articles

The image shows the scientific findings (by year) that were reached as part of these studies. From the curve's form, it is clear that there are two phases in the evolution of AI research in the

social sciences. The stages can be differentiated on the number of articles written at each stage. Artificial intelligence was rarely used during the first period (2013 – 2018) and there was little academic research that focused on the topic. Up until this period of time, the work done was minimal. The second period (2018–2022) indicates that production is growing very quickly, from 1,000 per year to approximately 5,000 by 2022.

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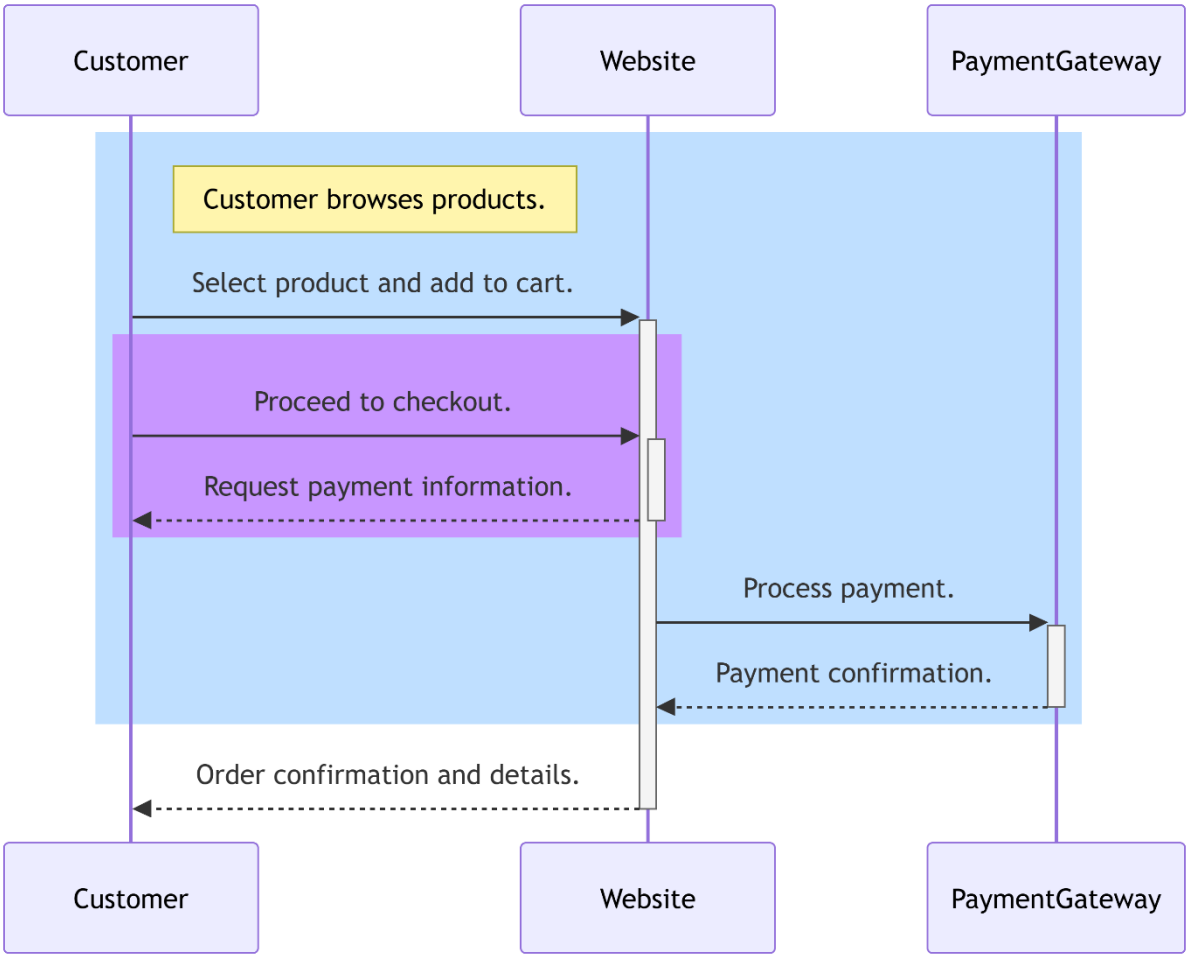
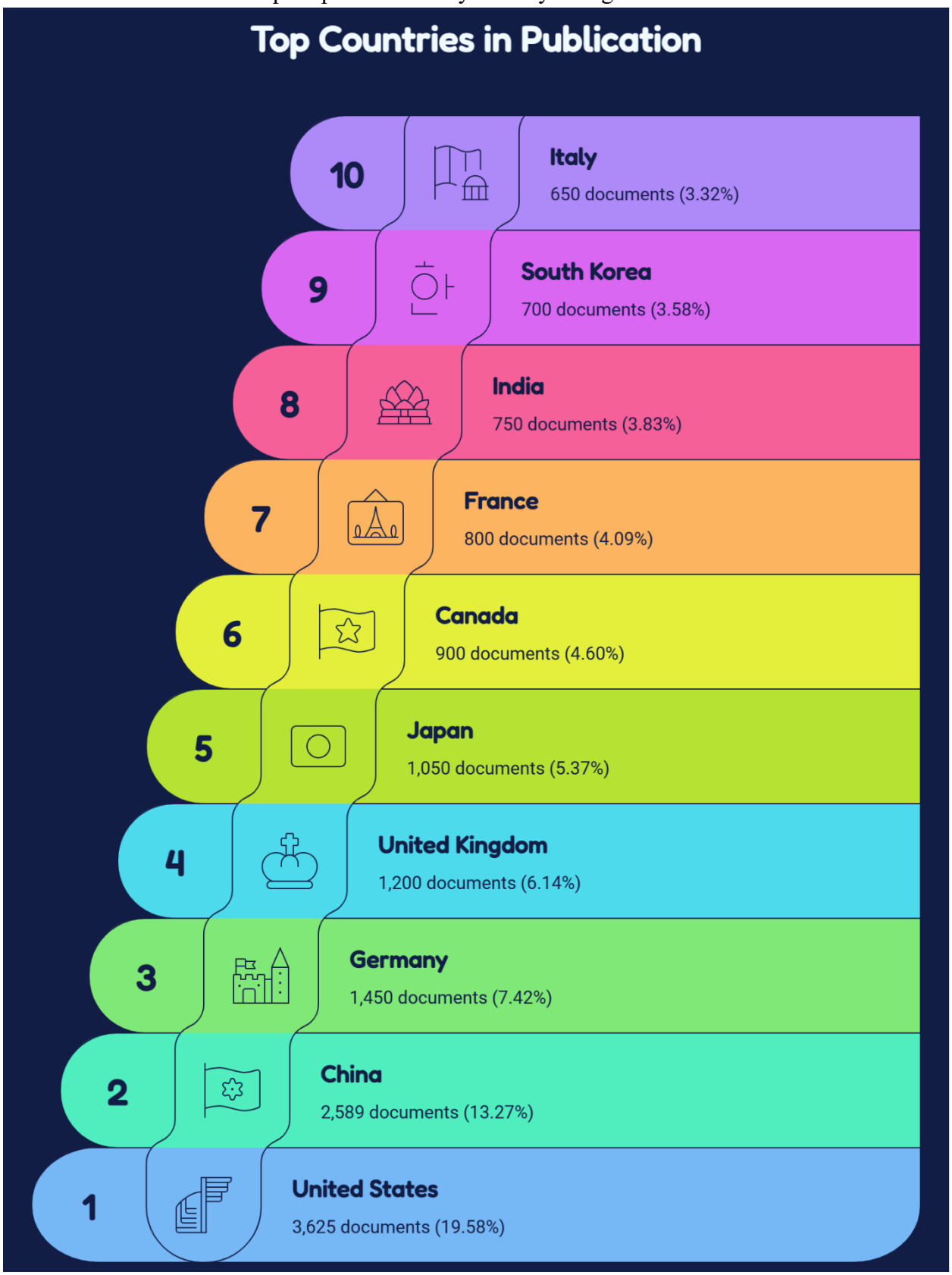



**Figure 1.** Annual publications in the main Scopus database.

## Contribution by country or region

The compilation of the documents was assisted by writers from 150 countries. The total number of documents is 644, and some of the documents are not from known countries. The ten most active countries – as listed in Table 2 – accounted for 70.91% of all papers published, or 13,833 papers. The number of publications is in first place, followed by the United States with 3625 papers (19.58%). China is in second place with 2589 documents (13.27%). These are the ones that experienced a decline in the number of people visiting.

**Table 2.** Top 10 publications by country or region 2013-2022.




The international cooperation network of the SSCC countries (Figure 2) reveals that the most cooperative countries are the developed ones: the U.S., China, and the United Kingdom. Even countries with good academic performance, such as India and Iran, are getting international aid in their development. The graph illustrates the relationship between various countries in terms of their collaboration in publishing research related to AI in the social sciences. The number of

countries involved is high (150), which means that it is rather low for a good co-authorship network; it should contain at least 5 frequencies or map publications. Only around 30% don't have this condition. In order to visualize the analysis results of Figure 2, the graph has four clusters corresponding to the node colors. Two of these, the yellow and green ones, are the most active and noticeable. U.S. is the leading player in the cluster with both publications and relationships; influences other countries. It has good ties with the countries of all the continents, both Europe and Asia and the East. There are two other relationships that are very strong as well as connected – they are special. The linkage with China is much more extensive than the linkage with the UK and the US. And the relationship with South Sudan is just as strong as the one with China. The yellow node in China indicates strong ties with the U.S. and a lack of its own network. China's relationship with neighbouring countries is very unique: Hong Kong, Singapore, India, and Taiwan. The second largest group is the green cluster, with the UK having the largest number of publications (1,616) and the largest number of references (10). The strongest and largest relationship is with the United States, with 165 shared documents. On the other hand, there are blue and red groups that have had ties between the two countries (Portugal and Brazil, as well as Saudi Arabia and India) that have led to the creation of these groups. The first two countries aren't connected to the other parts of the network. India, on the other hand, joins this group to the East (to China) and the West (to the United States and the United Kingdom).

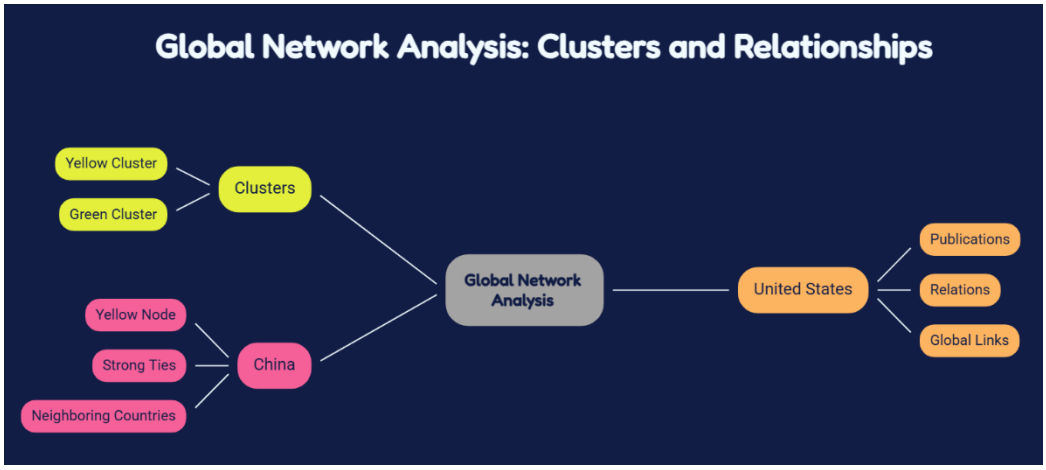



**Figure 2.** Network analysis of international cooperation between highly productive countries.

## Keyword Compatibility Analysis

This study examines AI-related articles in the social sciences to understand how keywords link to different areas of knowledge and how that knowledge is structured in these articles about AI. The term "artificial intelligence" was removed because, in a general sense, it would be the main topic of the network and might stop people from properly understanding how these terms are related to each other. This part is shown in Figure 3 as a network diagram that shows collaborative meetings based on keywords, using data from the social media analytics tool Pajek. The authors use several keywords to explain and guide their study, and these words are important because they help show the good and bad parts of using AI in the social sciences. The authors pick certain words that are very important for explaining and highlighting the main idea of the research paper. These words help to explain the theory, give helpful information, and show why the paper matters. A grid diagram can display the features of an AI-related idea and also help explain how different ideas are linked in a complicated way. Studying the keywords from both

AI-related topics can help identify common links and unique characteristics between them (the related results are shown in Figure 3). The most common words (keywords) are shown in different colors. The typical times people use these two words together are when they're discussing connections between different points.

The number in the middle shows the weight of the ratio, and the number next to that shows the activity. When there are many numbers, it's better to use a thicker link. Figure 3 puts words together to show the most common topics in social sciences that are linked to artificial intelligence. Clusters are represented with various colors. There are 7 groups, and each group has two or more computers. Our analysis looks at three main topics, and not every topic is related to the others. The three main color groups are: White stands for machine learning, Orange represents Covid-19, and Red is used for big data. It is thought to be the main part of the cluster, and the term 'machine learning' is part of it, with the word highlighted in white. This group includes some machine learning terms, such as deep learning, data mining, and neural networks. In red, there is a group that is referred to as "big data" and also connected to other related terms, which are located in an area that includes "cloud computing," "data science," or "Internet of Things." These terms are directly linked to the main machine learning term. On the right side of the figure, there are also a few different and separate groups, and they have some shared research interests in the field of AI. For example, green is used for education-related nodes, and blue is for virtual and augmented reality, which show information in the user's visual space. This includes things like museums, products and shopping, events, and training, among other areas. Blue areas show where AI helps add fake things to our real world, such as in augmented reality and virtual reality. Pink represents a group of activities related to artificial intelligence in industries or businesses, especially those that involve automation and robotics.

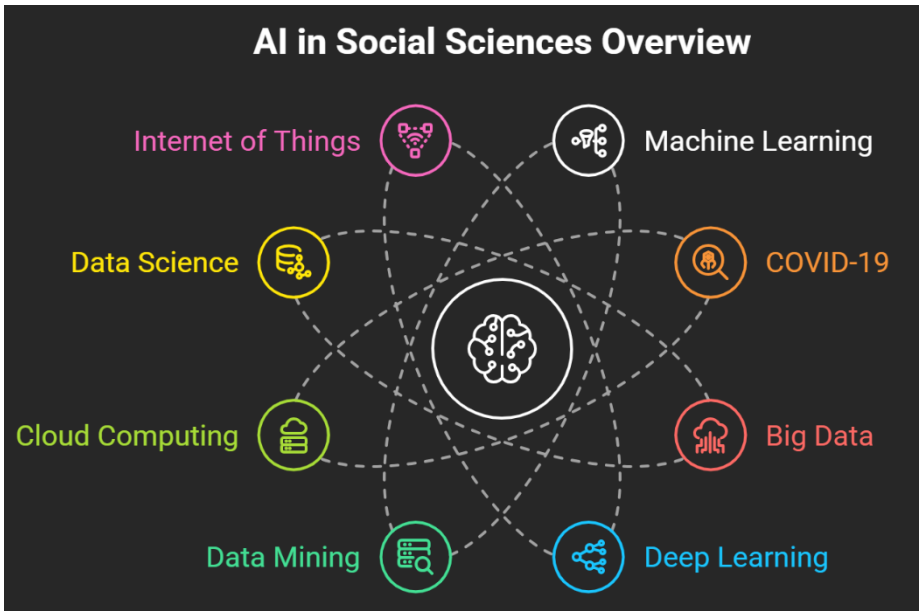



**Figure 3.** The conceptual network structure of keywords is related to the concept of "artificial intelligence".

## Lead authors and network of co-authors

Table 3 shows the top 10 most active IA authors in the social sciences, and they come from 8 different countries. The UK has the most authors listed among them. There is only one representative in other countries. Guien Huang from the National Taiwan University of Science and Technology has written the most papers so far, with a total of 22. In 2020, Huang started sharing information about artificial intelligence in a very impressive manner. The second person is a British researcher named Trevor Bench-Capon from the University of Liverpool's Computer Science department, and he has been writing articles in the IA journal since 1987.

**Table 3.** Top 10 participants and their productivity in 2013-2022

| Rank | Main Author | Country | No of Interpretations |
|---|---|---|---|
| 1. | **G. J. Huang** | TW Taiwan | **22** |
| 2. | **T. Bench-Capon** | GB United Kingdom | **20** |
| 3. | **G.P. Dadios** | PH India | **19** |
| 4. | **A.E. Hasanyen** | EG Germany | **18** |
| 5. | **H. Masch** | NL Netherlands | **18** |
| 6. | **D. Walton** | GB United Kingdom | **17** |
| 7. | **R. Dale** | US USA | **16** |
| 8. | **G. Governors** | AU Australian | **16** |
| 9. | **K. Atkinson** | GB United Kingdom | **14** |
| 10. | **N. Bizon** | RO Romania | **14** |

To do exploratory analysis, a person needs to know how scientists collaborate, so they can observe how different scientists communicate and work with each other. In this case, having co-authors in the article means that two or more people officially contributed to writing it. To make sure the network of co-authors is as good as it can be, a minimum of 5 frequencies or publications in the charts was chosen, since there were a very large number of authors, 41,860. The creator collaboration network is shown in the figure. The colored nodes represent authors who are linked to one another. Each node shows an author who has written five or more articles during the selected AI period. Each line links two authors and indicates that at least one of them has written an article along with the other. Numbers on the lines show how active the connection between them is. In Figure 4, 40 authors have written more than 5 papers from 2013 to 2022, and each of them has written between 6 and 9 papers with other authors in the network. Researchers from different places are working on a big study together, but their teamwork isn't very strong, as you can see in the collaboration network shown in Figure 4. The most important networks are the Atkinson K. and Bench-Capo groups. These groups are run by researchers from the University of Liverpool and lawyers, respectively. They worked together 13 and 10 times, respectively. They have the greatest influence and power when working with other authors. The Darvish A. and Hassanen A. E. groups are led by researchers from Helwan University and Cairo University. They also worked together 13 and 10 times each. They have a high level of influence and power when collaborating with other authors, as well as in areas like ethics and the impact of AI on climate change. The biggest network includes the Greeks: the University of Patras, Perikos, Grivokostoulou, and Hatziligeroudis. This group has no more than 6 publications, which mostly talk about improving education and training with the help of artificial intelligence.

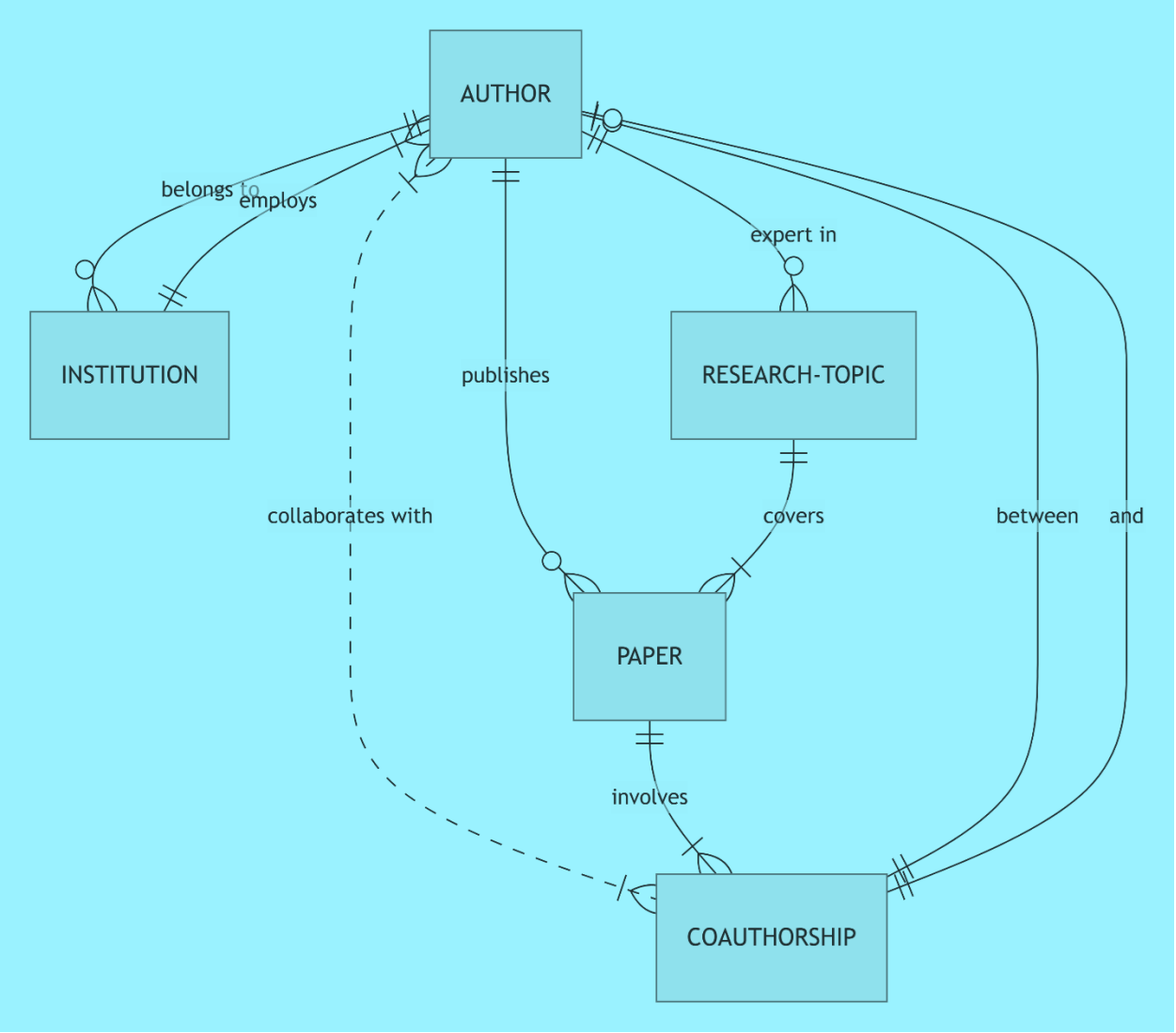



**Figure 4.** Collaboration Network for AI Creators.

# FINAL CONCLUSIONS

AI research has been growing really fast in the past few years, all over the world, and now it's a common part of daily life. People use it at work, for entertainment, at home, and it can be used in many new areas too. As artificial intelligence becomes more common and is used in many different ways, this article will look at the field of study called social sciences. Social sciences study how people act in society and culture. They help explain how changes, such as the rise of artificial intelligence, can impact the economy, lead to new ideas, change how we learn, affect sociology, and influence laws and policies. Measures like data protection help ensure that artificial intelligence is used fairly and responsibly. When I checked the Scopus database, which is an online collection, I went through the titles, summaries, and main keywords and found over 19,408 articles on social sciences from the last ten years, between 2013 and 2022.These articles show that the concept of artificial intelligence is broad and has been widely talked about around the world. Looking at the analysis, it's clear that AI has been a very busy area of research in the last 10 years. The number of papers published has increased ten times in the past five years, which makes up 85% of the total growth. The fact shows that people are starting to care more about AI in all areas of the social sciences, and the aim is to make life better by using machine

learning continuously. Using Pajek helps track how authors, keywords, and countries are linked, which reveals new trends in AI research, how often keywords are used, and how terms change over time. China and the United States are the most active and energetic countries, creating about 35% of all the publications. The United States is the main focus of the publishing network when it comes to size, working together, and the links it has.. It is linked to many countries, either directly or indirectly, and its connection with China is especially close. When you look at how the authors work together, you can see that they form small, close-knit, consistent, and dependable groups that stay together for a long time. There are two groups, each with three members, resulting in a total of six or more publications from Greece, plus one additional publication from China and Australia. The other connections are between players, and most of these happen within their own groups. This shows that the most active groups make changes and create things inside their own organizations. Even though the countries work together to some extent, the real efforts they put in are still very limited. In Figure 4, you can see the most active collaborative networks, which are centered around several important areas. The fast increase in artificial intelligence used in research and the large number of papers written about it have caused the creation of rules and laws for this new technology, for example. Research often helps come up with new ideas, makes sure people are safe, and supports the protection of human rights. Other researchers in Egypt are actively collaborating to examine how EA impacts human activities. They use smart technology to watch over people, keep them safe, and help find things, like during the COVID-19 health crisis, which makes everyday life better for people. Another big social problem is making farming better, using data and AI to manage water more effectively, predict the weather, and handle the challenges of climate change. They even went as far as predicting the GDP of some OPEC members.


The most active group was the Greeks, who took part in teaching and learning and in developing new ways to teach. Education is probably one of the most important problems that society is dealing with right now, which is why a lot of research groups are putting in a lot of effort to find solutions. In this case, progress happens through real and major improvements in learning, such as automatic learning systems, smart learning tools, and using virtual reality to learn skills like starting a business or learning a new language. Basically, it's about using new technology in education, especially things like artificial intelligence, to make learning more effective for each student and to provide a more personalized learning experience for everyone. As shown in Figure 3, the most common topics in the publications are Machine Learning,

COVID, and Big Data. However, some studies examine the long-term effects and usage of AI, but these are not as common. Ethics matters because when machines make choices, those choices can impact an individual, a business, and the entire society. Understanding things clearly is important when working with different parts of technology and how to use them properly, especially in a world where AI needs to develop and function effectively. In these ethical situations, people are making new rules and guidelines in various places around the world to assist others in following proper ethical behavior. These results show that typical trends in AI research are taking place, such as how the field is expanding and how the number of known problems is growing compared to new problems in different research areas. You need to be cautious when interpreting the results of this bibliometric study since it has certain limitations. The first issue occurred during the bibliometric analysis. Even though it's the largest database, there's a possibility that some key articles might not be included because they could be present in other databases like WoS or PubMed. It can also give a complete view of other authors or people involved in the study area or share details about new companies or groups entering the field that could influence the rankings of important terms, leading researchers, countries, or regions. This study is meant to discover trends, not to provide a plan, a formula, or a ready-made solution; it follows all the proper rules.

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