

Artificial Intelligence and Covid-19 A Bibliometric Analysis

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Abstract

The outbreak of the coronavirus disease first occurred in December of 2019 in Wuhan Hubei province, China. The new acute infectious disease later spread across the world and became a global pandemic. This study seeks to assess the numerous studies published on this topic, particularly artificial intelligence, as one of the top techniques used to combat it. Therefore, a bibliometric analysis of the scientific publications on artificial intelligence and COVID-19 may point to future research directions. This paper conducted a bibliometric analysis of Covid-19 and Artificial intelligence research using the Scopus database, then analyzed using VOSviewer to derive quantitative publication metrics and display coexisting key term networks obtained between 2019 and 2021. The bibliometric analysis showed that in the co-occurrence of all keywords in COVID-19 and artificial intelligence publications, the words "pandemic" and "covid-19" are the most occurring keywords. As well as an analysis of the co-authorship showed that "the United States" and "India" have the most publications. A tree-map of the distribution of research in Covid-19 and artificial intelligence between different fields revealed that the field where most research is done in medicine (21%), Computer Science (18%), and Engineering (11%). In conclusion, the number of global publications on COVID-19 is expected to rise steeply according to existing growth patterns.

Keywords

Covid-19, Artificial Intelligence, Bibliometric Analysis, Scopus, VOSviewer, Pandemic.

1. Introduction

Coronavirus disease 2019 (COVID-19) was first identified as a new acute infectious disease in Wuhan Hubei province, China. The outbreak of the contagious coronavirus disease occurred in early December of 2019, later spread to all of China's provinces before becoming a global pandemic. Covid-19 is caused by a novel extreme acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and was officially declared by The World Health Organization (WHO) as a global emergency. The outbreak continued spreading outside China very rapidly (Yu et al., 2020). As of today, February 28, 2020, a total of 114 million cases have been reported worldwide, including

2.53 million death cases, which as a result has caused a lot of public outrage (WHO 2020). After the worldwide disease outbreak, many studies have focused on deepening the understanding of COVID-19's clinical features and treatments and immune regulation of the disease. More than ten thousand articles had been written by the first quarter of last year, and several struggling countries had learned a lot of knowledge from the pandemic-related published articles (Ibid). Artificial intelligence is the ability of a certain technology or a robot operated by a computer to perform tasks that typically require human intelligence and discernment. Researchers are currently developing many approaches in artificial intelligence to understand and resolve the COVID-19 situation fully. Artificial intelligence and machine learning are some of the few approaches to have the benefit of high accuracy. AI has a big impact on Covid-19, as it's being used to classify, monitor, and forecast the outbreak. It is also used to diagnose the virus, to estimate its recovery and death rate (Chamola et al., 2020).

Bibliometrics is a statistical method that could quantify the total number of research papers done in a particular

field; it could also assess the quality of the studies done, analyze the key areas of research, and predict the direction of future studies. The two multidisciplinary bibliographic databases mostly used are Scopus from Elsevier and WoS from Clarivate Analytics (Zhu & Liu, 2020). Due to their widespread use and recognition, both WoS and Scopus are commercial subscription-based tools, making it difficult for an institution to afford to subscribe to both (Chadegani et al., 2013; Pranckute, 2021). Unlike WoS, Scopus' content can be accessed by anybody with a single subscription. Since our University has subscribed to Scopus, the assessment used in this study selected Scopus bibliographic database which includes all the important research papers related to Covid-19 and AI.

Moreover, software like (*VOSviewer - Visualizing Scientific Landscapes*, n.d.) is particularly interesting and important for these bibliometric analyses because it offers further research using visualization techniques. This research aims at conducting a bibliometric analysis of publications on COVID-19 and artificial intelligence due to the use of AI in combating the pandemic. Since the outbreak of the virus, much research has been done. Thus, it became crucial to know the areas that lack research about COVID-19 and AI; this should provide knowledge about future research directions (Yu et al., 2020). The rest of the paper is organized as follows: section two presents a broad literature review and discussion of work relating to the bibliometric analysis done on Covid-19 and/or artificial intelligence, section three presents the methodology of bibliometric analysis followed by the visualization results in section four, section five presents the discussion. Finally, a conclusion is presented in section six.

2. Literature Review

Extant studies reported that COVID-19 had sparked widespread concern as a global pandemic in recent months, and a growing number of related studies have been published (Radiom et al., 2020). According to the method used in scanning global literature about COVID-19 published in the last two years via the Web of Science collection database and applying VOSviewer to perform bibliometric analysis of these articles, results showed that 3,626 publications on the topic of the novel Coronavirus were published. This concludes the current growth and the significant increase in global publications on COVID-19 (Yu et al., 2020). Another study found that technological innovations such as artificial intelligence (AI) are becoming more widely used in various contexts due to the pandemic of the novel coronavirus disease. The MEDLINE database yielded a total of 105 publications focusing on the use of AI in the form of COVID-19. Furthermore, the United States with 22.86% and China with 21.9% have published most of the posts, while developed countries were underrepresented among the contributing nations. The global health group generated an increasing interest in using AI during the novel coronavirus disease period. A new systematic analysis found 51 studies comprising 66 AI models that could forecast hospital entry from pneumonia-related cases, COVID-19 infection, duration of hospital stay, progression to serious disease, and mortality risks in this pandemic. Since AI is becoming a valuable weapon in the fight against the pandemic, it's important to measure the field's research progress by looking at the number of academic publications that explain how AI is being used in the novel Coronavirus. Moreover, recent bibliometric analyses have shown how COVID-19-related literature is more widely generated worldwide (Hossain MM et al., 2020). According to "A Bibliometric Analysis of COVID-19 across Science and Social Science Research Landscape," The lack of understanding about the COVID-19 disease outbreak has prompted extensive academic research, as evidenced by the rapidly expanding scientific literature. While the current state of the COVID-19 study indicates that knowledge is still evolving, a thorough overview is still lacking. As a result, the paper's primary goal is to conduct a comprehensive bibliometric analysis of COVID-19 research across the scientific and social science research landscapes, using novel bibliometric methods (e.g., Venn diagram, Biblioshiny descriptive statistics, VOSviewer). The Scopus database was used to conduct the bibliometric analysis, which included all pertinent information on COVID-19-related publications ($n = 16,866$) available in the first half of 2020. The study results suggest that health sciences have a substantial lead in terms of the number of related publications and total citations. In contrast, physical sciences, social sciences, and humanities are significantly behind. While another paper written by Akpofure A. Enughwure, Isaac C. Febaide declared that Artificial Intelligence (AI), which has gained widespread acceptance in the medical field over the years, has proved useful in treating various illnesses. Following the spread of COVID-19, many studies have been published that propose methods and models for combating the virus, including AI-assisted diagnosis, therapy, prevention, and cure. This study conducted a systematic literature review to determine how Artificial Intelligence (AI) can be used to combat the COVID-19 pandemic. The data included COVID-19 research papers and AI, deep learning, and machine learning, all of Artificial Intelligence subsets. They didn't include review papers because the study improves previous COVID-19 and AI reviews (Enughwure & Febaide, 2020). Another article used bibliometric analysis to analyze the scope of research done on Covid-19 since the beginning of the pandemic. That's because the outbreak has increased research production in different domains to help combat the disease. This study utilized the Scopus database and fields like titles, keywords, and abstracts to conduct the bibliometric analysis. The mapping was done using VOSviewer. The extraction was done on April 25, 2020. The total number of research found was 3,513, out of which China had the greatest contribution. The most frequent keywords were Coronavirus, pandemic, and impact (Hamidah et al., 2020). This bibliometric analysis

could help policymakers and stakeholders invest in research and direct research to cover lacking areas and fields (Nandiyanto, Biddinika, & Triawan, 2020). Moreover, a study conducted an in-depth survey and bibliometric analysis on research about Covid-19 and machine learning-based technologies. This study used a literature survey to extract the data from databases like Scopus and Web of Science indexes. The researchers found that machine learning-based tools attracted most of the attention; for example, the conventional neural network was used to develop Covid-19 diagnosis tools. In addition, Covid-19 datasets, taxonomy, synthesis, and analysis were presented in this paper. The study also revealed that drugs and vaccine development remain mostly uncovered, and very little researches were done in those two major fields. Finally, this research could help identify future collaboration between authors, countries, and organizations, enriching and deepening the findings of studies (Chiroma, H. et al., 2020).

1. Methodology

In this paper, we are conducting a bibliometric analysis of research done on Covid-19 and Artificial intelligence. The data for the bibliometric study was extracted from the Scopus database, which includes numerous areas such as engineering, medicine, and a variety of others. Search terms included (("AI" OR "Machine learning" OR "artificial intelligence") AND ("covid-19" OR "coronavirus" OR "novel coronavirus" OR "SARS-COV-2" OR "corona")) and the time frame was between (2019-2021). The information retrieved included: citation information like the author, author ID, year, source title, volume issue page, etc., Abstract and keywords, affiliation, language, the publisher, and the editor. The data was exported in CSV format (AIRyalat et al., 2019) and was analyzed using VOSviewer (version 1.6.16). The software was used to map the co-authorships between countries, the co-occurrences of keywords, and the co-occurrences of author keywords. To use Scopus, we signed in to our university website and entered the search terms mentioned before; title, abstract, keywords field were applied, along with authors, affiliations, language, and references. (AND, OR) were used to refine the search. To analyze the type of document generated Scopus analyzing tool was used (using Analyze Search Results). After exporting the files, the option to create a map using bibliographic data was used in VOSviewer, the Scopus database was selected, and the file was uploaded in the software. Both the co-authorship and co-occurrences were selected for analysis. Other fields were kept as their default. The data was then used to draw two tree-maps using Excel. Finally, three world clouds were implemented using the website <https://www.wordclouds.com/>; the data was extracted in a plain text format from Scopus and uploaded to the website. The words were then filtered to produce a map for covid-19 keywords, another for artificial intelligence keywords, and one for both of them. The results of this process are discussed in the next section.

2. Results

Figure 1 shows a bibliometric analysis of the co-occurrence of all keywords in COVID-19 and artificial intelligence publications. The biggest nodes are for the words "pandemic" and "covid-19" this suggests they are the most occurring keywords. Furthermore, the distance between them is very short, which means their co-occurrence in the same research is very high.

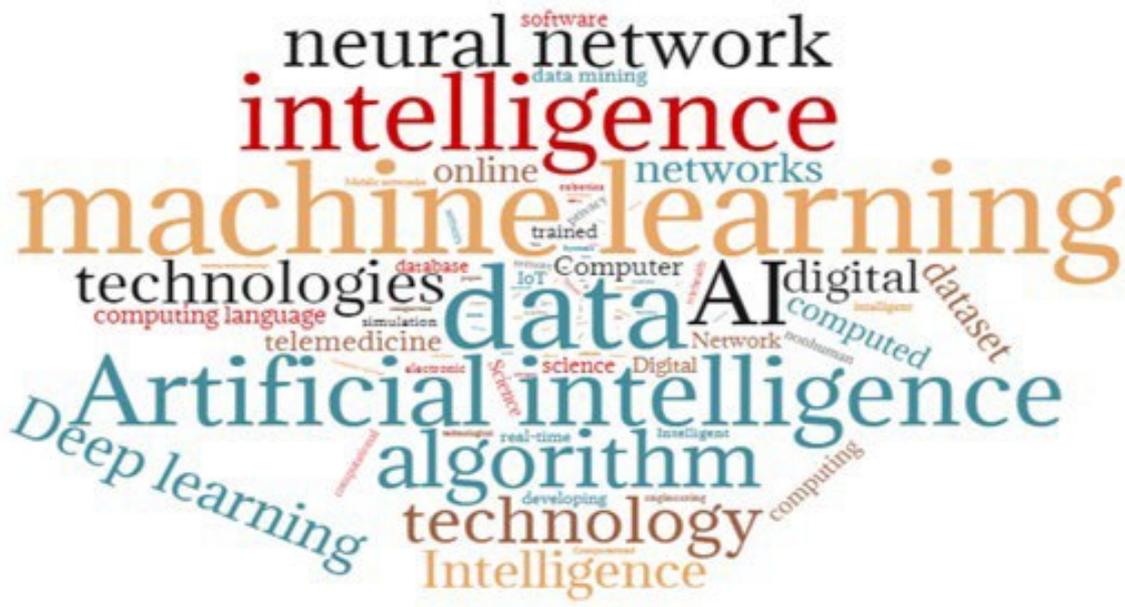


Figure 5. Word cloud visualization of the most occurring keywords related to Artificial Intelligence

Figure 6 shows a tree-map of the distribution of research in Covid-19 and artificial intelligence between different fields. The field where most research is done in medicine (21%), followed by Computer Science (18%) and Engineering (11%). In contrast, fields like Chemistry, Neuroscience, and Arts and Humanity include very little research (1%).



Figure 6. Distribution of the different fields of research on Covid-19 and Artificial Intelligence.

Figure 7 shows a tree-map of distributing research publications about Covid-19 and artificial intelligence between different countries. The countries with the greatest number of publications are the United States (17%), China, and India (10%). While other countries like South Africa, Denmark, and Japan include very few

publications (1%).

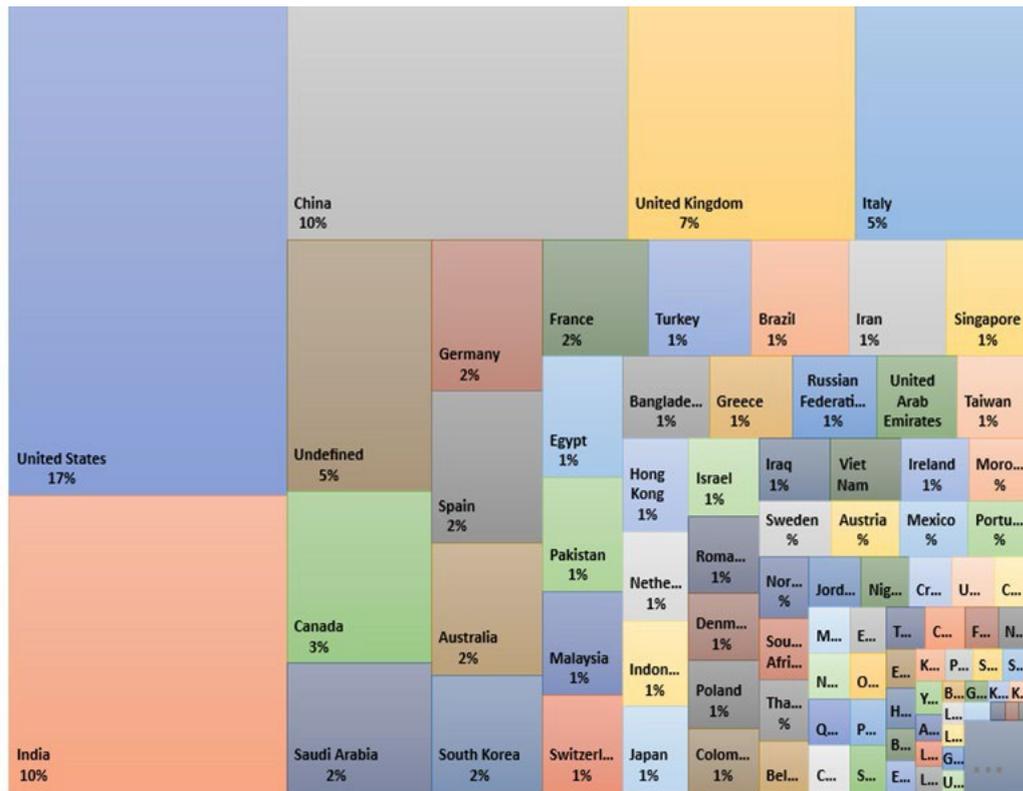


Figure 7. Distribution of the contribution of different countries to research on Covid-19 and Artificial Intelligence.

3. Discussion

The search conducted in this study generated around 2,914 research about Covid-19 and Artificial intelligence extracted from Scopus and analyzed. The retrieved data mostly focused on the medical, engineering, and computer science fields as shown in the treemap as Figure 8 and the word cloud as Figure 5, Figure 6, and Figure 7 with words like "Pandemic," "Covid-19", "intelligence," "AI." It also included data science and data mining aspects shown by the high frequency of the word "data." While at the beginning of the outbreak, much research was done by China (Yu et al., 2020), lately, the USA took the lead in the research field, as shown in Figure 9. Furthermore, a country like India seems to be contributing more to research (10%) as in Figure 9, giving a new perspective about the battle against this disease. Moreover, by examining Figure 3 that maps the co-authorship between different countries, the data is clustered into seven different groups (green, blue, orange, yellow, purple, red, and light blue). The first cluster, the green one, has countries like the United States, which strongly link with Italy, Poland, United Kingdom, and China.

Another important cluster is the blue, including countries like India, Saudi Arabia, Morocco, Jordan, and Bangladesh. The purple cluster establishes links between Egypt, Ireland. China (orange cluster) has links with Thailand and Peru. The yellow cluster links many European countries with the UK, like Germany, Portugal, and Greece. The last cluster, the red one, also links European countries like Spain and Norway with Asian countries like Indonesia, Taiwan, and Russia. This map helps to showcase interesting collaboration between different countries, regions, and continents. On the other hand, this map suggests new collaborations that could benefit the field example between Middle Eastern countries and Europe. In addition, this map gives an insight into underrepresented regions like Africa and South America. Figure 2 maps the co-occurrences of all keywords with four main clusters (red, green, blue, and yellow) and a small purple cluster. These clusters helped establish the relationship between topics: "covid-19", "pandemic", "non-human", "diagnostic" and "algorithms". The topics could be summed into the outbreak, the clinical response, and the robotic utilization.

Figure 4, on the other hand, contains three main clusters (green, the largest and most prominent, red and yellow), three sub-clusters (blue, purple, and orange), and many smaller clusters, including brown and pink, and light blue. The three main clusters evolve around the pandemic, "machine learning," and the diagnosis, with the pandemic one as the dominant cluster. Other clusters like the purple and orange one focus on the public and social media response with keywords like "public health," "social media," "stress."

One possible limitation might be that this study did not cover co-citation, and also, the total number of researches extracted was 2,000. This is due to the restrictions of the database. It is also important to note that Covid-19 and artificial intelligence are growing research field. Future research suggests conducting a bibliometric analysis on Covid-19 vaccination and drug development and the use of artificial intelligence in these domains. It is also recommended to look for data about Africa since it is the new epicenter of the pandemic.

4. Conclusion

This paper investigated and analyzed the relation between Covid-19 and Artificial Intelligence using bibliometric analysis. The discovery of certain keywords has been repeated in several papers, and the ones we faced multiple times include Covid-19, pandemic, data, machine learning, and Artificial Intelligence. Engineering, computer science, and, most importantly, the medical field are major fields we encountered while conducting studies. Empirical research has been conducted for specific countries, with the most concentrated places being the United States, China, and India. It has been confirmed that these three areas have the most exploratory study. Unlike South Africa, studies show that it lacks data, even though Africans have such a high prevalence of the Coronavirus. Each of these results was handled with the help of Scopus, which did indeed assist us in locating the primary keywords we were looking for, as it provided a total of 2,914 research; however, we only conducted a total of 2,000 papers due to the database's inability to add any additional studies. While VOSviewer aided in the construction of the maps, thus it prevented the creation of any co-citations.

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Biographies

Dr. Tayeb Brahimi, Assistant Professor at the College of Engineering, Effat University, Jeddah, Saudi Arabia, received his Ph.D. (1992) and Master's degree (1987) Ecole Polytechnique, University of Montreal, Canada. He has worked as Research Scientist under Bombardier Chair/Canadair from 1992-1998. In 1998, he joined Jeppesen DataPlan in California, then Peregrine System as a TS Analyst, Quality Assurance Engineer, and Consultant for Electronic data interchange (EDI) in Dallas, Texas. Dr. Tayeb Brahimi has been a consultant at IONPARA Inc. for wind energy and aeronautics. He published more than 100 articles in scientific journals and international conferences on renewable energy, aircraft icing, Sustainability, artificial intelligence, and the use of technology to support learning. Among other activities, he is a reviewer for many international journals, invited speaker by the Japan Society of Mechanical Engineering, the Gulf Educational Conference, and the Int. Conference on Eng. Education & Research. He also participated in Public Debate on Energy organized by the Government of Quebec, Canada. Current research interest relates to renewable energy (solar, wind, wave, and waste to energy), Sustainability, machine learning, technology use to support learning, and engineering education.

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