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Artificial Intelligence Technology and the Covid-19 Crisis: A Scientometric Study

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ABSTRACT

This study aims to investigate the scientific production of artificial intelligence in the management and crisis of Covid 19. It is of the scientometric type which has been done by co-occurrence analysis of words. The research population consists of 2,816 documents in the field of "artificial intelligence during the Covid-19 pandemic" indexed in the Scopus database. VOSviewer software has been used to draw scientific maps. A total of 2816 documents in the field of artificial intelligence and corona pandemic have been indexed by researchers all over the world in the Scopus database, of which 64.5% were in the form of scientific research articles. 18% of scientific products are related to medicine and 16.9% are related to computer science. The United States, China, and India are ranked first to third respectively. Iran is also ranked 17th out of 20 countries active in the field of artificial intelligence and Covid-19 such as Taiwan, Malaysia, South Korea, and Macau. Active authors in this field are Chou k.c, Hassanien A.E, and Ivano. D. The highest production in this field belongs to the United States, China, and India, respectively. The United States and China, as prominent and successful examples of the use of artificial intelligence in the management of Covid-19 disease, can be a model for other countries in overcoming this crisis.

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1. Introduction

Corona virus 2019 (COVID-19) was first detected in early December 2019 in Wuhan, China (Pan & et al, 2020). This epidemic, regardless of nations, races, and socioeconomic groups has affected people worldwide. Many countries now face fundamental changes in daily life due to global quarantine, school closures, and social isolation (Shanafelt, Ripp & Trockel, 2020). Coronavirus (SARS-CoV-2) can be transmitted by respiratory droplets and physical contact. The incubation period for SARS-CoV-2 is about 3 to 7 days, but in some cases, this period can be up to 24 days (Yang & et al, 2020). COVID-19 spreads rapidly across countries causing more than 60,000 deaths since April 6, 2020 (Wang & et al, 2020). After April 11, 2020, more than 1.6 million cases of COVID-19 have been reported worldwide. Scientists believe that it is not yet clear how and when the COVID-19 disaster will end. Recent reports indicate that artificial intelligence (AI) can be identified as a potential and powerful tool in the global fight against COVID-19 (Wynants & et al., 2020; Pourhomayoun and Shakibi, 2020). Artificial intelligence has also been introduced as an effective tool for accurately predicting patients who have recently had Acute respiratory distress syndrome (ARDS).

Like other crises, managing the corona outbreak requires several important actions. Because its prevalence is considered a threat to national and international security. Most governments and international institutions produce crisis policies against epidemics by creating emergency policies and actions that seek solutions to epidemics. In this regard, artificial intelligence can be used as an important tool in combating crises (Berryhill & et al, 2019). In other words, Artificial intelligence provides important results as part of COVID-19 prevention, response, and recovery policies.

Digital technologies are very important to help healthcare organizations. Data-based decision-making methods are now actively used in the timely preparation of health care professionals to monitor diseases and ensure coordination between communities. In this context, artificial intelligence technologies and programs are used as a tool in the analysis of complex health data. In addition, machine learning and deep learning techniques achieve faster and more efficient results in processing existing information and decision-making processes compared to humans (Önder & Saygılı, 2018; Yang & et al., 2020).

To study the status of scientific productions in the field of artificial intelligence during the Corona pandemic, it is necessary to conduct a scientometric study to get acquainted with countries, researchers, active institutions, and the process of scientific productions in this field. Therefore, the purpose of this study is a descriptive and analytical review of studies conducted in the field of artificial intelligence during the coronavirus crisis using the scientific output of the Scopus database. Finally, according to the lessons learned from China, policy programs will be presented to prevent, prepare, intervene, communicate and improve COVID-19.

Hence the research questions are:

Question 1: What is the status of scientific productions in the field of AI and Covid-19 in terms of the type of degree, number, and subject area?

Question 2: What is the process of scientific production in the field of AI and Covid-19 from the beginning until now?

Question 3: What are the most prolific authors in the field of AI and Covid-19 and what is their co-authorship status?

Question 4: What are the top institutions that have supported this research?

Question 5: How has the organizational co-authorship been in this field?

Question 6: How has the status of organizational citation been in this field?

Question 7: What are the top countries in terms of scientific production in this field?

Question 8: What is the status of cooperation between countries in the scientific production of this field?

Question 9: What is the status of bibliographic couples in this field?

2. Literature Review

To predict the success and spread of infectious diseases through the population, various statistical, mathematical, and dynamic prediction models have been used (Riad & et al, 2019; Venna & et al, 2018; Chae, Kwon & Lee, 2018; Kucharski & et al, 2020; Gambhir & et al., 2015; Rasmussen & Redd, 2015). Unlike traditional models of epidemiological prediction, big data models have the added benefit of adaptive learning, process-based calibration, flexibility, and newer understanding of disease progression, as well as estimating the impact of interventions such as social distance in inhibiting its spread (Koo & et al, 2020).

The most common method is Susceptible-Exposed-Infectious-Removed (*SEIR*) modeling, which is now used to predict the extent of COVID-19 (Hamzah & et al, 2020; Wu, Leung & Leung, 2020). These techniques can also be used to determine other epidemic parameters such as case reporting, the effectiveness of interventions, and the accuracy of testing methods (Zhao & et al, 2020; Karako & et al, 2020).

For example, a modeling algorithm attempted to simulate the conditions in which Ebola could spread in Chinese society, and the effectiveness of four levels of government intervention in such conditions was evaluated (Zhang & et al, 2015). Similar models have also attempted to predict the spread of the Zika virus in the continent of America in real-time, and they were found to be 85% accurate in quantitative assessments (Akhtar, Kraemer & Gardner, 2019). Attempts to validate different machine learning algorithms have determined that the neural network (BPNN) shows the highest predictive accuracy in modeling Zika virus transmission (Jiang et al., 2018).

Scientists at Johns Hopkins University developed a COVID-19 prediction model based on a previously published stochastic metapopulation epidemic model (Zlojutro, Rey & Gardner, 2019). Comparing the predictions of this modeling with real data determines the understanding of the virus and the limitations of the model (Dong, Du & Gardner, 2020). Artificial neural networks (ANNs) are used to predict antigenic regions with high concentrations of ligands (antigenic dots) in the coronavirus viral membrane protein of acute respiratory syndrome (Zhang & et al, 2005; Soam, Bhasker & Mishra, 2011). This information is very important for the production of vaccines. The use of machine learning for this purpose allows for rapid scanning of the entire viral proteome and faster and cheaper vaccine production. Reverse vaccinology and learning were used to identify six potential vaccine target proteins in the SARS-CoV-2 proteome. Machine learning has been used to predict strains of the influenza virus that are likely to cause infection in a population over the next year. It helps make the seasonal flu vaccine of the year. Predicting the success of the spread of small subtypes of small hemagglutinins (HA) of the viral antigen complex was possible through H3N2 training and testing on H1N1, using a timely reconstructed phylogenetic tree (Hayati, Biller & Colijn, 2020). Machine learning can also be used to predict the host of newly discovered viruses based on nucleoprotein gene sequence analysis and can be a useful tool for tracking viral origins, especially when the data set is large and comparative analysis is difficult or time-consuming. Early identification of cases, quarantine, and prevention of agglomerations are key elements in the management of epidemics such as COVID-19. Mobile-based surveys can be useful in the early detection of cases, especially in quarantined populations (Rao & Vazquez, 2020; Toninelli & et al., 2015). Deep learning algorithms have also been used to identify patterns of infectious diseases in imaging results such as CT and MRI. With CT scans showing a high correlation between COVID patients and positive PCR, such algorithms have shown significant ability to detect COVID-19-compatible findings in CT images of patients. Due to the importance of the subject, the researchers of this study intend to use the scientometric approach to study the literature in this field and use the results to introduce programs for health policy in the use of artificial intelligence techniques in the prevention and treatment of Covid 19.

To measure the quantity and quality of scientific products, special methods and techniques are needed to identify and evaluate the scientific status of different individuals, institutions, and nations and to make policies and plans for future scientific activities (Ramezani, Alipour Hafezi, and Mo'meni, 2020) One of the most important and common methods of measuring the quantity and quality of science production in the world is the scientometric method, whose various techniques have been presented since the second half of the twentieth century and are widely used (Baji et al., 2011; Abedi Jafari et al., 2011). In fact, the field of scientometrics is to facilitate access to information and help knowledge seekers to map the intellectual structure of knowledge, which provides the possibility of analysis, routing, and display of knowledge (Norouzi Chakoli and Hassanzadeh, 2009).

The spread of the global Corona pandemic has led to the production of significant knowledge in reputable international citation databases, including Web of Science and Scopus. Identifying and studying scientific texts in this field to be aware of the current situation is one of the most significant ways to achieve the latest scientific findings in this field. Therefore, scientometric studies are one of the most critical tools in raising awareness of the scientific achievements of countries in the Corona pandemic period.

The field of artificial intelligence in our country is a field of youth and in the field of scientometrics, it has not been paid much attention. Few studies with a scientometric approach to the subject of artificial intelligence have been conducted in recent years, which are introduced.

Farzin Yazdi and Sharif Abadi (2017) studied the status of scientific productions in the Middle East in the field of artificial intelligence during the years 1996 to 2014 and the extent of scientific progress. The findings show that Middle Eastern countries account for only 03.4% of the world's publications in the field of artificial intelligence. Iran ranks 17th in the world in terms of the number of scientific productions and the number of citations, and with the production of 5,156 documents, it ranks first in the Middle East. In terms of cooperation with other countries, and Hirsch indicators, the number of citations awarded the number of citations per document, and the scientific progress of the occupying regime in Jerusalem, and in terms of the number of self-citations, Turkey ranks first among the countries in the region. According to this study, the five countries active in the field of artificial intelligence are China, the United States, Japan, the United Kingdom, and Germany. Among the Middle Eastern countries, Iran has the highest number of degrees in the field of artificial intelligence. In the field of applications of artificial intelligence in the Covid 19 crisis, which is now recognized as the most important problem of countries, so far no study has been conducted in our country. Accordingly, studies in this field in other countries are reviewed. The research achievements of Chakli, Noor Mohammadi, and Chakoli (1398) in a study entitled "Evaluation of research productivity of Iranian universities and government research institutes in the field of expert systems" showed that Tehran, Amirkabir, and Tehran University of Medical Sciences were ranked first to third, respectively, in terms of research productivity of Iranian universities and public research institutes in the field of expert systems. Furthermore, the results of this study indicate that among the types of scientific and technological outputs, the indicators related to patents are more important for researchers in the field of expert systems.

2.1. The domain of Covid 19 studies

In Covid 19, some scientometric studies were conducted in 1998 and 1999. Including Jafari, Farshid, and Jabbari's (1399) research entitled "Thematic analysis of Covid 19 studies in five major continents". They studied Covid 19 research topics across five continents based on works indexed on the Web of Science. According to this study, Asian, European, American, African, Australian, and Pacific countries participated in 608, 391, 301, 66, and 43 works, respectively. After the Covid 19 keyword,

the SARS, Mers keywords are the most common keywords on the five continents.

Meskarpour Amiri, Nasiri, and Mehdizadeh (1313) examined thematic clusters and drew a scientific map of published research to identify the current state of research in the Covid-19 field in Scopus. The results of this study show that the United States (2,819), China (2,342), Italy (1,466), and the United Kingdom (1,264) had the highest number of scientific publications in the field of coronavirus in Scopus, respectively. Iran was ranked 12th with 318 scientific publications. The three main clusters of research activities in the field of Covid-19 were the health research cluster, basic science research cluster, and clinical research cluster, respectively.

Ahmadi Jashfaqani (1399) in a study entitled" Strategic Management of Covid 19 Disease Using Scientometric Approach", analyzed 26 authoritatively selected scientific articles published on Scopus or Science Direct at the beginning of the first half of 2020, and explained the general and medical strategies contained in it. According to this study, some of the most important strategies proposed in foreign studies related to Covid-19 are:

- Finding alternative methods to the traditional respiratory standard display for the treatment of Covid-19
- Doing (not leave) gastrointestinal surgeries following health protocols in the Covid-19 period
- Early detection of Covid-19
- Isolation and treatment of patients undergoing dialysis in coronary conditions
- Strengthening the management of medical and nursing personnel during the conflict with Covid-19
- Developing new management protocols for screening and detection of Covid-19
- Prevention, control, and treatment of gynecological tumors according to the specific conditions of Covid-19 education

Danesh and Ghavidel (2020) studied fifty years of global science production in coronavirus. The results of this study indicate that in the last 50 years, the largest amount of productions of global coronavirus science has been published in 2005 (349 documents), 2004 (348 documents), and 2006 (304 documents). Among the most productive countries, the United States ranks first with 38.924 percent of all scientific documents in this field. China and Germany are in second and third place, respectively. In addition, the University of Hong Kong, the Chinese Academy of Sciences, Utrecht University, the National Institutes of Health (NIH), and the University of North Carolina are the top five organizations that have published the most coronavirus dissertations, ranking first to fifth.

Haqqani et al. (2020) reviewed the scientific literature on coronaviruses, COVID-19, and the dimensions of safety-related research using a scientometric approach. An analysis of the literature in this area shows:

There are several potentially significant different safety problems caused by the Covid 19 pandemic, which is currently receiving limited scientific attention. These include cyber security, economic security, and supply chain security. These findings show why, from an academic research perspective, a comprehensive interdisciplinary approach and a collective scientific effort are needed to help understand and mitigate the various safety effects of this crisis, the consequences of which go beyond biomedical hazards. Such a comprehensive scientific-safety understanding of the COVID-19 crisis can ensure better preparedness for a future epidemic.

Haqqani and Bliemer (2020) studied the Covid-19 epidemic and the unprecedented collaboration of scientific efforts resulting from a health crisis: scientometric comparisons in the SARS, MERS, and Covid-19 literature.

According to this study, Covid-19 studies have been published in a wider range of journals and in a wide variety of different topics. Clear links have been made between the geographical roots of each outbreak, as well as the local geographical intensity of each outbreak and the extent of research

from the regions. Covid-19 studies also show the involvement of authors from a wider range of countries compared to SARS and MERS.

Sahoo & Pandey (2020) evaluated the research performance of Corona and Covid-19 viruses using scientometric indices. This study showed that 53.57% (8195) of research documents published in the open access platform. The United States and China dominate the research results, with the University of Hong Kong producing the highest number of research papers at 547 (3.58%). A significant part of research papers in the field of medicine (49.70%) has been published, followed by immunology and microbiology (35.72%), and the fields of biochemistry, genetics and molecular biology (32.22%). Since January 2020, there has been an unprecedented release of COVID-19 research as well as a significant distribution of research funding worldwide.

Patil (2020) scientifically analyzed COVID-19 global research based on database dimensions. This study demonstrates a multi-authoring trend in the COVID-19 literature. These data show that China has been cited as a very active country. Hiroshi Nishiura network was recognized as strong. Nature has emerged as the most influential journal in terms of citations. It is interesting to note that the researchers preferred "medRxiv" (Health Science Preprint Server) to distribute COVID-19 preprints. The results show that most of the prolific institutions that contribute to COVID-19-related publications belong to China. The network of cooperation between Fudan University, Oxford University and the University of Hong Kong was recognized as strong. In the list of highly cited sources, two journals, The Lancet and the New England Journal of Medicine, dominate. This study reported coronavirus, epidemics, data, ncov, etc. as keywords frequently in COVID-19 publications.

According to the review of domestic literature, it can be concluded that artificial intelligence is a new tool that unfortunately its use in the prevention and treatment of Covid 19 has been neglected in Iran. Therefore, by studying the scientometrics of scientific products of leading countries, we can use the details of the instructions on how to use artificial intelligence techniques in health policy-making to manage Covid 19 disease. Undoubtedly, using the lessons learned from other countries is the most important way to manage this disease in a crisis situation. A review of foreign literature shows that many studies have been conducted in the field of application of artificial intelligence during the Covid 19 pandemic, but only a few of these studies have been studied in the form of scientometric studies.

3. Research Method

The present research is an applied research with scientometric approach which has been done by the method of Co-Word Analysis. The research population consists of 2816 documents in the field of "The role of artificial intelligence on Covid 19", which were indexed in Scopus database from 1992 to 28 November 2020. Data retrieval was performed through the advanced search section of the database using the Boolean "AND" and "OR" operators. The search strategy was as follows:

- "artificial intelligence" AND "Covid-19 pandemic" OR "coronavirus"
- "machine learning" AND "Covid-19 pandemic" OR "coronavirus"
- "Robotic" AND "Covid-19 pandemic" OR "coronavirus"
- "deep learning" AND "Covid-19 pandemic" OR "coronavirus"
- expert systems AND "Covid-19 pandemic" OR "coronavirus"
- "natural language processing" AND "Covid 19 pandemic" OR "coronavirus"
- "Simulation "AND "Covid-19 pandemic" OR "coronavirus"
- "neural network" AND "Covid-19 pandemic" OR "coronavirus"
- "knowledge engineering" AND "Covid-19 pandemic" OR "coronavirus"
- "computing" AND "Covid 19 pandemic" OR "coronavirus"
- "thinking machines" AND "Covid-19 pandemic" OR "coronavirus"

After retrieving the results from Scopus database, the data with CSV format was converted to Excel and extracted. The

VOSviewer software was used to discover commonly used keywords and draw scientific maps.

4. Research Findings

Question 1: *What is the status of scientific productions in the field of AI and Covid-19 in terms of type of degree, number and subject area?*

Findings showed that a total of 2816 documents by researchers around the world, from 1992 to 2020, were indexed in the Scopus database, of which 64.5% in the form of scientific-research articles, 12.9% in the form of review articles, 10.1% in the form of Conference papers and other documents are presented in the form of notes, editor-in-chief's speeches, reviews, books, etc. Researchers in the present study have used all the evidence to analyze the role of artificial intelligence in the coronavirus management crisis.

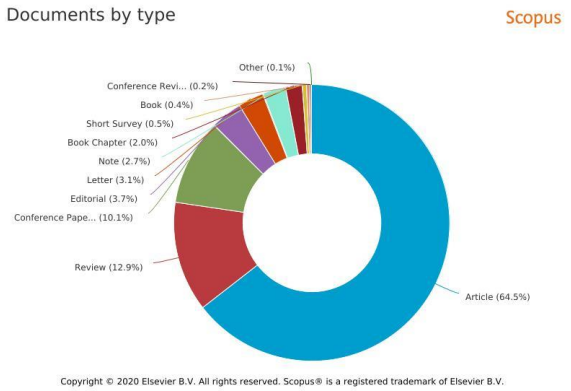

Figure 1. *Format of documents in the field of artificial intelligence and Covid-19*

According to Figure 2, the thematic analysis of the documents in the field of artificial intelligence and Covid-19 shows that 18% of scientific products are related to the field of medicine and 16.9% are related to computer science. In the next ranks, most of the scientific products are related to engineering, chemistry, mathematics, and social sciences.

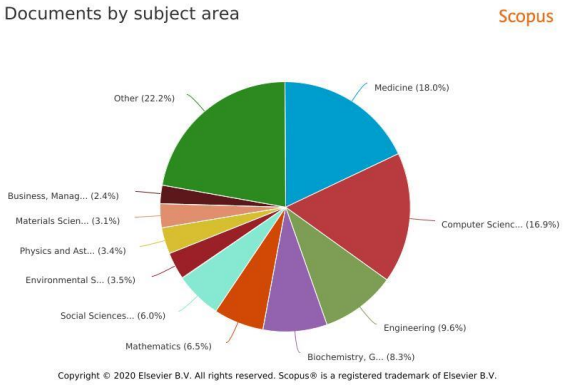

Figure 2. *Topics in the field of artificial intelligence and Covid-19*

Question 2: *What is the process of scientific production in the field of AI and Covid-19 from the beginning until now?*

According to Figure 3, it is clear that the trend of scientific production in the field of artificial intelligence and Covid 19 has been minimal from the beginning to 2002. Still, in 2020 we see a sudden growth in this production, which has reached its maximum of about 2,500 documents in this field. The reason for this exponential growth in 2020 is the prevalence of Covid 19 virus at the beginning of 2020 and its relative anonymity before this year. Naturally, most scientific evidence in this field has been produced this year.

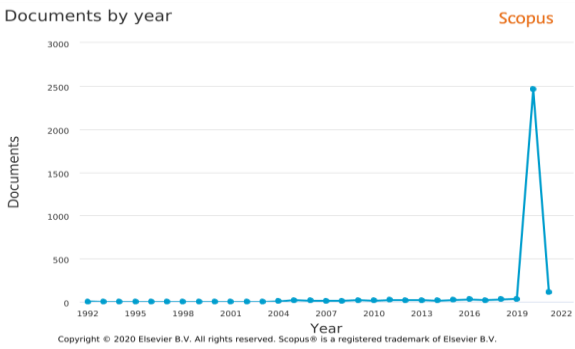

Figure 3. *Year of publication of scientific productions*

Question 3: *What are the most prolific authors in the field of AI and Covid-19 and what is their co-authorship status?*

According to Figure 4, it is clear that out of 7748 authors, the best author with 12 articles related to Chou K. C., and in the next ranks of Hassanien A.E. with 10 documents, Ivanov D. with 8 documents, Albahri A.S., Haleem, Javaid, and Zaidan with 7

documents are in the second, third and fourth ranks, respectively.

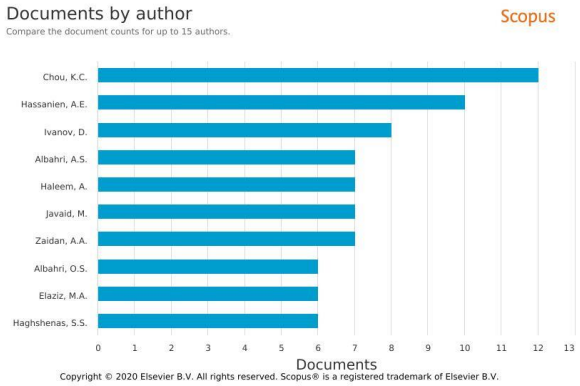

Figure 4. *Top authors in the field of artificial intelligence and Covid-19*

Table 1 shows who owns the largest amount of co-authorship in the works of AI and Covid-19; This information is made by limiting the analysis to the minimum number of citations per author to 5 and the minimum citation to each author to zero citations.
Of the 7748 authors, 92 authors were retrieved. The highest and highest correlation of the whole link in co-authorship is related to Zhang J. with 16 documents and 210 citations and research link is 156.

Table 1. *The highest total weight of the link in the co-authorship of the documents in the field of artificial intelligence and Covid 19*

Row	Author	Number of documents	Number of citations	Link Strength
1	zhang j.	16	210	156
2	Wang j.	14	154	143
3	li y.	17	15	142
4	zhang y.	17	32	137
5	chen x.	13	55	114
6	li h.	14	57	110
7	li l.	11	137	109
8	chen J.	10	9	107
9	zhang x.	17	109	107
10	zhang Z.	10	18	104

According to Table 1, Figure 4 shows Zhang J. Zhang Z. has had the most research cooperation and the least research cooperation.

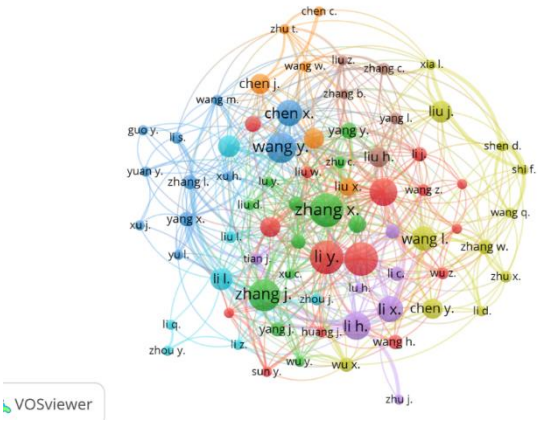

Figure 5. *Link Strength of top co-authors*

Question 4*: What are the top institutions that have supported this research?*

According to the results obtained from Scopus, 162 investment foundations have supported the authors and researchers. Table 2 shows these institutions in order of priority.

Table 2. *The most important investor organizations*

Row	investment foundations	Number of documents
1	National Natural Science Foundation of China	146
2	National Institutes of Health	67
3	National Science Foundation	57
4	Fundamental Research Funds for the Central Universities	32
5	European Commission	30
6	Horizon 2020 Framework Programme	30
7	National Key Research and Development Program of China	22
8	Natural Sciences and Engineering Research Council of Canada	20
9	European Regional Development Fund	18
10	Deutsche Forschungsgemeinschaft	17

According to the findings of Table 2, of the 162 institutions that sponsored these documents, the National Science Foundation of China was the top financial sponsor with 146 documents. The National Health Organization, the National Science Foundation, the Fundamental Research

Budget for Central Universities, and the European Commission are ranked second to fifth, respectively. As shown in Figure 6, the National Natural Science Foundation of China has sponsored the largest number of documents.

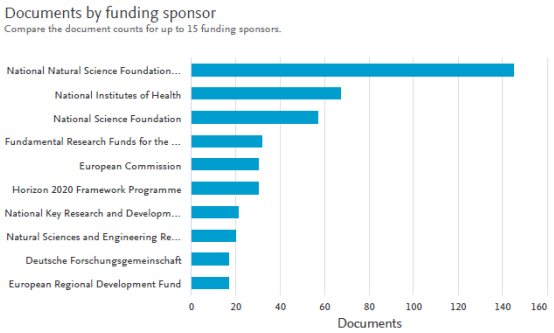

Figure 6. *The most important investor organizations*

Question 5*: How has the organizational co-authorship been in this field?*

Table 3 shows the most organizational co-authorship of researchers in writing highly cited articles in this field. The information in the table was obtained with a minimum number of citations to each organization of zero and a minimum number of documents of each organization of 1.

Table 3. *Organizational co-authorship*

Row	Research organization	Number of documents	Number of citations	Total number of link weights
1	department of radiology, massachusetts general hospital, boston, ma, united states	2	55	28
2	department of radiology, west china hospital, sichuan university, chengdu, china	2	49	26
3	university of california, berkeley, berkeley, ca, united states	2	47	26
4	alberta health services and project possum, university of alberta, edmonton, ab, canada	2	3	25
5	department of medicine, queen elizabeth hospital, hong kong	2	22	25
6	department of medicine, queen mary hospital, hong kong	2	22	25
7	department of medicine, the university of hong kong, hong kong	2	22	25
8	farr institute of health informatics, university college london (ucl) nhs foundation trust, birmingham, united kingdom	2	3	25
9	global brain health institute, trinity college dublin, dublin, ireland	2	3	25
10	penn medicine lancaster general hospital and project possum, lancaster, pa, united states	2	3	25

Table 3 shows that the department of radiology, Massachusetts general hospital, Boston, ma, united states has the highest corporate co-authorship (28). The researchers of this hospital have had the greatest weight of cooperation with other research organizations and institutes. Figure 7 shows an organizational co-authorship map with constraints of 1 and zero with a thesaurus.

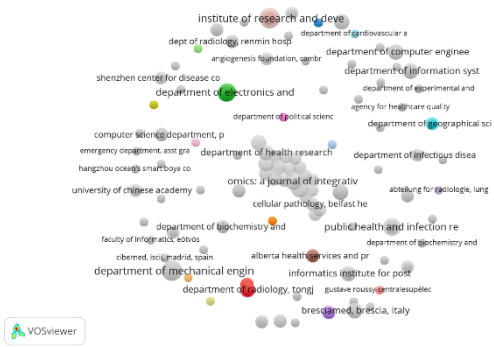

Figure 7. *Organizational co- authorship*

***Question 6**: How has the status of organizational citation been in this field?*

Table 4 shows the total citation link of organizations and research centers with a limit of the minimum number of citations to each organization is zero and the minimum number of documents per organization is 1. The result of this study was 1000 organizations out of 6362 organizations that the highest frequency of citations for the first 10 organizations is shown in Table 4.

***Table 4.** Organizational Co-citations*

Row	Research organization	Documents	Number of citations	Total link weight
1	bgi pathogenesis pharmaceutical technology, shenzhen, china	1	2488	144
2	center for biosafety mega-science, chinese academy of sciences, beijing, china	1	2488	144
3	center for influenza research and early-warning (cascire), cas-twas center of excellence for emerging infectious diseases (ceeid), chinese academy of sciences, beijing, china	1	2488	144
4	central theater, people's liberation army general hospital, wuhan, china	1	2488	144
5	chinese academy of sciences key laboratory of pathogenic microbiology and immunology, institute of microbiology, chinese academy of sciences, beijing, china	1	2488	144
6	division for viral disease detection, hubei provincial center for disease control and prevention, wuhan, china	1	2488	144
7	key laboratory of etiology and epidemiology of emerging infectious diseases in universities of shandong, shandong first medical university and shandong academy of medical sciences, tai'an, china	1	2488	144
8	key laboratory of laboratory medicine, ministry of education, and zhejiang provincial key laboratory of medical genetics, institute of medical virology, school of laboratory medicine and life sciences, wenzhou medical university, wenzhou, china	1	2488	144
9	research network of immunity and health (rnih), beijing institutes of life science, chinese academy of sciences, beijing, china	1	2488	144
10	marie bashir institute for infectious diseases and biosecurity, school of life and environmental sciences and school of medical sciences, university of sydney, sydney, nsw, australia	1	2488	144

Table 4 shows researchers affiliated with the BGI Pathogenesis Research Technology Organization in Shenzhen, China, Biosafety Center of the Chinese Science Foundation, Influenza Research and Early Warning Center of the Chinese Science Foundation, Chinese People's Liberation Army General Hospital, Main Laboratory of Microbiology and Disease Immunology Gene Science Foundation, China Science Foundation Viral Disease Diagnosis Center, Laboratory of Etiology and Epidemiology of Infectious Diseases, Shandong University, China, Wenzhou Medical University Key Genetics Laboratory, Safety and Health Research Network of China Science Foundation and Marie Bashir Institute for Infectious Diseases And Biodiversity of the University of Sydney, New York, received the highest number of citations (2488) with a citation weight of 144. According to the following findings, the CT scan center of China General Hospital, the Radiology Center of China Hospitals, Huangpi Hospital of China, and keya China Medical Technology Co. with a weight of 140 links and 107 citations are the second most corporate citations. Figure 8 shows an organizational co-

authorship network map with constraints of 1 and zero with a thesaurus.

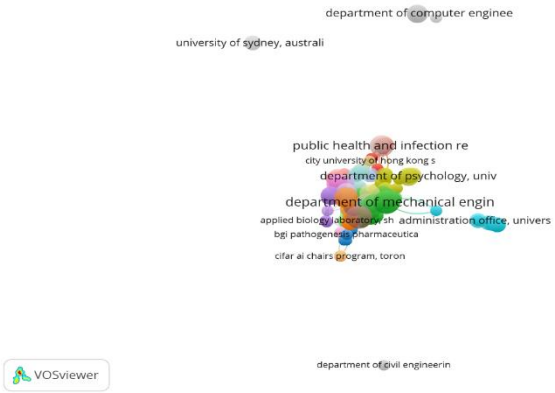

Figure 8. *Organizational co-citation network*

Question 7: *What are the top countries in terms of scientific production in this field?*

According to the findings, out of 146 countries that have participated in scientific productions in the field of artificial intelligence and Covid 19, with a limitation of 0 and 5, the most scientific productions are related to 64 countries.

Table 5. *Countries active in the production of scientific documents in the field of artificial intelligence and Covid 19.*

Row	Country	Documents	Number of citations	Total link weight
1	United states	481	2141	675
2	China	299	5593	677
3	India	244	623	396
4	United kingdom	236	1546	320
5	Italy	182	696	258
6	Australia	85	2670	192
7	Canada	86	394	157
8	Egypt	41	129	124
9	Turkey	52	214	123
10	Saudi Arabia	49	120	117

As shown in Table 6 and Figure 9, the United States ranks first with 481 documents and 675 links, China ranks second with 299 documents and a link power of 677, and India ranks third with 244 works and a link power of 396 among the countries active in scientific productions in this field. Iran is also ranked 17th out of Taiwan, Malaysia, South Korea, Macau, Japan, and France with 47 documents and 122 citations with a link power of 92, and is one of the 20 countries active in the field of artificial intelligence and Covid 19.

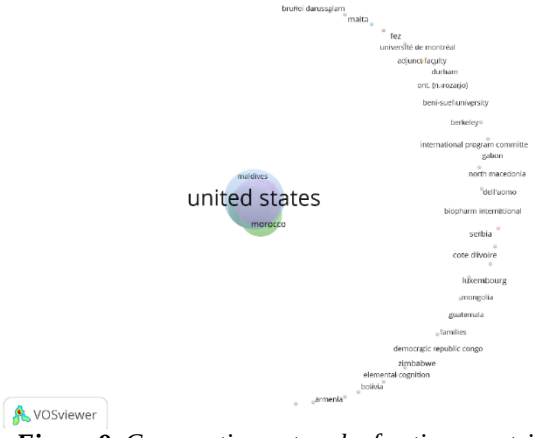

Figure 9. *Cooperation network of active countries*

Out of the 149 countries that have been influential in the scientific productions of the field of artificial intelligence and Covid 19 and have had the most co-authorship and scientific collaboration, 64 countries have at least 5 degrees.

Table 6. *Co-authorship of countries*

Row	Country	Documents	Number of citations	Total link weight
1	United states	481	2141	675
2	United kingdom	236	1546	350
3	China	299	5593	260
4	Italy	182	696	258
5	India	244	623	396
6	Germany	98	772	103
7	Spain	97	149	98
8	Canada	86	394	157
9	Australia	85	2670	192
10	Netherlands	43	1509	114

Question 8: *What is the status of cooperation between countries in the scientific production of this field?*

According to Table 5 and Figure 10, the findings show that the United States is in the first place with the production of 481 documents with a link power of 675. The United Kingdom is in the first place with the production of 236 documents with a link power of 350 and China is in third place with 299 documents and 260 link power.

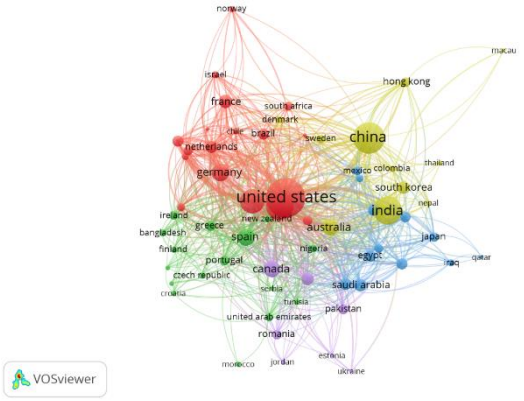

***Figure 10**. Scientific cooperation of countries*

***Question 9**: What is the status of bibliographic couples in this field?*

Table 7 shows which author has the most bibliographic pair relationship in scientific productions in this field. By limiting data analysis to at least 5 credits for one author and at least zero citations to the author, 92 authors were retrieved. The table below shows the top 10 authors.

***Table 7**. Bibliographic pair relationship of authors*

Row	Author	Documents	Number of citations	link power
1	li y.	17	15	3406
2	Wang j.	14	154	3047
3	zhang x.	17	109	2746
4	li l.	11	137	2641
5	chen x.	13	55	2555
6	Wang l.	12	24	2548
7	li h.	14	57	2664
8	zhang y.	17	32	2414
9	zhang j.	16	210	2377
10	liu x.	9	195	2162

Table 7 shows that the number of documents and citations is not an effective element in determining bibliographic pairs; Because Li is in fourth place with 12 documents and 137 citations, but Zhang J. is in ninth place with 16 documents and 210 citations. Figure 11 shows a map of these pairs with constraints 5 and zero and a thesaurus.

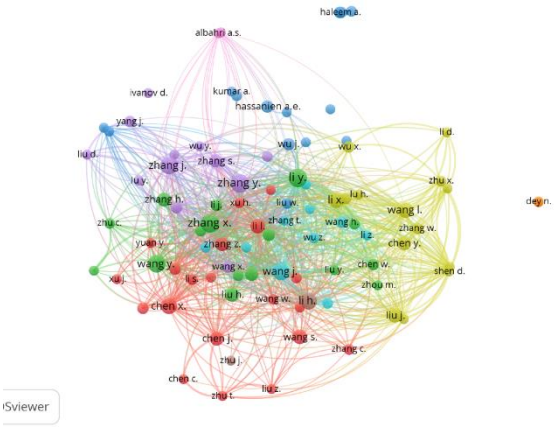

***Figure 11.** Bibliographic pair relationship of authors*

5. Discussion and Conclusion

During the corona pandemic period, the use of new technologies in the management and prevention or treatment of the disease is very important. Meanwhile, artificial intelligence technology has effective applications in the management of the corona pandemic due to its unique role as the superior power of technology in the present age.

In this study, to identify the status of scientific productions in the field of artificial intelligence during the Covid pandemic, 19 authors analyzed the situation in this field using a scientometric approach and using the Vosviewer tool.

An advanced search of the Scopus database showed that from 1992 to November 28, 2020, a total of 2,816 documents were indexed by researchers worldwide in the field of artificial intelligence application in the Corona pandemic on the Scopus database, of which 64.5% were in the form of scientific articles. A study of the relevant fields shows that the authors of the present articles were specialists in the field of medicine and computer science. 18% of scientific products are related to medicine and 16.9% are related to computer science.

Analysis of the trend of scientific production in the field of artificial intelligence and Covid-19 shows that dealing with this field was very slow before the Covid-19 crisis and after its onset has grown rapidly so that in 2020 we will see a sudden growth of these products to its maximum. That means about 2,500 documents have been received in this field.

A review of prolific writers in this field reveals 12 articles in the relevant field by Chou K. C. compiled and in the next ranks of Hassanian E.A. with 10 documents, Ivanov D. with 8 documents, the documents are ranked second and third, respectively.

A review of the co-authorship network shows that the highest correlation of the total link in co-authorship is related to Zhang with 16 documents and 210 citations and 156 research links.

A review of foundations and organizations sponsoring artificial intelligence and coronavirus research shows that 162 investment foundations have supported authors and researchers. Among these investors, the National Science Foundation of China ranks first with 146 documents. The National Health Organization, the National Science Foundation, the Fundamental Research Budget for Central Universities, and the European Commission are ranked second to fifth, respectively.

An analytical study of the co-authorship map of the organizations shows that the radiology department of the Massachusetts General Hospital in the United States has the most organizational co-authorship (28). In fact, the researchers of this hospital have had the greatest weight of cooperation with other research organizations and institutes.

Analysis of the organizational citation map shows that researchers affiliated with bgi pathogenesis research technology organizations in Shenzhen, China, Biosafety Center of the Chinese Science Foundation, Influenza Research and Early Warning Center of the Chinese Science Foundation, Chinese People's Liberation Army General Hospital, Main Microbiology Laboratory and Pathological Immunology of the Science Foundation of China, Virus Diagnosis Center of the Science Foundation of China, Laboratory of Etiology and Epidemiology of Infectious Diseases of Shandong University of China, Key Genetics Laboratory of Wenzhou Medical University in China, Safety and Health Research Network of the Chinese Science Foundation and Marie Bashir Institute for Diseases Infectious and Biosafety University of Sydney New York received the highest number of citations (2488) with a citation weight of 144.

Descriptive and analytical study of busy countries in this field shows that the United States with 481 documents and a link power of 675 is in the first place with the most scientific production, China with 299 documents and a link power of 677 is in the second place, and India with 244 documents and with a link power of 396 are in the third rank of countries active in scientific productions in this field.

Also, Iran with 47 documents and 122 citations with a link power of 92 is ranked 17th and higher than Taiwan, Malaysia, South Korea, Macau, Japan, and France and is one of the 20 countries active in the field of scientific production in the field of artificial intelligence and covid19.

The co-authorship map of the countries shows that the United States, with the production of 481 documents and a link power of 675, has the first rank of the most scientific co-authorship collaborations with other countries. The United Kingdom is in second place with 236 documents and a link power of 350 and China is in third place with 299 documents and a link power of 260.

The bibliographic pair map of the authors shows that the number of documents and citations is not an effective element in determining the bibliographic pairs; Because Li is in fourth place with 12 documents and 137 citations, but Zhang J. is in ninth place with 16 documents and 210 citations.

The virus, which has spread to more than 200 countries in less than three months, continues to infect more and more people every day. "Humanity" is looking for a solution to a virus that has stopped the global system. Researchers are using artificial intelligence technology to prevent and treat Covid 19.

Artificial intelligence is a useful tool for identifying primary infections caused by the coronavirus and also helps control the condition of infected patients. With the growth of artificial intelligence disciplines as opposed to traditional pattern recognition methods, machine learning tools are mapping large amounts of data and can

improve their access to new data and make it faster.

This can significantly improve adaptation and treatment decisions by creating useful algorithms. Artificial intelligence is not only useful in treating patients infected with COVID-19 but also in monitoring their health. This technology can detect COVID-19 crisis on various scales such as medical, molecular, and epidemiological applications. Facilitating research into the virus by analyzing existing data is also helpful. Artificial intelligence can help create the right treatment regimens, prevention strategies, drug production, and vaccines.

It is hoped that health policymakers will overcome this problem by using lessons learned from other countries to apply artificial intelligence in the Corona crisis. One of the lessons learned is the experience in China. The Chinese ambassador summed up the fight against COVID-19 in four basic principles: early detection, rapid reporting, quarantine, and early treatment.

China has used artificial intelligence not only to diagnose diseases but also to monitor the spread of epidemics. In fact, China has used artificial intelligence and machine learning to predict (optimistically, neutrally, and pessimistically) the size and timing of the outbreak. This is significant in predicting where the epidemic is spreading and at what rate. The main strategy applied in different stages of the epidemic, from patient treatment to quarantine control after the COVID-19 epidemic in China, is the active use of artificial intelligence technology. China has increased its investments in artificial intelligence in the past five years, and from the first moment of the coronavirus outbreak, it has used this technology effectively and successfully.

In this regard, a program has been developed by Alibaba Company that uses forecasting technology to help evaluate decision-makers to predict the prevalence of COVID-19 and design control measures.[1]

Using this technology, a 98% predictable COVID-19 strategy was created by loading initial input data such as flight information, number of new cases, number of confirmed cases, number of close calls, and call dates. To predict the release of COVID-19 in a system using machine learning and deep learning, an SEIR model (a technique used to simplify mathematical modeling of infectious diseases) is developed that is suitable for assessing the risk of infection.

On the other hand, WeChat and Alipay are widely used in China. The telephone app has been used as an effective tool in public policy against the epidemic. China is a country that has successfully expanded its smartphone evolution across the country. In the program presented by China on the outbreak of COVID-19, a government-private partnership (Cloud Alibaba) is an important example of the efficient use of artificial intelligence technology for public health. On the other hand, the Ministry of Science and Technology has created an online software platform to control COVID-19. The ministry stressed that it will continue to use the strengths of Chinese science and technology research institutes and high-tech regions to develop new technologies, products, and services used in epidemic prevention and control measures. In this regard, officials have compiled a list of more than 2,000 "new technologies" and providers of these technologies, from automatic body temperature detection to hospital diagnosis and information systems.

Researchers in this study believe that strategies related to the applications of artificial intelligence in coronavirus crisis can be divided into the following dimensions:

***Table 8**: Policies related to the use of artificial intelligence in coronavirus crisis*

Row	Policy type	Artificial intelligence programs
1	Prevention policies	Early detection of epidemics Transmission Monitoring (Using Hospital, Travel, and Traffic Data to Develop Strategies) Data collection and analysis
2	Preparation policies	Outbreak simulation (different scenarios for creating public policies) Prevalence analysis (cost and time, risk map, diagnosis of potential patients) Determining the order of priority of actions by observing genetic data and population movement Effective knowledge and resource mobilization (machine learning and deep learning

[1] AliBabaCloud WebSite:https://www.alibabacloud.com/campaign /fight-coronavirus-covid-19 (Access Date: 18.04.2020).

		techniques) Labor support (robotics and drones)
3	Intervention policies	Infection prevention and control Quarantine and isolation management (Alibaba payment program) Infection prevention and control (CT-based imaging systems) Procurement and allocation of materials Vaccine and Antiviral Drug Studies (IBM, Google DeepMind Summit) Development of diagnostic kits
4	Emergency communication policies	Data sharing between organizations and healthcare professionals Chatbot Coordination between logistics networks Filtering data generated on social networks and identifying spam
5	Improvement policies	Estimating / calculating potential losses in the context of social and economic impacts Collecting all relevant data to help manage future epidemics Establishing a consulting system

The virus, which emerged in late 2019 in Wuhan, Hubei Province, China, has been described as the biggest public health problem in the history of China. The researchers in this article hope that the study of scientometrics will be useful.

One of the limitations of the research was the lack of internal background to examine the further dimensions of the subject. It is hoped that this study will be the source of artificial intelligence scientometric studies in Iran.

Executive proposals

- Developing a policy framework for the health sector of Iran in the application of artificial intelligence in crisis management.
- Implementation and application of artificial intelligence in preventing the spread of Covid19.
- Application of machine learning techniques in the manufacture of Covid19 vaccine.

Suggestions for future research

- Investigation of thematic clusters of applications of artificial intelligence in the prevention and treatment of Covid 19.
- A scientometrics study of lessoned learned in the United States and China with a text-based approach.

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