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# Scientometric Analysis of Image Processing in Relation to Covid-19 Detection

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**The study examines global literature on "Scientometric analysis of image processing in relation to Covid-19 Detection". Various bibliometrics and scientometrics tools like VOSViewer and Biblioshiny are used to analyse the extensive bibliographic metadata (research articles, case study, reports and review articles) which was retrieved from Web of Science core collection database for detecting Covid-19 using image processing techniques This research work demonstrates the rapid increase of Covid-19 during 2020-22 . It considered 606 documents published in 333 sources by 3668 authors from 78 different countries. The citations for different countries, co-citations for the different sources, co-occurrence of keywords, and co-authorship of the countries were determined. Further, it was found that only 3 out of 78 countries were responsible for contributing more on detection of Covid-19 using image processing related research output. These findings are critical for academics, clinicians, journal editors, and those engaged in Covid-19 detection using image processing research to understand the present literature's strengths and potential gaps, as well as to plan future data collection and science policy investments.**

**Keywords:** *Covid-19, Image Processing, Global literature, Bibliometrics, Scientometrics*

## 1 INTRODUCTION

Image processing has made a significant contribution to medical diagnostics and the development of new drugs [1-2]. Image processing, according to experts, will have a significant influence by giving radiologists with tools for making faster and more accurate diagnosis and prognoses, which will lead to more successful therapy. Because computers will be able to process massive volumes of patient data, big data and image processing will revolutionise the way radiologists work, allowing them to become specialists on extremely important tasks. Artificial intelligence has

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already been successful in solving problems such as chronic diseases and skin cancer. Scientists currently expect artificial intelligence to play an important role in the hunt for a cure for the new corona virus, and thus in reducing the panic that has gripped the world [3-4].

Due to the Covid-19 epidemic, the health-care system has recently faced significant hurdles in terms of supporting an ever-increasing number of patients and accompanying expenses [5-6]. As a result, the recent impact of Covid-19 necessitates a mental shift in the health-care sector. Therefore, utilising modern technology such as artificial intelligence in order to build and develop intelligent and autonomous health-care solutions has become critical. When compared to other viruses, Covid-19 is notable for its rapid transmission, which allowed it to become a worldwide pandemic in record time. The medical and health-care systems are still researching and analysing it in order to gather more trustworthy information and gain a better understanding of this critical problem of rapid spread. As a result, accurately simulating the Covid-19 transmission remains a top priority in the fight against this virus [7]. The detection of viral RNA from sputum or a nasopharyngeal swab using real-time reverse transcription–polymerase chain reaction (RTPCR) is currently the most widely utilised diagnosing approach. These tests, on the other hand, require human interaction, have a low positive rate at early stages of infection, and can take up to 6 hours to produce findings. Thus, fast and early diagnosis tools are needed to speed up the control of this pandemic, especially in the long run, when lockdowns are entirely lifted, testing should be conducted on a broad scale to avoid the pandemic from resuming.

Due to a lack of resources and technology in some nations, testing has been confined to patients who have symptoms, and in many cases, several symptoms. The enormous burden that the situation has placed on national health-care systems and personnel, even in the most developed countries, exacerbates the difficulty of recognising and tracking potential cases [8].

Through this research work, the authors presents a detailed analysis of the papers published on the detection of Covid-19 using image processing techniques, with focus on which country contributing moret, co-occurrences of the keywords, citation, co-authorship and co-citation network analysis.

## 2 LITERATURE REVIEW

Several studies have been conducted to detect the coronavirus (Covid-19) using Chest X-Ray and CT scan by various image processing and deep learning techniques. Karim, Shahiratul, and Nohuddin [9] examined published articles (696) on medical image mining, using Scopus database. for research productivity, document and source formats, publishing languages, and subject area. Guo et al [10] examined AI-related health care research papers published up to December 2019 were retrieved from Web of Science (Clarivate PLC). A search approach was devised based on bibliometric characteristics to screen the title for eligibility, using the abstract and full text when appropriate. The HistCite software was used to calculate the growth rate of publications, features of research activity, publishing patterns, and research

hotspot tendencies. Saeed, Ali et al [11] examined the accuracy of using generative adversarial networks for Glaucoma detection, using bibliometric methods and by collect data. IEEE Xplore, Web of Science, Scopus, ScienceDirect, and PubMed were the data bases. Zhang et al [12] explored the academic publishing trends in medical image segmentation technologies, using Scopus and Web of Science databases. Peng, Xindong, and Dai [13] offered a neutrosophic set overview with the goal of providing a clear perspective on the many concepts, tools, and trends associated with their extensions. Lou et al [14] analyzed Covid-19 papers to summarise research hotspots until March 1, 2020. Gao et al [15] explored the use of magnetic resonance imaging for mood disorders. Gong, et al [16] examined 100 most cited articles on neuroimaging in primary mental illnesses. Liao et al [17] investigated the current state of medical big data. The authors looked at 988 references that were retrieved from Web of Science's Science Citation Index Expanded and Social Science Citation Index databases. Li[18] presented a bibliometric analysis on deep learning research during 2007–2019.

## 3 DATA COLLECTION AND RESEARCH METHODS

The data for the present study had been collected from Web of Science Core collection. The keywords ("COVID 19" or "2019 novel Coronavirus" or "Coronavirus 2019" or "coronavirus disease 2019" or "2019-novel CoV" OR "2019 ncov" or "covid 2019" or "covid19" or "corona virus 2019" or "ncov-2019"d or "ncov2019" or "nCoV 2019" or "2019-ncov" or "covid-19" or "Severe acute respiratory syndrome coronavirus 2" or "SARS-CoV-2") AND ("Image Processing") are used to extract the data. The methods like citation analysis of countries, co-citation on cited sources, co-occurrences of keywords and co-authorship analysis on countries are analysed, using bliometrics software like VOSViewer and Biblioshiny.

## 4 RESULT AND DISCUSSION

### *41 CITATION ANALYSIS BASED ON COUNTRIES*

In this study, 79 countries were involved for contributing articles on "Detection of Covid-19 using Image processing techniques". From the 79 countries, only 34 countries are selected with the threshold like minimum number of documents of country is set as 5. Table1 depicts the bibliometric profile of top 20 countries. Figure 1 presents the citation network visualization of top 20 countries on Covid-19 detection using image processing techniques. From the Table 1 and Figure 1, it is shown that only 3 countries like USA (108 articles), India (77 articles) and Peoples R China (100 Articles) have published more than 50 articles and USA scored more citation count of 500 than India and Peoples R China. India has comparatively higher number (188) in total link strength, than USA and Peoples R China.

**Table 1: Bibliometric Profile of Top 20 Countries**

| Country | Documents | Citations | Total link Strength |
|---|---|---|---|
| **India** | **77** | **268** | **188** |
| **Saudi Arabia** | 50 | 175 | 98 |
| **Turkey** | 37 | 137 | 92 |
| **USA** | **108** | **500** | **85** |
| **Egypt** | 26 | 101 | 79 |
| **South Korea** | 34 | 171 | 60 |
| **Italy** | 23 | 143 | 57 |
| **Peoples R China** | **100** | **219** | **54** |
| **Canada** | 33 | 116 | 46 |
| **England** | 36 | 163 | 39 |
| **Australia** | 25 | 185 | 37 |
| **Germany** | 25 | 118 | 35 |
| **Iran** | 23 | 142 | 35 |
| **Brazil** | 15 | 90 | 34 |
| **Vietnam** | 5 | 34 | 33 |
| **Portugal** | 5 | 41 | 30 |
| **Switzerland** | 11 | 74 | 27 |
| **Pakistan** | 19 | 66 | 21 |
| **Spain** | 26 | 128 | 21 |
| **Denmark** | 6 | 39 | 17 |

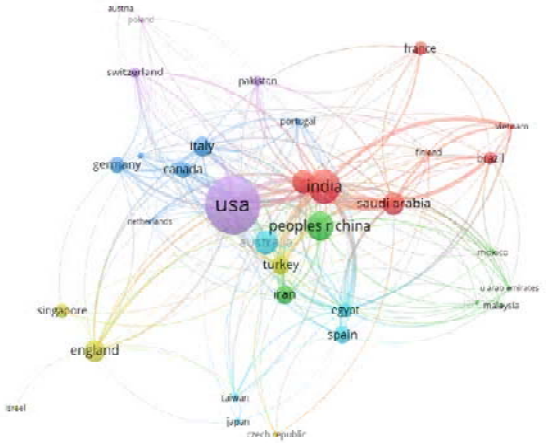


**Figure 1: Citation Network Visualization based on Countries**

## *42 CO-CITATION ANALYSIS BASED ON CITED SOURCES*

In this study, co-citation based on cited sources are considered. Table 2 gives the minimum of number of citations of a source, total number of sources and number

of sources selected. In this paper, the minimum number of citations of a source is set as 20, and 182 sources are considered for the analysis.

**Table 2:List of Citation Sources –Analysis by Co-Citation**

| Total Number of Sources | Minimum of Citations of a source | Number of Sources selected |
|---|---|---|
| 7745 | 5 | 832 |
| | 10 | 390 |
| | 15 | 240 |
| | **20** | **182** |
| | 25 | 137 |
| | 30 | 105 |
| | 40 | 73 |

Table 3 represents the top 20 sources selected based on total link strength. Figure 2 gives the Co-citation network visualization based on cited Sources. From the Table 4 and Figure 2, Arxiv preprint arxiv source has link strength of 16511, where the citation count is 427, but radiology has highest citation of 542, but less link strength than Arxiv preprint arxiv. Only 2 sources link strength are above 15000, whereas IEEE access has citation of 334 and link strength of 11908.

**Table 3: List the Top 20 Ssources based on Total Link Strength**

| **Source** | **Citation** | **Total Link Strength** |
|---|---|---|
| **Arxiv preprint arxiv** | 427 | 16511 |
| **Radiology** | 542 | 16503 |
| **Ieee Access** | 334 | 11908 |
| **Proc cvprieee** | 407 | 9932 |
| **Chaos soliton fract** | 134 | 9293 |
| **Ieee t med imaging** | 242 | 8896 |
| **Compute biol med** | 232 | 8371 |
| **Sci rep-uk** | 229 | 7602 |
| **New engl j med** | 237 | 7388 |
| **Eur radiol** | 194 | 6910 |
| **Plos one** | 185 | 6523 |
| **Lancet** | 215 | 6506 |
| **Nature** | 177 | 6027 |
| **Comput meth prog bio** | 123 | 5304 |
| **Appl intel** | 132 | 5019 |
| **Jama j-am med assoc** | 138 | 4829 |
| **Science** | 127 | 4763 |
| **Cell** | 111 | 4667 |
| **Lec notes computsc** | 187 | 4562 |
| **Nat communication** | 81 | 3562 |

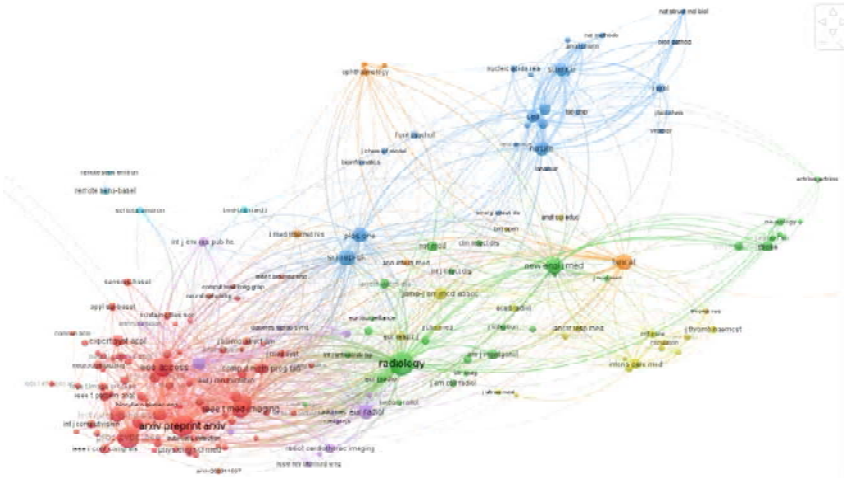


**Figure 2: Co-Citation Network Visualization based on Cited Sources**

## *43 CO-OCCURRENCESOF KEYWORDS*

In this study, co-occurrences of keywords on all keywords used in the publication are considered. Table 5 depicts the total number of keywords, minimum number of occurrences of a keyword, and number of keywords obtained with the minimum of number of occurrences. From the Table 5, 84 keywords are selected by setting the threshold as minimum number of occurrences of a keyword as 5

**Table 5: List of Keywords based on Minimum Number of Occurrences of a Keyword**

| Total Number of Keywords | Minimum number of occurrences of a Keyword | Number of Keywords selected |
|---|---|---|
| 2156 | **5** | **83** |
| | 6 | 60 |
| | 7 | 50 |
| | 8 | 40 |
| | 9 | 34 |
| | 10 | 29 |
| | 11 | 27 |
| | 12 | 24 |
| | 13 | 23 |
| | 14 | 21 |
| | 15 | 20 |

Table 6 gives the Co-Occurrences of a top 20 keyword and total link strengths is represented. Figure 3 depicts the co-occurrence of a keyword network visualization. From the Table 6 and Figure 3, Covid-19 keyword has 248 occurrences with total link strength of 673, Deep Learning has 105 occurrences with total link

strength of 364. Other keywords are occurred below 100 only. Only those keywords are co-occurred many times in the publication.

**Table 6: List of Co-Occurrence of a Keywords**

| Keyword | Occurrences | Total Link Strength |
|---|---|---|
| **Covid-19** | 248 | 673 |
| **Deep learning** | 105 | 364 |
| **Classification** | 57 | 224 |
| **Coronavirus** | 47 | 162 |
| **Machine learning** | 34 | 161 |
| **Pneumonia** | 36 | 157 |
| **Sars-cov-2** | 52 | 147 |
| **Artificial intelligence** | 30 | 132 |
| **Diagnosis** | 26 | 117 |
| **Feature extraction** | 22 | 111 |
| **Transfer learning** | 24 | 96 |
| **Convolutional neural network** | 24 | 89 |
| **Computed tomography** | 18 | 88 |
| **Segmentation** | 24 | 81 |
| **Ct** | 19 | 79 |
| **X-ray** | 17 | 77 |
| **Cnn** | 20 | 70 |
| **Image processing** | 22 | 70 |
| **Chest x-ray** | 12 | 66 |
| **Model** | 16 | 57 |


**Figure 3:Co-Occurrences of a Keywork Network Visualization**

## *44 CO-AUTHORSHIP NETWORK ANALYSIS BASED ON COUNTRIES*

In this study, co-authorship based on countries are considered. Table 7 depicts the threshold table for getting the number of countries to be selected based on the minimum number of documents of a country and minimum number of citations of a country on the total number of countries. From the Table 7, when the minimum number of documents of a country and minimum number of citations of a country is 5, the number of countries met the threshold is 34 out of 79 countries.

**Table 7: Depiction of Countries Based on Co-authorship Analysis**

| Total Number of Countries | Threshold Parameters | | Number of Countries met the Threshold |
|---|---|---|---|
| | Minimum number of documents of a country | Minimum number of citations of a country | |
| 79 | 5 | 0 | 34 |
| | 5 | 5 | 34 |
| | 6 | 5 | 30 |
| | 6 | 6 | 30 |
| | 7 | 6 | 25 |
| | 7 | 7 | 25 |
| | 8 | 7 | 23 |
| | 8 | 8 | 22 |
| | 9 | 8 | 21 |
| | 9 | 9 | 21 |
| | 10 | 9 | 20 |
| | 10 | 10 | 20 |

Table 8 gives the co-authorship based analysis of countries which contains number of documents by the countries, citations and total link strength. Figure 4 depicts the co-authorship network visualization based on countries. From the Table 8 and figure 4, the authors/researchers from countries like USA, People R China and India are jointly authored for many publications on Covid-19 detection using image processing, deep learning techniques since those countries have more than 100 total link strength. USA have co-authorship total link strength of 158, Peoples R china have co-authorship link strength of 107, where as India has link strength of 104. Other countries like Saudi Arabia, Canada, Germany, Australia, England, South Korea, Italy have co-authorship link strength are from above 50 to 100.

**Table 8: List of Countries with Number of Publications, Citations and Collaborative Linkages**

| Country | Documents | Citations | Total link Strength |
|---|---|---|---|
| **USA** | 108 | 500 | 158 |
| **Peoples R China** | 100 | 219 | 107 |
| **India** | 77 | 268 | 104 |
| **Saudi Arabia** | 50 | 175 | 93 |
| **Canada** | 33 | 116 | 80 |
| **Germany** | 25 | 118 | 71 |
| **Australia** | 25 | 185 | 70 |
| **England** | 36 | 163 | 70 |
| **South Korea** | 34 | 171 | 65 |
| **Italy** | 23 | 143 | 61 |
| **Pakistan** | 19 | 66 | 50 |
| **Switzerland** | 11 | 74 | 46 |
| **Egypt** | 26 | 101 | 45 |
| **France** | 13 | 95 | 45 |
| **Spain** | 26 | 128 | 42 |
| **Brazil** | 15 | 90 | 40 |
| **Japan** | 10 | 42 | 38 |
| **Singapore** | 9 | 100 | 38 |
| **Denmark** | 6 | 39 | 35 |
| **Iran** | 23 | 142 | 34 |

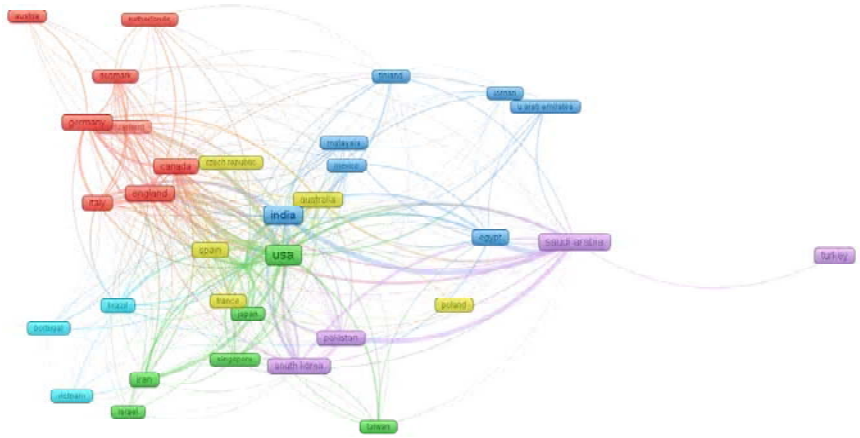


**Figure 4: Co-Authorship Network Visualization based on Countries**

## 5 CONCLUSION

This article we made an attempt to limit the impact of the COVID-19 epidemic since it began. Around the world, the search for effective therapies, vaccinations, and societal management methods has escalated. Image processing technologies have surely played a significant impact, providing academics with fresh insights and techniques.

The United States, China, and India have the highest output in this regard. It's worth noting that practically all of the top ten countries with the highest scientific output on the topic of Covid-19 and image processing have a lot of fund, demonstrating the importance of funding and economic support for research. On the other hand, we have demonstrated that, in an increasingly globalised society, there is a high level of cross-national collaboration. There was a lot of cooperation between surrounding and geographically close countries, in addition to collaborations between the US and China. This suggests that the ease of physical transportation and cultural similarities between countries on the same continent may lead to increased collaboration. The Covid-19 pandemic has expanded the use of teleworking, but it's unclear whether distant cooperation will change this view in the next years. The use of Web of Science, help us in comparing the results. Despite the fact that the samples were of varying sizes, equivalent classifications were identified. This suggests that the WoS sample, despite being smaller, is still representative of Covid-19 research in image processing technologies. This report outlined the research that was carried out over the course of several years. In order to expand our understanding of this fascinating issue, we will continue our resea

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