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A Literature Review to Evaluate the Impact of Machine Learning and Artificial Intelligence for Lung Cancer Patient in COVID-19 Pandemic

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ABSTRACK

Cancer patients, especially those with lung cancer, are highly vulnerable to COVID-19 due to weakened immunity. The treatment of lung cancer during the pandemic present numerous challenges and difficulties. Embracing technological advancements, expert employ machine learning and artificial intelligence in both treathment and detection of lung cancer. Artificial intelligence and machine learning prove instrumental in predicting lung cancer using diverse data sources. However, the application of machine learning and artificial intelligence for COVID-19 patients with lung cancer is hindered by limited patient data. Therefore, a literature review is imperative to elucidate the impact of machine learning and artificial intelligence on lung cancer patients during the COVID-19 period. Drawing fron journals across various countries, this literature review relies on searches conducted on platforms like PubMed, Science Drirect, and Google Scholar. The results show an important role of machine learning and artificial intelligence for lung cancer patients in COVID-19 pandemic.

ABSTRAK

Pasien kanker dianggap rentan terhadap COVID-19 karena keadaan imunosupresif. Salah satu jenis kanker yang banyak menyebabkan kematian adalah kanker paru-paru. Banyak tantangan dan kesulitan, terutama dalam pengobatan kanker paru-paru selama COVID-19. Seiring perkembangan teknologi, para ahli menggunakan pembelajaran mesin dan kecerdasan buatan dalam pengobatan dan deteksi kanker paru-paru. Kecerdasan buatan dan pembelajaran mesin dapat digunakan untuk memprediksi kanker paru-paru menggunakan data dari microarray, gambar, dan sumber lainnya. Keterbatasan data pasien COVID-19, informasi terkait penerapan pembelajaran mesin dan kecerdasan buatan untuk pengobatan pasien COVID-19 dengan kanker paru-paru masih terbatas. Oleh karena itu, diperlukan tinjauan literatur untuk menjelaskan efek pembelajaran mesin dan kecerdasan buatan untuk pasien kanker paru-paru selama periode COVID-19. Tinjauan literatur pada penelitian ini bersumber dari hasil penelusuran jurnal dari berbagai negara terkait kanker paru-paru dan COVID-19 di Pubmed, Science Direct, dan Google Scholar. Hasilnya menunjukkan peran penting pembelajaran mesin dan kecerdasan buatan untuk pasien kanker paru-paru dalam pandemi COVID-19.

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INTRODUCTION

A global pandemic outbreak caused by the SARS-CoV-2 coronavirus was first identified in late 2019 in Wuhan, Hubei province, China, and has since spread to other regions of the world (Ciotti et.al, 2020). On March 11, 2020, the World Health Organization (WHO) proclaimed COVID-19 as a global pandemic and reported that COVID-19 had infected 585,086,861 people and that 6,422,914 had died as of August 11, 2022 (Rice et.al, 2020). COVID-19 originated from animals sold at the Huanan seafood market in Wuhan, but it was not specified which animal was the source of COVID-19 (WHO, 2020). Dry cough, fever, shortness of breath, headaches, and pneumonia are some of the signs and symptoms of COVID-19. Attacks of this disease can cause progressive respiratory failure and even shortness of breath, headaches, and pneumonia. Attacks of this disease can cause progressive respiratory failure and even death (Zhou, 2020). COVID-19 can be transmitted when people are in close contact with each other. In an effort to control COVID-19, it is necessary to have early detection and isolation of infected people (Hussein et.al, 2021). The isolation period for COVID-19 patients can be an average of 5-6 days or up to 14 days (Sari et.al, 2020).

One of the most worrying things about COVID-19 is the presence of comorbidities. Many things are associated with comorbidities, including poorer health outcomes, more complicated clinical management, and high costs of care (Daef, 2020). Several meta-data-analyses suggest the prevalence of comorbidities in COVID-19 patients (Close, 2020; Emami, 2020; Wang, 2020). The data also shows that parents with comorbidities such as heart disease, lung disease, diabetes, and hypertension who are affected by COVID-19 are particularly vulnerable to the general population (Porzionato, 2020). Thus, it can be concluded that the age difference of COVID-19 patients can be one of the possibilities for COVID-19 patients to be weak against COVID-19 (Sanyaolu, 2020). These patients have a high probability of dying from their original comorbidities (Wang, 2020). Commodities make a person's immunity weak, and people with weak immune systems have a more dangerous risk of being infected with COVID-19 (Dai M, et al, 2020; Rogado, 2020; Zhang L, 2020).

Cancer is a disease that affects the immune system (Wu MY, et al, 2018). According to studies, COVID-19 raises cancer patients' risk of complications and mortality. The risk of dying from COVID-19 is three times higher for cancer patients than for the general population (Dai M, et al, 2020). A study utilizing COVID-19 was done on 105 cancer patients and 536 non-cancer individuals. The results show a higher mortality rate in cancer patients, one of which is lung cancer (Pathania, 2021). Unfortunately, there are many long steps that need to be taken to detect lung cancer. Additionally, it takes a long time to detection lung cancer and needs experts and specialists to detect it. This method is not effective for detecting patients who have the disease at an early stage. It is not uncommon for new lung cancer to show signs or symptoms at an advanced stage, and that's why many people with lung cancer are only diagnosed with lung cancer when it has spread to other parts of the body. Therefore, it is necessary to carry out early detection by all groups for more effective and rapid treatment of lung cancer.

Time by time, lung cancer detection is done using machine learning and artificial intelligence. Machine Learning is one of the methods of artificial intelligence by imitating human intelligence to solve a problem (Ula, 2021). The way machine learning works is to develop machine learning capabilities from a given dataset and provide useful insights for those who use it (Helm, 2020). A computer's ability to replicate intelligent behaviour with the least amount of human intervention is referred to as artificial intelligence (AI), which is a general term (Hamet, Pavel, & Tremblay, 2017). There are many challenges and difficulties regarding cancer patients and the treatment posed by COVID-19. Unfortunately, the available data regarding lung cancer patients during the pandemic is still very limited. Therefore, there is a need for elaboration of previously existing articles. The articles were identified by literature review method. By using the literature review method, it is expected to achieve the desired results and gain insight from the articles to be identified.

RESEARCH METHODS

This research method uses a qualitative approach and applies the research method of literature review (library research). Their main objective is to provide an objective, theoretical examination of a certain subject or theme (Rother, 2007). There are many reasons for using the literature review method, the most common reasons being to summarize existing evidence in the fields of medicine and technology, identify differences in research to suggest areas for future investigation, and provide a framework or context for the proper positioning of new research (Lamsa, 2021). The first step in compiling an literature review (LR) in this research is to create a Research Question (RQ). RQ are created according on the requirements of the selected topic. The following are the study's research questions:

RQ1. How many articles have been published for Lung Cancer Patient in COVID-19 Pandemic from 2020 to 2022?

The answer to this question helps researchers understand the history of lung cancer patient in COVID-19

RQ2. What percentage of the articles on lung cancer diagnosis are based on machine learning and artificial intelligence from 2020 to 2022?

The answer to this question introduces researchers to other areas of lung cancer and provides a percentage

RQ3. What kind of machine learning and artificial intelligence are used to detect and use in treatment for lung cancer in COVID-19 Pandemic?

The answer to this question helps researchers to have knowledge about machine learning and artificial intelligence techniques for lung cancer in COVID-19

The following scientific databases have searched this article, and books are cited in them. The electronic databases used in this research are Google Scholar, PubMed, and Science Direct. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) technique, which is used in this study, consists of: (1) Identification, this step is a literature search as much as possible in the database used, (2) Screening, this step focuses on the process of screening or selecting the collected literature, (3) Feasibility, all findings from the selected literature are then analyzed further and evaluated, (4) Inclusion, this step is the last step where the selected literature is made in the form of tabulated data and the findings become the basis for answering pre-determined questions (Lamsa, 2021).

The inclusion criteria set in this study were 1) a study about lung cancer during the Covid-19 pandemic using machine learning and artificial intelligence, 2) a study conducted in 2020-2022, 3) not a literature study, narrative review, systematic literature review, and meta analysis. From the results of a literature search using the keywords COVID-19 lung cancer machine learning artificial intelligence, 15,330 literatures were found which were searched on Google Scholar, PubMed, and Science Direct. From a total of 15,330 literatures obtained, 14,600 literatures came from Google Scholar searches. Meanwhile, 695 literatures are from Science Direct and 35 literatures are from PubMed. After the literatures have been collected, then a literature selection is carried out related to the results of searching the same literature or related to the existence of duplication of research.

From this selection, there are 695 similar literatures and 13,903 literatures that will be further selected by taking into account the research abstract. Literature that did not meet the criteria was excluded and not used. There are 3,120 articles which are study articles so that they are excluded in the articles to be analyzed. The literature used provides information on the detection and linkage of COVID-19 treatment with artificial intelligence and machine learning. After looking at the research abstracts, 46 articles related to the application of artificial intelligence and machine learning during the COVID-19 pandemic related to lung cancer were obtained. The PRISMA in this study is shown in Figure 1.

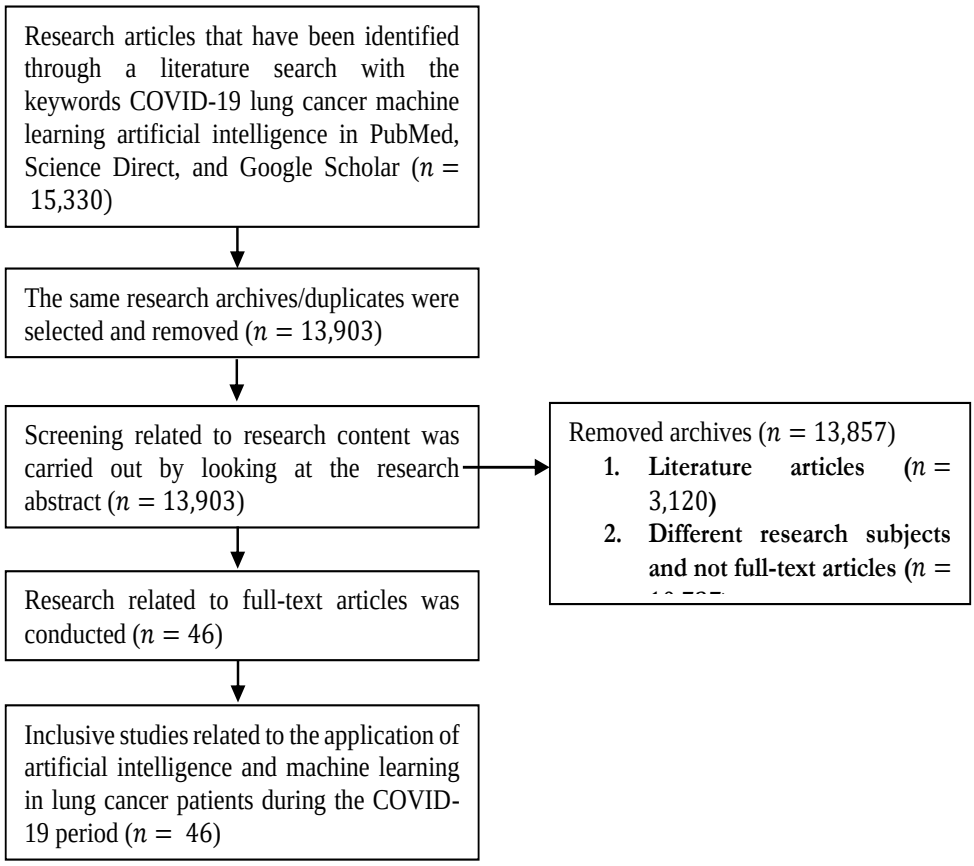

Figure 1. PRISMA research

RESULTS AND DISCUSSION

Studies on the use of AI (Artificial intelligence) and ML (Machine Learning) for the detection of lung cancer have been carried out for a long time. Many studies use various methods and data input to detect lung cancer and (probably) have been successful. Some studies use data input in the form of chest X-ray images and Computerized Tomography Scan (CT-Scan) of the chest, while some other studies use data on health information and characteristics possessed by patients as the features for the classification process. The methods used are also quite varied, ranging from simple classification methods such as SVM (Support Vector Machine) to the use of neural networks for the detection or classification process. The purpose of detection from these studies is broadly divided into two things. Some are aimed at detecting which lung cancer patients will survive or not and some are aimed at detecting which patients are positively suffered lung cancer and which are not based on the input data they have.

Rustam and Kharis used the SVM method on patient health data to classify lung cancer patients who would be able to survive and not be able to survive (Rustam & Kharis, 2018). While Lee, et al. (2020) and Ismail (2021) both use deep learning methods on patient data in the form of chest X-Ray and chest CT-Scan images to detect lung cancer patients. The level of use of AI and ML for lung cancer detection has even reached the level of further discussion. Some researchers no longer discuss the possibility of applying the method for detection but have reached the level of discussing the advantages, disadvantages, and biases that may occur in the classification process or algorithm. Sourlos et al. (2022) published research discussing possible biases in the algorithms used for the classification of lung cancer. Several review papers on the use of AI and ML for the classification of lung cancer have also been made and published, such as by Konstantina Karou et al (2021).

Research on the use of AI and ML for the detection of lung cancer is experiencing new challenges during the COVID-19 pandemic. There are at least two main problems that occur during this pandemic. The first problem according to Moraliyage et al. (2021) is the focus of most of the Health Resources on handling COVID-19 so that the resources for treating lung cancer patients are minimal, even though lung cancer patients need to be detected early so that they can get treatment immediately before the disease gets worse. The second problem occurs in research that uses input data in the form of images. According to Ibrahim et al. (2021) that if based on characteristics of chest X-Ray or chest CT-Scan images alone, it will be very difficult to distinguish which are the effects of COVID-19 and which are side effects of the therapeutic process (immunotherapy and radiotherapy) of healing lung cancer patients. The two problems of detecting lung cancer during the previously mentioned in COVID-19 pandemic era have a serious impact, especially in countries that are not yet developed well countries. Indonesia is one of them because Indonesia is still categorized as a developing country. Health facilities in developing countries are still relatively lacking and the facilities quality or experts are still not qualified. In the pre- COVID-19 pandemic, these health resources may not have been able to detect lung cancer early, especially during the COVID-19 pandemic. If this is not considered carefully, it is feared that quite a several lung cancer patients will not receive optimal treatment. This fact has also been discussed by Hunter et al. (2022) and Goncalves et al. (2022).

Detecting people with COVID-19 may be relatively easier and cheaper than detecting lung cancer, considering that there are already PCR or Rapid Antigen swab procedures. But that doesn't mean AI and ML researchers don't try to use AI and ML for these alternative detection solutions. Dong et al. discuss the use of several AI and ML methods for the COVID-19 diagnosis process in China (Dong et.al, 2021). Huang et al. also discussed the use of AI and ML for COVID-19 detection based on several input data such as chest X-rays, chest CT-Scan and patient blood samples (Huang et. al, 2021). Research related to AI and ML for COVID-19 has even gone quite far as has been done by Zhu et al. where they examined the severity of COVID-19 symptoms based on the patient's chest X-ray and chest CT-Scan image data (Zhu et.al, 2020).

Detection of lung cancer is relatively more expensive and difficult than the detection of COVID-19 as explained previously. Early detection of lung cancer is needed in a fast and relatively inexpensive way while the accuracy of the detection is also expected to be quite high. Especially if the input data used is an image. Do not let the patient experience mistreatment. The society do not expect COVID-19 patients to receive chemotherapy because of a misdiagnosis of lung cancer. Vice versa, people also do not expect lung cancer patients to only be asked to self-isolate because they are considered only exposed to COVID-19. Maybe that's why, from 2020 until now, several studies have been published that focus on using AI and ML that can distinguish which are COVID-19 patients and which are lung cancer patients based on image input data. Alnuaimi et al. (2022) and Suri et al. (2021) published research on the classification of COVID-19 and lung cancer based on chest X-Ray and chest CT-Scan image data. The difference is in the method used, Alnuaimi et al. used ML while Suri et al. used hybrid deep learning.

Early, inexpensive, and high accuracy detection are needed for the diagnosis of lung cancer and diseases caused by COVID-19. Diagnosis based on the symptoms alone may be very difficult because the symptoms between the two diseases are so similar, such as coughing and shortness of breath. So other alternative solutions are needed for the diagnosis process. It is also hoped that the early detection process with high accuracy will not absorb a lot of resources and health personnel, given the limitations of these matters. Therefore, the use of AI and ML for the process of detecting lung cancer from patient health data and distinguishing between lung cancer patients and COVID-19 patients from image data input is considered an inexpensive and appropriate solution. Several studies on the use of AI and ML for the process of detecting lung cancer from patient health data and distinguishing between lung cancer patients and COVID-19 patients from image data input have achieved relatively high success scores. The success parameters used vary, not always accuracy value, considering that the data studied may be unbalanced. Some studies use other parameter than accuracy value such as the AUC value, some other studies use the f1-score and some studies use the opacity value as a parameter of success.

CONCLUSION

For distinguishing between lung cancer and COVID-19, the AI model may be just as effective as medical professionals. In this paper, the prospects and challenges of ML and DL (Deep Learning) methods in lung cancer diagnosis during the COVID-19 epidemic, as well as the necessity for additional innovation and research, have been discussed. A more thorough study is required since the clinical use of AI in lung cancer identification during the COVID-19 epidemic seems hopeful. According to several studies, machine learning and deep learning approaches are very accurate at differentiating between chest pneumonia with COVID-19 and pneumonia without it. The use of AI has made it simpler to quickly and automatically evaluate images as input data. Since no approach is presently capable of differentiating between all lung ailments based just on symptoms and images from chest CT scans, it is strongly advised to use interdisciplinary solutions (in this case, using AI) to get around diagnostic challenges...

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