

How to Cite:

Hadi, E. H., Lafta, H. A., & Al-Rashid, S. Z. (2022). Survey for Lung diseases using machine learning methods. *International Journal of Health Sciences*, 6(S3), 4510–4523. <https://doi.org/10.53730/ijhs.v6nS3.6887>

Survey for Lung diseases using machine learning methods

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Abstract---Recent developments in artificial intelligence and machine learning are of great importance in supporting, identifying, and classifying Lung diseases, whether using medical images or using gene expression. That is why many researchers have worked to detect lung diseases using various methods of machine learning. This paper presents a survey of 20 papers using different methods. To screen for lung disease. And the goal from this paper present a classification of the latest lung diseases based on machine learning. Classification consists of a number of features common to the surveys are: Types of data used, types of lung diseases, types of machine learning algorithms used, and this classification is of great importance and can be used by many researchers to plan their contributions and research activities in many fields. It is also important in terms of improving the efficiency and accuracy of machine learning in examining and classifying lung diseases with the least possible error.

Keywords---COVID-19, CNN, genetic expression, deep learning, machine learning.

Introduction

Lung diseases are considered serious respiratory diseases [1]. Among the most important of these diseases are pneumonia, tuberculosis, lung cancer and the Corona virus, which appeared in 2019 and spread all over the world. According to

the Forum of International Respiratory Societies [2]. About (three hundred and thirty-four million people) suffer from asthma, tuberculosis kills (one million) people every year, and about (million) people die of lung cancer, while pneumonia causes the death of large numbers of people every year, estimated at millions of people. In addition, the Corona pandemic has affected all parts of the world [3], and this epidemic has infected millions of people and caused a huge burden on hospitals and health care systems [4]. In general, lung disease is one of the leading causes of disability and death in the world [5], therefore, early detection of lung diseases has a major role in increasing the chances of recovery [6]. There are different ways in which lung diseases can be detected, including blood testing, sputum sample testing, and skin testing [7]. As well as a chest x-ray. In addition to gene expression analysis. Machine learning, which is concerned with algorithms inspired by the function and structure of the brain, is one of the most important fields that are greatly interested in supporting, identifying, and classifying patterns, as well as predicting various diseases in the medical fields [8]. Deep learning is one of the most important fields of machine learning, as its use has increased recently, as its use has improved performance and efficiency in many medical applications. Accordingly, this will help clinicians in classifying, identifying and detecting some drugs and predicting diseases [9]. In addition, machine learning has a prominent role in bioinformation systems and the study of genetics [10].

Basic concepts

In this section, we will provide a brief description of the machine learning algorithms used in this survey.

Convolutional Neural Network (CNN)

CNN is an important and widely used deep learning network in various fields of machine vision. CNN (also known as ConvNet) is an example of a deep learning strategy that simulates the brain's function in processing information. It is a specific type of feed-forward neural network in artificial intelligence. A CNN network is similar to a multi-layer network (Perceptron), and differs only in its ability to combine many locally connected networks. The layers used for feature extraction are accompanied by some layers that are fully connected and used for classification [11]. CNN is a promising tool for improving automated diagnostic systems and achieving high accuracy for disease prediction [12]. CNNs are among the most widely used neural networks in the field of artificial intelligence, because CNN capable of processing huge amounts of data and do not need to extract features manually, and do not need to hash complexities [13].

Support Vector Machine (SVM)

Support Vector Machine is a type of supervised machine learning. SVM is used for classification tasks in various applications because it produces high fidelity. Vector Machine support is based on the idea of finding the optimal hyperplane file also called the decision surface that divides the data set into two parts that represent the layers in the best way, and the distance between the hyperplane and the closest point of any of the data sets is called the margin. The data closest

to the hyperplane (support vectors) are known. It is one of the most important types of supervised machine learning. SVM is used to classify tasks in various fields, because it produces high accuracy. Vector Machine support is based on the idea of finding the optimal hyperplane file also called the decision surface that divides the data set into two parts that represent the layers in the best way, and the distance between the hyperplane and the closest point of any of the data sets is called the margin. The data closest to the hyperplane (support vectors) are known [14].

Artificial Neural Network (ANN)

ANN is defined as a group of widely used algorithms that define interrelationships between data in a manner similar to the functioning of the human brain. Neural network (NN) refers to neuron systems, both organic and synthetic [15].

Lung Diseases

There are many diseases that affect the lung, and one of the most important diseases that have been surveyed within the research used is lung cancer. The main feature of various cancerous diseases that affect the lungs is the presence of lung nodules [16], and these nodules are either malignant (cancerous) cells or benign (noncancerous) cells [17]. Early on, researchers were able to use models from machine learning to detect lung cancer, and in 2015 researchers were able to use DBN and CNN models to classify cancer using CT scans. They show that, using deep learning methods, it is possible to select features easily and with high accuracy to classify lung nodules as malignant or benign [18].

This survey also included COVID-19. Corona disease is a type of infectious disease that occurs due to the newly discovered Corona virus [19]. Older people are more likely to develop serious diseases, as are those who have chronic health conditions [20]. The CNN approach is considered one of the most important approaches to detecting Covid-19 disease with high accuracy [21]. In addition, there are many diseases that affect the lungs, including pneumonia, tuberculosis and other diseases that cause death [22]. There are many researchers who were able to research in the field of lung diseases and used various methods to predict them and were able to obtain different accuracy. For example the researchers [23], [24], [25], [26], [28], [29] and [30] [31], [32], [33] and [39], [35], They were able to study Corona disease and predict this disease, and they used different methods to find out the causes of the disease and possible therapeutic targets. As for the researchers [30], [27], they were able to study cancer and was able to obtain good accuracy. There are also researchers who have been able to predict the disease of pneumonia using various methods, among them [36], [37], [38], [27], So are the researcher [34], There are also researchers who have been able to classify various chest diseases, such as the researchers [43], [44]. Details are mentioned in tables (1-3).

Table 1
Shows the names of researchers who used different methods to detect Covid-19 disease

Author Name	Data set	Disease type	Method	Accuracy
1-Nahida Habib, and et al., 2021 [23]	Gene expression And Image	(Covid-19)	Svm & deep CNN	ACC 93% & ACC 98%
2- Ahmed and Jeon, 2021 [24]	genome sequences	COVID-19 , SARS And the Middle East and the sychological assistant	Support Vector Machine	ACC 97% for COVID-19 ACC 96%, SARS ACC 95% for MERS and Ebola
3- Arslan, 2020 [25]	genome sequences	COVID-19 vs	SVM	ACC 93%
4-Yabsera Erdaw1 Tachbele, 2021 [26]	Images	(Covid-19)	SVM	ACC.97%,
5- Albert whata and chartes , 2021 [27]	DNA sequences	SARS-CoV-2	CNN-Bi-LSTM	ACC 99%,
6- Nayyar Iqbal and Pradeep , 2021 [28]	RNA-Seq	COVID-19	Hoeffding Tree	ACC 99%
7- Shuai Zhang ant et al., 2021 [29]	Gene expression	COVID-19	SVM	ACC 97%
8- Babu Karthik and et al., 2020 [30]	Images (CXR)	COVID-19	GDCNN	ACC 98%
9- Najam and et al, 2021 [31]	Images	COVID-19	CNN	ACC 99%
10-Hicham moujahed, 2020 [39]	Images	COVID-19	CNN	ACC 97%
11- Hassaan and et al, 2021 [32]	Images	COVID-19	CNN	ACC 98%
12- Patrick and Anish , 2020 [33]	Images	COVID-19	CNN	ACC 94%
13- Saïd and et al , 2022 [34]	Images	COVID-19	CNN	ACC 98%
14- Ashraf and Nada, 2021 [35]	Images	COVID-19	CNN	ACC 99%

Table 2
Shows the names of researchers who used different methods to detect cancer

Author Name	Data set	Disease type	Method	Accuracy
1- Sangick Park and et al., 2021 [36]	Gene expression	Lung cancer	Path Deep	ACC 99%
2- Hassaan and et al,2021[32]	Images	lung cancer	CNN	ACC.97%,

Table 3
Shows the names of researchers who used different methods to detect pneumonia

Author Name	Data set	Disease type	Method	Accuracy
1- Dejun Zhang,2021[37]	Images	Pneumonia	CNN	ACC 96%
2- Hassaan and et al [32]	Images	Pneumonia	CNN	ACC 97%
3- Inderpreet and et al,2020[38]	Images	Pneumonia	DW-CNN	ACC 98%

Figure (1)b shows the relative distribution of diseases detected using different machine learning methods. In recent years, most of the work has been directed toward detecting COVID-19.

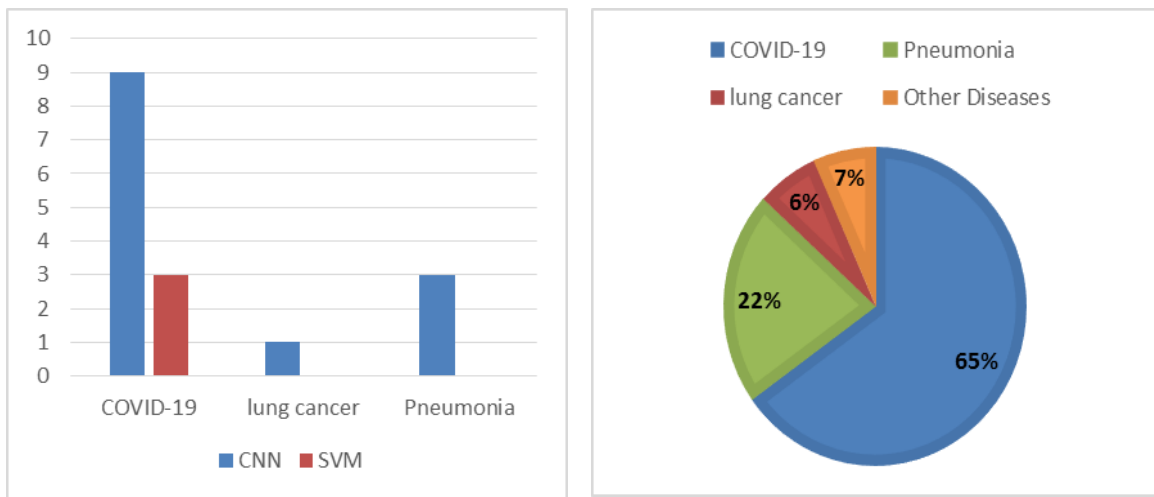


Figure 1. (a) the trend in lung disease detection using machine learning and (b) the distribution of diseases detected using machine learning

Data Types

The methods and types of data collection differ according to the different diseases to be studied. Some data about diseases are collected from hospitals, or they can be collected from the National Center for Biological Information. The types of data also differ. These data may be data in the form of images collected to study a specific disease, or the data may be in the form of genes or Extract properties for example researchers [26], [30] and [28] and [36], and [37], [39], [27], [35], and [38] [34], [40], and [41], They used images as a way to collect their data and were able to predict diseases.

Table 4
Shows the names of researchers who used images to detect diseases

Author Name	Dataset	Disease type	Method	Accuracy
1- Nahida Habib ,and et al.,2021[23]	Gene expression And Image	(Covid-19)	MI & deep CNN	ACC 93% and ACC 98%
2- Yabsera Erdaw1 Tachbele,2021 [26]	Image	(Covid-19)	SVM	ACC.97%,
3- Sangick Park and et al., 2021 [36]	Images	Cancer Disease	Path Deep	ACC 99%
4-- Babu Karthik and et al.,2020[30]	Image (CXR)	COVID-19	GDCNN	ACC 98%
5- Rahib and Mohammad,2018 [41]	Images	Diseases Detection	CNN	ACC 99%
6- Dejun Zhang,2021 [37]	Images	Pneumonia	CNN	ACC 96%
7- Inderpreet Singh,2020 [38]	Images	Pneumonia	CNN	Acc 98
10- Hicham moujahed,2020 [39]	Images	COVID-19	CNN	ACC 97%
11- Hassaan Malikand and et al,2021 [32]	Images	COVID-19	CNN	Acc 98%
12- Lingzhi Kong and Jinyong ,2021 [40]	Images	Pneumonia	CNN	ACC 96%
13- Patrick Ting and Anish,2022 [33]	Images	COVID-19	CNN	ACC 94%
14- Saïd Mahmoudi and et al,2022 [34]	Images	COVID-19	CNN	ACC 98%
15- Ashraf and Nada,2021 [35]	Images	COVID-19	CNN	ACC 99%
16- Andrew Bugajski and et al ,2020 [43]	Images	Chronic Obstructive Pulmonary Disease	Artificial Neural Network	ACC 93.8%
17- Almir Badnjević and et al, 2016 [44]	Images	asthma	Artificial Neural Network	

As for the researcher [23], the researchers [24], [25], [29] and the researcher [42] they used (gene expression) as a means to obtain their data and they were able to predict diseases. As for the researcher [27] and the researcher [28] they used other methods to collect data. Details are mentioned in tables (5).

Table 5
Shows the names of researchers who used gene expression to detect diseases

Author Name	Dataset	Disease type	Method	Accuracy
1- Nahida ,and et al.,2021	Gene expression And Image	(Covid-19)	Svm & deep CNN	ACC 93% ACC 98%
2-Ahmed and Jeon,2021 [24]	genome sequences	COVID-19 , SARS And the Middle East and the sychological assistant	SVM	ACC 97% for COVID-19 ACC 96%, SARS ACC 95% for MERS and Ebola
3-Milad and et al.,2020 [42]	Gene expression	Cancers	CNN	ACC 95%
4- Arslan,2020 [25]	Genomes sequences	(Covid-19)	SVM	ACC 93%
5-Shuai ant et al.,2021 [29]	Gene expression	Gene expression	SVM	ACC 97%

Table 6
Shows the names of researchers who used other methods to detect diseases

Author Name	Dataset	Disease type	Method	Accuracy
1- Albert and chartes ,2021 [27]	DNA sequences	SARS-CoV-2	CNN-Bi-STM	ACC 99%,
2- Nayyar and Pradeep,2021 [28]	RNA- sequences	COVID-19	Hoeffding Tree	ACC 99%

Figure (2) b shows that most of the research surveyed in this research used x-ray images by 69%, while the studies that used gene expression amounted to 22%. The reason for the use of X-rays can be largely due to the availability of X-ray machines and it is expected that the detection of lung diseases using X-ray images will remain the dominant option, while gene expression remains the second option because it provides more detailed information than X-rays, but it is more expensive.

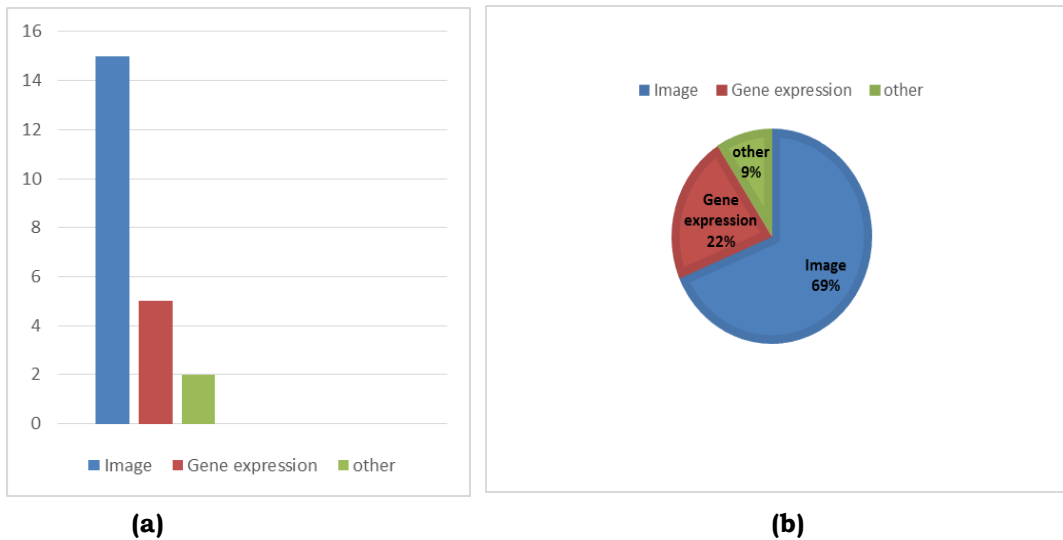


Figure 2. Shows the type of data used for the study

Machine learning methods

Recent developments in machine learning are important in identifying and classifying diseases where the researchers presented a classification of the latest cancer and lung diseases based on machine learning algorithms to predict diseases and know their causes and treatment methods. In general, different types of algorithms have been used to detect and predict different diseases that can be used by other researchers to plan their scientific activities and research contributions. As well as the proposed future business development, which could further improve the efficiency of the systems used to detect and classify diseases [10]. In this section, we show how machine learning can be applied to medically identify lung diseases. The researchers [23], [32],[40],[33] as well as the researchers [41],and [37, [39], [27], [34] ,[35], and [38] and,[30], They used the CNN deep learning method to study Corona disease. As for the researchers [24] and [25], [26], as well as the researcher [29] they used the SVM method to detect the disease. Details are mentioned in tables (7-9).

Table 7

Researchers used the CNN method to diagnose diseases with different accuracy

Author Name	Dataset	Disease type	Method	Accuracy
1- Albert and chartes 2021	DNA sequences	SARS-CoV-2	CNN-Bi-STM	ACC 99%,
2- Babu and et al.,2020 [30]	Images	COVID-19	GDCNN	ACC 98%
3- Rahib and Mohammad,2018 [41]	Images	Diseases Detection	CNN	
4- Dejun Zhang,2021 [37]	Images	Pneumonia	CNN	ACC 99%
5- Inderpreet Singh,2020 [38]	Images	Pneumonia	CNN	ACC 96%
6- Hicham moujahed,2020 [39]	Images	COVID-19	CNN	Acc 98
7- Hassaan and et al,2021 [32]	Images	COVID-19	CNN	ACC 97%

8- Lingzhi Kong and Jinyong ,2021 [40]	Images	Pneumonia	CNN	Acc 98
9- Patrick Ting and Anish,2022 [33]	Images	COVID-19	CNN	ACC 96%
10- Saïd and et al,2022 [34]	Images	COVID-19	CNN	ACC 94%
11- Ashraf and Nada,2021 [35]	Images	COVID-19	CNN	ACC 98%
12- Nahida Habib, and et l.,2021[23]	Gene expression And Image	COVID-19	Svm & deep CNN	ACC 93% & ACC 98%

Table 8
Researchers used the SVM method to diagnose diseases

Author Name	Dataset	Disease type	Method	Accuracy
1- Ahmed and Jeon,2021[24]	Genomes sequences	COVID-19 , SARS And the Middle East and the sychological assistant	SVM	ACC 97% for COVID-19 ACC 96%, SARS ACC 95% for MERS and Ebola
2-Arslan,2020 [25]	Genomes sequences	COVID-19 vs	SVM	ACC 93%
3- Shuai ant et al.,2021 [29]	Gene expression	COVID-19	SVM	ACC 97%
4-YabseraErdaw1 ,2021[26]	Images	(Covid-19)	SVM	ACC.97%,

Table 9
Researchers used the artificial neural network to diagnose diseases

Author Name	Dataset	Disease type	Method	Accuracy
1- Andrew Bugajski and et al ,2020 [43]	Images	Chronic Obstructive Pulmonary Disease	Artificial Neural Network	ACC 93.8%
2- Almir Badnjević and et al, 2016 [44]	Images	asthma	Artificial Neural Network	98.85 %ACC

Figure (3) shows that most of the research discussed in this survey used the convolutional neural network to detect lung diseases, because this network possesses great strength in achieving high classification accuracy.

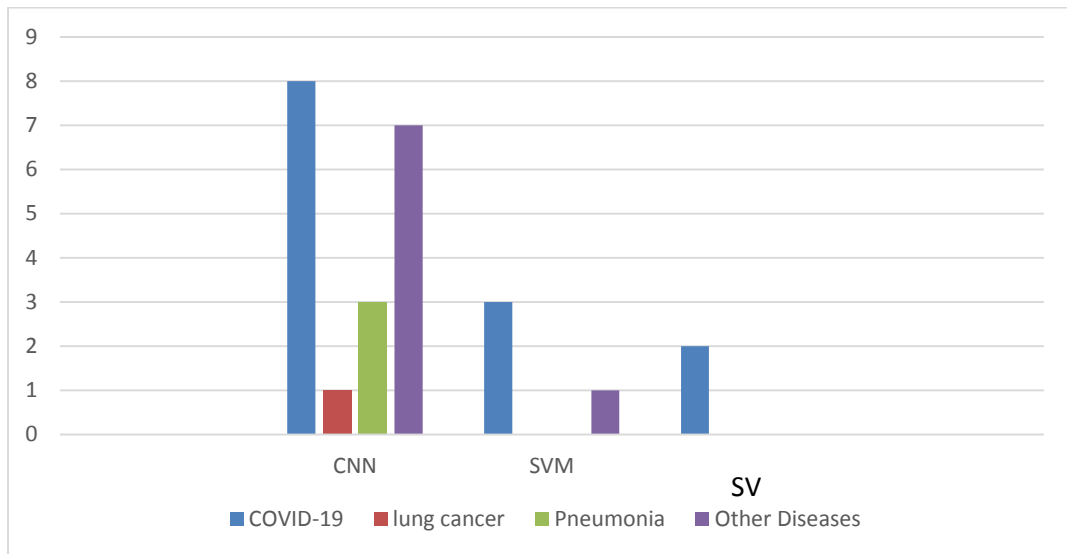


Figure 3. Shows the use of machine learning to discover various lung diseases

Figure (4) shows that most of the research discussed in this survey used the convolutional neural network to detect lung diseases, because this network possesses great strength in achieving high classification accuracy. Another benefit of using a convolutional neural network is to extract features automatically and take advantage of translational learning.

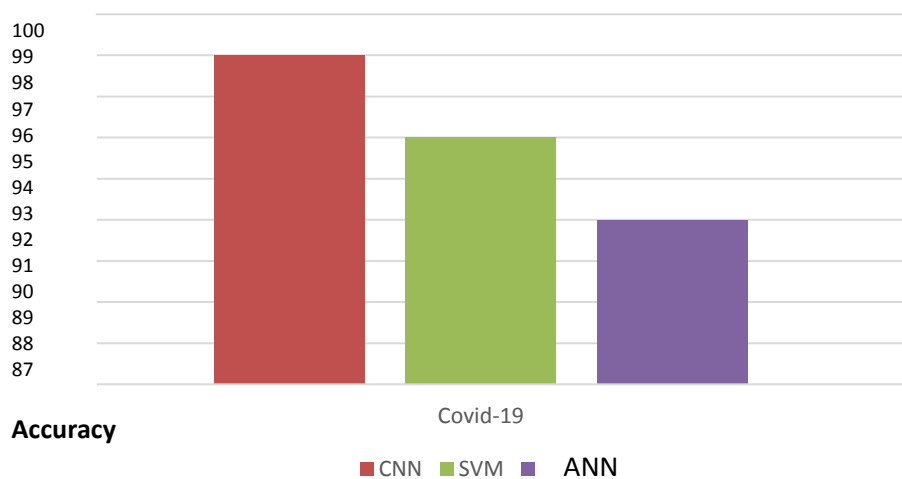


Figure 4. Shows the use of different methods to detect Covid-19 disease

Figure (5) shows the use of the convolutional neural network in detecting lung diseases with different accuracy. In recent years, a convolutional neural network (CNN) has been one of the most widely used deep learning algorithms for disease prediction and classification. Several surveyed works indicate that CNN has been used in COVID-19 detection and has achieved varying accuracy and has superior performance [45].

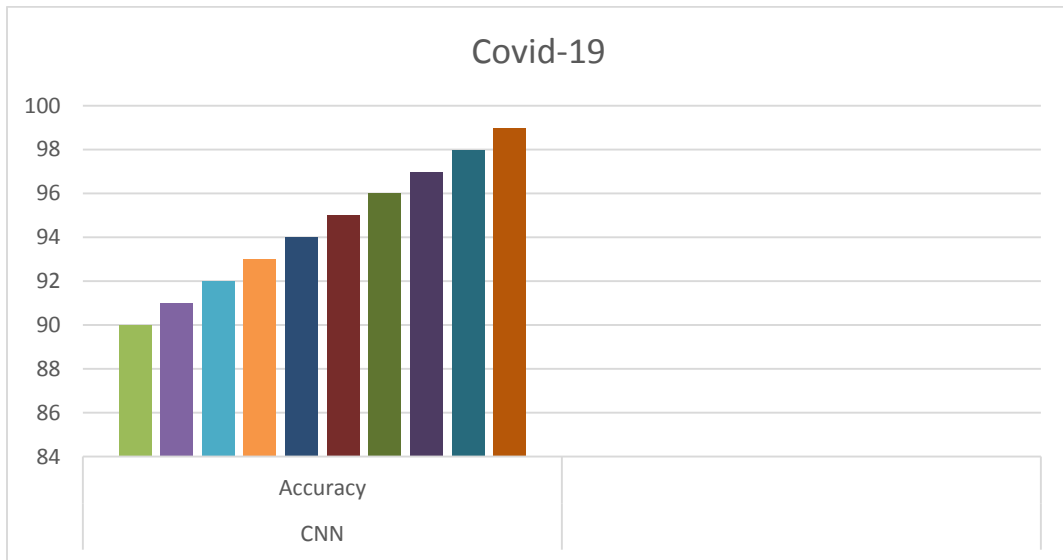


Figure 5. Shows the different accuracy in detecting Covid-19 disease

Conclusions

More work has been published for the detection of lung diseases using machine learning, and this paper was produced to provide a comprehensive survey for the detection of lung diseases, especially COVID-19 and cancers using machine learning, 22 papers on this topic were taken when preparing this survey, to provide simple knowledge With key concepts and emphasizing that future work used to predict lung diseases, especially COVID-19 using different methods of machine learning is heading in the right direction. A number of analyzes have been made in recent work on the topic, and based on the specific features of the taxonomy, the surveyed studies reveal the use of CNN for high-resolution detection of COVID-19. Investigating how machine learning can be used to detect lung diseases is critical to ensuring that future work is headed in the right direction, leading to an improvement in the role of disease detection methods. The study also revealed that most of the current studies are directed towards the use of gene expression in detecting lung diseases, as this trend gives high accuracy in predicting and classifying diseases.

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