IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Systematic Approach to Diagnose and Treat COVID 19 by Deep Machine Learning Techniques.

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Abstract

COVID-19 outbreak has put the whole world in an unmatched difficult situation bringing life around the world to a daunting halt and claiming thousands of lives. Due to COVID-19's spread in 212 countries and territories and increasing numbers of infected cases and death tolls, it remains a real threat to the public health system. This paper renders a response to combat the virus through Machine Learning and Deep Learning.

During this research, we glance at the Artificial Intelligence based Machine Learning and Deep Learning methods for COVID-19 diagnosis and treatment. Moreover, the war against COVID-19, we sum-up the Artificial Intelligence based Machine Learning methods and the available datasets, tools and performance. This research offers a detailed overview of the existing state-of-the-art methodologies for Machine Learning and Deep Learning researchers. The vast health community with descriptions of how Machine Learning and Deep Learning and data can improve the status of COVID19.It is also provided the details of challenges and future directions.

Keywords: **COVID19, Diagnosis, Treatment, Artificial Intelligence, Machine Learning, Deep Learning**

1. Introduction

The novel corona virus disease (COVID-19) pandemic caused by the SARS-coV-2 continues to pose a critical and urgent threat to global health. The outbreak in early December 2019 in the Hubei province of the people Republic of China has spread worldwide. Due to COVID-19's spread in 212 countries and territories and increasing numbers of infected cases and death tolls mounting to 5,212,172 and 334,915(as of May 22 2020).This pandemic continues to challenge medical systems worldwide in many aspects, including sharp increases in demands for hospital beds and critical shortages in medical equipment, while many healthcare workers have themselves been infected.

One of the greatest uses global Technology right now is Artificial Intelligence, which can track the speed and detect the growth rate of the corona virus and identify the risk and severity of Corona virus patients. Artificial Intelligence can also anticipate the possibility of death by adequately analysing previous patient data

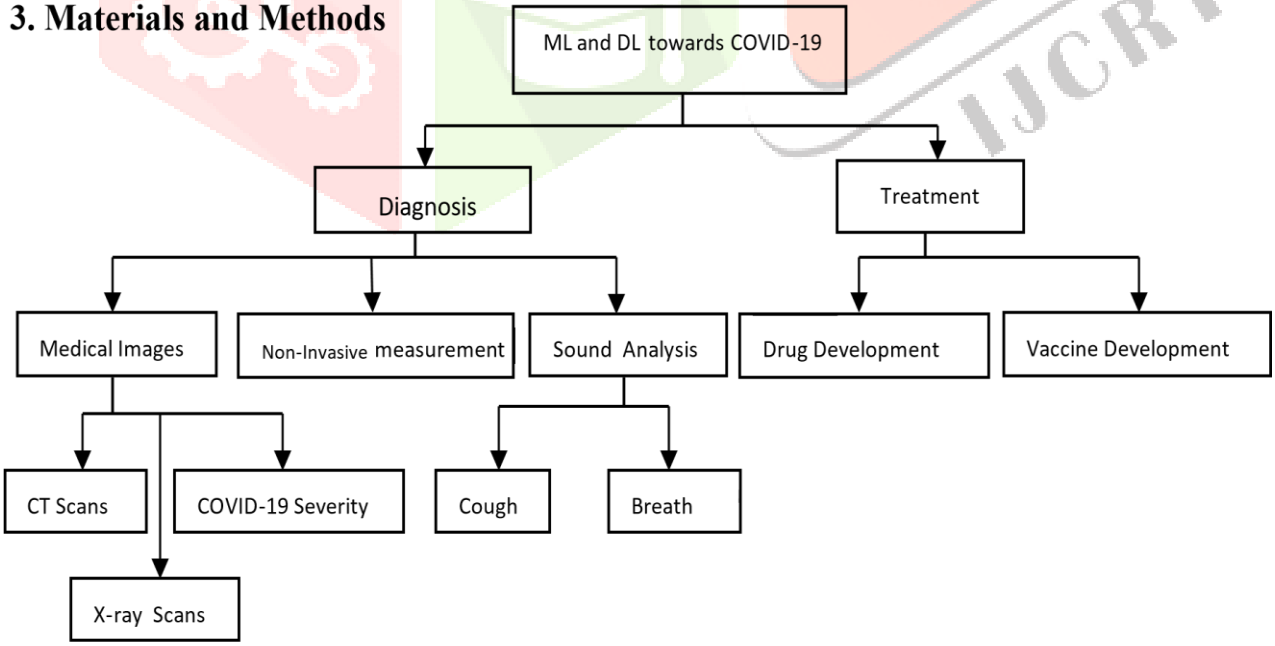
.Moreover, the war against COVID-19,we sum up the Artificial Intelligence based machine Learning and deep Learning methods and the available datasets ,tools and performance. For the solutions of complex problems in our lives, Artificial Intelligence is a broad umbrella that consists of many sub-areas-includes learning, preparation, thinking, representation of information and searching.

Machine Learning is the study of computer algorithms that improve automatically through experience and by the use of data. Machine Learning is the subset of Artificial Intelligence. Machine learning algorithms build a model based on sample data known as training data. It is used in a wide variety of applications, such as in medicine, email filtering and computer vision. Deep learning is a category of machine learning and artificial intelligence where intelligent machines can learn from their actions similar to the way humans learn from experience. Inherent in this type of machine learning is that an agent is rewarded or penalised based on their actions. In this research, we introduced the main scope of Artificial Intelligence focusing on machine Learning and deep Learning towards COVID-19 research incorporates the sides of disease diagnosis and drug and vaccine developments.

2. Related Works

In paper, Artificial Intelligence for COVID-19 Drug Discovery and Vaccine Development offers a detailed overview of the recent advances of COVID-19 drug and Vaccine development using artificial intelligence and the potential of intelligence training for the discovery of covid-19 therapies. To facilitate applications of deep learning for SARS-COV-2, it highlight multiple molecular targets of COVID-19, inhibition of which may increase patient survival. The information and datasets provided in this review can be used to train deep learning-based models and accelerate the discovery of effective viral therapies .In paper, Emerging role of artificial intelligence in therapeutics for COVID-19, offers a detailed overview of artificial intelligence has drawn substantial attention in the field of drug and vaccine development as it promises to accelerate these processes and reduce costs by facilitating the rapid identification of the compound. In paper, Machine Learning research towards combating COVID-19: Virus detection, spread prevention and Medical Assistance, offers a detailed review of what role ML has played so far in combating the virus, mainly looking at it from a screening, forecasting and vaccine perspective.

3. Materials and Methods



3.1 Medical Image Inception for the Detection of Covid-19 Using AI-Based ML and DL

The COVID-19 outbreak is increasing nationally and internationally. Medical imaging, X-ray and computed tomography play a key role in the universal battle against COVID-19.The latest AL developments tend to improve the capacity of imaging tools and facilitate healthcare personnel.

Medical imaging research is mainly used for the identification of COVID-19 by specialist. Chest X-ray and lung CT image samples are mostly used in COVID-19 clinical imaging trials.AI innovation plays a significant role in medical imaging testing. It has produced vast results in image identification, organ recognition, geographic infection classification and disease classification. It not only decreases the picture diagnosis time of the radiologist, but it also increases the accuracy and execution of the diagnosis.

3.1.1 Chest CT Images Detection

A values feature of the assessment of patients with doubtful SARS-coV-2 infection is the chest CT picture. The infection generate a comprehensive of CT scan imaging discoveries, most commonly ground-glass opacities and lung periphery consolidations. Chest CT sensitivity to diagnose COVID-19 has been found to be significantly higher and it can occur prior to positive viral lab test. Therefore, hospitals with in a Large Quantities of admissions use CT for the fast emergency of patients with conceivable COVID-19 disease in epidemic territories, where the basic healthcare system is under pressure.

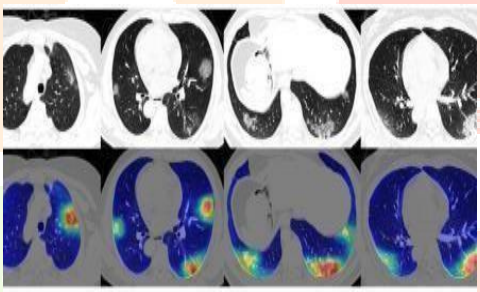


Fig: 1

Chest CT plays a crucial role within the estimation of COVID-19 patients with severe and compound respiratory symptoms. Supported scans, it's possible to work out how badly the lungs are affected and the way the sickness of the individual progresses, which is effective in making medical decisions.

In this pandemic, by reducing the strain and strain on specialist, the evaluation of AI may become the foremost significant factor. Although it can take up to 15min. to manually interpret a CT scan, AI can analyze the pictures in 10s.Therefor, advanced image processing with artificial neural network has the likelihood to significantly improve the function of CT in COVID-19 detection by allowing an outsized proportion of patients to identify disease easily and rapidly with accuracy. The AI based CT imaging tests usually involves the subsequent steps: regional infection, and classification of COVID-19.A basic basis for analyzing AI-based imagery is that the recognition of lung organs and ROIs.ROI has been expressed for extra testing and analysis in CT imaging in lungs, lung lobes, bronchopulmonary segments and regions with infection or ulcers. For CT image classification, differing types of DL networks example, U-Net, V-Net and VB-Net, VNET-IRRPN, has been used. The entire 905 patients assessed with real-time RT-PCR assay and nextgeneration RT-PCR,414,approximately(46.3%),were confirmed by an AI device with SARS-coV2.The AI method consists of deep CNN for the first CT scan to guage the image characteristics and attributes of people with SARS-CoV-2.The AI system enhanced the detection of patients, who aimed for RT-PCR detected COVID-19 who submitted standard CT scans, which correctly classified 17 out of 25 patients(68%) and every one of those patients were graded by radiologists as COVID-19 negative. The CNN based model categorized 13 out of 25, about (52%)of images, as positive for COVID19.The clinical model categorized 16 out of 25 about(64%)of images, as positive for disease, and therefore the joint model categorized 17 out of 25

(68%) as positive for disease, while the senior radiologist and their fellows classified 0 out of 25% of those images as being positive for disease.

3.1.2 Chest X-ray Image Detection

Chest X-rays are proposed as a highly helpful method for evaluating and testing COVID-19 patients. In comparison with CT images, chest X-ray (CXR) images are simpler to accumulate in clinical radiology examinations. There are many available studies that operates on chest X-Rat (CXR) images for corona virus detection. There are several methodologies of deep learning (such as CNN, nCOVnet and U-Net++) that are wont to find better and fast detection within the detection of COVID-19 on X-ray images.

In Medical Centres and hospitals, X-ray devices less expensive and quicker out comes from scanning different human organs. The interpretation of various X-ray images is usually performed by radiologists manually .Radiologists are only equipped to detect 69% of X-ray COVID-19 cases. It is much easier and quicker to detect COVID-19 using pre-trained models.

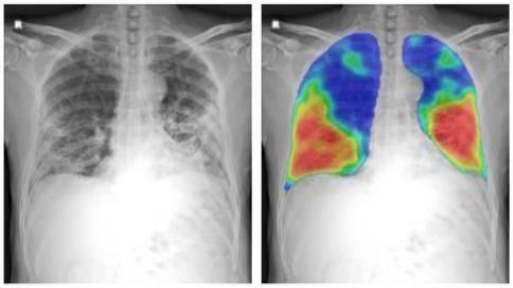


Fig:2

Students are also involved in the production of ML algorithm to identify novel COVID-19 patients. With the assistance of AI, Cranfield University students developed computer models that can diagnose COVID-19 in CXR images.ML and DL techniques were used in the proposed models in order to obtain characteristics and identify CXR images. It can discern data that would not generally be apparent to the naked human eye and aid with COVID-19 detection.

3.1.3 COVID-19 severity Classification Using X-ray with Deep Learning

With the support of AI, chest X-rays enable us to know more, particularly by using ML and DL techniques. Chest X-rays offer a non-invasive method for monitoring disease progression. Expansions of lung involvement and lightweight intensity also are included within the CXR image database. A pre-trained neural network model in large chest X-ray sets is employed so as to make features of covid-19 images to predict this activity.

Parameters	severity Score				
	0	1	2	3	
Extend of Lung Involvement	No	<25%	25-50%	50-75%	Degree of ambiguity
No	Ground glass ambiguity	unification	white-out		

COVID-19 severity stages using a score based system

3.2 Observing COVID-19 Through AL-Based cough sound Analysis

Coughing may be a symptom of quite 30 medical conditions that aren't COVID-19.This makes COVID-19 infection identification by coughing alone an enormous challenge for various problems. Physicians are also use sound signals that are made by human bodies. moaning, breathing, heartbeat, digestion and vibrating sounds are the examples.

An analysis of identification of COVID-19 supported coughs that were collected via phone app is reported employing a cohort of 48 COVID-19,103 bronchitis, 131 Pertussis, and 72 normal cough sounds to learn and evaluate this diagnostic method. An equation is used to transform the collected cough data into Mel scale m for data pre-processing,

$$m=2595*\log10\ (1+f/100)$$

Where, m may be a pitch scale that's measured by listeners to be equal in distance from one another .A portable device called FluSense was developed by the University of Massachusetts Amherst. The components of the FluSense machine that was operated by an AI-based neural network which will real-time identify cough and crowd size and directly evaluate and collect data for flu-like diseases such as covid-19.

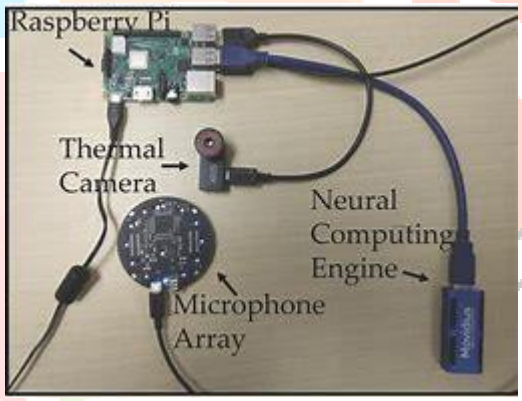


Fig 3: FluSense Device

A cross sectional system between vocal cords was created by researchers at the University of Cambridge in order to recognize safe and unhealthy individuals. Speech sounds are used to differentiate between COVID-19, normal persons and asthma. The three binary separation functions are structured as follows:

- Positive users of COVID-19 are separating from negative users.
- COVID-19 cough users are separating from healthy cough users.
- COVID-19 cough users are separating from asthma users who have declared coughing.

3.3 COVID-19 Diagnosis Based on Non-Invasive Measurements

Maghdid et al. planned for the invisible COVID-19 diagnostic system supported smart phone sensors. Smart phones could also be utilized in the proposed system to collect possibly patient disease features. for example, through a recording feature, sensors can detect a patient voice and detect the blood heat of a patients via a finger recognition function.

3.4 ML and DL for Drug and Vaccine Development

Drug discovery and vaccination affected two fields of high importance, where ML provided integrated property predictions, behaviour prediction, reaction prediction, and ligand-protein interactions .One of the main contributions to intelligent medicine is the use of ML and DL in the development of new medicines and vaccines and it plays a major function in the battle against COVID19.

3.4.1 ML and DL for Vaccine Development

ML and DL plays two important supporting roles: the dissemination of vaccine components by observing the viral protein structure, and helping medical researchers to review an outsized number of important research papers at a fantastic rate. Three main sorts of vaccines are available: vaccines for any pathogen, like flu or MMR, use deadly or compromised system infections; subunit vaccines only use a part of the virus, like protein; and vaccines for macromolecule inject viral genes into human cells to enhance the response of the body.

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Fig: 4 Vaccine developed

Google Deep Mind introduced AlphaFold in January, a complicated and specialized system that forecasts the formation of 3D proteins while using their genetic sequence. within the beginning of March, the system was tested in COVID-19.Researchers merged AL with cloud computing a stop the spike protein from binding to the ACE2 receptor in human cells and to supply a possible vaccine for COVID-19.Flinders University researchers studied the COVID-19 virus and therefore the applied their data to model a vaccine, called Covax19.

Fig: 5 Covax19

Some other researchers from the pc Science and AL laboratory of MIT have currently adopted a totally unique strategy, during which they have applied on optimized ML-based method that choose peptides that are expected to supply large vaccine numbers. The “OptiVax” design software used for designing new peptide medicines, evaluating existing vaccines and increasing the composition of existing vaccines.

3.4.2 Drug Development

The AI systems can easily drugs that can battle infectious diseases, such as COVID-19, with a drug recovery process. Drug development is a very dangerous, lengthy and costly phase. While it takes ten to fifteen years to make a new molecular venture, the success rate is only 2.01%, as reported by the Eastern Group (ERG).

Fig: 6 Development of drugs

The development of drugs generally involves five steps:

- Drug discovery and development
- Drug pre-clinical research
- Drug clinical research
- FDA drug review
- FDA drug after-market safety control and development But only drug repurposing requires four steps:
  - Compound identification
  - Compound acquisition
  - Drug clinical research
  - FDA drug after-market safety control and development

Using effective machine learning techniques, two similarity-based methods, Kron-RLS and SimBoost, have been proposed. However, there are two downsides to this matrix. First, the representation of features is reduced, which would cause the prediction faculty. Second, it involves the estimation of the matrix of similarity, which, is the training phase, will limit the maximum number of molecules. A deep learning based DTI model, Deep DTA, was proposed in order to address these limitations. In training the patterns of the data, three alternative combinations applied this knowledge as input to the proposed as enhanced Deep DTA model. The following are the three alternatives combinations for training this model:

- Training only compound representation
- Training only protein sequence representation
- Training both protein representation and compound representations.

The last strategy is the combined model. Combined model is used in many researchers for COVID19 drug repurposing.

4. Challenges and Future Directions

4.1 Challenges

AI based ML and DL applications in COVID-19 research are currently facing several obstacles.

• Regulation

At the time of pandemic, authorities play a key part in identifying regulations and policies which will promote the participation of citizens, researchers, scientists, business owners, medical centres, technology giants and major corporations to avert any barrier to COVID-19 prevention.

• Scarcity and unavailability of large-scale training data

Many AI-based DL techniques depend upon large-scale training data, including medical imaging and different details of the environment.

• Noisy data and online rumors

The Challenges emerge from counting on portable online social media; with none significant changes, large audio information and false reports about COVID-19 are reported in several online outlets.

• Lacking within the intersection of computing and medicine fields

Most AI-based ML and DL researchers come from computing major, but strong specialization in medical imaging and other related fields is additionally required to involve other medical knowledge for the utilization of ML and DL within the COVID-19 war.

• Data privacy and Protection

The cost of collecting personal privacy data within the age of massive data and AI is extremely weak.

• Incorrect structural and un structural data

Having an Ambiguous and misinformation in text descriptions are often a challenge.

4.2 Future Research Direction

•Detection of non-contact disease

The detection of X-ray and Ct images and camera facilities, AI based ML and DL systems can be involved.

•Remote video diagnosis and Consultations

It is possible to use the combination of AI and natural Language Processing (NLP) techniques to build remote video diagnostic programs and robot systems in order to provide COVID-19 patient visits and first group diagnoses.

•Biological Research

AI-based ML and DL systems can be used in context of biological research.

•Identification and screening of Fake information

AI based ML and DL systems can be used to minimize and delete false news and audio data on internet forums in order to provide credible, factual, and scientific information about the COVID19 outbreak.

•Patient contact Tracking

System can monitor and track characteristics of people neighbouring to patients with COVID-19. **•Smart Robots**

In programs such as sanitation in public areas, product deliver, and patient treatment without the need for human resources, intelligent robots are supposed to be used. This will stop the spreading the virus from COVID-19.

5. Conclusion

The COVID-19 outbreak has had a profound effect on the wellbeing of people worldwide and the number of disease related deaths continues to grow globally. Although technology has penetrated our daily lives with great success, especially in ML and DL, AI has also contributed to supporting people in the difficult battle against COVID-19.

In this survey, we explored the AI based Ml and Dl methods for COVID-19 diagnosis and treatment. It also offers a detailed overview of the existing state-of-the-art methodologies and applications for ML and DL researchers and the wider health community with descriptions of how the outbreak of COVID-19. Challenges and Potential guidance were also presented while using Ml and DL.

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