Challenges and Solutions in developing Artificial Intelligence based applications for Covid-19 detection

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***Abstract*— COVID-19 pandemic caused a vast impact worldwide. The imbalance between the number of tools for COVID-19 detection and the demand for COVID-19 tests from citizens has overwhelmed the government. To overcome this problem, artificial intelligence is utilized, specifically in the deep learning field. Many Researchers from the domain of Artificial Intelligence, Image Processing and Data Analysis have come up with innovative solutions. In this paper, we propose review of researches related to Application of Artificial intelligence for covid diagnosis using Deep learning by analysing strengths and weaknesses of each.**

Keywords*— *Artificial Intelligence, Covid19, Neural Network, Computer Vision, Xray, Deep learning.

I. INTRODUCTION

[1] The novel Coronavirus ie., SARS-CoV-2 appeared in December 2019 to in the form of a pandemic of respiratory disease in Wuhan, China, in 2019 and spread throughout the world in 2020, resulting in COVID-19 being declared as a Pandemic by WHO on March 11, 2020.

The lack of availability of a vaccine for COVID-19 caused the number of COVID-19 cases to continue to rise.[2] As of March 3rd 2021 10.40 WIB, cases of COVID-19 worldwide reached 21,623,570 positive patients, 91,115,487 patients recovered & 2,560,602 patients died which proved itself as a precarious illness that can emerge in various forms and levels of severity ranging from mild to severe with the risk of organ failure and death Determining proper approaches to reach solutions for the COVID-19 related problems have received a great deal of attention.

[3]Then researches tried to use digital methods to detect the coronavirus. As the number of coronavirus patients are increasing daily then It is needed to have a fast and an efficient method to diagnose a patient and where Artificial Intelligence is the best solution for diagnosis. The Artificial Intelligence is useful to evolve a methodology of covid detection without physical contact using techniques like Xray,CT scan analysis using Deep learning.

II. OBJECTIVES

A. Contact less Covid diagnosis using Image analysis.

CT T scan may show non-specific ground-glass opacities and subsegmental consolidation. There is growing effort, however, to coach DL to diagnose COVID-19 using chest imaging. Convolutional neural network (CNN) may be a sort of DL which is meant to process input images.

B. Early detection and Monitoring

In [16] established a deep learning paradigm for the screening of Coronavirus patients at an early stage. The main aim of this paper is to distinguish Coronavirus from Influenza-A viral pneumonia and normal cases with the use of CT images.

C. Contact tracing

[6] AI can help in analyzing the level of infection by this virus identifying the clusters and 'hot spots' and can successfully do the contact tracing of the individuals and also to monitor them. It can predict the future course of this disease and likely reappearance. This can be really helpful in 'Trace-test-treat" methodology

D. Prediction of death and mortality

[6]AI algorithms can track and forecast the nature of the virus from the available data, about the risks of the infection and its likely spread. Further, it can predict the number of positive cases and death in any region. AI can help identify the most vulnerable regions, people and countries and take measures accordingly.

E. Reducing the workload of healthcare workers:

. Due to a sudden and massive increase in the numbers of patients during COVID-19 pandemic, healthcare professionals have a very high workload. Here, AI is used to reduce the workload of healthcare workers [6], [7], [8].. It helps in early patient care and address more potential challenges which reduce In [15] They demonstrated that it can be a promising accompanying diagnostic tool for the clinical frontline doctors.

III. METHODOLOGY

A. *Data set collection*:

The study begins with collection of primary dataset containing two image classes: one class belonged to chest X-rays of COVID-19-confirmed cases and the

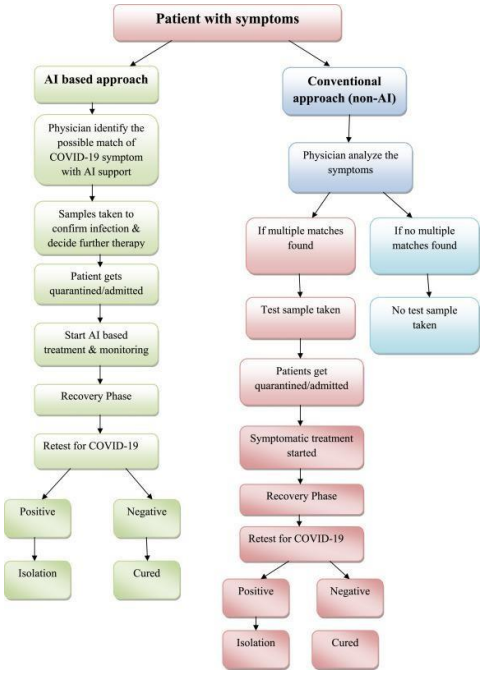
other class of images belonged to the normal people without the disease. The collected dataset was augmented using standard augmentation techniques to increase its size. After preprocessing of the dataset, the final dataset for training and testing the proposed CNN, the dataset was partitioned into two subsets.

B. *Deployment of AI model*

As in [15] used various deep learning-based techniques for Coronavirus detection diseases by using using X-ray images. Different classification models, based on SVM, using deep features of numerous deep learning architectures as following:

- AlexNet
- VGG16, VGG19
- GoogleNet
- ResNet18, ResNet50, ResNet101
- InceptionV3
- Inception ResNetV2
- DensNet201
- XceptionNet

are used for detecting the Coronavirus patients.



C. *Result analysis*

Various ML and DL-based algorithms and techniques used for classification of the novel disease known as Covid19 have been studied and reviewed.

III. CHALLENGES

A. *Data set Availablity*

Volume of sufficient data is not available for testing and training the AI models, which can affect the efficiency and AI model may produce skewed results. Less Variety of data can make the model less efficient in differentiating between complex cases (in this case, various respiratory diseases, or viral strains or % lung damage

B. *Lack of trained personnel for deploying AI*

Being a rapidly advancing domain, Artificial intelligence still lacks availability of skilled & technically equipped workforce.

C. *Right to privacy*

AI models sometimes require access and sharing of personal data (biometrics, sex, age, health history etc) to make predictions and generate the required results. This may lead to intrusion in the individual privacy.

IV. LIMITATIONS

A. *Lack of prospective validation*

6]One of the hurdles facing in application of AI in healthcare is lack of prospective validation studies and difficulty improving an algorithm's performance. Many investigations are validated by dividing one pre-existing dataset into a training and testing dataset. External validation using an independent dataset, however, is critical before implementation during a real-world environment, and inherently opaque black-box type models should be avoided the maximum amount as possible due to their lack of interpretability and explainability to Healthcare staff..

B. *Limits of Machine Intelligence*

[18] three ways in which DNNs are alleged to fall short of human intelligence: that their training is too data-hungry, that they are vulnerable to adversarial examples, and that their processing is not interpretable

V. COMPARISON

Various ML and DL-based algorithms and techniques used for classification of the novel disease known as Coronavirus 2019 have been studied and reviewed. Different papers used different deep learning architecture. According to the literature review of different papers , it is demonstrated that deep learning with convolutional neural networks might have remarkable impacts on the automatic detection and automatic extraction of highly essential features from chest images which is related to the diagnosing of Coronavirus.Comparative analysis is given in

TABLE 1

TABLE I. COMPARISON OF VARIOUS CNN MODELS

name	Deep Learning models		
	Data type	*Data source*	*Accuracy*
Deep CNN [11]	Xray	Github	98%
Deep Learning for Screening COVID-19 pneumonia [12]	CT	Hospital of Zhejiang, China	86.7%
Automated Deep Convolutional Neural Network [13]	CT& XRAY	50 Coronavirus patients (GitHub) 50 normal X-ray (Kaggle)	98%
Support Vector Machine based on deep learning approach (Deep Features)[14]	Xray	Coronavirus cases=25 Normal cases=25 (GitHub, Kaggle)	SVM+ResNet50 (FPR=95.52%, 1 score=95.52%, MCC=91.41% and Kappa=90.76 %)
Transfer Deep Learning for automatically predicting COVID-19	CT scan	GiTHub Kaggle	98%

a.

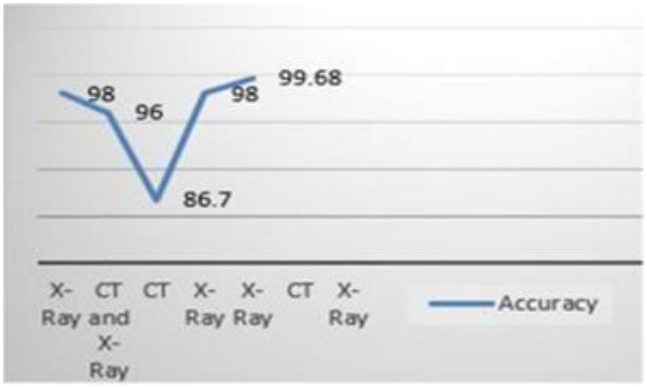


Figure 1: Relation between accuracy and data type

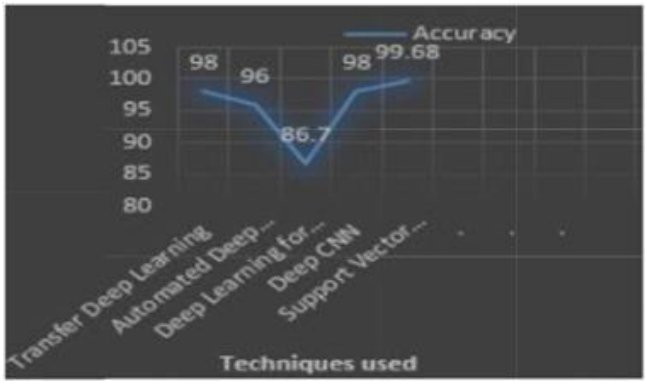


Figure 1: Relation between accuracy and technique

. VI. SOLUTION

A. Protection of personal data

[6]An example of strategy to preserve protect privacy uses a novel process called 'federated learning'. Which enables transferring data collaboratively without moving patient data beyond the firewall of the patient's institution. Therefore, aggregate local ML models can analyse confidential & decentralised data without transferring sensitive information to a central server.

B. Increasing accuracy of AI model

[10]CNN with extra convolutional layers (e.g., six layers have been used in the CNN proposed in this study) performs best in COVID-19 diagnosis.

C. Efficient use of limited dataset

[10] Data augmentation techniques are very effective to improve the CNN model performance remarkably by generating more data from an existing limited-size dataset. Data augmentation is also effective in image classification as it gives the ability of invariance to CNNs.

D. Creation of Open Source Data set

[16]Kaggle, a data science competition platform, has issued a data competition based on this data, a COVID-19 Open Research Dataset Challenge. And contributing to the need for more (accessible) data, Elsevier made publicly available in its Novel Coronavirus Information Center early-stage and peer-reviewed research on COVID-19 and to around 20,000 related articles on ScienceDirect, as well as the full texts for data mining. Similarly, The Lens has made available all its data on patents in what it calls the Human Coronavirus Innovation Landscape Patent and Research Works Open Datasets to support the search for new and repurposed drugs. And Chen et al. (2020a) published the first public COVID-19 Twitter dataset.

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CONCLUSION

AI works in a proficient way to mimic like human intelligence. In this paper we reviewed and critically analysed the present AI based techniques for Covid 19 detection, their challenges and tried to derive solutions from existing possibilities. This result-driven technology has tremendous potential to augment health care services in disease diagnosis and detection.

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