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Survey of Machine & Deep Learning Techniques for Prediction of COVID-19

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Abstract : For diagnosis of corona virus disease 2019 (COVID-19), a SARS-CoV-2 virus-specific reverse transcriptase polymerase chain reaction (RT–PCR) test is routinely used. The COVID-19 pandemic has rapidly propagated due to widespread person-to-person transmission. Laboratory confirmation of SARS-CoV-2 is performed with a virus-specific RT–PCR, but the test can take up to 2 d to complete. This study shows various techniques of artificial intelligence (AI) algorithms to findings with clinical symptoms, exposure history and laboratory testing to rapidly diagnose patients who are positive for COVID-19.

***IndexTerms* - Covid-19, Artificial intelligence (AI), Deep learning, Machine Learning.**

I. INTRODUCTION

The COVID-19 pandemic has resulted in over 10 billion cases worldwide. Early recognition of the disease is crucial not only for individual patient care related to rapid implementation of treatment, but also from a larger public health perspective to ensure adequate patient isolation and disease containment. Chest CT is more sensitive and specific than chest radiography in evaluation of SARS-CoV-2 pneumonia and there have been cases where CT findings were present before onset of clinical symptomatology4. In the current climate of stress on healthcare resources due to the COVID-19 outbreak, including a shortage of RT–PCR test kits, there is an unmet need for rapid, accurate and unsupervised diagnostic tests for SARS-CoV-2.

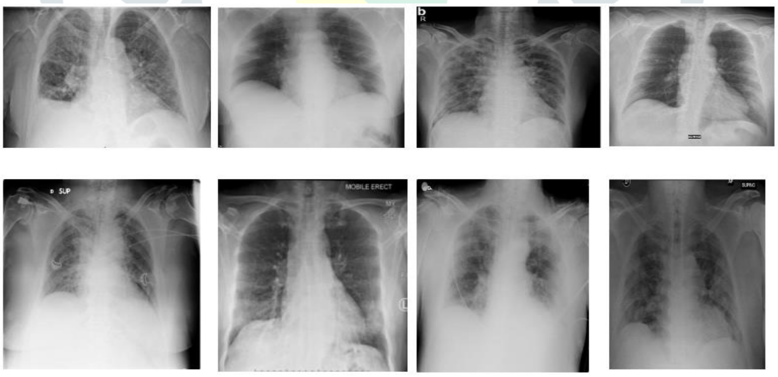

Figure 1: Chest condition due to Covid-19(2)

Chest CT is a valuable tool for the early diagnosis and triage of patients suspected of SARS-CoV-2 infection. In an effort to control the spread of infection, physicians, epidemiologists, virologists, phylogeneticists and others are working with public health officials and policymakers to better understand the disease pathogenesis. Early investigations have observed common imaging patterns on chest CT8,9. For example, an initial prospective analysis in Wuhan revealed bilateral lung opacities on 40 of 41 (98%) chest CTs in infected patients and described lobular and sub-segmental areas of consolidation as the most typical imaging findings4. Our initial study with chest CTs in 21 real-time RT–PCR assay-confirmed patients also found high rates of ground-glass opacities and consolidation, sometimes with a rounded morphology and peripheral lung distribution. A recent study has also shown that CT may demonstrate lung abnormalities in the setting of a negative RT–PCR test10.

During an outbreak of a highly infectious disease with person-to-person transmission, hospitals and physicians may have increased workloads and limited capabilities to triage and hospitalize suspected patients. Previous work demonstrated that early-stage coronavirus patients may have negative findings on CT7, limiting radiologists' ability to reliably exclude disease. While waiting 6–48 h for the confirmation of the SARS-CoV-2 coronavirus by RT–PCR, patients who are infected may spread the virus to other patients or caregivers if resources are not available to isolate patients who are only suspected to be infected; nosocomial infection was inferred in approximately 40% of cases in a recent large series11. Rapid detection of patients with COVID-19 is imperative because an initial false negative could both delay treatment and increase risk of viral transmission to others. In addition, radiologists with expertise in thoracic imaging may not be available at every institution, increasing the need for AI-aided detection.

II. BACKGROUND

S. A. -F. Sayed et al.,[1] Due to the increase in the number of patients who died as a result of the SARS-CoV-2 virus around the world, researchers are working tirelessly to find technological solutions to help doctors in their daily work. Fast and accurate Artificial Intelligence (AI) techniques are needed to assist doctors in their decisions to predict the severity and mortality risk of a patient. Early prediction of patient severity would help in saving hospital resources and decrease the continual death of patients by providing early medication actions. Currently, X-ray images are used as early symptoms in detecting COVID-19 patients. Therefore, in this research, a prediction model has been built to predict different levels of severity risks for the COVID-19 patient based on X-ray images by applying machine learning techniques.

R. G. Babukarthik et al.,[2] provides portion of the standard picture analysis accessible is Computed Tomography (CT) sweep and Chest X-Beam (CXR). Despite the fact that a CT filter is viewed as a best quality level in finding, CXR is most generally utilized because of widespread, quicker, and less expensive. This investigation expects to give an answer for recognizing pneumonia because of COVID-19 and solid lungs (ordinary individual) utilizing CXR pictures. One of the remarkable strategies utilized for separating a high dimensional component from clinical pictures is the Deep learning strategy. In this exploration, the best in class strategies utilized is Genetic Deep Learning Convolutional Neural Network (GDCNN). It is prepared from the scratch for separating features for ordering them between COVID-19 and ordinary pictures.

S. Sakib et al.,[3] propose a suitable and proficient deep learning-based chest radiograph classification (DL-CRC) framework to recognize the COVID-19 cases with high exactness from other unusual (e.g., pneumonia) and typical cases. An interesting dataset is prepared from four openly accessible sources containing the poster anterior (Dad) chest perspective on X-beam data for COVID-19, pneumonia, and ordinary cases. Our proposed DL-CRC framework use a data increase of radiograph pictures (DARI) calculation for the COVID-19 data by adaptively utilizing the generative antagonistic network (GAN) and conventional data expansion techniques to create manufactured COVID-19 contaminated chest X-beam pictures to prepare a strong model. The preparation data comprising of real and engineered chest X-beam pictures are taken care of into our altered convolutional neural network (CNN) model in DL-CRC, which accomplishes COVID-19 discovery precision of 93.94% contrasted with 54.55% for the situation without data expansion (i.e., when a couple real COVID-19 chest X-beam picture tests are accessible in the first dataset).

M. Abdel-Basset et al.,[4] propose a pressed energized thick convolutional network for learning concealed representations inside amino corrosive successions; while using progressed implanting strategies for encoding the two kinds of info arrangements. The exhibition of DeepH-DTA is assessed through broad trials against forefront approaches using two public datasets (Davis, and KIBA) which contain varied examples of the kinase protein family and the relevant inhibitors. DeepH-DTA accomplishes the most elevated Concordance File (CI) of 0.924 and 0.927 and furthermore accomplished a mean square mistake (MSE) of 0.195 and 0.111 on the Davis and KIBA datasets individually. Also, an investigation utilizing FDA-affirmed drugs from the Medication Bank database is performed utilizing DeepH-DTA to predict the liking scores of medications against SARS-CoV-2 amino corrosive arrangements, and the outcomes show that that the model can predict a portion of the SARS-Cov-2 inhibitors that have been as of late endorsed in numerous clinical examinations.

M. K. Elhadad et al.,[5] provides this gathered ground-truth data to construct a discovery framework that utilizations AI to distinguish deceiving data. Ten AI calculations, with seven element extraction methods, are utilized to build a democratic gathering AI classifier. It perform 5-overlay cross-approval to check the legitimacy of the gathered data and report the assessment of twelve execution measurements. The assessment results demonstrate the quality and legitimacy of the gathered ground-truth data and their adequacy in building models to distinguish misdirecting data.

E. Karaçuha et al., [6] presents thegaussian model is contrasted with a period subordinate helpless contaminated recuperated (SIR) model. In conclusion, an analysis of understanding the impact of history is made on memory vectors utilizing wavelet-based denoising and connection coefficients. Results demonstrate that Deep Evaluation Procedure effectively models the dataset with 0.6671%, 0.6957%, and 0.5756% normal mistakes for affirmed, recouped, and passing cases, separately. It found that utilizing the proposed Gaussian methodology belittles the pattern of the pandemic and the quickest increment is seen in the US while the slowest is seen in China and Spain. Analysis of the past indicated that, for all nations aside from Turkey, the current time moment is for the most part subject to the previous two weeks where nations like Germany, Italy, and the UK have a more limited normal hatching period when contrasted with the US and France.

A. Ramchandani et al., [7] propose a profound learning model to gauge the extent of augmentation in Corona virus debased cases in ongoing days and it present a clever technique to enroll equidimensional portrayals of multivariate time course of action and multivariate spatial time game plan information. Using this original system, the proposed model can both take in endless heterogeneous elements, for instance, insights information, intra-territory adaptability, between region convenientce, social eliminating information, past improvement of tainting, among others, and learn complex relationship between these provisions. Using information accumulated from various sources, it check the extent of addition in polluted cases seven days into the future for all U.S. areas. In addition, it use the model to recognize the most convincing elements for forecast of the improvement of defilement.

A. Mohammed et al., [8] provides a start to finish weakly-administered COVID-19 identification approach, ResNext+, that just requires volume level data marks and can give cut level prediction. The proposed approach fuses a lung division mask just as spatial and channel regard for separate spatial features. Plus, Long Momentary Memory (LSTM) is used to gain the pivotal reliance of the cuts. Also, a cut consideration module is applied before the last completely associated layer to produce the cut level prediction without extra oversight. A removal study is directed to show the proficiency of the consideration blocks and the division mask block. Trial results, gotten from openly accessible datasets, show a precision of 81.9% and F1 score of 81.4%. The nearest best in class gives 76.7% precision and 78.8% F1 score. The 5% improvement in precision and 3% in the F1 score exhibit the viability of the proposed technique.

M. J. Horry et al., [9] propose a picture pre-processing stage to make a dependable picture dataset for creating and testing the deep learning models. The new methodology is planned to diminish undesirable commotion from the pictures so deep learning models can zero in on identifying diseases with explicit features from them. Our outcomes demonstrate that Ultrasound pictures give better identification precision looked at than X-Beam and CT filters.

Y. Karadayi et al.,[10] provides, a half breed deep learning framework is proposed to tackle the solo oddity recognition issue in multivariate spatio-fleeting data. The proposed framework works with unlabeled data and no earlier knowledge about oddities are expected. As a contextual analysis, it utilize the public COVID-19 data gave by the Italian Branch of Common Assurance. Northern Italy areas' COVID-19 data are utilized to prepare the framework; and afterward any anomalous patterns or rises in COVID-19 data of focal and southern Italian locales are identified. The proposed framework recognizes early signals of the COVID-19 outbreak in test areas dependent on the recreation mistake. For execution examination, it plays out a nitty gritty assessment of 15 calculations on the COVID-19 Italy dataset including the cutting edge deep learning models.

A. Ulhaq et al.,[11] shows commitments are being imparted to each spending day. It persuaded us to survey the ongoing work, gather data about accessible exploration assets, and a sign of future examination bearings. it need to make it workable for PC vision analysts to discover existing and future examination bearings. This study article presents a preliminary survey of the writing on research network endeavors against COVID-19 pandemic.

Q. Pham et al., [12] present an audit of reproduced knowledge and huge information, by then perceive the applications highlighted doing combating against Coronavirus, next include challenges and issues related with state of the art game plans, finally devise proposition for the correspondences to sufficiently control the Coronavirus situation. It is generally expected that this work outfits researchers and organizations with new pieces of information into the habits in which PC based knowledge and huge information further develop the Coronavirus situation, and drives further examinations in ending the Coronavirus episode.

III. AI TECHNIQUES

AI may provide a method to augment early detection of SARS-CoV-2 infection. Our goal was to design an AI model that can identify SARS-CoV-2 infection based on initial chest CT scans and associated clinical information that could rapidly identify COVID-19 (+) patients in the early stage. We collected chest CT scans and corresponding clinical information obtained at patient presentation. Clinical information included travel and exposure history, leukocyte counts (including absolute neutrophil number, percentage neutrophils, and absolute lymphocyte number and percentage lymphocytes), symptomatology (presence of fever, cough and sputum), patient age.

Three AI models are used to generate the probability of a patient being COVID-19 (+): the first is based on a chest CT scan, the second on clinical information and the third on a combination of the chest CT scan and clinical information. For evaluation of chest CT scans, each slice was first ranked by the probability of containing a parenchymal abnormality, as predicted by the CNN model (slice selection CNN), which is a pretrained pulmonary tuberculosis (PTB) model that has a 99.4% accuracy to select abnormal lung slices from chest CT scans. The top ten abnormal CT images per patient were put into the second CNN (diagnosis CNN) to predict the likelihood of COVID-19 positivity (P1). Demographic and clinical data (the patient's age and sex, exposure history, symptoms and laboratory tests) were put into a machine-learning model to classify COVID-19 positivity (P2). Features generated by the diagnosis CNN model and the non imaging clinical information machine-learning model were integrated by an MLP network to generate the final output of the joint model (P3).

Table 1: Results of Machine Learning classifiers [1]

Sr No	Method	Accuracy	Precision	Recall	F1_Score
1	Random Forest	83%	81%	79%	80%
2	XGBoost	86%	85%	86%	85%
3	Bagging	79%	82%	74%	76%
4	ET	86%	88%	83%	83%
5	SVM	90%	90%	88%	87%

Table 1 is showing the various machine learning classifier techniques performance results in terms of the accuracy, precision, recall and f1_Score.

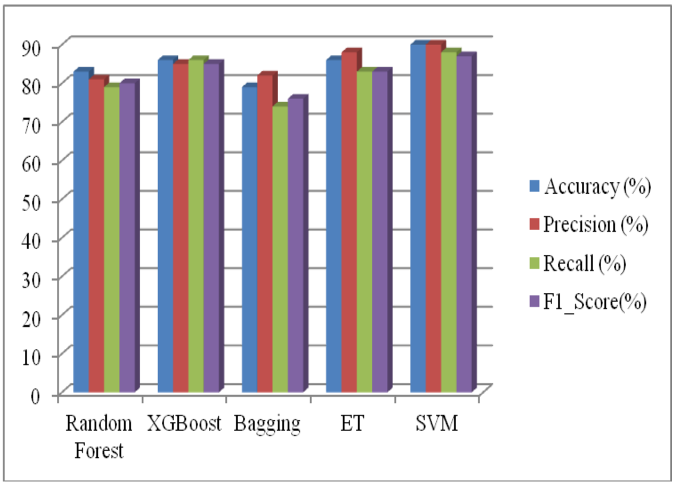

Figure 2: Result comparison

Figure 2 is presenting the graphical representation of the performance analysis of the different machine learning techniques.

IV. CHALLENGES

Private and public substances around the globe, especially in the medical care and administration areas, are creating and sending a scope of artificial intelligence (artificial intelligence) frameworks in crisis reaction to COVID-19. A portion of these frameworks work to track and predict its spread; others support clinical reaction or help keep up social control. Without a doubt, man-made intelligence frameworks can diminish strain on overpowered medical services frameworks; help spare lives by quickly diagnosing patients, and surveying wellbeing decreases or progress; and breaking point the virus' spread.

Yet, there's an issue: The calculations driving these frameworks are human manifestations, and accordingly, they are liable to inclinations that can deepen cultural imbalances and posture risks to organizations and society all the more extensively. In this article, it look at data on the pandemic, share two late uses of simulated intelligence, and propose various ways nonprofit and business pioneers can help guarantee that they create, oversee, and utilize extraordinary simulated intelligence evenhandedly and capably.

The recognized issue in existing work is according to the accompanying -

- Prediction not done of CT scan dataset.
- Less accuracy in diagnosis of covid-19 disease in existing research work.
- More error rate occurs during to prediction of the covid-19 disease.
- No efficient approach to give final clinical decision after diagnosis of the disease.
- Precision, recall and Fmeasure value is also not optimized.

V. CONCLUSION

There are many limitation of AI based study i.e.is the small sample size. Despite the promising results of using the AI model to screen patients with COVID-19, further data collection is required to test the generalize ability of the AI model to other patient populations. Collaborative effort in data collection may facilitate improving the AI model. Difficulties on model training also arise due to the limited sample size. This paper review about AI based technique to diagnosis the cobid-19 decease, The CNN approach of deep learning is lighting more than others to accurate detection. The research in ML based approach is also growing rapidly.

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