An Approach to Detect COVID-19 Disease from CT Scan Images using CNN - VGG16 Model

K.Sai Prasad*
Department of Computer Science and Engineering
MLR Institute of Technology, Hyderabad, India
saiprasad.kashi@gmail.com

Dr. S Pasupathy
Department of Computer Science and Engineering
Annamalai University, Chidambaram, Tamilnadu, India
pathyannamalai@gmail.com

P.Chinnasamy
Department of Computer Science and Engineering
MLR Institute of Technology, Hyderabad, India
chinnasamyponnusamy@gmail.com

A.Kalaiarasi
Department of Electrical and Electronics Engineering,
Sri Shakthi Institute of Engineering and Technology,
Coimbatore, India.
akalaiarasieee@siet.ac.in

2022 International Conference on Computer Communication and Informatics (ICCCI) | 978-1-6654-8035-2/22/$31.00 ©2022 IEEE | DOI: 10.1109/ICCCI54379.2022.9741050

Abstract—**As a result of the outbreak, an unusual virus spread event has occurred, threatening human safety worldwide. To prevent infections from spreading quickly, large numbers of people must be screened. Rapid Test and RT-PCR are common testing tool for regular testing that is used to test all covid affected users. However, the increasing number of false positives has paved the way for the investigation of alternative test methods for corona virus effected patients' chest X-rays have shown to be an effective alternate predictor for testing if an individual is affected with COVID-19 virus. However, consistency is, once again, dependent on radiological experience. A diagnostic decision support device that assists the physician in evaluating the victims' lung scans can alleviate the doctor's medical workload. Machine Learning Techniques, specifically Convolutional Neural Networks (CNN) VGG16 model is used to train dataset and use trained model to predict, have been developed in this project. Four distinct deep CNN architectures are tested on photographs of chest X-rays for treatment of COVID-19. The collection of data sets of covid 19 X-ray imageries and non-covid 19 X-ray imageries are used to train the model and test its accuracy. CNN-based architectures were discovered to be capable of diagnosing COVID-19 disease.**

Keywords- Covid'19, CNN, RT-PCR, VGG16 Model, Neural Networks

I. INTRODUCTION

The severe acute respiration disorder corona virus 2 (SARS-CoV-2) outbreak, which began in Wuhan, China, triggered a worldwide contagion of COVID-19 (coronavirus disease 2019) [1]. COVID-19 had a significant impact on people's health, particularly the elderly and patients with underlying medical disorders and low immunity. By mid-July 2020, the COVID-19 pandemic had resulted in about 570,000 deaths and over 13,000,000 cases of COVID-19 spread [2]. A critical step in battling the virus is identifying COVID19-affected patients as soon as possible so that they can receive appropriate care and treatment. COVID-19 must be identified early in order to determine which patients must be separated in order to prevent the disease from spreading in the community. However, given the COVID-19's recent spread, actual identification remains a difficult job, mainly in While RT-PCR- Reverse transcript polymerase chain reaction process have been adopted as the primary method for detecting COVID-19, chest X-ray, CT- computed tomography scans, and high C-Reactive Proteins-CRP, PCT, less number of lymphocytes, higher Interleukin-6 (IL6), and Interleukin-10 (IL10) are taken to account by several countries across the world to assistance analysis and offer indication of critical infection development [3].

The current method of identifying COVID-19 utilizing aforesaid disease and antibody checking procedure is time-taking and necessitates superfluous materials and support, which are not always available in developing communities. As a result, test kits are frequently unavailable at many medical centers. Due to a lack of tools and a high rate of false-negative

978-1-6654-8035-2/22/$31.00 ©2022 IEEE

virus and antibody checkups, establishments in Hubei Province, China temporarily used radiological examinations as a scientific enquiry for COVID19. As a result of this, numerous researchers and bases recommend the usage of a chest scan for alleged COVID19 identification [6]. As a result, radio-therapist will detect COVID-19-affected lung features (e.g., opacity and association) using non-aggressive techniques namely CT scans or chest X-rays. Though, distinguishing COVID-19-induced topographies from public-attained microbial pneumonia is difficult [9]. As a result for many patients, physical examination of radiographic information & precise analysis which is destroying thing for radio-therapists, necessitating in development of an automated classification method.

Additionally, radiologists may become infected and require isolation, which may have an impact on rural population consisting few hospitals, radio-therapists, and domestic servant. Besides, with COVID-19 3rd wave expected in 2021& 2022, alertness for such situations will entail increased usage of moveable radio graphical scan of chest equipment due to extensive accessibility and compact disease control problems that presently boundary CT utilization. As shown in Figure. 1, the goal is to progress an artificial intelligence (AI)-theme smart chest radiograph classification framework to distinguish COVID-19 cases in order to systematize COVID-19 recognition using radio graphical images of chest.

II. Literature Survey

A. Imaging Modalities for Covid'19 Detection

Most countries were forced to act in response to the sudden and speedy epidemic of COVID-19 in a comparatively less amount of time. After gathering sufficient knowledge about COVID-19, radiology departments began to focus more on preparedness rather than diagnostic capability. The study in [5] found similarities between COVID-19 and supplementary diseases caused by Covid virus variants such as the SARS-severe acute respiratory syndrome and the MERS- Middle East respiratory syndrome. The study also discovered that CT scans are used to track lung condition of a recovering covid patient. CT scan gives the score of the rate of infection in the lungs which are identified in the scanned images. To detect the COVID-19, bilateral nodular and peripheral opacity in pulmonary radiograph pictures, chest imaging methods were captured and highlighted as critical technique in the literature.

B. Radio Graphical Analysis via AI

The study [1-5] revealed that Artificial Intelligence is used for initial recognition, diagnosis, monitoring & development of covid-19 vaccines.

Several other studies have been published in the literature that used various deep learning methods on X-ray information to demonstrate reasonable performance. A model called Dark-CovidNet was proposed for early detection of COVID-19 that used 17 CNN layers to carry out binary classification & multi-class classification on pneumonia, COVID, and normal cases. Despite the fact that the model reported an accuracy of 87.02% for multi-class classification, 98.08% for binary classification, our reconstruction of the Dark-CovidNet using various datasets revealed over training and significantly lower accuracy when non-biased test data was presented to the model. Several other papers applied deep learning copies of CT scan images to spot and monitor COVID-19 structures in the radio graphic information. Ardakani et al. used cutting-edge CNN architectures like XceptionCT, SqueezeNet,ResNet-50,ResNet-101, VGG-16,AlexNet,VGG-19, ResNet18 MobileNetV2,GoogleNet[6] to distinguish among COVID-19 & non-COVID19 cases. The trials demonstrated that deep learning is a viable method for recognizing COVID19 from radiograph pictures. To dodge poor generalization and excess fitting because of inadequate COVID-19 specimen in existing datasets, using GAN prototype to create synthetic data, achieving a dice constant of 0.837. According to survey in literature [4], the relevancy of GAN for COVID-19 radio graphical information combination will be established by larger range of GAN submissions on much medicinal information. Review discovered several inimitable characteristics of GAN, namely field variation, information growth, and image to image conversion, which stimulated scholars to use it for picture rebuilding, dissection, recognition, clustering, and cross-model combination in a variety of medical applications.

C. Overview of the System

Software Development Life Cycle (SDLC) in engineering, info systems & software engineering, it's the process of

making or changing systems, as well as models and practices used to do so. SDLC notion underpins many types of software development methodologies in software engineering

- Taking the two-sided interior and the exterior ground glass opaqueness in pulmonary radiographic image was identified as a critical technique for detecting COVID-19.
- There are a number of research papers in the literature which use numerous deep learning methods on X-ray information to determine sensible performance. In, a so-called model Dark CovidNet proposed for initial identification of COVID-19, used 17 convolutional coatings to achieve dual and multi-class classification on usual, COVID, and pneumonia cases.

D. Drawbacks

- The major drawback with respect to patients is cost of CT scan. The covid affected patient need to undergo CT scan which is costly and also the limited availability of Ct machines in developing/rural areas, gives a picture that CT scan isn't a true resolution for detecting COVID-19.
- Next important point is X-ray imaging equipment is mostly available in hospital emergency centres, public health facilities, and rural clinics, a chest X-ray could be utilized to detect COVID-19 or other pneumonia cases as a practical and less expensive alternative. Further, skilled radiologists may have difficulty in discriminating between COVID-19 and public-acquired microbial pneumonia based on chest radio graphical images.

.

III. PROPOSED SYSTEM

Typical CNN construction is meant to develop the deep learning model for automatic feature extraction and categorization.

- In order to build a robust model, we propose utilizing data expansion of radio graphical images of COVID-19 information via using deep learning technique to make artificial COVID-19 diseased radiographical images of chest. Our personalized convolutional neural network [7] (VGG) model is fed genuine and simulated radiographical images of chest input training data[9].
- We propose a 2D custom VGG prototype for categorizing X-ray imageries in order to forecast COVID-19 cases, as shown in figure 1.

  Advantages:

  In order to predict COVID-19 cases, we propose a binary-dimensional (2-D) convention VGG model for clustering X-ray images, as shown in the figure 1.

A. SYSTEM MODULES

1) Data set collection:

In this module COVID-19 Data set is collected from Kaggle website which has with covid and without covid x ray images.

2) Preprocessing:

In this module image data is preprocessed by Loading images pre-processing images and storing to features and labels, Load dataset path to image paths, initialize two variables data for storing data and labels for storing 1 or 0, Copying with COVID-19 x –ray[8] data by iterating for loop and copying images to data array and 1 to labels array.

3) Model Training:

In this module data is split in to train and test sets and VGG16 model is used to train dataset and model is saved in folder which is loaded to test accuracy and predict results [10].

4) Prediction:

Pretrained model is loaded and new image is given to predict function to get label (0 or 1) if 0 no Covid found in x ray, if 1 Covid found in x ray.

IV. PERFOMANCE EVALUATION

The performance evaluation of the proposed method was analyzed in terms of accuracy by applying CNN method. The analysis is clearly shown in Figure 1, 2 and 3 respectively.

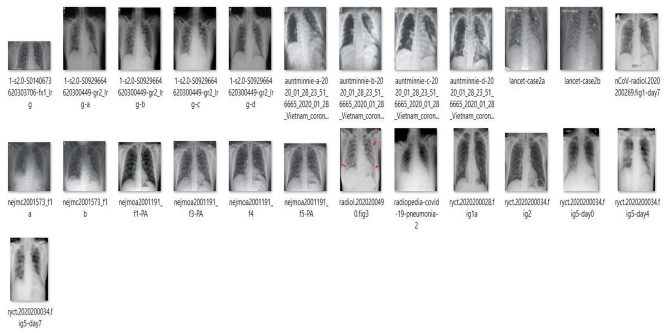

Figure 1. Without Covid'19

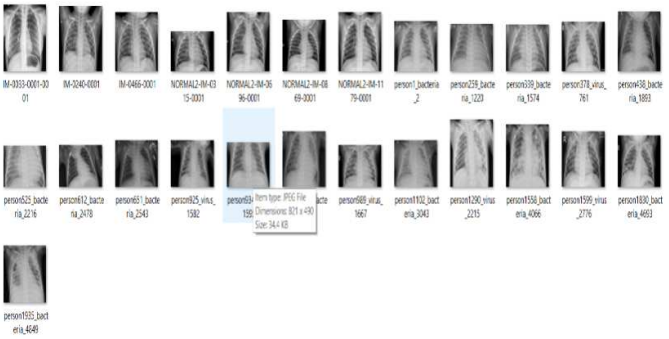

Figure 2. With Covid'19

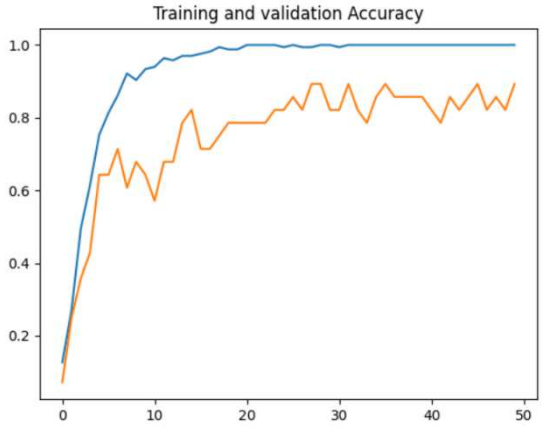

Figure 3. Accuracy of the Proposed Method

V. CONCLUSION

We have addressed the evolving encounters of spotting COVID-19 in this project. Many people remain undiagnosed due to a lack of efficient diagnosis kit and staffs in numerous areas, mainly in evolving and/or rural areas. As a result, there is a significant disparity among the amount of confirmed &real cases. Radiographs, namely radio graphical scan of chest and CT scans, been shown to consume possibility to detect COVID-19 contagion in pulmonary system, accompanying time-taking biological and antibody screening. Although CT scans have developed proposal or finer-grained particulars than radio graphical scan pictures, radio graphical scan machineries are commonly found in medical urgency wards, community health amenities, also country side medical centers or clinics. Furthermore, since radio graphical scan is low cost substitute and an alluring result for movability in trucks and COVID-19 examination stands with sufficient shielding & current supply, how to find COVID-19 contagion of the lung by identifying outlines by training data using vg19 model and prediction with accuracy to check if patient has covid or not from given input image is performed.

VI. FUTURE ENHANCEMENT

Our research and experiments were carried out at a serious stage and in a time-complex manner in order to combat COVID-19 spread with evidence-of-notion COVID-19 by means of radio graphical imageries. Inspite of assembling datasets after various bases containing X-ray pictures containing COVID-19 trials, the data used were relatively minute. In view of new mutants of Covid19 like Delta, Omicron, Demicron, etc., we need to understand the behavior of these mutants through deep learning models.

REFERENCES

[1]. G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of S. Karanam, R. Li, F. Yang, W. Hu, T. Chen, and Z. Wu, "Towards contactless patient positioning," IEEE Transactions on Medical Imaging, vol. 39, no. 8, pp. 2701–2710, Aug. 2020.

[2]. "WHO coronavirus disease (COVID-19) dashboard." World Health Organization (WHO). https://covid19.who.int/ (accessed Jul. 15, 2020).

[3]. W. Wang et al., "Detection of SARS-CoV-2 in different types of clinical specimens," Journal of the American Medical Association (JAMA), vol. 323, no. 18, pp. 1843–1844, May 2020, doi:10.1001/jama.2020.3786.

[4]. G. D. Rubin et al., "The role of chest imaging in patient management during the COVID-19 pandemic: A multinational consensus statement from the Fleischner society," Radiology, vol. 296, no. 1, pp. 172–180, Jul. 2020, pMID: 32255413, doi: 10.1148/radiol.2020201365.

[5]. M. Hosseiny, S. Kooraki, A. Gholamrezanezhad, S. Reddy, and L. Myers, "Radiology perspective of coronavirus disease 2019 (COVID-19): Lessons from severe acute respiratory syndrome and middle east respiratory syndrome," American Journal of Roentgenology, vol. 214, no. 5, pp. 1078– 1082, May 2020, doi: 10.2214/AJR.20.22969.

[6]. "ACR recommendations for the use of chest radiography and computed tomography (CT) for suspected COVID-19 infection." American College of Radiology (ACR).

[7]. K. Sai Prasad, O. SubhashChander, G. Prabhakar Reddy, S. Gururaj, Artificial Intelligence approach for Classifying Molecular Dataset using Density based technique with appropriate Euclidean Distance measure, Materials Today: Proceedings,Volume 4, Issue 8, 2017, Pages 8827-8836, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2017.07.233.

[8]. K. Sai Prasad & Rajender Miryala "Histopathological Image Classification Using Deep Learning Techniques" International Journal on Emerging Technologies 10(2): 467-473 (2019).

[9]. Dalton, G. Arul, G. Prabhakar Reddy and K. Sai Prasad. "Fuzzy logics associated with neural networks in intelligent control for better world." International Journal of Reasoning-based Intelligent Systems 10 (2018): 322-327.

[10]. G. Prabhakar Reddy, K. Sai Prasad, N. Chandra Shekar Reddy and R. Karthik, 2018. Privacy Preserving and Data Publishing using Tuple Grouping Algorithm. Journal of Engineering and Applied Sciences, 13: 930-933.DOI: 10.36478/jeasci.2018.930.933.