First International Conference on Computer Engineering
International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
Volume 5 Issue 8, November-December-2020

Artificial Intelligence based COVID-19 classification by using Deep Learning and Convolutional Neural Network

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ABSTRACT

COVID-19 irruption has place the total world in associate unexampled troublesome state of affairs delivery life round the world to a daunting halt and claiming thousands of lives. because of COVID-19 unfold in 212 countries and territories and increasing numbers of infected cases and death tolls mounting to five,212,172 and 334,915, it remains a true threat to the general public health system. This paper renders a response to combat the virus through Artificial Intelligence(AI) primarily based respiratory organ illness Classification by victimization organic process Deep Learning commonplace. The design of the projected model initial goes through a pre-processing of the input image is followed by a rise in information. Then the model begins a step to extract the characteristics followed by the training step. Finally, the model begins a classification and prediction method with a totally connected network fashioned of many classifiers. The model explains associate integrated bioinformatics approach during which completely different} aspects of information of knowledge taken from different data sources area unit place along to make the easy platforms for physicians and researchers. the most advantage of those AI-based platforms is to accelerate the method of identification and treatment of the COVID-19 illness. the foremost recent free publications and medical reports were investigated to decide on inputs and targets of the network that would facilitate reaching a reliable Artificial Neural Network-based tool for challenges related to COVID-19.

Keywords: Artificial Intelligence, Covid-19, Deep Learning, Convolution Neural Network, Image Processing

I. INTRODUCTION

The novel Coronavirus selected SARS-CoV-2 appeared in December 2019 to initiate an outbreak of health problem called COVID-19 that established itself as a tough illness which will emerge in numerous forms and levels of severity starting from delicate to severe with the chance of organ failure and death. From mild, selflimiting tract ill health to severe progressive respiratory illness, multi-organ failure, and death. the planet Health Organization declared it as an outbreak on Gregorian calendar month thirty, 2020. With the progress of the pandemic and also the rising range of the confirmed cases and patients WHO expertise severe metabolic process failure and vas complications, there area unit solid reasons to be enormously involved concerning the results of this virus infection. decisive acceptable

approaches to achieve solutions for the COVID-19 connected issues has received an excellent deal of attention. Healthcare systems round the world are trying to expand testing facilities for COVID-19. additional and additional testing can cause the identification and isolation of infected persons, thereby reducing the unfold among the community. however availableness doesn't guarantee responsibility. the key concern for the governments at this stage is that the false-negative take a look at results area unit negative for the infected individual. Such people could unwittingly transmit the virus to others. False take a look at outcomes so damage the efforts to curb the unfold of the virus. thence the sensitivity of those tests is unknown. In such a state of affairs, Deep Learning techniques area unit artificial neural networks during which every layer has multiple neurons that operate equally to the neurons of the flesh. Convolution neural networks (CNNs) area unit one in all the deep learning techniques that have proved to achieve success and effective within the field of medical imaging classification. There are many studies that have used CNN to diagnose respiratory illness and different diseases supported radiography. CNN primarily based design has been projected to spot completely different respiratory organ diseases. thence CNN becomes a natural candidate for identification recommendation of

COVID-19 patients. By coaching convolutional neural networks (CNN) victimization these characteristics extracted from X-ray pictures, we tend to may accurately predict COVID19. The results area unit encouraging and demonstrate the effectiveness of deep learning, and additional specifically, transfer learning with CNN to the automated detection of abnormal X-ray pictures from little information sets, associated with the Covid-19 illness.

II. RELATED WORK

In[1],Recent study proposed several COVID-19 detection paradigms. In [2], Li et al. proposed a methodology to recognize the infection rate using the coronal and axial view of lung CT scans. The proposed work achieved a specificity of 100%, AUC of 0.918, and sensitivity of 82.6%. Another study evaluated COVID19 disease using visual inspection. They claimed that visual inspection help to identify the infection. In [3], Yang et al. proposed a scheme to evaluate the lung CT scans and implemented visual inspection-based detection. Their scheme could achieve a Specificity of 94%., an AUC of 0.892, and a Sensitivity of 83.3%. In [4], Wang et al. investigated 90 patients' lung CT scans. Their investigation managed to detect the severity based on the time since the patient got infected. Also, a diagnostic methodology was proposed based on the CT scan's image features. They concluded that the combination of both images features evaluation and clinical findings could early detect the presence of COVID-19. In [5], Bai et al. investigated the patient's information and considered the CT scans and RT-PCR for the examination. They achieved a specificity of 100% and a sensitivity of 93%. In a similar study, authors clinically evaluated patients with both CT scans and real-time RT-PCR with an early detection accuracy of 90%.

In [6], an in-depth study of various techniques used for the classification of images is performed. The existing DCNN models were used for the prediction of COVID19 using CT and CXR images. The analysis is stated in terms of accuracy for various prediction models. A comprehensive study is performed in the automation of DCNN architecture for searching and classification of images.

Zhou et al. in 2020 [7] suggested a deep learning model for distinguishing influenza pneumonia taken from CT images and novel coronavirus pneumonia.

CT images are better than CXR images as it shows pulmonary infection clearly which is much costlier. . Li et al. [8] identified COVID-19 using Artificial Intelligence (AI), thus dataset comprising of affected COVID-19 images, various pneumonia, and diagnosed patients with pneumonia. The images are gathered from Chinese hospitals containing 2969 images of the training set, viral pneumonia 1396, more than 400 images of COVID-19 patients, and 1173 non-pneumonia. K. He, X.
Zhang et al. in 2016.

In [9], Jakimovski and Davcev proposed the Double convolutional deep neural network (DCDNN) for lung cancer stage prediction. In the training of both the CDNN and the regular CDNNs, they used Computed Tomography (CT) scans. These topologies have been experimented with against images of pulmonary cancer to assess the stage of TX cancer in that topologies can predict lung cancer. The first phase involved the preclassification of CT images from the first dataset to concentrate on CDNN research. Next, they create the double deep neural network Convolution with max pool to carry out a more comprehensive search. They eventually utilized Computed Tomography scans of various stages TX cancer of lung cancer to establish the TX stage where CDNN detects lung cancer potential. The findings are reviewed with the medical doctors of the oncology department and are deemed sufficient to detect cancer in T3. This technique is used by doctors for detection and treatment. Nasser and Abu-Naser introduced the Artificial Neural Network (ANN) for detecting lung cancer. A Network for the Prediction of the Absence or Presence of Lung Cancer in the Human Body was developed. Symptoms like yellow fingers, anxiety, chronic illness, weariness, allergy, wheezing, roar, breath shorter, swallowing difficulty, and chest pain was used to diagnose lung cancer. Symptoms like yellow fingers. They were used as input variables for our ANN and other details about the human. Trained and validated data collection entitled' survey cancer of the lung.' The system evaluation showed that the ANN model would detect 96.67 percent accuracy in the absence or presence of lung cancer. They have carried out some planning and analysis to make the data more predictive.

III. METHODOLOGY

In this section, we first describe the dataset used in the study, followed by the proposed CNN. The definition of the input data and desired outputs before the actual methods provides a better definition of the problem and a better understanding of the methods.

A. Datasets

We set up a database composed of three classes of chest radiographic images are collected from git hub repositories [10]. The first class is made up of images of patients declared positive for COVID-19 that we collected from the database published by Cohen. This database contained 230 images is open to various researchers to add new images or to use the already existing images. The second class consists of 100 images of patients declared normal without any pneumonia. The third class consists of 100 images of patients who have already had typical inflammatory pneumonia. We have divided the base of the collected X-ray images into two groups. A first learning group noted internal validation containing 80% of the images of the constructed base. The images of this group have been verified and annotated by radiologists to use them for the training of our CNN model. The second group noted external validation would be formed by 20% of the images

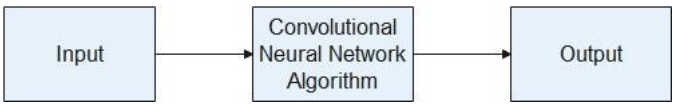
of the base constructed plus ten images provided by our radiologist colleagues and will be used for the validation of our proposed CNN model [11].

B. Deep Learning Algorithm

Deep learning AI is in a position to find out without human supervision, drawing from data that's both unstructured and unlabeled. Deep learning may be a part of machine learning in artificial intelligence that has networks that are capable of learning unsupervised from data that is unstructured or unlabeled, considered deep neural learning or deep neural networks [12]. In this model, we are going to use pre-trained CNN models on the Image Net databases that reduce the need to train the data from scratch. A pre-trained model is useful when there is a time boundary, every-time it is not possible to build the model from scratch why a pretrained model comes into existence. Image Net in one of the widest, large, real-world databases with the help of these pre-trained models weights obtained is then transferred to the specific CNN model which going to use transfer learning technique.

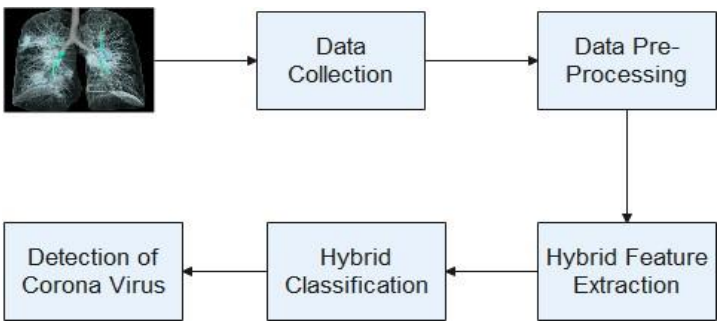
C. Convolution Neural Network

CNN is of the well-regarded machine learning methods in the literature. One of the reasons for its popularity is the automatic hierarchical feature representation in recognizing objects and patterns in images. CNN reduces the parameters of a given problem using spatial relationships between them [13]. This makes them a more practical classifier when dealing with images where we deal with a large number of parameters, rotation, translation, and scale of images. In fact, CNN's alleviate the drawbacks of Feel Forward Neural networks and Multi-Layer Explanations by using an alternative to matrix multiplication. We use this powerful method in this study due to the nature of COVID-19 diagnosis from CT images and its highdimensional nature [14s].



D. Transfer Learning

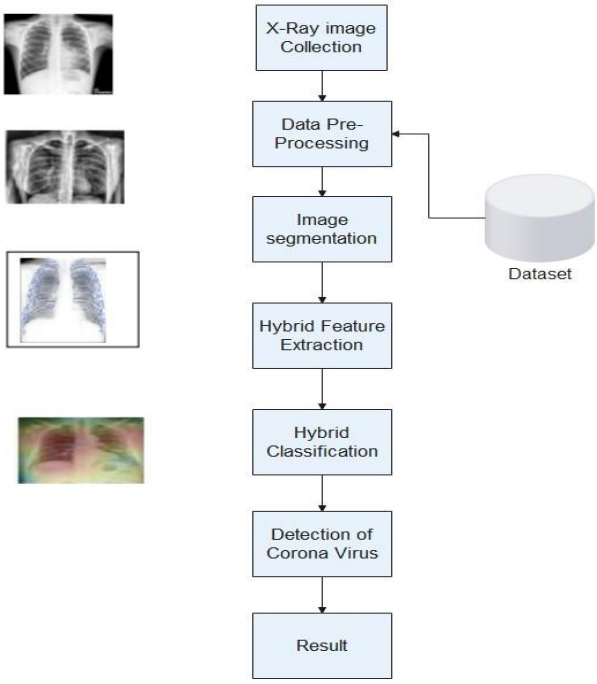
Transfer learning is a strategy wherein the knowledge mined by a CNN from given data is transferred to solve a different but related task, involving new data, which are the usually smaller population to train a CNN from scratch. In deep learning, this process involves the initial training of a convolutional neural network for a specific task and utilizing large-scale datasets. The availability of knowledge for the initial training is the most significant factor for successful training since CNN can learn to extract significant characteristics of the image. Depending on the potential of CNN to spot and extract the foremost outstanding image features, it's judged whether this model is suitable for transfer learning.



E. Image Processing

In this paper, we implement and analyze the image processing method for the detection of Covid-19. Image processing techniques are widely utilized in several medical problems for picture enhancement within the detection phase to support the first medical treatment [15].

In this research, we proposed a detection method of Covid-19 based on image segmentation. Image segmentation is one of the intermediate levels in image processing.



IV. CONCLUSION

In this project, we have a tendency to projected a clinical web for the first detection of COVID-19 victimisation deep learning supported chest X-ray pictures. this system conjointly differentiates the patients affected by respiratory illness and COVID-19 as each have constant symptoms victim sometimes gets confused between the 2. police work COVID-19 victimisation X-Ray is way cheaper than the medical COVID-19 check kit and as quick because the current thermal imaging technique. The model are way more correct and helpful within the current state of affairs. The results recommend that CNN based mostly architectures have the potential for the proper designation of COVID-19 malady. Transfer learning plays a serious role in rising the accuracy of detection. Fine-tuning of those models could additional improve the accuracy. alternative pre-trained models can also be explored for building a advocate designation system.

Future work could embrace developing new architectures supported CNN for the detection of COVID-19 in addition as alternative diseases within the medical domain.

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