International Journal of Future Generation Communication and Networking
Vol.14, No. 1, (2021), pp. 4494 - 4499

COVID-19 detection from chest X-ray imagery using deep learning

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Abstract

The COVID-19 pandemic has a rapid spread across the globe & is increasing exponentially, which has deployed life threatening complications ever since it started from China in December 2019. A quick detection of positive cases on corona virus will prevent the further community spread and initiates an earlier treatment to common man. In Recent findings, the images of Chest X ray and CT scan have shown salient features that illustrates the severity of corona virus in lungs. Scientific advancement of Artificial Intelligence in deploying a deep learning based medical field is remaining powerful to handle a huge data with accurate and fast results in medical imaging to diagnose diseases more accurately and efficiently with further assistance in the remote areas. Proposed method is developed for analysing chest X ray images to detect COVID-19, by using convolution 2D techniques that are applied on the open-source datasets of COVID-19 available at GitHub and Kaggle.

Keywords— *COVID-19, CNN, X-Rays, Deep Learning, COVID-19 Detection*

I. INTRODUCTION

Novel Corona virus has taken large attention of the entire globe. Every one joined the battle to fight the Corona virus. As a part of society, we develop the software for Corona detection using AI; specially designed for front-line use to help doctors to detect and monitor the disease efficiently and effectively. Patients with confirmed COVID-19 pneumonia have typical imaging features that can be helpful in early screening of highly suspected cases and in evaluation of the severity and extent of disease. Most patients with COVID-19 pneumonia have ground-glass opacities or mixed ground-glass opacities and consolidation and vascular enlargement in the lesion. Lesions are more likely to have peripheral distribution and bilateral involvement and be lower X-Rays predominant and multifocal. CT involvement score can help in evaluation of the severity and extent of the disease. In this paper, the decision-tree based denoising method is proposed. By utilizing the modules such as, ‘isolation module’, ‘fringe module’ and ‘similarity module’, the denoising is done quite effectively and the proposed edge preserving filter is used to preserve the edges in the image. In this paper we have proposed a denoising method based on Non-local Mean filter and has compared it with Anisotropic Diffusion filter. The ADF smooths the images by blurring them like Gaussian filter but the effect is, unlike Gaussian, blurring of edges is much less and the features of the image are clearly visible. But it doesn’t preserve the edge. Hence, we have used NLM filter to solve this problem. In this paper we have proposed an edge preserving filter. We have designed an algorithm which considers pixel values along a direction in a 3x3 mask. Eight directions have been defined and if the pixel values along this direction have similar values with minor variations, then that region in the image is considered an edge. Thus, edge can be preserved. We have proposed a denoising method for colour images using Adaptive Marginal Median filter. The Adaptive marginal median filter is effective in preserving details

ISSN: 2233-7853 IJFGCN

of the images and it smooths the image. In this paper we have proposed Image Histogram and Fuzzy Method and have used a Median filter to remove high noise levels in images. This method is especially effective for denoising medical images like X-rays, sonography reports, etc. This method is highly effective in removing high-level noise in medical images. To design and develop a system for COVID 19 detection from Chest X-Rays images with the help of Convolutional Neural Networks (CNN) for faster, more informative CT scans, Ability to experiment with new deep learning architects and highly reduced programming time.

II. LITERATURE SURVEY

Some survey analysed that the sensitivity of RT-PCR testing at various tissue sites, bronchoalveolar lavage fluid specimens demonstrated the highest positive rates of at 93% (n = 14). This was followed by sputum at 72% (n = 75), nasal swabs at 63% (n = 5), fibro bronchoscope brush biopsy at 46% (6/13), pharyngeal swabs at 32% (n = 126), feces at 29% (n = 44) and blood at 1% (n = 3). The authors of that study pointed out that testing of specimens from multiple sites may improve the sensitivity and reduce false-negative test results. The letter examined 1070 specimens that were collected from 205 hospitalized patients with confirmed COVID-19 in China. In another study published in Radiology, investigators found chest CT achieved higher sensitivity for diagnosis of COVID-19 as compared with initial RT-PCR from pharyngeal swab samples. This retrospective study analysed 1014 hospitalized patients with suspected COVID-19 in Wuhan, China with patients undergoing both serial RT-PCR testing and chest CT. Using RT-PCR results as reference standard, the sensitivity, specificity, and accuracy of chest CT in diagnosing COVID-19 were 97% (n = 580), 25% (n = 105), and 68% (n = 685), respectively.

III. PROPOSED SYSTEM

Proposed method takes X-Rays Images as input. It processes on input image using median filter. After that it extract the region of interest. Then our deep dense network will look for any symptoms for corona such as glass opacity. If it found any of the trained symptom then it will give result for COVID costiveness. The accuracy of any Deep Network depends on the training dataset. For our model we used normal X-Rays Images from LIDC Dataset [4] and Corona image are taken from web. As there are privacy issues of corona images. Also, in this situation no one is ready to make those dataset public. In Second generation, number of architectures or algorithms is present for classification problem. In other languages we have to start from scratch, but for MATLAB and Python this is another case. Simply calling that function and changing the input argument, you test.

IV. SYSTEM ARCHITECTURE

A breakthrough in building models for Covid-19 X-rays Images classification came with the discovery that a convolutional neural network (CNN) could be used to progressively extract higher- and higher-level representations of the X-Rays image content. Instead of pre-processing the CT image to derive features like textures and shapes, a CNN takes just the CT image's raw pixel data as input and "learns" how to extract these features, and ultimately infer what object they constitute.

ISSN: 2233-7853 IJFGCN

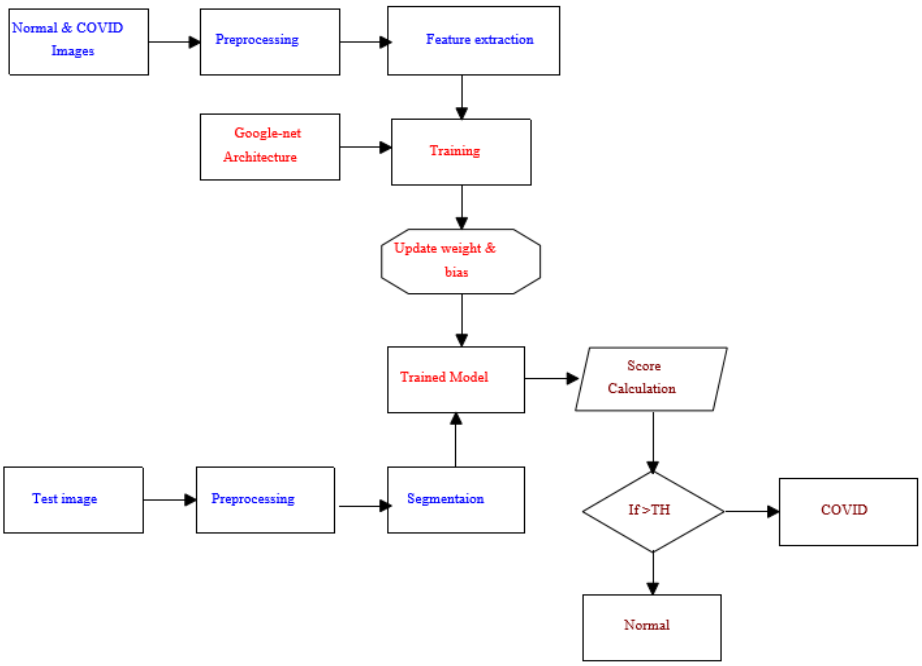

Fig. 1 System Architecture

Proposed method takes X-Rays Images as input. It processes on input image using median filter. After that it extract the region of interest. Then our deep dense network will look for any symptoms for corona such as glass opacity. If it found any of the trained symptom then it will give result for COVID costiveness. The accuracy of any Deep Network depends on the training dataset. For our model we used normal X-Rays Images from LIDC Dataset [4] and Corona image are taken from web. As there are privacy issues of corona images. Also, in this situation no one is ready to make those dataset public. A new artificial intelligence-powered deep learning model will help radiologists to distinguish COVID-19 from community-acquired pneumonia and other X-ray's diseases in chest CT imaging. Proposed model will help with a growing workload to be able to focus on complex clinical cases. With its deep learning algorithms, it automatically highlights abnormalities, segments anatomies. Proposed model gives better accuracy for Dataset. For real time imagery large dataset is needed.

V. RESULT AND DISCUSSION

In covid-19 detection and stage prediction system we have been implemented highly trained model that can accurately recognize diseases. In this system we used Gaussian blur for Gray scale conversion, Otsu's method for binary conversion of images after that we used convex hull for edge detection.

I. Gray scale conversion In Gray scale conversion colour image is converted into a Gray form using Gaussian blur. Colour image containing noise and unwanted background which is removed or blurred by using this method.
II. Binary conversion Gray scale image is given to input for Otsu's method for binary conversion. In Binary form of images converted in 0 and 1 form means black and white.
III.in Edge detection binary image get dimensions by counters using convex hull algorithm. In which eccentricity finding drawing edges around white portion of binary image.

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IV. Training Model In our system we are using tensor flow for extracting features of training dataset. In which 1200 image samples are trained by using training model. Finally plot files generated as an output of our trained model.

V. Testing Model In final phase of data testing in which X-ray's disease and normal X-Rays images were matched by our training model with higher precent of accuracy. After matching all type of disease images respective results of stage and detection display on console and stored in text file as well.

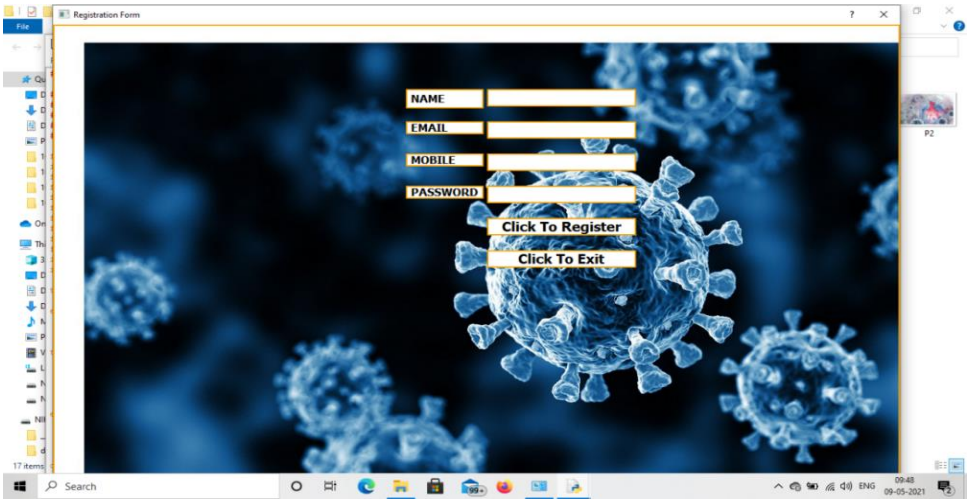

Fig. 2. Signup Screen

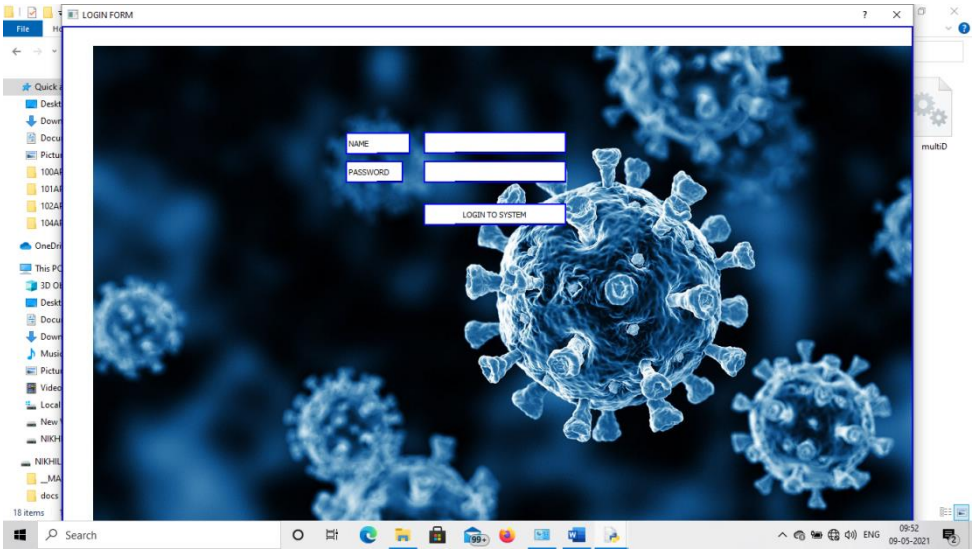

Fig. 3 Login Screen

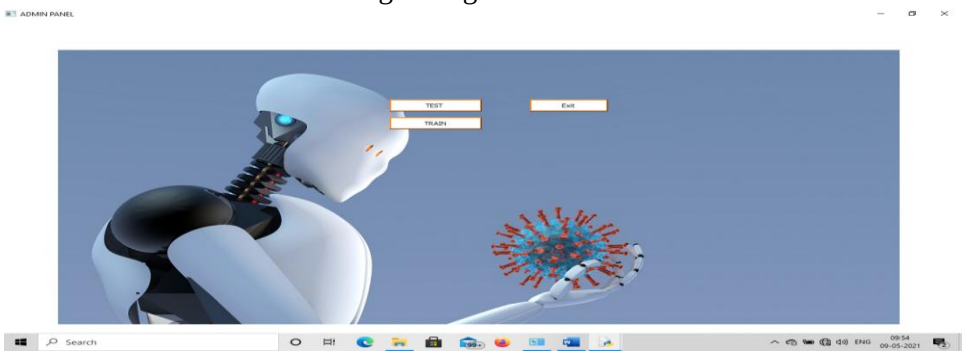

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Fig. 4 Main Screen

Fig. 5 Chest X-Ray Screen

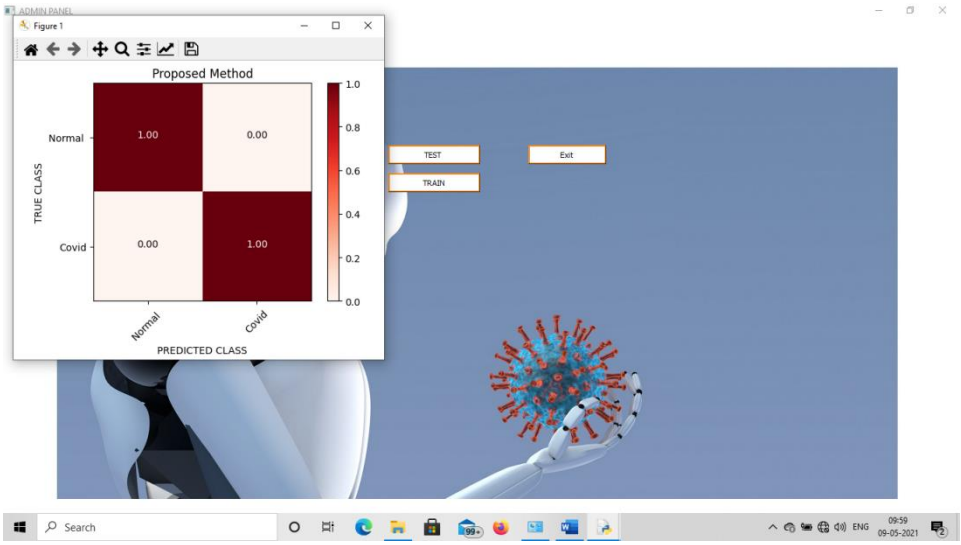

Fig. 6 Accuracy Screen

VI. CONCLUSION

I. Faster, more informative CT scans: Proposed method not only detects the availability of NOVEL CORONA but also it tracks the treatment progress.
II. Ability to experiment with new deep learning architects: In Second generation, number of architectures or algorithms is present for classification problem. In other languages we have to start from scratch, but for MATLAB and Python this is another case. Simply calling that function and changing the input argument, you test.
III. Highly reduced programming time: Due to available built-in commands, design and development time get reduced. With minimal Mathematics behind deep learning, we can design and test various architectures of neural network.

ISSN: 2233-7853 IJFGCN

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ISSN: 2233-7853 IJFGCN