Classification Of X-Ray Of Covid-19, Normal, And Pneumonia Affected Patient Using A Deep Learning Model

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Abstract
SARS CoV-2, the cause of the corona virus illness 2019 (COVID-19), may be found using chest X-ray scans, and this discovery could save the lives of both patients and medical professionals. This is especially more important in nations where it is impossible to buy laboratory kits for testing. In this study, we sought to demonstrate the use of deep learning to chest X-ray images for very accurate COVID-19 identification. Publicly available X-ray images (1583 healthy, 4292 pneumonia, and 225 confirmed COVID-19) were used in the experiments, which involved the training of deep learning and machine learning classifiers. Thirty-eight experiments were performed using convolutional neural networks, 10 experiments were performed using five machine learning models, and 14 experiments were performed using the state-of-the-art pre-trained networks for transfer learning. Images and statistical data were considered separately in the experiments to evaluate the performances of models, and eightfold cross-validation was used. A mean sensitivity of 93.84%, mean specificity of 99.18%, mean accuracy of 98.50%, and mean receiver operating characteristics–area under the curve scores of 96.51% are achieved. A convolutional neural network is able to identify COVID-19 in a small number of unbalanced chest X-ray pictures without pre-processing and with minimal layers.

Keywords: COVID-19, Training, Deep learning, pulmonary diseases, Transfer learning, Manuals, Inspection.

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I. INTRODUCTION

A popular Deep Learning (DL) method for image and document analysis is CNN. C NN has expanded along with recent advances in artificial intelligence (AI), and vice versa. In addition, CNN has already demonstrated impressive results in a variety of real-world applications, including document analysis, face recognition, scene labeling, image classification, action detection, and human posture estimation. CNN has also been successful in solving the medical image classification. This COVID-19 epidemic, which was first identified in December 2019, has been ongoing. It is a potentially zoonotic illness with a 2%–5% death rate. Respiratory droplets larger than 5 to 10 micrometers are involved in the transmission of Covid-19, according to the WHO's scientific brief. Additionally, there is the potential for aerial transmission. Therefore, this disease's growth factor is likewise very high, with estimates of 12.32 million confirmed cases and 0.556 million fatalities worldwide as of July 11, 2020.time-series graph showing the total number of verified COVID-19 cases and fatalities worldwide. The severity of the issue is depicted in this graph. On January 11, 2020, there were only 41 verified instances; by February 11, 2020, that number had nearly a thousand times climbed to 43,109. The number of verified cases increased quickly over the following three months, reaching 4.04 M on May 11, 2020, over 94 times the number on February 11, 2020. Despite taking numerous precautions, such as donning masks and keeping a social distance, the number of infected patients climbed three times over the course of the following two months, reaching 12.32 M on July 11, 2020.We can only hope that as people become more aware, the growth factor will start to decline. It is a matter of hope that the growth factor is decreasing day by day due to mass consciousness. Detecting the COVID-19 positive patients and taking necessary steps accordingly is one of the important aspects of fighting against this global pandemic. WHO listed a few rapid and detailed diagnostic tests for COVID-19 detection including genesis Real-Time PCR Coronavirus (COVID-19) testing and cobas SARS-CoV-2 for use on the cobas 6800/8800 systems.

II. EXISTING SYSTEM

Although rapid point-of-care COVID-19 tests are expected to be used in clinical settings at some point, for now, turnaround times for COVID-19 test results range from 3 to more than 48 hours, and probably not all countries will have access to those test kits that give results rapidly. According to a recently published multinational consensus statement by the Fleischner Society, one of the main recommendations is to use chest radiography for patients with COVID-19 in a resource-constrained environment when access to computed tomography (CT) is limited.3 The financial costs of the laboratory kits used for diagnosis, especially for developing and underdeveloped countries, are a significant issue when fighting the illness. Using X-ray images for the automated detection of COVID-19 might be helpful in particular for countries and hospitals that are unable to purchase a laboratory kit for tests or that do not have a CT scanner.

III. PROPOSED SYSTEM

Over the past ten years, image-based classification applications and regression problems have both benefited from the success of deep learning, which gets its name from the number of its hidden layers. Deep convolutional neural networks (Conv Net, or CNNs) are frequently used, which has allowed image-based applications to reach their peak in the last five years. Generally, pre-processing of images or data was necessary before feeding it to CNNs that attempt to imitate biological characteristics of human beings on computers. But when the Conv Net was first developed, it was explained as a neural network that only needs a minimal amount of pre-processing before feeding images to the network and as a system that can extract features from images to improve the neural network's learning performance. The feature extraction and classification processes are both included in the Conv Net's single network. Convolution, pooling, and fully connected layers make up the three layers of a conventional Conv Net. Applying masks—the process of dividing images into segments with predetermined dimensions and using filters to extract features from the resulting segments—performs feature extraction in the convolutional layer. A pooling operation is performed on the produced feature map to reduce the dimensions of the images. Finally, the feature map is flattened into a vector and sent to the fully connected layer. The fully connected layer is where the neural network converges and categorises input patterns. Its principles, which are used to update the layer's weights, are based on error back propagation.

IV. METHODOLOGY

MODULES

Our task was separated into two halves. We'll talk about data collection and annotation in the first section. Here, we briefly discuss our dataset and pre-processing information. We then used data annotation. There are other approaches to annotating the data, but for our purposes, just three will be briefly explored. Later, a brief overview of YOLOv3 was provided, along with setup environment and additional training technique.

- **Data Acquisition:**

In data-driven approaches like machine learning and deep learning, data is crucial; the more data, the better the outcome. For our YOLO-related study, we also want more data that is properly annotated. However, we are unable to locate any annotated data for our research. We have 650 photos of both masks and no-masks thanks to an internet scraping technique.

- **Data Annotation:**

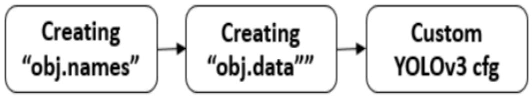
In our assignment, data annotation is also referred to as image annotation. Although the data hasn't been labelled yet, we still need to annotate it thoroughly for our object detection model. Detection problems differ greatly from classification ones. Data must therefore be properly marked. various sorts of annotations were discovered. Bounding boxes are necessary for our investigation.

Mention key characteristics that follow here:

- If only single image present then there is no issue, we just draw box around them (see upper left, right)
- If multiple objects present in a image like mask or no mask, then create bounding boxes both of them. (see down)
- If there are any blurry content present then we have to identify the objects presents here. If we can't identify ignore them.

- **Coding Implementation:**

Here, we separated the entire situation into two sections. The setup of YOLOv3 for our situation will be covered first, and then YOLOv3 will be used.



ALGORITHMS

1) **YOLOv3 Setup:** You look only once, commonly known as YOLO, was introduced in 2015 by Joseph Redmon and colleagues. Later, they received some upgrades, and in 2016 and 2018[21], respectively, YOLOv2 and YOLOv3 were released. The most recent version of the YOLO and YOLOv2 object detection models, YOLOv3, is now the industry standard. Amazing results in terms of object classification and detection have been obtained. Yolov2's Darknet-19 was employed as a feature extractor in an earlier version. Yolov3 made several tweaks and improvements, and they gave it the name "darknet-53." Darknet is a training platform for neural networks implemented in the C programming language that excels at these tasks. We need to discuss a few actions before working with this architecture, such as creating a "obj.names" file that contains the name.
2) **Applied YOLOv3:** Joseph Redmon and others presented You only look once, or YOLO, is a common phrase in 2015. Later, they received some upgrades, and in 2016 and 2018[21], respectively, YOLOv2 and YOLOv3 were released. Today, YOLOv3 is Here, an image is provided as input to the YOLOv3 model. This object detector scans the image to locate the coordinates that are visible there. In essence, it separates the input into a grid and uses that grid to

examine the properties of the target objects. The features that were recognised with a high degree of confidence from nearby cells are combined in one location to provide model output. The first image demonstrates how the image was actually divided into a grid. Next shows how it's find the features and last shows the detected object.

3) **CNN Modelling:** CNN has been really helpful in categorising photographs, particularly those that are medical-related. This has created new doors for opportunity and greatly improved the simplicity of illness detection. Additionally, it more accurately and successfully detects recent new coronaviruses. A small dataset for model training is one of the limitations that researchers face. Being a novel disease, the chest X-ray dataset of COVID-19 positive patients is also limited.

This model has 4 main components:

i. Input layers
ii. Convolutional layers
iii. Fully connected layers and
iv. Output layers.

The tuned data set is fed into the input layers of the model. This model is trained on 165 X-ray images of each category: normal and COVID-19. It has four convolutional layers, first one is a 2D convolutional layer with 3×3 kernels and Rectified Linear Unit (ReLU) activation function. ReLU is one of the most popular and effective activation functions that are being widely used in DL. ReLU does not activate all the neurons at the same time making it computationally efficient in comparison to other activation functions like tanh. The next three layers are 2D convolutional layer along with the ReLU activation function and Max pooling. Max pooling accumulates the features of the convolutional layer by convolving filters over it. It reduces the computational cost as it minimizes the number of parameters thus it helps to avoid overfitting. In each of three layers a 2×2 Max pooling layer is added after the convolutional layer to avoid overfitting and to make the model computationally efficient. In the next step of the model, the output of the convolutional layers is converted to a long 1D feature vector by a flatten layer. This output from the flatten layer is feed to the fully connected layer with dropout. In a fully connected layer, every input neuron is connected to every activation unit of the next layer. All the input features are passed through the ReLU activation function and this layer categorizes the images to the assigned labels. The Sigmoid activation function makes the classification decision depending on the classification label of the neurons. Finally, in the output layer, it is declared if the input X-ray image is COVID-19 positive or normal.

V. RESULTS

Fig 5.1 URL generated by our program which loads our website. Fig 5.2 Main page of our website which loads after the URL is pasted.

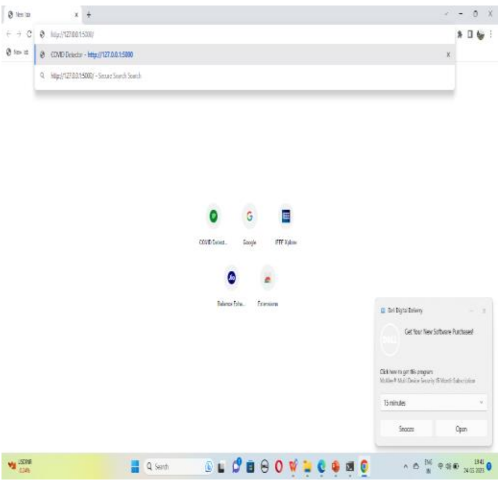


Fig 5.1 client website

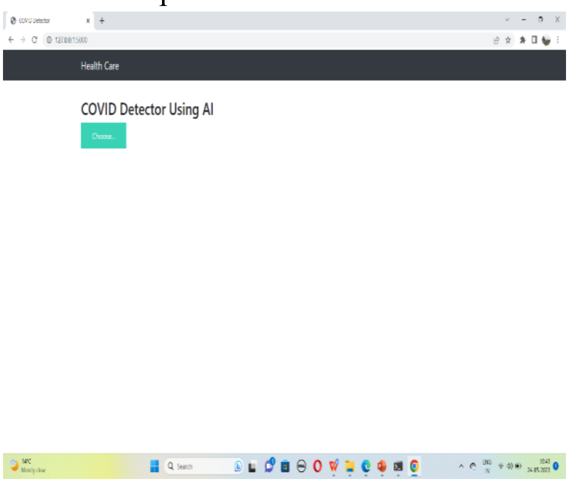


Fig 5.2 client main page after pasted

Fig 5.3 Page loads there opens a dialog box which contains all the X-ray images, Fig 5.4 Choose an other X-ray which predicts and gives result as(Covid).

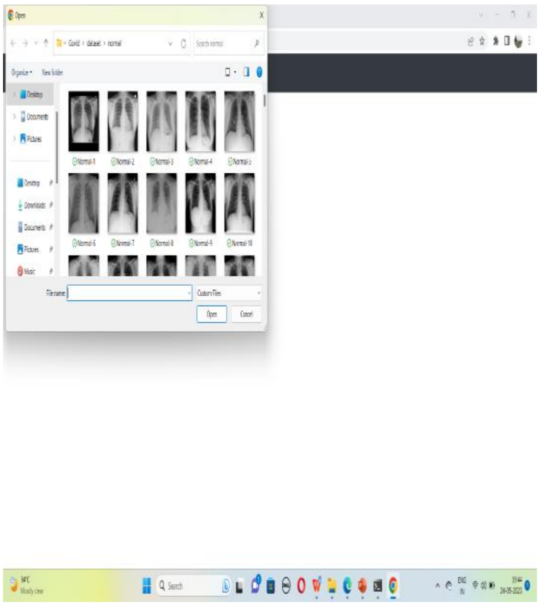


Fig 5.4 Dialog box X-Ray image

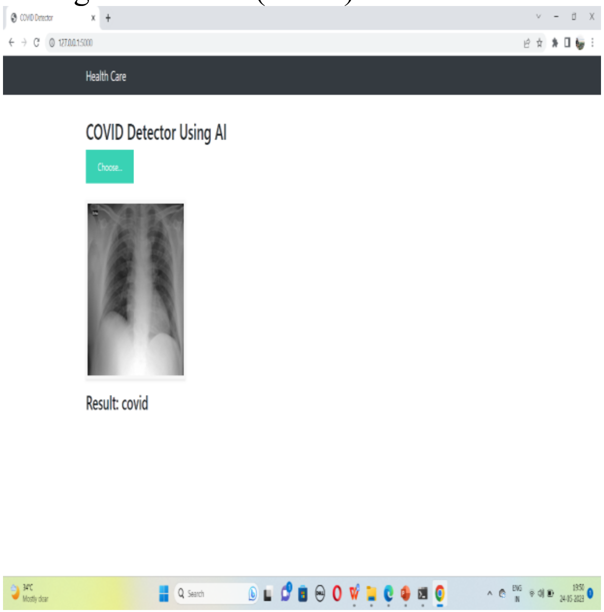


Fig 5.5 Covid X-Ray Result

VI. CONCLUSION

The latest global epidemic can be stopped in its tracks by mass testing and early COVID-19 diagnosis. The three main considerations in any disease detection procedure, particularly COVID-19, are speed, expense, and accuracy. In order to solve these problems, a CNN-based model for identifying COVID-19 cases in patient chest X-rays is proposed in this study. The analysis is conducted using 330 chest X-ray pictures that are evenly divided into the COVID-19 and "Normal" classes.setting up the model. For the model's validation, 82 chest X-rays are divided equally into a set of images. This model performs with 97.56% accuracy and 95.34% precision, respectively. Additionally, two alternative CNN models with a different number of convolutional layers are contrasted with this one. The comparative analyses reveal that the proposed model (Model 1) performs better overall than the other two in terms of F1-score. With access to the larger dataset, this model can be significantly enhanced. Therefore, CNN has excellent chances of detecting COVID-19 with a minimum of effort, expense, and time. The proposed model has promising results, but it has not been put to any sort of clinical test. For this model to be useful in clinical diagnosis, more advancements and clinical testing are required.

VII. FUTURE SCOPE

In this method, if doctors are unable to see details in the image that are not visible to the unaided eye, they may receive assistance. According to this study, COVID-19 may be found in chest X-ray images by employing machine vision. The features collected from X-ray images using the histogram oriented gradient (HOG) and convolutional neural network (CNN) were integrated to produce the classification model by the training of CNN (VGG Net). Modified anisotropic diffusion filtering (MADF) was used to enhance edge retention and reduce noise in the images. A watershed segmentation method was used to identify the main fracture zone in the unprocessed X-ray data. During the testing phase, generalised data were used to evaluate the model's performance.

VIII. REFERENCES

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