
COVID-19 DETECTION USING CHEST X-RAY

Shweta Gaikwad^{*1}, Pallavi Karde^{*2}, Vaibhav Maindad^{*3},
Kaustubh Pawar^{*4}, Prof. Sumit Harale^{*5}

^{*1,2,3,4}BE Student, Department Of Computer Engineering, Indira College Of Engineering And Management, Pune, Maharashtra, India.

^{*5}Professor, Department Of Computer Engineering, Indira College Of Engineering And Management, Pune, Maharashtra, India.

ABSTRACT

Covid-19 is discovered in 2019. No one knows the origin of this virus. Infection rate of the virus is very high. The whole world suffers from it. In the beginning, cases were low, but they increased, and WHO had to declare the pandemic. The virus spread all over the world and very high number of cases started to show. The pandemic was horrible. Lots of people are affected due to this. At the beginning of the pandemic, there wasn't a proper testing procedure to detect the infection of the patient. It caused lots of confusion among the people. To prevent the infection people had to take preventive measures and had to get quarantined even though you are not infected, which caused lots of problems. The RT-PCR test is used for checking the infection. But this test 2-3 days for detection. And there were millions of testing cases, so it took a lot more time to give results to the patients. There was another problem that is false positive or false negative reports. People got this kind of report and got the wrong medication. To confirm the report doctor recommended a CT scan of the chest to detect the infection. But CT scan is high in cost. Not every person has that kind of money. Also, not every hospital has a CT scan device. But there is another way to detect the infection and that is through x-ray. X-ray is cheap and almost every hospital has an x-ray machine. In this paper we have proposed the system, which uses deep learning method. In this system, we are going to use chest x-ray images to predict the infection. In this system, the user will get the result in a few seconds.

Keywords: Covid-19, X-Ray, AI, Deep Neural Network, Resnet, VGG16, CNN.

I. INTRODUCTION

Covid-19 is discovered in 2019. No one knows the origin of this virus. The virus was spread throughout the world. The whole world suffers from it. In the beginning, cases were low, but they increased, and WHO had to declare the pandemic. The pandemic was horrible. Lots of people are affected due to this. A lot of people suffer from lung failure. At the beginning of the pandemic, there wasn't a proper testing procedure to detect the infection of the patient. It caused lots of confusion among the people. To prevent the infection people had to take preventive measures and had to get quarantined even though you are not infected, which caused lots of problems. But this test takes 2-3 days for detection. And there were millions of testing cases, so it took a lot more time to give results to the patients. There was another problem that is false positive or false negative reports. People got this kind of report and got the wrong medication. To confirm the report doctor recommended a CT scan which is high in cost. Alternate way to detect the infection is through x-ray. In this paper we are proposing a system which will use X-ray to predict COVID_19 infection. We are going to use CNN (Convolutional neural network), ResNet (residual neural network), and VGG-16 and transfer learning. Our system will detect the infection spread in the lungs through a chest x-ray which the user will provide. Then the given image will process through the model and give the result. There will be three types of results COVID19-positive, COVID19-negative, and viral pneumonia.

The covid dataset will be divided into two different parts. The training dataset and testing dataset. Meanwhile, the dataset will be cleansed. In which image will get sharpen for training. In the next phase, data will be preprocessed after the preprocessing of the data-specific features of the covid infections will be extracted. This process is done on the training and testing of both datasets. These pre-trained models will be used for COVID-19 prediction. The proposed system will predict the infection is present or not.

II. LITERATURE SURVEY

The paper Automatic detection of COVID-19 from chest radiographs using deep learning written by M.K. Pandit, S.A. Bandy, R. Naaz, M.A. Chishti showed that we can use chest radiograph for the covid detection [10]. They made an automated system to process the data and infection detection. Deep learning convolution neural networks and transfer learning is used in it. They used a VGG-16 network for covid detection. VGG-16 is a 16-layer convolutional neural network. It has 13 convolutional layers along with 3 fully connected layers. It also contains 5 max-pooling layers. VGG-16 is quite slow to train and acquire a lot of disk space, which makes it very inefficient. The total number of parameters used is 134,268,738. Accuracy claimed by the author for 2-class is 96% and for 3-class is 92%.

Worapan Kusakunniran proposed that we can use chest X-ray and generate heat map for covid detection. They used Res-Net-101 architecture. The entire network is trained using 1500×1500 x-ray images [11]. The heatmap of the segmented lung is constructed to visualize signals of COVID-19 in each input x-ray image. Lungs are segmented using the pretrained U-Net. The confidence score of COVID-19 is also calculated for each classification result. In this paper, the authors have used the RESNET-101 network. Very deep neural network (101 layers) and the number of parameters is around 44 million. Better accuracy (for 3 classes) but very heavy network.

In the paper SOM-LWL method for identification of COVID-19 on chest X-rays written by Ahmed Hamza Osman, Hani Moetque Aljahdali, Sultan Menwer Altarrazi, Ali Ahmed [12]. They used the SOM-LWL algorithm to detect covid infection. They detected covid-19 pneumonia infection in the lungs using a chest X-Ray. In this paper, the authors have used the SOM-LWL algorithm (instance-based algorithm). In this case also classification costs is high, and a large amount of memory is used to store the data. Better accuracy is achieved for 3 class classification (97%).

III. METHODOLOGY

We used CNN, RES-net, VGG-16, and transfer learning. With the help of these models, we will be predicting user has a covid infection or not. The covid dataset will be divided into two different datasets training dataset and testing dataset. Aim of the project is to classify the images in to three types ie. COVID-19, Normal and Viral infection. The dataset will be cleansed. In which image will get cleared and sharp for training. In the next phase, data will be preprocessed after the preprocessing of the data-specific features of the covid infections will be extracted. This process is done on the training and testing of both datasets. After that machine learning classification or models will be run. The models we are using are CNN, ResNet, VGG-16. After the classification result will be predicted.

IV. MODELING AND ANALYSIS

System Architecture

The proposed system is shown in Fig. 1. It has 3 modules explained as follows:

1. Database and GUI: We downloaded the database from kaggle. Then we uploaded that database to our system for training and testing purpose. Our system contains 3 webpages. First is home, in home page there is a button named detect covid user have to click that button to upload the image. Second is upload image, in this page user have to upload x-ray image from their system and have to click on submit to get result. And third is result page, on this page user will get the result of their x-ray image.

2. Preprocessing and model training: Before accepting the image from user we trained our models and downloaded them to use as the backend to predict the user images. After accepting the image from user preprocessing is done in the backend. In this process image augmentation, resizing, image cleansing, etc., are implemented.

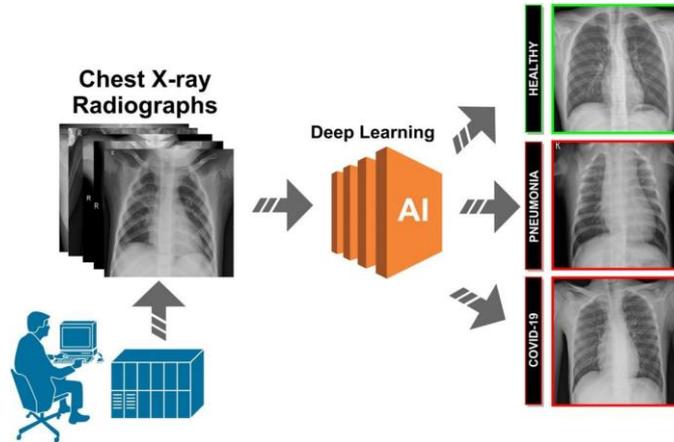


Figure 1: System Architecture.

3. **Output:** After accepting image from user and preprocessing, image goes through pre trained models. The predictions of all three models will be further processed by average polling method to give final output.

V. RESULTS AND DISCUSSION

We have taken up three different model for study in this paper. These models are CNN, Resnet and VGG-16. We have trained these models on the images in our datasets. The training and validation results indicating accuracy, F1-score are given Fig. 2,3 and 4.

	precision	recall	f1-score	support
0	0.81	0.95	0.88	616
1	0.99	0.93	0.96	2170
2	0.87	0.95	0.91	244
accuracy			0.93	3030
macro avg	0.89	0.95	0.91	3030
weighted avg	0.94	0.93	0.94	3030

Figure 2: Classification table for CNN.

	precision	recall	f1-score	support
0	0.90	0.95	0.92	723
1	0.97	0.98	0.97	2038
2	0.98	0.70	0.82	269
accuracy			0.95	3030
macro avg	0.95	0.88	0.90	3030
weighted avg	0.95	0.95	0.95	3030

Figure 3: Classification table for Resnet.

	precision	recall	f1-score	support
0	0.63	1.00	0.78	723
1	0.99	0.80	0.88	2038
2	0.96	0.90	0.93	269
accuracy			0.85	3030
macro avg	0.86	0.90	0.86	3030
weighted avg	0.90	0.85	0.86	3030

Figure 4: Classification table for VGG-16.

These pretrained models are individually used to do the prediction of the image. The predictions of these models will be average polled to give final output. With average polling variance in the results will be reduced.

FINAL OUTPUT

The final output of the system is given in Fig.5. It shows the uploaded image and the percentage chances of the person infected with COVID-19, Viral pneumonia or the person is Normal.

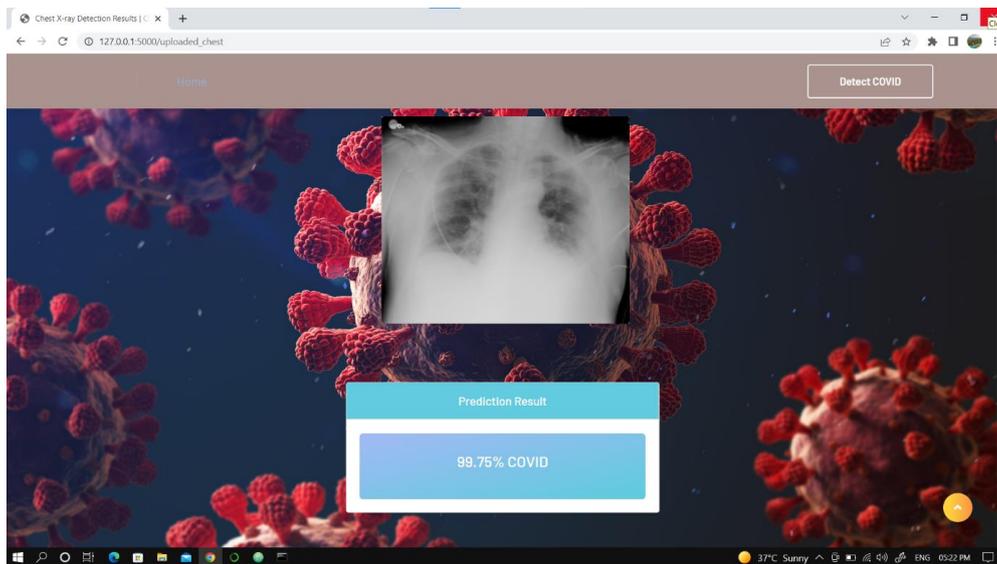


Figure 5: Final output of the system.

VI. CONCLUSION

We used the deep learning model to detect COVID19 using chest x-rays. Three different models are trained independently on our dataset. These pre-trained models are independently used to predict uploaded image on our system. Predictions obtained by all three models are averaged to give final prediction output. The study shows the effective method of non-human-contact testing on COVID-19 patients, which can help in early and low-cost detection of COVID cases.

VII. REFERENCES

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