ANALYSIS OF X-RAY IMAGES FOR COVID-19 USING CNN

A

Project Report

Submitted for Partial Fulfilment

of B.Tech. Degree

In

Information Technology

By

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May 2022

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Declaration

We hereby declare that this submission is our work and that, to the best of our belief and knowledge, it contains no material previously published or written by another person or material which to a substantial error has been accepted for the award of any degree or diploma of university or other institutes of higher learning, except where the acknowledgment has been made in the text. The project has not been submitted by us at any other institute for the requirement of any other degree.

Submitted by: Date: 31.05.2022

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CERTIFICATE

This is to certify that the project report entitled “Analysis of X-ray images for Covid-19 using CNN” presented by Ananya and Ameya Srivastava, in the partial fulfillment for the award of Bachelor of Technology in Computer Science and Engineering, is a record of work carried out by the under my supervision and guidance at the Department of Computer Science and Engineering at Institute of Engineering and Technology, Lucknow.

It is also certified that this project has not been submitted to any other institute for the award of any other degrees to the best of my knowledge.

Dr. Tulika Narang

Department of Computer Science and Engineering

Institute of Engineering and Technology, Lucknow

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Prof. Y N Singh

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ACKNOWLEDGMENT

We wish to thank everyone who contributed and supported us in our project work. Our deep bow of gratitude begins with Prof. Y N Singh, whose continuous guidance and critical, constructive feedback has not only enhanced our work but also developed our analytical and writing skills. We are duly thankful to Dr. Tulika Narang for her input in improving the quality of our work. We reserve a special place for our advisor, Promila Bahadur, for her enthusiastic encouragement and continuous advice. We express our heartfelt gratitude to her for her compassion and unwavering confidence in us. Thanks to the project supervisor who invested their time in guiding the team to achieve the goal. We have to hold a high estimation of all other supervisors as well as panels, especially in our project presentation that has improved our presentation skills cherish to their comments and advice.

ABSTRACT

COVID-19 cases have shown a rising trend in the country primarily due to the emergence of mutant variants of omicron, which have a high degree of transmissibility. Aggrandize by normal routine and relaxation of mask mandate and social pandemic norms in many states, the ability of mutant variant increases. Raising cases of Covid-19 and shortage of durable and less timeconsuming testing devices mark the new beginning of X-ray analysis using machine learning techniques. The emergence of the Covid-19 virus has a hazardous impact on human life. Therefore, it is the need of time to find an effective and faster way to detect the Covid-19 virus in the patients.

The standard RT-PCR (Real-Time reverse transcription–Polymerase Chain Reaction) method is considered the reference method. This project aims to develop an automated system that analyses the X-ray images using CNN for a robust and efficient way to diagnose Covid-19 infection. The developed model preprocesses the X-ray image using image processing techniques. Later the image segmentation is done along with image transformation and to classify it using deep learning. The utilized model of CNN returns a good classification accuracy near 90%.

The convolution neural network, we have designed for our model uses the standard dataset available from the University of Waterloo.

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CHAPTER 1

INTRODUCTION

Information technology is plethoric to serve holes in the safety net for all the frontline workers who have worked day and night to serve humankind in all possible ways. We are talking about doctors, nurses, and health workers. We are at a time of dark clouds of glass half empty where the domain will maintain body chemistry that is distinctly different from masses. With prelude bestow we harbinger preliminary test for COVID-19 which can ostensibly detect Covid-19 cases from image classification by radiology [2]. With the timorous increasing Covid-19 rate, we need to find out a constructive and efficacious way to diagnose the Covid-19 virus.

Radiology deals with the branch of medicine that deals with gleaming energy used to detect and provide a meaningful cure for the treatment of disease. Artificial Intelligence and Data Science have always excelled in every field beyond expectations and served every purpose beyond exceptional results. So it has now been considered to use in the field of clinical uses also. We already have significant development in brain tumors, and other heart diseases fields' prediction area.

Therefore, our project highlights the concept of using artificial intelligence for predicting the Covid-19 patients. There are several models to perform transfer learning e.g.: VGG, ResNet and Xception, etc. We have used ResNet for our model. The dataset used is publicly available from the University of Waterloo and consists of 3000 images of Covid-19 positive and negative chest X-ray images. Imbibing new life to old fears with great alacrity digging deep into the palliative curing power of radiology of COVID–19, targeted towards the specific task to detect the Coronavirus through the digitally scanned chest X-ray image of a suspicious individual.

The Artificial Neural network is implemented with the help of a convolution neural network and trained with the available dataset. Developing new jargon for our journey of the progress we have used the basic understanding of the CNN network and thus implemented it successfully as per our goal and requirements in the field of radiology [3]. There is two main task exception or we can say challenge while implementing any CNN model in real life which is basically in most cases the availability of a small dataset and over-fitting of the model. Therefore, we have tried to minimize it as much as possible as our dataset is comparatively huge to train a model very well. The model accuracy portrays that the model is not ill-fitted.

The model has been successful to learn spatial and other features of the images by using the concept of backpropagation. We have done an evacuated effort to exempt something extraordinary. As we head out of this pandemic, we can transform to take a leaf out of the playbook. Our laudable goal towards radiology detection through CNN fulfills the holes in the safety net with an embarked positive aspect.

CHAPTER 2

LITERATURE REVIEW

This chapter gives an insight from various studies that have been conducted by different researchers, and it explains the terms used concerning the CNN model we have used for Covid-19 detection and classification. The chapter aims to portray the present status along with the history of the problem to be addressed.

Artificial intelligence and data science have always excelled in every field beyond expectations and served every purpose beyond exceptional results. So it has been considered to use in the field of clinical uses also. We already have significant development in brain tumors, and other heart diseases fields' prediction area. Therefore, our project highlights the concept of using artificial intelligence for predicting the Covid-19 patients. There are several models to perform transfer learning e.g. VGG, ResNet and Xception, etc. We have used ResNet for our model. The dataset used is publicly available from the "University of Waterloo" and consists of 3000 images of Covid19 positive and negative chest X-ray images. Imbibing new life to old fears with great alacrity digging deep into the palliative curing power of radiology of COVID–19, targeted towards the specific task to detect the Coronavirus through the digitally scanned chest x-ray image of a suspicious individual. The Artificial Neural network is implemented with the help of a convolution neural network and trained with the available dataset. Developing new jargon for our journey of the progress we have used the basic understanding of the CNN network and thus implemented it successfully as per our goal and requirements in the field of radiology. There is two main task exception or we can say challenge while implementing any CNN model in real life, which is in most cases the availability of a small dataset and over-fitting of the model. Therefore, we have tried to minimize it as much as possible as our dataset is comparatively huge to train a model very well. The model accuracy portrays that the model is not ill-fitted.

The model learns the spatial and other features of the images using the concept of backpropagation. If we dig deeper into the matter and become a little more specific, we then tested the performance of the model in every possible severe condition and we have also tested how well the model can perform the process of transform learning for our CNN model to perform well. Finally, we merged the two datasets and performed 10- fold cross-validation to investigate the effect of the size of available data on accuracy, precision, and recall. The experimental evaluation demonstrated the potential of building diagnostic tools for automatic detection of COVID-19 positive cases from chest X-ray images and deep convolution neural networks and the development of larger and clinically standardized datasets would further help in this direction. We have taken the entire dataset and then split it up into training, testing, and validation parts. We have split it up in the ratio of 40:40:20 and then used the training dataset to make the model learn about the features and then the testing dataset is used to test whether the model is working fine in extreme situations or not. We have done intense pre-processing of the image before that so that our model performance would be high enough.

Liu F et al., stated that the Convolution Neural Network has always been dominant in all image-related prediction tasks as it learns the features of the images thoroughly and efficiently [5]. So, it is used extensively in the field of Computer vision, where the artificial agent is made to perceive the information from the real world same as the human eye and brain do. The CNN architecture consists of various layers we say the first layer is the convolution layer, then the pooling layer, the biases, and other various building block chains. CNN has a wide variety of applications in the radiology field, which involves studying the light emergence from the organs of the body. As we are very much familiar with the advantages, disadvantages, and the usage of the CNN, it allows us to extract the best performance out of it and complete potential from it, which ultimately fulfills the goal to enhance the performance and the accuracy of our model as a whole and hence becoming the superior among all other ways. It can be seen that CNN is now been used in almost every other field related to image prediction tasks and has achieved phenomenal results in all fields especially the medical-related fields to enhance patients' healthcare value.

The model is well built only when the data provided to the model is accurate and of higher information value. Many a time the numerical large value of the dataset only gets to loss of memory and does not provide any meaningful information to the model and the model collapses as the result of it or gets under fit or over fit, and both are highly undesirable in any of the cases.

Yasaka and Haung have stated that the convolution neural network, which is a class of Artificial Neural networks typically, shows an extraordinary beyond human intelligence performance in the tasks related to the image in the fields of computer vision and image processing [3]. The presently existing areas of CNN implementations include the prediction, classification tasks Image Classification, Object Detection, Video Processing, Natural Language Processing, and Speech

Recognition. CNN has enormously high power in learning and extracting the features from the current image being displayed as the input and mapping it to the correct output class. The power comes from so many internal hidden layers that also involve the process of backpropagation and learning the complex features as well. The larger the quality dataset available to the model for training the higher the performance achieved. There are many researchers working day and night to even bring more advancement to the already advanced CNN by using the appropriate activation function, optimizing the parameters, reducing the value of loss function as much as possible, regularization, and other innovations related to the typical architecture of the CNN.

It's a worthy point to note that the idea to extract the spatial and only meaningful information from the input sample data to make to model learn leaving behind the useless information to reduce the complexity of the model to learn and work efficiently has now gained substantial attention [6]. Similarly, we can also say that the concept of using linked blocks of layers as a fundamental discrete unit is also taking the light in the current days. There are quite a few surveys that tell to focus on the intrinsic taxonomy, which is contained in the typical CNN working. Hence, we can simply classify the current innovations in the current CNN infrastructure into seven basic domains. These seven categories broadly rely upon spatial exploitation, width, feature-map exploitation, depth, multi-path, channel boosting, and attention. In addition to it the basic understanding of the components, the typical challenger involved is also studied and applications are examined thoroughly. Therefore in a nutshell we can say that it will be best suited to use the CNN model for our project which contains valuable information and uses the process of transfer learning using ResNet and hence getting the desired outcome and providing the betterment to the society as a whole.

CHAPTER 3

METHODOLOGY

3.1 CONVOLUTIONAL NEURAL NETWORK

Convolutional Neural Networks also known as CNNs or ConvNets, are a type of feed-forward artificial neural network whose connectivity structure is inspired by the organization of the animal visual cortex. Small clusters of cells in the visual cortex are sensitive to certain areas of the visual field. Individual neuronal cells in the brain respond or fire only when certain orientations of edges are present. Some neurons activate when shown vertical edges, while others fire when shown horizontal or diagonal edges. A convolutional neural network is a type of artificial neural network used in deep learning to evaluate visual information. These networks can handle a wide range of tasks involving images, sounds, texts, videos, and other media.

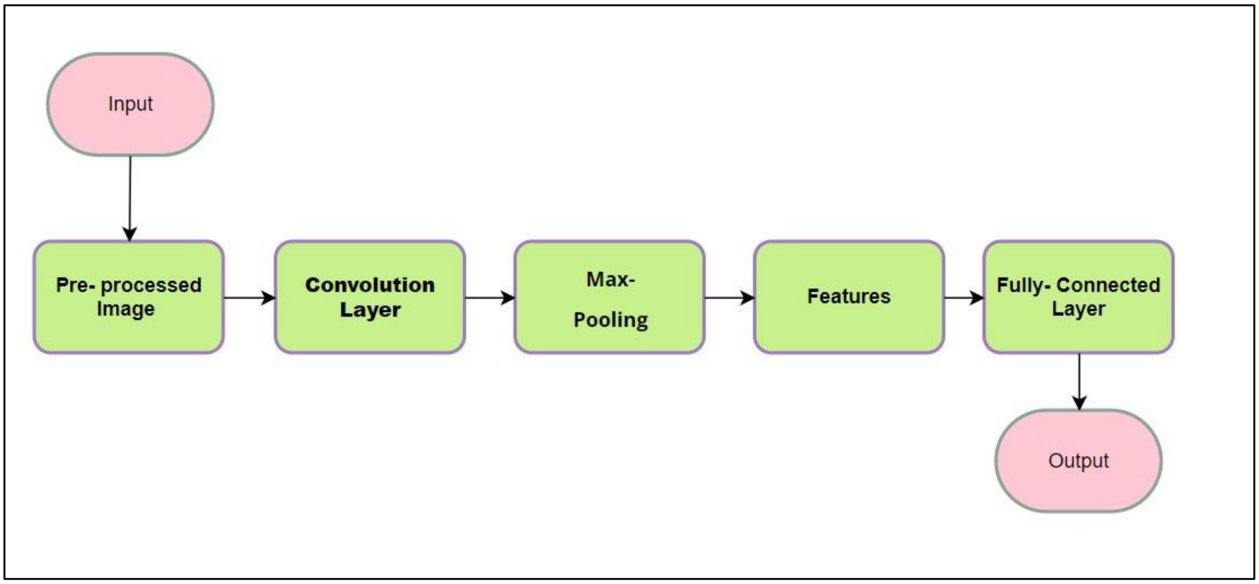


Fig. 1 Layers of CNN

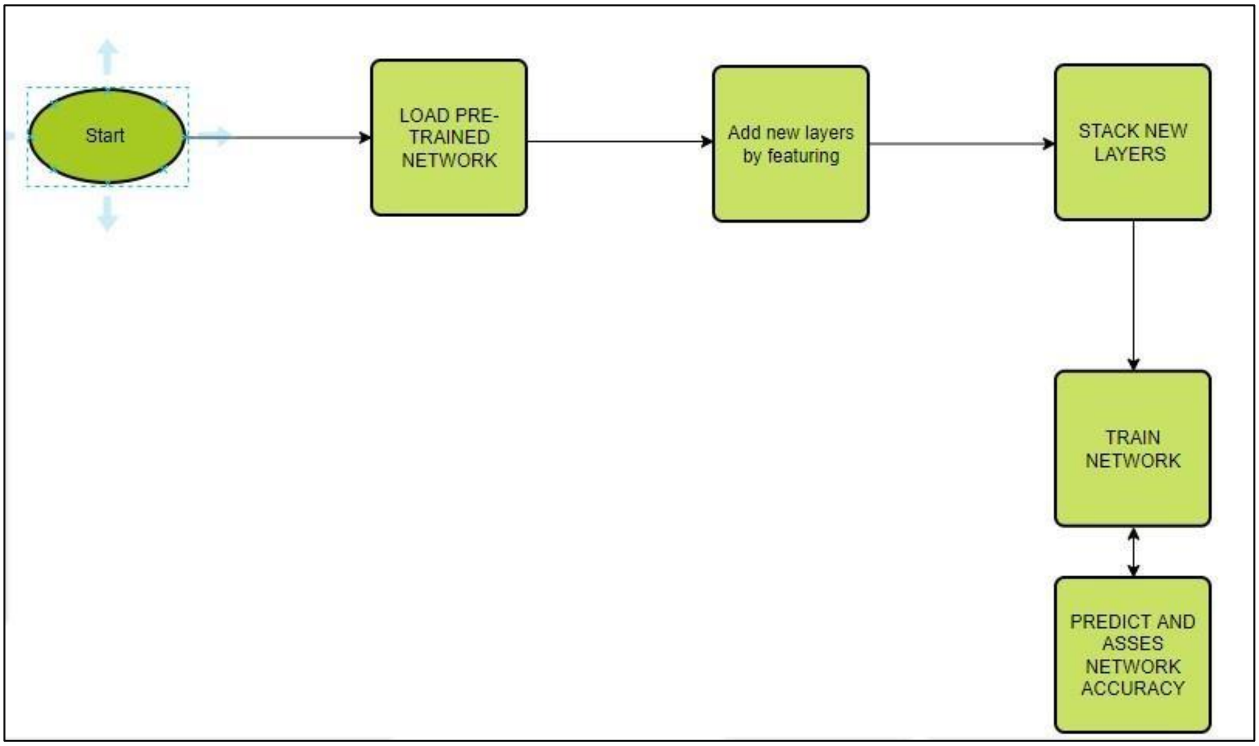


Fig. 2 Stack new layers in the neural network

We can define convolution as the process, which consists of using a filter and sampling it over the image and hence used to extract only the desired information from the image while removing or we can say filtering the other with the use of kernel. If we say that image is represented in pixels in the form of a matrix then the filter is also represented as a matrix and moved through the entire image matrix covering the entire row at once and then increasing the column value by the desired unit each time, basically hovering it over to the image, this is also known as a stride. The next step typically involves the multiplication of the image as a matrix to the weighted matrix filter each time along the rows and incrementing the unit value of the column. When we reach the ending of a particular row, we hover the filter to the next row incrementing it by one.

When this operation is performed, we will get a filtered output image, which has the size that can be given by the formula:

$$\text{Output width} = (W - F_w + 2P) / S_w + 1$$

$$\text{Output Height} = (H - F_H + 2P)/S_H + 1$$

W: width

H: height

F_W: Filter width

F_H: Filter Height

P: Padding

3.2 MODEL FOR COVID-19 DETECTION

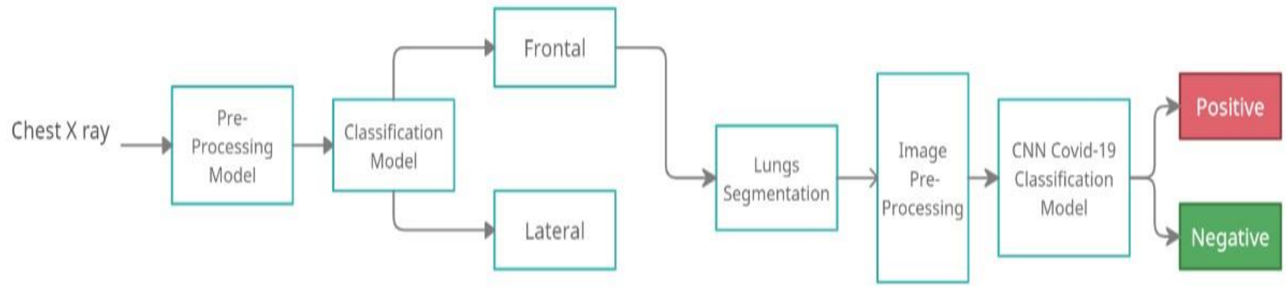


Fig. 3 Schematic of Covid-19 detection system using CNN

We use a convolution neural network (CNN) to process the X-ray images and analyze the information for the detection of Covid-19 infection.

The proposed system involves a pre-processing of the X-ray image. It consists of three steps those are resizing all images to standard pixels l (grayscale), normalization of the dataset to avoid irregularities and at last applying standardization. Then in the next step, we will remove the surroundings, which did not offer relevant information for the task and may produce biased results; after this initial stage the classification model i.e., the chest X-rays has a label corresponding to the image projection: frontal (poster anterior and ante posterior) and lateral. This model will allow us to filter images efficiently and keep the frontal projection images that offer more information than lateral images. Following the next stage, we will be applying the process of segmentation on the lungs to extract the detailed and accurate information from the X-ray and concentrate only on the relevant details. Going towards the next stage, we are going to apply the digital image preprocessing steps like image rescaling, dilation, and erosion to the image to make it an appropriate input to the final classification model. The processed image is now provided as the input to the Convolution Neural Network classifier model, which is going to classify the image based on its learning from the training datasets, and thus it finally gives the outcome as positive or negative.

In medical image analysis, classification with deep learning usually utilizes target lesions depicted in medical images, and these lesions are classified into two or more classes. For example, deep learning is frequently used for the classification of lung nodules on computed tomography (CT) images as benign or malignant [7]. For lung nodule classification, CT images of lung nodules and their labels (i.e., benign or cancerous) are used as training data. The training data where each datum includes an axial image and its label, and the training data where each data includes three images (axial, coronal, and sagittal images of a lung nodule) and their labels. After training CNN, the target lesions of medical images can be specified in the deployment phase by medical doctors or computer-aided detection (CADe) systems [8]. In this section, we first detailed the architecture of the proposed model. Next, we present a procedure followed by our method based on the transfer learning technique for the image pre-processing classification task dataset. Finally, we discuss the effect of one of the hyper parameters of a deep neural network in our model.

A- Pre - Requirements:

- Deep learning
- Convolution Neural Network
- Digital Image processing
- OpenCV: Image Preprocessing
- Django: Python Framework for backend
- Tesseract : Text Extraction
- Javascript: For Front End

B- Procedure followed for X-Ray Detection

Image Preprocessing from inputs derived from test results

The very first step includes the pre-processing of the chest X-ray image which we are going to provide as the input where we are going to apply various digital image pre-processing steps to make the image suitable for the models to generate optimal results [1]. Now in the next step, the X-rays consist of two views the frontal and the lateral we know that the lateral view consists of very little information, and thus we are going to discard those images, and hence the classifier is going to classify and produce the frontal images as the output.

Extracting Information from inputs

In the preceding step, Lung segmentation is to be performed which is going to remove all the information from the image which is not necessary for the model to make the prediction, and then, only with the images that pass as frontal from the previous stage[7]. To enhance the accuracy of the prediction a deep learning classification model will be used to predict COVID-19 positive and negative cases for the same chest X-ray in two ways:

- In variation I, the datasets passed through the classification without lung segmentation.
- In variation II, we will be using the segmented images, obtained by multiplying the mask by the original processed image, and then passing it through the CNN classifier model.

Segmentation Stage

These variations will allow us to assess the importance of the segmentation stage, by giving the model full or partial information and analyzing which part of the images contributes to the prediction. Thus, we will get the output from the model as a positive or negative label.

C - Classification Stage

Finally the segmented image is supplied as an input to the CNN model which classifies the image as subject is infected or not.

D - Effect of Hyper parameters on our Model

Although several methods facilitate learning on smaller datasets as described above, wellannotated large medical datasets are still needed since most of the notable accomplishments of deep learning are typically based on very large amounts of data. Unfortunately, building such datasets in medicine is costly and demands an enormous workload by experts, and may also possess ethical and privacy issues [2]. The goal of large medical datasets is the potential to enhance generalizability and minimize overfitting, as discussed previously. In addition, dedicated medical pre-trained networks can probably be proposed once such datasets become available, which may foster deep learning research on medical imaging, though whether transfer learning with such networks improves the performance in the medical field compared to that with ImageNet pretrained models is not clear and remains an area of further investigation.

Our model for image classification is based on deep convolution neural networks.

1. Input: Input the images from the data set by the University of Waterloo having a collection of images labeled by classification tags – called a training set.

2. Learning: In this step, we use the training set to learn for predictable inputs- a step called learning a model.

3. Evaluation Classifier is used to predict the classification of images that are labeled and eventually evaluate the quality of the classifier.

We compare the labels predicted by the classifier with the result obtained and judge the input the classification is true or not.

1. Dataset Evaluation and information extraction

The very first step includes the pre-processing of the chest X-ray image which we are going to provide as the input where we are going to apply various digital image pre-processing steps to make the image suitable for the models to generate optimal results [5]. Now in the next step, the X-rays consist of two views the frontal and the lateral we know that the lateral view consists of very little information, thus, we are going to discard those images, and hence the classifier is going to classify and produce the frontal images as the output.

2. Extracting Information from inputs in the preceding step

Lung segmentation is to be performed which is going to remove all the information from the image which is not necessary for the model to make the prediction and then, only with the images that pass as frontal from the previous stage [7]. To enhance the accuracy of the prediction a deep learning classification model will be used to predict COVID-19 positive and negative cases for the same chest X-ray in two ways:

• In variation a, the datasets passed through the classification without lung segmentation.

• Variation b we will be using the segmented images, obtained by multiplying the mask to the original processed image, and then passing it through the CNN classifier model.

Segmentation is an initial image processing technique for medical image classification analysis, illustrated by organ volume and shape using a computer-aided diagnosis system. Training data for the segmentation system consist of the medical images containing the organ images to produce segmentation results this would be more efficient than performing manual segmentation. As compared to classification where the whole image is treated as one in this step we segmented the image into different nodules to produce the latter result. Performing segmentation using CNN classifier used for calculating the probability of an organ defected for covid or not. Segmentation is divided into two steps:-

- Step 1 - construction of the probability map of the organ using CNN and image nodules.
- Step-2 - refinement step where the probability map is utilized.

These variations will allow us to assess the importance of the segmentation stage, by giving the model full or partial information and analyzing which part of the images contributes to the prediction. Thus, we will get the output from the model as a positive or negative label.

3. Detection

Detection of the image from inputs using dataset is the most crucial step to achieve the final results as lung detection from cropping using morphological process is treated to detect a person's lung got infected fro covid or not X-ray detection technique applied on the segmented image.

CHAPTER 4

EXPERIMENTAL RESULTS

4.1 INTRODUCTION

This chapter presents the experimental results of the model used to perform the classification of the chest X-ray image.The dataset used is publicly available from the University of Waterloo and consists of 3000 images of Covid-19 positive and negative chest X-ray images.

4.2 DATASET AND DESCRIPTION

A team of researchers from Qatar University, Doha, Qatar, and the University of Dhaka, Bangladesh along with their collaborators from Malaysia in collaboration with medical doctors have created a database of chest X-ray images for COVID-19 positive cases along with Normal and Viral Pneumonia images. This COVID-19, normal, and other lung infection dataset is released in stages.

In the first release, we released 219 COVID-19, 1341 normal, and 1345 viral pneumonia chest X-ray images. In the first update, they increased the COVID-19 class to 1200 images. In the second update, they have increased the database to 3616 COVID-19 positive cases along with 10,192 Normal, 6012 Lung Opacity (Non-COVID lung infection), and 1345 Viral Pneumonia images.

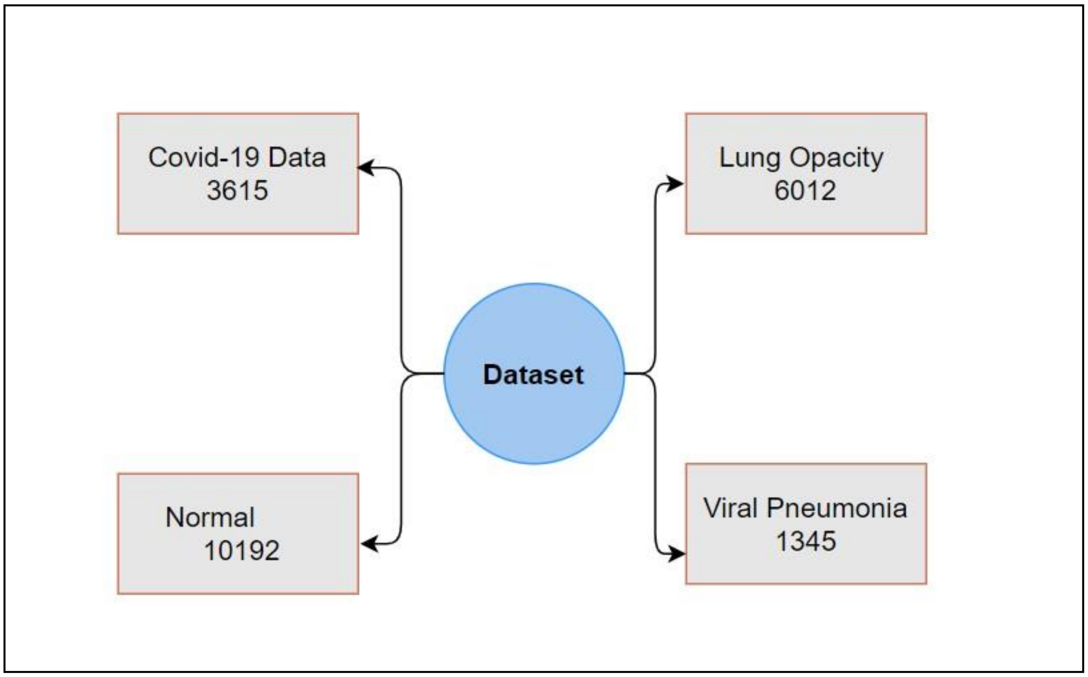


Fig. 4 Dataset Description

COVID data are collected from different publicly accessible datasets, online sources, and published papers.

- -2473 CXR images are collected from the padchest dataset[1].
- -183 CXR images from a German medical school[2].
- -559 CXR image from SIRM, Github, Kaggle & Tweeter[3,4,5,6] -400 CXR images from another Github source[7].

Normal images:10192 Normal data are collected from three different datasets.

- -8851 RSNA [8]
- -1341 Kaggle [9]

Lung opacity images: 6012 Lung opacity CXR images are collected from the Radiological Society of North America (RSNA) CXR dataset

Viral Pneumonia images: 1345 Viral Pneumonia data are collected from the Chest X-Ray Images (pneumonia) database [9]

4.3 TRAINING ON DATASET

The dataset we used was split into three subsets of training, testing, and validation parts in the ratio of 40:40:20. We have mentioned earlier also that we have kept a keen eye on fitting as well as overfitting of the model to avoid any kind of performance loss from our model.

The abundance of data imagining is desirable but rarely available due to cost. Techniques used to train the model are:

- Data augmentation
- Transfer Learning

I. An effective strategy to train the model on a small data set- network is a completely large dataset called an image Net

II. The generic features learned on a large enough dataset can be shared among seemingly disparate datasets. This portability of learned generic features is a unique advantage of deep learning that makes itself useful in various domain tasks with small datasets

III. A fixed feature extraction method is a process to remove fully connected layers from a network pre-trained on Image Net while maintaining the remaining network, which consists of a series of convolution and pooling layers, referred to as the convolution base, as a fixed feature extractor.

To enhance the accuracy of the prediction a deep learning classification model will be used to predict COVID-19 positive and negative cases for the chest X-ray in particular ways [7]. The datasets passed through the classification without lung segmentation and then we will be using the segmented images, obtained by multiplying the mask to the original processed image, and then passing it through the CNN classifier model.

	FILE NAME	FORMAT	SIZE	URL
0	COVID-1	PNG	256*256	https://sirm.org/category/senza-categoria/covi...
1	COVID-2	PNG	256*256	https://sirm.org/category/senza-categoria/covi...

	FILE NAME	FORMAT	SIZE	URL
0	Lung_Opacity-1	PNG	256*256	https://www.kaggle.com/c/rsna-pneumonia-detect...
1	Lung_Opacity-2	PNG	256*256	https://www.kaggle.com/c/rsna-pneumonia-detect...

	FILE NAME	FORMAT	SIZE	URL
0	NORMAL-1	PNG	256*256	https://www.kaggle.com/c/rsna-pneumonia-detect...
1	NORMAL-2	PNG	256*256	https://www.kaggle.com/c/rsna-pneumonia-detect...

	FILE NAME	FORMAT	SIZE	URL
0	Viral Pneumonia-1	PNG	256*256	https://www.kaggle.com/paultimothymooney/chest...
1	Viral Pneumonia-2	PNG	256*256	https://www.kaggle.com/paultimothymooney/chest...

Fig. 5 Dataset description

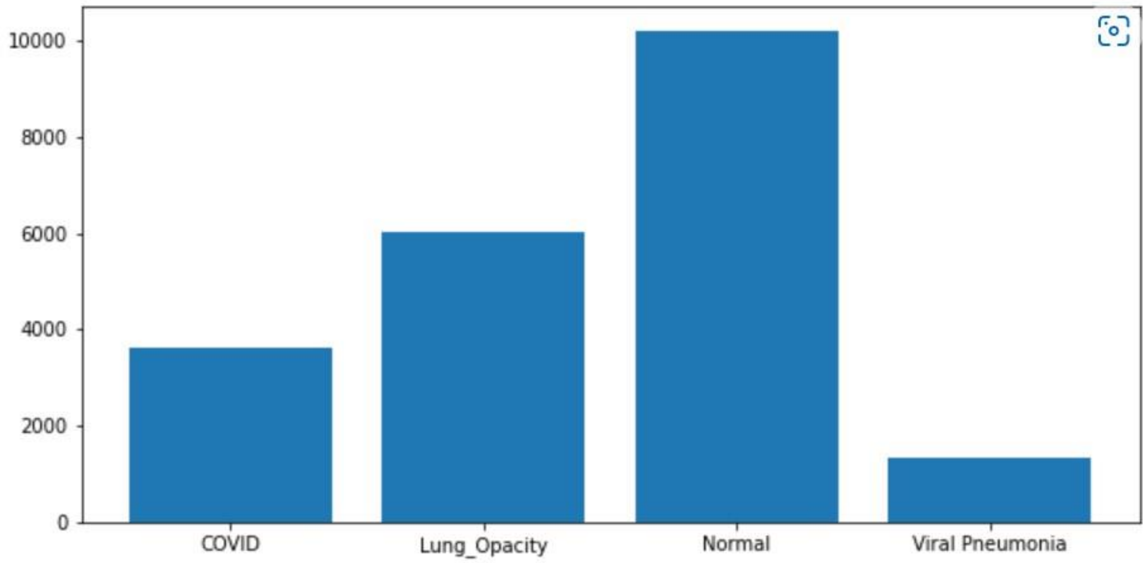
```
counter = {'COVID':0,'Lung_Opacity':0,'Normal':0,'Viral Pneumonia':0}

for image in imgs:
  for count in glob.iglob(NEW_DIR+image+"*"):
    counter[image] += 1

counter
```

```
{'COVID': 3616, 'Lung_Opacity': 6012, 'Normal': 10192, 'Viral Pneumonia': 1345}
```

Fig. 6 High-level description of the system




```
# First off we need to give equal amout of data for every class.
# we will be Deviding our data between Train, Test, Validation

Train Data:
        Normal : 3500
        Lung Opacity : 3500
        Covid+ Pneumonia : 3000 + 500

Validation Data:
        Normal : 1000
        Lung Opacity : 1000
        Covid + Pneumonia : 500 +500

Test Data:
        Normal : 1000
        Lung Opacity : 1000
        Covid + Pneumonia : 100 +500
```

Fig. 7 Graphical representation of metadata

a **b**

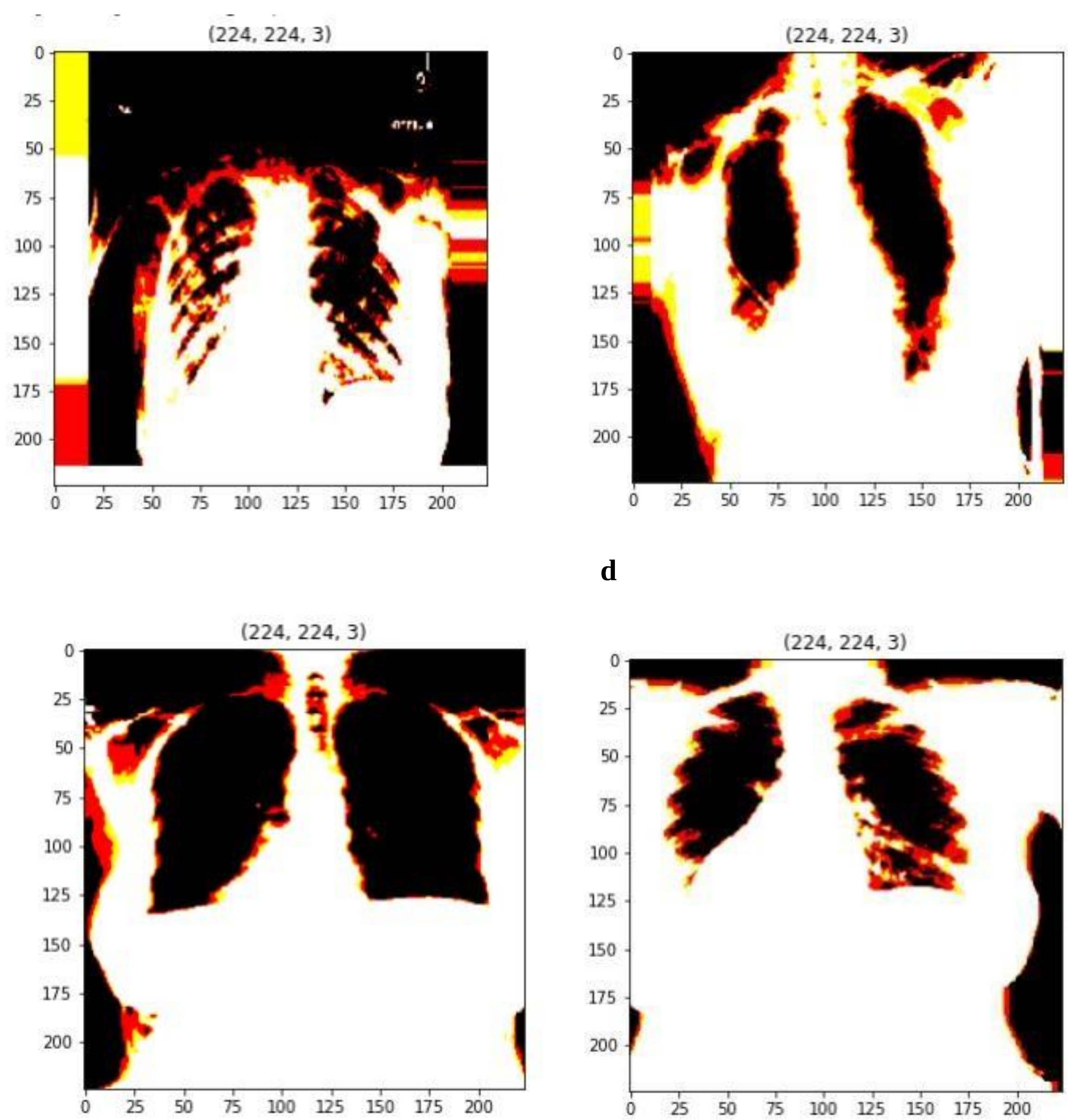
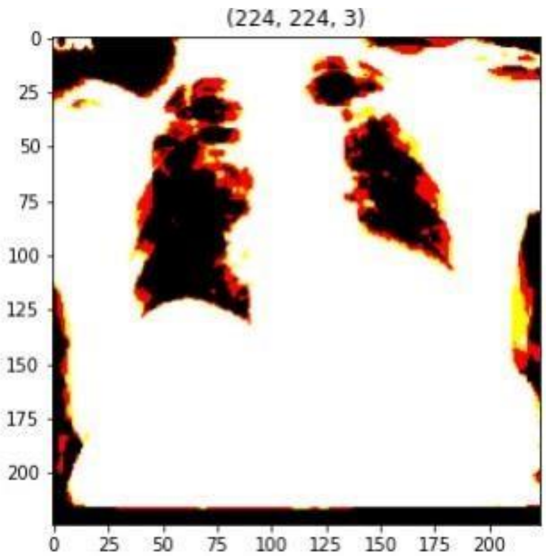
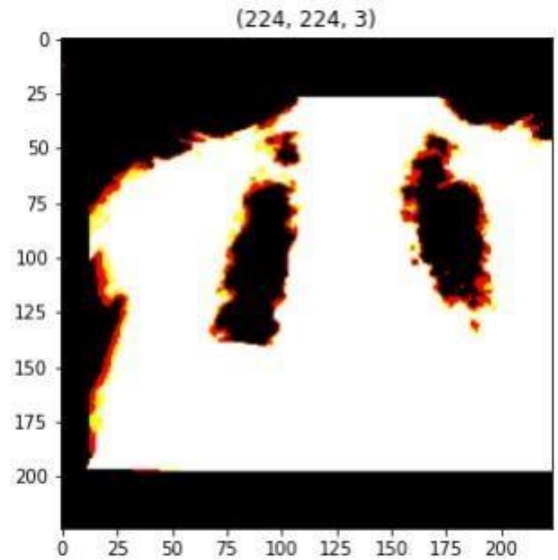


Fig. 8 a-p Clipping input data to convert it into a specific range

e **f**





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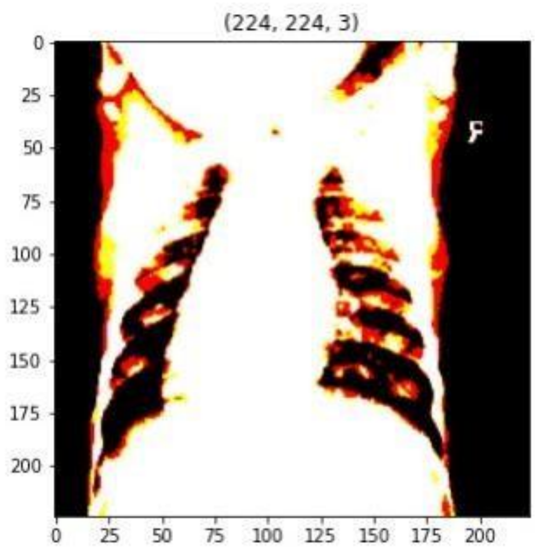

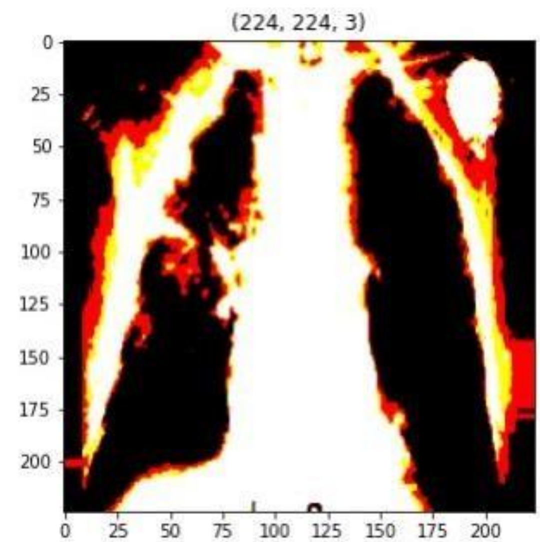

Fig. 8 (continued)

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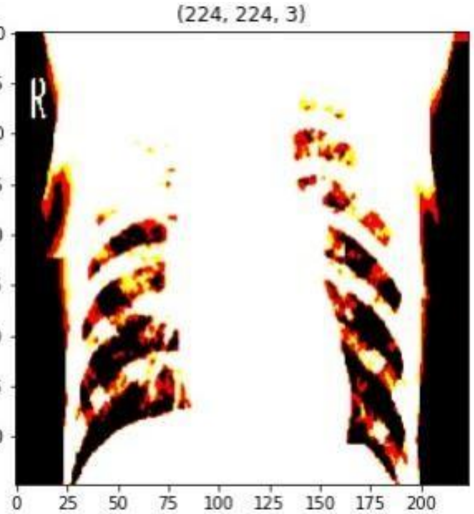

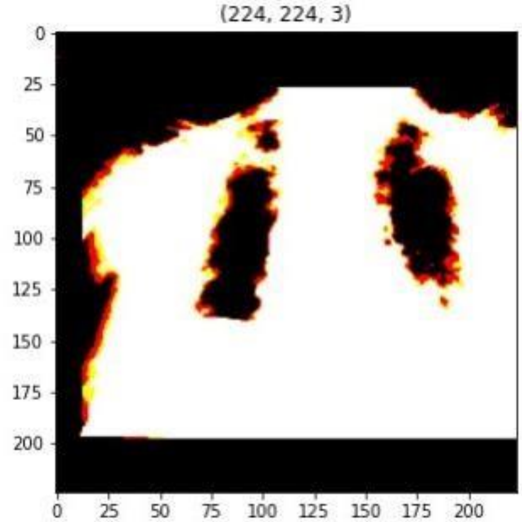

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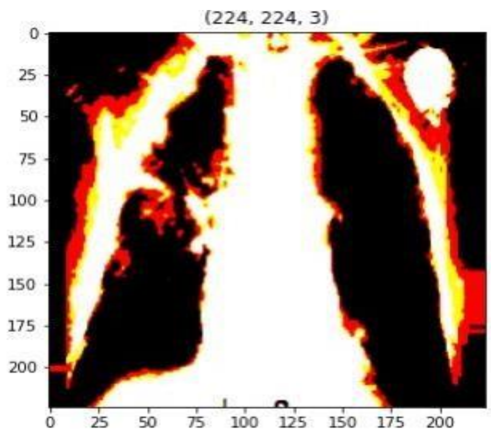


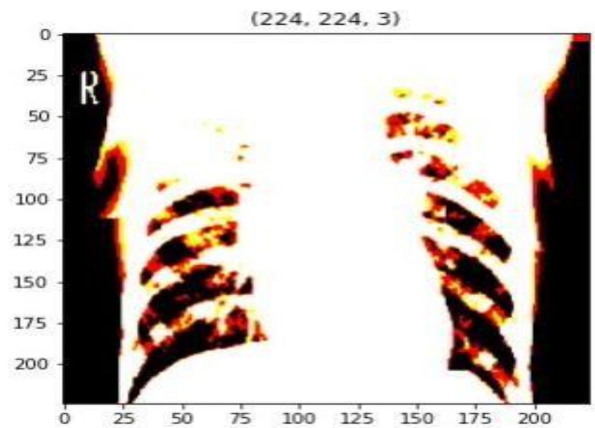
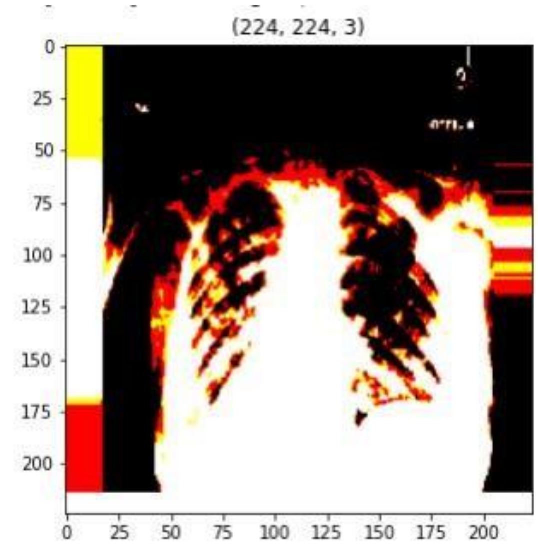
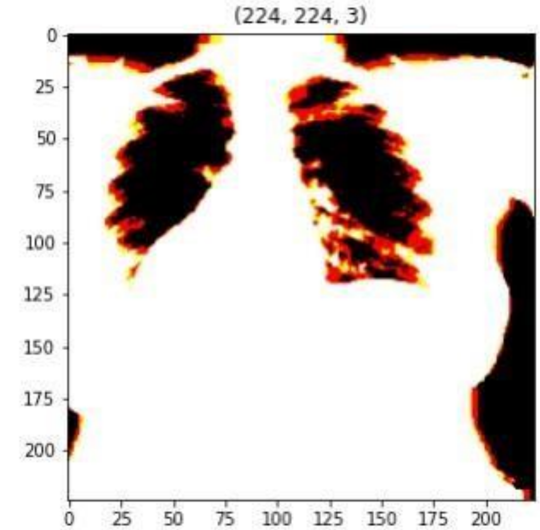


Fig. 8 (continued)

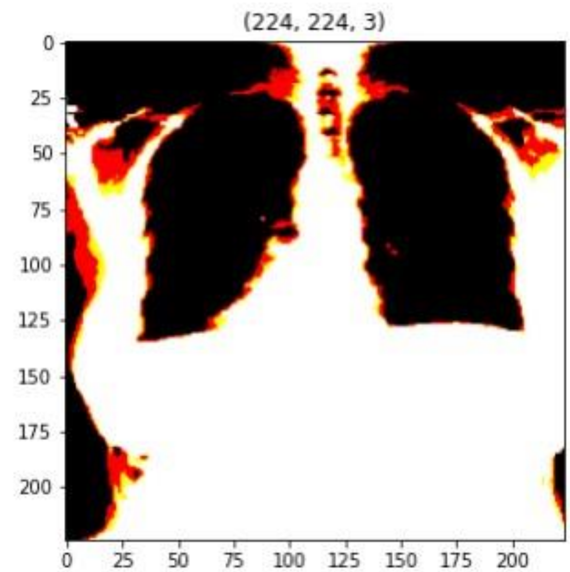
m

n





o p



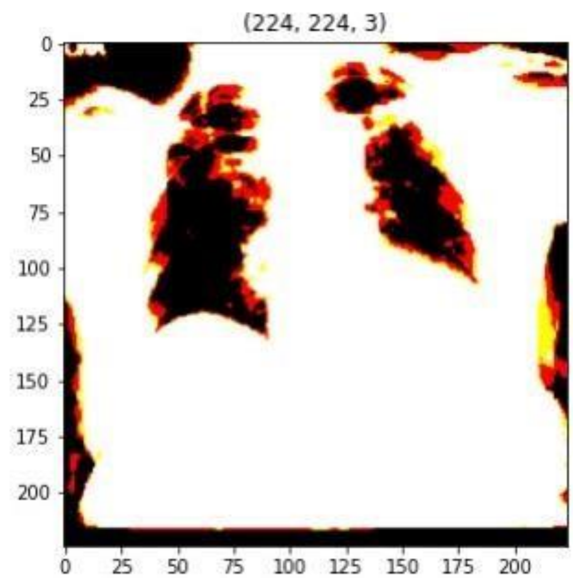


Fig. 8 (continued)

4.4 Result

When an X-ray image is given as an input to the CNN model, it can be seen that it gives the output whether the X-ray is Covid-19 positive or negative along with the chances of the X-ray being Corona virus-infected and being normal.

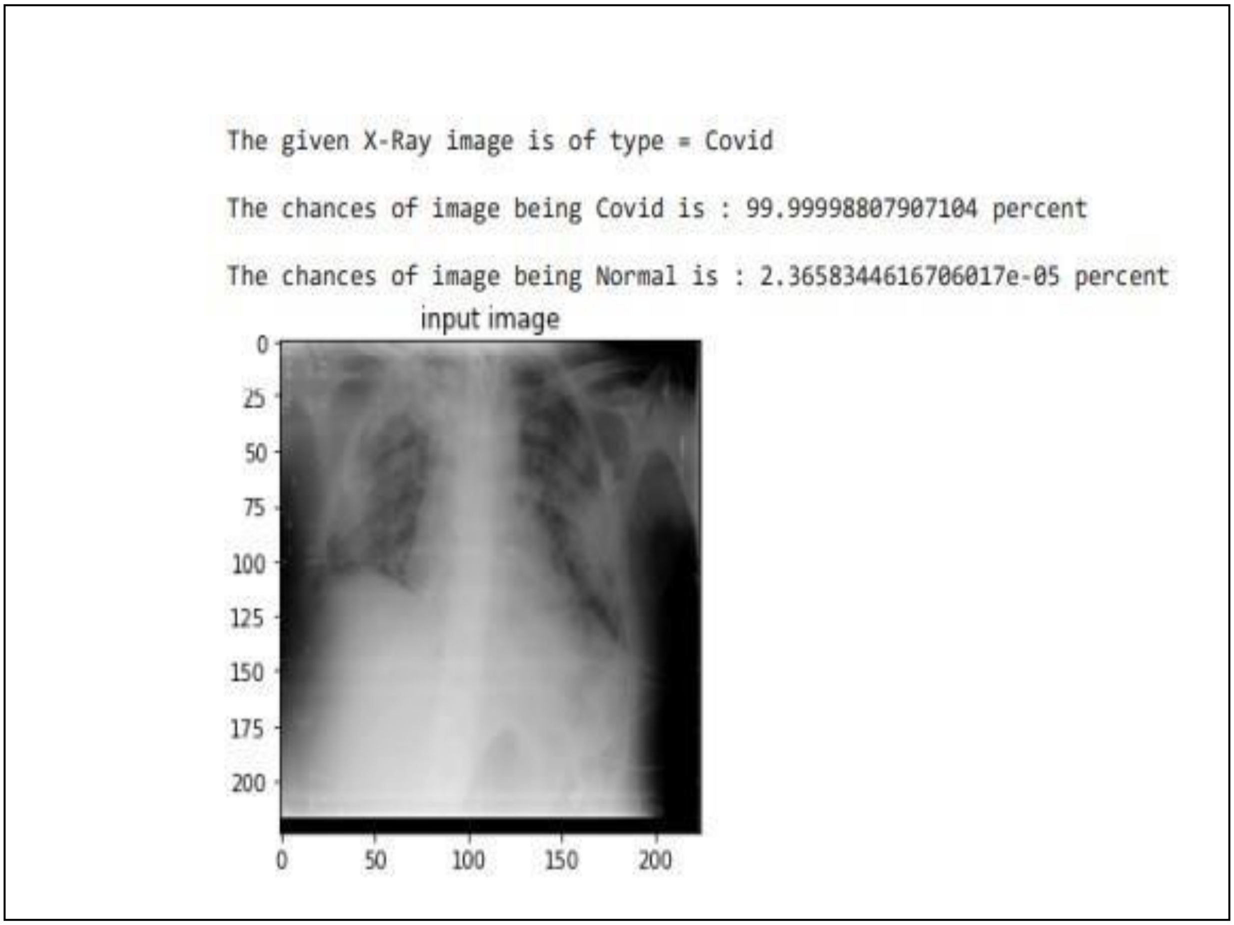
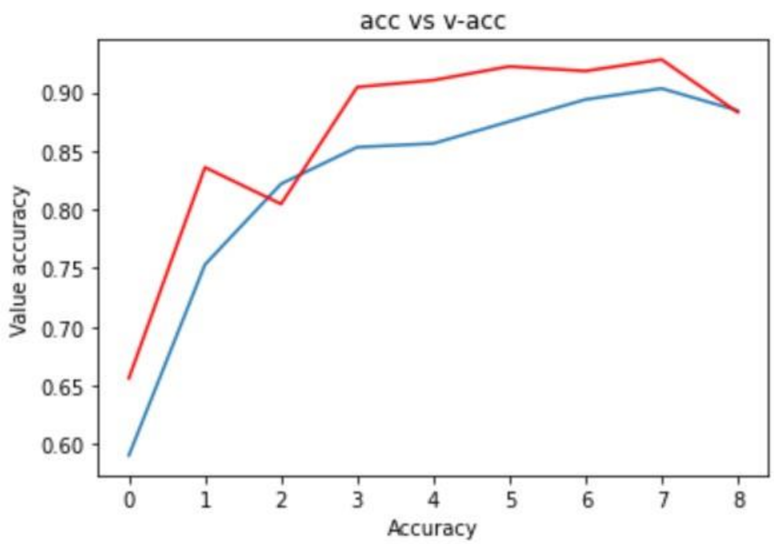


Fig. 9 X-ray infected with Covid-19 virus



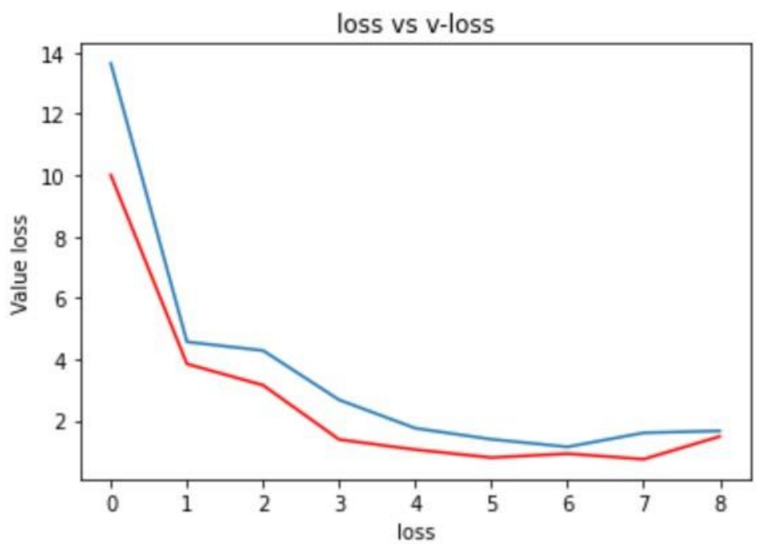


Fig. 10 Model performance

CHAPTER 5

CONCLUSION

5.1 Conclusion

We presented an evaluation of transfer learning using pre-trained deep convolution neural network models for COVID-19 identification using chest X-ray images. The experimental evaluation demonstrated the potential of building diagnostic tools for automatic detection of COVID19 positive cases from chest X-ray images and deep convolution neural networks and the development of larger and clinically standardized datasets would further help in this direction. Inspired by recent research that correlates the presence of COVID-19 to findings in Chest X-ray images. Our approach would be to use build and design deep learning models to process these images and classify them as positive or negative for COVID-19. The new COVID-19 virus has caused thousands of deaths, especially in elders and patients with health conditions. The standard method for detection and diagnosis of COVID-19 is the reverse transcription-polymerase chain reaction (RT-PCR) test after collection of proper respiratory tract specimen, which is time-consuming and in many cases not affordable, thus the development of new low-cost rapid tests of diagnostic tools to support clinical assessment is needed. We presented an evaluation of transfer learning using pre-trained deep convolution neural network models for COVID-19 identification using chest Xray images. Two publicly available datasets were used in different experimental setups.

In specific, we tested the binary COVID-19 identification performance of several convolution neural network models using 10-fold cross-validation on each dataset separately, then we tested the transferability of the models by using one dataset for training and the other for testing and vice versa. Finally, we merged the two datasets and performed a 10-fold cross-validation to investigate the effect of the size of available data on accuracy, precision, and recall. The experimental evaluation demonstrated the potential of building diagnostic tools for automatic detection of COVID-19 positive cases from chest X-ray images and deep convolution neural networks and the development of larger and clinically standardized datasets would further help in this direction.

5.2 Future Works

For the future, this deep learning using CNN architecture is in exigency to be trained on a macroscopic on high ranges of the available dataset to the performance silver check-in results. In collaboration with that, it will also be used to predict datasets on other identifying chest-related diseases such as Bronchiectasis and SARS. We admire our work inspires others too so that it may help in enhancing the accuracy and in all contributing to the communication.

REFERENCES

[1] R.yama, M. Misho, R.K.G Do and K, Togashi, *Convolution Neural Network: An Overview and Application in Radiology, Insight into Imaging*, 2018, 611-62.

[2] Convolutional neural networks*: An overview and application in radiology*, Online Available at:[Image Classification Using Convolutional Neural Networks (ijser.org)], Accessed on June 22, 2018

[3] Yasaka K and C. Huang, "*Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China,"* Lancet, vol. 395, no.12, pp. 344-365.

[4] World Health Organization, "*Pneumonia of unknown cause-China*, Online Available at: [1D convolutional neural networks and applications: A survey - ScienceDirect"], Accessed on 18 July 2022

[5] Liu F, A. H. Shurrab and A. Y. A. Maghari, "*Covid-19 detection using data mining techniques*", 2017 8th International Conference on Information Technology (ICIT), pp. 625-631.

[6] Catrin Sohrabia, Zaid Alsafi, Niamh O'Neill, Mehdi Khan, Ahmed Kerwan, Ahmed Al-Jabir, "*World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19)*", International Journal of Surgery, vol. 76, pp. 71-76, April 2020 V.

[7] Yasaka K et al., Predicting COVID-19 Pneumonia Severity on Chest X-ray with Deep Learning, vol.14 no. 7, pp.34-36.

[8] Simonyan K, Zisserman A (2015) *deep convolutional networks for large-scale image recognition. ArXiv*, Online Available at:[Very Deep Convolutional Networks for Large-Scale Image Recognition (arxiv.org)], Accessed on 22 Jan 2018

[9] __, Dataset Online available at: [https://uwaterloo.ca/news/news/researchers-use-open-sourcesoftware-improve-covid-19], Accessed on 2 Feb 2022