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Covid-19 Detection from Chest X-Ray Using CNN

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ABSTRACT: Covid-19 is a infective disease caused by the virus called Severe Acute Respiratory Syndrome Coronavirus-2(SARS-CoV2).Covid-19 has badly affected india as well as many other countries,hence spread worldwide.The most common symptoms of Covid-19 are fever,tiredness,Cough,loss of taste or smell,sore,throat,etc. still affects different people in different ways as X-Ray are easily available in every hospital and cheap way to detect infection in chest jupyter Notebook is used. Technologies used are Deep Learning and CNN.Total 400 images are taken from Kaggle website.200 images of Covid-19 +ve patients and 200 images of Covid-19 patients have been divided into training. The accuracy of our project is over 96%.This application can be used on any computer by any medical authority to detect Covid-19 +ve patients using chest X-Ray images

I. INTRODUCTION

X-radiation or X-ray is an electromagnetic form of penetrating radiation. These radiations are passed through the desired human body parts to create images of internal details of the body part. The X-ray image is a representation of the internal body parts in black and white shades. X-ray is one of the oldest and commonly used medical diagnosis tests. Chest X-ray is used to diagnose the chest-related diseases like pneumonia and other lung diseases [4], as it provides the image of the thoracic cavity, consisting of the chest and spine bones along with the soft organs including the lungs, blood vessels, and airways. The X-ray imaging technique provides numerous advantages as an alternative diagnosis procedure for COVID-19 over other testing procedures. These benefits include its low cost, the vast availability of X-ray facilities, noninvasiveness, less time consumption, and device affordability. Thus, X-ray imaging may be considered a better candidate for the mass, easy, and quick diagnosis procedure for a pandemic like COVID-19 considering the current global healthcare crisis.
The following are some of the key findings of this study:
CNN models require a sufficient amount of images for efficient and more accurate image classification.
Data augmentation techniques are very effective to improve the CNN model performance remarkably by generating more data from an existing limited-size dataset.

II. DATA AUGMENTATION

Data augmentation is a technique that can significantly increase the data instances of a dataset to train a model. In the case of image datasets, the technique uses the basic image processing operations, such as flipping, rotating, cropping, or padding for augmentation. The dataset is then extended by these transformed images resulted from the existing image set, which increases the size of dataset to train the neural networks., the data augmentation method has been used in this study. In this technique is increases the size of the dataset; in addition, it provides more learning features to the learning model. Two image processing operations, flipping and rotation, have been used in this study for data augmentation. In first phase of data augmentation, the 90 X-ray images have been flipped to get extra 90 images. The resulted dataset was increased to contain 180 images after applying this operation. In the second phase, the original 90 images have further been rotated by 90°angle to get 90 more images and then rotated by 180°angle to get 90 more images, and finally, These operations resulted in a dataset containing more COVID-19 X-ray images.
Data augmentation is also effective in image classification as it gives the ability of invariance to CNNs.
The proposed CNN model performance has been proved statistically significant in the performance of other ML models.CNN-based diagnosis using X-ray imaging can be very effective for medical sector to handle the mass testing situations in pandemics like COVID 19

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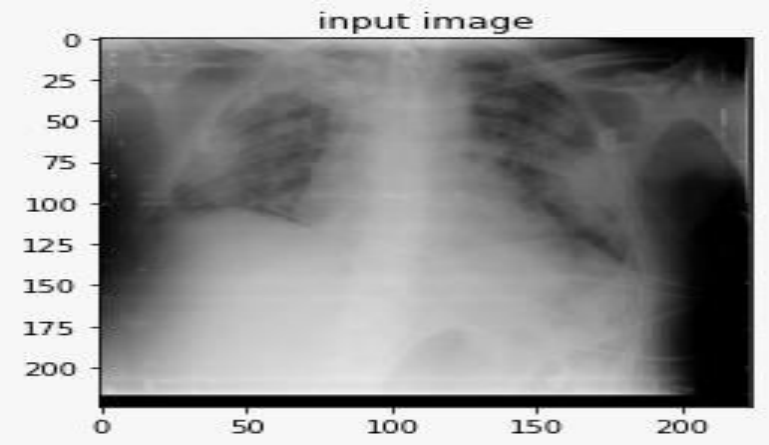
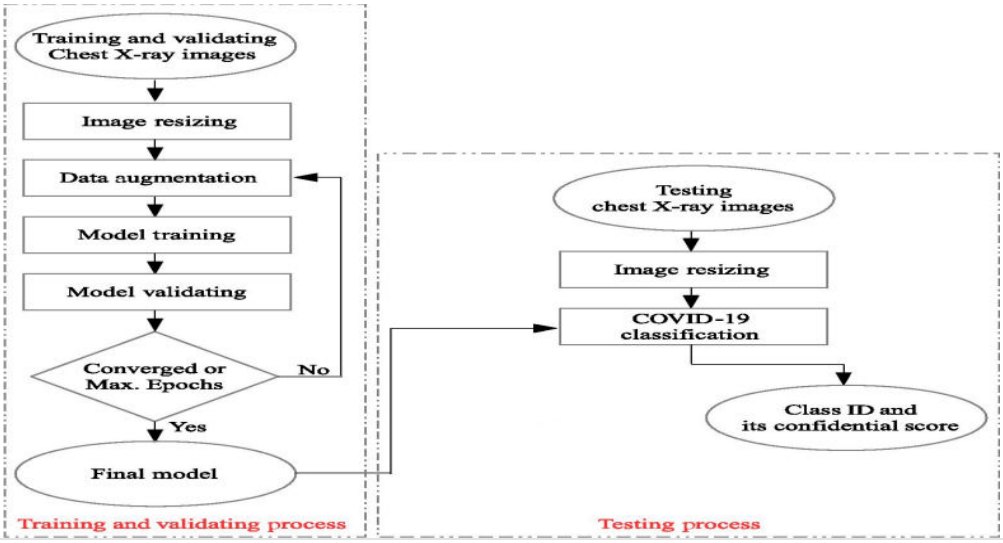


Chest Xray Image and Collaboration Diagram



III. CONVOLUTIONAL NEURAL NETWORK

Recently, CNNs are the most studied machine learning (ML) algorithms for medical lesions diagnosis using images. The justification behind this is that CNNs retain complex features when scanning input images. This proposed CNN architecture has five convolution layers that take a chest image tensor of 244 × 244 as its input. Subsequently, the first convolution layer uses 5 × 5 × 3 kernel filters with stride 1 × 1, and a total of 64 such filters are employed. The next layer, which receives the output from the first layer, is a max-pooling layer with 2 × 2 stride, reducing the input to half of its size 112 × 112. For all layers, the output from the pooling layer passes through the ReLU activation feature. The nonlinear output obtained now fed into the next convolution layer with 5 × 5 × 64 with 128 filters, and the stride value is the same 1 × 1. The obtained output pass through a max-pooling layer with the same 2 × 2 strides, which again reduced the input to half of its size 56 × 56. After the output pass through ReLU activation, it is fed into the third convolution layer with 256 filters and the kernel size 5 × 5 × 128 with 1 × 1 stride. The output is passed to a max-pooling layer, which results in a tensor of shape 28 × 28. Again the output pass through ReLU activation, fed into the fourth convolution layer with 512 filters and kernel size 5 × 5 × 256 and with the same stride 1 × 1.Now the resulting tensor has the shape 7 × 7 × 512. The obtained tensor is flattened with 25,088 neurons. The weighed values that emerge as neurons demonstrate the proximity to the symptoms of COVID-19. The dropout layer is applied here to drop values to handle network overfitting. In our work, we used a dropout rate of 0.5 during training. The fully connected layer converts the tensor with 25,088 neurons to 64 neurons and adds ReLU activation to the output. A tensor with 64 neurons is the product of the fully connected layers; these 64 neurons are translated into neuron counts equal to the number of categories to which the retinal image belongs, healthy, COVID-19, and pneumonia.

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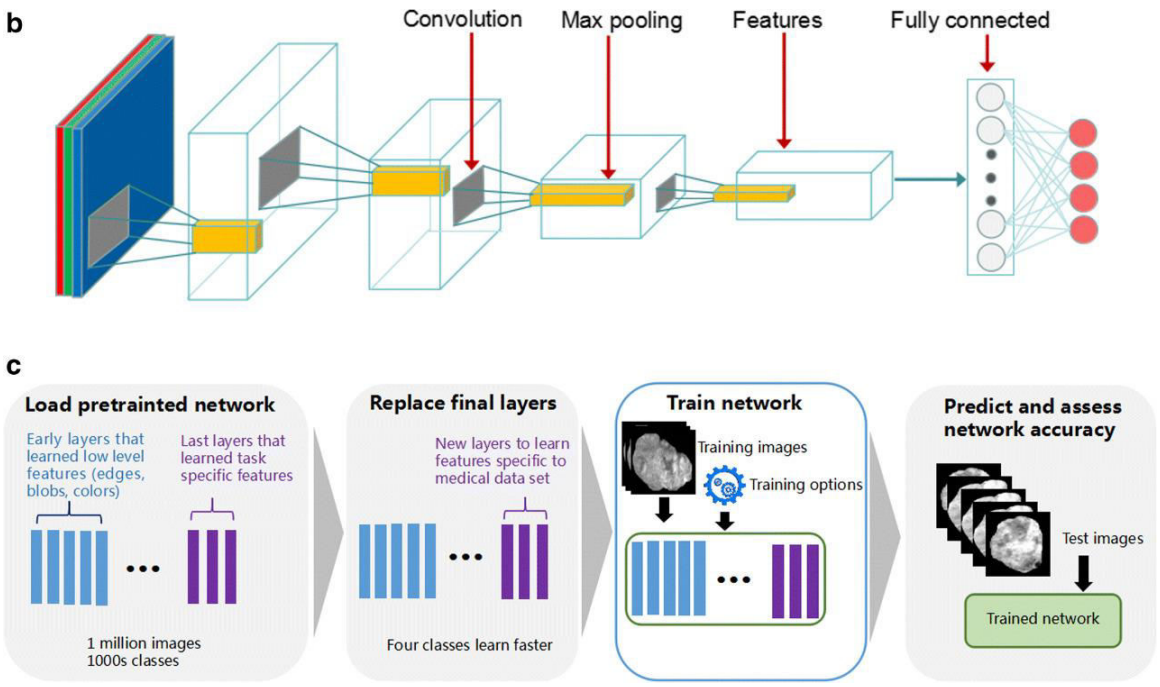

3.2.1 Convolution layer.

This layer comprises a filter set (kernel). Each filter is convoluted against the input image and then extract features by creating a new layer. Each layer signifies some of the important features or characteristics of the input image. The * symbol identifies the operation of the convolution.

3.2.2 Rectified Linear Unit (ReLU) layer.

This layer is an activation function that sets the negative input value to zero, which optimizes and speeds up analyses and training, and helps prevent the gradient from disappearing.

3.2.3 Maxpooling layer.

This Layer is a sample-based discretization method. It is employed to down-sample an input design (input image, hidden-layers, output matrix, etc.), and compressing it is dimensionality and enabling assumptions about the components available in the binned sub-regions to be made. This will decrease the size of learning parameters and provide fundamental interpretation invariance to internal depiction, thus further reducing the cost of computation. Our model adopted the kernel size of 3 × 3 during the Maxpooling process. After the final convolution block, the network flattened to one dimension.

IV. RESULTS AND DISCUSSION

The coronavirus pandemic has stretched the healthcare systems in every country in the world to its limit as they had to deal with a large number of deaths. Early detection of the COVID-19 in a faster, easier, and cheaper way can help in saving lives and reduce the burden on healthcare professionals. Artificial intelligence can play a big role in identifying COVID-19 by applying image processing techniques to X-ray images. This work designed and developed an intelligent system for the COVID-19 identification with high accuracy and minimum complexity by combining the features extracted by histogram-oriented gradient (HOG) features and convolutional neural network (CNN). Suitable feature selection and classification are absolutely vital in the COVID-19 detection using chest X-ray images. Chest X-ray images were entered into the system in order to produce the output of the marked lung significant region, which was used to identify COVID-19. The proposed feature fusion system showed a higher classification accuracy (99.49%) than the accuracies obtained by using features obtained by individual feature extraction techniques, such as HOG and CNN. CNN produced the best classification accuracy compared to the other classification techniques, such as ANN, KNN and

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SVM. Furthermore, the proposed fusion technique was validated with higher accuracies using generalization and k-fold validation techniques.

V. LITERATURE SURVEY

This section of literature survey reveals some facts based on thoughts analysis of many autho approach an follows Wang[1], the first cases were found using the Covid-19 pandemic at 2019-2020, which probably tasted around the end of December 2019 in the city of Wahan the capital of the Chinese province of hubes and supsequently spread o various countries of the world. Abroug[2], CoronaVirus represents an extended family of respiratory viruses that can cause mild to moderate diseases from cold to respiratory syndromes such as MERS & SARS These kind of viruses are common in many animal species but in some cases through rasely they can evolve & infect human & then spread to the population.

Narim A. Kaya . (pamuk Z.(2020), "Automate detection of coronavirus disease using X-Ray images & Deep convolutional neural networks".

VI. CONCLUSION AND FUTURESCOPE

The COVID-19 pandemic remains a serious threat that has caused chaos around the globe. This epidemic continues to pose a threat to personal health in various ways around the world, including mortality. Early detection of COVID-19 in a patient can reduce mortality and save lives. In this research, we introduced a methodology focused on DL to classify and detect the COVID-19 cases from x-ray images. Our model is entirely automated and is capable of categorizing binary class with 100% accuracy using VGG16 and multi-class with 93.75% using a built CNN. The study used the limited sets of data from diverse sources to analyze system robustness through its ability to respond to real-world scenarios. This framework effectively operates as an additional screening tool for COVID-19 detection. The proposed models can address a shortage of radiologists in rural areas and used to classify chest-related diseases such as viral pneumonia and COVID-19. The system implemented is fully prepared for testing with a considerably larger directory. The added of CNN includes the automatic detection of most exclusionary features among the classes.

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