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Deep Learning for Covid-19 Identification:A Comparative Analysis

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Abstract

Covid 19 was an epidemic in 2022. Detection of Covid in X-Ray samples is crucial for diagnosis and treatment. This was also challenging for the identification of covid by radiologists. This study proposes Transfer Learning for detecting Covid-19 from X-Ray images. The proposed Transfer Learning detects the normal x-ray and covid 19 x-ray samples. In addition to this proposed model, different architectures including trained Desnet121, Efficient_B4, Resnet 34, and mobilenetv2 were evaluated for the covid dataset. Our suggested model has compared the existing covid-19 detection algorithm in terms of accuracy. The Experimental model detects covid 19 patients with an accuracy of 98 percent. Our proposed work is to analyse the covid19 by the automation with helps of deep learning algorithms which results in high accuracy in detection Covid19 using x-ray samples. This model can assist radiologists and doctors in the diagnosis of covid-19 and make the test more accessible.

1. Introduction

The accuracy of the following algorithms will be checked and it will be higher compared the algorithms that are used in earlier papers and publications. The Covid-19 virus started spreading from Wuhan, China and led to the pandemic in 2020, and because there were few Corona virus test kits available, it was difficult to recognize an infected individual. It requires a strong economic need for testing kit price reductions. So, it will be extremely helpful for all the developing countries because the complete process was carried out using an x-ray to identify the dataset and assess if it was coherent or not. It will only need x-rays to operate. It will decrease the cost of producing the testing kits and can be done very cheaply since we can get a great efficient and accurate result by using machine learning & deep learning concepts of artificial intelligence. In 2020, testing kits weren't available due to the pandemic and supply crisis. As a covid-19 fortification, the following algorithms allow us to attain precision. The main concept is to perform the task entirely automatically.

The x-ray will detect the covid-19 infection as we administer it and indicate whether the individual infected or not. The idea centres on categorising a person as a healthy person and an infected person since this would enable the algorithm to perform to its maximum accuracy of 99%, which will be demonstrated in the upcoming sections. It scans the lung area in x-ray samples, compares the results obtained in every algorithm, and then precisely generates a significant impact. In order to convert the scanned reports into numbers using machine language, it selects the best approach for detecting diseases and creates a new output in the pt file.

The mobile net was very effective and achieved high accuracy in identifying the covid samples from the survey of algorithms, generating a check with the subsequent numbers in datasets with the greatest accuracy as we had completed a survey-based check with the algorithm we had obtained. These partition the dataset and distribute it 7:2:1 ratio throughout the workspace.

Three percentage points—seven for training, two for testing, and one for validation—are allowed. After the datasets have been combined, the data flow will be stopped and examined using all of the available algorithms. The best method is Mobilenet v2, which produces the best result. First, we'll utilise Densenet121, which from the supplied dataset produces an accuracy of 0.65. Next, we used Mobilenetv2, which produces an accuracy of 0. 99..

2. Working Materials and Methodology

2.1. Image Dataset

The X-Ray Dataset has been used in the project to get a better performance we can use machine learning models and deep learning models and material methodologies in Covid-19 prediction so that we can get accurate results on Covid-19 infection just by using X-rays.

Deep learning methodologies can be used in this case as deep learning models have a deeper coverage of various fields such as power, energy engineering, Medicine, Psychology, technology, etc. As we have used deep learning methodologies here it is more efficient for us to diagnose Covid-19 in the earlier stage itself just by using X-Rays and hence it will be easier for the doctors to rehabilitate the disease as it is found in the earlier stage itself. By doing so we can avoid taking Corona tests and waiting for two days for the test result and then starting the treatment. To achieve the accurate result, we need to train some datasets which consist of X-Rays of Covid-19 patients and persons who have not yet been affected by Covid-19 disease so that it is easy for the deep learning algorithm to diagnose Covid-19 easily.

2.2. Working Method

Before we train the pre-trained data set, we need to do some pre-processes to the images used in the datasets in order to achieve better processing in the deep learning algorithms. The pre-processing that we do will vary for each and every algorithm. As there are many types of pre-processes for every algorithm there is no defined process available yet for this pre-process, so it varies with the type of algorithm that we use. Some of the most common pre-process that we use while training image datasets are resizing with the right resolution/interpolation, applying inference transforms, rescaling the values, etc.

The datasets which are required for our study are taken from the Kaggle repository, which includes the X-Ray images of Corona patients and normal persons too so that it is easier for the algorithm to detect Covid-19 by comparing the X-Ray images of the affected person and normal person. In order to get a reliable result from the deep learning algorithm we need to train an enormous number of datasets to the deep learning algorithm and especially when it comes to medical-related problems we need to train a vast number of datasets so that the deep learning algorithm will be well trained and so that we can get a proper and accurate result which is very essential in the medical field as a small inaccuracy may lead to a bigger threat to life. However, for any problem we take in the medical field, it is more likely that there is an insufficient number of datasets available for that concern, and hence in order to overcome this problem we can make use of the process of **Augmentation**. By using Augmentation, we can avoid overfitting datasets and by doing so we can increase the accuracy of the algorithm.

We need to classify the datasets that we collect into two types such as training datasets and test datasets. The training datasets are the datasets that are used to train the deep learning algorithm which we use. Once the training is completed, we need to test the algorithm whether it is working properly. In normal datasets, 80% of the datasets will be allocated for training and the rest 20% will be allocated for testing as training requires a large number of datasets when compared to testing.

Here for this work, we have taken the PA view of chest X-Rays of persons affected by Covid-19 and also healthy patients. Once all the pre-process works and augmentation processes are done, the datasets will be undergoing some deep learning-based CNN models in order to compare their performances. Once the comparison process is done then the training process will begin for the deep learning algorithms used. Deep learning has the prospect

to transfigure the automation of lung radiography interpretation. There are more than 40,000 research publications available regarding this concern i.e., the usage of deep learning algorithms in this regard. The key component in deep learning is that there is an availability of training and testing datasets individually for better performance.

In this study, to get the results accurately, we need to train at least a million images for the deep learning algorithm, but it is a very tedious and time-consuming process of collecting that many images, and hence this can be overcome by usage of a technique named **Transfer learning.** The transfer learning technique allows previously used datasets to be trained once again in a particular application, which will be much more useful for us in this case. As we have used the Transfer learning technique here, we can reuse the datasets that have been already trained and by doing so we can avoid the large and time-consuming process of collecting millions of X-Ray images to train datasets of our deep learning algorithms.

Here in our study, we have compared four deep learning algorithms which can be used to diagnose Covid-19, and we have concluded which is the best algorithm for detecting Covid-19 by using X-Rays. The four deep learning algorithms we have used here are **Densenet121, Efficient_b4_covid-19, MobileNetV2, resnet-34**

We have trained many datasets to all these algorithms individually and got the output and we have concluded which is the best algorithm among all these to diagnose Covid-19.

2.3. Related Works

Machine Learning in AI and Deep Learning (Suresh, Robert, and Padmavathi) optimizes the covid thread while assisting person and proper treatment by the image processing Technique. The comparison (Sahin) in mobilenetv2 and Resnet 50 with the dataset of 13824 x-ray images had accuracy of 96.71 percentage in identification of Covid Patients. Deep learning and Machine learning in prediction (S. Gupta, Shabaz, and Vyas) of Xray images at Covid 19 patient is proved by giving sample dataset. Implemented (Darji et al.) the deep learning model for prediction of covid 19 with DenseNet50, DenseNet121 and DenseGapsNet got accuracy of 97.1% in identification of covid Patients. Machine Learning (Hasan et al.) gives improvement in baseline results. SVM and ANN method is used to cover the sensitivity and specificity in adverse outcome. Transfer learning (Roy and Kumar, "Early prediction of COVID-19 using ensemble of transfer learning") technique to predict the covid-19 patient at the early stage and identified the accuracy of infected patient. Monitored the patient health (Neog, Dutta, and Medhi) and accuracy of infecting stage of patient with better results of identification of covid19 in patients Predicted high accuracy by Gradient (Li, Chen, and Yang) based optimizer variational mode decomposition Technique for the confirmed Covid-19 Patient data. Detects the non-efficient restriction (Ghafouri-Fard et al., "Application of machine learning in the prediction of COVID-19 daily new cases: A scoping review") of the Covid-19 precautions and Infected Persons restrictions. The Spread Pattern (Hirschprung and Hajaj) of COVID-19 in confirmed cases was identified and prediction method with Co-IM gives best result. The information of treatment (Ansari and Baker) during the process of identification with the Covid_19 Patients (This gives more valuable about BMI and Temperature of the Patient) Proved the differentiation of Covid_19 (Bai et al.) from other viral pneumonia in Chest CT. Detects the prediction of machine learning (Ghafouri-Fard et al., "Application of machine learning in the prediction of COVID-19 daily new cases: A scoping review") which supports the algorithm capable of getting the results of Covid. Capsule Network (P. K. Gupta et al.) builds an efficient and fast in detection of Covid-19 which worked in real time of Covid-19 detection. Pneumonia and normal dataset (A. Gupta et al.) achieve the precision with high accuracy without help of human. Identified and classified Covid-19 (Ahemad, Hameed, and Vankdothu) dataset by using Decision Tree, Support Vector, K-mean clustering, Support Vector machine and radial bias function to gets the input and target of the dataset to predicted data. Automatic Covid detection (Roy and Kumar, "Early prediction of COVID-19 using ensemble of transfer learning") using IMOT (Internet of Medical Things) helps in monitoring patient and avoid physical contact of the patient during epidemic times. Proactive (Ali et al.) measures detect less in covid cases, monitoring the cases prevents Covid Spread across

the peoples and DL helps in Monitoring. Worked in radiologist (Perumal, Narayanan, and Rajasekar) to categories the covid patient by using CC Score in Normal or Severe Stage of Covid-19. Categories 2 different data set (Ds) and trained by cnn1 and cnn2 with hidden layers, this detects covid 19 patients and normal person with high accuracy in detection. Adaptive neuro-fuzzy inference system (Ghafouri-Fard et al., "Application of machine learning in the prediction of COVID-19 daily new cases: A scoping review"), long short-term memory, recurrent neural network and multilayer perceptron are used

2.4. Deep Learning Models

2.4.1. Densenet121

The densenet121 algorithm is the type of deep learning algorithm which is used to diagnose Covid-19 using X-Ray images. This algorithm is based on hybrid convolutional neural network (CNN) architecture and is proposed using an optimization algorithm. In every algorithm, there will be two parts such as the CNN architecture and the optimization algorithm. Here the CNN architecture is used for the Densenet121 and the optimization algorithm used is the gravitational search algorithm (GSA). The GSA used here is optimized well so that the densenet121 can get an accurate result on Covid-19 based on the chest X-Ray images. In order to test the efficacy of the GSA here we can also compare them with other related algorithms and find out which is a precise GSA that can be used here in order to get an accurate result at a faster time.

2.4.2. Efficient_B4

The efficient_b4_covid_19 is a type of deep learning algorithm which has a higher training speed and parameter efficiency. The efficient net models achieve greater accuracy and better efficiency when compared to other CNN models. The efficient net models achieve this by reducing parameter size and FLOPS by an order of magnitude. In order to achieve such great efficiency this deep learning model has been developed by using a training-aware **neural architecture search** and **scaling** which will jointly optimize training speed. The major difference between the efficient net algorithm and other algorithms is that this algorithm uses MB Conv in its early layers, which leads to smaller expansion ratios, which tend to have less memory access. The efficient net V2 also prefers smaller 3*3 kernel sizes. And it can also add up a few layers in order to compensate for the reduced receptive fields which happen due to the effect of the smaller kernel sizes. The efficient net V2 is far better than the original Efficient Net algorithm as the efficient net V2 completely removes the last stride-1 stage which acts as a major con in the original Efficient Net model.

2.4.3. Mobilenet_V2

The Mobile Net V2 is a deep learning algorithm that is used to detect objects using an image. While comparing to its predecessor Mobile Net V1 algorithm, the Mobile Net V2 algorithm uses a better module named **Inverted Module Structure,** and by using this module we can achieve a higher efficiency and a higher accuracy rate. Non-linearities in the narrow layers are removed in this Mobile Net V2 algorithm. This algorithm is developed by using two layers. In which the first layer is a **Depth-wise convolution**, which performs lightweight filtering by applying a single convolution filter per input channel. And the second is a **1*1 convolution**, which is known as Pointwise Convolution, which builds new features through computing linear combinations of the input channels. In simple terms, the Mobile Net algorithm is used to classify and detect objects in an image, and hence it is efficient in diagnosing Covid-19 by using X-Ray images.

2.4.4. Resnet-34

The Resnet-34 deep learning algorithm which is introduced by researchers at Microsoft Research centre. The Resnet-34 algorithm makes use of a new concept named residual blocks and it makes use of a technique named skip connection in order to add up the output from an earlier layer to the latest layer. It is also a part of CNN architecture. The Resnet-34 architecture was developed in 2015 in order to solve the vanishing gradient problem (It is a typical problem that arises when we try to train a machine learning module with artificial neural networks with gradient-based learning methods and backpropagation). The Resnet-34 is an effective algorithm that solves the vanishing gradient problem, and with the Resnet-34 the gradients can flow directly through connections backward from the latest layers to the initial layers. Since the Resnet-34 has higher efficiency in solving image detection-related problems we can use that algorithm for Covid-19 detection using X-Ray images as the Resnet-34 gives better

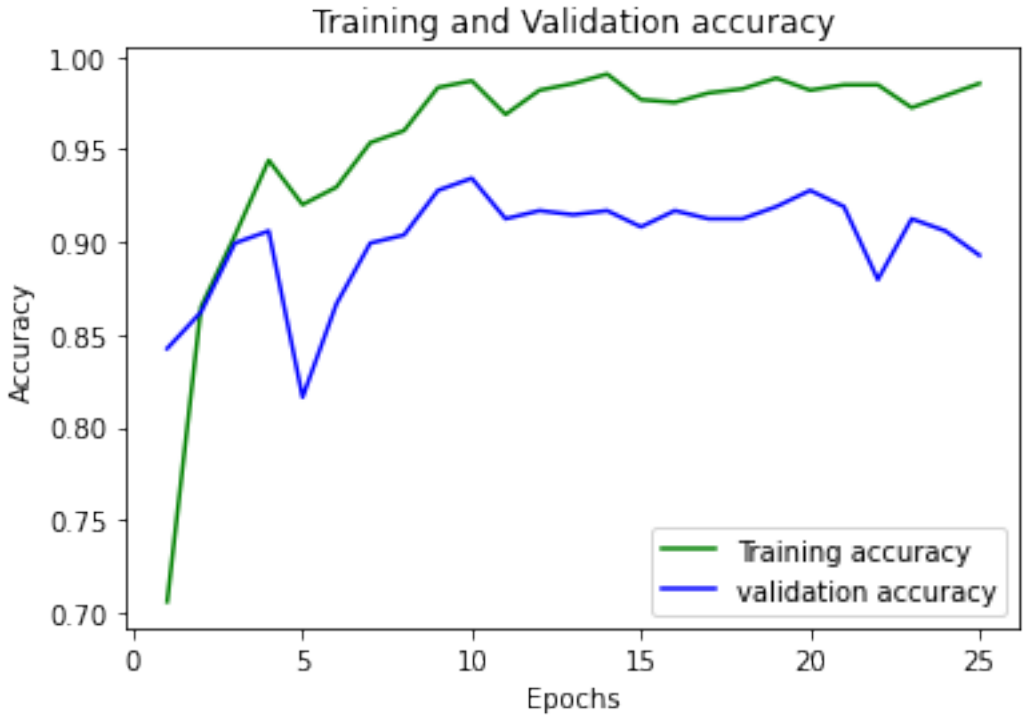

FIGURE 1. **Accuracy of Densenet121 on given X-ray samples**

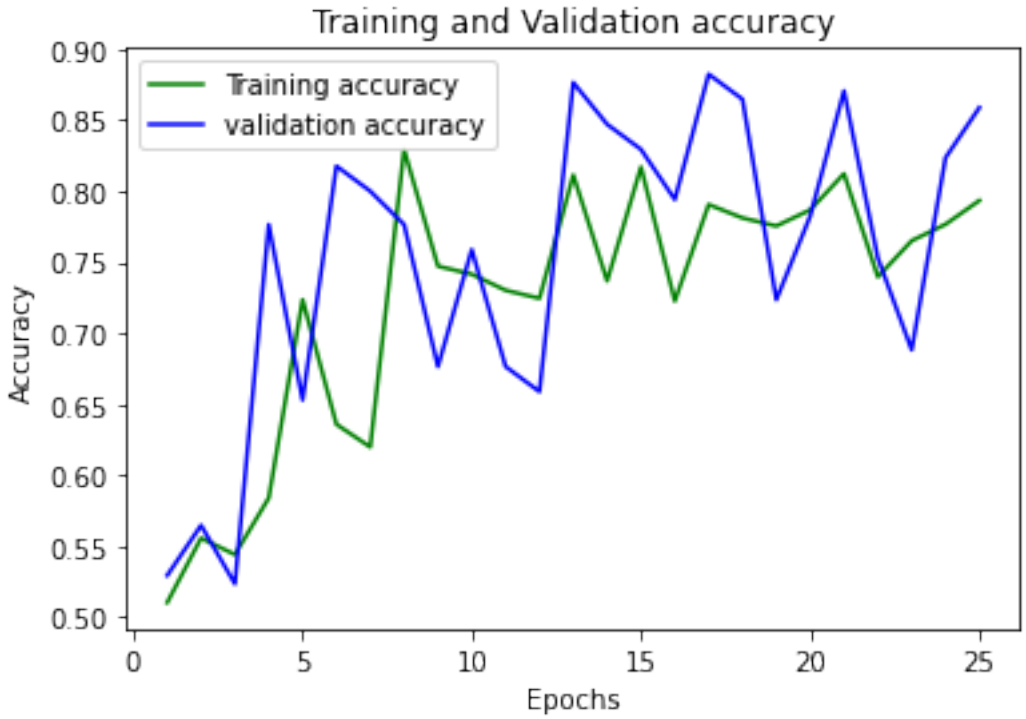

FIGURE 2. **Accuracy of Efficient_B4 on given X-ray samples**

accuracy.

3. Results and Discussion

In the detection model, the algorithm of Densenet121, MobileNetV2, ResNet34, and efficient-net-b4-PyTorch model was trained to detect covid-19 from the x-ray. In the beginning, the experiment detects up to twenty-five epochs. The training and validation accuracy were obtained in each model. Similarly, the loss variations for the models obtained in training and validation are also

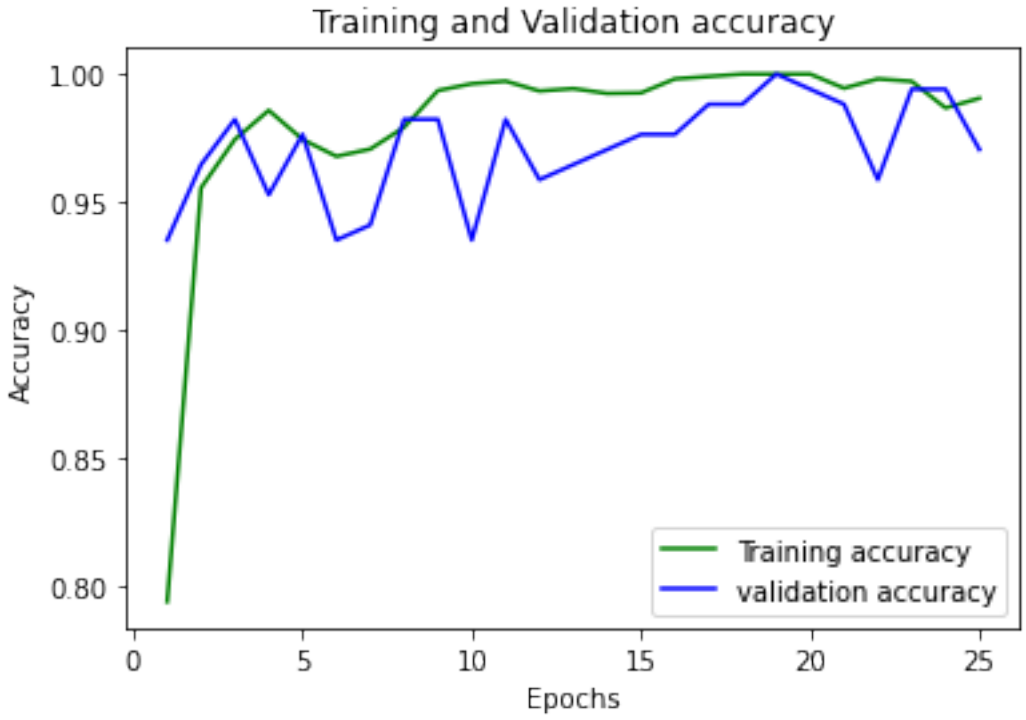

FIGURE 3. **Accuracy of Mobilenet_v2 on given X-ray samples**

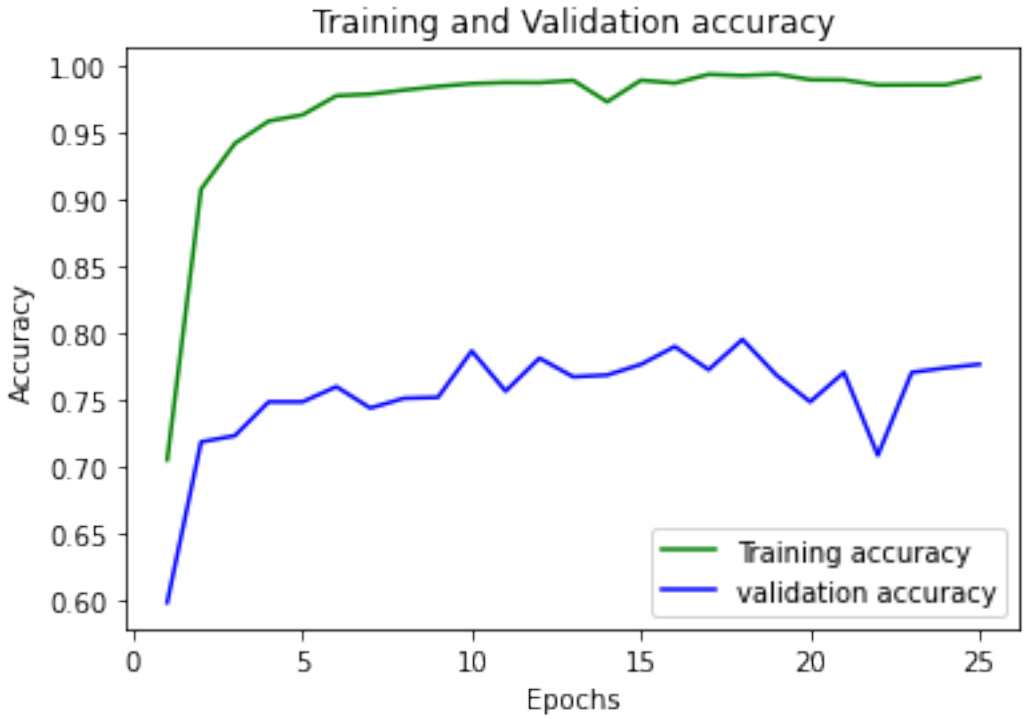

FIGURE 4. **Accuracy of Resnet-34 on given X-ray samples**

displayed

The Following figures are the output screenshots of the results.

The table shows the detailed report with the weight file the Resnet algorithm gives the lowest accuracy (78.11%), and the Efficient_B4 gives better results (83.5%) than Resnet. The Densenet121 gives the accuracy of (89.89%). The Mobilenetv2 results in the highest accuracy (98%) from the given algorithms

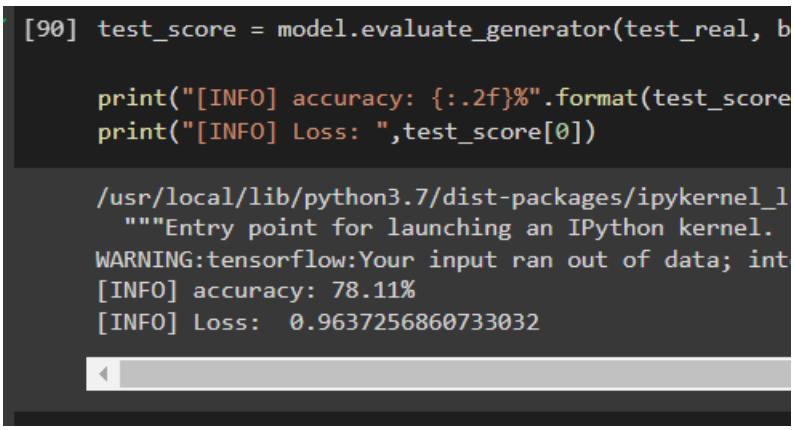

FIGURE 5. Accuracy of Resnet-34

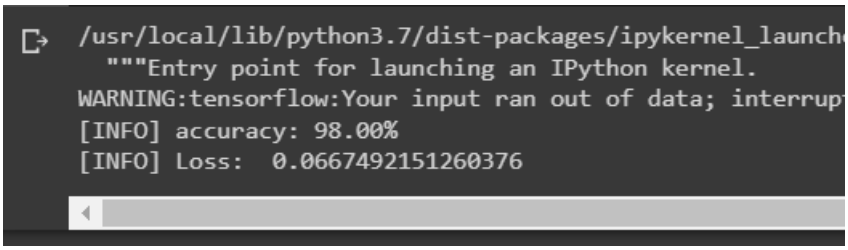

FIGURE 6. Accuracy of Mobilenet_v2

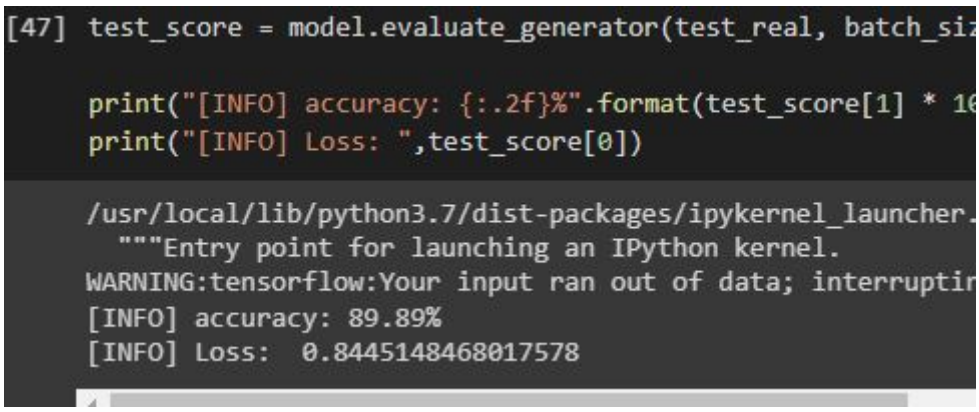

FIGURE 7. Accuracy of Densenet121

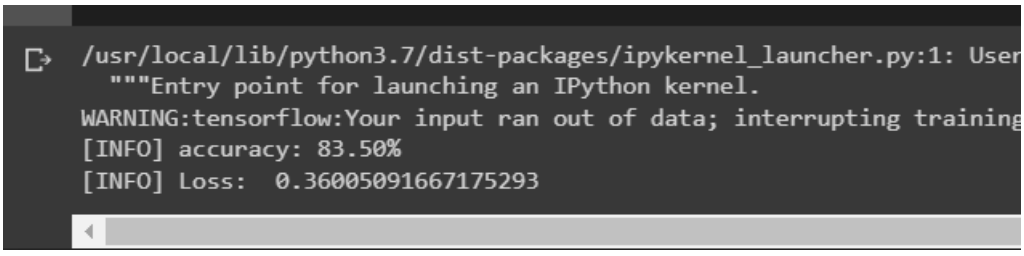

FIGURE 8. Accuracy of Efficient_B4

4. CONCLUSION

The entire world is experiencing the covid-19 Since 2019, The doctors facing challenges to identify covid 19 infected persons by using x-ray samples manually. In order to overcome this issue, technological advancement play a vital role. The algorithms used in Deep learning give high accuracy in the identification of Covid_19. The Mobilenet_v2 algorithm results the highest accuracy among the

TABLE 1. Performance Comparison of Various CNN Models

Models	Accuracy (%)	Loss
RESNET	78.11%	0.96
Efficient_B4	83.5%	0.36
Mobilenetv2	98%	0.06
Densenet-121	89%	0.84

compared algorithms from Resnet-34, Desnet-121, and Efficient_B4. It provides an accuracy of 98% from the given dataset. The mobilenet_v2 algorithm will identify the covid if the next wave occurs in the upcoming days.

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